

The package `nicematrix`*

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Abstract

The LaTeX package `nicematrix` provides new environments similar to the classical environments `{tabular}`, `{array}` and `{matrix}` of `array` and `amsmath` but with extended features.

$$\begin{array}{c} L_1 \\ L_2 \\ \vdots \\ L_n \end{array} \begin{array}{c} C_1 \\ C_2 \cdots \cdots C_n \end{array} \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

Product	dimensions (cm)			Price
	L	l	h	
small	3	5.5	1	30
standard	5.5	8	1.5	50.5
premium	8.5	10.5	2	80
extra	8.5	10	1.5	85.5
special	12	12	0.5	70

The package `nicematrix` is entirely contained in the file `nicematrix.sty`. This file may be put in the current directory or in a `texmf` tree. However, the best is to install `nicematrix` with a TeX distribution as MiKTeX, TeXlive or MacTeX.

Remark: If you use LaTeX via Internet with, for example, Overleaf, you can upload the file `nicematrix.sty` in the repertory of your project in order to take full advantage of the latest version de `nicematrix`.¹

This package can be used with `xelatex`, `lualatex`, `pdflatex` but also by the classical workflow `latex-dvips-ps2pdf` (or Adobe Distiller). However, the file `nicematrix.dtx` of the present documentation should be compiled with XeLaTeX.

This package requires and **loads** the packages `l3keys2e`, `array`, `amsmath`, `pgfcore` and the module `shapes` of PGF (`tikz`, which is a layer over PGF is *not* loaded). The final user only has to load the package with `\usepackage{nicematrix}`.

The idea of `nicematrix` is to create PGF nodes under the cells and the positions of the rules of the tabular created by `array` and to use these nodes to develop new features. As usual with PGF, the coordinates of these nodes are written in the `.aux` to be used on the next compilation and that's why `nicematrix` may need **several compilations**.²

Most features of `nicematrix` may be used without explicit use of PGF or Tikz (which, in fact, is not loaded by default).

A command `\NiceMatrixOptions` is provided to fix the options (the scope of the options fixed by this command is the current TeX group: they are semi-global).

*This document corresponds to the version 5.18 of `nicematrix`, at the date of 2021/07/15.

¹The latest version of the file `nicematrix.sty` may be downloaded from the SVN server of TeXLive:
<https://www.tug.org/svn/texlive/trunk/Master/texmf-dist/tex/latex/nicematrix/nicematrix.sty>

²If you use Overleaf, Overleaf will do automatically the right number of compilations.

1 The environments of this package

The package `nicematrix` defines the following new environments.

<code>{NiceTabular}</code>	<code>{NiceArray}</code>	<code>{NiceMatrix}</code>
<code>{NiceTabular*}</code>	<code>{pNiceArray}</code>	<code>{pNiceMatrix}</code>
	<code>{bNiceArray}</code>	<code>{bNiceMatrix}</code>
	<code>{BNiceArray}</code>	<code>{BNiceMatrix}</code>
	<code>{vNiceArray}</code>	<code>{vNiceMatrix}</code>
	<code>{VNiceArray}</code>	<code>{VNiceMatrix}</code>

The environments `{NiceArray}`, `{NiceTabular}` and `{NiceTabular*}` are similar to the environments `{array}`, `{tabular}` and `{tabular*}` of the package `array` (which is loaded by `nicematrix`).

The environments `{pNiceArray}`, `{bNiceArray}`, etc. have no equivalent in `array`.

The environments `{NiceMatrix}`, `{pNiceMatrix}`, etc. are similar to the corresponding environments of `amsmath` (which is loaded by `nicematrix`): `{matrix}`, `{pmatrix}`, etc.

It's recommended to use primarily the classical environments and to use the environments of `nicematrix` only when some feature provided by these environments is used (this will save memory).

All the environments of the package `nicematrix` accept, between square brackets, an optional list of `key=value` pairs. **There must be no space before the opening bracket (`[`) of this list of options.**

Important

Before the version 5.0, it was mandatory to use, for technical reasons, the letters `L`, `C` et `R` instead of `l`, `c` et `r` in the preambles of the environments of `nicematrix`. If we want to be able to go on using these letters, `nicematrix` must be loaded with the option `define-L-C-R`.

```
\usepackage[define-L-C-R]{nicematrix}
```

This key will probably be deleted in a future version of `nicematrix`.

2 The vertical space between the rows

It's well known that some rows of the arrays created by default with LaTeX are, by default, too close to each other. Here is a classical example.

```
\begin{pmatrix}
\frac{1}{2} & -\frac{1}{2} \\
\frac{1}{3} & \frac{1}{4}
\end{pmatrix}
```

Inspired by the package `cellspace` which deals with that problem, the package `nicematrix` provides two keys `cell-space-top-limit` and `cell-space-bottom-limit` similar to the parameters `\cellspacetoplimit` and `\cellspacebottomlimit` of `cellspace`.

There is also a key `cell-space-limits` to set both parameters at once.

The initial value of these parameters is 0 pt in order to have for the environments of `nicematrix` the same behaviour as those of `array` and `amsmath`. However, a value of 1 pt would probably be a good choice and we suggest to set them with `\NiceMatrixOptions`.³

```
\NiceMatrixOptions{cell-space-limits = 1pt}
```

³One should remark that these parameters apply also to the columns of type `S` of `siunitx` whereas the package `cellspace` is not able to act on such columns of type `S`.

```

 $\begin{pNiceMatrix}$ 
 $\frac{1}{2}$  &  $-\frac{1}{2}$  \\
 $\frac{1}{3}$  &  $\frac{1}{4}$  \\
 $\end{pNiceMatrix}$ 

```

$$\begin{pmatrix} \frac{1}{2} & -\frac{1}{2} \\ \frac{1}{3} & \frac{1}{4} \end{pmatrix}$$

3 The vertical position of the arrays

The package `nicematrix` provides a option `baseline` for the vertical position of the arrays. This option takes in as value an integer which is the number of the row on which the array will be aligned.

```

 $A = \begin{pNiceMatrix}[baseline=2]$ 
 $\frac{1}{\sqrt{1+p^2}}$  &  $p$  &  $1-p$  \\
1 & 1 & 1 \\
1 & p & 1+p \\
 $\end{pNiceMatrix}$ 

```

$$A = \begin{pmatrix} \frac{1}{\sqrt{1+p^2}} & p & 1-p \\ 1 & 1 & 1 \\ 1 & p & 1+p \end{pmatrix}$$

It's also possible to use the option `baseline` with one of the special values `t`, `c` or `b`. These letters may also be used absolutely like the option of the environments `{tabular}` and `{array}` of `array`. The initial value of `baseline` is `c`.

In the following example, we use the option `t` (equivalent to `baseline=t`) immediately after an `\item` of list. One should remark that the presence of a `\hline` at the beginning of the array doesn't prevent the alignment of the baseline with the baseline of the first row (with `{tabular}` or `{array}` of `array`, one must use `\firsthline`).

```

\begin{enumerate}
\item an item
\smallskip
\item \renewcommand{\arraystretch}{1.2}
 $\begin{NiceArray}[t]{lcccccc}$ 
\hline
n & 0 & 1 & 2 & 3 & 4 & 5 \\
u_n & 1 & 2 & 4 & 8 & 16 & 32 \\
\hline
\end{NiceArray}
\end{enumerate}

```

1. an item

$$\begin{array}{cccccc} n & 0 & 1 & 2 & 3 & 4 & 5 \\ u_n & 1 & 2 & 4 & 8 & 16 & 32 \end{array}$$

However, it's also possible to use the tools of `booktabs`⁴: `\toprule`, `\bottomrule`, `\midrule`, etc.

```

\begin{enumerate}
\item an item
\smallskip
\item
 $\begin{NiceArray}[t]{lcccccc}$ 
\toprule
n & 0 & 1 & 2 & 3 & 4 & 5 \\
\midrule
u_n & 1 & 2 & 4 & 8 & 16 & 32 \\
\bottomrule
\end{NiceArray}
\end{enumerate}

```

1. an item

$$\begin{array}{cccccc} n & 0 & 1 & 2 & 3 & 4 & 5 \\ u_n & 1 & 2 & 4 & 8 & 16 & 32 \end{array}$$

It's also possible to use the key `baseline` to align a matrix on an horizontal rule (drawn by `\hline`). In this aim, one should give the value `line-i` where *i* is the number of the row following the horizontal rule.

```

\NiceMatrixOptions{cell-space-limits=1pt}

```

⁴The extension `booktabs` is *not* loaded by `nicematrix`.

```

$A=\begin{pNiceArray}{cc|cc}[baseline=line-3]
\frac{1}{A} & \frac{1}{B} & 0 & 0 \\
\frac{1}{C} & \frac{1}{D} & 0 & 0 \\
\hline
0 & 0 & A & B \\
0 & 0 & D & D \\
\end{pNiceArray}$

```

$$A = \left(\begin{array}{cc|cc} \frac{1}{A} & \frac{1}{B} & 0 & 0 \\ \frac{1}{C} & \frac{1}{D} & 0 & 0 \\ \hline 0 & 0 & A & B \\ 0 & 0 & D & D \end{array} \right)$$

4 The blocks

4.1 General case

In the environments of `nicematrix`, it's possible to use the command `\Block` in order to place an element in the center of a rectangle of merged cells of the array.⁵

The command `\Block` must be used in the upper leftmost cell of the array with two arguments.

- The first argument is the size of the block with the syntax i - j where i is the number of rows of the block and j its number of columns.

If this argument is empty, its default value is 1-1. If the number of rows is not specified, or equal to `*`, the block extends until the last row (idem for the columns).

- The second argument is the content of the block. It's possible to use `\\` in that content to have a content on several lines. In `{NiceTabular}` the content of the block is composed in text mode whereas, in the other environments, it is composed in math mode.

Here is an example of utilisation of the command `\Block` in mathematical matrices.

```

$\begin{bNiceArray}{ccc|c}[margin]
\Block{3-3}{A} & & & 0 \\
& \hspace*{1cm} & & \Vdots \\
& & & 0 \\
\hline
0 & \Cdots & 0 & 0 \\
\end{bNiceArray}$

```

$$\left[\begin{array}{ccc|c} A & & & 0 \\ & \hspace*{1cm} & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array} \right]$$

One may wish to raise the size of the “A” placed in the block of the previous example. Since this element is composed in math mode, it's not possible to use directly a command like `\large`, `\Large` and `\LARGE`. That's why the command `\Block` provides an option between angle brackets to specify some TeX code which will be inserted before the beginning of the math mode.⁶

```

$\begin{bNiceArray}{ccc|c}[margin]
\Block{3-3}<\Large>{A} & & & 0 \\
& \hspace*{1cm} & & \Vdots \\
& & & 0 \\
\hline
0 & \Cdots & 0 & 0 \\
\end{bNiceArray}$

```

$$\left[\begin{array}{ccc|c} A & & & 0 \\ & \hspace*{1cm} & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array} \right]$$

It's possible to set the horizontal position of the block with one of the keys `l`, `c` and `r`.

⁵The spaces after a command `\Block` are deleted.

⁶This argument between angular brackets may also be used to insert a command of font such as `\bfseries` when the command `\\` is used in the content of the block.

```

$\begin{bNiceArray}{ccc|c}[margin]
\Block[r]{3-3}<\LARGE>{A} & & & 0 \\
& \hspace*{1cm} & & \Vdots \\
& & & 0 \\
\hline
0 & \Cdots & 0 & 0
\end{bNiceArray}$

```

$$\left[\begin{array}{ccc|c} & & & 0 \\ & & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array} \right]$$

In fact, the command `\Block` accepts as first optional argument (between square brackets) a list of couples key-value. The available keys are as follows:

- the keys `l`, `c` and `r` are used to fix the horizontal position of the content of the block, as explained previously;
- the key `fill` takes in as value a color and fills the block with that color;
- the key `draw` takes in as value a color and strokes the frame of the block with that color (the default value of that key is the current color of the rules of the array);
- the key `color` takes in as value a color and apply that color the content of the block but draws also the frame of the block with that color;
- the key `line-width` is the width (thickness) of the frame (this key should be used only when the key `draw` or the key `hvlines` is in force);
- the key `rounded-corners` requires rounded corners (for the frame drawn by `draw` and the shape drawn by `fill`) with a radius equal to the value of that key (the default value is 4 pt⁷);
- the key `borders` provides the ability to draw only some borders of the blocks; the value of that key is a (comma-separated) list of elements covered by `left`, `right`, `top` and `bottom`;
- the keys `t` and `b` fix the base line that will be given to the block when it has a multi-line content (the lines are separated by `\\`);
- the keys `hvlines` draws all the vertical and horizontal rules in the block.

One must remark that, by default, the commands `\Blocks` don't create space. There is exception only for the blocks mono-row and the blocks mono-column as explained just below.

In the following example, we have had to enlarge by hand the columns 2 and 3 (with the construction `wc{...}` of `array`).

```

\begin{NiceTabular}{cwc{2cm}wc{3cm}c}
rose      & tulipe & marguerite & dahlia \\
violette
& \Block[draw=red,fill=[RGB]{204,204,255},rounded-corners]{2-2}
& \LARGE De très jolies fleurs}
& & souci \\
pervenche & & lys \\
arum      & iris & jacinthe & muguet
\end{NiceTabular}

```

rose	tulipe	marguerite	dahlia
violette	De très jolies fleurs		souci
pervenche			lys
arum	iris	jacinthe	muguet

⁷This value is the initial value of the *rounded corners* of Tikz.

4.2 The mono-column blocks

The mono-column blocks have a special behaviour.

- The natural width of the contents of these blocks is taken into account for the width of the current column.
- The specification of the horizontal position provided by the type of column (c, r or l) is taken into account for the blocks.
- The specifications of font specified for the column by a construction `>{...}` in the preamble of the array are taken into account for the mono-column blocks of that column (this behaviour is probably expected).

<code>\begin{NiceTabular}{@{>{\bfseries}lr@{}} \hline</code>	
<code>\Block{2-1}{John} & 12 \\\</code>	John 12
<code>& 13 \\\ \hline</code>	13
<code>Steph & 8 \\\ \hline</code>	Steph 8
<code>\Block{3-1}{Sarah} & 18 \\\</code>	18
<code>& 17 \\\</code>	Sarah 17
<code>& 15 \\\ \hline</code>	15
<code>Ashley & 20 \\\ \hline</code>	Ashley 20
<code>Henry & 14 \\\ \hline</code>	Henry 14
<code>\Block{2-1}{Madison} & 15 \\\</code>	15
<code>& 19 \\\ \hline</code>	Madison 19
<code>\end{NiceTabular}</code>	

4.3 The mono-row blocks

For the mono-row blocks, the natural height and depth are taken into account for the height and depth of the current row (as does a standard `\multicolumn` of LaTeX).

4.4 The mono-cell blocks

A mono-cell block inherits all the properties of the mono-row blocks and mono-column blocks.

At first sight, one may think that there is no point using a mono-cell block. However, there are some good reasons to use such a block.

- It's possible to use the command `\` in a (mono-cell) block.
- It's possible to use the option of horizontal alignment of the block in derogation of the type of column given in the preamble of the array.
- It's possible to draw a frame around the cell with the key `draw` of the command `\Block` and to fill the background with rounded corners with the keys `fill` and `rounded-corners`.⁸
- It's possible to draw one or several borders of the cell with the key `borders`.

<code>\begin{NiceTabular}{cc}</code>	
<code>\toprule</code>	
<code>Writer & \Block[l]{year of birth} \\\</code>	Writer year of birth
<code>\midrule</code>	
<code>Hugo & 1802 \\\</code>	Hugo 1802
<code>Balzac & 1799 \\\</code>	Balzac 1799
<code>\bottomrule</code>	
<code>\end{NiceTabular}</code>	

We recall that if the first mandatory argument of `\Block` is left blank, the block is mono-cell.⁹

⁸If one simply wishes to color the background of a unique cell, there is no point using the command `\Block`: it's possible to use the command `\cellcolor` (when the key `colortbl-like` is used).

⁹One may consider that the default value of the first mandatory argument of `\Block` is 1-1.

4.5 Horizontal position of the content of the block

By default, the horizontal position of the content of a block is computed by using the positions of the *contents* of the columns implied in that block. That's why, in the following example, the header "First group" is correctly centered despite the instruction `!\qquad` in the preamble which has been used to increase the space between the columns (this is not the behaviour of `\multicolumn`).

```
\begin{NiceTabular}{@{}c!\qquad ccc!\qquad ccc@{}}
\toprule
Rank & \Block{1-3}{First group} & & \Block{1-3}{Second group} & \\
& 1A & 1B & 1C & 2A & 2B & 2C & \\
\midrule
1 & 0.657 & 0.913 & 0.733 & 0.830 & 0.387 & 0.893 \\
2 & 0.343 & 0.537 & 0.655 & 0.690 & 0.471 & 0.333 \\
3 & 0.783 & 0.885 & 0.015 & 0.306 & 0.643 & 0.263 \\
4 & 0.161 & 0.708 & 0.386 & 0.257 & 0.074 & 0.336 \\
\bottomrule
\end{NiceTabular}
```

Rank	First group			Second group		
	1A	1B	1C	2A	2B	2C
1	0.657	0.913	0.733	0.830	0.387	0.893
2	0.343	0.537	0.655	0.690	0.471	0.333
3	0.783	0.885	0.015	0.306	0.643	0.263
4	0.161	0.708	0.386	0.257	0.074	0.336

New 5.17 In order to have an horizontal positioning of the content of the block computed with the limits of the columns of the LaTeX array (and not with the contents of those columns), one may use the key L, R and C of the command `\Block`.

5 The rules

The usual techniques for the rules may be used in the environments of `nicematrix` (excepted `\vline`). However, there is some small differences with the classical environments.

5.1 Some differences with the classical environments

5.1.1 The vertical rules

In the environments of `nicematrix`, the vertical rules specified by `|` in the preambles of the environments are never broken, even by an incomplete row or by a double horizontal rule specified by `\hline\hline` (there is no need to use `hhline`).

```
\begin{NiceTabular}{|c|c|} \hline
First & Second \\ \hline\hline
Peter & \\ \hline
Mary & George \\ \hline
\end{NiceTabular}
```

First	Second
Peter	
Mary	George

However, the vertical rules are not drawn in the blocks (created by `\Block`: cf. p. 4) nor in the corners (created by the key `corner`: cf. p. 10).

If you use `booktabs` (which provides `\toprule`, `\midrule`, `\bottomrule`, etc.) and if you really want to add vertical rules (which is not in the spirit of `booktabs`), you should notice that the vertical rules drawn by `nicematrix` are compatible with `booktabs`.

```
\begin{NiceArray}{|cccc|} \toprule
a & b & c & d \\ \midrule
1 & 2 & 3 & 4 \\
1 & 2 & 3 & 4 \\ \bottomrule
\end{NiceArray}
```

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1	2	3	4
1	2	3	4

However, it's still possible to define a specifier (named, for instance, `I`) to draw vertical rules with the standard behaviour of `array`.

```
\newcolumntype{I}{!{\vrule}}
```

However, in this case, it is probably more clever to add a command `\OnlyMainNiceMatrix` (cf. p. 38):

```
\newcolumntype{I}{!{\OnlyMainNiceMatrix{\vrule}}}
```

5.1.2 The command `\cline`

The horizontal and vertical rules drawn by `\hline` and the specifier “|” make the array larger or wider by a quantity equal to the width of the rule (with `array` and also with `nicematrix`).

For historical reasons, this is not the case with the command `\cline`, as shown by the following example.

```
\setlength{\arrayrulewidth}{2pt}
\begin{tabular}{cccc} \hline
A&B&C&D \\ \cline{2-2}
A&B&C&D \\ \hline
\end{tabular}
```

A	B	C	D
A	<u>B</u>	C	D

In the environments of `nicematrix`, this situation is corrected (it's still possible to go to the standard behaviour of `\cline` with the key `standard-cline`).

```
\setlength{\arrayrulewidth}{2pt}
\begin{NiceTabular}{cccc} \hline
A&B&C&D \\ \cline{2-2}
A&B&C&D \\ \hline
\end{NiceTabular}
```

A	<u>B</u>	C	D
A	<u>B</u>	C	D

5.2 The thickness and the color of the rules

The environments of `nicematrix` provide a key `rules/width` to set the width (in fact the thickness) of the rules in the current environment. In fact, this key merely sets the value of the length `\arrayrulewidth`.

It's well known that `colortbl` provides the command `\arrayrulecolor` in order to specify the color of the rules.

With `nicematrix`, it's possible to specify the color of the rules even when `colortbl` is not loaded. For sake of compatibility, the command is also named `\arrayrulecolor`. The environments of `nicematrix` also provide a key `rules/color` to fix the color of the rules in the current environment. This key sets the value locally (whereas `\arrayrulecolor` acts globally).

```
\begin{NiceTabular}{|ccc|}[rules/color=gray]{0.9},rules/width=1pt]
\hline
rose & tulipe & lys \\
arum & iris & violette \\
muguet & dahlia & souci \\
\hline
\end{NiceTabular}
```

rose	tulipe	lys
arum	iris	violette
muguet	dahlia	souci

If one wishes to define new specifiers for columns in order to draw vertical rules (for example with a specific color or thicker than the standard rules), he should consider the command `\OnlyMainNiceMatrix` described on page 38.

5.3 The tools of nicematrix for the rules

Here are the tools provided by `nicematrix` for the rules.

- the keys `hlines`, `vlines` and `hvlines`;
- the specifier “|” in the preamble (for the environments with preamble);
- the command `\Hline`.

All these tools don’t draw the rules in the blocks nor in the empty corners (when the key `corners` is used).

- These blocks are:
 - the blocks created by the command `\Block`¹⁰ presented p. 4;
 - the blocks implicitly delimited by the continuous dotted lines created by `\Cdots`, `Vdots`, etc. (cf. p. 19).
- The corners are created by the key `corners` explained below (see p. 10).

In particular, this remark explains the difference between the standard command `\hline` and the command `\Hline` provided by `nicematrix`.

5.3.1 The keys `hlines` and `vlines`

The keys `hlines` and `vlines` (which draw, of course, horizontal and vertical rules) take in as value a list of numbers which are the numbers of the rules to draw.

In fact, for the environments with delimiters (such as `{pNiceMatrix}` or `{bNiceArray}`), the key `vlines` don’t draw the exterior rules (this is certainly the expected behaviour).

```
\begin{pNiceMatrix}[vlines,rules/width=0.2pt]
1 & 2 & 3 & 4 & 5 & 6 \\
1 & 2 & 3 & 4 & 5 & 6 \\
1 & 2 & 3 & 4 & 5 & 6 \\
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{pmatrix}$$

5.3.2 The key `hvlines`

The key `hvlines` (no value) is the conjunction of the keys `hlines` and `vlines`.

```
\setlength{\arrayrulewidth}{1pt}
\begin{NiceTabular}{cccc}[hvlines,rules/color=blue]
rose      & tulipe & marguerite & dahlia \\
violette  & \Block[draw=red]{2-2}{\LARGE fleurs} & & souci \\
pervenche & & lys \\
arum      & iris  & jacinthe & muguet \\
\end{NiceTabular}
```

rose	tulipe	marguerite	dahlia
violette	fleurs		souci
pervenche			lys
arum	iris	jacinthe	muguet

New 5.17 The key `hvlines-except-corners` is similar to the key `hvlines` but does not draw the rules on the horizontal and vertical borders of the array.

¹⁰And also the command `\multicolumn` also it’s recommended to use instead `\Block` in the environments of `nicematrix`.

5.3.3 The (empty) corners

The four **corners** of an array will be designed by NW, SW, NE and SE (*north west, south west, north east and south east*).

For each of these corners, we will call *empty corner* (or simply *corner*) the reunion of all the empty rectangles starting from the cell actually in the corner of the array.¹¹

However, it's possible, for a cell without content, to require `nicemarix` to consider that cell as not empty with the key `\NotEmpty`.

In the example on the right (where B is in the center of a block of size 2×2), we have colored in blue the four (empty) corners of the array.

				A	
			A	A	A
				A	
			A	A	A
A	A	A	A	A	A
A	A	A	A	A	A
	A	A	A		
			A		
			A		

When the key `corners` is used, `nicematrix` computes the (empty) corners and these corners will be taken into account by the tools for drawing the rules (the rules won't be drawn in the corners). *Remark:* In the previous versions of `nicematrix`, there was only a key `hvlines-except-corners` (now considered as obsolete).

```
\NiceMatrixOptions{cell-space-top-limit=3pt}
\begin{NiceTabular}{*{6}{c}}[corners,hvlines]
& & & & A & \\
& & A & A & A & \\
& & & A & & \\
& & A & A & A & A & \\
A & A & A & A & A & A & A & \\
A & A & A & A & A & A & A & \\
& A & A & A & & & \\
& \Block{2-2}{B} & & A & \\
& & & A & \\
\end{NiceTabular}
```

				A	
		A	A	A	
			A		
		A	A	A	A
A	A	A	A	A	A
A	A	A	A	A	A
	A	A	A		
	B		A		
			A		

It's also possible to provide to the key `corners` a (comma-separated) list of corners (designed by NW, SW, NE and SE).

```
\NiceMatrixOptions{cell-space-top-limit=3pt}
\begin{NiceTabular}{*{6}{c}}[corners=NE,hvlines]
1\\
1&1\\
1&2&1\\
1&3&3&1\\
1&4&6&4&1\\
&&&&&1
\end{NiceTabular}
```

1					
1	1				
1	2	1			
1	3	3	1		
1	4	6	4	1	
					1

▷ The corners are also taken into account by the tools provided by **nicematrix** to color cells, rows and columns. These tools don't color the cells which are in the corners (cf. p. 12).

¹¹For sake of completeness, we should also say that a cell contained in a block (even an empty cell) is not taken into account for the determination of the corners. That behaviour is natural.

5.4 The command `\diagbox`

The command `\diagbox` (inspired by the package `diagbox`), allows, when it is used in a cell, to slash that cell diagonally downwards.¹²

```
\begin{NiceArray}{*{5}{c}}[hvlines]
\diagbox{x}{y} & e & a & b & c \\
e & e & a & b & c \\
a & a & e & c & b \\
b & b & c & e & a \\
c & c & b & a & e
\end{NiceArray}
```

$\begin{smallmatrix} y \\ x \end{smallmatrix}$	e	a	b	c
e	e	a	b	c
a	a	e	c	b
b	b	c	e	a
c	c	b	a	e

It's possible to use the command `\diagbox` in a `\Block`.

5.5 Dotted rules

In the environments of the package `nicematrix`, it's possible to use the command `\hdottedline` (provided by `nicematrix`) which is a counterpart of the classical commands `\hline` and `\hdashline` (the latter is a command of `arydshln`).

```
\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 \\
\hdottedline
6 & 7 & 8 & 9 & 10 \\
11 & 12 & 13 & 14 & 15
\end{pNiceMatrix}
```

$$\left(\begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \\ \hdottedline 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \end{array} \right)$$

In the environments with an explicit preamble (like `{NiceTabular}`, `{NiceArray}`, etc.), it's possible to draw a vertical dotted line with the specifier “:”.

```
\left(\begin{NiceArray}{cccc:c}
1 & 2 & 3 & 4 & 5 \\
6 & 7 & 8 & 9 & 10 \\
11 & 12 & 13 & 14 & 15
\end{NiceArray}\right)
```

$$\left(\begin{array}{cccc:c} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \end{array} \right)$$

It's possible to change in `nicematrix` the letter used to specify a vertical dotted line with the option `letter-for-dotted-lines` available in `\NiceMatrixOptions`. Thus released, the letter “:” can be used otherwise (for example by the package `arydshln`¹³).

Remark: In the package `array` (on which the package `nicematrix` relies), horizontal and vertical rules make the array larger or wider by a quantity equal to the width of the rule¹⁴. In `nicematrix`, the dotted lines drawn by `\hdottedline` and “:” do likewise.

6 The color of the rows and columns

6.1 Use of `colortbl`

We recall that the package `colortbl` can be loaded directly with `\usepackage{colortbl}` or by loading `xcolor` with the key `table`: `\usepackage[table]{xcolor}`.

Since the package `nicematrix` is based on `array`, it's possible to use `colortbl` with `nicematrix`.

However, there is two drawbacks:

¹²The author of this document considers that type of construction as graphically poor.

¹³However, one should remark that the package `arydshln` is not fully compatible with `nicematrix`.

¹⁴In fact, with `array`, this is true only for `\hline` and “|” but not for `\cline`: cf p. 8

- The package `colortbl` patches `array`, leading to some incompatibilities (for instance with the command `\hdotsfor`).
- The package `colortbl` constructs the array row by row, alternating colored rectangles, rules and contents of the cells. The resulting PDF is difficult to interpret by some PDF viewers and may lead to artefacts on the screen.
 - Some rules seem to disappear. This is because many PDF viewers give priority to graphical element drawn posteriorly (which is in the spirit of the “painting model” of PostScript and PDF). Concerning this problem, MuPDF (which is used, for instance, by SumatraPDF) gives better results than Adobe Reader).
 - A thin white line may appear between two cells of the same color. This phenomenon occurs when each cell is colored with its own instruction `fill` (the PostScript operator `fill` noted `f` in PDF). This is the case with `colortbl`: each cell is colored on its own, even when `\columncolor` or `\rowcolor` is used.

As for this phenomenon, Adobe Reader gives better results than MuPDF.

The package `nicematrix` provides tools to avoid those problems.

6.2 The tools of `nicematrix` in the `\CodeBefore`

The package `nicematrix` provides some tools (independent of `colortbl`) to draw the colored panels first, and, then, the content of the cells and the rules. This strategy is more conform to the “painting model” of the formats PostScript and PDF and is more suitable for the PDF viewers. However, it requires several compilations.¹⁵

The extension `nicematrix` provides a key `code-before` for some code that will be executed before the drawing of the tabular.

An alternative syntax is provided: it’s possible to put the content of that `code-before` between the keywords `\CodeBefore` and `\Body` at the beginning of the environment.

```
\begin{pNiceArray}{preamble}
\CodeBefore
instructions of the code-before
\Body
contents of the environnement
\end{pNiceArray}
```

New commands are available in that `\CodeBefore`: `\cellcolor`, `\rectanglecolor`, `\rowcolor`, `\columncolor`, `\rowcolors`, `\chessboardcolors` and `arraycolor`.¹⁶

All these commands accept an optional argument (between square brackets and in first position) which is the color model for the specification of the colors.

These commands don’t color the cells which are in the “corners” if the key `corners` is used. This key has been described p. 10.

- The command `\cellcolor` takes its name from the command `\cellcolor` of `colortbl`.

This command takes in as mandatory arguments a color and a list of cells, each of which with the format i - j where i is the number of the row and j the number of the column of the cell.

¹⁵If you use Overleaf, Overleaf will do automatically the right number of compilations.

¹⁶Remark that, in the `\CodeBefore`, PGF/Tikz nodes of the form “(i-lj)” are also available to indicate the position to the potential rules: cf. p. 36.

```

\begin{NiceTabular}{|c|c|c|}
\CodeBefore
  \cellcolor[HTML]{FFFF88}{3-1,2-2,1-3}
\Body
\hline
a & b & c \\ \hline
e & f & g \\ \hline
h & i & j \\ \hline
\end{NiceTabular}

```

a	b	c
e	f	g
h	i	j

- The command `\rectanglecolor` takes three mandatory arguments. The first is the color. The second is the upper-left cell of the rectangle and the third is the lower-right cell of the rectangle.

```

\begin{NiceTabular}{|c|c|c|}
\CodeBefore
  \rectanglecolor{blue!15}{2-2}{3-3}
\Body
\hline
a & b & c \\ \hline
e & f & g \\ \hline
h & i & j \\ \hline
\end{NiceTabular}

```

a	b	c
e	f	g
h	i	j

- The command `\arraycolor` takes in as mandatory argument a color and color the whole tabular with that color (excepted the potential exterior rows and columns: cf. p. 17). It's only a particular case of `\rectanglecolor`.
- The command `\chessboardcolors` takes in as mandatory arguments two colors and it colors the cells of the tabular in quincunx with these colors.

```

$\begin{pNiceMatrix}[r,margin]
\CodeBefore
  \chessboardcolors{red!15}{blue!15}
\Body
1 & -1 & 1 \\
-1 & 1 & -1 \\
1 & -1 & 1
\end{pNiceMatrix}$

```

1	-1	1
-1	1	-1
1	-1	1

We have used the key `r` which aligns all the columns rightwards (cf. p. 31).

- The command `\rowcolor` takes its name from the command `\rowcolor` of `colortbl`. Its first mandatory argument is the color and the second is a comma-separated list of rows or interval of rows with the form `a-b` (an interval of the form `a-` represent all the rows from the row `a` until the end).

```

$\begin{NiceArray}{l l l}[hvlines]
\CodeBefore
  code-before = \rowcolor{red!15}{1,3-5,8-}
\Body
a_1 & b_1 & c_1 \\
a_2 & b_2 & c_2 \\
a_3 & b_3 & c_3 \\
a_4 & b_4 & c_4 \\
a_5 & b_5 & c_5 \\
a_6 & b_6 & c_6 \\
a_7 & b_7 & c_7 \\
a_8 & b_8 & c_8 \\
a_9 & b_9 & c_9 \\
a_{10} & b_{10} & c_{10} \\
\end{NiceArray}$

```

a_1	b_1	c_1
a_2	b_2	c_2
a_3	b_3	c_3
a_4	b_4	c_4
a_5	b_5	c_5
a_6	b_6	c_6
a_7	b_7	c_7
a_8	b_8	c_8
a_9	b_9	c_9
a_{10}	b_{10}	c_{10}

- The command `\columncolor` takes its name from the command `\columncolor` of `colortbl`. Its syntax is similar to the syntax of `\rowcolor`.
- The command `\rowcolors` (with a *s*) takes its name from the command `\rowcolors` of `xcolor`¹⁷. The *s* emphasizes the fact that there is *two* colors. This command colors alternately the rows of the tabular with the tow colors (provided in second and third argument), beginning with the row whose number is given in first (mandatory) argument.

In fact, the first (mandatory) argument is, more generally, a comma separated list of intervals describing the rows involved in the action of `\rowcolors` (an interval of the form *i*- describes in fact the interval of all the rows of the tabular, beginning with the row *i*).

The last argument of `\rowcolors` is an optional list of pairs key-value (the optional argument in the first position corresponds to the colorimetric space). The available keys are `cols`, `restart` and `respect-blocks`.

- The key `cols` describes a set of columns. The command `\rowcolors` will color only the cells of these columns. The value is a comma-separated list of intervals of the form *i*-*j* (where *i* or *j* may be replaced by *).
- With the key `restart`, each interval of rows (specified by the first mandatory argument) begins with the same color.¹⁸
- With the key `respect-blocks` the “rows” alternately colored may extend over several rows if they have to incorporate blocks (created with the command `\Block`: cf. p. 4).

```
\begin{NiceTabular}{clr}[hvlines]
\CodeBefore
  \rowcolors[gray]{2}{0.8}{}[cols=2-3,restart]
\Body
\Block{1-*}{Results} \
John & 12 \
Stephen & 8 \
Sarah & 18 \
Ashley & 20 \
Henry & 14 \
Madison & 15
\end{NiceTabular}
```

Results		
A	John	12
	Stephen	8
B	Sarah	18
	Ashley	20
	Henry	14
	Madison	15

```
\begin{NiceTabular}{lr}[hvlines]
\CodeBefore
  \rowcolors{1}{blue!10}{}[respect-blocks]
\Body
\Block{2-1}{John} & 12 \
& 13 \
Steph & 8 \
\Block{3-1}{Sarah} & 18 \
& 17 \
& 15 \
Ashley & 20 \
Henry & 14 \
\Block{2-1}{Madison} & 15 \
& 19
\end{NiceTabular}
```

John	12
	13
Steph	8
Sarah	18
	17
	15
Ashley	20
Henry	14
Madison	15
	19

¹⁷The command `\rowcolors` of `xcolor` is available when `xcolor` is loaded with the option `table`. That option also loads the package `colortbl`.

¹⁸Otherwise, the color of a given row relies only upon the parity of its absolute number.

We recall that all the color commands we have described don't color the cells which are in the "corners". In the following example, we use the key `corners` to require the determination of the corner *north east* (NE).

```
\begin{NiceTabular}{cccccc}[corners=NE,margin,hvlines,first-row,first-col]
\CodeBefore
  \rowcolors{1}{blue!15}{}
\Body
  & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\
0 & 1 & & & & & & \\
1 & 1 & 1 & & & & & \\
2 & 1 & 2 & 1 & & & & \\
3 & 1 & 3 & 3 & 1 & & & \\
4 & 1 & 4 & 6 & 4 & 1 & & \\
5 & 1 & 5 & 10 & 10 & 5 & 1 & \\
6 & 1 & 6 & 15 & 20 & 15 & 6 & 1 \\
\end{NiceTabular}
```

	0	1	2	3	4	5	6
0	1						
1	1	1					
2	1	2	1				
3	1	3	3	1			
4	1	4	6	4	1		
5	1	5	10	10	5	1	
6	1	6	15	20	15	6	1

One should remark that all the previous commands are compatible with the commands of `booktabs` (`\toprule`, `\midrule`, `\bottomrule`, etc). However, `booktabs` is not loaded by `nicematrix`.

```
\begin{NiceTabular}[c]{lSSSS}
\CodeBefore
  \rowcolor{red!15}{1-2}
  \rowcolors{3}{blue!15}{}
\Body
\toprule
\Block{2-1}{Product} &
\Block{1-3}{dimensions (cm)} & & &
\Block{2-1}{\rotate Price} \\
\cmidrule{2-4}
& L & l & h & \\
\midrule
small & 3 & 5.5 & 1 & 30 \\
standard & 5.5 & 8 & 1.5 & 50.5 \\
premium & 8.5 & 10.5 & 2 & 80 \\
extra & 8.5 & 10 & 1.5 & 85.5 \\
special & 12 & 12 & 0.5 & 70 \\
\bottomrule
\end{NiceTabular}
```

Product	dimensions (cm)			Price
	L	l	h	
small	3	5.5	1	30
standard	5.5	8	1.5	50.5
premium	8.5	10.5	2	80
extra	8.5	10	1.5	85.5
special	12	12	0.5	70

We have used the type of column `S` of `siunitx`.

6.3 Color tools with the syntax of `colortbl`

It's possible to access the preceding tools with a syntax close to the syntax of `colortbl`. For that, one must use the key `colortbl-like` in the current environment.¹⁹

There are three commands available (they are inspired by `colortbl` but are *independent* of `colortbl`):

- `\cellcolor` which colorizes a cell;
- `\rowcolor` which must be used in a cell and which colorizes the end of the row;
- `\columncolor` which must be used in the preamble of the environment with the same syntax as the corresponding command of `colortbl` (however, unlike the command `\columncolor` of `colortbl`, this command `\columncolor` can appear within another command, itself used in the preamble of the array).

¹⁹Up to now, this key is *not* available in `\NiceMatrixOptions`.

```

\NewDocumentCommand { \Blue } { } { { \columncolor{blue!15} }
\begin{NiceTabular}[colortbl-like]{>{\Blue}c>{\Blue}cc}
\toprule
\rowcolor{red!15}
Last name & First name & Birth day \\
\midrule
Achard & Jacques & 5 juin 1962 \\
Lefebvre & Mathilde & 23 mai 1988 \\
Vanesse & Stephany & 30 octobre 1994 \\
Dupont & Chantal & 15 janvier 1998 \\
\bottomrule
\end{NiceTabular}

```

Last name	First name	Birth day
Achard	Jacques	5 juin 1962
Lefebvre	Mathilde	23 mai 1988
Vanesse	Stephany	30 octobre 1994
Dupont	Chantal	15 janvier 1998

7 The command `\RowStyle`

New 5.18 The command `\RowStyle` takes in as argument some formatting intructions that will be applied to each cell on the rest of the current row.

That command also takes in as optional argument (between square brackets) a list of key-value pairs. The available keys are `cell-space-top-limit`, `cell-space-bottom-limit` and `cell-space-limits` with the same meaning that the corresponding global keys (cf. p. 2).

```

\begin{NiceTabular}{cccc}[hlines,colortbl-like]
\RowStyle[cell-space-limits=3pt]{\rotate}
first & second & third & fourth \\
\rowcolor{blue!50}\RowStyle{\color{white}\sffamily}
1 & 2 & 3 & 4 \\
\end{NiceTabular}

```

first	second	third	fourth
1	2	3	4

The command `\rotate` is described p. 31.

8 The width of the columns

In the environments with an explicit preamble (like `{NiceTabular}`, `{NiceArray}`, etc.), it's possible to fix the width of a given column with the standard letters `w` and `W` of the package `array`.

```

\begin{NiceTabular}{Wc{2cm}cc}[hvlines]
Paris & New York & Madrid \\
Berlin & London & Roma \\
Rio & Tokyo & Oslo \\
\end{NiceTabular}

```

Paris	New York	Madrid
Berlin	London	Roma
Rio	Tokyo	Oslo

In the environments of `nicematrix`, it's also possible to fix the *minimal* width of all the columns of an array directly with the key `columns-width`.

```

$\begin{pNiceMatrix}[columns-width = 1cm]
1 & 12 & -123 \\
12 & 0 & 0 \\
4 & 1 & 2 \\
\end{pNiceMatrix}$

```

$$\begin{pmatrix} 1 & 12 & -123 \\ 12 & 0 & 0 \\ 4 & 1 & 2 \end{pmatrix}$$

Note that the space inserted between two columns (equal to `2 \tabcolsep` in `{NiceTabular}` and to `2 \arraycolsep` in the other environments) is not suppressed (of course, it's possible to suppress this space by setting `\tabcolsep` or `\arraycolsep` equal to 0 pt before the environment).

It's possible to give the special value `auto` to the option `columns-width`: all the columns of the array will have a width equal to the widest cell of the array.²⁰

```


$$\begin{pmatrix} 1 & 12 & -123 \\ 12 & 0 & 0 \\ 4 & 1 & 2 \end{pmatrix}$$


```

Without surprise, it's possible to fix the minimal width of the columns of all the matrices of a current scope with the command `\NiceMatrixOptions`.

```


$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 1 & 1245 \\ 345 & 2 \end{pmatrix}$$


```

But it's also possible to fix a zone where all the matrices will have their columns of the same width, equal to the widest cell of all the matrices. This construction uses the environment `{NiceMatrixBlock}` with the option `auto-columns-width`²¹. The environment `{NiceMatrixBlock}` has no direct link with the command `\Block` presented previously in this document (cf. p. 4).

```


$$\begin{bmatrix} 9 & 17 \\ -2 & 5 \end{bmatrix} \quad \begin{bmatrix} 1 & 1245345 \\ 345 & 2 \end{bmatrix}$$


```

9 The exterior rows and columns

The options `first-row`, `last-row`, `first-col` and `last-col` allow the composition of exterior rows and columns in the environments of `nicematrix`.

A potential “first row” (exterior) has the number 0 (and not 1). Idem for the potential “first column”.

```


$$\begin{array}{ccccccccc} & & C_1 & & \cdots & & C_4 & & \\ L_1 & a_{11} & a_{12} & a_{13} & a_{14} & L_1 & & & \\ \vdots & a_{21} & a_{22} & a_{23} & a_{24} & \vdots & & & \\ & a_{31} & a_{32} & a_{33} & a_{34} & & & & \\ L_4 & a_{41} & a_{42} & a_{43} & a_{44} & L_4 & & & \end{array}$$


```

²⁰The result is achieved with only one compilation (but PGF/Tikz will have written informations in the `.aux` file and a message requiring a second compilation will appear).

²¹At this time, this is the only usage of the environment `{NiceMatrixBlock}` but it may have other usages in the future.

```

& C_1 & \Cdots & & C_4 & \\
\end{pNiceMatrix}$

```

$$\begin{array}{c}
C_1 \dots\dots\dots C_4 \\
L_1 \left(\begin{array}{cccc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) L_1 \\
\vdots \\
\vdots \\
L_4 \left(\begin{array}{cccc} a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) L_4 \\
C_1 \dots\dots\dots C_4
\end{array}$$

The dotted lines have been drawn with the tools presented p. 19.

We have several remarks to do.

- For the environments with an explicit preamble (i.e. `{NiceTabular}`, `{NiceArray}` and its variants), no letter must be given in that preamble for the potential first column and the potential last column: they will automatically (and necessarily) be of type `r` for the first column and `l` for the last one.²²
- One may wonder how `nicematrix` determines the number of rows and columns which are needed for the composition of the “last row” and “last column”.
 - For the environments with explicit preamble, like `{NiceTabular}` and `{pNiceArray}`, the number of columns can obviously be computed from the preamble.
 - When the option `light-syntax` (cf. p. 33) is used, `nicematrix` has, in any case, to load the whole body of the environment (and that’s why it’s not possible to put verbatim material in the array with the option `light-syntax`). The analysis of this whole body gives the number of rows (but not the number of columns).
 - In the other cases, `nicematrix` compute the number of rows and columns during the first compilation and write the result in the `aux` file for the next run.

However, it’s possible to provide the number of the last row and the number of the last column as values of the options `last-row` and `last-col`, tending to an acceleration of the whole compilation of the document. That’s what we will do throughout the rest of the document.

It’s possible to control the appearance of these rows and columns with options `code-for-first-row`, `code-for-last-row`, `code-for-first-col` and `code-for-last-col`. These options specify tokens that will be inserted before each cell of the corresponding row or column.

```

\NiceMatrixOptions{code-for-first-row = \color{red},
                  code-for-first-col = \color{blue},
                  code-for-last-row = \color{green},
                  code-for-last-col = \color{magenta}}
$\begin{pNiceArray}{cc|cc}[first-row,last-row=5,first-col,last-col,nullify-dots]
& C_1 & & \Cdots & & & C_4 & & \\
L_1 & & a_{11} & & a_{12} & & a_{13} & & a_{14} & & L_1 \\
\vdots & & a_{21} & & a_{22} & & a_{23} & & a_{24} & & \vdots \\
\hline
& & a_{31} & & a_{32} & & a_{33} & & a_{34} & & \\
L_4 & & a_{41} & & a_{42} & & a_{43} & & a_{44} & & L_4 \\
& & C_1 & & \Cdots & & & & C_4 & & \\
\end{pNiceArray}$

```

²²The users wishing exteriors columns with another type of alignment should consider the command `\SubMatrix` available in the `\CodeAfter` (cf. p. 25).

$$\begin{array}{c}
C_1 \cdots \cdots \cdots C_4 \\
L_1 \left(\begin{array}{cc|cc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) L_1 \\
L_4 \left(\begin{array}{cc|cc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) L_4 \\
C_1 \cdots \cdots \cdots C_4
\end{array}$$

Remarks

- As shown in the previous example, the horizontal and vertical rules doesn't extend in the exterior rows and columns.
However, if one wishes to define new specifiers for columns in order to draw vertical rules (for example thicker than the standard rules), he should consider the command `\OnlyMainNiceMatrix` described on page 38.
- A specification of color present in `code-for-first-row` also applies to a dotted line draw in this exterior "first row" (excepted if a value has been given to `xdots/color`). Idem for the other exterior rows and columns.
- Logically, the potential option `columns-width` (described p. 16) doesn't apply to the "first column" and "last column".
- For technical reasons, it's not possible to use the option of the command `\` after the "first row" or before the "last row". The placement of the delimiters would be wrong. If you are looking for a workaround, consider the command `\SubMatrix` in the `\CodeAfter` described p. 25.

10 The continuous dotted lines

Inside the environments of the package `nicematrix`, new commands are defined: `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, and `\Iddots`. These commands are intended to be used in place of `\dots`, `\cdots`, `\vdots`, `\ddots` and `\iddots`.²³

Each of them must be used alone in the cell of the array and it draws a dotted line between the first non-empty cells²⁴ on both sides of the current cell. Of course, for `\Ldots` and `\Cdots`, it's an horizontal line; for `\Vdots`, it's a vertical line and for `\Ddots` and `\Iddots` diagonal ones. It's possible to change the color of these lines with the option `color`.²⁵

```

\begin{bNiceMatrix}
a_1      & \Cdots &      & & a_1      & \\
\Vdots   & a_2    & \Cdots & & a_2      & \\
          & \Vdots & \Ddots[color=red] & &          & \\
\\
a_1      & a_2    &      & & a_n      & \\
\end{bNiceMatrix}

```

$$\begin{bmatrix}
a_1 \cdots \cdots \cdots a_1 \\
\vdots \\
\vdots & a_2 \cdots \cdots a_2 \\
\vdots & \vdots & \ddots \\
a_1 & a_2 & & a_n
\end{bmatrix}$$

In order to represent the null matrix, one can use the following codage:

```

\begin{bNiceMatrix}
0      & \Cdots & 0      & \\
\Vdots &      & \Vdots & \\
0      & \Cdots & 0      & \\
\end{bNiceMatrix}

```

$$\begin{bmatrix}
0 \cdots \cdots 0 \\
\vdots \\
\vdots \\
0 \cdots \cdots 0
\end{bmatrix}$$

²³The command `\iddots`, defined in `nicematrix`, is a variant of `\ddots` with dots going forward. If `mathdots` is loaded, the version of `mathdots` is used. It corresponds to the command `\adots` of `unicode-math`.

²⁴The precise definition of a "non-empty cell" is given below (cf. p. 39).

²⁵It's also possible to change the color of all theses dotted lines with the option `xdots/color` (`xdots` to remind that it works for `\Cdots`, `\Ldots`, `\Vdots`, etc.): cf. p. 23.

However, one may want a larger matrix. Usually, in such a case, the users of LaTeX add a new row and a new column. It's possible to use the same method with `nicematrix`:

```
\begin{bNiceMatrix}
0      & \Cdots & \Cdots & 0      & \\
\Vdots &         &         & \Vdots & \\
\Vdots &         &         & \Vdots & \\
0      & \Cdots & \Cdots & 0      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & \cdots & 0 \\ \vdots & & & \vdots \\ \vdots & & & \vdots \\ 0 & \cdots & \cdots & 0 \end{bmatrix}$$

In the first column of this exemple, there are two instructions `\Vdots` but, of course, only one dotted line is drawn.

In fact, in this example, it would be possible to draw the same matrix more easily with the following code:

```
\begin{bNiceMatrix}
0      & \Cdots & & 0      & \\
\Vdots &         & & \Vdots & \\
      &         & & \Vdots & \\
0      &         & \Cdots & 0      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & & 0 \\ \vdots & & & \vdots \\ & & & \vdots \\ 0 & & \cdots & 0 \end{bmatrix}$$

There are also other means to change the size of the matrix. Someone might want to use the optional argument of the command `\Vdots` for the vertical dimension and a command `\hspace*` in a cell for the horizontal dimension.²⁶

However, a command `\hspace*` might interfere with the construction of the dotted lines. That's why the package `nicematrix` provides a command `\Hspace` which is a variant of `\hspace` transparent for the dotted lines of `nicematrix`.

```
\begin{bNiceMatrix}
0      & \Cdots & \Hspace*{1cm} & 0      & \\
\Vdots &         &         & \Vdots & \\
0      & \Cdots &         & 0      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & & 0 \\ \vdots & & & \vdots \\ 0 & \cdots & & 0 \end{bmatrix}$$

10.1 The option `nullify-dots`

Consider the following matrix composed classically with the environment `{pmatrix}` of `amsmath`.

```
$A = \begin{pmatrix}
h & i & j & k & l & m \\
x & & & & & x
\end{pmatrix}$
```

$$A = \begin{pmatrix} h & i & j & k & l & m \\ x & & & & & x \end{pmatrix}$$

If we add `\ldots` instructions in the second row, the geometry of the matrix is modified.

```
$B = \begin{pmatrix}
h & i & j & k & l & m \\
x & \ldots & \ldots & \ldots & \ldots & x
\end{pmatrix}$
```

$$B = \begin{pmatrix} h & i & j & k & l & m \\ x & \dots & \dots & \dots & \dots & x \end{pmatrix}$$

By default, with `nicematrix`, if we replace `{pmatrix}` by `{pNiceMatrix}` and `\ldots` by `\Ldots`, the geometry of the matrix is not changed.

```
$C = \begin{pNiceMatrix}
h & i & j & k & l & m \\
x & \Ldots & \Ldots & \Ldots & \Ldots & x
\end{pNiceMatrix}$
```

$$C = \begin{pmatrix} h & i & j & k & l & m \\ x & \dots & \dots & \dots & \dots & x \end{pmatrix}$$

²⁶In `nicematrix`, one should use `\hspace*` and not `\hspace` for such an usage because `nicematrix` loads `array`. One may also remark that it's possible to fix the width of a column by using the environment `{NiceArray}` (or one of its variants) with a column of type `w` or `W`: see p. 16

However, one may prefer the geometry of the first matrix A and would like to have such a geometry with a dotted line in the second row. It's possible by using the option `nullify-dots` (and only one instruction `\Ldots` is necessary).

```
$D = \begin{pNiceMatrix}[nullify-dots]
h & i & j & k & l & m \\
x & \Ldots & & & & x
\end{pNiceMatrix}$
```

$$D = \begin{pmatrix} h & i & j & k & l & m \\ x & \dots & & & & x \end{pmatrix}$$

The option `nullify-dots` smashes the instructions `\Ldots` (and the variants) horizontally but also vertically.

10.2 The commands `\Hdotsfor` and `\Vdotsfor`

Some people commonly use the command `\hdotsfor` of `amsmath` in order to draw horizontal dotted lines in a matrix. In the environments of `nicematrix`, one should use instead `\Hdotsfor` in order to draw dotted lines similar to the other dotted lines drawn by the package `nicematrix`.

As with the other commands of `nicematrix` (like `\Cdots`, `\Ldots`, `\Vdots`, etc.), the dotted line drawn with `\Hdotsfor` extends until the contents of the cells on both sides.

```
$\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 \\
1 & \Hdotsfor{3} & & & 5 \\
1 & 2 & 3 & 4 & 5 \\
1 & 2 & 3 & 4 & 5
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 1 & \dots & & & 5 \\ 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 3 & 4 & 5 \end{pmatrix}$$

However, if these cells are empty, the dotted line extends only in the cells specified by the argument of `\Hdotsfor` (by design).

```
$\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 \\
& \Hdotsfor{3} \\
1 & 2 & 3 & 4 & 5 \\
1 & 2 & 3 & 4 & 5
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ & \dots & & & \\ 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 3 & 4 & 5 \end{pmatrix}$$

Remark: Unlike the command `\hdotsfor` of `amsmath`, the command `\Hdotsfor` may be used even when the package `colortbl`²⁷ is loaded (but you might have problem if you use `\rowcolor` on the same row as `\Hdotsfor`).

The package `nicematrix` also provides a command `\Vdotsfor` similar to `\Hdotsfor` but for the vertical dotted lines. The following example uses both `\Hdotsfor` and `\Vdotsfor`:

```
\begin{bNiceMatrix}
C[a_1,a_1] & \Cdots & C[a_1,a_n]
& \hspace*{20mm} & C[a_1,a_1^{(p)}] & \Cdots & C[a_1,a_n^{(p)}] \\
\Vdots & \Ddots & \Vdots
& \Hdotsfor{1} & \Vdots & \Ddots & \Vdots \\
C[a_n,a_1] & \Cdots & C[a_n,a_n]
& & C[a_n,a_1^{(p)}] & \Cdots & C[a_n,a_n^{(p)}] \\
\rule{0pt}{15mm}\NotEmpty & \Vdotsfor{1} & & \Ddots & & \Vdotsfor{1} \\
C[a_1^{(p)},a_1] & \Cdots & C[a_1^{(p)},a_n]
& & C[a_1^{(p)},a_1^{(p)}] & \Cdots & C[a_1^{(p)},a_n^{(p)}] \\
\Vdots & \Ddots & \Vdots
& \Hdotsfor{1} & \Vdots & \Ddots & \Vdots \\
C[a_n^{(p)},a_1] & \Cdots & C[a_n^{(p)},a_n]
& & C[a_n^{(p)},a_1^{(p)}] & \Cdots & C[a_n^{(p)},a_n^{(p)}]
\end{bNiceMatrix}
```

²⁷We recall that when `xcolor` is loaded with the option `table`, the package `colortbl` is loaded.

$$\left[\begin{array}{ccc} C[a_1, a_1] \cdots \cdots C[a_1, a_n] & & C[a_1, a_1^{(p)}] \cdots \cdots C[a_1, a_n^{(p)}] \\ \vdots & \ddots & \vdots \\ C[a_n, a_1] \cdots \cdots C[a_n, a_n] & & C[a_n, a_1^{(p)}] \cdots \cdots C[a_n, a_n^{(p)}] \\ & \ddots & \\ C[a_1^{(p)}, a_1] \cdots \cdots C[a_1^{(p)}, a_n] & & C[a_1^{(p)}, a_1^{(p)}] \cdots \cdots C[a_1^{(p)}, a_n^{(p)}] \\ \vdots & \ddots & \vdots \\ C[a_n^{(p)}, a_1] \cdots \cdots C[a_n^{(p)}, a_n] & & C[a_n^{(p)}, a_1^{(p)}] \cdots \cdots C[a_n^{(p)}, a_n^{(p)}] \end{array} \right]$$

10.3 How to generate the continuous dotted lines transparently

Imagine you have a document with a great number of mathematical matrices with ellipsis. You may wish to use the dotted lines of `nicematrix` without having to modify the code of each matrix. It's possible with the keys `renew-dots` and `renew-matrix`.²⁸

- The option `renew-dots`

With this option, the commands `\ldots`, `\cdots`, `\vdots`, `\ddots`, `\iddots`²³ and `\hdotsfor` are redefined within the environments provided by `nicematrix` and behave like `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor`; the command `\dots` (“automatic dots” of `amsmath`) is also redefined to behave like `\Ldots`.

- The option `renew-matrix`

With this option, the environment `{matrix}` is redefined and behave like `{NiceMatrix}`, and so on for the five variants.

Therefore, with the keys `renew-dots` and `renew-matrix`, a classical code gives directly the output of `nicematrix`.

```
\NiceMatrixOptions{renew-dots,renew-matrix}
\begin{pmatrix}
1 & & \cdots & & \cdots & & 1 & \\
0 & & \ddots & & & & & \vdots \\
\vdots & & \ddots & & \ddots & & \vdots & \\
0 & & \cdots & & 0 & & & 1
\end{pmatrix}
\end{pmatrix}
```

$$\begin{pmatrix} 1 & & \cdots & & \cdots & & 1 \\ 0 & & \ddots & & & & \vdots \\ \vdots & & \ddots & & \ddots & & \vdots \\ 0 & & \cdots & & 0 & & 1 \end{pmatrix}$$

10.4 The labels of the dotted lines

The commands `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` (and the command `\line` in the `\CodeAfter` which is described p. 24) accept two optional arguments specified by the tokens `_` and `^` for labels positionned below and above the line. The arguments are composed in math mode with `\scriptstyle`.

```
$\begin{bNiceMatrix}
1 & & \hspace*{1cm} & & 0 & \ll[8mm]
& & \Ddots^{n \text{ times}} & & & \\
0 & & & & & 1 \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 1 & & & & 0 \\ & \ddots & & & \\ & & n \text{ times} & & \\ 0 & & & & 1 \end{bmatrix}$$

²⁸The options `renew-dots`, `renew-matrix` can be fixed with the command `\NiceMatrixOptions` like the other options. However, they can also be fixed as options of the command `\usepackage`. There is also a key `transparent` which is an alias for the conjunction of `renew-dots` and `renew-matrix` but it must be considered as obsolete.

10.5 Customisation of the dotted lines

The dotted lines drawn by `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` (and by the command `\line` in the `\CodeAfter` which is described p. 24) may be customized by three options (specified between square brackets after the command):

- `color`;
- `shorten`;
- `line-style`.

These options may also be fixed with `\NiceMatrixOptions`, as options of `\CodeAfter` or at the level of a given environment but, in those cases, they must be prefixed by `xdots`, and, thus have for names:

- `xdots/color`;
- `xdots/shorten`;
- `xdots/line-style`.

For the clarity of the explanations, we will use those names.

The option `xdots/color`

The option `xdots/color` fixes the color of the dotted line. However, one should remark that the dotted lines drawn in the exterior rows and columns have a special treatment: cf. p. 17.

The option `xdots/shorten`

The option `xdots/shorten` fixes the margin of both extremities of the line. The name is derived from the options “`shorten >`” and “`shorten <`” of Tikz but one should notice that `nicematrix` only provides `xdots/shorten`. The initial value of this parameter is 0.3 em (it is recommended to use a unit of length dependent of the current font).

The option `xdots/line-style`

It should be pointed that, by default, the lines drawn by Tikz with the parameter `dotted` are composed of square dots (and not rounded ones).²⁹

`\tikz \draw [dotted] (0,0) -- (5,0) ;`

In order to provide lines with rounded dots in the style of those provided by `\ldots` (at least with the *Computer Modern* fonts), the package `nicematrix` embeds its own system to draw a dotted line (and this system uses PGF and not Tikz). This style is called **standard** and that’s the initial value of the parameter `xdots/line-style`.

However (when Tikz is loaded) it’s possible to use for `xdots/line-style` any style provided by Tikz, that is to say any sequence of options provided by Tikz for the Tikz pathes (with the exception of “`color`”, “`shorten >`” and “`shorten <`”).

Here is for example a tridiagonal matrix with the style `loosely dotted`:

```
\begin{pNiceMatrix}[nullify-dots,xdots/line-style=loosely dotted]
a      & b      & 0      & & & \Cdots & 0      & \\
b      & a      & b      & & \Ddots & & \Vdots & \\
0      & b      & a      & & \Ddots & & & \\
      & \Ddots & \Ddots & & \Ddots & & 0      & \\
\Vdots & & & & & & b      & \\
0      & \Cdots & & & 0      & b      & a      & 
\end{pNiceMatrix}
```

$$\begin{pmatrix} a & b & 0 & \cdots & 0 \\ b & a & b & \cdots & \\ 0 & b & a & \cdots & \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & \cdots & 0 & b & a \end{pmatrix}$$

²⁹The first reason of this behaviour is that the PDF format includes a description for dashed lines. The lines specified with this descriptor are displayed very efficiently by the PDF readers. It’s easy, starting from these dashed lines, to create a line composed by square dots whereas a line of rounded dots needs a specification of each dot in the PDF file.

10.6 The dotted lines and the rules

The dotted lines determine virtual blocks which have the same behaviour regarding the rules (the rules specified by the specifier `|` in the preamble, by the command `\Hline` and by the keys `hlines`, `vlines` and `hvlines` are not drawn within the blocks).³⁰

```
\begin{bNiceMatrix}[margin,hvlines]
\Block{3-3}<\LARGE>\{A\} & & 0 \\
& \hspace*{1cm} & & \Vdots \\
& & 0 \\
0 & \Cdots & 0 & 0
\end{bNiceMatrix}
```

$$\left[\begin{array}{ccc|c} & & & 0 \\ & & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array} \right]$$

11 The `\CodeAfter`

The option `code-after` may be used to give some code that will be executed *after* the construction of the matrix.³¹

For the legibility of the code, an alternative syntax is provided: it's possible to give the instructions of the `code-after` at the end of the environment, after the keyword `\CodeAfter`. Although `\CodeAfter` is a keyword, it takes in an optional argument (between square brackets). The keys accepted form a subset of the keys of the command `\WithArrowsOptions`.

The experienced users may, for instance, use the PGF/Tikz nodes created by `nicematrix` in the `\CodeAfter`. These nodes are described further beginning on p. 34.

Moreover, two special commands are available in the `\CodeAfter`: `line` and `\SubMatrix`.

11.1 The command `\line` in the `\CodeAfter`

The command `\line` draws directly dotted lines between nodes. It takes in two arguments for the two cells to link, both of the form *i-j* where *i* is the number of the row and *j* is the number of the column. The options available for the customisation of the dotted lines created by `\Cdots`, `\Vdots`, etc. are also available for this command (cf. p. 23).

This command may be used, for example, to draw a dotted line between two adjacent cells.

```
\NiceMatrixOptions{xdots/shorten = 0.6 em}
\begin{pNiceMatrix}
I & 0 & & \Cdots & 0 & \\
0 & & I & & \Ddots & \Vdots \\
\Vdots & & \Ddots & & I & 0 \\
0 & & \Cdots & & 0 & I
\CodeAfter \line{2-2}{3-3}
\end{pNiceMatrix}
```

$$\begin{pmatrix} I & 0 & \cdots & 0 \\ 0 & & I & \\ \vdots & & \ddots & I \\ 0 & \cdots & 0 & I \end{pmatrix}$$

It can also be used to draw a diagonal line not parallel to the other diagonal lines (by default, the dotted lines drawn by `\Ddots` are “parallelized”: cf. p. 39).

³⁰On the other side, the command `\line` in the `\CodeAfter` (cf. p. 24) does *not* create block.

³¹There is also a key `code-before` described p. 12.

```

\begin{bNiceMatrix}
1      & \Cdots & & 1      & & 2      & & \Cdots & & 2      & \\\
0      & \Ddots & & \Vdots & & \Vdots & & \hspace*{2.5cm} & & \Vdots & \\\
\Vdots & \Ddots & & & & & & & & & \\\
0      & \Cdots & 0 & 1      & & 2      & & \Cdots & & 2      & \\
\CodeAfter \line[shorten=6pt]{1-5}{4-7}
\end{bNiceMatrix}

```

$$\left[\begin{array}{cc|cc} 1 & \cdots & 1 & 2 \\ 0 & \ddots & \vdots & \vdots \\ \vdots & \ddots & \vdots & \vdots \\ 0 & \cdots & 0 & 1 \end{array} \right]$$

11.2 The command `\SubMatrix` in the `\CodeAfter`

The command `\SubMatrix` provides a way to put delimiters on a portion of the array considered as a submatrix. The command `\SubMatrix` takes in five arguments:

- the first argument is the left delimiter, which may be any extensible delimiter provided by LaTeX : `(`, `[`, `\{`, `\langle`, `\lgroup`, `\lfloor`, etc. but also the null delimiter `.`;
- the second argument is the upper-left corner of the submatrix with the syntax $i-j$ where i the number of row and j the number of column;
- the third argument is the lower-right corner with the same syntax;
- the fourth argument is the right delimiter;
- the last argument, which is optional, is a list of key-value pairs.³²

One should remark that the command `\SubMatrix` draws the delimiters after the construction of the array: no space is inserted by the command `\SubMatrix` itself. That's why, in the following example, we have used the key `margin` and you have added by hand some space between the third and fourth column with `@{\hspace{1.5em}}` in the preamble of the array.

```

\[\begin{NiceArray}{ccc@{\hspace{1.5em}}c}[cell-space-limits=2pt,margin]
1      & & 1      & & 1      & & x \\\
\dfrac{1}{4} & & \dfrac{1}{2} & & \dfrac{1}{4} & & y \\\
1      & & 2      & & 3      & & z \\
\CodeAfter
  \SubMatrix({1-1}{3-3})
  \SubMatrix({1-4}{3-4})
\end{NiceArray}\]

```

$$\begin{pmatrix} 1 & 1 & 1 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 1 & 2 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

New 5.18 In fact, the command `\SubMatrix` also takes in two optional arguments specified by the traditionnal symbols `^` and `_` for material in superscript and subscript.

```

$\begin{bNiceMatrix}[right-margin=1em]
1 & 1 & 1 \\\
1 & a & b \\\
1 & c & d \\
\CodeAfter
  \SubMatrix[{2-2}{3-3}]^{\mathrm{T}}
\end{bNiceMatrix}$

```

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & b \\ 1 & c & d \end{bmatrix}^T$$

The options of the command `\SubMatrix` are as follows:

³²There is no optional argument between square brackets in first position because a square bracket just after `\SubMatrix` must be interpreted as the first (mandatory) argument of the command `\SubMatrix`: that bracket is the left delimiter of the sub-matrix to construct (eg.: `\SubMatrix[{2-2}{4-7}]`).

- `left-xshift` and `right-shift` shift horizontally the delimiters (there exists also the key `xshift` which fixes both parameters);
- `extra-height` adds a quantity to the total height of the delimiters (height $\backslash ht$ + depth $\backslash dp$);
- `delimiters/color` fixes the color of the delimiters (also available in `\NiceMatrixOptions`, in the environments with delimiters and as option of the keyword `\CodeAfter`);
- `slim` is a boolean key: when that key is in force, the horizontal position of the delimiters is computed by using only the contents of the cells of the submatrix whereas, in the general case, the position is computed by taking into account the cells of the whole columns implied in the submatrix (see example below). ;
- `vlines` contents a list of numbers of vertical rules that will be drawn in the sub-matrix (if this key is used without value, all the vertical rules of the sub-matrix are drawn);
- `hlines` is similar to `vlines` but for the horizontal rules;
- `hvlines`, which must be used without value, draws all the vertical and horizontal rules.

One should remark that these keys add their rules after the construction of the main matrix: no space is added between the rows and the columns of the array for theses rules.

All these keys are also available in `\NiceMatrixOptions`, at the level of the environments of `nicematrix` or as option of the command `\CodeAfter` with the prefix `sub-matrix` which means that their names are therefore `sub-matrix/left-xshift`, `sub-matrix/right-xshift`, `sub-matrix/xshift`, etc.

```


$$\begin{array}{cc|c}
& & \frac{1}{2} \\
& & \frac{1}{4} \\
a & b & \frac{1}{2}a + \frac{1}{4}b \\
c & d & \frac{1}{2}c + \frac{1}{4}d
\end{array}
\begin{array}{c}
\left( \begin{array}{cc} a & b \\ c & d \end{array} \right)
\begin{array}{c}
\left( \begin{array}{c} \frac{1}{2}a + \frac{1}{4}b \\ \frac{1}{2}c + \frac{1}{4}d \end{array} \right)
\end{array}
\end{array}$$


```

Here is the same example with the key `slim` used for one of the submatrices.

```


$$\begin{array}{cc|c}
& & \frac{1}{2} \\
& & \frac{1}{4} \\
a & b & \frac{1}{2}a + \frac{1}{4}b \\
c & d & \frac{1}{2}c + \frac{1}{4}d
\end{array}
\begin{array}{c}
\left( \begin{array}{cc} a & b \\ c & d \end{array} \right)
\begin{array}{c}
\left( \begin{array}{c} \frac{1}{2}a + \frac{1}{4}b \\ \frac{1}{2}c + \frac{1}{4}d \end{array} \right)
\end{array}
\end{array}$$


```

There is also a key `name` which gives a name to the submatrix created by `\SubMatrix`. That name is used to create PGF/Tikz nodes: cf p. 37.

It's also possible to specify some delimiters³³ by placing them in the preamble of the environment (for the environments with a preamble: `{NiceArray}`, `{pNiceArray}`, etc.). This syntax is inspired by the extension `blkarray`.

When there are two successive delimiters (necessarily a closing one following by an opening one for another submatrix), a space equal to `\enskip` is automatically inserted.

³³Those delimiters are `(`, `[`, `\{` and the closing ones. Of course, it's also possible to put `|` and `||` in the preamble of the environment.

```

 $\begin{pNiceArray}{(c)(c)(c)}
a_{11} & a_{12} & a_{13} \\
a_{21} & \displaystyle \int_0^1 \frac{1}{x^2+1} dx & a_{23} \\
a_{31} & a_{32} & a_{33}
\end{pNiceArray}$ 

```

$$\begin{pmatrix} a_{11} \\ a_{21} \\ a_{31} \end{pmatrix} \begin{pmatrix} a_{12} \\ \int_0^1 \frac{1}{x^2+1} dx \\ a_{32} \end{pmatrix} \begin{pmatrix} a_{13} \\ a_{23} \\ a_{33} \end{pmatrix}$$

12 The notes in the tabulars

12.1 The footnotes

The package `nicematrix` allows, by using `footnote` or `footnotehyper`, the extraction of the notes inserted by `\footnote` in the environments of `nicematrix` and their composition in the footpage with the other notes of the document.

If `nicematrix` is loaded with the option `footnote` (with `\usepackage[footnote]{nicematrix}` or with `\PassOptionsToPackage`), the package `footnote` is loaded (if it is not yet loaded) and it is used to extract the footnotes.

If `nicematrix` is loaded with the option `footnotehyper`, the package `footnotehyper` is loaded (if it is not yet loaded) and it is used to extract footnotes.

Caution: The packages `footnote` and `footnotehyper` are incompatible. The package `footnotehyper` is the successor of the package `footnote` and should be used preferently. The package `footnote` has some drawbacks, in particular: it must be loaded after the package `xcolor` and it is not perfectly compatible with `hyperref`.

12.2 The notes of tabular

The package `nicematrix` also provides a command `\tabularnote` which gives the ability to specify notes that will be composed at the end of the array with a width of line equal to the width of the array (excepted the potential exterior columns). With no surprise, that command is available only in the environments without delimiters, that is to say `{NiceTabular}`, `{NiceArray}` and `{NiceMatrix}`. In fact, this command is available only if the extension `enumitem` has been loaded (before or after `nicematrix`). Indeed, the notes are composed at the end of the array with a type of list provided by the package `enumitem`.

```

\begin{NiceTabular}{@{}llr@{}}[first-row,code-for-first-row = \bfseries]
\toprule
Last name & First name & Birth day \\
\midrule
Achard\tabularnote{Achard is an old family of the Poitou.}
& Jacques & 5 juin 1962 \\
Lefebvre\tabularnote{The name Lefebvre is an alteration of the name Lefebure.}
& Mathilde & 23 mai 1988 \\
Vanesse & Stephany & 30 octobre 1994 \\
Dupont & Chantal & 15 janvier 1998 \\
\bottomrule
\end{NiceTabular}

```

Last name	First name	Birth day
Achard ^a	Jacques	June 5, 2005
Lefebvre ^b	Mathilde	January 23, 1975
Vanesse	Stephany	October 30, 1994
Dupont	Chantal	January 15, 1998

^a Achard is an old family of the Poitou.

^b The name Lefebvre is an alteration of the name Lefebure.

- If you have several successive commands `\tabularnote{...}` with no space at all between them, the labels of the corresponding notes are composed together, separated by commas (this is similar to the option `multiple` of `footmisc` for the footnotes).
- If a command `\tabularnote{...}` is exactly at the end of a cell (with no space at all after), the label of the note is composed in an overlapping position (towards the right). This structure may provide a better alignment of the cells of a given column.
- If the key `notes/para` is used, the notes are composed at the end of the array in a single paragraph (as with the key `para` of `threeparttable`).
- There is a key `tabularnote` which provides a way to insert some text in the zone of the notes before the numbered tabular notes.
- If the package `booktabs` has been loaded (before or after `nicematrix`), the key `notes/bottomrule` draws a `\bottomrule` of `booktabs` after the notes.
- The command `\tabularnote` may be used before the environment of `nicematrix`. Thus, it's possible to use it on the title inserted by `\caption` in an environment `{table}` of LaTeX.
- It's possible to create a reference to a tabular note created by `\tabularnote` (with the usual command `\label` used after the `\tabularnote`).

For an illustration of some of those remarks, see table 1, p. 29. This table has been composed with the following code.

```
\begin{table}
\setlength{\belowcaptionskip}{1ex}
\centering
\caption{Use of \texttt{\textbackslash tabularnote}\tabularnote{It's possible
to put a note in the caption.}}
\label{t:tabularnote}
\begin{NiceTabular}{@{}llc@{}}
[notes/bottomrule, tabularnote = Some text before the notes.]
\toprule
Last name & First name & Length of life \\
\midrule
Churchill & Wiston & 91\\
Nightingale\tabularnote{Considered as the first nurse of
history.}\tabularnote{Nicknamed ``the Lady with the Lamp''.}
& Florence & 90 \\
Schoelcher & Victor & 89\tabularnote{The label of the note is overlapping.}\\
Touchet & Marie & 89 \\
Wallis & John & 87 \\
\bottomrule
\end{NiceTabular}
\end{table}
```

12.3 Customisation of the tabular notes

The tabular notes can be customized with a set of keys available in `\NiceMatrixOptions`. The name of these keys is prefixed by `notes`.

- `notes/para`
- `notes/bottomrule`
- `notes/style`
- `notes/label-in-tabular`
- `notes/label-in-list`
- `notes/enumitem-keys`
- `notes/enumitem-keys-para`
- `notes/code-before`

For sake of commodity, it is also possible to set these keys in `\NiceMatrixOptions` via a key `notes` which takes in as value a list of pairs `key=value` where the name of the keys need no longer be prefixed by `notes`:

```
\NiceMatrixOptions
{
  notes =
  {
    bottomrule ,
    style = ... ,
    label-in-tabular = ... ,
    enumitem-keys =
    {
      labelsep = ... ,
      align = ... ,
      ...
    }
  }
}
```

We detail these keys.

- The key `notes/para` requires the composition of the notes (at the end of the tabular) in a single paragraph.

Initial value: `false`

That key is also available within a given environment.

Table 1: Use of `\tablarnote`^a

Last name	First name	Length of life
Churchill	Wiston	91
Nightingale ^{b,c}	Florence	90
Schoelcher	Victor	89 ^d
Touchet	Marie	89
Wallis	John	87

Some text before the notes.

^a It's possible to put a note in the caption.

^b Considered as the first nurse of history.

^c Nicknamed “the Lady with the Lamp”.

^d The label of the note is overlapping.

- The key `notes/bottomrule` adds a `\bottomrule` of `booktabs` *after* the notes. Of course, that rule is drawn only if there is really notes in the tabular. The package `booktabs` must have been loaded (before or after the package `nicematrix`). If it is not, an error is raised.

Initial value: `false`

That key is also available within a given environment.

- The key `notes/style` is a command whose argument is specified by `#1` and which gives the style of numerotation of the notes. That style will be used by `\ref` when referencing a tabular note marked with a command `\label`. The labels formatted by that style are used, separated by commas, when the user puts several consecutive commands `\tabularnote`. The marker `#1` is meant to be the name of a LaTeX counter.

Initial value: `\textit{\alph{#1}}`

Another possible value should be a mere `\arabic{#1}`

- The key `notes/label-in-tabular` is a command whose argument is specified by `#1` which is used when formatting the label of a note in the tabular. Internally, this number of note has already been formatted by `notes/style` before sent to that command.

Initial value: `#1`

In French, it's a tradition of putting a small space before the label of note. That tuning could be achieved by the following code:

```
\NiceMatrixOptions{notes/label-in-tabular = \,\textsuperscript{#1}}
```

- The key `notes/label-in-list` is a command whose argument is specified by `#1` which is used when formatting the label in the list of notes at the end of the tabular. Internally, this number of note has already been formatted by `notes/style` before sent to that command.

Initial value: `#1`

In French, the labels of notes are not composed in upper position when composing the notes. Such behaviour could be achieved by:

```
\NiceMatrixOptions{notes/label-in-list = #1.\nobreak\hspace{0.25em}}
```

The command `\nobreak` is for the event that the option `para` is used.

- The notes are composed at the end of the tabular by using internally a style of list of `enumitem`. The key `notes/enumitem-keys` specifies a list of pairs `key=value` (following the specifications of `enumitem`) to customize that type of list.

Initial value: `noitemsep , leftmargin = * , align = left , labelsep = Opt`

This initial value contains the specification `align = left` which requires a composition of the label leftwards in the box affected to that label. With that tuning, the notes are composed flush left, which is pleasant when composing tabulars in the spirit of `booktabs` (see for example the table 1, p. 29).

- The key `notes/enumitem-keys-para` is similar to the previous one but corresponds to the type of list used when the option `para` is in force. Of course, when the option `para` is used, a list of type `inline` (as called by `enumitem`) is used and the pairs `key=value` should correspond to such a list of type `inline`.

Initial value: `afterlabel = \nobreak, itemjoin = \quad`

- The key `notes/code-before` is a token list inserted by `nicematrix` just before the composition of the notes at the end of the tabular.

Initial value: `empty`

For example, if one wishes to compose all the notes in gray and `\footnotesize`, he should use that key:

```
\NiceMatrixOptions{notes/code-before = \footnotesize \color{gray}}
```

It's also possible to add `\raggedright` or `\RaggedRight` in that key (`\RaggedRight` is a command of `ragged2e`).

For an example of customisation of the tabular notes, see p. 41.

12.4 Use of `{NiceTabular}` with `threeparttable`

If you wish to use the environment `{NiceTabular}` or `{NiceTabular*}` in an environment `{threeparttable}` of the eponymous package, you have to patch the environment `{threeparttable}` with the following code (with a version of LaTeX at least 2020/10/01).

```
\makeatletter
\AddToHook{env/threeparttable/begin}
  {\TPT@hookin{NiceTabular}\TPT@hookin{NiceTabular*}}
\makeatother
```

13 Other features

13.1 Use of the column type `S` of `siunitx`

If the package `siunitx` is loaded (before or after `nicematrix`), it's possible to use the `S` column type of `siunitx` in the environments of `nicematrix`. The implementation doesn't use explicitly any private macro of `siunitx`.

```
$\begin{pNiceArray}{\ScWc{1cm}c}[nullify-dots,first-row]
{C_1} & \Cdots & & C_n \\
2.3 & 0 & \Cdots & 0 \\
12.4 & \Vdots & & \Vdots \\
1.45 & \\
7.2 & 0 & \Cdots & 0 \\
\end{pNiceArray}$
```

$$\begin{pmatrix} C_1 & \dots & C_n \\ 2.3 & 0 & \dots & 0 \\ 12.4 & \vdots & & \vdots \\ 1.45 & \vdots & & \vdots \\ 7.2 & 0 & \dots & 0 \end{pmatrix}$$

On the other hand, the `d` columns of the package `dcolumn` are not supported by `nicematrix`.

13.2 Alignment option in `{NiceMatrix}`

The environments without preamble (`{NiceMatrix}`, `{pNiceMatrix}`, `{bNiceMatrix}`, etc.) provide two options `l` and `r` which generate all the columns aligned leftwards (or rightwards).

```
$\begin{bNiceMatrix}[r]
\cos x & - \sin x \\
\sin x & \cos x
\end{bNiceMatrix}$
```

$$\begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$$

13.3 The command `\rotate`

The package `nicematrix` provides a command `\rotate`. When used in the beginning of a cell, this command composes the contents of the cell after a rotation of 90° in the direct sens.

In the following command, we use that command in the `code-for-first-row`.³⁴

³⁴It can also be used in `RowStyle` (cf. p. 16).

```

\NiceMatrixOptions%
{code-for-first-row = \scriptstyle \rotate \text{image of },
code-for-last-col = \scriptstyle }
$A = \begin{pNiceMatrix}[first-row,last-col=4]
e_1 & e_2 & e_3 & \\
1 & 2 & 3 & e_1 \\
4 & 5 & 6 & e_2 \\
7 & 8 & 9 & e_3
\end{pNiceMatrix}$

```

$$A = \begin{pmatrix} \text{image of } e_1 & \text{image of } e_2 & \text{image of } e_3 \\ 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \begin{matrix} e_1 \\ e_2 \\ e_3 \end{matrix}$$

If the command `\rotate` is used in the “last row” (exterior to the matrix), the corresponding elements are aligned upwards as shown below.

```

\NiceMatrixOptions%
{code-for-last-row = \scriptstyle \rotate ,
code-for-last-col = \scriptstyle }
$A = \begin{pNiceMatrix}[last-row=4,last-col=4]
1 & 2 & 3 & e_1 \\
4 & 5 & 6 & e_2 \\
7 & 8 & 9 & e_3 \\
\text{image of } e_1 & \text{image of } e_2 & \text{image of } e_3 & 
\end{pNiceMatrix}$

```

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \begin{matrix} e_1 \\ e_2 \\ e_3 \end{matrix}$$

13.4 The option `small`

With the option `small`, the environments of the package `nicematrix` are composed in a way similar to the environment `{smallmatrix}` of the package `amsmath` (and the environments `{psmallmatrix}`, `{bsmallmatrix}`, etc. of the package `mathtools`).

```

$\begin{bNiceArray}{cccc|c}[small,
last-col,
code-for-last-col = \scriptscriptstyle,
columns-width = 3mm ]
1 & -2 & 3 & 4 & 5 \\
0 & 3 & 2 & 1 & 2 & L_2 \text{ \gets } 2L_1 - L_2 \\
0 & 1 & 1 & 2 & 3 & L_3 \text{ \gets } L_1 + L_2
\end{bNiceArray}$

```

$$\left[\begin{array}{cccc|c} 1 & -2 & 3 & 4 & 5 \\ 0 & 3 & 2 & 1 & 2 \\ 0 & 1 & 1 & 2 & 3 \end{array} \right] \begin{matrix} \\ L_2 \leftarrow 2L_1 - L_2 \\ L_3 \leftarrow L_1 + L_2 \end{matrix}$$

One should note that the environment `{NiceMatrix}` with the option `small` is not composed *exactly* as the environment `{smallmatrix}`. Indeed, all the environments of `nicematrix` are constructed upon `{array}` (of the package `array`) whereas the environment `{smallmatrix}` is constructed directly with an `\halign` of TeX.

In fact, the option `small` corresponds to the following tuning:

- the cells of the array are composed with `\scriptstyle`;
- `\arraystretch` is set to 0.47;
- `\arraycolsep` is set to 1.45 pt;
- the characteristics of the dotted lines are also modified.

13.5 The counters iRow and jCol

In the cells of the array, it's possible to use the LaTeX counters `iRow` and `jCol` which represent the number of the current row and the number of the current column³⁵. Of course, the user must not change the value of these counters which are used internally by `nicematrix`.

In the `\CodeBefore` (cf. p. 12) and in the `\CodeAfter` (cf. p. 24), `iRow` represents the total number of rows (excepted the potential exterior rows) and `jCol` represents the total number of columns (excepted the potential exterior columns).

```
$\begin{pNiceMatrix}% don't forget the %
  [first-row,
   first-col,
   code-for-first-row = \mathbf{\alphajCol} ,
   code-for-first-col = \mathbf{\arabic{iRow}} ]
& & & & \\
& 1 & 2 & 3 & 4 \\
& 5 & 6 & 7 & 8 \\
& 9 & 10 & 11 & 12
\end{pNiceMatrix}$
```

$$\begin{matrix} & \mathbf{a} & \mathbf{b} & \mathbf{c} & \mathbf{d} \\ \mathbf{1} & \begin{pmatrix} 1 & 2 & 3 & 4 \end{pmatrix} \\ \mathbf{2} & \begin{pmatrix} 5 & 6 & 7 & 8 \end{pmatrix} \\ \mathbf{3} & \begin{pmatrix} 9 & 10 & 11 & 12 \end{pmatrix} \end{matrix}$$

If LaTeX counters called `iRow` and `jCol` are defined in the document by packages other than `nicematrix` (or by the final user), they are shadowed in the environments of `nicematrix`.

The package `nicematrix` also provides commands in order to compose automatically matrices from a general pattern. These commands are `\AutoNiceMatrix`, `\pAutoNiceMatrix`, `\bAutoNiceMatrix`, `\vAutoNiceMatrix`, `\VAutoNiceMatrix` and `\BAutoNiceMatrix`.

These commands take in two mandatory arguments. The first is the format of the matrix, with the syntax `n-p` where `n` is the number of rows and `p` the number of columns. The second argument is the pattern (it's a list of tokens which are inserted in each cell of the constructed matrix, excepted in the cells of the potential exterior rows and columns).

```
$C = \pAutoNiceMatrix{3-3}{C_{\arabic{iRow},\arabic{jCol}}}$
```

$$C = \begin{pmatrix} C_{1,1} & C_{1,2} & C_{1,3} \\ C_{2,1} & C_{2,2} & C_{2,3} \\ C_{3,1} & C_{3,2} & C_{3,3} \end{pmatrix}$$

13.6 The option light-syntax

The option `light-syntax` (inpired by the package `spalign`) allows the user to compose the arrays with a lighter syntax, which gives a better legibility of the TeX source.

When this option is used, one should use the semicolon for the end of a row and spaces or tabulations to separate the columns. However, as usual in the TeX world, the spaces after a control sequence are discarded and the elements between curly braces are considered as a whole.

```
$\begin{bNiceMatrix}[light-syntax,first-row,first-col]
{} a & & b & ;
a & 2\cos a & {\cos a + \cos b} & ;
b & \cos a + \cos b & { 2 \cos b } & 
\end{bNiceMatrix}$
```

$$\begin{matrix} & a & b \\ a & \begin{bmatrix} 2 \cos a & \cos a + \cos b \end{bmatrix} \\ b & \begin{bmatrix} \cos a + \cos b & 2 \cos b \end{bmatrix} \end{matrix}$$

It's possible to change the character used to mark the end of rows with the option `end-of-row`. As said before, the initial value is a semicolon.

When the option `light-syntax` is used, it is not possible to put verbatim material (for example with the command `\verb`) in the cells of the array.³⁶

³⁵We recall that the exterior “first row” (if it exists) has the number 0 and that the exterior “first column” (if it exists) has also the number 0.

³⁶The reason is that, when the option `light-syntax` is used, the whole content of the environment is loaded as a TeX argument to be analyzed. The environment doesn't behave in that case as a standard environment of LaTeX which only put TeX commands before and after the content.

13.7 Color of the delimiters

For the environments with delimiters (`{pNiceArray}`, `{pNiceMatrix}`, etc.), it's possible to change the color of the delimiters with the key `delimiters/color`.

```

\begin{bNiceMatrix}[delimiters/color=red]
1 & 2 & \\
3 & 4 & 
\end{bNiceMatrix}
```

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

This colour also applies to the delimiters drawn by the command `\SubMatrix` (cf. p. 25).

13.8 The environment `{NiceArrayWithDelims}`

In fact, the environment `{pNiceArray}` and its variants are based upon a more general environment, called `{NiceArrayWithDelims}`. The first two mandatory arguments of this environment are the left and right delimiters used in the construction of the matrix. It's possible to use `{NiceArrayWithDelims}` if we want to use atypical or asymmetrical delimiters.

```

\begin{NiceArrayWithDelims}
{\downarrow}{\uparrow}{ccc}[margin]
1 & 2 & 3 & \\
4 & 5 & 6 & \\
7 & 8 & 9 & 
\end{NiceArrayWithDelims}
```

$$\begin{array}{ccc} \downarrow & 1 & 2 & 3 & \uparrow \\ & 4 & 5 & 6 & \\ & 7 & 8 & 9 & \end{array}$$

14 Use of Tikz with nicematrix

14.1 The nodes corresponding to the contents of the cells

The package `nicematrix` creates a PGF/Tikz node for each (non-empty) cell of the considered array. These nodes are used to draw the dotted lines between the cells of the matrix (inter alia).

Caution : By default, no node is created in a empty cell.

However, it's possible to impose the creation of a node with the command `\NotEmpty`. ³⁷

The nodes of a document must have distinct names. That's why the names of the nodes created by `nicematrix` contains the number of the current environment. Indeed, the environments of `nicematrix` are numbered by a internal global counter.

In the environment with the number n , the node of the row i and column j has for name `nm-n-i-j`. The command `\NiceMatrixLastEnv` provides the number of the last environment of `nicematrix` (for LaTeX, it's a “fully expandable” command and not a counter).

However, it's advisable to use instead the key `name`. This key gives a name to the current environment. When the environment has a name, the nodes are accessible with the name “*name-i-j*” where *name* is the name given to the array and i and j the numbers of row and column. It's possible to use these nodes with PGF but the final user will probably prefer to use Tikz (which is a convenient layer upon PGF). However, one should remind that `nicematrix` doesn't load Tikz by default. In the following examples, we assume that Tikz has been loaded.

```

\begin{pNiceMatrix}[name=mymatrix]
1 & 2 & 3 & \\
4 & 5 & 6 & \\
7 & 8 & 9 & 
\end{pNiceMatrix}
\tikz[remember picture,overlay]
\draw (mymatrix-2-2) circle (2mm) ;
```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & \textcircled{5} & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

³⁷One should note that, with that command, the cell is considered as non-empty, which has consequences for the continuous dotted lines (cf. p. 19) and the computation of the “corners” (cf. p. 10).

Don't forget the options `remember picture` and `overlay`.

In the `\CodeAfter`, the things are easier : one must refer to the nodes with the form i - j (we don't have to indicate the environment which is of course the current environment).

```

 $\begin{pNiceMatrix}$ 
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9
 $\CodeAfter$ 
\tikz \draw (2-2) circle (2mm) ;
 $\end{pNiceMatrix}$ 

```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & \textcircled{5} & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

In the following example, we have underlined all the nodes of the matrix (we explain below the technic used : cf. p. 46).

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

14.2 The “medium nodes” and the “large nodes”

In fact, the package `nicematrix` can create “extra nodes”: the “medium nodes” and the “large nodes”. The first ones are created with the option `create-medium-nodes` and the second ones with the option `create-large-nodes`.³⁸

These nodes are not used by `nicematrix` by default, and that's why they are not created by default.

The names of the “medium nodes” are constructed by adding the suffix “-medium” to the names of the “normal nodes”. In the following example, we have underlined the “medium nodes”. We consider that this example is self-explanatory.

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

The names of the “large nodes” are constructed by adding the suffix “-large” to the names of the “normal nodes”. In the following example, we have underlined the “large nodes”. We consider that this example is self-explanatory.³⁹

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

The “large nodes” of the first column and last column may appear too small for some usage. That's why it's possible to use the options `left-margin` and `right-margin` to add space on both sides of the array and also space in the “large nodes” of the first column and last column. In the following example, we have used the options `left-margin` and `right-margin`.⁴⁰

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

³⁸There is also an option `create-extra-nodes` which is an alias for the conjunction of `create-medium-nodes` and `create-large-nodes`.

³⁹There is no “large nodes” created in the exterior rows and columns (for these rows and columns, cf. p. 17).

⁴⁰The options `left-margin` and `right-margin` take dimensions as values but, if no value is given, the default value is used, which is `\arraycolsep` (by default: 5 pt). There is also an option `margin` to fix both `left-margin` and `right-margin` to the same value.

It's also possible to add more space on both side of the array with the options `extra-left-margin` and `extra-right-margin`. These margins are not incorporated in the “large nodes”. It's possible to fix both values with the option `extra-margin` and, in the following example, we use `extra-margin` with the value 3 pt.

$$\left(\begin{array}{|c|c|c|} \hline a & a+b & a+b+c \\ \hline a & a & a+b \\ \hline a & a & a \\ \hline \end{array} \right)$$

Be careful : These nodes are reconstructed from the contents of the contents cells of the array. Usually, they do not correspond to the cells delimited by the rules (if we consider that these rules are drawn).

Here is an array composed with the following code:

```
\large
\begin{NiceTabular}{\wl{2cm}\ll}[hvlines]
fraise & amande & abricot \\
prune & pêche & poire \\
noix & noisette & brugnon
\end{NiceTabular}
```

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

Here, we have colored all the cells of the array with `\chessboardcolors`.

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

Here are the “large nodes” of this array (without use of `margin` nor `extra-margin`).

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

The nodes we have described are not available by default in the `\CodeBefore` (described p. 12).

New 5.16 It's possible to have these nodes available in the `\CodeBefore` by using the key `create-cell-nodes` of the keyword `\CodeBefore` (in that case, the nodes are created first before the construction of the array by using informations written on the `aux` file and created a second time during the construction of the array itself).

14.3 The nodes which indicate the position of the rules

The package `nicematrix` creates a PGF/Tikz node merely called i (with the classical prefix) at the intersection of the horizontal rule of number i and the vertical rule of number i (more specifically the potential position of those rules because maybe there are not actually drawn). The last node has also an alias called `last`. There is also a node called $i.5$ midway between the node i and the node $i+1$. These nodes are available in the `\CodeBefore` and the `\CodeAfter`.

	$\bullet^{1.5}$	\bullet^2 tulipe	lys
arum		$\bullet^{2.5}$	violette mauve
muguet	dahlia	\bullet^3	$\bullet^{3.5}$

If we use Tikz (we remind that `nicematrix` does not load Tikz by default, by only PGF, which is a sub-layer of Tikz), we can access, in the `\CodeAfter` but also in the `\CodeBefore`, to the intersection of the (potential) horizontal rule i and the (potential) vertical rule j with the syntax $(i-j)$.

```

\begin{NiceMatrix}
\CodeBefore
  \tikz \draw [fill=red!15] (7-|4) |- (8-|5) |- (9-|6) |- cycle ;
\Body
1 \\\
1 & 1 \\\
1 & 2 & 1 \\\
1 & 3 & 3 & 1 \\\
1 & 4 & 6 & 4 & 1 \\\
1 & 5 & 10 & 10 & 5 & 1 \\\
1 & 6 & 15 & 20 & 15 & 6 & 1 \\\
1 & 7 & 21 & 35 & 35 & 21 & 7 & 1 \\\
1 & 8 & 28 & 56 & 70 & 56 & 28 & 8 & 1
\end{NiceMatrix}

```

```

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1
1 8 28 56 70 56 28 8 1

```

The nodes of the form $i.5$ may be used, for example to cross a row of a matrix (if Tikz is loaded).

```

$\begin{pNiceArray}{ccc|c}
2 & 1 & 3 & 0 \\\
3 & 3 & 1 & 0 \\\
3 & 3 & 1 & 0
\CodeAfter
  \tikz \draw [red] (3.5-|1) -- (3.5-|last) ;
\end{pNiceArray}$

```

$$\left(\begin{array}{ccc|c} 2 & 1 & 3 & 0 \\ 3 & 3 & 1 & 0 \\ \hline 3 & 3 & 1 & 0 \end{array}\right)$$

14.4 The nodes corresponding to the command `\SubMatrix`

The command `\SubMatrix` available in the `\CodeAfter` has been described p. 25.

If a command `\SubMatrix` has been used with the key `name` with an expression such as `name=MyName` three PGF/Tikz nodes are created with the names `MyName-left`, `MyName` and `MyName-right`.

The nodes `MyName-left` and `MyName-right` correspond to the delimiters left and right and the node `MyName` correspond to the submatrix itself.

In the following example, we have highlighted these nodes (the submatrix itself has been created with `\SubMatrix\{{2-2}\{3-3}\}`).

$$\left(\begin{array}{cccc} 121 & 23 & 345 & 345 \\ 45 & \left\{ \begin{array}{cc} 346 & 863 \\ 38458 & 34 \end{array} \right\} & 444 & \\ 3462 & & & 294 \\ 34 & 7 & 78 & 309 \end{array}\right)$$

15 API for the developers

The package `nicematrix` provides two variables which are internal but public⁴¹:

- `\g_nicematrix_code_before_tl` ;
- `\g_nicematrix_code_after_tl`.

These variables contain the code of what we have called the “code-before” and the “code-after”. The developer can use them to add code from a cell of the array (the affectation must be global, allowing to exit the cell, which is a TeX group).

One should remark that the use of `\g_nicematrix_code_before_tl` needs one compilation more (because the instructions are written on the `aux` file to be used during the next run).

Example : We want to write a command `\hatchcell` to hatch the current cell (with an optional argument between brackets for the color). It’s possible to program such command `\hatchcell` as follows, explicitly using the public variable `\g_nicematrix_code_before_tl` (this code requires the Tikz library `patterns`: `\usetikzlibrary{patterns}`).

```
ExplSyntaxOn
\cs_new_protected:Nn \__pantigny_hatch:nnn
{
  \tikz \fill [ pattern = north-west-lines , pattern-color = #3 ]
    ( #1 -| #2 ) rectangle ( \int_eval:n { #1 + 1 } -| \int_eval:n { #2 + 1 } ) ;
}

\NewDocumentCommand \hatchcell { ! 0 { black } }
{
  \tl_gput_right:Nx \g_nicematrix_code_before_tl
    { \__pantigny_hatch:nnn { \arabic { iRow } } { \arabic { jCol } } { #1 } }
}
\ExplSyntaxOff
```

Here is an example of use:

```
\begin{NiceTabular}{ccc}[hvlines]
Tokyo & Paris & London \\
Lima & \hatchcell[blue!30]Oslo & Miami \\
Los Angeles & Madrid & Roma
\end{NiceTabular}
```

Tokyo	Paris	London
Lima	Oslo	Miami
Los Angeles	Madrid	Roma

16 Technical remarks

16.1 Definition of new column types

The package `nicematrix` provides the command `\OnlyMainNiceMatrix` which is meant to be used in definitions of new column types. Its argument is evaluated if and only if we are in the main part of the array, that is to say not in a potential exterior row.

For example, one may wish to define a new column type `?` in order to draw a (black) heavy rule of width 1 pt. The following definition will do the job⁴²:

```
\newcolumnmtype{?}{!\OnlyMainNiceMatrix{\vrule width 1 pt}}}
```

⁴¹According to the LaTeX3 conventions, each variable with name beginning with `\g_nicematrix` ou `\l_nicematrix` is public and each variable with name beginning with `\g__nicematrix` or `\l__nicematrix` is private.

⁴²The command `\vrule` is a TeX (and not LaTeX) command.

The heavy vertical rule won't extend in the exterior rows.⁴³

```
\begin{pNiceArray}{cc?cc}[first-row,last-row=3]
C_1 & C_2 & & C_3 & C_4 \\
a & b & c & d & \\
e & f & g & h & \\
C_1 & C_2 & & C_3 & C_4 \\
\end{pNiceArray}
```

$$\begin{pmatrix} C_1 & C_2 & C_3 & C_4 \\ a & b & c & d \\ e & f & g & h \\ C_1 & C_2 & C_3 & C_4 \end{pmatrix}$$

This specifier ? may be used in the standard environments `{tabular}` and `{array}` (of the package `array`) and, in this case, the command `\OnlyMainNiceMatrix` is no-op.

16.2 Diagonal lines

By default, all the diagonal lines⁴⁴ of a same array are “parallelized”. That means that the first diagonal line is drawn and, then, the other lines are drawn parallel to the first one (by rotation around the left-most extremity of the line). That’s why the position of the instructions `\Ddots` in the array can have a marked effect on the final result.

In the following examples, the first `\Ddots` instruction is written in color:

Example with parallelization (default):

```
$A = \begin{pNiceMatrix}
1      & \Cdots &      & 1      & \\
a+b    & \Ddots &      & \Vdots & \\
\Vdots & \Ddots &      &        & \\
a+b    & \Cdots & a+b  & 1      & \\
\end{pNiceMatrix}
```

$$A = \begin{pmatrix} 1 & \cdots & \cdots & \cdots & 1 \\ a+b & \ddots & & & \vdots \\ \vdots & \ddots & \ddots & & \vdots \\ a+b & \cdots & \cdots & a+b & 1 \end{pmatrix}$$

```
$A = \begin{pNiceMatrix}
1      & \Cdots &      & 1      & \\
a+b    &      &      & \Vdots & \\
\Vdots & \Ddots & \Ddots &        & \\
a+b    & \Cdots & a+b  & 1      & \\
\end{pNiceMatrix}
```

$$A = \begin{pmatrix} 1 & \cdots & \cdots & \cdots & 1 \\ a+b & & & & \vdots \\ \vdots & \ddots & \ddots & & \vdots \\ a+b & \cdots & \cdots & a+b & 1 \end{pmatrix}$$

It’s possible to turn off the parallelization with the option `parallelize-diags` set to `false`:

The same example without parallelization:

$$A = \begin{pmatrix} 1 & \cdots & \cdots & \cdots & 1 \\ a+b & \ddots & & & \vdots \\ \vdots & \ddots & \ddots & & \vdots \\ a+b & \cdots & \cdots & a+b & 1 \end{pmatrix}$$

It’s possible to specify the instruction `\Ddots` which will be drawn first (and which will be used to draw the other diagonal dotted lines when the parallelization is in force) with the key `draw-first`: `\Ddots[draw-first]`.

16.3 The “empty” cells

An instruction like `\Ldots`, `\Cdots`, etc. tries to determine the first non-empty cell on both sides. However, an “empty cell” is not necessarily a cell with no TeX content (that is to say a cell with no token between the two ampersands `&`). The precise rules are as follow.

- An implicit cell is empty. For example, in the following matrix:

⁴³Of course, such rule is defined by the classical technics of `nicematrix` and, for this reason, won’t cross the double rules of `\hline\hline`.

⁴⁴We speak of the lines created by `\Ddots` and not the lines created by a command `\line` in `code-after`.

```

\begin{pmatrix}
a & b & \\
c & & \\
\end{pmatrix}

```

the last cell (second row and second column) is empty.

- Each cell whose TeX output has a width equal to zero is empty.
- A cell containing the command `\NotEmpty` is not empty (and a PGF/Tikz node) is created in that cell.
- A cell with a command `\Hspace` (or `\Hspace*`) is empty. This command `\Hspace` is a command defined by the package `nicematrix` with the same meaning as `\hspace` except that the cell where it is used is considered as empty. This command can be used to fix the width of some columns of the matrix without interfering with `nicematrix`.
- A cell of a column of type `p`, `m` or `t` is always considered as not empty. *Caution* : One should not rely upon that point because it may change if a future version of `nicematrix`.

16.4 The option `exterior-arraycolsep`

The environment `{array}` inserts an horizontal space equal to `\arraycolsep` before and after each column. In particular, there is a space equal to `\arraycolsep` before and after the array. This feature of the environment `{array}` was probably not a good idea⁴⁵. The environment `{matrix}` of `amsmath` and its variants (`{pmatrix}`, `{vmatrix}`, etc.) of `amsmath` prefer to delete these spaces with explicit instructions `\hskip -\arraycolsep`⁴⁶. The package `nicematrix` does the same in all its environments, `{NiceArray}` included. However, if the user wants the environment `{NiceArray}` behaving by default like the environment `{array}` (for example, when adapting an existing document) it's possible to control this behaviour with the option `exterior-arraycolsep`, set by the command `\NiceMatrixOptions`. With this option, exterior spaces of length `\arraycolsep` will be inserted in the environments `{NiceArray}` (the other environments of `nicematrix` are not affected).

16.5 Incompatibilities

The package `nicematrix` is not fully compatible with the package `arydshln` (because this package redefines many internal of `array`).

Anyway, in order to use `arydshln`, one must first free the letter “:” by giving a new letter for the vertical dotted rules of `nicematrix`:

```

\NiceMatrixOptions{letter-for-dotted-lines=;}

```

Up to now, the package `nicematrix` is not compatible with `aastex63`. If you want to use `nicematrix` with `aastex63`, send me an email and I will try to solve the incompatibilities.

the package `nicematrix` is not compatible with the class `ieeeaccess` (because that class is not compatible with PGF/Tikz).

⁴⁵In the documentation of `{amsmath}`, we can read: *The extra space of `\arraycolsep` that `array` adds on each side is a waste so we remove it [in `{matrix}`] (perhaps we should instead remove it from `array` in general, but that's a harder task).*

⁴⁶And not by inserting `@{}` on both sides of the preamble of the array. As a consequence, the length of the `\hline` is not modified and may appear too long, in particular when using square brackets.

17 Examples

17.1 Notes in the tabulars

The tools provided by `nicematrix` for the composition of the tabular notes have been presented in the section 12 p. 27.

Let's consider that we wish to number the notes of a tabular with stars.⁴⁷

First, we write a command `\stars` similar the well-known commands `\arabic`, `\alph`, `\Alph`, etc. which produces a number of stars equal to its argument ⁴⁸

```
\ExplSyntaxOn
\NewDocumentCommand \stars { m }
{ \prg_replicate:nn { \value { #1 } } { $ \star $ } }
\ExplSyntaxOff
```

Of course, we change the style of the labels with the key `notes/style`. However, it would be interesting to change also some parameters in the type of list used to compose the notes at the end of the tabular. First, we required a composition flush right for the labels with the setting `align=right`. Moreover, we want the labels to be composed on a width equal to the width of the widest label. The widest label is, of course, the label with the greatest number of stars. We know that number: it is equal to `\value{tabularnote}` (because `tabularnote` is the LaTeX counter used by `\tabularnote` and, therefore, at the end of the tabular, its value is equal to the total number of tabular notes). We use the key `widest*` of `enumitem` in order to require a width equal to that value: `widest*=\value{tabularnote}`.

```
\NiceMatrixOptions
{
  notes =
  {
    style = \stars{#1} ,
    enumitem-keys =
    {
      widest* = \value{tabularnote} ,
      align = right
    }
  }
}

\begin{NiceTabular}{{\llr{}}}[first-row,code-for-first-row = \bfseries]
\toprule
Last name & First name & Birth day \\\
\midrule
Achard\tabularnote{Achard is an old family of the Poitou.}
& Jacques & 5 juin 1962 \\\
Lefebvre\tabularnote{The name Lefebvre is an alteration of the name Lefebure.}
& Mathilde & 23 mai 1988 \\\
Vanesse & Stephany & 30 octobre 1994 \\\
Dupont & Chantal & 15 janvier 1998 \\\
\bottomrule
\end{NiceTabular}
```

⁴⁷Of course, it's realistic only when there is very few notes in the tabular.

⁴⁸In fact: the value of its argument.

Last name	First name	Birth day
Achard*	Jacques	June 5, 2005
Lefebvre**	Mathilde	January 23, 1975
Vanesse	Stephany	October 30, 1994
Dupont	Chantal	January 15, 1998

*Achard is an old family of the Poitou.

**The name Lefebvre is an alteration of the name Lefebure.

17.2 Dotted lines

An example with the resultant of two polynoms:

```
\setlength{\extrarowheight}{1mm}
\[\begin{vNiceArray}{ccc}[columns-width=6mm]
a_0 & & & & b_0 & & & \\
a_1 & & \Ddots & & b_1 & & \Ddots & \\
\vdots & & \Ddots & & \vdots & & \Ddots & b_0 \\
a_p & & & & a_0 & & & \\
& & \Ddots & & a_1 & & & \vdots \\
& & & \Ddots & & & & \vdots \\
& & & & a_p & & & b_q \\
\end{vNiceArray}\]
```

$$\left(\begin{array}{cccccc} a_0 & & & & & \\ & \ddots & & & & \\ & & a_0 & & & \\ & & & \ddots & & \\ & & & & a_1 & \\ & & & & & \ddots \\ & & & & & & a_p \end{array} \right) \left(\begin{array}{cccccc} b_0 & & & & & \\ & \ddots & & & & \\ & & b_1 & & & \\ & & & \ddots & & \\ & & & & b_1 & \\ & & & & & \ddots \\ & & & & & & b_q \end{array} \right)$$

An example for a linear system:

```
\begin{pNiceArray}{*6c|c}[nullify-dots,last-col,code-for-last-col=\scriptstyle]
1 & 1 & 1 & \Cdots & 1 & 0 & \\
0 & 1 & 0 & \Cdots & 0 & & L_2 \gets L_2 - L_1 \\
0 & 0 & 1 & \Ddots & \vdots & & L_3 \gets L_3 - L_1 \\
& & & \Ddots & & \vdots & \\
\vdots & & & \Ddots & 0 & & \\
0 & & & \Cdots & 0 & 1 & L_n \gets L_n - L_1 \\
\end{pNiceArray}
```

$$\left(\begin{array}{cccccc|c} 1 & 1 & 1 & \dots & 1 & 0 \\ 0 & 1 & 0 & \dots & 0 & \\ 0 & 0 & 1 & \dots & \vdots & \\ \vdots & & & \ddots & & \\ \vdots & & & & 0 & \\ 0 & \dots & \dots & 0 & 1 & \end{array} \right) \begin{array}{l} 0 \\ \vdots \\ L_2 \leftarrow L_2 - L_1 \\ L_3 \leftarrow L_3 - L_1 \\ \vdots \\ L_n \leftarrow L_n - L_1 \end{array}$$

17.3 Dotted lines which are no longer dotted

The option `line-style` controls the style of the lines drawn by `\Ldots`, `\Cdots`, etc. Thus, it's possible with these commands to draw lines which are not longer dotted.

```

\NiceMatrixOptions{code-for-first-row = \scriptstyle,code-for-first-col = \scriptstyle }
\setcounter{MaxMatrixCols}{12}
\newcommand{\blue}{\color{blue}}
\[ \begin{pNiceMatrix}[last-row,last-col,nullify-dots,xdots/line-style={dashed,blue}]
1& & \Vdots & & & \Vdots \\
& \Ddots[line-style=standard] \\
& & 1 \\
& \Cdots[color=blue,line-style=dashed]& & & \blue 0 & \\
& \Cdots & & & \blue 1 & & & \Cdots & \blue \leftarrow i \\
& & & & 1 \\
& & & \Vdots & & \Ddots[line-style=standard] & & \Vdots \\
& & & & & & & 1 \\
& \Cdots & & & \blue 1 & \Cdots & & \Cdots & \blue 0 & & \Cdots & \blue \leftarrow j \\
& & & & & & & & & & 1 \\
& & & & & & & \Ddots[line-style=standard] \\
& & & \Vdots & & & & \Vdots & & & 1 \\
& & & \blue \overset{\uparrow}{i} & & & & \blue \overset{\uparrow}{j} \\
\end{pNiceMatrix}\]

```

$$\left(\begin{array}{ccc|ccc|ccc} 1 & \dots & & & & & & & \\ & & 1 & & & & & & \\ \hline & & & 0 & & & 1 & & \\ & & & & 1 & \dots & & & \\ & & & & & & & 1 & \\ \hline & & & & & & & & 0 \\ & & & 1 & & & & & \\ \hline & & & & & & & & \\ & & & & & & & 1 & \dots & 1 \end{array} \right) \begin{array}{l} \\ \\ \leftarrow i \\ \\ \\ \leftarrow j \\ \\ \end{array}$$

In fact, it's even possible to draw solid lines with the commands `\Cdots`, `\Vdots`, etc.

```

\NiceMatrixOptions
  {nullify-dots,code-for-first-col = \color{blue},code-for-first-col=\color{blue}}
\begin{pNiceMatrix}[first-row,first-col]
    & & \Ldots[line-style={solid,<->},shorten=0pt]^{n \text{ columns}} \\
    & 1 & 1 & 1 & \Ldots & 1 \\
    & 1 & 1 & 1 & 1 & 1 \\
\vdots[line-style={solid,<->}]_n \text{ rows} & 1 & 1 & 1 & 1 & 1 \\
    & 1 & 1 & 1 & 1 & 1 \\
    & 1 & 1 & 1 & 1 & \Ldots & 1
\end{pNiceMatrix}$

```

$$\begin{matrix} & \xrightarrow{n \text{ columns}} \\ \begin{matrix} \uparrow \\ n \text{ rows} \\ \downarrow \end{matrix} & \begin{pmatrix} 1 & 1 & 1 & \dots & 1 \\ 1 & 1 & 1 & & 1 \\ 1 & 1 & 1 & & 1 \\ 1 & 1 & 1 & & 1 \\ 1 & 1 & 1 & \dots & 1 \end{pmatrix} \end{matrix}$$

17.4 Stacks of matrices

We often need to compose mathematical matrices on top on each other (for example for the resolution of linear systems).

In order to have the columns aligned one above the other, it's possible to fix a width for all the columns. That's what is done in the following example with the environment `{NiceMatrixBlock}` and its option `auto-columns-width`.

```
\begin{NiceMatrixBlock}[auto-columns-width]
\NiceMatrixOptions
{
  light-syntax,
  last-col, code-for-last-col = \color{blue} \scriptstyle,
}
\setlength{\extrarowheight}{1mm}

$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 {} ;
3 -18 12 1 4 ;
-3 -46 29 -2 -15 ;
9 10 -5 4 7
\end{pNiceArray}$

\smallskip
$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 ;
0 64 -41 1 19 { L_2 \gets L_1-4L_2 } ;
0 -192 123 -3 -57 { L_3 \gets L_1+4L_3 } ;
0 -64 41 -1 -19 { L_4 \gets 3L_1-4L_4 } ;
\end{pNiceArray}$

\smallskip
$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 ;
0 64 -41 1 19 ;
0 0 0 0 0 { L_3 \gets 3 L_2 + L_3 }
\end{pNiceArray}$

\smallskip
$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 {} ;
0 64 -41 1 19 ;
\end{pNiceArray}$

\end{NiceMatrixBlock}
```

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{array} \right)$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{array} \right) \begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)_{L_3 \leftarrow 3L_2 + L_3}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{array}\right)$$

However, one can see that the last matrix is not perfectly aligned with others. That's why, in LaTeX, the parenthesis have not exactly the same width (smaller parenthesis are a bit slimer).

In order to solve that problem, it's possible to require the delimiters to be composed with the maximal width, thanks to the boolean key `delimiters/max-width`.

```
\begin{NiceMatrixBlock}[auto-columns-width]
\NiceMatrixOptions
{
  delimiters/max-width,
  light-syntax,
  last-col, code-for-last-col = \color{blue}\scriptstyle,
}
\setlength{\extrarowheight}{1mm}

$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 {} ;
3 -18 12 1 4 ;
-3 -46 29 -2 -15 ;
9 10 -5 4 7
\end{pNiceArray}$

...
\end{NiceMatrixBlock}
```

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{array}\right)$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{array}\right)_{\begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)_{L_3 \leftarrow 3L_2 + L_3}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{array}\right)$$

If you wish an alignment of the different matrices without the same width for all the columns, you can construct a unique array and place the parenthesis with commands `\SubMatrix` in the `\CodeAfter`. Of course, that array can't be broken by a page break.

```
\setlength{\extrarowheight}{1mm}
\[\begin{NiceMatrix}[ r, last-col=6, code-for-last-col = \scriptstyle \color{blue} ]
12 & -8 & & 7 & 5 & 3 \\
3 & -18 & & 12 & 1 & 4 \\
-3 & -46 & & 29 & -2 & -15 \end{NiceMatrix}]
```

```

9 & 10 & -5 & 4 & 7 \\[1mm]
12 & -8 & 7 & 5 & 3 \\
0 & 64 & -41 & 1 & 19 & L_2 \gets L_1-4L_2 \\
0 & -192 & 123 & -3 & -57 & L_3 \gets L_1+4L_3 \\
0 & -64 & 41 & -1 & -19 & L_4 \gets 3L_1-4L_4 \\
12 & -8 & 7 & 5 & 3 \\
0 & 64 & -41 & 1 & 19 \\
0 & 0 & 0 & 0 & 0 & L_3 \gets 3L_2+L_3 \\
12 & -8 & 7 & 5 & 3 \\
0 & 64 & -41 & 1 & 19 \\
\CodeAfter [sub-matrix/vlines=4]
\SubMatrix({1-1}{4-5})
\SubMatrix({5-1}{8-5})
\SubMatrix({9-1}{11-5})
\SubMatrix({12-1}{13-5})
\end{NiceMatrix}\]

```

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{pmatrix}$$

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{pmatrix}
\begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}$$

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}
\begin{array}{l} L_3 \leftarrow 3L_2 + L_3 \end{array}$$

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{pmatrix}$$

17.5 How to highlight cells of a matrix

In order to highlight a cell of a matrix, it's possible to “draw” that cell with the key `draw` of the command `\Block` (this is one of the uses of a mono-cell block⁴⁹).

```

$\begin{pNiceArray}{>{\strut}cccc}[margin,rules/color=blue]
\Block[draw]{a_{11}} & a_{12} & a_{13} & a_{14} \\
a_{21} & \Block[draw]{a_{22}} & a_{23} & a_{24} \\
a_{31} & a_{32} & \Block[draw]{a_{33}} & a_{34} \\
a_{41} & a_{42} & a_{43} & \Block[draw]{a_{44}} \\
\end{pNiceArray}$

```

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{pmatrix}$$

We should remark that the rules we have drawn are drawn *after* the construction of the array and thus, they don't spread the cells of the array. We recall that, on the other side, the commands `\hline` and `\Hline`, the specifier “|” and the options `hlines`, `vlines` and `hvlines` spread the cells.⁵⁰

⁴⁹We recall that, if the first mandatory argument of the command `\Block` is left empty, that means that the block is a mono-cell block

⁵⁰For the command `\cline`, see the remark p. 8.

It's possible to color a row with `\rowcolor` in the `code-before` (or with `\rowcolor` in the first cell of the row if the key `colortbl-like` is used—even when `colortbl` is not loaded).

```
\begin{pNiceArray}{>{\strut}cccc}[margin, extra-margin=2pt,colortbl-like]
  \rowcolor{red!15}A_{11} & A_{12} & A_{13} & A_{14} \\
  A_{21} & \rowcolor{red!15}A_{22} & A_{23} & A_{24} \\
  A_{31} & A_{32} & \rowcolor{red!15}A_{33} & A_{34} \\
  A_{41} & A_{42} & A_{43} & \rowcolor{red!15}A_{44}
\end{pNiceArray}
```

$$\begin{pmatrix} A_{11} & A_{12} & A_{13} & A_{14} \\ A_{21} & A_{22} & A_{23} & A_{24} \\ A_{31} & A_{32} & A_{33} & A_{34} \\ A_{41} & A_{42} & A_{43} & A_{44} \end{pmatrix}$$

However, it's not possible to do a fine tuning. That's why we describe now a method to highlight a row of the matrix. We create a rectangular Tikz node which encompasses the nodes of the second row with the Tikz library `fit`. This Tikz node is filled after the construction of the matrix. In order to see the text *under* this node, we have to use transparency with the `blend mode` equal to `multiply`.

Caution : Some PDF readers are not able to show transparency.⁵¹

That example and the following ones require Tikz (by default, `nicematrix` only loads PGF, which is a sub-layer of Tikz) and the Tikz library `fit`. The following lines in the preamble of your document do the job:

```
\usepackage{tikz}
\usetikzlibrary{fit}
```

We create a rectangular Tikz node which encompasses the nodes of the second row by using the tools of the Tikz library `fit`. Those nodes are not available by default in the `\CodeBefore` (for efficiency). We have to require their creation with the key `create-cell-nodes` of the keyword `\CodeBefore`.

```
\tikzset{highlight/.style={rectangle,
                           fill=red!15,
                           rounded corners = 0.5 mm,
                           inner sep=1pt,
                           fit=#1}}

$\begin{bNiceMatrix}
\CodeBefore [create-cell-nodes]
  \tikz \node [highlight = (2-1) (2-3)] {} ;
\Body
0 & \Cdots & 0 \\
1 & \Cdots & 1 \\
0 & \Cdots & 0 \\
\end{bNiceMatrix}$
```

$$\begin{bmatrix} 0 & \cdots & 0 \\ 1 & \cdots & 1 \\ 0 & \cdots & 0 \end{bmatrix}$$

We consider now the following matrix. If we want to highlight each row of this matrix, we can use the previous technique three times.

⁵¹In Overleaf, the “built-in” PDF viewer does not show transparency. You can switch to the “native” viewer in that case.

```

\[\begin{pNiceArray}{ccc}[last-col]
\CodeBefore [create-cell-nodes]
\begin{tikzpicture}
\node [highlight = (1-1) (1-3)] {} ;
\node [highlight = (2-1) (2-3)] {} ;
\node [highlight = (3-1) (3-3)] {} ;
\end{tikzpicture}
\Body
a & a + b & a + b + c & L_1 \\
a & a & a + b & L_2 \\
a & a & a & L_3
\end{pNiceArray}\]

```

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix} \begin{matrix} L_1 \\ L_2 \\ L_3 \end{matrix}$$

The result may seem disappointing. We can improve it by using the “medium nodes” instead of the “normal nodes”.

```

\[\begin{pNiceArray}{ccc}[last-col,create-medium-nodes]
\CodeBefore [create-cell-nodes]
\begin{tikzpicture} [name suffix = -medium]
\node [highlight = (1-1) (1-3)] {} ;
\node [highlight = (2-1) (2-3)] {} ;
\node [highlight = (3-1) (3-3)] {} ;
\end{tikzpicture}
\Body
a & a + b & a + b + c & L_1 \\
a & a & a + b & L_2 \\
a & a & a & L_3
\end{pNiceArray}\]

```

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix} \begin{matrix} L_1 \\ L_2 \\ L_3 \end{matrix}$$

17.6 Utilisation of \SubMatrix in the \CodeBefore

In the following example, we illustrate the mathematical product of two matrices.

The whole figure is an environment `{NiceArray}` and the three pairs of parenthesis have been added with `\SubMatrix` in the `\CodeBefore`.

$$L_i \begin{pmatrix} a_{11} & \dots & a_{1n} \\ \vdots & & \vdots \\ a_{i1} & \dots & a_{in} \\ \vdots & & \vdots \\ a_{n1} & \dots & a_{nn} \end{pmatrix} \begin{pmatrix} b_{11} & \dots & b_{1j} & \dots & b_{1n} \\ \vdots & & \vdots & & \vdots \\ b_{k1} & \dots & b_{kj} & \dots & b_{kn} \\ \vdots & & \vdots & & \vdots \\ b_{n1} & \dots & b_{nj} & \dots & b_{nn} \end{pmatrix} \begin{pmatrix} \vdots \\ \vdots \\ c_{ij} \\ \vdots \end{pmatrix}$$

```

\tikzset{highlight/.style={rectangle,
    fill=red!15,
    rounded corners = 0.5 mm,
    inner sep=1pt,
    fit=#1}}

\[\begin{NiceArray}{*{6}{c}@{\hspace{6mm}}*{5}{c}}[nullify-dots]
\CodeBefore [create-cell-nodes]
    \SubMatrix({2-7}{6-11})
    \SubMatrix({7-2}{11-6})
    \SubMatrix({7-7}{11-11})
    \begin{tikzpicture}
        \node [highlight = (9-2) (9-6)] { } ;
        \node [highlight = (2-9) (6-9)] { } ;
    \end{tikzpicture}
\Body
    & & & & & & & \color{blue}\scriptstyle C_j \\
    & & & & & & b_{11} & \Cdots & b_{1j} & \Cdots & b_{1n} \\
    & & & & & & \Vdots & & \Vdots & & \Vdots \\
    & & & & & & & & b_{kj} \\
    & & & & & & & & \Vdots \\
    & & & & & & b_{n1} & \Cdots & b_{nj} & \Cdots & b_{nn} \\
    & a_{11} & \Cdots & & & a_{1n} \\
    & \Vdots & & & & \Vdots & & & \Vdots \\
\color{blue}\scriptstyle L_i
    & a_{i1} & \Cdots & a_{ik} & \Cdots & a_{in} & \Cdots & & c_{ij} \\
    & \Vdots & & & & \Vdots \\
    & a_{n1} & \Cdots & & & a_{nn} \\
\CodeAfter
\tikz \draw [gray,shorten > = 1mm, shorten < = 1mm] (9-4.north) to [bend left] (4-9.west) ;
\end{NiceArray}\]

```

18 Implementation

By default, the package `nicematrix` doesn't patch any existing code.

However, when the option `renew-dots` is used, the commands `\cdots`, `\ldots`, `\dots`, `\vdots`, `\ddots` and `\iddots` are redefined in the environments provided by `nicematrix` as explained previously. In the same way, if the option `renew-matrix` is used, the environment `{matrix}` of `amsmath` is redefined.

On the other hand, the environment `{array}` is never redefined.

Of course, the package `nicematrix` uses the features of the package `array`. It tries to be independent of its implementation. Unfortunately, it was not possible to be strictly independent. For example, the package `nicematrix` relies upon the fact that the package `{array}` uses `\ialign` to begin the `\halign`.

Declaration of the package and packages loaded

The prefix `nicematrix` has been registered for this package.

See: <http://mirrors.ctan.org/macros/latex/contrib/l3kernel/l3prefixes.pdf>

<@@=nicematrix>

First, we load `pgfcore` and the module `shapes`. We do so because it's not possible to use `\usepgfmodule` in `\ExplSyntaxOn`.

```

1 \RequirePackage{pgfcore}
2 \usepgfmodule{shapes}

```

We give the traditional declaration of a package written with `expl3`:

```

3 \RequirePackage{l3keys2e}
4 \ProvidesExplPackage
5   {nicematrix}
6   {\myfiledate}
7   {\myfileversion}
8   {Enhanced arrays with the help of PGF/TikZ}

```

The command for the treatment of the options of `\usepackage` is at the end of this package for technical reasons.

We load some packages. The package `xparse` is still loaded for use on Overleaf.

```

9 \RequirePackage { xparse }
10 \RequirePackage { array }
11 \RequirePackage { amsmath }

12 \cs_new_protected:Npn \@@_error:n { \msg_error:nn { nicematrix } }
13 \cs_new_protected:Npn \@@_error:nn { \msg_error:nnn { nicematrix } }
14 \cs_new_protected:Npn \@@_error:nnn { \msg_error:nnnn { nicematrix } }
15 \cs_new_protected:Npn \@@_fatal:n { \msg_fatal:nn { nicematrix } }
16 \cs_new_protected:Npn \@@_fatal:nn { \msg_fatal:nnn { nicematrix } }
17 \cs_new_protected:Npn \@@_msg_new:nn { \msg_new:nnn { nicematrix } }
18 \cs_new_protected:Npn \@@_msg_new:nnn { \msg_new:nnnn { nicematrix } }

19 \cs_new_protected:Npn \@@_msg_redirect_name:nn
20   { \msg_redirect_name:nnn { nicematrix } }

```

Technical definitions

```

21 \bool_new:N \c_@@_in_preamble_bool
22 \bool_set_true:N \c_@@_in_preamble_bool
23 \AtBeginDocument { \bool_set_false:N \c_@@_in_preamble_bool }

24 \bool_new:N \c_@@_arydshln_loaded_bool
25 \bool_new:N \c_@@_booktabs_loaded_bool
26 \bool_new:N \c_@@_enumitem_loaded_bool
27 \bool_new:N \c_@@_tikz_loaded_bool
28 \AtBeginDocument
29   {
30     \ifpackageloaded { arydshln }
31       { \bool_set_true:N \c_@@_arydshln_loaded_bool }
32     { }
33     \ifpackageloaded { booktabs }
34       { \bool_set_true:N \c_@@_booktabs_loaded_bool }
35     { }
36     \ifpackageloaded { enumitem }
37       { \bool_set_true:N \c_@@_enumitem_loaded_bool }
38     { }
39     \ifpackageloaded { tikz }
40     {

```

In some constructions, we will have to use a `{pgfpicture}` which *must* be replaced by a `{tikzpicture}` if Tikz is loaded. However, this switch between `{pgfpicture}` and `{tikzpicture}` can't be done dynamically with a conditional because, when the Tikz library `external` is loaded by the user, the pair `\tikzpicture-\endtikzpicture` (or `\begin{tikzpicture}-\end{tikzpicture}`) must be statically “visible” (even when externalization is not activated).

That's why we create `\c_@@_pgfortikzpicture_tl` and `\c_@@_endpgfortikzpicture_tl` which will be used to construct in a `\AtBeginDocument` the correct version of some commands.

```

41     \bool_set_true:N \c_@@_tikz_loaded_bool
42     \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \tikzpicture }

```

```

43     \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endtikzpicture }
44   }
45   {
46     \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \pgfpicture }
47     \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endpgfpicture }
48   }
49 }

```

We test whether the current class is `revtex4-1` (deprecated) or `revtex4-2` because these classes redefines `\array` (of `array`) in a way incompatible with our programming. At the date January 2021, the current version `revtex4-2` is 4.2e (compatible with `booktabs`).

```

50 \bool_new:N \c_@@_revtex_bool
51 \ifclassloaded { revtex4-1 }
52   { \bool_set_true:N \c_@@_revtex_bool }
53   { }
54 \ifclassloaded { revtex4-2 }
55   { \bool_set_true:N \c_@@_revtex_bool }
56   { }

```

Maybe one of the previous classes will be loaded inside another class... We try to detect that situation.

```

57 \cs_if_exist:NT \rvtx@ifformat@geq { \bool_set_true:N \c_@@_revtex_bool }

58 \cs_generate_variant:Nn \tl_if_single_token_p:n { V }

```

The following regex will be used to modify the preamble of the array when the key `colortbl-like` is used.

```

59 \regex_const:Nn \c_@@_columncolor_regex { \c { columncolor } }

```

If the final user uses `nicematrix`, PGF/Tikz will write instruction `\pgfsyspdfmark` in the aux file. If he changes its mind and no longer loads `nicematrix`, an error may occur at the next compilation because of remanent instructions `\pgfsyspdfmark` in the aux file. With the following code, we try to avoid that situation.

```

60 \cs_new_protected:Npn \@@_provide_pgfsyspdfmark:
61   {
62     \iow_now:Nn \@mainaux
63     {
64       \ExplSyntaxOn
65       \cs_if_free:NT \pgfsyspdfmark
66         { \cs_set_eq:NN \pgfsyspdfmark \@gobblethree }
67       \ExplSyntaxOff
68     }
69     \cs_gset_eq:NN \@@_provide_pgfsyspdfmark: \prg_do_nothing:
70   }

```

We define a command `\iddots` similar to `\ddots` (`\ddots`) but with dots going forward (`\iddots`). We use `\ProvideDocumentCommand` and so, if the command `\iddots` has already been defined (for example by the package `mathdots`), we don't define it again.

```

71 \ProvideDocumentCommand \iddots { }
72   {
73     \mathinner
74     {
75       \tex_mkern:D 1 mu
76       \box_move_up:nn { 1 pt } { \hbox:n { . } }
77       \tex_mkern:D 2 mu
78       \box_move_up:nn { 4 pt } { \hbox:n { . } }
79       \tex_mkern:D 2 mu
80       \box_move_up:nn { 7 pt }
81       { \vbox:n { \kern 7 pt \hbox:n { . } } }
82       \tex_mkern:D 1 mu
83     }
84   }

```

This definition is a variant of the standard definition of `\ddots`.

In the aux file, we will have the references of the PGF/Tikz nodes created by nicematrix. However, when booktabs is used, some nodes (more precisely, some row nodes) will be defined twice because their position will be modified. In order to avoid an error message in this case, we will redefine `\pgfutil@check@rerun` in the aux file.

```

85 \AtBeginDocument
86 {
87   \ifpackageloaded { booktabs }
88     { \iow_now:Nn \mainaux \nicematrix@redefine@check@rerun }
89     { }
90 }
91 \cs_set_protected:Npn \nicematrix@redefine@check@rerun
92 {
93   \cs_set_eq:NN \@@_old_pgful@check@rerun \pgfutil@check@rerun

```

The new version of `\pgfutil@check@rerun` will not check the PGF nodes whose names start with `nm-` (which is the prefix for the nodes created by nicematrix).

```

94   \cs_set_protected:Npn \pgfutil@check@rerun ##1 ##2
95   {
96     \str_if_eq:eeF { nm- } { \tl_range:nnn { ##1 } 1 3 }
97     { \@@_old_pgful@check@rerun { ##1 } { ##2 } }
98   }
99 }

```

We have to know whether colortbl is loaded in particular for the redefinition of `\everycr`.

```

100 \bool_new:N \c_@@_colortbl_loaded_bool
101 \AtBeginDocument
102 {
103   \ifpackageloaded { colortbl }
104   {
105     \bool_set_true:N \c_@@_colortbl_loaded_bool
106   }
107   {

```

The command `\CT@arc@` is a command of colortbl which sets the color of the rules in the array. We will use it to store the instruction of color for the rules even if colortbl is not loaded.

```

108     \cs_set_protected:Npn \CT@arc@ { }
109     \cs_set:Npn \arrayrulecolor #1 # { \CT@arc@ { #1 } }
110     \cs_set:Npn \CT@arc@ #1 #2
111     {
112       \dim_compare:nNnT \baselineskip = \c_zero_dim \noalign
113       { \cs_gset:Npn \CT@arc@ { \color #1 { #2 } } }
114     }

```

Idem for `\CT@drs@`.

```

115     \cs_set:Npn \doublerulesepcolor #1 # { \CT@drs@ { #1 } }
116     \cs_set:Npn \CT@drs@ #1 #2
117     {
118       \dim_compare:nNnT \baselineskip = \c_zero_dim \noalign
119       { \cs_gset:Npn \CT@drsc@ { \color #1 { #2 } } }
120     }
121     \cs_set:Npn \hline
122     {
123       \noalign { \ifnum 0 = ` } \fi
124       \cs_set_eq:NN \hskip \vskip
125       \cs_set_eq:NN \vrule \hrule
126       \cs_set_eq:NN \@width \@height
127       { \CT@arc@ \vline }
128       \futurelet \reserved@a
129       \@xhline
130     }
131   }
132 }

```

We need that line for the case where you use `||` with colortbl loaded.

```

133 \cs_set_protected:Npn \CT@drsc@ { }

```

We have to redefine `\cline` for several reasons. The command `\@@_cline` will be linked to `\cline` in the beginning of `{NiceArrayWithDelims}`. The following commands must *not* be protected.

```

134 \cs_set:Npn \@@_standard_cline #1 { \@@_standard_cline:w #1 \q_stop }
135 \cs_set:Npn \@@_standard_cline:w #1-#2 \q_stop
136 {
137   \int_compare:nNnT \l_@@_first_col_int = 0 { \omit & }
138   \int_compare:nNnT { #1 } > 1 { \multispan { \@@_pred:n { #1 } } & }
139   \multispan { \int_eval:n { #2 - #1 + 1 } }
140   {
141     \CT@arc@
142     \leaders \hrule \@height \arrayrulewidth \hfill

```

The following `\skip_horizontal:N \c_zero_dim` is to prevent a potential `\unskip` to delete the `\leaders`⁵²

```

143   \skip_horizontal:N \c_zero_dim
144 }

```

Our `\everycr` has been modified. In particular, the creation of the `row` node is in the `\everycr` (maybe we should put it with the incrementation of `\c@iRow`). Since the following `\cr` correspond to a “false row”, we have to nullify `\everycr`.

```

145   \everycr { }
146   \cr
147   \noalign { \skip_vertical:N -\arrayrulewidth }
148 }

```

The following version of `\cline` spreads the array of a quantity equal to `\arrayrulewidth` as does `\hline`. It will be loaded excepted if the key `standard-cline` has been used.

```

149 \cs_set:Npn \@@_cline

```

We have to act in a fully expandable way since there may be `\noalign` (in the `\multispan`) to detect. That’s why we use `\@@_cline_i:en`.

```

150 { \@@_cline_i:en \l_@@_first_col_int }

```

The command `\cline_i:nn` has two arguments. The first is the number of the current column (it *must* be used in that column). The second is a standard argument of `\cline` of the form *i-j*.

```

151 \cs_set:Npn \@@_cline_i:nn #1 #2 { \@@_cline_i:w #1-#2 \q_stop }
152 \cs_set:Npn \@@_cline_i:w #1-#2-#3 \q_stop
153 {

```

Now, `#1` is the number of the current column and we have to draw a line from the column `#2` to the column `#3` (both included).

```

154   \int_compare:nNnT { #1 } < { #2 }
155   { \multispan { \int_eval:n { #2 - #1 } } & }
156   \multispan { \int_eval:n { #3 - #2 + 1 } }
157   {
158     \CT@arc@
159     \leaders \hrule \@height \arrayrulewidth \hfill
160     \skip_horizontal:N \c_zero_dim
161   }

```

You look whether there is another `\cline` to draw (the final user may put several `\cline`).

```

162   \peek_meaning_remove_ignore_spaces:NTF \cline
163   { & \@@_cline_i:en { \@@_succ:n { #3 } } }
164   { \everycr { } \cr }
165 }
166 \cs_generate_variant:Nn \@@_cline_i:nn { e n }

```

The following commands are only for efficiency. They must *not* be protected because it will be used (for instance) in names of PGF nodes.

```

167 \cs_new:Npn \@@_succ:n #1 { \the \numexpr #1 + 1 \relax }
168 \cs_new:Npn \@@_pred:n #1 { \the \numexpr #1 - 1 \relax }

```

The following command is a small shortcut.

⁵²See question 99041 on TeX StackExchange.

```

169 \cs_new:Npn \@@_math_toggle_token:
170   { \bool_if:NF \l_@@_NiceTabular_bool \c_math_toggle_token }

171 \cs_new_protected:Npn \@@_set_CT@arc@:
172   { \peek_meaning:NTF [ \@@_set_CT@arc@_i: \@@_set_CT@arc@_ii: }
173 \cs_new_protected:Npn \@@_set_CT@arc@_i: [ #1 ] #2 \q_stop
174   { \cs_set:Npn \CT@arc@ { \color [ #1 ] { #2 } } }
175 \cs_new_protected:Npn \@@_set_CT@arc@_ii: #1 \q_stop
176   { \cs_set:Npn \CT@arc@ { \color { #1 } } }

177 \cs_set_eq:NN \@@_old_pgfpintanchor \pgfpintanchor

```

The column S of siunitx

We want to know whether the package siunitx is loaded and, if it is loaded, we redefine the S columns of siunitx.

```

178 \bool_new:N \c_@@_siunitx_loaded_bool
179 \AtBeginDocument
180   {
181     \ifpackageloaded { siunitx }
182       { \bool_set_true:N \c_@@_siunitx_loaded_bool }
183       { }
184   }

```

The command \@@_renew_NC@rewrite@S: will be used in each environment of nicematrix in order to “rewrite” the S column in each environment.

```

185 \AtBeginDocument
186   {
187     \bool_if:NTF { ! \c_@@_siunitx_loaded_bool }
188       { \cs_set_eq:NN \@@_renew_NC@rewrite@S: \prg_do_nothing: }
189       {

```

For version of siunitx at least equal to 3.0, the adaptation is different from previous ones. We test the version of siunitx by the existence of the control sequence \siunitx_cell_begin:w.

```

190     \cs_if_exist:NTF \siunitx_cell_begin:w
191     {
192       \cs_new_protected:Npn \@@_renew_NC@rewrite@S:
193       {
194         \renewcommand*{\NC@rewrite@S}[1] []
195         {
196           \@temptokena \exp_after:wN
197           {
198             \tex_the:D \@temptokena
199             > {
200               \@@_Cell:
201               \keys_set:nn { siunitx } { ##1 }
202               \siunitx_cell_begin:w
203             }

```

\@@_true_c: will be replaced statically by c at the end of the construction of the preamble.

```

204         \@@_true_c:
205         < { \siunitx_cell_end: \@@_end_Cell: }
206       }
207     \NC@find
208   }
209 }
210 {
211   {
212     \cs_new_protected:Npn \@@_renew_NC@rewrite@S:
213     {
214       \renewcommand*{\NC@rewrite@S}[1] []
215       {
216         \@temptokena \exp_after:wN

```

```

217         {
218             \tex_the:D \@temptokena
219             > { \@@_Cell: \c_@@_table_collect_begin_tl S {##1} }
220             \@@_true_c:
221             < { \c_@@_table_print_tl \@@_end_Cell: }
222         }
223     \NC@find
224 }
225 }
226 }
227 }
228 }

```

The following code is used to define `\c_@@_table_collect_begin_tl` and `\c_@@_table_print_tl` when the version of `siunitx` is prior to 3.0. The command `\@@_adapt_S_column` is used in the environment `{NiceArrayWithDelims}`.

```

229 \AtBeginDocument
230 {
231     \cs_set_eq:NN \@@_adapt_S_column: \prg_do_nothing:
232     \bool_lazy_and:nnT
233     { \c_@@_siunitx_loaded_bool }
234     { ! \cs_if_exist_p:N \siunitx_cell_begin:w }
235     {
236         \cs_set_protected:Npn \@@_adapt_S_column:
237         {
238             \group_begin:
239             \@temptokena = { }
240             \cs_set_eq:NN \NC@find \prg_do_nothing:
241             \NC@rewrite@S { }
242             \tl_gset:NV \g_tmpa_tl \@temptokena
243             \group_end:
244             \tl_new:N \c_@@_table_collect_begin_tl
245             \tl_set:Nx \l_tmpa_tl { \tl_item:Nn \g_tmpa_tl 2 }
246             \tl_gset:Nx \c_@@_table_collect_begin_tl { \tl_item:Nn \l_tmpa_tl 1 }
247             \tl_new:N \c_@@_table_print_tl
248             \tl_gset:Nx \c_@@_table_print_tl { \tl_item:Nn \g_tmpa_tl { -1 } }
249             \cs_gset_eq:NN \@@_adapt_S_column: \prg_do_nothing:
250         }
251     }
252 }

```

Parameters

For compatibility with versions prior to 5.0, we provide a load-time option `define_L_C_R`. With this option, it's possible to use the letters `L`, `C` and `R` instead of `l`, `c` and `r` in the preamble of the environments of `nicematrix` as it was mandatory before version 5.0.

```

253 \bool_new:N \c_@@_define_L_C_R_bool
254 \cs_new_protected:Npn \@@_define_L_C_R:
255 {
256     \newcolumnntype L l
257     \newcolumnntype C c
258     \newcolumnntype R r
259 }

```

The following counter will count the environments `{NiceArray}`. The value of this counter will be used to prefix the names of the Tikz nodes created in the array.

```

260 \int_new:N \g_@@_env_int

```

The following command is only a syntactic shortcut. It must *not* be protected (it will be used in names of PGF nodes).

```

261 \cs_new:Npn \@@_env: { nm - \int_use:N \g_@@_env_int }

```

The command `\NiceMatrixLastEnv` is not used by the package `nicematrix`. It's only a facility given to the final user. It gives the number of the last environment (in fact the number of the current environment but it's meant to be used after the environment in order to refer to that environment — and its nodes — without having to give it a name). This command *must* be expandable since it will be used in `pgf` nodes.

```
262 \NewExpandableDocumentCommand \NiceMatrixLastEnv { }
263 { \int_use:N \g_@@_env_int }
```

The following command is only a syntactic shortcut. The `q` in `qpoint` means *quick*.

```
264 \cs_new_protected:Npn \@@_qpoint:n #1
265 { \pgfpointanchor { \@@_env: - #1 } { center } }
```

The following counter will count the environments `{NiceMatrixBlock}`.

```
266 \int_new:N \g_@@_NiceMatrixBlock_int
```

The dimension `\l_@@_columns_width_dim` will be used when the options specify that all the columns must have the same width (but, if the key `columns-width` is used with the special value `auto`, the boolean `\l_@@_auto_columns_width_bool` also will be raised).

```
267 \dim_new:N \l_@@_columns_width_dim
```

The following counters will be used to count the numbers of rows and columns of the array.

```
268 \int_new:N \g_@@_row_total_int
269 \int_new:N \g_@@_col_total_int
```

The following token list will contain the type of the current cell (`l`, `c` or `r`). It will be used by the blocks.

```
270 \tl_new:N \l_@@_cell_type_tl
271 \tl_set:Nn \l_@@_cell_type_tl { c }
```

When there is a mono-column block (created by the command `\Block`), we want to take into account the width of that block for the width of the column. That's why we compute the width of that block in the `\g_@@_blocks_wd_dim` and, after the construction of the box `\l_@@_cell_box`, we change the width of that box to take into account the length `\g_@@_blocks_wd_dim`.

```
272 \dim_new:N \g_@@_blocks_wd_dim
```

Idem pour the mono-row blocks.

```
273 \dim_new:N \g_@@_blocks_ht_dim
274 \dim_new:N \g_@@_blocks_dp_dim
```

The sequence `\g_@@_names_seq` will be the list of all the names of environments used (via the option `name`) in the document: two environments must not have the same name. However, it's possible to use the option `allow-duplicate-names`.

```
275 \seq_new:N \g_@@_names_seq
```

We want to know whether we are in an environment of `nicematrix` because we will raise an error if the user tries to use nested environments.

```
276 \bool_new:N \l_@@_in_env_bool
```

If the user uses `{NiceArray}` or `{NiceTabular}` the flag `\l_@@_NiceArray_bool` will be raised.

```
277 \bool_new:N \l_@@_NiceArray_bool
```

In fact, if there is delimiters in the preamble of `{NiceArray}` (eg: `[cccc]`), this boolean will be set to false.

If the user uses `{NiceTabular}` or `{NiceTabular*}`, we will raise the following flag.

```
278 \bool_new:N \l_@@_NiceTabular_bool
```

If the user uses `{NiceTabular*}`, the width of the tabular (in the first argument of the environment `{NiceTabular*}`) will be stored in the following dimension.

```
279 \dim_new:N \l_@@_tabular_width_dim
```

If the user uses an environment without preamble, we will raise the following flag.

```
280 \bool_new:N \l_@@_Matrix_bool
```

The following boolean will be raised when the command `\rotate` is used.

```
281 \bool_new:N \g_@@_rotate_bool
```

We will write in `\g_@@_aux_tl` all the instructions that we have to write on the `aux` file for the current environment. The content of that token list will be written on the `aux` file at the end of the environment (in an instruction `\tl_gset:cn { c_@@_ \int_use:N \g_@@_env_int _ tl }`).

```
282 \tl_new:N \g_@@_aux_tl
```

```
283 \cs_new_protected:Npn \@@_test_if_math_mode:
284 {
285   \if_mode_math: \else:
286     \@@_fatal:n { Outside-math-mode }
287   \fi:
288 }
```

The letter used for the vlines which will be drawn only in the sub-matrices. `vlism` stands for *vertical lines in sub-matrices*.

```
289 \tl_new:N \l_@@_letter_vlism_tl
```

The list of the columns where vertical lines in sub-matrices (vlism) must be drawn. Of course, the actual value of this sequence will be known after the analyse of the preamble of the array.

```
290 \seq_new:N \g_@@_cols_vlism_seq
```

The following colors will be used to memorize the color of the potential “first col” and the potential “first row”.

```
291 \colorlet { nicematrix-last-col } { . }
292 \colorlet { nicematrix-last-row } { . }
```

The following string is the name of the current environment or the current command of `nicematrix` (despite its name which contains `env`).

```
293 \str_new:N \g_@@_name_env_str
```

The following string will contain the word *command* or *environment* whether we are in a command of `nicematrix` or in an environment of `nicematrix`. The default value is *environment*.

```
294 \tl_set:Nn \g_@@_com_or_env_str { environment }
```

The following command will be able to reconstruct the full name of the current command or environment (despite its name which contains `env`). This command must *not* be protected since it will be used in error messages and we have to use `\str_if_eq:VnTF` and not `\tl_if_eq:NnTF` because we need to be fully expandable).

```
295 \cs_new:Npn \@@_full_name_env:
296 {
297   \str_if_eq:VnTF \g_@@_com_or_env_str { command }
298     { command \space \c_backslash_str \g_@@_name_env_str }
299     { environment \space \{ \g_@@_name_env_str \} }
300 }
```

The following token list corresponds to the option `code-after` (it’s also possible to set the value of that parameter with the keyword `\CodeAfter`).

```
301 \tl_new:N \g_nicematrix_code_after_tl
```

For the key `code` of the command `\SubMatrix` (itself in the main `\CodeAfter`), we will use the following token list.

```
302 \tl_new:N \l_@@_code_tl
```

The following token list has a function similar to `\g_nicematrix_code_after_tl` but it is used internally by `nicematrix`. In fact, we have to distinguish between `\g_nicematrix_code_after_tl` and `\g_@@_internal_code_after_tl` because we must take care of the order in which instructions stored in that parameters are executed.

```
303 \tl_new:N \g_@@_internal_code_after_tl
```

The counters `\l_@@_old_iRow_int` and `\l_@@_old_jCol_int` will be used to save the values of the potential LaTeX counters `iRow` and `jCol`. These LaTeX counters will be restored at the end of the environment.

```
304 \int_new:N \l_@@_old_iRow_int
```

```
305 \int_new:N \l_@@_old_jCol_int
```

The TeX counters `\c@iRow` and `\c@jCol` will be created in the beginning of `{NiceArrayWithDelims}` (if they don't exist previously).

The following token list corresponds to the key `rules/color` available in the environments.

```
306 \tl_new:N \l_@@_rules_color_tl
```

This boolean will be used only to detect in an expandable way whether we are at the beginning of the (potential) column zero, in order to raise an error if `\Hdotsfor` is used in that column.

```
307 \bool_new:N \g_@@_after_col_zero_bool
```

A kind of false row will be inserted at the end of the array for the construction of the `col` nodes (and also to fix the width of the columns when `columns-width` is used). When this special row will be created, we will raise the flag `\g_@@_row_of_col_done_bool` in order to avoid some actions set in the redefinition of `\everycr` when the last `\cr` of the `\halign` will occur (after that row of `col` nodes).

```
308 \bool_new:N \g_@@_row_of_col_done_bool
```

It's possible to use the command `\NotEmpty` to specify explicitly that a cell must be considered as non empty by `nicematrix` (the Tikz nodes are constructed only in the non empty cells).

```
309 \bool_new:N \g_@@_not_empty_cell_bool
```

`\l_@@_code_before_tl` may contain two types of informations:

- A `code-before` written in the `aux` file by a previous run. When the `aux` file is read, this `code-before` is stored in `\g_@@_code_before_i_tl` (where *i* is the number of the environment) and, at the beginning of the environment, it will be put in `\l_@@_code_before_tl`.
- The final user can explicitly add material in `\l_@@_code_before_tl` by using the key `code-before` or the keyword `\CodeBefore` (with the keyword `\Body`).

```
310 \tl_new:N \l_@@_code_before_tl
```

```
311 \bool_new:N \l_@@_code_before_bool
```

The following token list will contain the code inserted in each cell of the current row (this token list will be cleared at the beginning of each row).

```
312 \tl_new:N \g_@@_row_style_tl
```

The following dimensions will be used when drawing the dotted lines.

```
313 \dim_new:N \l_@@_x_initial_dim
```

```
314 \dim_new:N \l_@@_y_initial_dim
```

```
315 \dim_new:N \l_@@_x_final_dim
```

```
316 \dim_new:N \l_@@_y_final_dim
```

expl3 provides scratch dimensions `\l_tmpa_dim` and `\l_tmpb_dim`. We create two more in the same spirit (if they don't exist yet: that's why we use `\dim_zero_new:N`).

```
317 \dim_zero_new:N \l_tmpc_dim
318 \dim_zero_new:N \l_tmpd_dim
```

Some cells will be declared as “empty” (for example a cell with an instruction `\Cdots`).

```
319 \bool_new:N \g_@@_empty_cell_bool
```

The following dimensions will be used internally to compute the width of the potential “first column” and “last column”.

```
320 \dim_new:N \g_@@_width_last_col_dim
321 \dim_new:N \g_@@_width_first_col_dim
```

The following sequence will contain the characteristics of the blocks of the array, specified by the command `\Block`. Each block is represented by 6 components surrounded by curly braces:

`{imin}{jmin}{imax}{jmax}{options}{contents}`.

The variable is global because it will be modified in the cells of the array.

```
322 \seq_new:N \g_@@_blocks_seq
```

We also manage a sequence of the *positions* of the blocks. Of course, it's redundant with the previous sequence, but it's for efficiency. In that sequence, each block is represented by only the four first components: `{imin}{jmin}{imax}{jmax}`.

```
323 \seq_new:N \g_@@_pos_of_blocks_seq
```

In fact, this sequence will also contain the positions of the cells with a `\diagbox`. The sequence `\g_@@_pos_of_blocks_seq` will be used when we will draw the rules (which respect the blocks).

We will also manage a sequence for the positions of the dotted lines. These dotted lines are created in the array by `\Cdots`, `\Vdots`, `\Ddots`, etc. However, their positions, that is to say, their extremities, will be determined only after the construction of the array. In this sequence, each item contains four components: `{imin}{jmin}{imax}{jmax}`.

```
324 \seq_new:N \g_@@_pos_of_xdots_seq
```

The sequence `\g_@@_pos_of_xdots_seq` will be used when we will draw the rules required by the key `hvlines` (these rules won't be drawn within the virtual blocks corresponding to the dotted lines).

The final user may decide to “stroke” a block (using, for example, the key `draw=red!15` when using the command `\Block`). In that case, the rules specified, for instance, by `hvlines` must not be drawn around the block. That's why we keep the information of all that stroken blocks in the following sequence.

```
325 \seq_new:N \g_@@_pos_of_stroken_blocks_seq
```

If the user has used the key `corners` (or the key `hvlines-except-corners`), all the cells which are in an (empty) corner will be stored in the following sequence.

```
326 \seq_new:N \l_@@_corners_cells_seq
```

The list of the names of the potential `\SubMatrix` in the `\CodeAfter` of an environment. Unfortunately, that list has to be global (we have to use it inside the group for the options of a given `\SubMatrix`).

```
327 \seq_new:N \g_@@_submatrix_names_seq
```

The sequence `\g_@@_multicolumn_cells_seq` will contain the list of the cells of the array where a command `\multicolumn{n}{...}{...}` with $n > 1$ is issued. In `\g_@@_multicolumn_sizes_seq`, the “sizes” (that is to say the values of n) correspondent will be stored. These lists will be used for the creation of the “medium nodes” (if they are created).

```
328 \seq_new:N \g_@@_multicolumn_cells_seq
329 \seq_new:N \g_@@_multicolumn_sizes_seq
```

The following counters will be used when searching the extremities of a dotted line (we need these counters because of the potential “open” lines in the `\SubMatrix`—the `\SubMatrix` in the `code-before`).

```
330 \int_new:N \l_@@_row_min_int
331 \int_new:N \l_@@_row_max_int
332 \int_new:N \l_@@_col_min_int
333 \int_new:N \l_@@_col_max_int
```

The following sequence will be used when the command `\SubMatrix` is used in the `code-before` (and not in the `\CodeAfter`). It will contain the position of all the sub-matrices specified in the `code-before`. Each sub-matrix is represented by an “object” of the forme $\{i\}\{j\}\{k\}\{l\}$ where i and j are the number of row and column of the upper-left cell and k and l the number of row and column of the lower-right cell.

```
334 \seq_new:N \g_@@_submatrix_seq
```

We are able to determine the number of columns specified in the preamble (for the environments with explicit preamble of course and without the potential exterior columns).

```
335 \int_new:N \g_@@_static_num_of_col_int
```

The following parameters correspond to the keys `fill`, `draw`, `borders` and `rounded-corners` of the command `\Block`.

```
336 \tl_new:N \l_@@_fill_tl
337 \tl_new:N \l_@@_draw_tl
338 \clist_new:N \l_@@_borders_clist
339 \dim_new:N \l_@@_rounded_corners_dim
```

The last parameter has no direct link with the [empty] corners of the array (which are computed and taken into account by `nicematrix` when the key `corners` is used).

The following token list correspond to the key `color` of the command `\Block`.

```
340 \tl_new:N \l_@@_color_tl
```

Here is the dimension for the width of the rule when a block (created by `\Block`) is stroked.

```
341 \dim_new:N \l_@@_line_width_dim
```

The parameters of the horizontal position of the label of a block. If the user uses the key `c` or `C`, the value is `c`. If the user uses the key `l` or `L`, the value is `l`. If the user uses the key `r` or `R`, the value is `r`. If the user has used a capital letter, the boolean `\l_@@_hpos_of_block_cap_bool` will be raised (in the second pass of the analyze of the keys of the command `\Block`).

```
342 \tl_new:N \l_@@_hpos_of_block_tl
343 \tl_set:Nn \l_@@_hpos_of_block_tl { c }
344 \bool_new:N \l_@@_hpos_of_block_cap_bool
```

For the vertical position, the possible values are `c`, `t` and `b`. Of course, it would be interesting to program a key `T` and a key `B`.

```
345 \tl_new:N \l_@@_vpos_of_block_tl
346 \tl_set:Nn \l_@@_vpos_of_block_tl { c }
```

Used when the key `draw-first` is used for `\Ddots` or `\Iddots`.

```
347 \bool_new:N \l_@@_draw_first_bool
```

The following flag corresponds to the key `hvlines` of the command `\Block`.

```
348 \bool_new:N \l_@@_hvlines_block_bool
```

The blocks which use the key `-` will store their content in a box. These boxes are numbered with the following counter.

```
349 \int_new:N \g_@@_block_box_int
```

```

350 \dim_new:N \l_@@_submatrix_extra_height_dim
351 \dim_new:N \l_@@_submatrix_left_xshift_dim
352 \dim_new:N \l_@@_submatrix_right_xshift_dim
353 \clist_new:N \l_@@_hlines_clist
354 \clist_new:N \l_@@_vlines_clist
355 \clist_new:N \l_@@_submatrix_hlines_clist
356 \clist_new:N \l_@@_submatrix_vlines_clist

```

Variables for the exterior rows and columns

The keys for the exterior rows and columns are `first-row`, `first-col`, `last-row` and `last-col`. However, internally, these keys are not coded in a similar way.

• First row

The integer `\l_@@_first_row_int` is the number of the first row of the array. The default value is 1, but, if the option `first-row` is used, the value will be 0.

```

357 \int_new:N \l_@@_first_row_int
358 \int_set:Nn \l_@@_first_row_int 1

```

• First column

The integer `\l_@@_first_col_int` is the number of the first column of the array. The default value is 1, but, if the option `first-col` is used, the value will be 0.

```

359 \int_new:N \l_@@_first_col_int
360 \int_set:Nn \l_@@_first_col_int 1

```

• Last row

The counter `\l_@@_last_row_int` is the number of the potential “last row”, as specified by the key `last-row`. A value of `-2` means that there is no “last row”. A value of `-1` means that there is a “last row” but we don’t know the number of that row (the key `last-row` has been used without value and the actual value has not still been read in the `aux` file).

```

361 \int_new:N \l_@@_last_row_int
362 \int_set:Nn \l_@@_last_row_int { -2 }

```

If, in an environment like `{pNiceArray}`, the option `last-row` is used without value, we will globally raise the following flag. It will be used to know if we have, after the construction of the array, to write in the `aux` file the number of the “last row”.⁵³

```

363 \bool_new:N \l_@@_last_row_without_value_bool

```

Idem for `\l_@@_last_col_without_value_bool`

```

364 \bool_new:N \l_@@_last_col_without_value_bool

```

• Last column

For the potential “last column”, we use an integer. A value of `-2` means that there is no last column. A value of `-1` means that we are in an environment without preamble (e.g. `{bNiceMatrix}`) and there is a last column but we don’t know its value because the user has used the option `last-col` without value. A value of 0 means that the option `last-col` has been used in an environment with preamble (like `{pNiceArray}`): in this case, the key was necessary without argument.

```

365 \int_new:N \l_@@_last_col_int
366 \int_set:Nn \l_@@_last_col_int { -2 }

```

⁵³We can’t use `\l_@@_last_row_int` for this usage because, if `nicematrix` has read its value from the `aux` file, the value of the counter won’t be `-1` any longer.

However, we have also a boolean. Consider the following code:

```
\begin{pNiceArray}{cc}[last-col]
1 & 2 \\
3 & 4
\end{pNiceArray}
```

In such a code, the “last column” specified by the key `last-col` is not used. We want to be able to detect such a situation and we create a boolean for that job.

```
367 \bool_new:N \g_@@_last_col_found_bool
```

This boolean is set to `false` at the end of `\@@_pre_array_ii:`.

The command `\tabularnote`

The LaTeX counter `tabularnote` will be used to count the tabular notes during the construction of the array (this counter won’t be used during the composition of the notes at the end of the array). You use a LaTeX counter because we will use `\refstepcounter` in order to have the tabular notes referenceable.

```
368 \newcounter { tabularnote }
```

We will store in the following sequence the tabular notes of a given array.

```
369 \seq_new:N \g_@@_tabularnotes_seq
```

However, before the actual tabular notes, it’s possible to put a text specified by the key `tabularnote` of the environment. The token list `\l_@@_tabularnote_tl` corresponds to the value of that key.

```
370 \tl_new:N \l_@@_tabularnote_tl
```

The following counter will be used to count the number of successive tabular notes such as in `\tabularnote{Note 1}\tabularnote{Note 2}\tabularnote{Note 3}`. In the tabular, the labels of those nodes are composed as a comma separated list (e.g. a,b,c).

```
371 \int_new:N \l_@@_number_of_notes_int
```

The following function can be redefined by using the key `notes/style`.

```
372 \cs_new:Npn \@@_notes_style:n #1 { \textit { \alph { #1 } } }
```

The following fonction can be redefined by using the key `notes/label-in-tabular`.

```
373 \cs_new:Npn \@@_notes_label_in_tabular:n #1 { \textsuperscript { #1 } }
```

The following function can be redefined by using the key `notes/label-in-list`.

```
374 \cs_new:Npn \@@_notes_label_in_list:n #1 { \textsuperscript { #1 } }
```

We define `\thetabularnote` because it will be used by LaTeX if the user want to reference a footnote which has been marked by a `\label`. The TeX group is for the case where the user has put an instruction such as `\color{red}` in `\@@_notes_style:n`.

```
375 \cs_set:Npn \thetabularnote { { \@@_notes_style:n { tabularnote } } }
```

The tabular notes will be available for the final user only when `enumitem` is loaded. Indeed, the tabular notes will be composed at the end of the array with a list customized by `enumitem` (a list `tabularnotes` in the general case and a list `tabularnotes*` if the key `para` is in force). However, we can test whether `enumitem` has been loaded only at the beginning of the document (we want to allow the user to load `enumitem` after `nicematrix`).

```

376 \AtBeginDocument
377 {
378   \bool_if:nTF { ! \c_@@_enumitem_loaded_bool }
379   {
380     \NewDocumentCommand \tabularnote { m }
381     { \@@_error:n { enumitem~not~loaded } }
382   }
383   {

```

The type of list `tabularnotes` will be used to format the tabular notes at the end of the array in the general case and `tabularnotes*` will be used if the key `para` is in force.

```

384   \newlist { tabularnotes } { enumerate } { 1 }
385   \setlist [ tabularnotes ]
386   {
387     topsep = 0pt ,
388     noitemsep ,
389     leftmargin = * ,
390     align = left ,
391     labelsep = 0pt ,
392     label =
393     \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotesi } } ,
394   }
395   \newlist { tabularnotes* } { enumerate* } { 1 }
396   \setlist [ tabularnotes* ]
397   {
398     afterlabel = \nobreak ,
399     itemjoin = \quad ,
400     label =
401     \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotes*i } }
402   }

```

The command `\tabularnote` is available in the whole document (and not only in the environments of `nicematrix`) because we want it to be available in the caption of a `{table}` (before the following `{NiceTabular}` or `{NiceArray}`). That's also the reason why the variables `\c@tabularnote` and `\g_@@_tabularnotes_seq` will be cleared at the end of the environment of `nicematrix` (and not at the beginning).

Unfortunately, if the package `caption` is loaded, the command `\caption` evaluates its argument twice and since it is not aware (of course) of `\tabularnote`, the command `\tabularnote` is, in fact, not usable in `\caption` when `caption` is loaded.⁵⁴

```

403   \NewDocumentCommand \tabularnote { m }
404   {
405     \bool_if:nTF { ! \l_@@_NiceArray_bool && \l_@@_in_env_bool }
406     { \@@_error:n { tabularnote~forbidden } }
407     {

```

`\l_@@_number_of_notes_int` is used to count the number of successive tabular notes such as in `\tabularnote{Note 1}\tabularnote{Note 2}\tabularnote{Note 3}`. We will have to compose the labels of theses notes as a comma separated list (e.g. a,b,c).

```

408     \int_incr:N \l_@@_number_of_notes_int

```

We expand the content of the note at the point of use of `\tabularnote` as does `\footnote`.

```

409     \seq_gput_right:Nn \g_@@_tabularnotes_seq { #1 }
410     \peek_meaning:NF \tabularnote
411     {

```

⁵⁴We should try to find a solution to that problem.

If the following token is *not* a `\tabularnote`, we have finished the sequence of successive commands `\tabularnote` and we have to format the labels of these tabular notes (in the array). We compose those labels in a box `\l_tmpa_box` because we will do a special construction in order to have this box in a overlapping position if we are at the end of a cell.

```
412         \hbox_set:Nn \l_tmpa_box
413         {
```

We remind that it is the command `\@@_notes_label_in_tabular:n` that will (most of the time) put the labels in a `\textsuperscript`.

```
414         \@@_notes_label_in_tabular:n
415         {
416             \stepcounter { tabularnote }
417             \@@_notes_style:n { tabularnote }
418             \prg_replicate:nn { \l_@@_number_of_notes_int - 1 }
419             {
420                 ,
421                 \stepcounter { tabularnote }
422                 \@@_notes_style:n { tabularnote }
423             }
424         }
425     }
```

We use `\refstepcounter` in order to have the (last) tabular note referenceable (with the standard command `\label`) and that's why we have to go back with a decrementation of the counter `tabularnote` first.

```
426         \addtocounter { tabularnote } { -1 }
427         \refstepcounter { tabularnote }
428         \int_zero:N \l_@@_number_of_notes_int
429         \hbox_overlap_right:n { \box_use:N \l_tmpa_box }
```

If the command `\tabularnote` is used exactly at the end of the cell, the `\unskip` (inserted by `array?`) will delete the skip we insert now and the label of the footnote will be composed in an overlapping position (by design).

```
430         \skip_horizontal:n { \box_wd:N \l_tmpa_box }
431     }
432 }
433 }
434 }
435 }
```

Command for creation of rectangle nodes

The following command should be used in a `{pgfpicture}`. It creates a rectangle (empty but with a name).

#1 is the name of the node which will be created; **#2** and **#3** are the coordinates of one of the corner of the rectangle; **#4** and **#5** are the coordinates of the opposite corner.

```
436 \cs_new_protected:Npn \@@_pgf_rect_node:nnnnn #1 #2 #3 #4 #5
437 {
438     \begin { pgfscope }
439     \pgfset
440     {
441         outer~sep = \c_zero_dim ,
442         inner~sep = \c_zero_dim ,
443         minimum~size = \c_zero_dim
444     }
445     \pgftransformshift { \pgfpoint { 0.5 * ( #2 + #4 ) } { 0.5 * ( #3 + #5 ) } }
446     \pgfnode
447     { rectangle }
448     { center }
449     {
450         \vbox_to_ht:nn
451         { \dim_abs:n { #5 - #3 } }
```

```

452     {
453         \vfill
454         \hbox_to_wd:nn { \dim_abs:n { #4 - #2 } } { }
455     }
456 }
457 { #1 }
458 { }
459 \end { pgfscope }
460 }

```

The command `\@@_pgf_rect_node:nnn` is a variant of `\@@_pgf_rect_node:nnnn`: it takes two PGF points as arguments instead of the four dimensions which are the coordinates.

```

461 \cs_new_protected:Npn \@@_pgf_rect_node:nnn #1 #2 #3
462 {
463     \begin { pgfscope }
464     \pgfset
465     {
466         outer-sep = \c_zero_dim ,
467         inner-sep = \c_zero_dim ,
468         minimum-size = \c_zero_dim
469     }
470     \pgftransformshift { \pgfpointscale { 0.5 } { \pgfpointadd { #2 } { #3 } } }
471     \pgfpointdiff { #3 } { #2 }
472     \pgfgetlastxy \l_tmpa_dim \l_tmpb_dim
473     \pgfnode
474     { rectangle }
475     { center }
476     {
477         \vbox_to_ht:nn
478         { \dim_abs:n \l_tmpb_dim }
479         { \vfill \hbox_to_wd:nn { \dim_abs:n \l_tmpa_dim } { } }
480     }
481     { #1 }
482     { }
483     \end { pgfscope }
484 }

```

The options

By default, the commands `\cellcolor` and `\rowcolor` are available for the user in the cells of the `tabular` (the user may use the commands provided by `\colortbl`). However, if the key `colortbl-like` is used, these commands are available.

```

485 \bool_new:N \l_@@_colortbl_like_bool

```

By default, the behaviour of `\cline` is changed in the environments of `nicematrix`: a `\cline` spreads the array by an amount equal to `\arrayrulewidht`. It's possible to disable this feature with the key `\l_@@_standard_line_bool`.

```

486 \bool_new:N \l_@@_standard_cline_bool

```

The following dimensions correspond to the options `cell-space-top-limit` and `co` (these parameters are inspired by the package `cellspace`).

```

487 \dim_new:N \l_@@_cell_space_top_limit_dim
488 \dim_new:N \l_@@_cell_space_bottom_limit_dim

```

The following dimension is the distance between two dots for the dotted lines (when `line-style` is equal to `standard`, which is the initial value). The initial value is 0.45 em but it will be changed if the option `small` is used.

```

489 \dim_new:N \l_@@_inter_dots_dim
490 \AtBeginDocument { \dim_set:Nn \l_@@_inter_dots_dim { 0.45 em } }

```

The `\AtBeginDocument` is only a security in case `revtex4-1` is used (even though it is obsolete).

The following dimension is the minimal distance between a node (in fact an anchor of that node) and a dotted line (we say “minimal” because, by definition, a dotted line is not a continuous line and, therefore, this distance may vary a little).

```
491 \dim_new:N \l_@@_xdots_shorten_dim
492 \AtBeginDocument { \dim_set:Nn \l_@@_xdots_shorten_dim { 0.3 em } }
```

The `\AtBeginDocument` is only a security in case `revtex4-1` is used (even though it is obsolete).

The following dimension is the radius of the dots for the dotted lines (when `line-style` is equal to `standard`, which is the initial value). The initial value is 0.53 pt but it will be changed if the option `small` is used.

```
493 \dim_new:N \l_@@_radius_dim
494 \AtBeginDocument { \dim_set:Nn \l_@@_radius_dim { 0.53 pt } }
```

The `\AtBeginDocument` is only a security in case `revtex4-1` is used (even if it is obsolete).

The token list `\l_@@_xdots_line_style_tl` corresponds to the option `tikz` of the commands `\Cdots`, `\Ldots`, etc. and of the options `line-style` for the environments and `\NiceMatrixOptions`. The constant `\c_@@_standard_tl` will be used in some tests.

```
495 \tl_new:N \l_@@_xdots_line_style_tl
496 \tl_const:Nn \c_@@_standard_tl { standard }
497 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
```

The boolean `\l_@@_light_syntax_bool` corresponds to the option `light-syntax`.

```
498 \bool_new:N \l_@@_light_syntax_bool
```

The string `\l_@@_baseline_tl` may contain one of the three values `t`, `c` or `b` as in the option of the environment `{array}`. However, it may also contain an integer (which represents the number of the row to which align the array).

```
499 \tl_new:N \l_@@_baseline_tl
500 \tl_set:Nn \l_@@_baseline_tl c
```

The flag `\l_@@_exterior_arraycolsep_bool` corresponds to the option `exterior-arraycolsep`. If this option is set, a space equal to `\arraycolsep` will be put on both sides of an environment `{NiceArray}` (as it is done in `{array}` of `array`).

```
501 \bool_new:N \l_@@_exterior_arraycolsep_bool
```

The flag `\l_@@_parallelize_diags_bool` controls whether the diagonals are parallelized. The initial value is `true`.

```
502 \bool_new:N \l_@@_parallelize_diags_bool
503 \bool_set_true:N \l_@@_parallelize_diags_bool
```

The following parameter correspond to the key `corners`. The elements of that `clist` must be in NW, SW, NE and SE.

```
504 \clist_new:N \l_@@_corners_clist
```

```
505 \dim_new:N \l_@@_notes_above_space_dim
506 \AtBeginDocument { \dim_set:Nn \l_@@_notes_above_space_dim { 1 mm } }
```

The `\AtBeginDocument` is only a security in case `revtex4-1` is used (even if it is obsolete).

The flag `\l_@@_nullify_dots_bool` corresponds to the option `nullify-dots`. When the flag is down, the instructions like `\vdots` are inserted within a `\hphantom` (and so the constructed matrix has exactly the same size as a matrix constructed with the classical `{matrix}` and `\ldots`, `\vdots`, etc.).

```
507 \bool_new:N \l_@@_nullify_dots_bool
```

The following flag will be used when the current options specify that all the columns of the array must have the same width equal to the largest width of a cell of the array (except the cells of the potential exterior columns).

```
508 \bool_new:N \l_@@_auto_columns_width_bool
```

The following boolean corresponds to the key `create-cell-nodes` of the keyword `\CodeBefore`.

```
509 \bool_new:N \g_@@_recreate_cell_nodes_bool
```

The string `\l_@@_name_str` will contain the optional name of the environment: this name can be used to access to the Tikz nodes created in the array from outside the environment.

```
510 \str_new:N \l_@@_name_str
```

The boolean `\l_@@_medium_nodes_bool` will be used to indicate whether the “medium nodes” are created in the array. Idem for the “large nodes”.

```
511 \bool_new:N \l_@@_medium_nodes_bool
```

```
512 \bool_new:N \l_@@_large_nodes_bool
```

The boolean `\l_@@_except_borders_bool` will be raised when the key `hvlines-except-borders` will be used (but that key has also other effects).

```
513 \bool_new:N \l_@@_except_borders_bool
```

The dimension `\l_@@_left_margin_dim` correspond to the option `left-margin`. Idem for the right margin. These parameters are involved in the creation of the “medium nodes” but also in the placement of the delimiters and the drawing of the horizontal dotted lines (`\hdottedline`).

```
514 \dim_new:N \l_@@_left_margin_dim
```

```
515 \dim_new:N \l_@@_right_margin_dim
```

The dimensions `\l_@@_extra_left_margin_dim` and `\l_@@_extra_right_margin_dim` correspond to the options `extra-left-margin` and `extra-right-margin`.

```
516 \dim_new:N \l_@@_extra_left_margin_dim
```

```
517 \dim_new:N \l_@@_extra_right_margin_dim
```

The token list `\l_@@_end_of_row_tl` corresponds to the option `end-of-row`. It specifies the symbol used to mark the ends of rows when the light syntax is used.

```
518 \tl_new:N \l_@@_end_of_row_tl
```

```
519 \tl_set:Nn \l_@@_end_of_row_tl { ; }
```

The following parameter is for the color the dotted lines drawn by `\Cdots`, `\Ldots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` but *not* the dotted lines drawn by `\hdottedline` and “:”.

```
520 \tl_new:N \l_@@_xdots_color_tl
```

The following token list corresponds to the key `delimiters/color`.

```
521 \tl_new:N \l_@@_delimiters_color_tl
```

Sometimes, we want to have several arrays vertically juxtaposed in order to have an alignment of the columns of these arrays. To achieve this goal, one may wish to use the same width for all the columns (for example with the option `columns-width` or the option `auto-columns-width` of the environment `{NiceMatrixBlock}`). However, even if we use the same type of delimiters, the width of the delimiters may be different from an array to another because the width of the delimiter is fonction of its size. That’s why we create an option called `delimiters/max-width` which will give to the delimiters the width of a delimiter (of the same type) of big size. The following boolean corresponds to this option.

```
522 \bool_new:N \l_@@_delimiters_max_width_bool
```

```

523 \keys_define:nn { NiceMatrix / xdots }
524 {
525     line-style .code:n =
526     {
527         \bool_lazy_or:nnTF

```

We can't use `\c_@@tikz_loaded_bool` to test whether `tikz` is loaded because `\NiceMatrixOptions` may be used in the preamble of the document.

```

528         { \cs_if_exist_p:N \tikzpicture }
529         { \str_if_eq_p:nn { #1 } { standard } }
530         { \tl_set:Nn \l_@@xdots_line_style_tl { #1 } }
531         { \@@_error:n { bad-option-for-line-style } }
532     } ,
533     line-style .value_required:n = true ,
534     color .tl_set:N = \l_@@xdots_color_tl ,
535     color .value_required:n = true ,
536     shorten .dim_set:N = \l_@@xdots_shorten_dim ,
537     shorten .value_required:n = true ,

```

The options `down` and `up` are not documented for the final user because he should use the syntax with `^` and `_`.

```

538     down .tl_set:N = \l_@@xdots_down_tl ,
539     up .tl_set:N = \l_@@xdots_up_tl ,

```

The key `draw-first`, which is meant to be used only with `\Ddots` and `\Iddots`, which be caught when `\Ddots` or `\Iddots` is used (during the construction of the array and not when we draw the dotted lines).

```

540     draw-first .code:n = \prg_do_nothing: ,
541     unknown .code:n = \@@_error:n { Unknown-key-for-xdots }
542 }

```

```

543 \keys_define:nn { NiceMatrix / rules }
544 {
545     color .tl_set:N = \l_@@_rules_color_tl ,
546     color .value_required:n = true ,
547     width .dim_set:N = \arrayrulewidth ,
548     width .value_required:n = true
549 }

```

First, we define a set of keys “NiceMatrix / Global” which will be used (with the mechanism of `.inherit:n`) by other sets of keys.

```

550 \keys_define:nn { NiceMatrix / Global }
551 {
552     delimiters .code:n =
553         \keys_set:nn { NiceMatrix / delimiters } { #1 } ,
554     delimiters .value_required:n = true ,
555     rules .code:n = \keys_set:nn { NiceMatrix / rules } { #1 } ,
556     rules .value_required:n = true ,
557     standard-cline .bool_set:N = \l_@@_standard_cline_bool ,
558     standard-cline .default:n = true ,
559     cell-space-top-limit .dim_set:N = \l_@@_cell_space_top_limit_dim ,
560     cell-space-top-limit .value_required:n = true ,
561     cell-space-bottom-limit .dim_set:N = \l_@@_cell_space_bottom_limit_dim ,
562     cell-space-bottom-limit .value_required:n = true ,
563     cell-space-limits .meta:n =
564     {
565         cell-space-top-limit = #1 ,
566         cell-space-bottom-limit = #1 ,
567     } ,
568     cell-space-limits .value_required:n = true ,
569     xdots .code:n = \keys_set:nn { NiceMatrix / xdots } { #1 } ,
570     light-syntax .bool_set:N = \l_@@_light_syntax_bool ,

```

```

571 light-syntax .default:n = true ,
572 end-of-row .tl_set:N = \l_@@_end_of_row_tl ,
573 end-of-row .value_required:n = true ,
574 first-col .code:n = \int_zero:N \l_@@_first_col_int ,
575 first-row .code:n = \int_zero:N \l_@@_first_row_int ,
576 last-row .int_set:N = \l_@@_last_row_int ,
577 last-row .default:n = -1 ,
578 code-for-first-col .tl_set:N = \l_@@_code_for_first_col_tl ,
579 code-for-first-col .value_required:n = true ,
580 code-for-last-col .tl_set:N = \l_@@_code_for_last_col_tl ,
581 code-for-last-col .value_required:n = true ,
582 code-for-first-row .tl_set:N = \l_@@_code_for_first_row_tl ,
583 code-for-first-row .value_required:n = true ,
584 code-for-last-row .tl_set:N = \l_@@_code_for_last_row_tl ,
585 code-for-last-row .value_required:n = true ,
586 hlines .clist_set:N = \l_@@_hlines_clist ,
587 vlines .clist_set:N = \l_@@_vlines_clist ,
588 hlines .default:n = all ,
589 vlines .default:n = all ,
590 vlines-in-sub-matrix .code:n =
591 {
592   \tl_if_single_token:nTF { #1 }
593   { \tl_set:Nn \l_@@_letter_vlism_tl { #1 } }
594   { @@_error:n { One-letter~allowed } }
595 } ,
596 vlines-in-sub-matrix .value_required:n = true ,
597 hvlines .code:n =
598 {
599   \clist_set:Nn \l_@@_vlines_clist { all }
600   \clist_set:Nn \l_@@_hlines_clist { all }
601 } ,
602 hvlines-except-borders .code:n =
603 {
604   \clist_set:Nn \l_@@_vlines_clist { all }
605   \clist_set:Nn \l_@@_hlines_clist { all }
606   \bool_set_true:N \l_@@_except_borders_bool
607 } ,
608 parallelize-diags .bool_set:N = \l_@@_parallelize_diags_bool ,

```

With the option `renew-dots`, the command `\cdots`, `\ldots`, `\vdots`, `\ddots`, etc. are redefined and behave like the commands `\Cdots`, `\Ldots`, `\Vdots`, `\Ddots`, etc.

```

609 renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
610 renew-dots .value_forbidden:n = true ,
611 nullify-dots .bool_set:N = \l_@@_nullify_dots_bool ,
612 create-medium-nodes .bool_set:N = \l_@@_medium_nodes_bool ,
613 create-large-nodes .bool_set:N = \l_@@_large_nodes_bool ,
614 create-extra-nodes .meta:n =
615 { create-medium-nodes , create-large-nodes } ,
616 left-margin .dim_set:N = \l_@@_left_margin_dim ,
617 left-margin .default:n = \arraycolsep ,
618 right-margin .dim_set:N = \l_@@_right_margin_dim ,
619 right-margin .default:n = \arraycolsep ,
620 margin .meta:n = { left-margin = #1 , right-margin = #1 } ,
621 margin .default:n = \arraycolsep ,
622 extra-left-margin .dim_set:N = \l_@@_extra_left_margin_dim ,
623 extra-right-margin .dim_set:N = \l_@@_extra_right_margin_dim ,
624 extra-margin .meta:n =
625 { extra-left-margin = #1 , extra-right-margin = #1 } ,
626 extra-margin .value_required:n = true ,
627 }

```

We define a set of keys used by the environments of `nicematrix` (but not by the command `\NiceMatrixOptions`).

```

628 \keys_define:nn { NiceMatrix / Env }
629 {
630

```

The key `hvlines-except-corners` is now deprecated.

```

631 hvlines-except-corners .code:n =
632 {
633   \clist_set:Nn \l_@@_corners_clist { #1 }
634   \clist_set:Nn \l_@@_vlines_clist { all }
635   \clist_set:Nn \l_@@_hlines_clist { all }
636 } ,
637 hvlines-except-corners .default:n = { NW , SW , NE , SE } ,
638 corners .clist_set:N = \l_@@_corners_clist ,
639 corners .default:n = { NW , SW , NE , SE } ,
640 code-before .code:n =
641 {
642   \tl_if_empty:nF { #1 }
643   {
644     \tl_put_right:Nn \l_@@_code_before_tl { #1 }
645     \bool_set_true:N \l_@@_code_before_bool
646   }
647 } ,

```

The options `c`, `t` and `b` of the environment `{NiceArray}` have the same meaning as the option of the classical environment `{array}`.

```

648 c .code:n = \tl_set:Nn \l_@@_baseline_tl c ,
649 t .code:n = \tl_set:Nn \l_@@_baseline_tl t ,
650 b .code:n = \tl_set:Nn \l_@@_baseline_tl b ,
651 baseline .tl_set:N = \l_@@_baseline_tl ,
652 baseline .value_required:n = true ,
653 columns-width .code:n =
654   \tl_if_eq:nnTF { #1 } { auto }
655   { \bool_set_true:N \l_@@_auto_columns_width_bool }
656   { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,
657 columns-width .value_required:n = true ,
658 name .code:n =

```

We test whether we are in the measuring phase of an environment of `amsmath` (always loaded by `nicematrix`) because we want to avoid a fallacious message of duplicate name in this case.

```

659 \legacy_if:nF { measuring@ }
660 {
661   \str_set:Nn \l_tmpa_str { #1 }
662   \seq_if_in:NVTF \g_@@_names_seq \l_tmpa_str
663   { \@@_error:nn { Duplicate-name } { #1 } }
664   { \seq_gput_left:NV \g_@@_names_seq \l_tmpa_str }
665   \str_set_eq:NN \l_@@_name_str \l_tmpa_str
666 } ,
667 name .value_required:n = true ,
668 code-after .tl_gset:N = \g_nicematrix_code_after_tl ,
669 code-after .value_required:n = true ,
670 colortbl-like .code:n =
671   \bool_set_true:N \l_@@_colortbl_like_bool
672   \bool_set_true:N \l_@@_code_before_bool ,
673 colortbl-like .value_forbidden:n = true
674 }
675 \keys_define:nn { NiceMatrix / notes }
676 {
677   para .bool_set:N = \l_@@_notes_para_bool ,
678   para .default:n = true ,
679   code-before .tl_set:N = \l_@@_notes_code_before_tl ,
680   code-before .value_required:n = true ,
681   code-after .tl_set:N = \l_@@_notes_code_after_tl ,
682   code-after .value_required:n = true ,

```

```

683 bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
684 bottomrule .default:n = true ,
685 style .code:n = \cs_set:Nn \@@_notes_style:n { #1 } ,
686 style .value_required:n = true ,
687 label-in-tabular .code:n =
688   \cs_set:Nn \@@_notes_label_in_tabular:n { #1 } ,
689 label-in-tabular .value_required:n = true ,
690 label-in-list .code:n =
691   \cs_set:Nn \@@_notes_label_in_list:n { #1 } ,
692 label-in-list .value_required:n = true ,
693 enumitem-keys .code:n =
694   {
695     \bool_if:NTF \c_@@_in_preamble_bool
696     {
697       \AtBeginDocument
698       {
699         \bool_if:NT \c_@@_enumitem_loaded_bool
700         { \setlist* [ tabularnotes ] { #1 } }
701       }
702     }
703     {
704       \bool_if:NT \c_@@_enumitem_loaded_bool
705       { \setlist* [ tabularnotes ] { #1 } }
706     }
707   } ,
708 enumitem-keys .value_required:n = true ,
709 enumitem-keys-para .code:n =
710   {
711     \bool_if:NTF \c_@@_in_preamble_bool
712     {
713       \AtBeginDocument
714       {
715         \bool_if:NT \c_@@_enumitem_loaded_bool
716         { \setlist* [ tabularnotes* ] { #1 } }
717       }
718     }
719     {
720       \bool_if:NT \c_@@_enumitem_loaded_bool
721       { \setlist* [ tabularnotes* ] { #1 } }
722     }
723   } ,
724 enumitem-keys-para .value_required:n = true ,
725 unknown .code:n = \@@_error:n { Unknown~key~for~notes }
726 }
727 \keys_define:nn { NiceMatrix / delimiters }
728 {
729   max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
730   max-width .default:n = true ,
731   color .tl_set:N = \l_@@_delimiters_color_tl ,
732   color .value_required:n = true ,
733 }

```

We begin the construction of the major sets of keys (used by the different user commands and environments).

```

734 \keys_define:nn { NiceMatrix }
735 {
736   NiceMatrixOptions .inherit:n =
737     { NiceMatrix / Global } ,
738   NiceMatrixOptions / xdots .inherit:n = NiceMatrix / xdots ,
739   NiceMatrixOptions / rules .inherit:n = NiceMatrix / rules ,
740   NiceMatrixOptions / notes .inherit:n = NiceMatrix / notes ,
741   NiceMatrixOptions / delimiters .inherit:n = NiceMatrix / delimiters ,

```

```

742 NiceMatrixOptions / sub-matrix .inherit:n = NiceMatrix / sub-matrix ,
743 SubMatrix / rules .inherit:n = NiceMatrix / rules ,
744 CodeAfter / xdots .inherit:n = NiceMatrix / xdots ,
745 NiceMatrix .inherit:n =
746 {
747     NiceMatrix / Global ,
748     NiceMatrix / Env ,
749 } ,
750 NiceMatrix / xdots .inherit:n = NiceMatrix / xdots ,
751 NiceMatrix / rules .inherit:n = NiceMatrix / rules ,
752 NiceMatrix / delimiters .inherit:n = NiceMatrix / delimiters ,
753 NiceTabular .inherit:n =
754 {
755     NiceMatrix / Global ,
756     NiceMatrix / Env
757 } ,
758 NiceTabular / xdots .inherit:n = NiceMatrix / xdots ,
759 NiceTabular / rules .inherit:n = NiceMatrix / rules ,
760 NiceTabular / delimiters .inherit:n = NiceMatrix / delimiters ,
761 NiceArray .inherit:n =
762 {
763     NiceMatrix / Global ,
764     NiceMatrix / Env ,
765 } ,
766 NiceArray / xdots .inherit:n = NiceMatrix / xdots ,
767 NiceArray / rules .inherit:n = NiceMatrix / rules ,
768 NiceArray / delimiters .inherit:n = NiceMatrix / delimiters ,
769 pNiceArray .inherit:n =
770 {
771     NiceMatrix / Global ,
772     NiceMatrix / Env ,
773 } ,
774 pNiceArray / xdots .inherit:n = NiceMatrix / xdots ,
775 pNiceArray / rules .inherit:n = NiceMatrix / rules ,
776 pNiceArray / delimiters .inherit:n = NiceMatrix / delimiters ,
777 }

```

We finalise the definition of the set of keys “NiceMatrix / NiceMatrixOptions” with the options specific to \NiceMatrixOptions.

```

778 \keys_define:nn { NiceMatrix / NiceMatrixOptions }
779 {
780     last-col .code:n = \tl_if_empty:nF { #1 }
781                 { \@@_error:n { last-col~non-empty~for~NiceMatrixOptions } }
782                 \int_zero:N \l_@@_last_col_int ,
783     small .bool_set:N = \l_@@_small_bool ,
784     small .value_forbidden:n = true ,

```

With the option `renew-matrix`, the environment `{matrix}` of `amsmath` and its variants are redefined to behave like the environment `{NiceMatrix}` and its variants.

```

785 renew-matrix .code:n = \@@_renew_matrix: ,
786 renew-matrix .value_forbidden:n = true ,

```

The key `transparent` is now considered as obsolete (because its name is ambiguous).

```

787 transparent .code:n =
788 {
789     \@@_renew_matrix:
790     \bool_set_true:N \l_@@_renew_dots_bool
791     \@@_error:n { Key~transparent }
792 } ,
793 transparent .value_forbidden:n = true,

```

The option `exterior-arraycolsep` will have effect only in `{NiceArray}` for those who want to have for `{NiceArray}` the same behaviour as `{array}`.

```

794 exterior-arraycolsep .bool_set:N = \l_@@_exterior_arraycolsep_bool ,

```

If the option `columns-width` is used, all the columns will have the same width. In `\NiceMatrixOptions`, the special value `auto` is not available.

```

795 columns-width .code:n =
796   \tl_if_eq:nnTF { #1 } { auto }
797   { \@@_error:n { Option~auto~for~columns~width } }
798   { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,

```

Usually, an error is raised when the user tries to give the same name to two distinct environments of `nicematrix` (these names are global and not local to the current TeX scope). However, the option `allow-duplicate-names` disables this feature.

```

799 allow-duplicate-names .code:n =
800   \@@_msg_redirect_name:nn { Duplicate-name } { none } ,
801 allow-duplicate-names .value_forbidden:n = true ,

```

By default, the specifier used in the preamble of the array (for example in `{pNiceArray}`) to draw a vertical dotted line between two columns is the colon “:”. However, it’s possible to change this letter with `letter-for-dotted-lines` and, by the way, the letter “:” will remain free for other packages (for example `arydshln`).

```

802 letter-for-dotted-lines .code:n =
803   {
804     \tl_if_single_token:nTF { #1 }
805     { \str_set:Nx \l_@@_letter_for_dotted_lines_str { #1 } }
806     { \@@_error:n { One~letter~allowed } }
807   } ,
808 letter-for-dotted-lines .value_required:n = true ,
809 notes .code:n = \keys_set:nn { NiceMatrix / notes } { #1 } ,
810 notes .value_required:n = true ,
811 sub-matrix .code:n =
812   \keys_set:nn { NiceMatrix / sub-matrix } { #1 } ,
813 sub-matrix .value_required:n = true ,
814 unknown .code:n = \@@_error:n { Unknown~key~for~NiceMatrixOptions }
815 }

816 \str_new:N \l_@@_letter_for_dotted_lines_str
817 \str_set_eq:NN \l_@@_letter_for_dotted_lines_str \c_colon_str

```

`\NiceMatrixOptions` is the command of the `nicematrix` package to fix options at the document level. The scope of these specifications is the current TeX group.

```

818 \NewDocumentCommand \NiceMatrixOptions { m }
819 { \keys_set:nn { NiceMatrix / NiceMatrixOptions } { #1 } }

```

We finalise the definition of the set of keys “`NiceMatrix / NiceMatrix`” with the options specific to `{NiceMatrix}`.

```

820 \keys_define:nn { NiceMatrix / NiceMatrix }
821 {
822   last-col .code:n = \tl_if_empty:nTF {#1}
823   {
824     \bool_set_true:N \l_@@_last_col_without_value_bool
825     \int_set:Nn \l_@@_last_col_int { -1 }
826   }
827   { \int_set:Nn \l_@@_last_col_int { #1 } } ,
828   l .code:n = \tl_set:Nn \l_@@_type_of_col_tl l ,
829   r .code:n = \tl_set:Nn \l_@@_type_of_col_tl r ,
830   small .bool_set:N = \l_@@_small_bool ,
831   small .value_forbidden:n = true ,
832   unknown .code:n = \@@_error:n { Unknown~key~for~NiceMatrix }
833 }

```

We finalise the definition of the set of keys “NiceMatrix / NiceArray” with the options specific to {NiceArray}.

```
834 \keys_define:nn { NiceMatrix / NiceArray }
835 {
```

In the environments {NiceArray} and its variants, the option last-col must be used without value because the number of columns of the array is read from the preamble of the array.

```
836   small .bool_set:N = \l_@@_small_bool ,
837   small .value_forbidden:n = true ,
838   last-col .code:n = \tl_if_empty:nF { #1 }
839     { \@@_error:n { last-col-non-empty-for-NiceArray } }
840     \int_zero:N \l_@@_last_col_int ,
841   notes / para .bool_set:N = \l_@@_notes_para_bool ,
842   notes / para .default:n = true ,
843   notes / bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
844   notes / bottomrule .default:n = true ,
845   tabularnote .tl_set:N = \l_@@_tabularnote_tl ,
846   tabularnote .value_required:n = true ,
847   r .code:n = \@@_error:n { r-or-l-with-preamble } ,
848   l .code:n = \@@_error:n { r-or-l-with-preamble } ,
849   unknown .code:n = \@@_error:n { Unknown-key-for-NiceArray }
850 }

851 \keys_define:nn { NiceMatrix / pNiceArray }
852 {
853   first-col .code:n = \int_zero:N \l_@@_first_col_int ,
854   last-col .code:n = \tl_if_empty:nF {#1}
855     { \@@_error:n { last-col-non-empty-for-NiceArray } }
856     \int_zero:N \l_@@_last_col_int ,
857   first-row .code:n = \int_zero:N \l_@@_first_row_int ,
858   small .bool_set:N = \l_@@_small_bool ,
859   small .value_forbidden:n = true ,
860   r .code:n = \@@_error:n { r-or-l-with-preamble } ,
861   l .code:n = \@@_error:n { r-or-l-with-preamble } ,
862   unknown .code:n = \@@_error:n { Unknown-key-for-NiceMatrix }
863 }
```

We finalise the definition of the set of keys “NiceMatrix / NiceTabular” with the options specific to {NiceTabular}.

```
864 \keys_define:nn { NiceMatrix / NiceTabular }
865 {
866   notes / para .bool_set:N = \l_@@_notes_para_bool ,
867   notes / para .default:n = true ,
868   notes / bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
869   notes / bottomrule .default:n = true ,
870   tabularnote .tl_set:N = \l_@@_tabularnote_tl ,
871   tabularnote .value_required:n = true ,
872   last-col .code:n = \tl_if_empty:nF {#1}
873     { \@@_error:n { last-col-non-empty-for-NiceArray } }
874     \int_zero:N \l_@@_last_col_int ,
875   r .code:n = \@@_error:n { r-or-l-with-preamble } ,
876   l .code:n = \@@_error:n { r-or-l-with-preamble } ,
877   unknown .code:n = \@@_error:n { Unknown-key-for-NiceTabular }
878 }
```

Important code used by {NiceArrayWithDelims}

The pseudo-environment \@@_Cell:–\@@_end_Cell: will be used to format the cells of the array. In the code, the affectations are global because this pseudo-environment will be used in the cells of a \halign (via an environment {array}).

```

879 \cs_new_protected:Npn \@@_Cell:
880 {
881   \tl_gclear:N \g_@@_exit_cell_tl

```

At the beginning of the cell, we link `\CodeAfter` to a command which do *not* begin with `\omit` (whereas the standard version of `\CodeAfter` begins with `\omit`).

```

882   \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:n

```

We increment `\c@jCol`, which is the counter of the columns.

```

883   \int_gincr:N \c@jCol

```

Now, we increment the counter of the rows. We don't do this incrementation in the `\everycr` because some packages, like `arydshln`, create special rows in the `\halign` that we don't want to take into account.

```

884   \int_compare:nNnT \c@jCol = 1
885     { \int_compare:nNnT \l_@@_first_col_int = 1 \@@_begin_of_row: }

```

The content of the cell is composed in the box `\l_@@_cell_box` because we want to compute some dimensions of the box. The `\hbox_set_end:` corresponding to this `\hbox_set:Nw` will be in the `\@@_end_Cell:` (and the potential `\c_math_toggle_token` also).

```

886   \hbox_set:Nw \l_@@_cell_box
887   \bool_if:NF \l_@@_NiceTabular_bool
888     {
889       \c_math_toggle_token
890       \bool_if:NT \l_@@_small_bool \scriptstyle
891     }

```

We will call *corners* of the matrix the cases which are at the intersection of the exterior rows and exterior columns (of course, the four corners doesn't always exist simultaneously).

The codes `\l_@@_code_for_first_row_tl` and `al` don't apply in the corners of the matrix.

```

892   \g_@@_row_style_tl
893   \int_compare:nNnTF \c@iRow = 0
894     {
895       \int_compare:nNnT \c@jCol > 0
896         {
897           \l_@@_code_for_first_row_tl
898           \xglobal \colorlet { nicematrix-first-row } { . }
899         }
900     }
901     {
902       \int_compare:nNnT \c@iRow = \l_@@_last_row_int
903         {
904           \l_@@_code_for_last_row_tl
905           \xglobal \colorlet { nicematrix-last-row } { . }
906         }
907     }
908 }

```

The following macro `\@@_begin_of_row` is usually used in the cell number 1 of the row. However, when the key `first-col` is used, `\@@_begin_of_row` is executed in the cell number 0 of the row.

```

909 \cs_new_protected:Npn \@@_begin_of_row:
910 {
911   \tl_gclear:N \g_@@_row_style_tl
912   \int_gincr:N \c@iRow
913   \dim_gset_eq:NN \g_@@_dp_ante_last_row_dim \g_@@_dp_last_row_dim
914   \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \@arstrutbox }
915   \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
916   \pgfpicture
917   \pgfrememberpicturepositiononpagetrue
918   \pgfcoordinate
919     { \@@_env: - row - \int_use:N \c@iRow - base }
920     { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
921   \str_if_empty:NF \l_@@_name_str

```

```

922     {
923       \pgfnodealias
924       { \l_@@_name_str - row - \int_use:N \c@iRow - base }
925       { \@@_env: - row - \int_use:N \c@iRow - base }
926     }
927   \endpgfpicture
928 }

```

Remark: If the key `recreate-cell-nodes` of the `\CodeBefore` is used, then we will add some lines to that command.

The following code is used in each cell of the array. It actualises quantities that, at the end of the array, will give informations about the vertical dimension of the two first rows and the two last rows. If the user uses the `last-row`, some lines of code will be dynamically added to this command.

```

929 \cs_new_protected:Npn \@@_update_for_first_and_last_row:
930 {
931   \int_compare:nNnTF \c@iRow = 0
932   {
933     \dim_gset:Nn \g_@@_dp_row_zero_dim
934     { \dim_max:nn \g_@@_dp_row_zero_dim { \box_dp:N \l_@@_cell_box } }
935     \dim_gset:Nn \g_@@_ht_row_zero_dim
936     { \dim_max:nn \g_@@_ht_row_zero_dim { \box_ht:N \l_@@_cell_box } }
937   }
938   {
939     \int_compare:nNnT \c@iRow = 1
940     {
941       \dim_gset:Nn \g_@@_ht_row_one_dim
942       { \dim_max:nn \g_@@_ht_row_one_dim { \box_ht:N \l_@@_cell_box } }
943     }
944   }
945 }
946 \cs_new_protected:Npn \@@_rotate_cell_box:
947 {
948   \box_rotate:Nn \l_@@_cell_box { 90 }
949   \int_compare:nNnT \c@iRow = \l_@@_last_row_int
950   {
951     \vbox_set_top:Nn \l_@@_cell_box
952     {
953       \vbox_to_zero:n { }
954       \skip_vertical:n { - \box_ht:N \@arstrutbox + 0.8 ex }
955       \box_use:N \l_@@_cell_box
956     }
957   }
958   \bool_gset_false:N \g_@@_rotate_bool
959 }
960 \cs_new_protected:Npn \@@_adjust_size_box:
961 {
962   \dim_compare:nNnT \g_@@_blocks_wd_dim > \c_zero_dim
963   {
964     \box_set_wd:Nn \l_@@_cell_box
965     { \dim_max:nn { \box_wd:N \l_@@_cell_box } \g_@@_blocks_wd_dim }
966     \dim_gzero:N \g_@@_blocks_wd_dim
967   }
968   \dim_compare:nNnT \g_@@_blocks_dp_dim > \c_zero_dim
969   {
970     \box_set_dp:Nn \l_@@_cell_box
971     { \dim_max:nn { \box_dp:N \l_@@_cell_box } \g_@@_blocks_dp_dim }
972     \dim_gzero:N \g_@@_blocks_dp_dim
973   }
974   \dim_compare:nNnT \g_@@_blocks_ht_dim > \c_zero_dim
975   {
976     \box_set_ht:Nn \l_@@_cell_box

```

```

977         { \dim_max:nn { \box_ht:N \l_@@_cell_box } \g_@@_blocks_ht_dim }
978         \dim_gzero:N \g_@@_blocks_ht_dim
979     }
980 }
981 \cs_new_protected:Npn \@@_end_Cell:
982 {
983     \@@_math_toggle_token:
984     \hbox_set_end:
985     \g_@@_exit_cell_tl
986     \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
987     \@@_adjust_size_box:
988     \box_set_ht:Nn \l_@@_cell_box
989     { \box_ht:N \l_@@_cell_box + \l_@@_cell_space_top_limit_dim }
990     \box_set_dp:Nn \l_@@_cell_box
991     { \box_dp:N \l_@@_cell_box + \l_@@_cell_space_bottom_limit_dim }

```

We want to compute in `\g_@@_max_cell_width_dim` the width of the widest cell of the array (except the cells of the “first column” and the “last column”).

```

992     \dim_gset:Nn \g_@@_max_cell_width_dim
993     { \dim_max:nn \g_@@_max_cell_width_dim { \box_wd:N \l_@@_cell_box } }

```

The following computations are for the “first row” and the “last row”.

```

994     \@@_update_for_first_and_last_row:

```

If the cell is empty, or may be considered as if, we must not create the PGF node, for two reasons:

- it’s a waste of time since such a node would be rather pointless;
- we test the existence of these nodes in order to determine whether a cell is empty when we search the extremities of a dotted line.

However, it’s very difficult to determine whether a cell is empty. Up to now we use the following technic:

- if the width of the box `\l_@@_cell_box` (created with the content of the cell) is equal to zero, we consider the cell as empty (however, this is not perfect since the user may have used a `\rlap`, a `\llap` or a `\mathclap` of `mathtools`).
- the cells with a command `\Ldots` or `\Cdots`, `\Vdots`, etc., should also be considered as empty; if `nullify-dots` is in force, there would be nothing to do (in this case the previous commands only write an instruction in a kind of `\CodeAfter`); however, if `nullify-dots` is not in force, a phantom of `\ldots`, `\cdots`, `\vdots` is inserted and its width is not equal to zero; that’s why these commands raise a boolean `\g_@@_empty_cell_bool` and we begin by testing this boolean.

```

995     \bool_if:NTF \g_@@_empty_cell_bool
996     { \box_use_drop:N \l_@@_cell_box }
997     {
998         \bool_lazy_or:nnTF
999         \g_@@_not_empty_cell_bool
1000         { \dim_compare_p:nNn { \box_wd:N \l_@@_cell_box } > \c_zero_dim }
1001         \@@_node_for_cell:
1002         { \box_use_drop:N \l_@@_cell_box }
1003     }
1004     \int_gset:Nn \g_@@_col_total_int { \int_max:nn \g_@@_col_total_int \c@jCol }
1005     \bool_gset_false:N \g_@@_empty_cell_bool
1006     \bool_gset_false:N \g_@@_not_empty_cell_bool
1007 }

```

The following command creates the PGF name of the node with, of course, `\l_@@_cell_box` as the content.

```

1008 \cs_new_protected:Npn \@@_node_for_cell:
1009 {
1010     \pgfpicture
1011     \pgfsetbaseline \c_zero_dim

```

```

1012 \pgfrememberpicturepositiononpagetrue
1013 \pgfset
1014 {
1015     inner-sep = \c_zero_dim ,
1016     minimum-width = \c_zero_dim
1017 }
1018 \pgfnode
1019 { rectangle }
1020 { base }
1021 { \box_use_drop:N \l_@@_cell_box }
1022 { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1023 { }
1024 \str_if_empty:NF \l_@@_name_str
1025 {
1026     \pgfnodealias
1027     { \l_@@_name_str - \int_use:N \c@iRow - \int_use:N \c@jCol }
1028     { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1029 }
1030 \endpgfpicture
1031 }

```

As its name says, the following command is a patch for the command `\@@_node_for_cell:`. This patch will be appended on the left of `\@@_node_for_the_cell:` when the construction of the cell nodes (of the form $(i-j)$) in the `\CodeBefore` is required.

```

1032 \cs_new_protected:Npn \@@_patch_node_for_cell:n #1
1033 {
1034     \cs_new_protected:Npn \@@_patch_node_for_cell:
1035     {
1036         \hbox_set:Nn \l_@@_cell_box
1037         {
1038             \box_move_up:nn { \box_ht:N \l_@@_cell_box }
1039             \hbox_overlap_left:n
1040             {
1041                 \pgfsys@markposition
1042                 { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol - NW }

```

I don't know why the following adjustment is needed when the compilation is done with XeLaTeX or with the classical way `latex`, `divps`, `ps2pdf` (or Adobe Distiller). However, it seems to work.

```

1043         #1
1044     }
1045     \box_use:N \l_@@_cell_box
1046     \box_move_down:nn { \box_dp:N \l_@@_cell_box }
1047     \hbox_overlap_left:n
1048     {
1049         \pgfsys@markposition
1050         { \@@_env:- \int_use:N \c@iRow - \int_use:N \c@jCol - SE }
1051         #1
1052     }
1053 }
1054 }
1055 }

```

We have no explanation for the different behaviour between the TeX engines...

```

1056 \bool_lazy_or:nnTF \sys_if_engine_xetex_p: \sys_if_output_dvi_p:
1057 {
1058     \@@_patch_node_for_cell:n
1059     { \skip_horizontal:n { 0.5 \box_wd:N \l_@@_cell_box } }
1060 }
1061 { \@@_patch_node_for_cell:n { } }

```

The second argument of the following command `\@@_instruction_of_type:nnn` defined below is the type of the instruction (`Cdots`, `Vdots`, `Ddots`, etc.). The third argument is the list of options.

This command writes in the corresponding `\g_@@_type_lines_tl` the instruction which will actually draw the line after the construction of the matrix.

For example, for the following matrix,

```
\begin{pNiceMatrix}
1 & 2 & 3 & 4 \\
5 & \Cdots & & 6 \\
7 & \Cdots[color=red] & & 
\end{pNiceMatrix}
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & \cdots & & 6 \\ 7 & \cdots & & \end{pmatrix}$$

the content of `\g_@@_Cdots_lines_tl` will be:

```
\@@_draw_Cdots:nnn {2}{2}{ }
\@@_draw_Cdots:nnn {3}{2}{color=red}
```

The first argument is a boolean which indicates whether you must put the instruction on the left or on the right on the list of instructions.

```
1062 \cs_new_protected:Npn \@@_instruction_of_type:nnn #1 #2 #3
1063 {
1064   \bool_if:NTF { #1 } \tl_gput_left:cx \tl_gput_right:cx
1065   { \g_@@_#2 _ lines _ tl }
1066   {
1067     \use:c { @@ _ draw _ #2 : nnn }
1068     { \int_use:N \c_iRow }
1069     { \int_use:N \c_jCol }
1070     { \exp_not:n { #3 } }
1071   }
1072 }
```

We want to use `\array` of `array`. However, if the class used is `revtex4-1` or `revtex4-2`, we have to do some tuning and use the command `\@array@array` instead of `\array` because these classes do a redefinition of `\array` incompatible with our use of `\array`.

```
1073 \cs_new_protected:Npn \@@_revtex_array:
1074 {
1075   \cs_set_eq:NN \@acol1 \@arrayacol
1076   \cs_set_eq:NN \@acolr \@arrayacol
1077   \cs_set_eq:NN \@acol \@arrayacol
1078   \cs_set_nopar:Npn \@halignto { }
1079   \@array@array
1080 }
1081 \cs_new_protected:Npn \@@_array:
1082 {
1083   \bool_if:NTF \c_@@_revtex_bool
1084   \@@_revtex_array:
1085   {
1086     \bool_if:NTF \l_@@_NiceTabular_bool
1087     { \dim_set_eq:NN \col@sep \tabcolsep }
1088     { \dim_set_eq:NN \col@sep \arraycolsep }
1089     \dim_compare:nNnTF \l_@@_tabular_width_dim = \c_zero_dim
1090     { \cs_set_nopar:Npn \@halignto { } }
1091     { \cs_set_nopar:Npx \@halignto { to \dim_use:N \l_@@_tabular_width_dim } }
1092   }
1093 }
```

If `colortbl` is loaded, `\@tabarray` has been redefined to incorporate `\CT@start`.

```
1092   \@tabarray
1093 }
```

`\l_@@_baseline_tl` may have the value `t`, `c` or `b`. However, if the value is `b`, we compose the `\array` (of `array`) with the option `t` and the right translation will be done further. Remark that `\str_if_eq:VnTF` is fully expandable and you need something fully expandable here.

```
1094   [ \str_if_eq:VnTF \l_@@_baseline_tl c c t ]
1095 }
```

We keep in memory the standard version of `\ialign` because we will redefine `\ialign` in the environment `{NiceArrayWithDelims}` but restore the standard version for use in the cells of the array.

```
1096 \cs_set_eq:NN \@@_old_ialign: \ialign
```

The following command creates a row node (and not a row of nodes!).

```
1097 \cs_new_protected:Npn \@@_create_row_node:
1098 {
```

The `\hbox:n` (or `\hbox`) is mandatory.

```
1099   \hbox
1100   {
1101     \bool_if:NT \l_@@_code_before_bool
1102     {
1103       \vtop
1104       {
1105         \skip_vertical:N 0.5\arrayrulewidth
1106         \pgfsys@markposition { \@@_env: - row - \@@_succ:n \c@iRow }
1107         \skip_vertical:N -0.5\arrayrulewidth
1108       }
1109     }
1110     \pgfpicture
1111     \pgfrememberpicturerepositiononpagetrue
1112     \pgfcoordinate { \@@_env: - row - \@@_succ:n \c@iRow }
1113     { \pgfpoint \c_zero_dim { - 0.5 \arrayrulewidth } }
1114     \str_if_empty:NF \l_@@_name_str
1115     {
1116       \pgfnodealias
1117       { \l_@@_name_str - row - \@@_succ:n \c@iRow }
1118       { \@@_env: - row - \@@_succ:n \c@iRow }
1119     }
1120     \endpgfpicture
1121   }
1122 }
```

The following must *not* be protected because it begins with `\noalign`.

```
1123 \cs_new:Npn \@@_everycr: { \noalign { \@@_everycr_i: } }
1124 \cs_new_protected:Npn \@@_everycr_i:
1125 {
1126   \int_gzero:N \c@jCol
1127   \bool_gset_false:N \g_@@_after_col_zero_bool
1128   \bool_if:NF \g_@@_row_of_col_done_bool
1129   {
1130     \@@_create_row_node:
```

We don't draw the rules of the key `hlines` (or `hvlines`) but we reserve the vertical space for theses rules.

```
1131   \tl_if_empty:NF \l_@@_hlines_clist
1132   {
1133     \tl_if_eq:NnF \l_@@_hlines_clist { all }
1134     {
1135       \exp_args:NNx
1136       \clist_if_in:NnT
1137       \l_@@_hlines_clist
1138       { \@@_succ:n \c@iRow }
1139     }
1140   }
```

The counter `\c@iRow` has the value `-1` only if there is a “first row” and that we are before that “first row”, i.e. just before the beginning of the array.

```
1141   \int_compare:nNnT \c@iRow > { -1 }
1142   {
1143     \int_compare:nNnF \c@iRow = \l_@@_last_row_int
```

The command `\CT@arc@` is a command of `colortbl` which sets the color of the rules in the array. The package `nicematrix` uses it even if `colortbl` is not loaded. We use a TeX group in order to limit the scope of `\CT@arc@`.

```

1144         { \hrule height \arrayrulewidth width \c_zero_dim }
1145     }
1146 }
1147 }
1148 }
1149 }
```

The command `\@@_newcolumntype` is the command `\newcolumntype` of `array` without the warnings for redefinitions of columns types (we will use it to redefine the columns types `w` and `W`).

```

1150 \cs_set_protected:Npn \@@_newcolumntype #1
1151 {
1152     \cs_set:cpn { NC @ find @ #1 } ##1 #1 { \NC@ { ##1 } }
1153     \peek_meaning:NTF [
1154         { \newcol@ #1 }
1155         { \newcol@ #1 [ 0 ] }
1156 }
```

When the key `renew-dots` is used, the following code will be executed.

```

1157 \cs_set_protected:Npn \@@_renew_dots:
1158 {
1159     \cs_set_eq:NN \ldots \@@_Ldots
1160     \cs_set_eq:NN \cdots \@@_Cdots
1161     \cs_set_eq:NN \vdots \@@_Vdots
1162     \cs_set_eq:NN \ddots \@@_Ddots
1163     \cs_set_eq:NN \iddots \@@_Iddots
1164     \cs_set_eq:NN \dots \@@_Ldots
1165     \cs_set_eq:NN \hdotsfor \@@_Hdotsfor:
1166 }
```

When the key `colortbl-like` is used, the following code will be executed.

```

1167 \cs_new_protected:Npn \@@_colortbl_like:
1168 {
1169     \cs_set_eq:NN \cellcolor \@@_cellcolor_tabular
1170     \cs_set_eq:NN \rowcolor \@@_rowcolor_tabular
1171     \cs_set_eq:NN \columncolor \@@_columncolor_preamble
1172 }
```

The following code `\@@_pre_array_ii:` is used in `{NiceArrayWithDelims}`. It exists as a standalone macro only for legibility.

```

1173 \cs_new_protected:Npn \@@_pre_array_ii:
1174 {
```

If `booktabs` is loaded, we have to patch the macro `\@BTnormal` which is a macro of `booktabs`. The macro `\@BTnormal` draws an horizontal rule but it occurs after a vertical skip done by a low level TeX command. When this macro `\@BTnormal` occurs, the `row` node has yet been inserted by `nicematrix` *before* the vertical skip (and thus, at a wrong place). That why we decide to create a new `row` node (for the same row). We patch the macro `\@BTnormal` to create this `row` node. This new `row` node will overwrite the previous definition of that `row` node and we have managed to avoid the error messages of that redefinition ⁵⁵.

```

1175     \bool_if:NT \c_@@_booktabs_loaded_bool
1176     { \tl_put_left:Nn \@BTnormal \@@_create_row_node: }
1177     \box_clear_new:N \l_@@_cell_box
1178     \normalbaselines
```

⁵⁵cf. `\nicematrix@redefine@check@rerun`

If the option `small` is used, we have to do some tuning. In particular, we change the value of `\arraystretch` (this parameter is used in the construction of `\@arstrutbox` in the beginning of `{array}`).

```

1179   \bool_if:NT \l_@@_small_bool
1180   {
1181       \cs_set_nopar:Npn \arraystretch { 0.47 }
1182       \dim_set:Nn \arraycolsep { 1.45 pt }
1183   }

1184   \bool_if:NT \g_@@_recreate_cell_nodes_bool
1185   {
1186       \tl_put_right:Nn \@@_begin_of_row:
1187       {
1188           \pgfsys@markposition
1189           { \@@_env: - row - \int_use:N \c@iRow - base }
1190       }
1191   }

```

The environment `{array}` uses internally the command `\ialign`. We change the definition of `\ialign` for several reasons. In particular, `\ialign` sets `\everycr` to `{ }` and we *need* to have to change the value of `\everycr`.

```

1192   \cs_set_nopar:Npn \ialign
1193   {
1194       \bool_if:NTF \c_@@_colortbl_loaded_bool
1195       {
1196           \CT@everycr
1197           {
1198               \noalign { \cs_gset_eq:NN \CT@row@color \prg_do_nothing: }
1199               \@@_everycr:
1200           }
1201       }
1202       { \everycr { \@@_everycr: } }
1203       \tabskip = \c_zero_skip

```

The box `\@arstrutbox` is a box constructed in the beginning of the environment `{array}`. The construction of that box takes into account the current value of `\arraystretch`⁵⁶ and `\extrarowheight` (of `array`). That box is inserted (via `\@arstrut`) in the beginning of each row of the array. That's why we use the dimensions of that box to initialize the variables which will be the dimensions of the potential first and last row of the environment. This initialization must be done after the creation of `\@arstrutbox` and that's why we do it in the `\ialign`.

```

1204       \dim_gzero_new:N \g_@@_dp_row_zero_dim
1205       \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \@arstrutbox }
1206       \dim_gzero_new:N \g_@@_ht_row_zero_dim
1207       \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \@arstrutbox }
1208       \dim_gzero_new:N \g_@@_ht_row_one_dim
1209       \dim_gset:Nn \g_@@_ht_row_one_dim { \box_ht:N \@arstrutbox }
1210       \dim_gzero_new:N \g_@@_dp_ante_last_row_dim
1211       \dim_gzero_new:N \g_@@_ht_last_row_dim
1212       \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
1213       \dim_gzero_new:N \g_@@_dp_last_row_dim
1214       \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \@arstrutbox }

```

After its first use, the definition of `\ialign` will revert automatically to its default definition. With this programming, we will have, in the cells of the array, a clean version of `\ialign`.

```

1215       \cs_set_eq:NN \ialign \@@_old_ialign:
1216       \halign
1217   }

```

⁵⁶The option `small` of `nicematrix` changes (among other) the value of `\arraystretch`. This is done, of course, before the call of `{array}`.

We keep in memory the old versions of `\ldots`, `\cdots`, etc. only because we use them inside `\phantom` commands in order that the new commands `\Ldots`, `\Cdots`, etc. give the same spacing (except when the option `nullify-dots` is used).

```

1218 \cs_set_eq:NN \@@_old_ldots \ldots
1219 \cs_set_eq:NN \@@_old_cdots \cdots
1220 \cs_set_eq:NN \@@_old_vdots \vdots
1221 \cs_set_eq:NN \@@_old_ddots \ddots
1222 \cs_set_eq:NN \@@_old_iddots \iddots
1223 \bool_if:NTF \l_@@_standard_cline_bool
1224 { \cs_set_eq:NN \cline \@@_standard_cline }
1225 { \cs_set_eq:NN \cline \@@_cline }
1226 \cs_set_eq:NN \Ldots \@@_Ldots
1227 \cs_set_eq:NN \Cdots \@@_Cdots
1228 \cs_set_eq:NN \Vdots \@@_Vdots
1229 \cs_set_eq:NN \Ddots \@@_Ddots
1230 \cs_set_eq:NN \Iddots \@@_Iddots
1231 \cs_set_eq:NN \hdottedline \@@_hdottedline:
1232 \cs_set_eq:NN \Hline \@@_Hline:
1233 \cs_set_eq:NN \Hspace \@@_Hspace:
1234 \cs_set_eq:NN \Hdotsfor \@@_Hdotsfor:
1235 \cs_set_eq:NN \Vdotsfor \@@_Vdotsfor:
1236 \cs_set_eq:NN \multicolumn \@@_multicolumn:nnn
1237 \cs_set_eq:NN \Block \@@_Block:
1238 \cs_set_eq:NN \rotate \@@_rotate:
1239 \cs_set_eq:NN \OnlyMainNiceMatrix \@@_OnlyMainNiceMatrix:n
1240 \cs_set_eq:NN \dotfill \@@_old_dotfill:
1241 \cs_set_eq:NN \CodeAfter \@@_CodeAfter:
1242 \cs_set_eq:NN \diagbox \@@_diagbox:nn
1243 \cs_set_eq:NN \NotEmpty \@@_NotEmpty:
1244 \cs_set_eq:NN \RowStyle \@@_RowStyle:n
1245 \bool_if:NT \l_@@_colortbl_like_bool \@@_colortbl_like:
1246 \bool_if:NT \l_@@_renew_dots_bool \@@_renew_dots:

```

The sequence `\g_@@_multicolumn_cells_seq` will contain the list of the cells of the array where a command `\multicolumn{n}{...}{...}` with $n > 1$ is issued. In `\g_@@_multicolumn_sizes_seq`, the “sizes” (that is to say the values of n) correspondent will be stored. These lists will be used for the creation of the “medium nodes” (if they are created).

```

1247 \seq_gclear:N \g_@@_multicolumn_cells_seq
1248 \seq_gclear:N \g_@@_multicolumn_sizes_seq

```

The counter `\c@iRow` will be used to count the rows of the array (its incrementation will be in the first cell of the row).

```

1249 \int_gset:Nn \c@iRow { \l_@@_first_row_int - 1 }

```

At the end of the environment `{array}`, `\c@iRow` will be the total number de rows.

`\g_@@_row_total_int` will be the number or rows excepted the last row (if `\l_@@_last_row_bool` has been raised with the option `last-row`).

```

1250 \int_gzero_new:N \g_@@_row_total_int

```

The counter `\c@jCol` will be used to count the columns of the array. Since we want to know the total number of columns of the matrix, we also create a counter `\g_@@_col_total_int`. These counters are updated in the command `\@@_Cell:` executed at the beginning of each cell.

```

1251 \int_gzero_new:N \g_@@_col_total_int
1252 \cs_set_eq:NN \@ifnextchar \new@ifnextchar
1253 \@@_renew_NC@rewrite@S:
1254 \bool_gset_false:N \g_@@_last_col_found_bool

```

During the construction of the array, the instructions `\Cdots`, `\Ldots`, etc. will be written in token lists `\g_@@_Cdots_lines_tl`, etc. which will be executed after the construction of the array.

```

1255 \tl_gclear_new:N \g_@@_Cdots_lines_tl
1256 \tl_gclear_new:N \g_@@_Ldots_lines_tl
1257 \tl_gclear_new:N \g_@@_Vdots_lines_tl

```

```

1258 \tl_gclear_new:N \g_@@Ddots_lines_tl
1259 \tl_gclear_new:N \g_@@Iddots_lines_tl
1260 \tl_gclear_new:N \g_@@HVDotsfor_lines_tl

1261 \tl_gclear_new:N \g_nicematrix_code_before_tl
1262 }

```

This is the end of \@@_pre_array_ii:.

The command \@@_pre_array: will be executed after analyse of the keys of the environment.

```

1263 \cs_new_protected:Npn \@@_pre_array:
1264 {
1265   \cs_if_exist:NT \theiRow { \int_set_eq:NN \l_@@_old_iRow_int \c@iRow }
1266   \int_gzero_new:N \c@iRow
1267   \cs_if_exist:NT \thejCol { \int_set_eq:NN \l_@@_old_jCol_int \c@jCol }
1268   \int_gzero_new:N \c@jCol

```

We recall that \l_@@_last_row_int and \l_@@_last_column_int are *not* the numbers of the last row and last column of the array. There are only the values of the keys `last-row` and `last-column` (maybe the user has provided erroneous values). The meaning of that counters does not change during the environment of `nicematrix`. There is only a slight adjustment: if the user have used one of those keys without value, we provide now the right value as read on the `aux` file (of course, it's possible only after the first compilation).

```

1269   \int_compare:nNnT \l_@@_last_row_int = { -1 }
1270   {
1271     \bool_set_true:N \l_@@_last_row_without_value_bool
1272     \bool_if:NT \g_@@_aux_found_bool
1273     { \int_set:Nn \l_@@_last_row_int { \seq_item:Nn \c_@@_size_seq 3 } }
1274   }
1275   \int_compare:nNnT \l_@@_last_col_int = { -1 }
1276   {
1277     \bool_if:NT \g_@@_aux_found_bool
1278     { \int_set:Nn \l_@@_last_col_int { \seq_item:Nn \c_@@_size_seq 6 } }
1279   }

```

If there is a exterior row, we patch a command used in \@@_Cell: in order to keep track of some dimensions needed to the construction of that “last row”.

```

1280   \int_compare:nNnT \l_@@_last_row_int > { -2 }
1281   {
1282     \tl_put_right:Nn \@@_update_for_first_and_last_row:
1283     {
1284       \dim_gset:Nn \g_@@_ht_last_row_dim
1285       { \dim_max:nn \g_@@_ht_last_row_dim { \box_ht:N \l_@@_cell_box } }
1286       \dim_gset:Nn \g_@@_dp_last_row_dim
1287       { \dim_max:nn \g_@@_dp_last_row_dim { \box_dp:N \l_@@_cell_box } }
1288     }
1289   }

1290   \seq_gclear:N \g_@@_submatrix_seq

```

Now the \CodeBefore.

```

1291   \bool_if:NT \l_@@_code_before_bool \@@_exec_code_before:

```

The value of \g_@@_pos_of_blocks_seq has been written on the `aux` file and loaded before the (potential) execution of the \CodeBefore. Now, we clear that variable because it will be reconstructed during the creation of the array.

```

1292   \seq_gclear:N \g_@@_pos_of_blocks_seq

```

Idem for other sequences written on the aux file.

```
1293 \seq_gclear_new:N \g_@@_multicolumn_cells_seq
1294 \seq_gclear_new:N \g_@@_multicolumn_sizes_seq
```

The code in `\@@_pre_array_ii:` is used only here.

```
1295 \@@_pre_array_ii:
```

The array will be composed in a box (named `\l_@@_the_array_box`) because we have to do manipulations concerning the potential exterior rows.

```
1296 \box_clear_new:N \l_@@_the_array_box
```

If the user has loaded `nicematrix` with the option `define-L-C-R`, he will be able to use `L`, `C` and `R` instead of `l`, `c` and `r` in the preambles of the environments of `nicematrix` (it's a compatibility mode since `L`, `C` and `R` were mandatory before version 5.0).

```
1297 \bool_if:NT \c_@@_define_L_C_R_bool \@@_define_L_C_R:
```

The preamble will be constructed in `\g_@@_preamble_tl`.

```
1298 \@@_construct_preamble:
```

Now, the preamble is constructed in `\g_@@_preamble_tl`

We compute the width of both delimiters. We remember that, when the environment `{NiceArray}` is used, it's possible to specify the delimiters in the preamble (eg `[ccc]`).

```
1299 \dim_zero_new:N \l_@@_left_delim_dim
1300 \dim_zero_new:N \l_@@_right_delim_dim
1301 \bool_if:NTF \l_@@_NiceArray_bool
1302 {
1303   \dim_gset:Nn \l_@@_left_delim_dim { 2 \arraycolsep }
1304   \dim_gset:Nn \l_@@_right_delim_dim { 2 \arraycolsep }
1305 }
1306 {
```

The command `\bBigg@` is a command of `amsmath`.

```
1307 \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 \g_@@_left_delim_tl $ }
1308 \dim_set:Nn \l_@@_left_delim_dim { \box_wd:N \l_tmpa_box }
1309 \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 \g_@@_right_delim_tl $ }
1310 \dim_set:Nn \l_@@_right_delim_dim { \box_wd:N \l_tmpa_box }
1311 }
```

Here is the beginning of the box which will contain the array. The `\hbox_set_end:` corresponding to this `\hbox_set:Nw` will be in the second part of the environment (and the closing `\c_math_toggle_token` also).

```
1312 \hbox_set:Nw \l_@@_the_array_box
1313 \skip_horizontal:N \l_@@_left_margin_dim
1314 \skip_horizontal:N \l_@@_extra_left_margin_dim
1315 \c_math_toggle_token
1316 \bool_if:NTF \l_@@_light_syntax_bool
1317 { \use:c { @@-light-syntax } }
1318 { \use:c { @@-normal-syntax } }
1319 }
```

The following command `\@@_pre_array_i:w` will be used when the keyword `\CodeBefore` is present at the beginning of the environment.

```
1320 \cs_new_protected:Npn \@@_pre_array_i:w #1 \Body
1321 {
1322   \tl_put_right:Nn \l_@@_code_before_tl { #1 }
1323   \bool_set_true:N \l_@@_code_before_bool
```

We go on with `\@@_pre_array`: which will (among other) execute the `\CodeBefore` (specified in the key `code-before` or after the keyword `\CodeBefore`). By definition, the `\CodeBefore` must be executed before the body of the array...

```

1324 \@@_pre_array:
1325 }

1326 \keys_define:nn { NiceMatrix / RowStyle }
1327 {
1328   cell-space-top-limit .code:n =
1329   {
1330     \tl_gput_right:Nn \g_@@_row_style_tl
1331     {
1332       \tl_gput_right:Nn \g_@@_exit_cell_tl
1333       { \dim_set:Nn \l_@@_cell_space_top_limit_dim { #1 } }
1334     }
1335   } ,
1336   cell-space-top-limit .value_required:n = true ,
1337   cell-space-bottom-limit .code:n =
1338   {
1339     \tl_gput_right:Nn \g_@@_row_style_tl
1340     {
1341       \tl_gput_right:Nn \g_@@_exit_cell_tl
1342       { \dim_set:Nn \l_@@_cell_space_bottom_limit_dim { #1 } }
1343     }
1344   } ,
1345   cell-space-bottom-limit .value_required:n = true ,
1346   cell-space-limits .meta:n =
1347   {
1348     cell-space-top-limit = #1 ,
1349     cell-space-bottom-limit = #1 ,
1350   } ,
1351   unknown .code:n = \@@_error:n { Unknown-key-for-RowStyle }
1352 }

1353 \NewDocumentCommand \@@_RowStyle:n { 0 { } m }
1354 {
1355   \tl_gset:Nn \g_@@_row_style_tl { #2 }
1356   \keys_set:nn { NiceMatrix / RowStyle } { #1 }
1357   #2
1358   \ignorespaces
1359 }

```

The `\CodeBefore`

The following command will be executed if the `\CodeBefore` has to be actually executed.

```

1360 \cs_new_protected:Npn \@@_pre_code_before:
1361 {

```

First, we give values to the LaTeX counters `iRow` and `jCol`. We remind that, in the `code-before` (and in the `\CodeAfter`) they represent the numbers of rows and columns of the array (without the potential last row and last column). The value of `\g_@@_row_total_int` is the number of the last row (with potentially a last exterior row) and `\g_@@_col_total_int` is the number of the last column (with potentially a last exterior column).

```

1362   \int_set:Nn \c@iRow { \seq_item:Nn \c_@@_size_seq 2 }
1363   \int_set:Nn \c@jCol { \seq_item:Nn \c_@@_size_seq 5 }
1364   \int_set_eq:NN \g_@@_row_total_int { \seq_item:Nn \c_@@_size_seq 3 }
1365   \int_set_eq:NN \g_@@_col_total_int { \seq_item:Nn \c_@@_size_seq 6 }

```

Now, we will create all the `col` nodes and `row` nodes with the informations written in the `aux` file. You use the technique described in the page 1229 of `pgfmanual.pdf`, version 3.1.4b.

```

1366 \pgfsys@markposition { \@@_env: - position }
1367 \pgfsys@getposition { \@@_env: - position } \@@_picture_position:
1368 \pgfpicture
1369 \pgf@relevantforpicturesizefalse

```

First, the recreation of the `row` nodes.

```

1370 \int_step_inline:nnn \l_@@_first_row_int { \g_@@_row_total_int + 1 }
1371 {
1372   \pgfsys@getposition { \@@_env: - row - ##1 } \@@_node_position:
1373   \pgfcoordinate { \@@_env: - row - ##1 }
1374   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1375 }

```

Now, the recreation of the `col` nodes.

```

1376 \int_step_inline:nnn \l_@@_first_col_int { \g_@@_col_total_int + 1 }
1377 {
1378   \pgfsys@getposition { \@@_env: - col - ##1 } \@@_node_position:
1379   \pgfcoordinate { \@@_env: - col - ##1 }
1380   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1381 }

```

Now, you recreate the diagonal nodes by using the `row` nodes and the `col` nodes.

```

1382 \@@_create_diag_nodes:

```

Now, the creation of the cell nodes ($i-j$), and, maybe also the “medium nodes” and the “large nodes”.

```

1383 \bool_if:NT \g_@@_recreate_cell_nodes_bool \@@_recreate_cell_nodes:
1384 \endpgfpicture

1385 \bool_if:NT \c_@@_tikz_loaded_bool
1386 {
1387   \tikzset
1388   {
1389     every~picture / .style =
1390     { overlay , name~prefix = \@@_env: - }
1391   }
1392 }
1393 \cs_set_eq:NN \cellcolor \@@_cellcolor
1394 \cs_set_eq:NN \rectanglecolor \@@_rectanglecolor
1395 \cs_set_eq:NN \roundedrectanglecolor \@@_roundedrectanglecolor
1396 \cs_set_eq:NN \rowcolor \@@_rowcolor
1397 \cs_set_eq:NN \rowcolors \@@_rowcolors
1398 \cs_set_eq:NN \arraycolor \@@_arraycolor
1399 \cs_set_eq:NN \columncolor \@@_columncolor
1400 \cs_set_eq:NN \chessboardcolors \@@_chessboardcolors
1401 \cs_set_eq:NN \SubMatrix \@@_SubMatrix_in_code_before
1402 }

```

```

1403 \cs_new_protected:Npn \@@_exec_code_before:
1404 {
1405   \seq_gclear_new:N \g_@@_colors_seq
1406   \bool_gset_false:N \g_@@_recreate_cell_nodes_bool
1407   \group_begin:

```

We compose the `code-before` in math mode in order to nullify the spaces put by the user between instructions in the `code-before`.

```

1408 \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token

```

Here is the `\CodeBefore`. The construction is a bit complicated because `\l_@@_code_before_tl` may begin with keys between square brackets. Moreover, after the analyze of those keys, we sometimes have to decide to do *not* execute the rest of `\l_@@_code_before_tl` (when it is asked for the creation

of cell nodes in the `\CodeBefore`). That's why we begin with a `\q_stop`: it will be used to discard the rest of `\l_@@_code_before_tl`.

```
1409 \exp_last_unbraced:NV \@@_CodeBefore_keys: \l_@@_code_before_tl \q_stop
```

Now, all the cells which are specified to be colored by instructions in the `\CodeBefore` will actually be colored. It's a two-stages mechanism because we want to draw all the cells with the same color at the same time to absolutely avoid thin white lines in some PDF viewers.

```
1410 \@@_actually_color:
1411 \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
1412 \group_end:
1413 \bool_if:NT \g_@@_recreate_cell_nodes_bool
1414 { \tl_put_left:Nn \@@_node_for_cell: \@@_patch_node_for_cell: }
1415 }

1416 \keys_define:nn { NiceMatrix / CodeBefore }
1417 {
1418   create-cell-nodes .bool_gset:N = \g_@@_recreate_cell_nodes_bool ,
1419   create-cell-nodes .default:n = true ,
1420   sub-matrix .code:n = \keys_set:nn { NiceMatrix / sub-matrix } { #1 } ,
1421   sub-matrix .value_required:n = true ,
1422   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1423   delimiters / color .value_required:n = true ,
1424   unknown .code:n = \@@_error:n { Unknown-key-for-CodeAfter }
1425 }

1426 \NewDocumentCommand \@@_CodeBefore_keys: { 0 { } }
1427 {
1428   \keys_set:nn { NiceMatrix / CodeBefore } { #1 }
1429   \@@_CodeBefore:w
1430 }
```

We have extracted the options of the keyword `\CodeBefore` in order to see whether the key `create-cell-nodes` has been used. Now, you can execute the rest of the `\CodeAfter`, excepted, of course, if we are in the first compilation.

```
1431 \cs_new_protected:Npn \@@_CodeBefore:w #1 \q_stop
1432 {
1433   \bool_if:NT \g_@@_aux_found_bool
1434   {
1435     \@@_pre_code_before:
1436     #1
1437   }
1438 }
```

By default, if the user uses the `\CodeBefore`, only the `col` nodes, `row` nodes and `diag` nodes are available in that `\CodeBefore`. With the key `create-cell-nodes`, the cell nodes, that is to say the nodes of the form `(i-j)` (but not the extra nodes) are also available because those nodes also are recreated and that recreation is done by the following command.

```
1439 \cs_new_protected:Npn \@@_recreate_cell_nodes:
1440 {
1441   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
1442   {
1443     \pgfsys@getposition { \@@_env: - ##1 - base } \@@_node_position:
1444     \pgfcoordinate { \@@_env: - row - ##1 - base }
1445     { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1446     \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
1447     {
1448       \cs_if_exist:cT
1449       { pgf @ sys @ pdf @ mark @ pos @ \@@_env: - ##1 - #####1 - NW }
1450       {
1451         \pgfsys@getposition
1452         { \@@_env: - ##1 - #####1 - NW }
```

```

1453         \@@_node_position:
1454         \pgfsys@getposition
1455         { \@@_env: - ##1 - ####1 - SE }
1456         \@@_node_position_i:
1457         \@@_pgf_rect_node:nnn
1458         { \@@_env: - ##1 - ####1 }
1459         { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1460         { \pgfpointdiff \@@_picture_position: \@@_node_position_i: }
1461     }
1462 }
1463 }
1464 \@@_create_extra_nodes:
1465 }

```

The environment {NiceArrayWithDelims}

```

1466 \NewDocumentEnvironment { NiceArrayWithDelims }
1467 { m m O { } m ! O { } t \CodeBefore }
1468 {
1469     \@@_provide_pgfsyspdfmark:
1470     \bool_if:NT \c_@@_footnote_bool \savenotes

```

The aim of the following `\bgroup` (the corresponding `\egroup` is, of course, at the end of the environment) is to be able to put an exposant to a matrix in a mathematical formula.

```

1471     \bgroup

1472     \tl_gset:Nn \g_@@_left_delim_tl { #1 }
1473     \tl_gset:Nn \g_@@_right_delim_tl { #2 }
1474     \tl_gset:Nn \g_@@_preamble_tl { #4 }

1475     \int_gzero:N \g_@@_block_box_int
1476     \dim_zero:N \g_@@_width_last_col_dim
1477     \dim_zero:N \g_@@_width_first_col_dim
1478     \bool_gset_false:N \g_@@_row_of_col_done_bool
1479     \str_if_empty:NT \g_@@_name_env_str
1480     { \str_gset:Nn \g_@@_name_env_str { NiceArrayWithDelims } }

```

The following line will be deleted when we will consider that only versions of `siunitx` after v3.0 are compatible with `nicematrix`.

```

1481     \@@_adapt_S_column:
1482     \bool_if:NTF \l_@@_NiceTabular_bool
1483         \mode_leave_vertical:
1484         \@@_test_if_math_mode:
1485     \bool_if:NT \l_@@_in_env_bool { \@@_fatal:n { Yet~in~env } }
1486     \bool_set_true:N \l_@@_in_env_bool

```

The command `\CT@arc@` contains the instruction of color for the rules of the array⁵⁷. This command is used by `\CT@arc@` but we use it also for compatibility with `colortbl`. But we want also to be able to use color for the rules of the array when `colortbl` is *not* loaded. That's why we do the following instruction which is in the patch of the beginning of arrays done by `colortbl`. Of course, we restore the value of `\CT@arc@` at the end of our environment.

```

1487     \cs_gset_eq:NN \@@_old_CT@arc@ \CT@arc@

```

We deactivate Tikz externalization because we will use PGF pictures with the options `overlay` and `remember picture` (or equivalent forms). We deactivate with `\tikzexternaldisable` and not with `\tikzset{external/export=false}` which is *not* equivalent.

```

1488     \cs_if_exist:NT \tikz@library@external@loaded
1489     {
1490         \tikzexternaldisable

```

⁵⁷e.g. `\color[rgb]{0.5,0.5,0}`

```

1491     \cs_if_exist:NT \ifstandalone
1492     { \tikzset { external / optimize = false } }
1493 }

```

We increment the counter `\g_@@_env_int` which counts the environments of the package.

```

1494     \int_gincr:N \g_@@_env_int
1495     \bool_if:NF \l_@@_block_auto_columns_width_bool
1496     { \dim_gzero_new:N \g_@@_max_cell_width_dim }

```

The sequence `\g_@@_blocks_seq` will contain the carateristics of the blocks (specified by `\Block`) of the array. The sequence `\g_@@_pos_of_blocks_seq` will contain only the position of the blocks. Of course, this is redundant but it's for efficiency.

```

1497     \seq_gclear:N \g_@@_blocks_seq
1498     \seq_gclear:N \g_@@_pos_of_blocks_seq

```

In fact, the sequence `\g_@@_pos_of_blocks_seq` will also contain the positions of the cells with a `\diagbox`.

```

1499     \seq_gclear:N \g_@@_pos_of_stroken_blocks_seq
1500     \seq_gclear:N \g_@@_pos_of_xdots_seq
1501     \tl_gclear_new:N \g_@@_code_before_tl
1502     \tl_gclear:N \g_@@_row_style_tl

```

We load all the informations written in the aux file during previous compilations corresponding to the current environment.

```

1503     \bool_gset_false:N \g_@@_aux_found_bool
1504     \tl_if_exist:cT { c_@@ _ \int_use:N \g_@@_env_int _ tl }
1505     {
1506         \bool_gset_true:N \g_@@_aux_found_bool
1507         \use:c { c_@@ _ \int_use:N \g_@@_env_int _ tl }
1508     }

```

Now, we prepare the token list for the instructions that we will have to write on the aux file at the end of the environment.

```

1509     \tl_gclear:N \g_@@_aux_tl
1510     \tl_if_empty:NF \g_@@_code_before_tl
1511     {
1512         \bool_set_true:N \l_@@_code_before_bool
1513         \tl_put_right:NV \l_@@_code_before_tl \g_@@_code_before_tl
1514     }

```

The set of keys is not exactly the same for `{NiceArray}` and for the variants of `{NiceArray}` (`{pNiceArray}`, `{bNiceArray}`, etc.) because, for `{NiceArray}`, we have the options `t`, `c`, `b` and `baseline`.

```

1515     \bool_if:NTF \l_@@_NiceArray_bool
1516     { \keys_set:nn { NiceMatrix / NiceArray } }
1517     { \keys_set:nn { NiceMatrix / pNiceArray } }
1518     { #3 , #5 }

1519     \tl_if_empty:NF \l_@@_rules_color_tl
1520     { \exp_after:wN \@@_set_CT@arc@: \l_@@_rules_color_tl \q_stop }
1521 % \bigskip

```

The argument `#6` is the last argument of `{NiceArrayWithDelims}`. With that argument of type “`t \CodeBefore`”, we test whether there is the keyword `\CodeBefore` at the beginning of the environment. If that keyword is present, we have now to extract all the content between that keyword `\CodeBefore` and the (other) keyword `\Body`. It's the job that will do the command `\@@_pre_array_i:w`. After that job, the command `\@@_pre_array_i:w` will go on with `\@@_pre_array:`.

```

1522     \IfBooleanTF { #6 } \@@_pre_array_i:w \@@_pre_array:
1523 }
1524 {
1525     \bool_if:NTF \l_@@_light_syntax_bool
1526     { \use:c { end @@-light-syntax } }
1527     { \use:c { end @@-normal-syntax } }
1528     \c_math_toggle_token

```

```

1529 \skip_horizontal:N \l_@@_right_margin_dim
1530 \skip_horizontal:N \l_@@_extra_right_margin_dim
1531 \hbox_set_end:

```

End of the construction of the array (in the box `\l_@@_the_array_box`).

If the user has used the key `last-row` with a value, we control that the given value is correct (since we have just constructed the array, we know the real number of rows of the array).

```

1532 \int_compare:nNnT \l_@@_last_row_int > { -2 }
1533 {
1534   \bool_if:NF \l_@@_last_row_without_value_bool
1535   {
1536     \int_compare:nNnF \l_@@_last_row_int = \c@iRow
1537     {
1538       \@@_error:n { Wrong~last~row }
1539       \int_gset_eq:NN \l_@@_last_row_int \c@iRow
1540     }
1541   }
1542 }

```

Now, the definition of `\c@jCol` and `\g_@@_col_total_int` change: `\c@jCol` will be the number of columns without the “last column”; `\g_@@_col_total_int` will be the number of columns with this “last column”.⁵⁸

```

1543 \int_gset_eq:NN \c@jCol \g_@@_col_total_int
1544 \bool_if:nTF \g_@@_last_col_found_bool
1545 { \int_gdecr:N \c@jCol }
1546 {
1547   \int_compare:nNnT \l_@@_last_col_int > { -1 }
1548   { \@@_error:n { last~col~not~used } }
1549 }

```

We fix also the value of `\c@iRow` and `\g_@@_row_total_int` with the same principle.

```

1550 \int_gset_eq:NN \g_@@_row_total_int \c@iRow
1551 \int_compare:nNnT \l_@@_last_row_int > { -1 } { \int_gdecr:N \c@iRow }

```

Now, we begin the real construction in the output flow of TeX. First, we take into account a potential “first column” (we remind that this “first column” has been constructed in an overlapping position and that we have computed its width in `\g_@@_width_first_col_dim`: see p. 113).

```

1552 \int_compare:nNnT \l_@@_first_col_int = 0
1553 {
1554   \skip_horizontal:N \col@sep
1555   \skip_horizontal:N \g_@@_width_first_col_dim
1556 }

```

The construction of the real box is different when `\l_@@_NiceArray_bool` is true (`{NiceArray}` or `{NiceTabular}`) and in the other environments because, in `{NiceArray}` or `{NiceTabular}`, we have no delimiter to put (but we have tabular notes to put). We begin with this case.

```

1557 \bool_if:NTF \l_@@_NiceArray_bool
1558 {
1559   \str_case:VnF \l_@@_baseline_tl
1560   {
1561     b \@@_use_arraybox_with_notes_b:
1562     c \@@_use_arraybox_with_notes_c:
1563   }
1564   \@@_use_arraybox_with_notes:
1565 }

```

Now, in the case of an environment `{pNiceArray}`, `{bNiceArray}`, etc. We compute `\l_tmpa_dim` which is the total height of the “first row” above the array (when the key `first-row` is used).

```

1566 {
1567   \int_compare:nNnTF \l_@@_first_row_int = 0
1568   {

```

⁵⁸We remind that the potential “first column” (exterior) has the number 0.

```

1569         \dim_set_eq:NN \l_tmpa_dim \g_@@_dp_row_zero_dim
1570         \dim_add:Nn \l_tmpa_dim \g_@@_ht_row_zero_dim
1571     }
1572     { \dim_zero:N \l_tmpa_dim }

```

We compute `\l_tmpb_dim` which is the total height of the “last row” below the array (when the key `last-row` is used). A value of `-2` for `\l_@@_last_row_int` means that there is no “last row”.⁵⁹

```

1573     \int_compare:nNnTF \l_@@_last_row_int > { -2 }
1574     {
1575         \dim_set_eq:NN \l_tmpb_dim \g_@@_ht_last_row_dim
1576         \dim_add:Nn \l_tmpb_dim \g_@@_dp_last_row_dim
1577     }
1578     { \dim_zero:N \l_tmpb_dim }
1579     \hbox_set:Nn \l_tmpa_box
1580     {
1581         \c_math_toggle_token
1582         \tl_if_empty:NF \l_@@_delimiters_color_tl
1583         { \color { \l_@@_delimiters_color_tl } }
1584         \exp_after:wN \left \g_@@_left_delim_tl
1585         \vcenter
1586         {

```

We take into account the “first row” (we have previously computed its total height in `\l_tmpa_dim`). The `\hbox:n` (or `\hbox`) is necessary here.

```

1587         \skip_vertical:N -\l_tmpa_dim
1588         \hbox
1589         {
1590             \bool_if:NTF \l_@@_NiceTabular_bool
1591             { \skip_horizontal:N -\tabcolsep }
1592             { \skip_horizontal:N -\arraycolsep }
1593             \@@_use_arraybox_with_notes_c:
1594             \bool_if:NTF \l_@@_NiceTabular_bool
1595             { \skip_horizontal:N -\tabcolsep }
1596             { \skip_horizontal:N -\arraycolsep }
1597         }

```

We take into account the “last row” (we have previously computed its total height in `\l_tmpb_dim`).

```

1598         \skip_vertical:N -\l_tmpb_dim
1599     }

```

Curiously, we have to put again the following specification of color. Otherwise, with XeLaTeX (and not with the other engines), the closing delimiter is not colored.

```

1600         \tl_if_empty:NF \l_@@_delimiters_color_tl
1601         { \color { \l_@@_delimiters_color_tl } }
1602         \exp_after:wN \right \g_@@_right_delim_tl
1603         \c_math_toggle_token
1604     }

```

Now, the box `\l_tmpa_box` is created with the correct delimiters.

We will put the box in the TeX flow. However, we have a small work to do when the option `delimiters/max-width` is used.

```

1605     \bool_if:NTF \l_@@_delimiters_max_width_bool
1606     {
1607         \@@_put_box_in_flow_bis:nn
1608         \g_@@_left_delim_tl \g_@@_right_delim_tl
1609     }
1610     \@@_put_box_in_flow:
1611 }

```

We take into account a potential “last column” (this “last column” has been constructed in an overlapping position and we have computed its width in `\g_@@_width_last_col_dim`: see p. 114).

```

1612     \bool_if:NT \g_@@_last_col_found_bool

```

⁵⁹A value of `-1` for `\l_@@_last_row_int` means that there is a “last row” but the the user have not set the value with the option `last row` (and we are in the first compilation).

```

1613     {
1614       \skip_horizontal:N \g_@@_width_last_col_dim
1615       \skip_horizontal:N \col@sep
1616     }
1617     \bool_if:NF \l_@@_Matrix_bool
1618     {
1619       \int_compare:nNnT \c@jCol < \g_@@_static_num_of_col_int
1620       { \@@_error:n { columns-not-used } }
1621     }
1622     \group_begin:
1623     \globaldefs = 1
1624     \@@_msg_redirect_name:nn { columns-not-used } { error }
1625     \group_end:
1626     \@@_after_array:

```

The aim of the following `\egroup` (the corresponding `\bgroup` is, of course, at the beginning of the environment) is to be able to put an exposant to a matrix in a mathematical formula.

```

1627     \egroup

```

We want to write on the aux file all the informations corresponding to the current environment.

```

1628     \iow_now:Nn \@mainaux { \ExplSyntaxOn }
1629     \iow_now:Nx \@mainaux
1630     {
1631       \tl_gset:cn { c_@@_ \int_use:N \g_@@_env_int _tl }
1632       \iow_newline: { \iow_newline: \exp_not:V \g_@@_aux_tl }
1633     }
1634     \iow_now:Nn \@mainaux { \ExplSyntaxOff }

1635     \bool_if:NT \c_@@_footnote_bool \endsavenotes
1636   }

```

This is the end of the environment `{NiceArrayWithDelims}`.

We construct the preamble of the array

The transformation of the preamble is an operation in several steps.

The preamble given by the final user is in `\g_@@_preamble_tl` and the modified version will be stored in `\g_@@_preamble_tl` also.

```

1637 \cs_new_protected:Npn \@@_construct_preamble:
1638 {

```

First, we will do an “expansion” of the preamble with the tools of the package `array` itself. This “expansion” will expand all the constructions with `*` and with all column types (defined by the user or by various packages using `\newcolumntype`).

Since we use the tools of `array` to do this expansion, we will have a programmation which is not in the style of `expl3`.

We redefine the column types `w` and `W`. We use `\@@_newcolumntype` instead of `\newcolumntype` because we don’t want warnings for column types already defined. These redefinitions are in fact *protections* of the letters `w` and `W`. We don’t want these columns type expanded because we will do the patch ourselves after. We want to be able the standard column types `w` and `W` in potential `{tabular}` of `array` in some cells of our array. That’s why we do those redefinitions in a TeX group.

```

1639   \group_begin:

```

If we are in an environment without explicit preamble, we have nothing to do (excepted the treatment on both sides of the preamble which will be done at the end).

```

1640   \bool_if:NF \l_@@_Matrix_bool
1641   {
1642     \@@_newcolumntype w [ 2 ] { \@@_w: { ##1 } { ##2 } }
1643     \@@_newcolumntype W [ 2 ] { \@@_W: { ##1 } { ##2 } }

```

First, we have to store our preamble in the token register `\@temptokena` (those “token registers” are *not* supported by `expl3`).

```
1644 \exp_args:NV \@temptokena \g_@@_preamble_tl
```

Initialisation of a flag used by `array` to detect the end of the expansion.

```
1645 \@tempswatrue
```

The following line actually does the expansion (it’s has been copied from `array.sty`). The expanded version is still in `\@temptokena`.

```
1646 \@whilesw \if@tempswa \fi { \@tempswafalse \the \NC@list }
```

Now, we have to “patch” that preamble by transforming some columns. We will insert in the TeX flow the preamble in its actual form (that is to say after the “expansion”) following by a marker `\q_stop` and we will consume these tokens constructing the (new form of the) preamble in `\g_@@_preamble_tl`. This is done recursively with the command `\@@_patch_preamble:n`. In the same time, we will count the columns with the counter `\c@jCol`.

```
1647 \int_gzero:N \c@jCol
```

```
1648 \tl_gclear:N \g_@@_preamble_tl
```

`\g_tmpb_bool` will be raised if you have a `|` at the end of the preamble.

```
1649 \bool_gset_false:N \g_tmpb_bool
```

```
1650 \tl_if_eq:NnTF \l_@@_vlines_clist { all }
```

```
1651 {
```

```
1652 \tl_gset:Nn \g_@@_preamble_tl
```

```
1653 { ! { \skip_horizontal:N \arrayrulewidth } }
```

```
1654 }
```

```
1655 {
```

```
1656 \clist_if_in:NnT \l_@@_vlines_clist 1
```

```
1657 {
```

```
1658 \tl_gset:Nn \g_@@_preamble_tl
```

```
1659 { ! { \skip_horizontal:N \arrayrulewidth } }
```

```
1660 }
```

```
1661 }
```

The sequence `\g_@@_cols_vlism_seq` will contain the numbers of the columns where you will to have to draw vertical lines in the potential sub-matrices (hence the name `vlism`).

```
1662 \seq_clear:N \g_@@_cols_vlism_seq
```

The counter `\l_tmpa_int` will count the number of consecutive occurrences of the symbol `|`.

```
1663 \int_zero:N \l_tmpa_int
```

Now, we actually patch the preamble (and it is constructed in `\g_@@_preamble_tl`).

```
1664 \exp_after:wN \@@_patch_preamble:n \the \@temptokena \q_stop
```

```
1665 \int_gset_eq:NN \g_@@_static_num_of_col_int \c@jCol
```

```
1666 }
```

Now, we replace `\columncolor` by `\@@_columncolor_preamble`.

```
1667 \bool_if:NT \l_@@_colortbl_like_bool
```

```
1668 {
```

```
1669 \regex_replace_all:NnN
```

```
1670 \c_@@_columncolor_regex
```

```
1671 { \c { @@_columncolor_preamble } }
```

```
1672 \g_@@_preamble_tl
```

```
1673 }
```

Now, we can close the TeX group which was opened for the redefinition of the columns of type `w` and `W`.

```
1674 \group_end:
```

If there was delimiters at the beginning or at the end of the preamble, the environment `{NiceArray}` is transformed into an environment `{xNiceMatrix}`.

```
1675 \bool_lazy_or:nnT
```

```
1676 { ! \str_if_eq_p:Vn \g_@@_left_delim_tl { . } }
```

```
1677 { ! \str_if_eq_p:Vn \g_@@_right_delim_tl { . } }
```

```
1678 { \bool_set_false:N \l_@@_NiceArray_bool }
```

We want to remind whether there is a specifier | at the end of the preamble.

```
1679 \bool_if:NT \g_tmpb_bool { \bool_set_true:N \l_@@_bar_at_end_of_pream_bool }
```

We complete the preamble with the potential “exterior columns”.

```
1680 \int_compare:nNnTF \l_@@_first_col_int = 0
1681 { \tl_gput_left:N \g_@@_preamble_tl \c_@@_preamble_first_col_tl }
1682 {
1683   \bool_lazy_all:nT
1684   {
1685     \l_@@_NiceArray_bool
1686     { \bool_not_p:n \l_@@_NiceTabular_bool }
1687     { \tl_if_empty_p:N \l_@@_vlines_clist }
1688     { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
1689   }
1690   { \tl_gput_left:Nn \g_@@_preamble_tl { @ { } } }
1691 }
1692 \int_compare:nNnTF \l_@@_last_col_int > { -1 }
1693 { \tl_gput_right:N \g_@@_preamble_tl \c_@@_preamble_last_col_tl }
1694 {
1695   \bool_lazy_all:nT
1696   {
1697     \l_@@_NiceArray_bool
1698     { \bool_not_p:n \l_@@_NiceTabular_bool }
1699     { \tl_if_empty_p:N \l_@@_vlines_clist }
1700     { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
1701   }
1702   { \tl_gput_right:Nn \g_@@_preamble_tl { @ { } } }
1703 }
```

We add a last column to raise a good error message when the user put more columns than allowed by its preamble. However, for technical reasons, it’s not possible to do that in {NiceTabular*} (\l_@@_tabular_width_dim=0pt).

```
1704 \dim_compare:nNnT \l_@@_tabular_width_dim = \c_zero_dim
1705 {
1706   \tl_gput_right:Nn \g_@@_preamble_tl
1707   { > { \@@_error_too_much_cols: } 1 }
1708 }
1709 }
```

```
1710 \cs_new_protected:Npn \@@_patch_preamble:n #1
1711 {
1712   \str_case:nnF { #1 }
1713   {
1714     c { \@@_patch_preamble_i:n #1 }
1715     l { \@@_patch_preamble_i:n #1 }
1716     r { \@@_patch_preamble_i:n #1 }
1717     > { \@@_patch_preamble_ii:nn #1 }
1718     ! { \@@_patch_preamble_ii:nn #1 }
1719     @ { \@@_patch_preamble_ii:nn #1 }
1720     | { \@@_patch_preamble_iii:n #1 }
1721     p { \@@_patch_preamble_iv:nnn t #1 }
1722     m { \@@_patch_preamble_iv:nnn c #1 }
1723     b { \@@_patch_preamble_iv:nnn b #1 }
1724     \@@_w: { \@@_patch_preamble_v:nnnn { } #1 }
1725     \@@_W: { \@@_patch_preamble_v:nnnn { \cs_set_eq:NN \hss \hfil } #1 }
1726     \@@_true_c: { \@@_patch_preamble_vi:n #1 }
1727     ( { \@@_patch_preamble_vii:nn #1 }
1728     [ { \@@_patch_preamble_vii:nn #1 }
1729     \{ { \@@_patch_preamble_vii:nn #1 }
1730     ) { \@@_patch_preamble_viii:nn #1 }
1731     ] { \@@_patch_preamble_viii:nn #1 }
1732     \} { \@@_patch_preamble_viii:nn #1 }
```

```

1733 C { \@@_error:nn { old~column~type } #1 }
1734 L { \@@_error:nn { old~column~type } #1 }
1735 R { \@@_error:nn { old~column~type } #1 }
1736 \q_stop { }
1737 }
1738 {
1739 \str_if_eq:VnTF \l_@@_letter_for_dotted_lines_str { #1 }
1740 { \@@_patch_preamble_xi:n #1 }
1741 {
1742 \str_if_eq:VnTF \l_@@_letter_vlism_tl { #1 }
1743 {
1744 \seq_gput_right:Nx \g_@@_cols_vlism_seq
1745 { \int_eval:n { \c@jCol + 1 } } }
1746 \tl_gput_right:Nx \g_@@_preamble_tl
1747 { \exp_not:N ! { \skip_horizontal:N \arrayrulewidth } }
1748 \@@_patch_preamble:n
1749 }
1750 {
1751 \bool_lazy_and:nnTF
1752 { \str_if_eq_p:nn { : } { #1 } }
1753 \c_@@_arydshln_loaded_bool
1754 {
1755 \tl_gput_right:Nn \g_@@_preamble_tl { : }
1756 \@@_patch_preamble:n
1757 }
1758 { \@@_fatal:nn { unknown~column~type } { #1 } }
1759 }
1760 }
1761 }
1762 }

```

For c, l and r

```

1763 \cs_new_protected:Npn \@@_patch_preamble_i:n #1
1764 {
1765 \tl_gput_right:Nn \g_@@_preamble_tl
1766 {
1767 > { \@@_Cell: \tl_set:Nn \l_@@_cell_type_tl { #1 } }
1768 #1
1769 < \@@_end_Cell:
1770 }

```

We increment the counter of columns and then we test for the presence of a <.

```

1771 \int_gincr:N \c@jCol
1772 \@@_patch_preamble_x:n
1773 }

```

For >, ! and @

```

1774 \cs_new_protected:Npn \@@_patch_preamble_ii:nn #1 #2
1775 {
1776 \tl_gput_right:Nn \g_@@_preamble_tl { #1 { #2 } }
1777 \@@_patch_preamble:n
1778 }

```

For |

```

1779 \cs_new_protected:Npn \@@_patch_preamble_iii:n #1
1780 {

```

\l_tmpa_int is the number of successive occurrences of |

```

1781 \int_incr:N \l_tmpa_int
1782 \@@_patch_preamble_iii_i:n
1783 }

```

```

1784 \cs_new_protected:Npn \@@_patch_preamble_iii_i:n #1
1785 {
1786   \str_if_eq:nnTF { #1 } |
1787   { \@@_patch_preamble_iii:n | }
1788   {
1789     \tl_gput_right:Nx \g_@@_preamble_tl
1790     {
1791       \exp_not:N !
1792       {
1793         \skip_horizontal:n
1794         {
1795           \dim_eval:n
1796           {
1797             \arrayrulewidth * \l_tmpa_int
1798             + \doublerulesep * ( \l_tmpa_int - 1)
1799           }
1800         }
1801       }
1802     }
1803     \tl_gput_right:Nx \g_@@_internal_code_after_tl
1804     { \@@_vline:nn { \@@_succ:n \c@jCol } { \int_use:N \l_tmpa_int } }
1805     \int_zero:N \l_tmpa_int
1806     \str_if_eq:nnT { #1 } { \q_stop }
1807     { \bool_gset_true:N \g_tmpb_bool }
1808     \@@_patch_preamble:n #1
1809   }
1810 }
1811 \bool_new:N \l_@@_bar_at_end_of_pream_bool

```

For p, m and b

```

1812 \cs_new_protected:Npn \@@_patch_preamble_iv:nnn #1 #2 #3
1813 {
1814   \tl_gput_right:Nn \g_@@_preamble_tl
1815   {
1816     > {
1817       \@@_Cell:
1818       \begin { minipage } [ #1 ] { \dim_eval:n { #3 } }
1819       \mode_leave_vertical:
1820       \arraybackslash
1821       \vrule height \box_ht:N \@@arstrutbox depth 0 pt width 0 pt
1822     }
1823     c
1824     < {
1825       \vrule height 0 pt depth \box_dp:N \@@arstrutbox width 0 pt
1826       \end { minipage }
1827       \@@_end_Cell:
1828     }
1829   }

```

We increment the counter of columns, and then we test for the presence of a <.

```

1830   \int_gincr:N \c@jCol
1831   \@@_patch_preamble_x:n
1832 }

```

For w and W

```

1833 \cs_new_protected:Npn \@@_patch_preamble_v:nnnn #1 #2 #3 #4
1834 {
1835   \tl_gput_right:Nn \g_@@_preamble_tl
1836   {
1837     > {
1838       \hbox_set:Nw \l_@@_cell_box
1839       \@@_Cell:
1840       \tl_set:Nn \l_@@_cell_type_tl { #3 }

```

```

1841     }
1842     c
1843     < {
1844         \@@_end_Cell:
1845         #1
1846         \hbox_set_end:
1847         \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
1848         \@@_adjust_size_box:
1849         \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
1850     }
1851 }

```

We increment the counter of columns and then we test for the presence of a <.

```

1852     \int_gincr:N \c@jCol
1853     \@@_patch_preamble_x:n
1854 }

```

For \@@_true_c: which will appear in our redefinition of the columns of type S (of siunitx).

```

1855 \cs_new_protected:Npn \@@_patch_preamble_vi:n #1
1856 {
1857     \tl_gput_right:Nn \g_@@_preamble_tl { c }

```

We increment the counter of columns and then we test for the presence of a <.

```

1858     \int_gincr:N \c@jCol
1859     \@@_patch_preamble_x:n
1860 }

```

For (, [and \{.

```

1861 \cs_new_protected:Npn \@@_patch_preamble_vii:nn #1 #2
1862 {
1863     \bool_if:NT \l_@@_small_bool { \@@_fatal:n { Delimiter~with~small } }

```

If we are before the column 1 and not in {NiceArray}, we reserve space for the left delimiter.

```

1864     \int_compare:nNnTF \c@jCol = \c_zero_int
1865     {
1866         \str_if_eq:VnTF \g_@@_left_delim_tl { . }
1867         {

```

In that case, in fact, the first letter of the preamble must be considered as the left delimiter of the array.

```

1868         \tl_gset:Nn \g_@@_left_delim_tl { #1 }
1869         \tl_gset:Nn \g_@@_right_delim_tl { . }
1870         \@@_patch_preamble:n #2
1871     }
1872     {
1873         \tl_gput_right:Nn \g_@@_preamble_tl { ! { \enskip } }
1874         \@@_patch_preamble_vii_i:nn { #1 } { #2 }
1875     }
1876 }
1877 { \@@_patch_preamble_vii_i:nn { #1 } { #2 } }
1878 }

```

```

1879 \cs_new_protected:Npn \@@_patch_preamble_vii_i:nn #1 #2
1880 {
1881     \tl_gput_right:Nx \g_@@_internal_code_after_tl
1882     { \@@_delimiter:nnn #1 { \@@_succ:n \c@jCol } \c_true_bool }
1883     \tl_if_in:nnTF { ( [ \{ ) ] \} } { #2 }
1884     {
1885         \@@_error:nn { delimiter~after~opening } { #2 }
1886         \@@_patch_preamble:n
1887     }
1888     { \@@_patch_preamble:n #2 }
1889 }

```

For `)`, `]` and `\}`. We have two arguments for the following command because we directly read the following letter in the preamble (we have to see whether we have a opening delimiter following and we also have to see whether we are at the end of the preamble because, in that case, our letter must be considered as the right delimiter of the environment if the environment is `{NiceArray}`).

```

1890 \cs_new_protected:Npn \@@_patch_preamble_viii:nn #1 #2
1891 {
1892   \bool_if:NT \l_@@_small_bool { \@@_fatal:n { Delimiter-with-small } }
1893   \tl_if_in:nnTF { ) ] \} } { #2 }
1894   { \@@_patch_preamble_viii_i:nnn #1 #2 }
1895   {
1896     \tl_if_eq:nnTF { \q_stop } { #2 }
1897     {
1898       \str_if_eq:VnTF \g_@@_right_delim_tl { . }
1899       { \tl_gset:Nn \g_@@_right_delim_tl { #1 } }
1900       {
1901         \tl_gput_right:Nn \g_@@_preamble_tl { ! { \enskip } }
1902         \tl_gput_right:Nx \g_@@_internal_code_after_tl
1903         { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
1904         \@@_patch_preamble:n #2
1905       }
1906     }
1907     {
1908       \tl_if_in:nnT { ( [ \{ } { #2 }
1909       { \tl_gput_right:Nn \g_@@_preamble_tl { ! { \enskip } } }
1910       \tl_gput_right:Nx \g_@@_internal_code_after_tl
1911       { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
1912       \@@_patch_preamble:n #2
1913     }
1914   }
1915 }

1916 \cs_new_protected:Npn \@@_patch_preamble_viii_i:nnn #1 #2 #3
1917 {
1918   \tl_if_eq:nnTF { \q_stop } { #3 }
1919   {
1920     \str_if_eq:VnTF \g_@@_right_delim_tl { . }
1921     {
1922       \tl_gput_right:Nn \g_@@_preamble_tl { ! { \enskip } }
1923       \tl_gput_right:Nx \g_@@_internal_code_after_tl
1924       { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
1925       \tl_gset:Nn \g_@@_right_delim_tl { #2 }
1926     }
1927     {
1928       \tl_gput_right:Nn \g_@@_preamble_tl { ! { \enskip } }
1929       \tl_gput_right:Nx \g_@@_internal_code_after_tl
1930       { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
1931       \@@_error:nn { double-closing-delimiter } { #2 }
1932     }
1933   }
1934   {
1935     \tl_gput_right:Nx \g_@@_internal_code_after_tl
1936     { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
1937     \@@_error:nn { double-closing-delimiter } { #2 }
1938     \@@_patch_preamble:n #3
1939   }
1940 }

1941 \cs_new_protected:Npn \@@_patch_preamble_xi:n #1
1942 {
1943   \tl_gput_right:Nn \g_@@_preamble_tl
1944   { ! { \skip_horizontal:N 2\l_@@_radius_dim } }

```

The command `\@@_vdottedline:n` is protected, and, therefore, won't be expanded before writing on `\g_@@_internal_code_after_tl`.

```

1945 \tl_gput_right:Nx \g_@@_internal_code_after_tl
1946 { \@@_vdottedline:n { \int_use:N \c@jCol } }
1947 \@@_patch_preamble:n
1948 }

```

After a specifier of column, we have to test whether there is one or several <{...} because, after those potential <{...}, we have to insert !{\skip_horizontal:N ...} when the key `vlines` is used.

```

1949 \cs_new_protected:Npn \@@_patch_preamble_x:n #1
1950 {
1951   \str_if_eq:nnTF { #1 } { < }
1952   \@@_patch_preamble_ix:n
1953   {
1954     \tl_if_eq:NnTF \l_@@_vlines_clist { all }
1955     {
1956       \tl_gput_right:Nn \g_@@_preamble_tl
1957       { ! { \skip_horizontal:N \arrayrulewidth } }
1958     }
1959     {
1960       \exp_args:NNx
1961       \clist_if_in:NnT \l_@@_vlines_clist { \@@_succ:n \c@jCol }
1962       {
1963         \tl_gput_right:Nn \g_@@_preamble_tl
1964         { ! { \skip_horizontal:N \arrayrulewidth } }
1965       }
1966     }
1967     \@@_patch_preamble:n { #1 }
1968   }
1969 }
1970 \cs_new_protected:Npn \@@_patch_preamble_ix:n #1
1971 {
1972   \tl_gput_right:Nn \g_@@_preamble_tl { < { #1 } }
1973   \@@_patch_preamble_x:n
1974 }

```

The redefinition of `\multicolumn`

The following command must *not* be protected since it begins with `\multispan` (a TeX primitive).

```

1975 \cs_new:Npn \@@_multicolumn:nnn #1 #2 #3
1976 {

```

The following lines are from the definition of `\multicolumn` in `array` (and *not* in standard LaTeX). The first line aims to raise an error if the user has put more than one column specifier in the preamble of `\multicolumn`.

```

1977   \multispan { #1 }
1978   \begingroup
1979   \cs_set:Npn \@addamp { \if@firstamp \@firstampfalse \else \@preamerr 5 \fi }

```

You do the expansion of the (small) preamble with the tools of `array`.

```

1980   \@temptokena = { #2 }
1981   \@tempswatrue
1982   \@whilesw \if@tempswa \fi { \@tempswafalse \the \NC@list }

```

Now, we patch the (small) preamble as we have done with the main preamble of the `array`.

```

1983   \tl_gclear:N \g_@@_preamble_tl
1984   \exp_after:wN \@@_patch_m_preamble:n \the \@temptokena \q_stop

```

The following lines are an adaptation of the definition of `\multicolumn` in `array`.

```

1985   \exp_args:NV \@mkpream \g_@@_preamble_tl
1986   \@addtopreamble \@empty
1987   \endgroup

```

Now, you do a treatment specific to `nicematrix` which has no equivalent in the original definition of `\multicolumn`.

```

1988 \int_compare:nNnT { #1 } > 1
1989 {
1990   \seq_gput_left:Nx \g_@@_multicolumn_cells_seq
1991   { \int_use:N \c@iRow - \@@_succ:n \c@jCol }
1992   \seq_gput_left:Nn \g_@@_multicolumn_sizes_seq { #1 }
1993   \seq_gput_right:Nx \g_@@_pos_of_blocks_seq
1994   {
1995     { \int_use:N \c@iRow }
1996     { \int_eval:n { \c@jCol + 1 } }
1997     { \int_use:N \c@iRow }
1998     { \int_eval:n { \c@jCol + #1 } }
1999   }
2000 }

```

The following lines were in the original definition of `\multicolumn`.

```

2001 \cs_set:Npn \@sharp { #3 }
2002 \@arstrut
2003 \@preamble
2004 \null

```

We add some lines.

```

2005 \int_gadd:Nn \c@jCol { #1 - 1 }
2006 \int_compare:nNnT \c@jCol > \g_@@_col_total_int
2007 { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
2008 \ignorespaces
2009 }

```

The following commands will patch the (small) preamble of the `\multicolumn`. All those commands have a `m` in their name to recall that they deal with the redefinition of `\multicolumn`.

```

2010 \cs_new_protected:Npn \@@_patch_m_preamble:n #1
2011 {
2012   \str_case:nnF { #1 }
2013   {
2014     c { \@@_patch_m_preamble_i:n #1 }
2015     l { \@@_patch_m_preamble_i:n #1 }
2016     r { \@@_patch_m_preamble_i:n #1 }
2017     > { \@@_patch_m_preamble_ii:nn #1 }
2018     ! { \@@_patch_m_preamble_ii:nn #1 }
2019     @ { \@@_patch_m_preamble_ii:nn #1 }
2020     | { \@@_patch_m_preamble_iii:n #1 }
2021     p { \@@_patch_m_preamble_iv:nnn t #1 }
2022     m { \@@_patch_m_preamble_iv:nnn c #1 }
2023     b { \@@_patch_m_preamble_iv:nnn b #1 }
2024     \@@_w: { \@@_patch_m_preamble_v:nnnn { } #1 }
2025     \@@_W: { \@@_patch_m_preamble_v:nnnn { \cs_set_eq:NN \hss \hfil } #1 }
2026     \@@_true_c: { \@@_patch_m_preamble_vi:n #1 }
2027     C { \@@_error:nn { old~column~type } #1 }
2028     L { \@@_error:nn { old~column~type } #1 }
2029     R { \@@_error:nn { old~column~type } #1 }
2030     \q_stop { }
2031   }
2032   { \@@_fatal:nn { unknown~column~type } { #1 } }
2033 }

```

For `c`, `l` and `r`

```

2034 \cs_new_protected:Npn \@@_patch_m_preamble_i:n #1
2035 {
2036   \tl_gput_right:Nn \g_@@_preamble_tl
2037   {
2038     > { \@@_Cell: \tl_set:Nn \l_@@_cell_type_tl { #1 } }

```

```

2039         #1
2040         < \@@_end_Cell:
2041     }

```

We test for the presence of a <.

```

2042     \@@_patch_m_preamble_x:n
2043 }

```

For >, ! and @

```

2044 \cs_new_protected:Npn \@@_patch_m_preamble_ii:nn #1 #2
2045 {
2046     \tl_gput_right:Nn \g_@@_preamble_tl { #1 { #2 } }
2047     \@@_patch_m_preamble:n
2048 }

```

For |

```

2049 \cs_new_protected:Npn \@@_patch_m_preamble_iii:n #1
2050 {
2051     \tl_gput_right:Nn \g_@@_preamble_tl { #1 }
2052     \@@_patch_m_preamble:n
2053 }

```

For p, m and b

```

2054 \cs_new_protected:Npn \@@_patch_m_preamble_iv:nnn #1 #2 #3
2055 {
2056     \tl_gput_right:Nn \g_@@_preamble_tl
2057     {
2058         > {
2059             \@@_Cell:
2060             \begin { minipage } [ #1 ] { \dim_eval:n { #3 } }
2061             \mode_leave_vertical:
2062             \arraybackslash
2063             \vrule height \box_ht:N \@@arstrutbox depth 0 pt width 0 pt
2064         }
2065         c
2066         < {
2067             \vrule height 0 pt depth \box_dp:N \@@arstrutbox width 0 pt
2068             \end { minipage }
2069             \@@_end_Cell:
2070         }
2071     }

```

We test for the presence of a <.

```

2072     \@@_patch_m_preamble_x:n
2073 }

```

For w and W

```

2074 \cs_new_protected:Npn \@@_patch_m_preamble_v:nnnn #1 #2 #3 #4
2075 {
2076     \tl_gput_right:Nn \g_@@_preamble_tl
2077     {
2078         > {
2079             \hbox_set:Nw \l_@@_cell_box
2080             \@@_Cell:
2081             \tl_set:Nn \l_@@_cell_type_tl { #3 }
2082         }
2083         c
2084         < {
2085             \@@_end_Cell:
2086             #1
2087             \hbox_set_end:
2088             \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
2089             \@@_adjust_size_box:
2090             \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }

```

```

2091     }
2092 }

```

We test for the presence of a <.

```

2093 \@@_patch_m_preamble_x:n
2094 }

```

For \@@_true_c: which will appear in our redefinition of the columns of type S (of siunitx).

```

2095 \cs_new_protected:Npn \@@_patch_m_preamble_vi:n #1
2096 {
2097   \tl_gput_right:Nn \g_@@_preamble_tl { c }

```

We test for the presence of a <.

```

2098 \@@_patch_m_preamble_x:n
2099 }

```

After a specifier of column, we have to test whether there is one or several <{..} because, after those potential <{...}, we have to insert !{\skip_horizontal:N ...} when the key vlines is used.

```

2100 \cs_new_protected:Npn \@@_patch_m_preamble_x:n #1
2101 {
2102   \str_if_eq:nnTF { #1 } { < }
2103   \@@_patch_m_preamble_ix:n
2104   {
2105     \tl_if_eq:NnTF \l_@@_vlines_clist { all }
2106     {
2107       \tl_gput_right:Nn \g_@@_preamble_tl
2108       { ! { \skip_horizontal:N \arrayrulewidth } }
2109     }
2110     {
2111       \exp_args:NNx
2112       \clist_if_in:NnT \l_@@_vlines_clist { \@@_succ:n \c@jCol }
2113       {
2114         \tl_gput_right:Nn \g_@@_preamble_tl
2115         { ! { \skip_horizontal:N \arrayrulewidth } }
2116       }
2117     }
2118     \@@_patch_m_preamble:n { #1 }
2119   }
2120 }

2121 \cs_new_protected:Npn \@@_patch_m_preamble_ix:n #1
2122 {
2123   \tl_gput_right:Nn \g_@@_preamble_tl { < { #1 } }
2124   \@@_patch_m_preamble_x:n
2125 }

```

The command \@@_put_box_in_flow: puts the box \l_tmpa_box (which contains the array) in the flow. It is used for the environments with delimiters. First, we have to modify the height and the depth to take back into account the potential exterior rows (the total height of the first row has been computed in \l_tmpa_dim and the total height of the potential last row in \l_tmpb_dim).

```

2126 \cs_new_protected:Npn \@@_put_box_in_flow:
2127 {
2128   \box_set_ht:Nn \l_tmpa_box { \box_ht:N \l_tmpa_box + \l_tmpa_dim }
2129   \box_set_dp:Nn \l_tmpa_box { \box_dp:N \l_tmpa_box + \l_tmpb_dim }
2130   \tl_if_eq:NnTF \l_@@_baseline_tl { c }
2131   { \box_use_drop:N \l_tmpa_box }
2132   \@@_put_box_in_flow_i:
2133 }

```

The command \@@_put_box_in_flow_i: is used when the value of \l_@@_baseline_tl is different of c (which is the initial value and the most used).

```

2134 \cs_new_protected:Npn \@@_put_box_in_flow_i:
2135 {
2136   \pgfpicture

```

```

2137 \@@_qpoint:n { row - 1 }
2138 \dim_gset_eq:NN \g_tmpa_dim \pgf@y
2139 \@@_qpoint:n { row - \@@_succ:n \c@iRow }
2140 \dim_gadd:Nn \g_tmpa_dim \pgf@y
2141 \dim_gset:Nn \g_tmpa_dim { 0.5 \g_tmpa_dim }

```

Now, `\g_tmpa_dim` contains the y -value of the center of the array (the delimiters are centered in relation with this value).

```

2142 \str_if_in:NnTF \l_@@_baseline_tl { line- }
2143 {
2144   \int_set:Nn \l_tmpa_int
2145   {
2146     \str_range:Nnn
2147       \l_@@_baseline_tl
2148       6
2149       { \tl_count:V \l_@@_baseline_tl }
2150   }
2151   \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
2152 }
2153 {
2154   \str_case:VnF \l_@@_baseline_tl
2155   {
2156     { t } { \int_set:Nn \l_tmpa_int 1 }
2157     { b } { \int_set_eq:NN \l_tmpa_int \c@iRow }
2158   }
2159   { \int_set:Nn \l_tmpa_int \l_@@_baseline_tl }
2160   \bool_lazy_or:nnT
2161   { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
2162   { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
2163   {
2164     \@@_error:n { bad~value~for~baseline }
2165     \int_set:Nn \l_tmpa_int 1
2166   }
2167   \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }

```

We take into account the position of the mathematical axis.

```

2168 \dim_gsub:Nn \g_tmpa_dim { \fontdimen22 \textfont2 }
2169 }
2170 \dim_gsub:Nn \g_tmpa_dim \pgf@y

```

Now, `\g_tmpa_dim` contains the value of the y translation we have to to.

```

2171 \endpgfpicture
2172 \box_move_up:nn \g_tmpa_dim { \box_use_drop:N \l_tmpa_box }
2173 \box_use_drop:N \l_tmpa_box
2174 }

```

The following command is *always* used by `{NiceArrayWithDelims}` (even if, in fact, there is no tabular notes: in fact, it's not possible to know whether there is tabular notes or not before the composition of the blocks).

```

2175 \cs_new_protected:Npn \@@_use_arraybox_with_notes_c:
2176 {

```

With an environment `{Matrix}`, you want to remove the exterior `\arraycolsep` but we don't know the number of columns (since there is no preamble) and that's why we can't put `@{}` at the end of the preamble. That's why we remove a `\arraycolsep` now.

```

2177 \bool_lazy_and:nnT \l_@@_Matrix_bool \l_@@_NiceArray_bool
2178 {
2179   \box_set_wd:Nn \l_@@_the_array_box
2180   { \box_wd:N \l_@@_the_array_box - \arraycolsep }
2181 }

```

We need a `{minipage}` because we will insert a LaTeX list for the tabular notes (that means that a `\vtop{\hsize=...}` is not enough).

```

2182 \begin { minipage } [ t ] { \box_wd:N \l_@@_the_array_box }
2183 \box_use_drop:N \l_@@_the_array_box

```

We have to draw the blocks right now because there may be tabular notes in some blocks (which are not mono-column: the blocks which are mono-column have been composed in boxes yet)... and we have to create (potentially) the extra nodes before creating the blocks since there are `medium` nodes to create for the blocks.

```

2184 \@@_create_extra_nodes:
2185 \seq_if_empty:NF \g_@@_blocks_seq \@@_draw_blocks:
2186 \bool_lazy_or:nnT
2187   { \int_compare_p:nNn \c@tabularnote > 0 }
2188   { ! \tl_if_empty_p:V \l_@@_tabularnote_tl }
2189 \@@_insert_tabularnotes:
2190 \end { minipage }
2191 }
2192 \cs_new_protected:Npn \@@_insert_tabularnotes:
2193 {
2194   \skip_vertical:N 0.65ex

```

The TeX group is for potential specifications in the `\l_@@_notes_code_before_tl`.

```

2195 \group_begin:
2196 \l_@@_notes_code_before_tl
2197 \tl_if_empty:NF \l_@@_tabularnote_tl { \l_@@_tabularnote_tl \par }

```

We compose the tabular notes with a list of `enumitem`. The `\strut` and the `\unskip` are designed to give the ability to put a `\bottomrule` at the end of the notes with a good vertical space.

```

2198 \int_compare:nNnT \c@tabularnote > 0
2199 {
2200   \bool_if:NTF \l_@@_notes_para_bool
2201   {
2202     \begin { tabularnotes* }
2203     \seq_map_inline:Nn \g_@@_tabularnotes_seq { \item ##1 } \strut
2204     \end { tabularnotes* }

```

The following `\par` is mandatory for the event that the user has put `\footnotesize` (for example) in the `notes/code-before`.

```

2205 \par
2206 }
2207 {
2208   \tabularnotes
2209   \seq_map_inline:Nn \g_@@_tabularnotes_seq { \item ##1 } \strut
2210   \endtabularnotes
2211 }
2212 }
2213 \unskip
2214 \group_end:
2215 \bool_if:NT \l_@@_notes_bottomrule_bool
2216 {
2217   \bool_if:NTF \c_@@_booktabs_loaded_bool
2218   {

```

The two dimensions `\aboverulesep` et `\heavyrulewidth` are parameters defined by `booktabs`.

```

2219 \skip_vertical:N \aboverulesep
\CT@arc@ is the specification of color defined by colortbl but you use it even if colortbl is not loaded.
2220 { \CT@arc@ \hrule height \heavyrulewidth }
2221 }
2222 { \@_error:n { bottomrule~without~booktabs } }
2223 }
2224 \l_@@_notes_code_after_tl
2225 \seq_gclear:N \g_@@_tabularnotes_seq
2226 \int_gzero:N \c@tabularnote
2227 }

```

The case of `baseline` equal to `b`. Remember that, when the key `b` is used, the `{array}` (of `array`) is constructed with the option `t` (and not `b`). Now, we do the translation to take into account the option `b`.

```

2228 \cs_new_protected:Npn \@@_use_arraybox_with_notes_b:
2229 {
2230   \pgfpicture
2231     \@@_qpoint:n { row - 1 }
2232     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
2233     \@@_qpoint:n { row - \int_use:N \c@iRow - base }
2234     \dim_gsub:Nn \g_tmpa_dim \pgf@y
2235   \endpgfpicture
2236   \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
2237   \int_compare:nNnT \l_@@_first_row_int = 0
2238   {
2239     \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
2240     \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
2241   }
2242   \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
2243 }

```

Now, the general case.

```

2244 \cs_new_protected:Npn \@@_use_arraybox_with_notes:
2245 {

```

We convert a value of `t` to a value of 1.

```

2246   \tl_if_eq:NnT \l_@@_baseline_tl { t }
2247   { \tl_set:Nn \l_@@_baseline_tl { 1 } }

```

Now, we convert the value of `\l_@@_baseline_tl` (which should represent an integer) to an integer stored in `\l_tmpa_int`.

```

2248   \pgfpicture
2249   \@@_qpoint:n { row - 1 }
2250   \dim_gset_eq:NN \g_tmpa_dim \pgf@y
2251   \str_if_in:NnTF \l_@@_baseline_tl { line- }
2252   {
2253     \int_set:Nn \l_tmpa_int
2254     {
2255       \str_range:Nnn
2256         \l_@@_baseline_tl
2257         6
2258         { \tl_count:V \l_@@_baseline_tl }
2259     }
2260     \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
2261   }
2262   {
2263     \int_set:Nn \l_tmpa_int \l_@@_baseline_tl
2264     \bool_lazy_or:nnT
2265       { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
2266       { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
2267     {
2268       \@@_error:n { bad-value-for-baseline }
2269       \int_set:Nn \l_tmpa_int 1
2270     }
2271     \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }
2272   }
2273   \dim_gsub:Nn \g_tmpa_dim \pgf@y
2274   \endpgfpicture
2275   \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
2276   \int_compare:nNnT \l_@@_first_row_int = 0
2277   {
2278     \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
2279     \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
2280   }
2281   \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
2282 }

```

The command `\@@_put_box_in_flow_bis:` is used when the option `delimiters/max-width` is used because, in this case, we have to adjust the widths of the delimiters. The arguments `#1` and `#2` are the delimiters specified by the user.

```
2283 \cs_new_protected:Npn \@@_put_box_in_flow_bis:nn #1 #2
2284 {
```

We will compute the real width of both delimiters used.

```
2285 \dim_zero_new:N \l_@@_real_left_delim_dim
2286 \dim_zero_new:N \l_@@_real_right_delim_dim
2287 \hbox_set:Nn \l_tmpb_box
2288 {
2289   \c_math_toggle_token
2290   \left #1
2291   \vcenter
2292   {
2293     \vbox_to_ht:nn
2294     { \box_ht:N \l_tmpa_box + \box_dp:N \l_tmpa_box }
2295     { }
2296   }
2297   \right .
2298   \c_math_toggle_token
2299 }
2300 \dim_set:Nn \l_@@_real_left_delim_dim
2301 { \box_wd:N \l_tmpb_box - \nullldelimiterspace }
2302 \hbox_set:Nn \l_tmpb_box
2303 {
2304   \c_math_toggle_token
2305   \left .
2306   \vbox_to_ht:nn
2307   { \box_ht:N \l_tmpa_box + \box_dp:N \l_tmpa_box }
2308   { }
2309   \right #2
2310   \c_math_toggle_token
2311 }
2312 \dim_set:Nn \l_@@_real_right_delim_dim
2313 { \box_wd:N \l_tmpb_box - \nullldelimiterspace }
```

Now, we can put the box in the TeX flow with the horizontal adjustments on both sides.

```
2314 \skip_horizontal:N \l_@@_left_delim_dim
2315 \skip_horizontal:N -\l_@@_real_left_delim_dim
2316 \@@_put_box_in_flow:
2317 \skip_horizontal:N \l_@@_right_delim_dim
2318 \skip_horizontal:N -\l_@@_real_right_delim_dim
2319 }
```

The construction of the array in the environment `{NiceArrayWithDelims}` is, in fact, done by the environment `{@@-light-syntax}` or by the environment `{@@-normal-syntax}` (whether the option `light-syntax` is in force or not). When the key `light-syntax` is not used, the construction is a standard environment (and, thus, it's possible to use verbatim in the array).

```
2320 \NewDocumentEnvironment { @@-normal-syntax } { }
```

First, we test whether the environment is empty. If it is empty, we raise a fatal error (it's only a security). In order to detect whether it is empty, we test whether the next token is `\end` and, if it's the case, we test if this is the end of the environment (if it is not, an standard error will be raised by LaTeX for incorrect nested environments).

```
2321 {
2322   \peek_meaning_ignore_spaces:NTF \end \@@_analyze_end:Nn
```

Here is the call to `\array` (we have a dedicated macro `\@@_array:` because of compatibility with the classes `revtex4-1` and `revtex4-2`).

```
2323 { \exp_args:NV \@@_array: \g_@@_preamble_tl }
2324 }
2325 {
```

```

2326 \@@_create_col_nodes:
2327 \endarray
2328 }

```

When the key `light-syntax` is in force, we use an environment which takes its whole body as an argument (with the specifier `b` of `xparse`).

```

2329 \NewDocumentEnvironment { @@-light-syntax } { b }
2330 {

```

First, we test whether the environment is empty. It's only a security. Of course, this test is more easy than the similar test for the "normal syntax" because we have the whole body of the environment in `#1`.

```

2331 \tl_if_empty:nT { #1 } { \@@_fatal:n { empty-environment } }
2332 \tl_map_inline:nn { #1 }
2333 {
2334   \str_if_eq:nnT { ##1 } { & }
2335   { \@@_fatal:n { ampersand-in~light-syntax } }
2336   \str_if_eq:nnT { ##1 } { \ }
2337   { \@@_fatal:n { double-backslash-in~light-syntax } }
2338 }

```

Now, you extract the `\CodeAfter` of the body of the environment. Maybe, there is no command `\CodeAfter` in the body. That's why you put a marker `\CodeAfter` after `#1`. If there is yet a `\CodeAfter` in `#1`, this second (or third...) `\CodeAfter` will be caught in the value of `\g_nicematrix_code_after_tl`. That doesn't matter because `\CodeAfter` will be set to *no-op* before the execution of `\g_nicematrix_code_after_tl`.

```

2339 \@@_light_syntax_i #1 \CodeAfter \q_stop
2340 }

```

Now, the second part of the environment. It is empty. That's not surprising because we have caught the whole body of the environment with the specifier `b` provided by `xparse`.

```

2341 { }
2342 \cs_new_protected:Npn \@@_light_syntax_i #1\CodeAfter #2\q_stop
2343 {
2344   \tl_gput_right:Nn \g_nicematrix_code_after_tl { #2 }

```

The body of the array, which is stored in the argument `#1`, is now splitted into items (and *not* tokens).

```

2345 \seq_gclear_new:N \g_@@_rows_seq
2346 \tl_set_rescan:Nno \l_@@_end_of_row_tl { } \l_@@_end_of_row_tl
2347 \exp_args:NNV \seq_gset_split:Nnn \g_@@_rows_seq \l_@@_end_of_row_tl { #1 }

```

If the environment uses the option `last-row` without value (i.e. without saying the number of the rows), we have now the opportunity to know that value. We do it, and so, if the token list `\l_@@_code_for_last_row_tl` is not empty, we will use directly where it should be.

```

2348 \int_compare:nNnT \l_@@_last_row_int = { -1 }
2349 { \int_set:Nn \l_@@_last_row_int { \seq_count:N \g_@@_rows_seq } }

```

Here is the call to `\array` (we have a dedicated macro `\@@_array`: because of compatibility with the classes `revtex4-1` and `revtex4-2`).

```

2350 \exp_args:NV \@@_array: \g_@@_preamble_tl

```

We need a global affectation because, when executing `\l_tmpa_tl`, we will exit the first cell of the array.

```

2351 \seq_gpop_left:NN \g_@@_rows_seq \l_tmpa_tl
2352 \exp_args:NV \@@_line_with_light_syntax_i:n \l_tmpa_tl
2353 \seq_map_function:NN \g_@@_rows_seq \@@_line_with_light_syntax:n
2354 \@@_create_col_nodes:
2355 \endarray
2356 }
2357 \cs_new_protected:Npn \@@_line_with_light_syntax:n #1
2358 { \tl_if_empty:nF { #1 } { \ \ \@@_line_with_light_syntax_i:n { #1 } } }

```

```

2359 \cs_new_protected:Npn \@@_line_with_light_syntax_i:n #1
2360 {
2361   \seq_gclear_new:N \g_@@_cells_seq
2362   \seq_gset_split:Nnn \g_@@_cells_seq { ~ } { #1 }
2363   \seq_gpop_left:NN \g_@@_cells_seq \l_tmpa_tl
2364   \l_tmpa_tl
2365   \seq_map_inline:Nn \g_@@_cells_seq { & ##1 }
2366 }

```

The following command is used by the code which detects whether the environment is empty (we raise a fatal error in this case: it's only a security).

```

2367 \cs_new_protected:Npn \@@_analyze_end:Nn #1 #2
2368 {
2369   \str_if_eq:VnT \g_@@_name_env_str { #2 }
2370   { \@@_fatal:n { empty-environment } }

```

We repeat in the stream the `\end{...}` we have extracted and the user will have an error for incorrect nested environments.

```

2371   \end { #2 }
2372 }

```

The command `\@@_create_col_nodes:` will construct a special last row. That last row is a false row used to create the `col` nodes and to fix the width of the columns (when the array is constructed with an option which specifies the width of the columns).

```

2373 \cs_new:Npn \@@_create_col_nodes:
2374 {
2375   \crrcr
2376   \int_compare:nNnT \l_@@_first_col_int = 0
2377   {
2378     \omit
2379     \hbox_overlap_left:n
2380     {
2381       \bool_if:NT \l_@@_code_before_bool
2382       { \pgfsys@markposition { \@@_env: - col - 0 } }
2383       \pgfpicture
2384       \pgfrememberpicturepositiononpagetrue
2385       \pgfcoordinate { \@@_env: - col - 0 } \pgfpintorigin
2386       \str_if_empty:NF \l_@@_name_str
2387       { \pgfnodelalias { \l_@@_name_str - col - 0 } { \@@_env: - col - 0 } }
2388       \endpgfpicture
2389       \skip_horizontal:N 2\col@sep
2390       \skip_horizontal:N \g_@@_width_first_col_dim
2391     }
2392     &
2393   }
2394   \omit

```

The following instruction must be put after the instruction `\omit`.

```

2395   \bool_gset_true:N \g_@@_row_of_col_done_bool

```

First, we put a `col` node on the left of the first column (of course, we have to do that *after* the `\omit`).

```

2396   \int_compare:nNnTF \l_@@_first_col_int = 0
2397   {
2398     \bool_if:NT \l_@@_code_before_bool
2399     {
2400       \hbox
2401       {
2402         \skip_horizontal:N -0.5\arrayrulewidth
2403         \pgfsys@markposition { \@@_env: - col - 1 }
2404         \skip_horizontal:N 0.5\arrayrulewidth
2405       }
2406     }

```

```

2407 \pgfpicture
2408 \pgfrememberpicturerepositiononpagetrue
2409 \pgfcoordinate { \@@_env: - col - 1 }
2410 { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
2411 \str_if_empty:NF \l_@@_name_str
2412 { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
2413 \endpgfpicture
2414 }
2415 {
2416 \bool_if:NT \l_@@_code_before_bool
2417 {
2418 \hbox
2419 {
2420 \skip_horizontal:N 0.5\arrayrulewidth
2421 \pgfsys@markposition { \@@_env: - col - 1 }
2422 \skip_horizontal:N -0.5\arrayrulewidth
2423 }
2424 }
2425 \pgfpicture
2426 \pgfrememberpicturerepositiononpagetrue
2427 \pgfcoordinate { \@@_env: - col - 1 }
2428 { \pgfpoint { 0.5 \arrayrulewidth } \c_zero_dim }
2429 \str_if_empty:NF \l_@@_name_str
2430 { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
2431 \endpgfpicture
2432 }

```

We compute in `\g_tmpa_skip` the common width of the columns (it's a skip and not a dimension). We use a global variable because we are in a cell of an `\halign` and because we have to use this variable in other cells (of the same row). The affectation of `\g_tmpa_skip`, like all the affectations, must be done after the `\omit` of the cell.

We give a default value for `\g_tmpa_skip` (0 pt plus 1 fill) but it will just after be erased by a fixed value in the concerned cases.

```

2433 \skip_gset:Nn \g_tmpa_skip { 0 pt+plus 1 fill }
2434 \bool_if:NF \l_@@_auto_columns_width_bool
2435 { \dim_compare:nNt \l_@@_columns_width_dim > \c_zero_dim }
2436 {
2437 \bool_lazy_and:nnTF
2438 \l_@@_auto_columns_width_bool
2439 { \bool_not_p:n \l_@@_block_auto_columns_width_bool }
2440 { \skip_gset_eq:NN \g_tmpa_skip \g_@@_max_cell_width_dim }
2441 { \skip_gset_eq:NN \g_tmpa_skip \l_@@_columns_width_dim }
2442 \skip_gadd:Nn \g_tmpa_skip { 2 \col@sep }
2443 }
2444 \skip_horizontal:N \g_tmpa_skip
2445 \hbox
2446 {
2447 \bool_if:NT \l_@@_code_before_bool
2448 {
2449 \hbox
2450 {
2451 \skip_horizontal:N -0.5\arrayrulewidth
2452 \pgfsys@markposition { \@@_env: - col - 2 }
2453 \skip_horizontal:N 0.5\arrayrulewidth
2454 }
2455 }
2456 \pgfpicture
2457 \pgfrememberpicturerepositiononpagetrue
2458 \pgfcoordinate { \@@_env: - col - 2 }
2459 { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
2460 \str_if_empty:NF \l_@@_name_str
2461 { \pgfnodealias { \l_@@_name_str - col - 2 } { \@@_env: - col - 2 } }
2462 \endpgfpicture

```

```
2463     }
```

We begin a loop over the columns. The integer `\g_tmpa_int` will be the number of the current column. This integer is used for the Tikz nodes.

```
2464 \int_gset:Nn \g_tmpa_int 1
2465 \bool_if:NTF \g_@@_last_col_found_bool
2466 { \prg_replicate:nn { \g_@@_col_total_int - 3 } }
2467 { \prg_replicate:nn { \g_@@_col_total_int - 2 } }
2468 {
2469     &
2470     \omit
2471     \int_gincr:N \g_tmpa_int
```

The incrementation of the counter `\g_tmpa_int` must be done after the `\omit` of the cell.

```
2472     \skip_horizontal:N \g_tmpa_skip
2473     \bool_if:NT \l_@@_code_before_bool
2474     {
2475         \hbox
2476         {
2477             \skip_horizontal:N -0.5\arrayrulewidth
2478             \pgfsys@markposition { \@@_env: - col - \@@_succ:n \g_tmpa_int }
2479             \skip_horizontal:N 0.5\arrayrulewidth
2480         }
2481     }
```

We create the col node on the right of the current column.

```
2482     \pgfpicture
2483     \pgfrememberpicturepositiononpagetrue
2484     \pgfcoordinate { \@@_env: - col - \@@_succ:n \g_tmpa_int }
2485     { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
2486     \str_if_empty:NF \l_@@_name_str
2487     {
2488         \pgfnodealias
2489         { \l_@@_name_str - col - \@@_succ:n \g_tmpa_int }
2490         { \@@_env: - col - \@@_succ:n \g_tmpa_int }
2491     }
2492     \endpgfpicture
2493 }
```

```
2494     &
2495     \omit
2496     \int_gincr:N \g_tmpa_int
2497     \skip_horizontal:N \g_tmpa_skip
2498     \bool_lazy_all:nT
2499     {
2500         \l_@@_NiceArray_bool
2501         { \bool_not_p:n \l_@@_NiceTabular_bool }
2502         { \clist_if_empty_p:N \l_@@_vlines_clist }
2503         { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
2504         { ! \l_@@_bar_at_end_of_pream_bool }
2505     }
2506     { \skip_horizontal:N -\col@sep }
2507     \bool_if:NT \l_@@_code_before_bool
2508     {
2509         \hbox
2510         {
2511             \skip_horizontal:N -0.5\arrayrulewidth
```

With an environment `{Matrix}`, you want to remove the exterior `\arraycolsep` but we don't know the number of columns (since there is no preamble) and that's why we can't put `@{}` at the end of the preamble. That's why we remove a `\arraycolsep` now.

```
2512         \bool_lazy_and:nnT \l_@@_Matrix_bool \l_@@_NiceArray_bool
2513         { \skip_horizontal:N -\arraycolsep }
2514         \pgfsys@markposition { \@@_env: - col - \@@_succ:n \g_tmpa_int }
```

```

2515         \skip_horizontal:N 0.5\arrayrulewidth
2516         \bool_lazy_and:nnT \l_@@_Matrix_bool \l_@@_NiceArray_bool
2517         { \skip_horizontal:N \arraycolsep }
2518     }
2519 }
2520 \pgfpicture
2521 \pgfrememberpicturepositiononpagetrue
2522 \pgfcoordinate { \@@_env: - col - \@@_succ:n \g_tmpa_int }
2523 {
2524     \bool_lazy_and:nnTF \l_@@_Matrix_bool \l_@@_NiceArray_bool
2525     {
2526         \pgfpoint
2527         { - 0.5 \arrayrulewidth - \arraycolsep }
2528         \c_zero_dim
2529     }
2530     { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
2531 }
2532 \str_if_empty:NF \l_@@_name_str
2533 {
2534     \pgfnodealias
2535     { \l_@@_name_str - col - \@@_succ:n \g_tmpa_int }
2536     { \@@_env: - col - \@@_succ:n \g_tmpa_int }
2537 }
2538 \endpgfpicture

2539 \bool_if:NT \g_@@_last_col_found_bool
2540 {
2541     \hbox_overlap_right:n
2542     {
2543         \skip_horizontal:N \g_@@_width_last_col_dim
2544         \bool_if:NT \l_@@_code_before_bool
2545         {
2546             \pgfsys@markposition
2547             { \@@_env: - col - \@@_succ:n \g_@@_col_total_int }
2548         }
2549         \pgfpicture
2550         \pgfrememberpicturepositiononpagetrue
2551         \pgfcoordinate { \@@_env: - col - \@@_succ:n \g_@@_col_total_int }
2552         \pgfpintorigin
2553         \str_if_empty:NF \l_@@_name_str
2554         {
2555             \pgfnodealias
2556             { \l_@@_name_str - col - \@@_succ:n \g_@@_col_total_int }
2557             { \@@_env: - col - \@@_succ:n \g_@@_col_total_int }
2558         }
2559         \endpgfpicture
2560     }
2561 }
2562 \cr
2563 }

```

Here is the preamble for the “first column” (if the user uses the key `first-col`)

```

2564 \tl_const:Nn \c_@@_preamble_first_col_tl
2565 {
2566     >
2567     {

```

At the beginning of the cell, we link `\CodeAfter` to a command which do *not* begin with `\omit` (whereas the standard version of `\CodeAfter` begins with `\omit`).

```

2568     \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:n
2569     \bool_gset_true:N \g_@@_after_col_zero_bool
2570     \@@_begin_of_row:

```

The contents of the cell is constructed in the box `\l_@@_cell_box` because we have to compute some dimensions of this box.

```

2571 \hbox_set:Nw \l_@@_cell_box
2572 \@@_math_toggle_token:
2573 \bool_if:NT \l_@@_small_bool \scriptstyle

```

We insert `\l_@@_code_for_first_col_tl...` but we don't insert it in the potential “first row” and in the potential “last row”.

```

2574 \bool_lazy_and:nnT
2575 { \int_compare_p:nNn \c@iRow > 0 }
2576 {
2577   \bool_lazy_or_p:nn
2578   { \int_compare_p:nNn \l_@@_last_row_int < 0 }
2579   { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
2580 }
2581 {
2582   \l_@@_code_for_first_col_tl
2583   \xglobal \colorlet { nicematrix-first-col } { . }
2584 }
2585 }

```

Be careful: despite this letter `l` the cells of the “first column” are composed in a **R** manner since they are composed in a `\hbox_overlap_left:n`.

```

2586 l
2587 <
2588 {
2589   \@@_math_toggle_token:
2590   \hbox_set_end:
2591   \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
2592   \@@_adjust_size_box:
2593   \@@_update_for_first_and_last_row:

```

We actualise the width of the “first column” because we will use this width after the construction of the array.

```

2594 \dim_gset:Nn \g_@@_width_first_col_dim
2595 { \dim_max:nn \g_@@_width_first_col_dim { \box_wd:N \l_@@_cell_box } }

```

The content of the cell is inserted in an overlapping position.

```

2596 \hbox_overlap_left:n
2597 {
2598   \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \c_zero_dim
2599   \@@_node_for_cell:
2600   { \box_use_drop:N \l_@@_cell_box }
2601   \skip_horizontal:N \l_@@_left_delim_dim
2602   \skip_horizontal:N \l_@@_left_margin_dim
2603   \skip_horizontal:N \l_@@_extra_left_margin_dim
2604 }
2605 \bool_gset_false:N \g_@@_empty_cell_bool
2606 \skip_horizontal:N -2\col@sep
2607 }
2608 }

```

Here is the preamble for the “last column” (if the user uses the key `last-col`).

```

2609 \tl_const:Nn \c_@@_preamble_last_col_tl
2610 {
2611   >
2612   {

```

At the beginning of the cell, we link `\CodeAfter` to a command which do *not* begin with `\omit` (whereas the standard version of `\CodeAfter` begins with `\omit`).

```

2613 \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:n

```

With the flag `\g_@@_last_col_found_bool`, we will know that the “last column” is really used.

```

2614 \bool_gset_true:N \g_@@_last_col_found_bool
2615 \int_gincr:N \c@jCol
2616 \int_gset_eq:NN \g_@@_col_total_int \c@jCol

```

The contents of the cell is constructed in the box `\l_tmpa_box` because we have to compute some dimensions of this box.

```
2617 \hbox_set:Nw \l_@@_cell_box
2618 \@@_math_toggle_token:
2619 \bool_if:NT \l_@@_small_bool \scriptstyle
```

We insert `\l_@@_code_for_last_col_tl...` but we don't insert it in the potential “first row” and in the potential “last row”.

```
2620 \int_compare:nNnT \c@iRow > 0
2621 {
2622   \bool_lazy_or:nnT
2623     { \int_compare_p:nNn \l_@@_last_row_int < 0 }
2624     { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
2625   {
2626     \l_@@_code_for_last_col_tl
2627     \xglobal \colorlet { nicematrix-last-col } { . }
2628   }
2629 }
2630 }
2631 l
2632 <
2633 {
2634   \@@_math_toggle_token:
2635   \hbox_set_end:
2636   \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
2637   \@@_adjust_size_box:
2638   \@@_update_for_first_and_last_row:
```

We actualise the width of the “last column” because we will use this width after the construction of the array.

```
2639 \dim_gset:Nn \g_@@_width_last_col_dim
2640 { \dim_max:nn \g_@@_width_last_col_dim { \box_wd:N \l_@@_cell_box } }
2641 \skip_horizontal:N -2\col@sep
```

The content of the cell is inserted in an overlapping position.

```
2642 \hbox_overlap_right:n
2643 {
2644   \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } > \c_zero_dim
2645   {
2646     \skip_horizontal:N \l_@@_right_delim_dim
2647     \skip_horizontal:N \l_@@_right_margin_dim
2648     \skip_horizontal:N \l_@@_extra_right_margin_dim
2649     \@@_node_for_cell:
2650   }
2651 }
2652 \bool_gset_false:N \g_@@_empty_cell_bool
2653 }
2654 }
```

The environment `{NiceArray}` is constructed upon the environment `{NiceArrayWithDelims}` but, in fact, there is a flag `\l_@@_NiceArray_bool`. In `{NiceArrayWithDelims}`, some special code will be executed if this flag is raised.

```
2655 \NewDocumentEnvironment { NiceArray } { }
2656 {
2657   \bool_set_true:N \l_@@_NiceArray_bool
2658   \str_if_empty:NT \g_@@_name_env_str
2659   { \str_gset:Nn \g_@@_name_env_str { NiceArray } }
```

We put `.` and `.` for the delimiters but, in fact, that doesn't matter because these arguments won't be used in `{NiceArrayWithDelims}` (because the flag `\l_@@_NiceArray_bool` is raised).

```
2660 \NiceArrayWithDelims . .
2661 }
2662 { \endNiceArrayWithDelims }
```

We create the variants of the environment `{NiceArrayWithDelims}`.

```

2663 \cs_new_protected:Npn \@@_def_env:nnn #1 #2 #3
2664 {
2665   \NewDocumentEnvironment { #1 NiceArray } { }
2666   {
2667     \str_if_empty:NT \g_@@_name_env_str
2668     { \str_gset:Nn \g_@@_name_env_str { #1 NiceArray } }
2669     \@@_test_if_math_mode:
2670     \NiceArrayWithDelims #2 #3
2671   }
2672   { \endNiceArrayWithDelims }
2673 }
2674 \@@_def_env:nnn p ( )
2675 \@@_def_env:nnn b [ ]
2676 \@@_def_env:nnn B {\ }
2677 \@@_def_env:nnn v | |
2678 \@@_def_env:nnn V \| \|

```

The environment `{NiceMatrix}` and its variants

```

2679 \cs_new_protected:Npn \@@_begin_of_NiceMatrix:nn #1 #2
2680 {
2681   \bool_set_true:N \l_@@_Matrix_bool
2682   \use:c { #1 NiceArray }
2683   {
2684     *
2685     {
2686       \int_compare:nNnTF \l_@@_last_col_int < 0
2687       \c@MaxMatrixCols
2688       { \@@_pred:n \l_@@_last_col_int }
2689     }
2690     { > \@@_Cell: #2 < \@@_end_Cell: }
2691   }
2692 }
2693 \clist_map_inline:nn { { } , p , b , B , v , V }
2694 {
2695   \NewDocumentEnvironment { #1 NiceMatrix } { ! 0 { } }
2696   {
2697     \str_gset:Nn \g_@@_name_env_str { #1 NiceMatrix }
2698     \tl_set:Nn \l_@@_type_of_col_tl c
2699     \keys_set:nn { NiceMatrix / NiceMatrix } { ##1 }
2700     \exp_args:Nne \@@_begin_of_NiceMatrix:nn { #1 } \l_@@_type_of_col_tl
2701   }
2702   { \use:c { end #1 NiceArray } }
2703 }

```

The following command will be linked to `\NotEmpty` in the environments of `nicematrix`.

```

2704 \cs_new_protected:Npn \@@_NotEmpty:
2705 { \bool_gset_true:N \g_@@_not_empty_cell_bool }

```

The environments `{NiceTabular}` and `{NiceTabular*}`

```

2706 \NewDocumentEnvironment { NiceTabular } { 0 { } m ! 0 { } }
2707 {
2708   \str_gset:Nn \g_@@_name_env_str { NiceTabular }
2709   \keys_set:nn { NiceMatrix / NiceTabular } { #1 , #3 }
2710   \bool_set_true:N \l_@@_NiceTabular_bool
2711   \NiceArray { #2 }
2712 }

```

```

2713 { \endNiceArray }

2714 \NewDocumentEnvironment { NiceTabular* } { m O { } m ! O { } }
2715 {
2716   \str_gset:Nn \g_@@_name_env_str { NiceTabular* }
2717   \dim_set:Nn \l_@@_tabular_width_dim { #1 }
2718   \keys_set:nn { NiceMatrix / NiceTabular } { #2 , #4 }
2719   \bool_set_true:N \l_@@_NiceTabular_bool
2720   \NiceArray { #3 }
2721 }
2722 { \endNiceArray }

```

After the construction of the array

```

2723 \cs_new_protected:Npn \@@_after_array:
2724 {
2725   \group_begin:

```

When the option `last-col` is used in the environments with explicit preambles (like `{NiceArray}`, `{pNiceArray}`, etc.) a special type of column is used at the end of the preamble in order to compose the cells in an overlapping position (with `\hbox_overlap_right:n`) but (if `last-col` has been used), we don't have the number of that last column. However, we have to know that number for the color of the potential `\Vdots` drawn in that last column. That's why we fix the correct value of `\l_@@_last_col_int` in that case.

```

2726   \bool_if:NT \g_@@_last_col_found_bool
2727   { \int_set_eq:NN \l_@@_last_col_int \g_@@_col_total_int }

```

If we are in an environment without preamble (like `{NiceMatrix}` or `{pNiceMatrix}`) and if the option `last-col` has been used without value we also fix the real value of `\l_@@_last_col_int`.

```

2728   \bool_if:NT \l_@@_last_col_without_value_bool
2729   { \int_set_eq:NN \l_@@_last_col_int \g_@@_col_total_int }

```

It's also time to give to `\l_@@_last_row_int` its real value.

```

2730   \bool_if:NT \l_@@_last_row_without_value_bool
2731   { \int_set_eq:NN \l_@@_last_row_int \g_@@_row_total_int }

```

```

2732   \tl_gput_right:Nx \g_@@_aux_tl
2733   {
2734     \seq_gset_from_clist:Nn \exp_not:N \c_@@_size_seq
2735     {
2736       \int_use:N \l_@@_first_row_int ,
2737       \int_use:N \c_iRow ,
2738       \int_use:N \g_@@_row_total_int ,
2739       \int_use:N \l_@@_first_col_int ,
2740       \int_use:N \c_jCol ,
2741       \int_use:N \g_@@_col_total_int
2742     }
2743     \iow_newline:
2744   }

```

We write also the potential content of `\g_@@_pos_of_blocks_seq` (it will be useful if the command `\rowcolors` is used with the key `respect-blocks`).

```

2745   \seq_if_empty:NF \g_@@_pos_of_blocks_seq
2746   {
2747     \tl_gput_right:Nx \g_@@_aux_tl
2748     {
2749       \seq_gset_from_clist:Nn \exp_not:N \g_@@_pos_of_blocks_seq
2750       { \seq_use:Nnnn \g_@@_pos_of_blocks_seq , , , }
2751       \iow_newline:
2752     }
2753   }
2754   \seq_if_empty:NF \g_@@_multicolumn_cells_seq
2755   {

```

```

2756 \tl_gput_right:Nx \g_@@_aux_tl
2757 {
2758   \seq_gset_from_clist:Nn \exp_not:N \g_@@_multicolumn_cells_seq
2759   { \seq_use:Nnnn \g_@@_multicolumn_cells_seq , , , }
2760   \iow_newline:
2761   \seq_gset_from_clist:Nn \exp_not:N \g_@@_multicolumn_sizes_seq
2762   { \seq_use:Nnnn \g_@@_multicolumn_sizes_seq , , , }
2763   \iow_newline:
2764 }
2765 }

```

Now, you create the diagonal nodes by using the row nodes and the col nodes.

```

2766 \@@_create_diag_nodes:

```

By default, the diagonal lines will be parallelized⁶⁰. There are two types of diagonals lines: the `\Ddots` diagonals and the `\Iddots` diagonals. We have to count both types in order to know whether a diagonal is the first of its type in the current `{NiceArray}` environment.

```

2767 \bool_if:NT \l_@@_parallelize_diags_bool
2768 {
2769   \int_gzero_new:N \g_@@_ddots_int
2770   \int_gzero_new:N \g_@@_iddots_int

```

The dimensions `\g_@@_delta_x_one_dim` and `\g_@@_delta_y_one_dim` will contain the Δ_x and Δ_y of the first `\Ddots` diagonal. We have to store these values in order to draw the others `\Ddots` diagonals parallel to the first one. Similarly `\g_@@_delta_x_two_dim` and `\g_@@_delta_y_two_dim` are the Δ_x and Δ_y of the first `\Iddots` diagonal.

```

2771   \dim_gzero_new:N \g_@@_delta_x_one_dim
2772   \dim_gzero_new:N \g_@@_delta_y_one_dim
2773   \dim_gzero_new:N \g_@@_delta_x_two_dim
2774   \dim_gzero_new:N \g_@@_delta_y_two_dim
2775 }
2776 \int_zero_new:N \l_@@_initial_i_int
2777 \int_zero_new:N \l_@@_initial_j_int
2778 \int_zero_new:N \l_@@_final_i_int
2779 \int_zero_new:N \l_@@_final_j_int
2780 \bool_set_false:N \l_@@_initial_open_bool
2781 \bool_set_false:N \l_@@_final_open_bool

```

If the option `small` is used, the values `\l_@@_radius_dim` and `\l_@@_inter_dots_dim` (used to draw the dotted lines created by `\hdottedline` and `\vdotteline` and also for all the other dotted lines when `line-style` is equal to `standard`, which is the initial value) are changed.

```

2782 \bool_if:NT \l_@@_small_bool
2783 {
2784   \dim_set:Nn \l_@@_radius_dim { 0.37 pt }
2785   \dim_set:Nn \l_@@_inter_dots_dim { 0.25 em }

```

The dimension `\l_@@_xdots_shorten_dim` corresponds to the option `xdots/shorten` available to the user. That's why we give a new value according to the current value, and not an absolute value.

```

2786   \dim_set:Nn \l_@@_xdots_shorten_dim { 0.6 \l_@@_xdots_shorten_dim }
2787 }

```

Now, we actually draw the dotted lines (specified by `\Cdots`, `\Vdots`, etc.).

```

2788 \@@_draw_dotted_lines:

```

The following computes the “corners” (made up of empty cells) but if there is no corner to compute, it won't do anything. The corners are computed in `\l_@@_corners_cells_seq` which will contain all the cells which are empty (and not in a block) considered in the corners of the array.

```

2789 \@@_compute_corners:

```

The sequence `\g_@@_pos_of_blocks_seq` must be “adjusted” (for the case where the user have written something like `\Block{1-*}`).

⁶⁰It's possible to use the option `parallelize-diags` to disable this parallelization.

```
2790 \@@_adjust_pos_of_blocks_seq:
```

The following code is only for efficiency. We determine whether the potential horizontal and vertical rules are “complete”, that is to say drawn in the whole array. We are sure that all the rules will be complete when there is no block, no virtual block (determined by a command such as `\Cdots`, `\Vdots`, etc.) and no corners. In that case, we switch to a shortcut version of `\@@_vline_i:nn` and `\@@_hline:nn`.

```
2791 \bool_lazy_all:nT
2792 {
2793   { \seq_if_empty_p:N \g_@@_pos_of_blocks_seq }
2794   { \seq_if_empty_p:N \g_@@_pos_of_xdots_seq }
2795   { \seq_if_empty_p:N \l_@@_corners_cells_seq }
2796 }
2797 {
2798   \cs_set_eq:NN \@@_vline_i:nn \@@_vline_i_complete:nn
2799   \cs_set_eq:NN \@@_hline_i:nn \@@_hline_i_complete:nn
2800 }
2801 \tl_if_empty:NF \l_@@_hlines_clist \@@_draw_hlines:
2802 \tl_if_empty:NF \l_@@_vlines_clist \@@_draw_vlines:
2803 \cs_set_eq:NN \SubMatrix \@@_SubMatrix
```

Now, the internal code-after and then, the `\CodeAfter`.

```
2804 \bool_if:NT \c_@@_tikz_loaded_bool
2805 {
2806   \tikzset
2807   {
2808     every~picture / .style =
2809     {
2810       overlay ,
2811       remember~picture ,
2812       name~prefix = \@@_env: -
2813     }
2814   }
2815 }
2816 \cs_set_eq:NN \line \@@_line
2817 \g_@@_internal_code_after_tl
2818 \tl_gclear:N \g_@@_internal_code_after_tl
```

When `light-syntax` is used, we insert systematically a `\CodeAfter` in the flow. Thus, it’s possible to have two instructions `\CodeAfter` and the second may be in `\g_nicematrix_code_after_tl`. That’s why we set `\Code-after` to be *no-op* now.

```
2819 \cs_set_eq:NN \CodeAfter \prg_do_nothing:
```

We clear the list of the names of the potential `\SubMatrix` that will appear in the `\CodeAfter` (unfortunately, that list has to be global).

```
2820 \seq_gclear:N \g_@@_submatrix_names_seq
```

We compose the `code-after` in math mode in order to nullify the spaces put by the user between instructions in the `code-after`.

```
2821 % \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
```

And here’s the `\CodeAfter`. Since the `\CodeAfter` may begin with an “argument” between square brackets of the options, we extract and treat that potential “argument” with the command `\@@_CodeAfter_keys:`.

```
2822 \exp_last_unbraced:NV \@@_CodeAfter_keys: \g_nicematrix_code_after_tl
2823 \scan_stop:
2824 % \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
2825 \tl_gclear:N \g_nicematrix_code_after_tl
2826 \group_end:
```

`\g_nicematrix_code_before_tl` is for instructions in the cells of the array such as `\rowcolor` and `\cellcolor` (when the key `colortbl-like` is in force). These instructions will be written on the aux file to be added to the `code-before` in the next run.

```

2827 \tl_if_empty:NF \g_nicematrix_code_before_tl
2828 {
The command \rowcolor in tabular will in fact use \rectanglecolor in order to follow the be-
haviour of \rowcolor of colortbl. That's why there may be a command \rectanglecolor in
\g_nicematrix_code_before_tl. In order to avoid an error during the expansion, we define a
protected version of \rectanglecolor.
2829 \cs_set_protected:Npn \rectanglecolor { }
2830 \cs_set_protected:Npn \columncolor { }
2831 \tl_gput_right:Nx \g_@@_aux_tl
2832 {
2833 \tl_gset:Nn \exp_not:N \g_@@_code_before_tl
2834 { \exp_not:V \g_nicematrix_code_before_tl }
2835 \iow_newline:
2836 }
2837 \bool_set_true:N \l_@@_code_before_bool
2838 }
2839 % \bool_if:NT \l_@@_code_before_bool \@@_write_aux_for_cell_nodes:

2840 \str_gclear:N \g_@@_name_env_str
2841 \@@_restore_iRow_jCol:

```

The command \CT@arc@ contains the instruction of color for the rules of the array⁶¹. This command is used by \CT@arc@ but we use it also for compatibility with colortbl. But we want also to be able to use color for the rules of the array when colortbl is *not* loaded. That's why we do the following instruction which is in the patch of the end of arrays done by colortbl.

```

2842 \cs_gset_eq:NN \CT@arc@ \@@_old_CT@arc@
2843 }

```

The following command will extract the potential options (between square brackets) at the beginning of the \CodeAfter (that is to say, when \CodeAfter is used, the options of that “command” \CodeAfter). Idem for the \CodeBefore.

```

2844 \NewDocumentCommand \@@_CodeAfter_keys: { 0 { } }
2845 { \keys_set:nn { NiceMatrix / CodeAfter } { #1 } }

```

We remind that the first mandatory argument of the command \Block is the size of the block with the special format *i-j*. However, the user is allowed to omit *i* or *j* (or both). This will be interpreted as: the last row (resp. column) of the block will be the last row (resp. column) of the block (without the potential exterior row—resp. column—of the array). By convention, this is stored in \g_@@_pos_of_blocks_seq (and \g_@@_blocks_seq) as a number of rows (resp. columns) for the block equal to 100. It's possible, after the construction of the array, to replace these values by the correct ones (since we know the number of rows and columns of the array).

```

2846 \cs_new_protected:Npn \@@_adjust_pos_of_blocks_seq:
2847 {
2848 \seq_gset_map_x:NNn \g_@@_pos_of_blocks_seq \g_@@_pos_of_blocks_seq
2849 { \@@_adjust_pos_of_blocks_seq_i:nnnn ##1 }
2850 }

```

The following command must *not* be protected.

```

2851 \cs_new:Npn \@@_adjust_pos_of_blocks_seq_i:nnnn #1 #2 #3 #4
2852 {
2853 { #1 }
2854 { #2 }
2855 {
2856 \int_compare:nNnTF { #3 } > { 99 }
2857 { \int_use:N \c@iRow }
2858 { #3 }
2859 }
2860 {
2861 \int_compare:nNnTF { #4 } > { 99 }

```

⁶¹e.g. \color[rgb]{0.5,0.5,0}

```

2862     { \int_use:N \c@jCol }
2863     { #4 }
2864   }
2865 }

```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible”. That’s why we have to define the adequate version of `\@@_draw_dotted_lines`: whether Tikz is loaded or not (in that case, only PGF is loaded).

```

2866 \AtBeginDocument
2867 {
2868   \cs_new_protected:Npx \@@_draw_dotted_lines:
2869   {
2870     \c_@@_pgfortikzpicture_tl
2871     \@@_draw_dotted_lines_i:
2872     \c_@@_endpgfortikzpicture_tl
2873   }
2874 }

```

The following command *must* be protected because it will appear in the construction of the command `\@@_draw_dotted_lines:`.

```

2875 \cs_new_protected:Npn \@@_draw_dotted_lines_i:
2876 {
2877   \pgfrememberpicturepositiononpagetrue
2878   \pgf@relevantforpicturesizefalse
2879   \g_@@_HVdotsfor_lines_tl
2880   \g_@@_Vdots_lines_tl
2881   \g_@@_Ddots_lines_tl
2882   \g_@@_Iddots_lines_tl
2883   \g_@@_Cdots_lines_tl
2884   \g_@@_Ldots_lines_tl
2885 }

2886 \cs_new_protected:Npn \@@_restore_iRow_jCol:
2887 {
2888   \cs_if_exist:NT \theiRow { \int_gset_eq:NN \c@iRow \l_@@_old_iRow_int }
2889   \cs_if_exist:NT \thejCol { \int_gset_eq:NN \c@jCol \l_@@_old_jCol_int }
2890 }

```

We define a new PGF shape for the diag nodes because we want to provide a anchor called `.5` for those nodes.

```

2891 \pgfdeclareshape { @@_diag_node }
2892 {
2893   \savedanchor { \five }
2894   {
2895     \dim_gset_eq:NN \pgf@x \l_tmpa_dim
2896     \dim_gset_eq:NN \pgf@y \l_tmpb_dim
2897   }
2898   \anchor { 5 } { \five }
2899   \anchor { center } { \pgfpointorigin }
2900 }

2901 \cs_new_protected:Npn \@@_write_aux_for_cell_nodes:
2902 {
2903   \pgfpicture
2904   \pgfrememberpicturepositiononpagetrue
2905   \pgf@relevantforpicturesizefalse
2906   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
2907   {
2908     \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
2909     {
2910       \cs_if_exist:cT { pgf @ sh @ ns @ \@@_env: - ##1 - ####1 }
2911       {

```

```

2912         \pgfscope
2913         \pgftransformshift
2914         { \pgfpointanchor { \@@_env: - ##1 - #####1 } { north-west } }
2915         \pgfnode
2916         { rectangle }
2917         { center }
2918         {
2919             \hbox
2920             { \pgfsys@markposition { \@@_env: - ##1 - #####1 - NW } }
2921         }
2922         { }
2923         { }
2924         \endpgfscope
2925         \pgfscope
2926         \pgftransformshift
2927         { \pgfpointanchor { \@@_env: - ##1 - #####1 } { south-east } }
2928         \pgfnode
2929         { rectangle }
2930         { center }
2931         {
2932             \hbox
2933             { \pgfsys@markposition { \@@_env: - ##1 - #####1 - SE } }
2934         }
2935         { }
2936         { }
2937         \endpgfscope
2938     }
2939 }
2940 }
2941 \endpgfpicture
2942 \@@_create_extra_nodes:
2943 }
2944 % \end{macrocode}
2945 %
2946 % \bigskip
2947 % The following command creates the diagonal nodes (in fact, if the matrix is
2948 % not a square matrix, not all the nodes are on the diagonal).
2949 % \begin{macrocode}
2950 \cs_new_protected:Npn \@@_create_diag_nodes:
2951 {
2952     \pgfpicture
2953     \pgfrememberpicturerepositiononpagetrue
2954     \int_step_inline:nn { \int_max:nn \c@iRow \c@jCol }
2955     {
2956         \@@_qpoint:n { col - \int_min:nn { ##1 } { \c@jCol + 1 } }
2957         \dim_set_eq:NN \l_tmpa_dim \pgf@x
2958         \@@_qpoint:n { row - \int_min:nn { ##1 } { \c@iRow + 1 } }
2959         \dim_set_eq:NN \l_tmpb_dim \pgf@y
2960         \@@_qpoint:n { col - \int_min:nn { ##1 + 1 } { \c@jCol + 1 } }
2961         \dim_set_eq:NN \l_tmpc_dim \pgf@x
2962         \@@_qpoint:n { row - \int_min:nn { ##1 + 1 } { \c@iRow + 1 } }
2963         \dim_set_eq:NN \l_tmpd_dim \pgf@y
2964         \pgftransformshift { \pgfpoint \l_tmpa_dim \l_tmpb_dim }

```

Now, `\l_tmpa_dim` and `\l_tmpb_dim` become the width and the height of the node (of shape `@â_diag_node`) that we will construct.

```

2965         \dim_set:Nn \l_tmpa_dim { ( \l_tmpc_dim - \l_tmpa_dim ) / 2 }
2966         \dim_set:Nn \l_tmpb_dim { ( \l_tmpd_dim - \l_tmpb_dim ) / 2 }
2967         \pgfnode { @â_diag_node } { center } { } { \@@_env: - ##1 } { }
2968         \str_if_empty:NF \l_@@_name_str
2969         { \pgfnodealias { \l_@@_name_str - ##1 } { \@@_env: - ##1 } }
2970     }

```

Now, the last node. Of course, that is only a coordinate because there is not `.5` anchor for that node.

```

2971 \int_set:Nn \l_tmpa_int { \int_max:nn \c@iRow \c@jCol + 1 }
2972 \@@_qpoint:n { row - \int_min:nn { \l_tmpa_int } { \c@iRow + 1 } }
2973 \dim_set_eq:NN \l_tmpa_dim \pgf@y
2974 \@@_qpoint:n { col - \int_min:nn { \l_tmpa_int } { \c@jCol + 1 } }
2975 \pgfcoordinate
2976 { \@@_env: - \int_use:N \l_tmpa_int } { \pgfpoint \pgf@x \l_tmpa_dim }
2977 \pgfnodealias
2978 { \@@_env: - last }
2979 { \@@_env: - \int_eval:n { \int_max:nn \c@iRow \c@jCol + 1 } }
2980 \str_if_empty:NF \l_@@_name_str
2981 {
2982   \pgfnodealias
2983   { \l_@@_name_str - \int_use:N \l_tmpa_int }
2984   { \@@_env: - \int_use:N \l_tmpa_int }
2985   \pgfnodealias
2986   { \l_@@_name_str - last }
2987   { \@@_env: - last }
2988 }
2989 \endpgfpicture
2990 }

```

We draw the dotted lines

A dotted line will be said *open* in one of its extremities when it stops on the edge of the matrix and *closed* otherwise. In the following matrix, the dotted line is closed on its left extremity and open on its right.

$$\begin{pmatrix} a+b+c & a+b & a \\ a & \dots & \dots \\ a & a+b & a+b+c \end{pmatrix}$$

The command `\@@_find_extremities_of_line:nnnn` takes four arguments:

- the first argument is the row of the cell where the command was issued;
- the second argument is the column of the cell where the command was issued;
- the third argument is the x -value of the orientation vector of the line;
- the fourth argument is the y -value of the orientation vector of the line.

This command computes:

- `\l_@@_initial_i_int` and `\l_@@_initial_j_int` which are the coordinates of one extremity of the line;
- `\l_@@_final_i_int` and `\l_@@_final_j_int` which are the coordinates of the other extremity of the line;
- `\l_@@_initial_open_bool` and `\l_@@_final_open_bool` to indicate whether the extremities are open or not.

```

2991 \cs_new_protected:Npn \@@_find_extremities_of_line:nnnn #1 #2 #3 #4
2992 {

```

First, we declare the current cell as “dotted” because we forbid intersections of dotted lines.

```

2993 \cs_set:cpn { @@ _ dotted _ #1 - #2 } { }

```

Initialization of variables.

```

2994 \int_set:Nn \l_@@_initial_i_int { #1 }
2995 \int_set:Nn \l_@@_initial_j_int { #2 }
2996 \int_set:Nn \l_@@_final_i_int { #1 }
2997 \int_set:Nn \l_@@_final_j_int { #2 }

```

We will do two loops: one when determinating the initial cell and the other when determinating the final cell. The boolean `\l_@@_stop_loop_bool` will be used to control these loops. In the first loop, we search the “final” extremity of the line.

```

2998     \bool_set_false:N \l_@@_stop_loop_bool
2999     \bool_do_until:Nn \l_@@_stop_loop_bool
3000     {
3001         \int_add:Nn \l_@@_final_i_int { #3 }
3002         \int_add:Nn \l_@@_final_j_int { #4 }

```

We test if we are still in the matrix.

```

3003     \bool_set_false:N \l_@@_final_open_bool
3004     \int_compare:nNnTF \l_@@_final_i_int > \l_@@_row_max_int
3005     {
3006         \int_compare:nNnTF { #3 } = 1
3007         { \bool_set_true:N \l_@@_final_open_bool }
3008         {
3009             \int_compare:nNnT \l_@@_final_j_int > \l_@@_col_max_int
3010             { \bool_set_true:N \l_@@_final_open_bool }
3011         }
3012     }
3013     {
3014         \int_compare:nNnTF \l_@@_final_j_int < \l_@@_col_min_int
3015         {
3016             \int_compare:nNnT { #4 } = { -1 }
3017             { \bool_set_true:N \l_@@_final_open_bool }
3018         }
3019         {
3020             \int_compare:nNnT \l_@@_final_j_int > \l_@@_col_max_int
3021             {
3022                 \int_compare:nNnT { #4 } = 1
3023                 { \bool_set_true:N \l_@@_final_open_bool }
3024             }
3025         }
3026     }
3027     \bool_if:NTF \l_@@_final_open_bool

```

If we are outside the matrix, we have found the extremity of the dotted line and it’s an *open* extremity.

```

3028     {

```

We do a step backwards.

```

3029         \int_sub:Nn \l_@@_final_i_int { #3 }
3030         \int_sub:Nn \l_@@_final_j_int { #4 }
3031         \bool_set_true:N \l_@@_stop_loop_bool
3032     }

```

If we are in the matrix, we test whether the cell is empty. If it’s not the case, we stop the loop because we have found the correct values for `\l_@@_final_i_int` and `\l_@@_final_j_int`.

```

3033     {
3034         \cs_if_exist:cTF
3035         {
3036             @@ _ dotted _
3037             \int_use:N \l_@@_final_i_int -
3038             \int_use:N \l_@@_final_j_int
3039         }
3040         {
3041             \int_sub:Nn \l_@@_final_i_int { #3 }
3042             \int_sub:Nn \l_@@_final_j_int { #4 }
3043             \bool_set_true:N \l_@@_final_open_bool
3044             \bool_set_true:N \l_@@_stop_loop_bool
3045         }
3046         {
3047             \cs_if_exist:cTF
3048             {
3049                 pgf @ sh @ ns @ \@@_env:
3050                 - \int_use:N \l_@@_final_i_int

```

```

3051         - \int_use:N \l_@@_final_j_int
3052     }
3053     { \bool_set_true:N \l_@@_stop_loop_bool }

```

If the case is empty, we declare that the cell as non-empty. Indeed, we will draw a dotted line and the cell will be on that dotted line. All the cells of a dotted line have to be marked as “dotted” because we don’t want intersections between dotted lines. We recall that the research of the extremities of the lines are all done in the same TeX group (the group of the environment), even though, when the extremities are found, each line is drawn in a TeX group that we will open for the options of the line.

```

3054     {
3055         \cs_set:cpn
3056         {
3057             @@ _ dotted _
3058             \int_use:N \l_@@_final_i_int -
3059             \int_use:N \l_@@_final_j_int
3060         }
3061         { }
3062     }
3063 }
3064 }
3065 }

```

For `\l_@@_initial_i_int` and `\l_@@_initial_j_int` the programming is similar to the previous one.

```

3066 \bool_set_false:N \l_@@_stop_loop_bool
3067 \bool_do_until:Nn \l_@@_stop_loop_bool
3068 {
3069     \int_sub:Nn \l_@@_initial_i_int { #3 }
3070     \int_sub:Nn \l_@@_initial_j_int { #4 }
3071     \bool_set_false:N \l_@@_initial_open_bool
3072     \int_compare:nNnTF \l_@@_initial_i_int < \l_@@_row_min_int
3073     {
3074         \int_compare:nNnTF { #3 } = 1
3075         { \bool_set_true:N \l_@@_initial_open_bool }
3076         {
3077             \int_compare:nNnT \l_@@_initial_j_int = { \l_@@_col_min_int -1 }
3078             { \bool_set_true:N \l_@@_initial_open_bool }
3079         }
3080     }
3081     {
3082         \int_compare:nNnTF \l_@@_initial_j_int < \l_@@_col_min_int
3083         {
3084             \int_compare:nNnT { #4 } = 1
3085             { \bool_set_true:N \l_@@_initial_open_bool }
3086         }
3087         {
3088             \int_compare:nNnT \l_@@_initial_j_int > \l_@@_col_max_int
3089             {
3090                 \int_compare:nNnT { #4 } = { -1 }
3091                 { \bool_set_true:N \l_@@_initial_open_bool }
3092             }
3093         }
3094     }
3095     \bool_if:NnTF \l_@@_initial_open_bool
3096     {
3097         \int_add:Nn \l_@@_initial_i_int { #3 }
3098         \int_add:Nn \l_@@_initial_j_int { #4 }
3099         \bool_set_true:N \l_@@_stop_loop_bool
3100     }
3101     {
3102         \cs_if_exist:cTF
3103         {

```

```

3104         @@ _ dotted _
3105         \int_use:N \l_@@_initial_i_int -
3106         \int_use:N \l_@@_initial_j_int
3107     }
3108     {
3109         \int_add:Nn \l_@@_initial_i_int { #3 }
3110         \int_add:Nn \l_@@_initial_j_int { #4 }
3111         \bool_set_true:N \l_@@_initial_open_bool
3112         \bool_set_true:N \l_@@_stop_loop_bool
3113     }
3114     {
3115         \cs_if_exist:cTF
3116         {
3117             pgf @ sh @ ns @ \@@_env:
3118             - \int_use:N \l_@@_initial_i_int
3119             - \int_use:N \l_@@_initial_j_int
3120         }
3121         { \bool_set_true:N \l_@@_stop_loop_bool }
3122         {
3123             \cs_set:cpn
3124             {
3125                 @@ _ dotted _
3126                 \int_use:N \l_@@_initial_i_int -
3127                 \int_use:N \l_@@_initial_j_int
3128             }
3129             { }
3130         }
3131     }
3132 }
3133 }

```

We remind the rectangle described by all the dotted lines in order to respect the corresponding virtual “block” when drawing the horizontal and vertical rules.

```

3134     \seq_gput_right:Nx \g_@@_pos_of_xdots_seq
3135     {
3136         { \int_use:N \l_@@_initial_i_int }
3137         { \int_use:N \l_@@_initial_j_int }
3138         { \int_use:N \l_@@_final_i_int }
3139         { \int_use:N \l_@@_final_j_int }
3140     }
3141 }

```

The following command (*when it will be written*) will set the four counters `\l_@@_row_min_int`, `\l_@@_row_max_int`, `\l_@@_col_min_int` and `\l_@@_col_max_int` to the intersections of the submatrices which contains the cell of row #1 and column #2. As of now, it’s only the whole array (excepted exterior rows and columns).

```

3142 \cs_new_protected:Npn \@@_adjust_to_submatrix:nn #1 #2
3143 {
3144     \int_set:Nn \l_@@_row_min_int 1
3145     \int_set:Nn \l_@@_col_min_int 1
3146     \int_set_eq:NN \l_@@_row_max_int \c@iRow
3147     \int_set_eq:NN \l_@@_col_max_int \c@jCol

```

We do a loop over all the submatrices specified in the `code-before`. We have stored the position of all those submatrices in `\g_@@_submatrix_seq`.

```

3148     \seq_map_inline:Nn \g_@@_submatrix_seq
3149     { \@@_adjust_to_submatrix:nnnnnn { #1 } { #2 } ##1 }
3150 }

```

#1 and #2 are the numbers of row and columns of the cell where the command of dotted line (ex.: `\Vdots`) has been issued. #3, #4, #5 and #6 are the specification (in *i* and *j*) of the submatrix where are analysing.

```

3151 \cs_set_protected:Npn \@@_adjust_to_submatrix:nnnnnn #1 #2 #3 #4 #5 #6

```

```

3152 {
3153   \bool_if:nT
3154   {
3155     \int_compare_p:n { #3 <= #1 }
3156     && \int_compare_p:n { #1 <= #5 }
3157     && \int_compare_p:n { #4 <= #2 }
3158     && \int_compare_p:n { #2 <= #6 }
3159   }
3160   {
3161     \int_set:Nn \l_@@_row_min_int { \int_max:nn \l_@@_row_min_int { #3 } }
3162     \int_set:Nn \l_@@_col_min_int { \int_max:nn \l_@@_col_min_int { #4 } }
3163     \int_set:Nn \l_@@_row_max_int { \int_min:nn \l_@@_row_max_int { #5 } }
3164     \int_set:Nn \l_@@_col_max_int { \int_min:nn \l_@@_col_max_int { #6 } }
3165   }
3166 }

3167 \cs_new_protected:Npn \@@_set_initial_coords:
3168 {
3169   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
3170   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
3171 }
3172 \cs_new_protected:Npn \@@_set_final_coords:
3173 {
3174   \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
3175   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
3176 }
3177 \cs_new_protected:Npn \@@_set_initial_coords_from_anchor:n #1
3178 {
3179   \pgfpointanchor
3180   {
3181     \@@_env:
3182     - \int_use:N \l_@@_initial_i_int
3183     - \int_use:N \l_@@_initial_j_int
3184   }
3185   { #1 }
3186   \@@_set_initial_coords:
3187 }
3188 \cs_new_protected:Npn \@@_set_final_coords_from_anchor:n #1
3189 {
3190   \pgfpointanchor
3191   {
3192     \@@_env:
3193     - \int_use:N \l_@@_final_i_int
3194     - \int_use:N \l_@@_final_j_int
3195   }
3196   { #1 }
3197   \@@_set_final_coords:
3198 }
3199 \cs_new_protected:Npn \@@_open_x_initial_dim:
3200 {
3201   \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
3202   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
3203   {
3204     \cs_if_exist:cT
3205     { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_initial_j_int }
3206     {
3207       \pgfpointanchor
3208       { \@@_env: - ##1 - \int_use:N \l_@@_initial_j_int }
3209       { west }
3210       \dim_set:Nn \l_@@_x_initial_dim
3211       { \dim_min:nn \l_@@_x_initial_dim \pgf@x }
3212     }
3213   }

```

If, in fact, all the cells of the columns are empty (no PGF/Tikz nodes in those cells).

```

3214 \dim_compare:nNnT \l_@@_x_initial_dim = \c_max_dim
3215 {
3216   \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
3217   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
3218   \dim_add:Nn \l_@@_x_initial_dim \col@sep
3219 }
3220 }
3221 \cs_new_protected:Npn \@@_open_x_final_dim:
3222 {
3223   \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }
3224   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
3225   {
3226     \cs_if_exist:cT
3227     { \pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_final_j_int }
3228     {
3229       \pgfpointanchor
3230       { \@@_env: - ##1 - \int_use:N \l_@@_final_j_int }
3231       { east }
3232       \dim_set:Nn \l_@@_x_final_dim
3233       { \dim_max:nn \l_@@_x_final_dim \pgf@x }
3234     }
3235   }

```

If, in fact, all the cells of the columns are empty (no PGF/Tikz nodes in those cells).

```

3236 \dim_compare:nNnT \l_@@_x_final_dim = { - \c_max_dim }
3237 {
3238   \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
3239   \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
3240   \dim_sub:Nn \l_@@_x_final_dim \col@sep
3241 }
3242 }

```

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

3243 \cs_new_protected:Npn \@@_draw_Ldots:nnn #1 #2 #3
3244 {
3245   \@@_adjust_to_submatrix:nn { #1 } { #2 }
3246   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
3247   {
3248     \@@_find_extremities_of_line:nnnn { #1 } { #2 } 0 1

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

3249 \group_begin:
3250 \int_compare:nNnTF { #1 } = 0
3251 { \color { nicematrix-first-row } }
3252 {

```

We remind that, when there is a “last row” `\l_@@_last_row_int` will always be (after the construction of the array) the number of that “last row” even if the option `last-row` has been used without value.

```

3253 \int_compare:nNnT { #1 } = \l_@@_last_row_int
3254 { \color { nicematrix-last-row } }
3255 }
3256 \keys_set:nn { NiceMatrix / xdots } { #3 }
3257 \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3258 \@@_actually_draw_Ldots:
3259 \group_end:
3260 }
3261 }

```

The command `\@@_actually_draw_Ldots:` has the following implicit arguments:

- \l_@@_initial_i_int
- \l_@@_initial_j_int
- \l_@@_initial_open_bool
- \l_@@_final_i_int
- \l_@@_final_j_int
- \l_@@_final_open_bool.

The following function is also used by \Hdotsfor.

```

3262 \cs_new_protected:Npn \@@_actually_draw_Ldots:
3263 {
3264   \bool_if:NTF \l_@@_initial_open_bool
3265   {
3266     \@@_open_x_initial_dim:
3267     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
3268     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
3269   }
3270   { \@@_set_initial_coords_from_anchor:n { base~east } }
3271   \bool_if:NTF \l_@@_final_open_bool
3272   {
3273     \@@_open_x_final_dim:
3274     \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
3275     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
3276   }
3277   { \@@_set_final_coords_from_anchor:n { base~west } }

```

We raise the line of a quantity equal to the radius of the dots because we want the dots really “on” the line of text. Of course, maybe we should not do that when the option `line-style` is used (?).

```

3278   \dim_add:Nn \l_@@_y_initial_dim \l_@@_radius_dim
3279   \dim_add:Nn \l_@@_y_final_dim \l_@@_radius_dim
3280   \@@_draw_line:
3281 }

```

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

3282 \cs_new_protected:Npn \@@_draw_Cdots:nnn #1 #2 #3
3283 {
3284   \@@_adjust_to_submatrix:nn { #1 } { #2 }
3285   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
3286   {
3287     \@@_find_extremities_of_line:nnnn { #1 } { #2 } 0 1

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

3288     \group_begin:
3289     \int_compare:nNnTF { #1 } = 0
3290     { \color { nicematrix-first-row } }
3291     {

```

We remind that, when there is a “last row” `\l_@@_last_row_int` will always be (after the construction of the array) the number of that “last row” even if the option `last-row` has been used without value.

```

3292     \int_compare:nNnT { #1 } = \l_@@_last_row_int
3293     { \color { nicematrix-last-row } }
3294   }
3295   \keys_set:nn { NiceMatrix / xdots } { #3 }
3296   \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3297   \@@_actually_draw_Cdots:
3298   \group_end:
3299 }
3300 }

```

The command `\@@_actually_draw_Cdots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool.`

```

3301 \cs_new_protected:Npn \@@_actually_draw_Cdots:
3302 {
3303   \bool_if:NTF \l_@@_initial_open_bool
3304     { \@@_open_x_initial_dim: }
3305     { \@@_set_initial_coords_from_anchor:n { mid-east } }
3306   \bool_if:NTF \l_@@_final_open_bool
3307     { \@@_open_x_final_dim: }
3308     { \@@_set_final_coords_from_anchor:n { mid-west } }
3309   \bool_lazy_and:nnTF
3310     \l_@@_initial_open_bool
3311     \l_@@_final_open_bool
3312   {
3313     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
3314     \dim_set_eq:NN \l_tmpa_dim \pgf@y
3315     \@@_qpoint:n { row - \@@_succ:n \l_@@_initial_i_int }
3316     \dim_set:Nn \l_@@_y_initial_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
3317     \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim
3318   }
3319   {
3320     \bool_if:NT \l_@@_initial_open_bool
3321       { \dim_set_eq:NN \l_@@_y_initial_dim \l_@@_y_final_dim }
3322     \bool_if:NT \l_@@_final_open_bool
3323       { \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim }
3324   }
3325   \@@_draw_line:
3326 }

3327 \cs_new_protected:Npn \@@_open_y_initial_dim:
3328 {
3329   \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
3330   \dim_set:Nn \l_@@_y_initial_dim
3331     { \pgf@y + ( \box_ht:N \strutbox + \extrarowheight ) * \arraystretch }
3332   \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
3333     {
3334       \cs_if_exist:cT
3335         { \pgf @ sh @ ns @ \@@_env: - \int_use:N \l_@@_initial_i_int - ##1 }
3336       {
3337         \pgfpointanchor
3338           { \@@_env: - \int_use:N \l_@@_initial_i_int - ##1 }
3339           { north }
3340         \dim_set:Nn \l_@@_y_initial_dim
3341           { \dim_max:nn \l_@@_y_initial_dim \pgf@y }
3342       }
3343     }
3344 }

3345 \cs_new_protected:Npn \@@_open_y_final_dim:
3346 {
3347   \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
3348   \dim_set:Nn \l_@@_y_final_dim
3349     { \pgf@y - ( \box_dp:N \strutbox ) * \arraystretch }
3350   \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int

```

```

3351 {
3352   \cs_if_exist:cT
3353   { pgf @ sh @ ns @ \l_@@_env: - \int_use:N \l_@@_final_i_int - ##1 }
3354   {
3355     \pgfpointanchor
3356     { \l_@@_env: - \int_use:N \l_@@_final_i_int - ##1 }
3357     { south }
3358     \dim_set:Nn \l_@@_y_final_dim
3359     { \dim_min:nn \l_@@_y_final_dim \pgf@y }
3360   }
3361 }
3362 }

```

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

3363 \cs_new_protected:Npn \l_@@_draw_Vdots:nnn #1 #2 #3
3364 {
3365   \l_@@_adjust_to_submatrix:nn { #1 } { #2 }
3366   \cs_if_free:cT { \l_@@_dotted_ #1 - #2 }
3367   {
3368     \l_@@_find_extremities_of_line:nnnn { #1 } { #2 } 1 0

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

3369   \group_begin:
3370   \int_compare:nNnTF { #2 } = 0
3371   { \color { nicematrix-first-col } }
3372   {
3373     \int_compare:nNnT { #2 } = \l_@@_last_col_int
3374     { \color { nicematrix-last-col } }
3375   }
3376   \keys_set:nn { NiceMatrix / xdots } { #3 }
3377   \tl_if_empty:VF \l_@@_xdots_color_tl
3378   { \color { \l_@@_xdots_color_tl } }
3379   \l_@@_actually_draw_Vdots:
3380   \group_end:
3381 }
3382 }

```

The command `\l_@@_actually_draw_Vdots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool`.

The following function is also used by `\Vdotsfor`.

```

3383 \cs_new_protected:Npn \l_@@_actually_draw_Vdots:
3384 {

```

The boolean `\l_tmpa_bool` indicates whether the column is of type 1 or may be considered as if.

```

3385   \bool_set_false:N \l_tmpa_bool

```

First the case when the line is closed on both ends.

```

3386   \bool_lazy_or:nnF \l_@@_initial_open_bool \l_@@_final_open_bool
3387   {
3388     \l_@@_set_initial_coords_from_anchor:n { south-west }
3389     \l_@@_set_final_coords_from_anchor:n { north-west }
3390     \bool_set:Nn \l_tmpa_bool
3391     { \dim_compare_p:nNn \l_@@_x_initial_dim = \l_@@_x_final_dim }
3392   }

```

Now, we try to determine whether the column is of type `c` or may be considered as if.

```

3393 \bool_if:NTF \l_@@_initial_open_bool
3394 \@@_open_y_initial_dim:
3395 { \@@_set_initial_coords_from_anchor:n { south } }
3396 \bool_if:NTF \l_@@_final_open_bool
3397 \@@_open_y_final_dim:
3398 { \@@_set_final_coords_from_anchor:n { north } }
3399 \bool_if:NTF \l_@@_initial_open_bool
3400 {
3401 \bool_if:NTF \l_@@_final_open_bool
3402 {
3403 \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
3404 \dim_set_eq:NN \l_tmpa_dim \pgf@x
3405 \@@_qpoint:n { col - \@@_succ:n \l_@@_initial_j_int }
3406 \dim_set:Nn \l_@@_x_initial_dim { ( \pgf@x + \l_tmpa_dim ) / 2 }
3407 \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim

```

We may think that the final user won't use a "last column" which contains only a command `\Vdots`. However, if the `\Vdots` is in fact used to draw, not a dotted line, but an arrow (to indicate the number of rows of the matrix), it may be really encountered.

```

3408 \int_compare:nNnT \l_@@_last_col_int > { -2 }
3409 {
3410 \int_compare:nNnT \l_@@_initial_j_int = \g_@@_col_total_int
3411 {
3412 \dim_set_eq:NN \l_tmpa_dim \l_@@_right_margin_dim
3413 \dim_add:Nn \l_tmpa_dim \l_@@_extra_right_margin_dim
3414 \dim_add:Nn \l_@@_x_initial_dim \l_tmpa_dim
3415 \dim_add:Nn \l_@@_x_final_dim \l_tmpa_dim
3416 }
3417 }
3418 }
3419 { \dim_set_eq:NN \l_@@_x_initial_dim \l_@@_x_final_dim }
3420 }
3421 {
3422 \bool_if:NTF \l_@@_final_open_bool
3423 { \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim }
3424 {

```

Now the case where both extremities are closed. The first conditional tests whether the column is of type `c` or may be considered as if.

```

3425 \dim_compare:nNnF \l_@@_x_initial_dim = \l_@@_x_final_dim
3426 {
3427 \dim_set:Nn \l_@@_x_initial_dim
3428 {
3429 \bool_if:NTF \l_tmpa_bool \dim_min:nn \dim_max:nn
3430 \l_@@_x_initial_dim \l_@@_x_final_dim
3431 }
3432 \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
3433 }
3434 }
3435 }
3436 \@@_draw_line:
3437 }

```

For the diagonal lines, the situation is a bit more complicated because, by default, we parallelize the diagonals lines. The first diagonal line is drawn and then, all the other diagonal lines are drawn parallel to the first one.

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

3438 \cs_new_protected:Npn \@@_draw_Ddots:nnn #1 #2 #3
3439 {
3440 \@@_adjust_to_submatrix:nn { #1 } { #2 }

```

```

3441 \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
3442 {
3443     \@@_find_extremities_of_line:nnnn { #1 } { #2 } 1 1

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

3444     \group_begin:
3445     \keys_set:nn { NiceMatrix / xdots } { #3 }
3446     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3447     \@@_actually_draw_Ddots:
3448     \group_end:
3449 }
3450 }

```

The command `\@@_actually_draw_Ddots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool`.

```

3451 \cs_new_protected:Npn \@@_actually_draw_Ddots:
3452 {
3453     \bool_if:NTF \l_@@_initial_open_bool
3454     {
3455         \@@_open_y_initial_dim:
3456         % \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
3457         % \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
3458         \@@_open_x_initial_dim:
3459     }
3460     { \@@_set_initial_coords_from_anchor:n { south-east } }
3461     \bool_if:NTF \l_@@_final_open_bool
3462     {
3463         % \@@_open_y_final_dim:
3464         % \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
3465         \@@_open_x_final_dim:
3466         \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
3467     }
3468     { \@@_set_final_coords_from_anchor:n { north-west } }

```

We have retrieved the coordinates in the usual way (they are stored in `\l_@@_x_initial_dim`, etc.). If the parallelization of the diagonals is set, we will have (maybe) to adjust the fourth coordinate.

```

3469     \bool_if:NT \l_@@_parallelize_diags_bool
3470     {
3471         \int_gincr:N \g_@@_ddots_int

```

We test if the diagonal line is the first one (the counter `\g_@@_ddots_int` is created for this usage).

```

3472         \int_compare:nNnTF \g_@@_ddots_int = 1

```

If the diagonal line is the first one, we have no adjustment of the line to do but we store the Δ_x and the Δ_y of the line because these values will be used to draw the others diagonal lines parallels to the first one.

```

3473     {
3474         \dim_gset:Nn \g_@@_delta_x_one_dim
3475         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
3476         \dim_gset:Nn \g_@@_delta_y_one_dim
3477         { \l_@@_y_final_dim - \l_@@_y_initial_dim }
3478     }

```

If the diagonal line is not the first one, we have to adjust the second extremity of the line by modifying the coordinate `\l_@@_x_initial_dim`.

```

3479     {
3480         \dim_set:Nn \l_@@_y_final_dim
3481         {
3482             \l_@@_y_initial_dim +
3483             ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
3484             \dim_ratio:nn \g_@@_delta_y_one_dim \g_@@_delta_x_one_dim
3485         }
3486     }
3487 }
3488 \@@_draw_line:
3489 }

```

We draw the `\Iddots` diagonals in the same way.

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

3490 \cs_new_protected:Npn \@@_draw_Iddots:nnn #1 #2 #3
3491 {
3492     \@@_adjust_to_submatrix:nn { #1 } { #2 }
3493     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
3494     {
3495         \@@_find_extremities_of_line:nnnn { #1 } { #2 } 1 { -1 }

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

3496     \group_begin:
3497     \keys_set:nn { NiceMatrix / xdots } { #3 }
3498     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3499     \@@_actually_draw_Iddots:
3500     \group_end:
3501 }
3502 }

```

The command `\@@_actually_draw_Iddots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool`.

```

3503 \cs_new_protected:Npn \@@_actually_draw_Iddots:
3504 {
3505     \bool_if:NTF \l_@@_initial_open_bool
3506     {
3507         \@@_open_y_initial_dim:
3508         \@@_open_x_initial_dim:
3509     }
3510     { \@@_set_initial_coords_from_anchor:n { south-west } }
3511     \bool_if:NTF \l_@@_final_open_bool
3512     {
3513         \@@_open_y_final_dim:
3514         \@@_open_x_final_dim:
3515     }
3516     { \@@_set_final_coords_from_anchor:n { north-east } }
3517     \bool_if:NT \l_@@_parallelize_diags_bool
3518     {

```

```

3519 \int_gincr:N \g_@@_iddots_int
3520 \int_compare:nNnTF \g_@@_iddots_int = 1
3521 {
3522     \dim_gset:Nn \g_@@_delta_x_two_dim
3523     { \l_@@_x_final_dim - \l_@@_x_initial_dim }
3524     \dim_gset:Nn \g_@@_delta_y_two_dim
3525     { \l_@@_y_final_dim - \l_@@_y_initial_dim }
3526 }
3527 {
3528     \dim_set:Nn \l_@@_y_final_dim
3529     {
3530         \l_@@_y_initial_dim +
3531         ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
3532         \dim_ratio:nn \g_@@_delta_y_two_dim \g_@@_delta_x_two_dim
3533     }
3534 }
3535 }
3536 \@@_draw_line:
3537 }

```

The actual instructions for drawing the dotted line with Tikz

The command `\@@_draw_line:` should be used in a `{pgfpicture}`. It has six implicit arguments:

- `\l_@@_x_initial_dim`
- `\l_@@_y_initial_dim`
- `\l_@@_x_final_dim`
- `\l_@@_y_final_dim`
- `\l_@@_initial_open_bool`
- `\l_@@_final_open_bool`

```

3538 \cs_new_protected:Npn \@@_draw_line:
3539 {
3540     \pgfrememberpicturepositiononpagetrue
3541     \pgf@relevantforpicturesizefalse
3542     \tl_if_eq:NNTF \l_@@_xdots_line_style_tl \c_@@_standard_tl
3543     \@@_draw_standard_dotted_line:
3544     \@@_draw_non_standard_dotted_line:
3545 }

```

We have to do a special construction with `\exp_args:NV` to be able to put in the list of options in the correct place in the Tikz instruction.

```

3546 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:
3547 {
3548     \begin { scope }
3549     \exp_args:No \@@_draw_non_standard_dotted_line:n
3550     { \l_@@_xdots_line_style_tl , \l_@@_xdots_color_tl }
3551 }

```

We have used the fact that, in PGF, un color name can be put directly in a list of options (that's why we have put directly `\l_@@_xdots_color_tl`).

The argument of `\@@_draw_non_standard_dotted_line:n` is, in fact, the list of options.

```

3552 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:n #1
3553 {
3554     \@@_draw_non_standard_dotted_line:nVV
3555     { #1 }
3556     \l_@@_xdots_up_tl
3557     \l_@@_xdots_down_tl
3558 }

```

```

3559 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:nnn #1 #2 #3
3560 {
3561   \draw
3562   [
3563     #1 ,
3564     shorten~> = \l_@@_xdots_shorten_dim ,
3565     shorten~< = \l_@@_xdots_shorten_dim ,
3566   ]
3567   ( \l_@@_x_initial_dim , \l_@@_y_initial_dim )

```

Be careful: We can't put `\c_math_toggle_token` instead of `$` in the following lines because we are in the contents of Tikz nodes (and they will be *rescanned* if the Tikz library `babel` is loaded).

```

3568     -- node [ sloped , above ] { $ \scriptstyle #2 $ }
3569     node [ sloped , below ] { $ \scriptstyle #3 $ }
3570     ( \l_@@_x_final_dim , \l_@@_y_final_dim ) ;
3571   \end { scope }
3572 }
3573 \cs_generate_variant:Nn \@@_draw_non_standard_dotted_line:nnn { n V V }

```

The command `\@@_draw_standard_dotted_line:` draws the line with our system of dots (which gives a dotted line with real round dots).

```

3574 \cs_new_protected:Npn \@@_draw_standard_dotted_line:
3575 {
3576   \bool_lazy_and:nnF
3577   { \tl_if_empty_p:N \l_@@_xdots_up_tl }
3578   { \tl_if_empty_p:N \l_@@_xdots_down_tl }
3579   {
3580     \pgfscope
3581     \pgftransformshift
3582     {
3583       \pgfpointlineattime { 0.5 }
3584       { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
3585       { \pgfpoint \l_@@_x_final_dim \l_@@_y_final_dim }
3586     }
3587     \pgftransformrotate
3588     {
3589       \fp_eval:n
3590       {
3591         atand
3592         (
3593           \l_@@_y_final_dim - \l_@@_y_initial_dim ,
3594           \l_@@_x_final_dim - \l_@@_x_initial_dim
3595         )
3596       }
3597     }
3598     \pgfnode
3599     { rectangle }
3600     { south }
3601     {
3602       \c_math_toggle_token
3603       \scriptstyle \l_@@_xdots_up_tl
3604       \c_math_toggle_token
3605     }
3606     { }
3607     { \pgfusepath { } }
3608     \pgfnode
3609     { rectangle }
3610     { north }
3611     {
3612       \c_math_toggle_token
3613       \scriptstyle \l_@@_xdots_down_tl
3614       \c_math_toggle_token
3615     }
3616     { }

```

```

3616         { }
3617         { \pgfusepath { } }
3618     \endpgfscope
3619 }
3620 \group_begin:

```

The dimension `\l_@@_l_dim` is the length ℓ of the line to draw. We use the floating point reals of `expl3` to compute this length.

```

3621     \dim_zero_new:N \l_@@_l_dim
3622     \dim_set:Nn \l_@@_l_dim
3623     {
3624         \fp_to_dim:n
3625         {
3626             sqrt
3627             (
3628                 ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) ^ 2
3629                 +
3630                 ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) ^ 2
3631             )
3632         }
3633     }

```

It seems that, during the first compilations, the value of `\l_@@_l_dim` may be erroneous (equal to zero or very large). We must detect these cases because they would cause errors during the drawing of the dotted line. Maybe we should also write something in the aux file to say that one more compilation should be done.

```

3634     \bool_lazy_or:nnF
3635     { \dim_compare_p:nNn { \dim_abs:n \l_@@_l_dim } > \c_@@_max_l_dim }
3636     { \dim_compare_p:nNn \l_@@_l_dim = \c_zero_dim }
3637     \@@_draw_standard_dotted_line_i:
3638 \group_end:
3639 }
3640 \dim_const:Nn \c_@@_max_l_dim { 50 cm }
3641 \cs_new_protected:Npn \@@_draw_standard_dotted_line_i:
3642 {

```

The number of dots will be `\l_tmpa_int + 1`.

```

3643     \bool_if:NTF \l_@@_initial_open_bool
3644     {
3645         \bool_if:NTF \l_@@_final_open_bool
3646         {
3647             \int_set:Nn \l_tmpa_int
3648             { \dim_ratio:nn \l_@@_l_dim \l_@@_inter_dots_dim }
3649         }
3650         {
3651             \int_set:Nn \l_tmpa_int
3652             {
3653                 \dim_ratio:nn
3654                 { \l_@@_l_dim - \l_@@_xdots_shorten_dim }
3655                 \l_@@_inter_dots_dim
3656             }
3657         }
3658     }
3659     {
3660         \bool_if:NTF \l_@@_final_open_bool
3661         {
3662             \int_set:Nn \l_tmpa_int
3663             {
3664                 \dim_ratio:nn
3665                 { \l_@@_l_dim - \l_@@_xdots_shorten_dim }
3666                 \l_@@_inter_dots_dim
3667             }
3668         }

```

```

3669     {
3670         \int_set:Nn \l_tmpa_int
3671         {
3672             \dim_ratio:nn
3673             { \l_@@_l_dim - 2 \l_@@_xdots_shorten_dim }
3674             \l_@@_inter_dots_dim
3675         }
3676     }
3677 }

```

The dimensions `\l_tmpa_dim` and `\l_tmpb_dim` are the coordinates of the vector between two dots in the dotted line.

```

3678 \dim_set:Nn \l_tmpa_dim
3679 {
3680     ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
3681     \dim_ratio:nn \l_@@_inter_dots_dim \l_@@_l_dim
3682 }
3683 \dim_set:Nn \l_tmpb_dim
3684 {
3685     ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
3686     \dim_ratio:nn \l_@@_inter_dots_dim \l_@@_l_dim
3687 }

```

The length ℓ is the length of the dotted line. We note Δ the length between two dots and n the number of intervals between dots. We note $\delta = \frac{1}{2}(\ell - n\Delta)$. The distance between the initial extremity of the line and the first dot will be equal to $k \cdot \delta$ where $k = 0, 1$ or 2 . We first compute this number k in `\l_tmpb_int`.

```

3688 \int_set:Nn \l_tmpb_int
3689 {
3690     \bool_if:NTF \l_@@_initial_open_bool
3691     { \bool_if:NTF \l_@@_final_open_bool 1 0 }
3692     { \bool_if:NTF \l_@@_final_open_bool 2 1 }
3693 }

```

In the loop over the dots, the dimensions `\l_@@_x_initial_dim` and `\l_@@_y_initial_dim` will be used for the coordinates of the dots. But, before the loop, we must move until the first dot.

```

3694 \dim_gadd:Nn \l_@@_x_initial_dim
3695 {
3696     ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
3697     \dim_ratio:nn
3698     { \l_@@_l_dim - \l_@@_inter_dots_dim * \l_tmpa_int }
3699     { 2 \l_@@_l_dim }
3700     * \l_tmpb_int
3701 }
3702 \dim_gadd:Nn \l_@@_y_initial_dim
3703 {
3704     ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
3705     \dim_ratio:nn
3706     { \l_@@_l_dim - \l_@@_inter_dots_dim * \l_tmpa_int }
3707     { 2 \l_@@_l_dim }
3708     * \l_tmpb_int
3709 }
3710 \pgf@relevantforpicturesizefalse
3711 \int_step_inline:nnn 0 \l_tmpa_int
3712 {
3713     \pgfpathcircle
3714     { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
3715     { \l_@@_radius_dim }
3716     \dim_add:Nn \l_@@_x_initial_dim \l_tmpa_dim
3717     \dim_add:Nn \l_@@_y_initial_dim \l_tmpb_dim
3718 }
3719 \pgfusepath{qfill}
3720 }

```

User commands available in the new environments

The commands `\@@_Ldots`, `\@@_Cdots`, `\@@_Vdots`, `\@@_Ddots` and `\@@_Iddots` will be linked to `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots` and `\Iddots` in the environments `{NiceArray}` (the other environments of `nicematrix` rely upon `{NiceArray}`).

The syntax of these commands uses the character `_` as embellishment and that's why we have to insert a character `_` in the *arg spec* of these commands. However, we don't know the future catcode of `_` in the main document (maybe the user will use `underscore`, and, in that case, the catcode is 13 because `underscore` activates `_`). That's why these commands will be defined in a `\AtBeginDocument` and the *arg spec* will be rescanned.

```

3721 \AtBeginDocument
3722 {
3723   \tl_set:Nn \l_@@_argspec_tl { 0 { } E { _ ^ } { { } { } } }
3724   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
3725   \exp_args:NNV \NewDocumentCommand \@@_Ldots \l_@@_argspec_tl
3726   {
3727     \int_compare:nNnTF \c@jCol = 0
3728     { \@@_error:nn { in~first~col } \Ldots }
3729     {
3730       \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
3731       { \@@_error:nn { in~last~col } \Ldots }
3732       {
3733         \@@_instruction_of_type:nnn \c_false_bool { \Ldots }
3734         { #1 , down = #2 , up = #3 }
3735       }
3736     }
3737     \bool_if:NF \l_@@_nullify_dots_bool
3738     { \phantom { \ensuremath { \@@_old_ldots } } }
3739     \bool_gset_true:N \g_@@_empty_cell_bool
3740   }

3741   \exp_args:NNV \NewDocumentCommand \@@_Cdots \l_@@_argspec_tl
3742   {
3743     \int_compare:nNnTF \c@jCol = 0
3744     { \@@_error:nn { in~first~col } \Cdots }
3745     {
3746       \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
3747       { \@@_error:nn { in~last~col } \Cdots }
3748       {
3749         \@@_instruction_of_type:nnn \c_false_bool { \Cdots }
3750         { #1 , down = #2 , up = #3 }
3751       }
3752     }
3753     \bool_if:NF \l_@@_nullify_dots_bool
3754     { \phantom { \ensuremath { \@@_old_cdots } } }
3755     \bool_gset_true:N \g_@@_empty_cell_bool
3756   }

3757   \exp_args:NNV \NewDocumentCommand \@@_Vdots \l_@@_argspec_tl
3758   {
3759     \int_compare:nNnTF \c@iRow = 0
3760     { \@@_error:nn { in~first~row } \Vdots }
3761     {
3762       \int_compare:nNnTF \c@iRow = \l_@@_last_row_int
3763       { \@@_error:nn { in~last~row } \Vdots }
3764       {
3765         \@@_instruction_of_type:nnn \c_false_bool { \Vdots }
3766         { #1 , down = #2 , up = #3 }
3767       }

```

```

3768     }
3769     \bool_if:NF \l_@@_nullify_dots_bool
3770     { \phantom { \ensuremath { \@@_old_vdots } } }
3771     \bool_gset_true:N \g_@@_empty_cell_bool
3772 }

\exp_args:NNV \NewDocumentCommand \@@_Ddots \l_@@_argspec_tl
{
  \int_case:nnF \c@iRow
  {
    0 { \@@_error:nn { in~first~row } \Ddots }
    \l_@@_last_row_int { \@@_error:nn { in~last~row } \Ddots }
  }
  {
    \int_case:nnF \c@jCol
    {
      0 { \@@_error:nn { in~first~col } \Ddots }
      \l_@@_last_col_int { \@@_error:nn { in~last~col } \Ddots }
    }
    {
      \keys_set_known:nn { NiceMatrix / Ddots } { #1 }
      \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Ddots }
      { #1 , down = #2 , up = #3 }
    }
  }
}

\bool_if:NF \l_@@_nullify_dots_bool
{ \phantom { \ensuremath { \@@_old_ddots } } }
\bool_gset_true:N \g_@@_empty_cell_bool
}

\exp_args:NNV \NewDocumentCommand \@@_Iddots \l_@@_argspec_tl
{
  \int_case:nnF \c@iRow
  {
    0 { \@@_error:nn { in~first~row } \Iddots }
    \l_@@_last_row_int { \@@_error:nn { in~last~row } \Iddots }
  }
  {
    \int_case:nnF \c@jCol
    {
      0 { \@@_error:nn { in~first~col } \Iddots }
      \l_@@_last_col_int { \@@_error:nn { in~last~col } \Iddots }
    }
    {
      \keys_set_known:nn { NiceMatrix / Ddots } { #1 }
      \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Iddots }
      { #1 , down = #2 , up = #3 }
    }
  }
}

\bool_if:NF \l_@@_nullify_dots_bool
{ \phantom { \ensuremath { \@@_old_iddots } } }
\bool_gset_true:N \g_@@_empty_cell_bool
}
}

```

End of the \AtBeginDocument.

Despite its name, the following set of keys will be used for \Ddots but also for \Iddots.

```

3821 \keys_define:nn { NiceMatrix / Ddots }
3822 {
3823   draw-first .bool_set:N = \l_@@_draw_first_bool ,

```

```

3824     draw-first .default:n = true ,
3825     draw-first .value_forbidden:n = true
3826 }

```

The command `\@@_Hspace:` will be linked to `\hspace` in `{NiceArray}`.

```

3827 \cs_new_protected:Npn \@@_Hspace:
3828 {
3829     \bool_gset_true:N \g_@@_empty_cell_bool
3830     \hspace
3831 }
3832 \cs_set_eq:NN \@@_old_multicolumn \multicolumn

```

The command `\@@_Hdotsfor` will be linked to `\Hdotsfor` in `{NiceArrayWithDelims}`. Tikz nodes are created also in the implicit cells of the `\Hdotsfor` (maybe we should modify that point).

This command must *not* be protected since it begins with `\multicolumn`.

```

3833 \cs_new:Npn \@@_Hdotsfor:
3834 {
3835     \bool_lazy_and:nnTF
3836     { \int_compare_p:nNn \c@jCol = 0 }
3837     { \int_compare_p:nNn \l_@@_first_col_int = 0 }
3838     {
3839         \bool_if:NTF \g_@@_after_col_zero_bool
3840         {
3841             \multicolumn { 1 } { c } { }
3842             \@@_Hdotsfor_i
3843         }
3844         { \@@_fatal:n { Hdotsfor~in~col~0 } }
3845     }
3846     {
3847         \multicolumn { 1 } { c } { }
3848         \@@_Hdotsfor_i
3849     }
3850 }

```

The command `\@@_Hdotsfor_i` is defined with `\NewDocumentCommand` because it has an optional argument. Note that such a command defined by `\NewDocumentCommand` is protected and that's why we have put the `\multicolumn` before (in the definition of `\@@_Hdotsfor:`).

```

3851 \AtBeginDocument
3852 {
3853     \tl_set:Nn \l_@@_argspec_tl { 0 { } m 0 { } E { _ ^ } { { } { } } }
3854     \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl

```

We don't put `!` before the last optionnal argument for homogeneity with `\Cdots`, etc. which have only one optional argument.

```

3855     \exp_args:NNV \NewDocumentCommand \@@_Hdotsfor_i \l_@@_argspec_tl
3856     {
3857         \tl_gput_right:Nx \g_@@_HVdotsfor_lines_tl
3858         {
3859             \@@_Hdotsfor:nnnn
3860             { \int_use:N \c@iRow }
3861             { \int_use:N \c@jCol }
3862             { #2 }
3863             {
3864                 #1 , #3 ,
3865                 down = \exp_not:n { #4 } ,
3866                 up = \exp_not:n { #5 }
3867             }
3868         }
3869         \prg_replicate:nn { #2 - 1 } { & \multicolumn { 1 } { c } { } }
3870     }
3871 }

```

Enf of \AtBeginDocument.

```

3872 \cs_new_protected:Npn \@@_Hdotsfor:nnnn #1 #2 #3 #4
3873 {
3874   \bool_set_false:N \l_@@_initial_open_bool
3875   \bool_set_false:N \l_@@_final_open_bool

```

For the row, it's easy.

```

3876   \int_set:Nn \l_@@_initial_i_int { #1 }
3877   \int_set_eq:NN \l_@@_final_i_int \l_@@_initial_i_int

```

For the column, it's a bit more complicated.

```

3878   \int_compare:nNnTF { #2 } = 1
3879   {
3880     \int_set:Nn \l_@@_initial_j_int 1
3881     \bool_set_true:N \l_@@_initial_open_bool
3882   }
3883   {
3884     \cs_if_exist:cTF
3885     {
3886       pgf @ sh @ ns @ \@@_env:
3887       - \int_use:N \l_@@_initial_i_int
3888       - \int_eval:n { #2 - 1 }
3889     }
3890     { \int_set:Nn \l_@@_initial_j_int { #2 - 1 } }
3891     {
3892       \int_set:Nn \l_@@_initial_j_int { #2 }
3893       \bool_set_true:N \l_@@_initial_open_bool
3894     }
3895   }
3896   \int_compare:nNnTF { #2 + #3 - 1 } = \c@jCol
3897   {
3898     \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
3899     \bool_set_true:N \l_@@_final_open_bool
3900   }
3901   {
3902     \cs_if_exist:cTF
3903     {
3904       pgf @ sh @ ns @ \@@_env:
3905       - \int_use:N \l_@@_final_i_int
3906       - \int_eval:n { #2 + #3 }
3907     }
3908     { \int_set:Nn \l_@@_final_j_int { #2 + #3 } }
3909     {
3910       \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
3911       \bool_set_true:N \l_@@_final_open_bool
3912     }
3913   }
3914   \group_begin:
3915   \int_compare:nNnTF { #1 } = 0
3916   { \color { nicematrix-first-row } }
3917   {
3918     \int_compare:nNnT { #1 } = \g_@@_row_total_int
3919     { \color { nicematrix-last-row } }
3920   }
3921   \keys_set:nn { NiceMatrix / xdots } { #4 }
3922   \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3923   \@@_actually_draw_Ldots:
3924   \group_end:

```

We declare all the cells concerned by the \Hdotsfor as “dotted” (for the dotted lines created by \Cdots, \Ldots, etc., this job is done by \@@_find_extremities_of_line:nnnn). This declaration is done by defining a special control sequence (to nil).

```

3925 \int_step_inline:nnn { #2 } { #2 + #3 - 1 }
3926 { \cs_set:cpn { @@ _ dotted _ #1 - ##1 } { } }
3927 }

3928 \AtBeginDocument
3929 {
3930 \tl_set:Nn \l_@@_argspec_tl { 0 { } m 0 { } E { _ ^ } { { } { } } }
3931 \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
3932 \exp_args:NNV \NewDocumentCommand \@@_Vdotsfor: \l_@@_argspec_tl
3933 {
3934 \tl_gput_right:Nx \g_@@_HVdotsfor_lines_tl
3935 {
3936 \@@_Vdotsfor:nnnn
3937 { \int_use:N \c@iRow }
3938 { \int_use:N \c@jCol }
3939 { #2 }
3940 {
3941 #1 , #3 ,
3942 down = \exp_not:n { #4 } , up = \exp_not:n { #5 }
3943 }
3944 }
3945 }
3946 }

```

Enf of \AtBeginDocument.

```

3947 \cs_new_protected:Npn \@@_Vdotsfor:nnnn #1 #2 #3 #4
3948 {
3949 \bool_set_false:N \l_@@_initial_open_bool
3950 \bool_set_false:N \l_@@_final_open_bool

```

For the column, it's easy.

```

3951 \int_set:Nn \l_@@_initial_j_int { #2 }
3952 \int_set_eq:NN \l_@@_final_j_int \l_@@_initial_j_int

```

For the row, it's a bit more complicated.

```

3953 \int_compare:nNnTF #1 = 1
3954 {
3955 \int_set:Nn \l_@@_initial_i_int 1
3956 \bool_set_true:N \l_@@_initial_open_bool
3957 }
3958 {
3959 \cs_if_exist:cTF
3960 {
3961 pgf @ sh @ ns @ \@@_env:
3962 - \int_eval:n { #1 - 1 }
3963 - \int_use:N \l_@@_initial_j_int
3964 }
3965 { \int_set:Nn \l_@@_initial_i_int { #1 - 1 } }
3966 {
3967 \int_set:Nn \l_@@_initial_i_int { #1 }
3968 \bool_set_true:N \l_@@_initial_open_bool
3969 }
3970 }
3971 \int_compare:nNnTF { #1 + #3 - 1 } = \c@iRow
3972 {
3973 \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
3974 \bool_set_true:N \l_@@_final_open_bool
3975 }
3976 {
3977 \cs_if_exist:cTF
3978 {
3979 pgf @ sh @ ns @ \@@_env:
3980 - \int_eval:n { #1 + #3 }
3981 - \int_use:N \l_@@_final_j_int

```

```

3982     }
3983     { \int_set:Nn \l_@@_final_i_int { #1 + #3 } }
3984     {
3985         \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
3986         \bool_set_true:N \l_@@_final_open_bool
3987     }
3988 }
3989 \group_begin:
3990 \int_compare:nNnTF { #2 } = 0
3991 { \color { nicematrix-first-col } }
3992 {
3993     \int_compare:nNnT { #2 } = \g_@@_col_total_int
3994     { \color { nicematrix-last-col } }
3995 }
3996 \keys_set:nn { NiceMatrix / xdots } { #4 }
3997 \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3998 \@@_actually_draw_Vdots:
3999 \group_end:

```

We declare all the cells concerned by the `\Vdotsfor` as “dotted” (for the dotted lines created by `\Cdots`, `\Ldots`, etc., this job is done by `\@@_find_extremities_of_line:nnnn`). This declaration is done by defining a special control sequence (to nil).

```

4000     \int_step_inline:nnn { #1 } { #1 + #3 - 1 }
4001     { \cs_set:cpn { @@ _ dotted _ ##1 - #2 } { } }
4002 }

```

The command `\@@_rotate:` will be linked to `\rotate` in `{NiceArrayWithDelims}`.

```

4003 \cs_new_protected:Npn \@@_rotate: { \bool_gset_true:N \g_@@_rotate_bool }

```

The command `\line` accessible in code-after

In the `\CodeAfter`, the command `\@@_line:nn` will be linked to `\line`. This command takes two arguments which are the specifications of two cells in the array (in the format *i-j*) and draws a dotted line between these cells.

First, we write a command with an argument of the format *i-j* and applies the command `\int_eval:n` to *i* and *j* ; this must *not* be protected (and is, of course fully expandable).⁶²

```

4004 \cs_new:Npn \@@_double_int_eval:n #1-#2 \q_stop
4005 { \int_eval:n { #1 } - \int_eval:n { #2 } }

```

With the following construction, the command `\@@_double_int_eval:n` is applied to both arguments before the application of `\@@_line_i:nn` (the construction uses the fact the `\@@_line_i:nn` is protected and that `\@@_double_int_eval:n` is fully expandable).

```

4006 \AtBeginDocument
4007 {
4008     \tl_set:Nn \l_@@_argspec_tl { 0 { } m m ! 0 { } E { _ ^ } { { } { } } }
4009     \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
4010     \exp_args:NNV \NewDocumentCommand \@@_line \l_@@_argspec_tl
4011     {
4012         \group_begin:
4013         \keys_set:nn { NiceMatrix / xdots } { #1 , #4 , down = #5 , up = #6 }
4014         \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
4015         \use:e
4016     }

```

⁶²Indeed, we want that the user may use the command `\line` in `\CodeAfter` with LaTeX counters in the arguments — with the command `\value`.

```

4017         \@@_line_i:nn
4018         { \@@_double_int_eval:n #2 \q_stop }
4019         { \@@_double_int_eval:n #3 \q_stop }
4020     }
4021     \group_end:
4022 }
4023 }
4024 \cs_new_protected:Npn \@@_line_i:nn #1 #2
4025 {
4026     \bool_set_false:N \l_@@_initial_open_bool
4027     \bool_set_false:N \l_@@_final_open_bool
4028     \bool_if:nTF
4029     {
4030         \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #1 }
4031         ||
4032         \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #2 }
4033     }
4034     {
4035         \@@_error:nnn { unknown~cell~for~line~in~CodeAfter } { #1 } { #2 }
4036     }
4037     { \@@_draw_line_ii:nn { #1 } { #2 } }
4038 }
4039 \AtBeginDocument
4040 {
4041     \cs_new_protected:Npx \@@_draw_line_ii:nn #1 #2
4042     {

```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible” and that why we do this static construction of the command `\@@_draw_line_ii:.`

```

4043     \c_@@_pgfortikzpicture_tl
4044     \@@_draw_line_iii:nn { #1 } { #2 }
4045     \c_@@_endpgfortikzpicture_tl
4046 }
4047 }

```

The following command *must* be protected (it’s used in the construction of `\@@_draw_line_ii:nn`).

```

4048 \cs_new_protected:Npn \@@_draw_line_iii:nn #1 #2
4049 {
4050     \pgfrememberpicturepositiononpagetrue
4051     \pgfpointshapeborder { \@@_env: - #1 } { \@@_qpoint:n { #2 } }
4052     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4053     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4054     \pgfpointshapeborder { \@@_env: - #2 } { \@@_qpoint:n { #1 } }
4055     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
4056     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
4057     \@@_draw_line:
4058 }

```

The commands `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, and `\Iddots` don’t use this command because they have to do other settings (for example, the diagonal lines must be parallelized).

Colors of cells, rows and columns

We want to avoid the thin white lines that are shown in some PDF viewers (eg: with the engine MuPDF used by SumatraPDF). That’s why we try to draw rectangles of the same color in the same instruction `\pgfusepath { fill }` (and they will be in the same instruction `fill`—coded `f`— in the resulting PDF).

The commands `\@@_rowcolor`, `\@@_columncolor` and `\@@_rectanglecolor` (which are linked to `\rowcolor`, `\columncolor` and `\rectanglecolor` before the execution of the `code-before`) don’t directly draw the corresponding rectangles. Instead, they store their instructions color by color:

- A sequence `\g_@@_colors_seq` will be built containing all the colors used by at least one of these instructions. Each *color* may be prefixed by its color model (eg: `[gray]{0.5}`).
- For the color whose index in `\g_@@_colors_seq` is equal to *i*, a list of instructions which use that color will be constructed in the token list `\g_@@_color_i_tl`. In that token list, the instructions will be written using `\@@_rowcolor:n`, `\@@_columncolor:n` and `\@@_rectanglecolor:nn` (corresponding of `\@@_rowcolor`, `\@@_columncolor` and `\@@_rectanglecolor`).

`bigskip #1` is the color and `#2` is an instruction using that color. Despite its name, the command `\@@_add_to_color_seq` doesn't only add a color to `\g_@@_colors_seq`: it also updates the corresponding token list `\g_@@_color_i_tl`. We add in a global way because the final user may use the instructions such as `\cellcolor` in a loop of `pgffor` in the `\CodeBefore` (and we recall that a loop of `pgffor` is encapsulated in a group).

```
4059 \cs_new_protected:Npn \@@_add_to_colors_seq:nn #1 #2
4060 {
```

First, we look for the number of the color and, if it's found, we store it in `\l_tmpa_int`. If the color is not present in `\l_@@_colors_seq`, `\l_tmpa_int` will remain equal to 0.

```
4061   \int_zero:N \l_tmpa_int
4062   \seq_map_indexed_inline:Nn \g_@@_colors_seq
4063   { \tl_if_eq:nnT { #1 } { ##2 } { \int_set:Nn \l_tmpa_int { ##2 } } }
4064   \int_compare:nNnTF \l_tmpa_int = \c_zero_int
```

First, the case where the color is a *new* color (not in the sequence).

```
4065   {
4066     \seq_gput_right:Nn \g_@@_colors_seq { #1 }
4067     \tl_gset:cx { g_@@_color _ \seq_count:N \g_@@_colors_seq _ tl } { #2 }
4068   }
```

Now, the case where the color is *not* a new color (the color is in the sequence at the position `\l_tmpa_int`).

```
4069   { \tl_gput_right:cx { g_@@_color _ \int_use:N \l_tmpa_int _tl } { #2 } }
4070   }
4071 \cs_generate_variant:Nn \@@_add_to_colors_seq:nn { x n }
```

The macro `\@@_actually_color:` will actually fill all the rectangles, color by color (using the sequence `\l_@@_colors_seq` and all the token lists of the form `\l_@@_color_i_tl`).

```
4072 \cs_new_protected:Npn \@@_actually_color:
4073 {
4074   \pgfpicture
4075   \pgf@relevantforpicturesizefalse
4076   \seq_map_indexed_inline:Nn \g_@@_colors_seq
4077   {
4078     \color ##2
4079     \use:c { g_@@_color _ ##1 _tl }
4080     \tl_gclear:c { g_@@_color _ ##1 _tl }
4081     \pgfusepath { fill }
4082   }
4083   \endpgfpicture
4084 }
4085 \cs_set_protected:Npn \@@_cut_on_hyphen:w #1-#2\q_stop
4086 {
4087   \tl_set:Nn \l_tmpa_tl { #1 }
4088   \tl_set:Nn \l_tmpb_tl { #2 }
4089 }
```

Here is an example : `\@@_rowcolor {red!15} {1,3,5-7,10-}`

```
4090 \NewDocumentCommand \@@_rowcolor { 0 { } m m }
4091 {
4092   \tl_if_blank:nF { #2 }
4093   {
```

```

4094     \@@_add_to_colors_seq:xn
4095     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
4096     { \@@_rowcolor:n { #3 } }
4097   }
4098 }
4099 \cs_new_protected:Npn \@@_rowcolor:n #1
4100 {
4101   \tl_set:Nn \l_@@_rows_tl { #1 }
4102   \tl_set:Nn \l_@@_cols_tl { - }

```

The command `\@@_cartesian_path:` takes in two implicit arguments: `\l_@@_cols_tl` and `\l_@@_rows_tl`.

```

4103   \@@_cartesian_path:
4104 }

```

Here an example : `\@@_columncolor:nn {red!15} {1,3,5-7,10-}`

```

4105 \NewDocumentCommand \@@_columncolor { 0 { } m m }
4106 {
4107   \tl_if_blank:nF { #2 }
4108   {
4109     \@@_add_to_colors_seq:xn
4110     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
4111     { \@@_columncolor:n { #3 } }
4112   }
4113 }
4114 \cs_new_protected:Npn \@@_columncolor:n #1
4115 {
4116   \tl_set:Nn \l_@@_rows_tl { - }
4117   \tl_set:Nn \l_@@_cols_tl { #1 }

```

The command `\@@_cartesian_path:` takes in two implicit arguments: `\l_@@_cols_tl` and `\l_@@_rows_tl`.

```

4118   \@@_cartesian_path:
4119 }

```

Here is an example : `\@@_rectanglecolor{red!15}{2-3}{5-6}`

```

4120 \NewDocumentCommand \@@_rectanglecolor { 0 { } m m m }
4121 {
4122   \tl_if_blank:nF { #2 }
4123   {
4124     \@@_add_to_colors_seq:xn
4125     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
4126     { \@@_rectanglecolor:nnn { #3 } { #4 } { 0 pt } }
4127   }
4128 }

```

The last argument is the radius of the corners of the rectangle.

```

4129 \NewDocumentCommand \@@_roundedrectanglecolor { 0 { } m m m m }
4130 {
4131   \tl_if_blank:nF { #2 }
4132   {
4133     \@@_add_to_colors_seq:xn
4134     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
4135     { \@@_rectanglecolor:nnn { #3 } { #4 } { #5 } }
4136   }
4137 }

```

The last argument is the radius of the corners of the rectangle.

```

4138 \cs_new_protected:Npn \@@_rectanglecolor:nnn #1 #2 #3
4139 {

```

```

4140 \@@_cut_on_hyphen:w #1 \q_stop
4141 \tl_clear_new:N \l_tmpc_tl
4142 \tl_clear_new:N \l_tmpd_tl
4143 \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl
4144 \tl_set_eq:NN \l_tmpd_tl \l_tmpb_tl
4145 \@@_cut_on_hyphen:w #2 \q_stop
4146 \tl_set:Nx \l_@@_rows_tl { \l_tmpc_tl - \l_tmpa_tl }
4147 \tl_set:Nx \l_@@_cols_tl { \l_tmpd_tl - \l_tmpb_tl }

```

The command `\@@_cartesian_path:n` takes in two implicit arguments: `\l_@@_cols_tl` and `\l_@@_rows_tl`.

```

4148 \@@_cartesian_path:n { #3 }
4149 }

```

Here is an example : `\@@_cellcolor[rgb]{0.5,0.5,0}{2-3,3-4,4-5,5-6}`

```

4150 \NewDocumentCommand \@@_cellcolor { 0 { } m m }
4151 {
4152   \clist_map_inline:nn { #3 }
4153   { \@@_rectanglecolor [ #1 ] { #2 } { ##1 } { ##1 } }
4154 }

```

```

4155 \NewDocumentCommand \@@_chessboardcolors { 0 { } m m }
4156 {
4157   \int_step_inline:nn { \int_use:N \c@iRow }
4158   {
4159     \int_step_inline:nn { \int_use:N \c@jCol }
4160     {
4161       \int_if_even:nTF { ####1 + ##1 }
4162       { \@@_cellcolor [ #1 ] { #2 } }
4163       { \@@_cellcolor [ #1 ] { #3 } }
4164       { ##1 - ####1 }
4165     }
4166   }
4167 }

```

```

4168 \keys_define:nn { NiceMatrix / arraycolor }
4169 { except-corners .code:n = \@@_error:n { key except-corners } }

```

The command `\@@_arraycolor` (linked to `\arraycolor` at the beginning of the `\CodeBefore`) will color the whole tabular (excepted the potential exterior rows and columns). The third argument is a optional argument which a list of pairs key-value.

```

4170 \NewDocumentCommand \@@_arraycolor { 0 { } m 0 { } }
4171 {
4172   \keys_set:nn { NiceMatrix / arraycolor } { #3 }
4173   \@@_rectanglecolor [ #1 ] { #2 }
4174   { 1 - 1 }
4175   { \int_use:N \c@iRow - \int_use:N \c@jCol }
4176 }

```

```

4177 \keys_define:nn { NiceMatrix / rowcolors }
4178 {
4179   respect-blocks .bool_set:N = \l_@@_respect_blocks_bool ,
4180   respect-blocks .default:n = true ,
4181   cols .tl_set:N = \l_@@_cols_tl ,
4182   restart .bool_set:N = \l_@@_rowcolors_restart_bool ,
4183   restart .default:n = true ,
4184   unknown .code:n = \@@_error:n { Unknown-key-for-rowcolors }
4185 }

```

The command `\rowcolors` (accessible in the `code-before`) is inspired by the command `\rowcolors` of the package `xcolor` (with the option `table`). However, the command `\rowcolors` of `nicematrix` has *not* the optional argument of the command `\rowcolors` of `xcolor`. Here is an example: `\rowcolors{1}{blue!10}{}[respect-blocks]`.

#1 (optional) is the color space ; #2 is a list of intervals of rows ; #3 is the first color ; #4 is the second color ; #5 is for the optional list of pairs key-value.

```
4186 \NewDocumentCommand \@@_rowcolors { 0 { } m m m 0 { } }
4187 {
```

The group is for the options.

```
4188 \group_begin:
4189 \tl_clear_new:N \l_@@_cols_tl
4190 \tl_set:Nn \l_@@_cols_tl { - }
4191 \keys_set:nn { NiceMatrix / rowcolors } { #5 }
```

The boolean `\l_tmpa_bool` will indicate whereas we are in a row of the first color or of the second color.

```
4192 \bool_set_true:N \l_tmpa_bool
4193 \bool_if:NT \l_@@_respect_blocks_bool
4194 {
```

We don't want to take into account a block which is completely in the “first column” of (number 0) or in the “last column” and that's why we filter the sequence of the blocks (in a the sequence `\l_tmpa_seq`).

```
4195 \seq_set_eq:NN \l_tmpb_seq \g_@@_pos_of_blocks_seq
4196 \seq_set_filter:NNn \l_tmpa_seq \l_tmpb_seq
4197 { \@@_not_in_exterior_p:nnnn ##1 }
4198 }
4199 \pgfpicture
4200 \pgf@relevantforpicturesizefalse
4201 \clist_map_inline:nn { #2 }
4202 {
4203 \tl_set:Nn \l_tmpa_tl { ##1 }
4204 \tl_if_in:NnTF \l_tmpa_tl { - }
4205 { \@@_cut_on_hyphen:w ##1 \q_stop }
4206 { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@iRow } }
```

The counter `\l_tmpa_int` will be the index of the loop.

```
4207 \int_set:Nn \l_tmpa_int \l_tmpa_tl
4208 \bool_if:NNTF \l_@@_rowcolors_restart_bool
4209 { \bool_set_true:N \l_tmpa_bool }
4210 { \bool_set:Nn \l_tmpa_bool { \int_if_odd_p:n { \l_tmpa_tl } } }
4211 \int_zero_new:N \l_tmpc_int
4212 \int_set:Nn \l_tmpc_int \l_tmpb_tl
4213 \int_do_until:nNnn \l_tmpa_int > \l_tmpc_int
4214 {
```

We will compute in `\l_tmpb_int` the last row of the “block”.

```
4215 \int_set_eq:NN \l_tmpb_int \l_tmpa_int
```

If the key `respect-blocks` is in force, we have to adjust that value (of course).

```
4216 \bool_if:NT \l_@@_respect_blocks_bool
4217 {
4218 \seq_set_filter:NNn \l_tmpb_seq \l_tmpa_seq
4219 { \@@_intersect_our_row_p:nnnn ####1 }
4220 \seq_map_inline:Nn \l_tmpb_seq { \@@_rowcolors_i:nnnn ####1 }
```

Now, the last row of the block is computed in `\l_tmpb_int`.

```
4221 }
4222 \tl_set:Nx \l_@@_rows_tl
4223 { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }
4224 \bool_if:NNTF \l_tmpa_bool
4225 {
4226 \tl_if_blank:nF { #3 }
4227 {
```

```

4228         \tl_if_empty:nTF { #1 }
4229         \color
4230         { \color [ #1 ] }
4231         { #3 }

```

The command `\@@_cartesian_path:` takes in two implicit arguments: `\l_@@_cols_tl` and `\l_@@_rows_tl`.

```

4232         \@@_cartesian_path:
4233         \pgfusepath { fill }
4234     }
4235     \bool_set_false:N \l_tmpa_bool
4236 }
4237 {
4238     \tl_if_blank:nF { #4 }
4239     {
4240         \tl_if_empty:nTF { #1 }
4241         \color
4242         { \color [ #1 ] }
4243         { #4 }

```

The command `\@@_cartesian_path:` takes in two implicit arguments: `\l_@@_cols_tl` and `\l_@@_row_tl`.

```

4244         \@@_cartesian_path:
4245         \pgfusepath { fill }
4246     }
4247     \bool_set_true:N \l_tmpa_bool
4248 }
4249     \int_set:Nn \l_tmpa_int { \l_tmpb_int + 1 }
4250 }
4251 }
4252 \endpgfpicture
4253 \group_end:
4254 }

```

```

4255 \cs_new_protected:Npn \@@_rowcolors_i:nnnn #1 #2 #3 #4
4256 {
4257     \int_compare:nNnT { #3 } > \l_tmpb_int
4258     { \int_set:Nn \l_tmpb_int { #3 } }
4259 }

```

```

4260 \prg_new_conditional:Nnn \@@_not_in_exterior:nnnn p
4261 {
4262     \bool_lazy_or:nnTF
4263     { \int_compare_p:nNn { #4 } = \c_zero_int }
4264     { \int_compare_p:nNn { #2 } = { \@@_succ:n { \c_jCol } } }
4265     \prg_return_false:
4266     \prg_return_true:
4267 }

```

The following command return true when the block intersects the row `\l_tmpa_int`.

```

4268 \prg_new_conditional:Nnn \@@_intersect_our_row:nnnn p
4269 {
4270     \bool_if:nTF
4271     {
4272         \int_compare_p:n { #1 <= \l_tmpa_int }
4273         &&
4274         \int_compare_p:n { \l_tmpa_int <= #3 }
4275     }
4276     \prg_return_true:
4277     \prg_return_false:
4278 }

```

The following command uses two implicit arguments: `\l_@@_rows_tl` and `\l_@@_cols_tl` which are specifications for a set of rows and a set of columns. It creates a path but does *not* fill it. It must be filled by another command after. The argument is the radius of the corners. We define below a command `\@@_cartesian_path:` which corresponds to a value 0 pt for the radius of the corners. This command is in particular used in `\@@_rectanglecolor:nnn` (used in `\@@_rectanglecolor`, itself used in `\@@_cellcolor`).

```

4279 \cs_new_protected:Npn \@@_cartesian_path:n #1
4280 {
4281   \bool_lazy_and:nnT
4282     { ! \seq_if_empty_p:N \l_@@_corners_cells_seq }
4283     { \dim_compare_p:nNn { #1 } = \c_zero_dim }
4284   {
4285     \@@_expand_clist:NN \l_@@_cols_tl \c@jCol
4286     \@@_expand_clist:NN \l_@@_rows_tl \c@iRow
4287   }

```

We begin the loop over the columns.

```

4288   \clist_map_inline:Nn \l_@@_cols_tl
4289   {
4290     \tl_set:Nn \l_tmpa_tl { ##1 }
4291     \tl_if_in:NnTF \l_tmpa_tl { - }
4292       { \@@_cut_on_hyphen:w ##1 \q_stop }
4293       { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
4294     \bool_lazy_or:nnT
4295       { \tl_if_blank_p:V \l_tmpa_tl }
4296       { \str_if_eq_p:Vn \l_tmpa_tl { * } }
4297     { \tl_set:Nn \l_tmpa_tl { 1 } }
4298     \bool_lazy_or:nnT
4299       { \tl_if_blank_p:V \l_tmpb_tl }
4300       { \str_if_eq_p:Vn \l_tmpb_tl { * } }
4301     { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
4302     \int_compare:nNnT \l_tmpb_tl > \c@jCol
4303     { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }

```

`\l_tmpc_tl` will contain the number of column.

```

4304     \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl

```

If we decide to provide the commands `\cellcolor`, `\rectanglecolor`, `\rowcolor`, `\columncolor`, `\rowcolors` and `\chessboardcolors` in the code-before of a `\SubMatrix`, we will have to modify the following line, by adding a kind of offset. We will have also some other lines to modify.

```

4305     \@@_qpoint:n { col - \l_tmpa_tl }
4306     \int_compare:nNnTF \l_@@_first_col_int = \l_tmpa_tl
4307       { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
4308       { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
4309     \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
4310     \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }

```

We begin the loop over the rows.

```

4311   \clist_map_inline:Nn \l_@@_rows_tl
4312   {
4313     \tl_set:Nn \l_tmpa_tl { ####1 }
4314     \tl_if_in:NnTF \l_tmpa_tl { - }
4315       { \@@_cut_on_hyphen:w ####1 \q_stop }
4316       { \@@_cut_on_hyphen:w ####1 - ####1 \q_stop }
4317     \tl_if_empty:NT \l_tmpa_tl { \tl_set:Nn \l_tmpa_tl { 1 } }
4318     \tl_if_empty:NT \l_tmpb_tl
4319     { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@iRow } }
4320     \int_compare:nNnT \l_tmpb_tl > \c@iRow
4321     { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@iRow } }

```

Now, the numbers of both rows are in `\l_tmpa_tl` and `\l_tmpb_tl`.

```

4322     \seq_if_in:NxF \l_@@_corners_cells_seq
4323     { \l_tmpa_tl - \l_tmpc_tl }
4324     {
4325       \@@_qpoint:n { row - \@@_succ:n \l_tmpb_tl }

```

```

4326         \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
4327         \@@_qpoint:n { row - \l_tmpa_tl }
4328         \dim_set:Nn \l_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
4329         \pgfsetcornersarced { \pgfpoint { #1 } { #1 } }
4330         \pgfpathrectanglecorners
4331         { \pgfpoint \l_tmpc_dim \l_tmpd_dim }
4332         { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
4333     }
4334 }
4335 }
4336 }

```

The following command corresponds to a radius of the corners equal to 0 pt. This command is used by the commands `\@@_rowcolors`, `\@@_columncolor` and `\@@_rowcolor:n` (used in `\@@_rowcolor`).

```

4337 \cs_new_protected:Npn \@@_cartesian_path: { \@@_cartesian_path:n { 0 pt } }

```

The following command will be used only with `\l_@@_cols_tl` and `\c@jCol` (first case) or with `\l_@@_rows_tl` and `\c@iRow` (second case). For instance, with `\l_@@_cols_tl` equal to 2,4-6,8-* and `\c@jCol` equal to 10, the clist `\l_@@_cols_tl` will be replaced by 2,4,5,6,8,9,10.

```

4338 \cs_new_protected:Npn \@@_expand_clist:NN #1 #2
4339 {
4340     \clist_set_eq:NN \l_tmpa_clist #1
4341     \clist_clear:N #1
4342     \clist_map_inline:Nn \l_tmpa_clist
4343     {
4344         \tl_set:Nn \l_tmpa_tl { ##1 }
4345         \tl_if_in:NnTF \l_tmpa_tl { - }
4346         { \@@_cut_on_hyphen:w ##1 \q_stop }
4347         { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
4348         \bool_lazy_or:nnT
4349         { \tl_if_blank_p:V \l_tmpa_tl }
4350         { \str_if_eq_p:Vn \l_tmpa_tl { * } }
4351         { \tl_set:Nn \l_tmpa_tl { 1 } }
4352         \bool_lazy_or:nnT
4353         { \tl_if_blank_p:V \l_tmpb_tl }
4354         { \str_if_eq_p:Vn \l_tmpb_tl { * } }
4355         { \tl_set:Nx \l_tmpb_tl { \int_use:N #2 } }
4356         \int_compare:nNnT \l_tmpb_tl > #2
4357         { \tl_set:Nx \l_tmpb_tl { \int_use:N #2 } }
4358         \int_step_inline:nnn \l_tmpa_tl \l_tmpb_tl
4359         { \clist_put_right:Nn #1 { #####1 } }
4360     }
4361 }

```

When the user uses the key `colortbl`-like, the following command will be linked to `\cellcolor` in the tabular.

```

4362 \NewDocumentCommand \@@_cellcolor_tabular { 0 { } m }
4363 {
4364     \peek_remove_spaces:n
4365     {
4366         \tl_gput_right:Nx \g_nicematrix_code_before_tl
4367         {

```

We must not expand the color (`#2`) because the color may contain the token `!` which may be activated by some packages (ex.: `babel` with the option `french` on `latex` and `pdflatex`).

```

4368         \cellcolor [ #1 ] { \exp_not:n { #2 } }
4369         { \int_use:N \c@iRow - \int_use:N \c@jCol }
4370     }
4371 }
4372 }

```

When the user uses the key `colortbl`-like, the following command will be linked to `\rowcolor` in the `tabular`.

```

4373 \NewDocumentCommand \@@_rowcolor_tabular { 0 { } m }
4374 {
4375   \peek_remove_spaces:n
4376   {
4377     \tl_gput_right:Nx \g_nicematrix_code_before_tl
4378     {
4379       \exp_not:N \rectanglecolor [ #1 ] { \exp_not:n { #2 } }
4380       { \int_use:N \c@iRow - \int_use:N \c@jCol }
4381       { \int_use:N \c@iRow - \exp_not:n { \int_use:N \c@jCol } }
4382     }
4383   }
4384 }

```

```

4385 \NewDocumentCommand \@@_columncolor_preamble { 0 { } m }
4386 {

```

With the following line, we test whether the cell is the first one we encounter in its column (don't forget that some rows may be incomplete).

```

4387   \int_compare:nNnT \c@jCol > \g_@@_col_total_int
4388   {

```

You use `gput_left` because we want the specification of colors for the columns drawn before the specifications of color for the rows (and the cells). Be careful: maybe this is not effective since we have an analyze of the instructions in the `\CodeBefore` in order to fill color by color (to avoid the thin white lines).

```

4389     \tl_gput_left:Nx \g_nicematrix_code_before_tl
4390     {
4391       \exp_not:N \columncolor [ #1 ]
4392       { \exp_not:n { #2 } } { \int_use:N \c@jCol }
4393     }
4394   }
4395 }

```

The vertical rules

We give to the user the possibility to define new types of columns (with `\newcolumnntype` of `array`) for special vertical rules (*e.g.* rules thicker than the standard ones) which will not extend in the potential exterior rows of the array.

We provide the command `\OnlyMainNiceMatrix` in that goal. However, that command must be no-op outside the environments of `nicematrix` (and so the user will be allowed to use the same new type of column in the environments of `nicematrix` and in the standard environments of `array`).

That's why we provide first a global definition of `\OnlyMainNiceMatrix`.

```

4396 \cs_set_eq:NN \OnlyMainNiceMatrix \use:n

```

Another definition of `\OnlyMainNiceMatrix` will be linked to the command in the environments of `nicematrix`. Here is that definition, called `\@@_OnlyMainNiceMatrix:n`.

```

4397 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix:n #1
4398 {
4399   \int_compare:nNnTF \l_@@_first_col_int = 0
4400   { \@@_OnlyMainNiceMatrix_i:n { #1 } }
4401   {
4402     \int_compare:nNnTF \c@jCol = 0
4403     {
4404       \int_compare:nNnF \c@iRow = { -1 }
4405       { \int_compare:nNnF \c@iRow = { \l_@@_last_row_int - 1 } { #1 } }
4406     }
4407     { \@@_OnlyMainNiceMatrix_i:n { #1 } }
4408   }
4409 }

```

This definition may seem complicated by we must remind that the number of row `\c@iRow` is incremented in the first cell of the row, *after* a potential vertical rule on the left side of the first cell.

The command `\@@_OnlyMainNiceMatrix_i:n` is only a short-cut which is used twice in the above command. This command must *not* be protected.

```

4410 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix_i:n #1
4411 {
4412   \int_compare:nNnF \c@iRow = 0
4413     { \int_compare:nNnF \c@iRow = \l_@@_last_row_int { #1 } }
4414 }

```

Remember that `\c@iRow` is not always inferior to `\l_@@_last_row_int` because `\l_@@_last_row_int` may be equal to -2 or -1 (we can't write `\int_compare:nNnT \c@iRow < \l_@@_last_row_int`).

The following command will be executed in the `internal-code-after`. The rule will be drawn *before* the column `#1` (that is to say on the left side). `#2` is the number of consecutive occurrences of `|`.

```

4415 \cs_new_protected:Npn \@@_vline:nn #1 #2
4416 {

```

The following test is for the case where the user don't use all the columns specified in the preamble of the environment (for instance, a preamble of `|c|c|c|` but only two columns used).

```

4417   \int_compare:nNnT { #1 } < { \c@jCol + 2 }
4418   {
4419     \pgfpicture
4420     \@@_vline_i:nn { #1 } { #2 }
4421     \endpgfpicture
4422   }
4423 }

4424 \cs_new_protected:Npn \@@_vline_i:nn #1 #2
4425 {

```

`\l_tmpa_tl` is the number of row and `\l_tmpb_tl` the number of column. When we have found a row corresponding to a rule to draw, we note its number in `\l_tmptc_tl`.

```

4426   \tl_set:Nx \l_tmpb_tl { #1 }
4427   \tl_clear_new:N \l_tmptc_tl
4428   \int_step_variable:nNn \c@iRow \l_tmpa_tl
4429   {

```

The boolean `\g_tmpa_bool` indicates whether the small vertical rule will be drawn. If we find that it is in a block (a real block, created by `\Block` or a virtual block corresponding to a dotted line, created by `\Cdots`, `\Vdots`, etc.), we will set `\g_tmpa_bool` to `false` and the small vertical rule won't be drawn.

```

4430     \bool_gset_true:N \g_tmpa_bool
4431     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
4432       { \@@_test_vline_in_block:nnnn ##1 }
4433     \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
4434       { \@@_test_vline_in_block:nnnn ##1 }
4435     \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
4436       { \@@_test_vline_in_stroken_block:nnnn ##1 }
4437     \clist_if_empty:NF \l_@@_corners_clist
4438     \@@_test_in_corner_v:
4439     \bool_if:NTF \g_tmpa_bool
4440     {
4441       \tl_if_empty:NT \l_tmptc_tl

```

We keep in memory that we have a rule to draw.

```

4442       { \tl_set_eq:NN \l_tmptc_tl \l_tmpa_tl }
4443     }
4444     {
4445       \tl_if_empty:NF \l_tmptc_tl
4446       {
4447         \@@_vline_ii:nnnn
4448         { #1 }
4449         { #2 }

```

```

4450         \l_tmpc_tl
4451         { \int_eval:n { \l_tmpa_tl - 1 } }
4452         \tl_clear:N \l_tmpc_tl
4453     }
4454 }
4455 }
4456 \tl_if_empty:NF \l_tmpc_tl
4457 {
4458     \@@_vline_ii:nnnn
4459     { #1 }
4460     { #2 }
4461     \l_tmpc_tl
4462     { \int_use:N \c@iRow }
4463     \tl_clear:N \l_tmpc_tl
4464 }
4465 }

4466 \cs_new_protected:Npn \@@_test_in_corner_v:
4467 {
4468     \int_compare:nNnTF \l_tmpb_tl = { \@@_succ:n \c@jCol }
4469     {
4470         \seq_if_in:NxT
4471         \l_@@_corners_cells_seq
4472         { \l_tmpa_tl - \@@_pred:n \l_tmpb_tl }
4473         { \bool_set_false:N \g_tmpa_bool }
4474     }
4475     {
4476         \seq_if_in:NxT
4477         \l_@@_corners_cells_seq
4478         { \l_tmpa_tl - \l_tmpb_tl }
4479         {
4480             \int_compare:nNnTF \l_tmpb_tl = 1
4481             { \bool_set_false:N \g_tmpa_bool }
4482             {
4483                 \seq_if_in:NxT
4484                 \l_@@_corners_cells_seq
4485                 { \l_tmpa_tl - \@@_pred:n \l_tmpb_tl }
4486                 { \bool_set_false:N \g_tmpa_bool }
4487             }
4488         }
4489     }
4490 }

```

#1 is the number of the column; #2 is the number of vertical rules to draw (with potentially a color between); #3 and #4 are the numbers of the rows between which the rule has to be drawn.

```

4491 \cs_new_protected:Npn \@@_vline_ii:nnnn #1 #2 #3 #4
4492 {
4493     \pgfrememberpicturepositiononpagetrue
4494     \pgf@relevantforpicturesizefalse
4495     \@@_qpoint:n { row - #3 }
4496     \dim_set_eq:NN \l_tmpa_dim \pgf@y
4497     \@@_qpoint:n { col - #1 }
4498     \dim_set_eq:NN \l_tmpb_dim \pgf@x
4499     \@@_qpoint:n { row - \@@_succ:n { #4 } }
4500     \dim_set_eq:NN \l_tmpc_dim \pgf@y
4501     \bool_lazy_and:nnT
4502     { \int_compare_p:nNn { #2 } > 1 }
4503     { ! \tl_if_blank_p:V \CT@drsc@ }
4504     {
4505         \group_begin:
4506         \CT@drsc@
4507         \dim_add:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }

```

```

4508 \dim_sub:Nn \l_tmpc_dim { 0.5 \arrayrulewidth }
4509 \dim_set:Nn \l_tmpd_dim
4510 { \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth ) * ( #2 - 1 ) }
4511 \pgfpathrectanglecorners
4512 { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
4513 { \pgfpoint \l_tmpd_dim \l_tmpc_dim }
4514 \pgfusepath { fill }
4515 \group_end:
4516 }
4517 \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
4518 \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
4519 \prg_replicate:nn { #2 - 1 }
4520 {
4521 \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
4522 \dim_sub:Nn \l_tmpb_dim \doublerulesep
4523 \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
4524 \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
4525 }
4526 \CT@arc@
4527 \pgfsetlinewidth { 1.1 \arrayrulewidth }
4528 \pgfsetrectcap
4529 \pgfusepathqstroke
4530 }

```

The following command draws a complete vertical rule in the column #1 (#2 is the number of consecutive rules specified by the number of | in the preamble). This command will be used if there is no block in the array (and the key `corners` is not used).

```

4531 \cs_new_protected:Npn \@@_vline_i_complete:nn #1 #2
4532 { \@@_vline_ii:nnnn { #1 } { #2 } 1 { \int_use:N \c@iRow } }

```

The command `\@@_draw_vlines:` draws all the vertical rules excepted in the blocks, in the virtual blocks (determined by a command such as `\Cdots`) and in the corners (if the key `corners` is used).

```

4533 \cs_new_protected:Npn \@@_draw_vlines:
4534 {
4535 \int_step_inline:nnn
4536 {
4537 \bool_if:NTF { \l_@@_NiceArray_bool && ! \l_@@_except_borders_bool }
4538 1 2
4539 }
4540 {
4541 \bool_if:NTF { \l_@@_NiceArray_bool && ! \l_@@_except_borders_bool }
4542 { \@@_succ:n \c@jCol }
4543 \c@jCol
4544 }
4545 {
4546 \tl_if_eq:NnF \l_@@_vlines_clist { all }
4547 { \clist_if_in:NnT \l_@@_vlines_clist { ##1 } }
4548 { \@@_vline:nn { ##1 } 1 }
4549 }
4550 }

```

The horizontal rules

The following command will be executed in the `internal-code-after`. The rule will be drawn *before* the row #1. #2 is the number of consecutive occurrences of `\Hline`.

```

4551 \cs_new_protected:Npn \@@_hline:nn #1 #2
4552 {
4553 \pgfpicture
4554 \@@_hline_i:nn { #1 } { #2 }
4555 \endpgfpicture
4556 }

```

```

4557 \cs_new_protected:Npn \@@_hline_i:nn #1 #2
4558 {

```

\l_tmpa_tl is the number of row and \l_tmpb_tl the number of column. When we have found a column corresponding to a rule to draw, we note its number in \l_tmpc_tl.

```

4559   \tl_set:Nn \l_tmpa_tl { #1 }
4560   \tl_clear_new:N \l_tmpc_tl
4561   \int_step_variable:nNn \c@jCol \l_tmpb_tl
4562   {

```

The boolean \g_tmpa_bool indicates whether the small horizontal rule will be drawn. If we find that it is in a block (a real block, created by \Block or a virtual block corresponding to a dotted line, created by \Cdots, \Vdots, etc.), we will set \g_tmpa_bool to false and the small horizontal rule won't be drawn.

```

4563       \bool_gset_true:N \g_tmpa_bool
4564       \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
4565         { \@@_test_hline_in_block:nnnn ##1 }
4566       \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
4567         { \@@_test_hline_in_block:nnnn ##1 }
4568       \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
4569         { \@@_test_hline_in_stroken_block:nnnn ##1 }
4570       \clist_if_empty:NF \l_@@_corners_clist \@@_test_in_corner_h:
4571       \bool_if:NTF \g_tmpa_bool
4572       {
4573         \tl_if_empty:NT \l_tmpc_tl

```

We keep in memory that we have a rule to draw.

```

4574         { \tl_set_eq:NN \l_tmpc_tl \l_tmpb_tl }
4575       }
4576     {
4577       \tl_if_empty:NF \l_tmpc_tl
4578       {
4579         \@@_hline_ii:nnnn
4580         { #1 }
4581         { #2 }
4582         \l_tmpc_tl
4583         { \int_eval:n { \l_tmpb_tl - 1 } }
4584         \tl_clear:N \l_tmpc_tl
4585       }
4586     }
4587   }
4588   \tl_if_empty:NF \l_tmpc_tl
4589   {
4590     \@@_hline_ii:nnnn
4591     { #1 }
4592     { #2 }
4593     \l_tmpc_tl
4594     { \int_use:N \c@jCol }
4595     \tl_clear:N \l_tmpc_tl
4596   }
4597 }

```

```

4598 \cs_new_protected:Npn \@@_test_in_corner_h:
4599 {
4600   \int_compare:nNnTF \l_tmpa_tl = { \@@_succ:n \c@iRow }
4601   {
4602     \seq_if_in:NxT
4603       \l_@@_corners_cells_seq
4604       { \@@_pred:n \l_tmpa_tl - \l_tmpb_tl }
4605       { \bool_set_false:N \g_tmpa_bool }
4606   }
4607   {
4608     \seq_if_in:NxT
4609       \l_@@_corners_cells_seq

```

```

4610     { \l_tmpa_tl - \l_tmpb_tl }
4611     {
4612         \int_compare:nNnTF \l_tmpa_tl = 1
4613         { \bool_set_false:N \g_tmpa_bool }
4614         {
4615             \seq_if_in:NxT
4616             \l_@@_corners_cells_seq
4617             { \@@_pred:n \l_tmpa_tl - \l_tmpb_tl }
4618             { \bool_set_false:N \g_tmpa_bool }
4619         }
4620     }
4621 }
4622 }

```

#1 is the number of the row; #2 is the number of horizontal rules to draw (with potentially a color between); #3 and #4 are the number of the columns between which the rule has to be drawn.

```

4623 \cs_new_protected:Npn \@@_hline_ii:nnnn #1 #2 #3 #4
4624 {
4625     \pgfrememberpicturepositiononpagetrue
4626     \pgf@relevantforpicturesizefalse
4627     \@@_qpoint:n { col - #3 }
4628     \dim_set_eq:NN \l_tmpa_dim \pgf@x
4629     \@@_qpoint:n { row - #1 }
4630     \dim_set_eq:NN \l_tmpb_dim \pgf@y
4631     \@@_qpoint:n { col - \@@_succ:n { #4 } }
4632     \dim_set_eq:NN \l_tmpc_dim \pgf@x
4633     \bool_lazy_and:nnT
4634     { \int_compare_p:nNn { #2 } > 1 }
4635     { ! \tl_if_blank_p:V \CT@drsc@ }
4636     {
4637         \group_begin:
4638         \CT@drsc@
4639         \dim_set:Nn \l_tmpd_dim
4640         { \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth ) * ( #2 - 1 ) }
4641         \pgfpathrectanglecorners
4642         { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
4643         { \pgfpoint \l_tmpc_dim \l_tmpd_dim }
4644         \pgfusepathqfill
4645         \group_end:
4646     }
4647     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
4648     \pgfpathlineto { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
4649     \prg_replicate:nn { #2 - 1 }
4650     {
4651         \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
4652         \dim_sub:Nn \l_tmpb_dim \doublerulesep
4653         \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
4654         \pgfpathlineto { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
4655     }
4656     \CT@arc@
4657     \pgfsetlinewidth { 1.1 \arrayrulewidth }
4658     \pgfsetrectcap
4659     \pgfusepathqstroke
4660 }

4661 \cs_new_protected:Npn \@@_hline_i_complete:nn #1 #2
4662 { \@@_hline_ii:nnnn { #1 } { #2 } 1 { \int_use:N \c@jCol } }

```

The command `\@@_draw_hlines:` draws all the horizontal rules excepted in the blocks (even the virtual drawn determined by commands such as `\Cdots` and in the corners (if the key `corners` is used).

```

4663 \cs_new_protected:Npn \@@_draw_hlines:
4664 {
4665   \int_step_inline:nnn
4666   {
4667     \bool_if:nTF { \l_@@_NiceArray_bool && ! \l_@@_except_borders_bool }
4668     1 2
4669   }
4670   {
4671     \bool_if:nTF { \l_@@_NiceArray_bool && ! \l_@@_except_borders_bool }
4672     { \@@_succ:n \c@iRow }
4673     \c@iRow
4674   }
4675   {
4676     \tl_if_eq:NnF \l_@@_hlines_clist { all }
4677     { \clist_if_in:NnT \l_@@_hlines_clist { ##1 } }
4678     { \@@_hline:nn { ##1 } 1 }
4679   }
4680 }

```

The command `\@@_Hline:` will be linked to `\Hline` in the environments of `nicematrix`.

```

4681 \cs_set:Npn \@@_Hline: { \noalign { \ifnum 0 = ` } \fi \@@_Hline_i:n { 1 } }

```

The argument of the command `\@@_Hline_i:n` is the number of successive `\Hline` found.

```

4682 \cs_set:Npn \@@_Hline_i:n #1
4683 {
4684   \peek_meaning_ignore_spaces:NTF \Hline
4685   { \@@_Hline_ii:nn { #1 + 1 } }
4686   { \@@_Hline_iii:n { #1 } }
4687 }
4688 \cs_set:Npn \@@_Hline_ii:nn #1 #2 { \@@_Hline_i:n { #1 } }
4689 \cs_set:Npn \@@_Hline_iii:n #1
4690 {
4691   \skip_vertical:n
4692   {
4693     \arrayrulewidth * ( #1 )
4694     + \doublerulesep * ( \int_max:nn 0 { #1 - 1 } )
4695   }
4696   \tl_gput_right:Nx \g_@@_internal_code_after_tl
4697   { \@@_hline:nn { \@@_succ:n { \c@iRow } } { #1 } }
4698   \ifnum 0 = ` { \fi }
4699 }

```

The key hvlines

The following command tests whether the current position in the array (given by `\l_tmpa_tl` for the row and `\l_tmpb_tl` for the column) would provide an horizontal rule towards the right in the block delimited by the four arguments `#1`, `#2`, `#3` and `#4`. If this rule would be in the block (it must not be drawn), the boolean `\l_tmpa_bool` is set to false.

```

4700 \cs_new_protected:Npn \@@_test_hline_in_block:nnnn #1 #2 #3 #4
4701 {
4702   \bool_lazy_all:nT
4703   {
4704     { \int_compare_p:nNn \l_tmpa_tl > { #1 } }
4705     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
4706     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
4707     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
4708   }
4709   { \bool_gset_false:N \g_tmpa_bool }
4710 }

```

The same for vertical rules.

```

4711 \cs_new_protected:Npn \@@_test_vline_in_block:nnnn #1 #2 #3 #4
4712 {
4713   \bool_lazy_all:nT
4714   {
4715     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
4716     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
4717     { \int_compare_p:nNn \l_tmpb_tl > { #2 } }
4718     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
4719   }
4720   { \bool_gset_false:N \g_tmpa_bool }
4721 }
4722 \cs_new_protected:Npn \@@_test_hline_in_stroken_block:nnnn #1 #2 #3 #4
4723 {
4724   \bool_lazy_all:nT
4725   {
4726     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
4727     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 2 } }
4728     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
4729     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
4730   }
4731   { \bool_gset_false:N \g_tmpa_bool }
4732 }
4733 \cs_new_protected:Npn \@@_test_vline_in_stroken_block:nnnn #1 #2 #3 #4
4734 {
4735   \bool_lazy_all:nT
4736   {
4737     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
4738     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
4739     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
4740     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 2 } }
4741   }
4742   { \bool_gset_false:N \g_tmpa_bool }
4743 }

```

The key corners

When the key `corners` is raised, the rules are not drawn in the corners. Of course, we have to compute the corners before we begin to draw the rules.

```

4744 \cs_new_protected:Npn \@@_compute_corners:
4745 {

```

The sequence `\l_@@_corners_cells_seq` will be the sequence of all the empty cells (and not in a block) considered in the corners of the array.

```

4746   \seq_clear_new:N \l_@@_corners_cells_seq
4747   \clist_map_inline:Nn \l_@@_corners_clist
4748   {
4749     \str_case:nnF { ##1 }
4750     {
4751       { NW }
4752       { \@@_compute_a_corner:nnnnnn 1 1 1 1 \c@iRow \c@jCol }
4753       { NE }
4754       { \@@_compute_a_corner:nnnnnn 1 \c@jCol 1 { -1 } \c@iRow 1 }
4755       { SW }
4756       { \@@_compute_a_corner:nnnnnn \c@iRow 1 { -1 } 1 1 \c@jCol }
4757       { SE }
4758       { \@@_compute_a_corner:nnnnnn \c@iRow \c@jCol { -1 } { -1 } 1 1 }
4759     }
4760     { \@@_error:nn { bad~corner } { ##1 } }
4761   }

```

Even if the user has used the key `corners` (or the key `hvlines-except-corners`), the list of cells in the corners may be empty.

```
4762 \seq_if_empty:NF \l_@@_corners_cells_seq
4763 {
```

You write on the `aux` file the list of the cells which are in the (empty) corners because you need that information in the `\CodeBefore` since the commands which color the `rows`, `columns` and `cells` must not color the cells in the corners.

```
4764 \tl_gput_right:Nx \g_@@_aux_tl
4765 {
4766   \seq_set_from_clist:Nn \exp_not:N \l_@@_corners_cells_seq
4767   { \seq_use:Nnnn \l_@@_corners_cells_seq , , , }
4768   \iow_newline:
4769 }
4770 }
4771 }
```

“Computing a corner” is determining all the empty cells (which are not in a block) that belong to that corner. These cells will be added to the sequence `\l_@@_corners_cells_seq`.

The six arguments of `\@@_compute_a_corner:nnnnnn` are as follow:

- #1 and #2 are the number of row and column of the cell which is actually in the corner;
- #3 and #4 are the steps in rows and the step in columns when moving from the corner;
- #5 is the number of the final row when scanning the rows from the corner;
- #6 is the number of the final column when scanning the columns from the corner.

```
4772 \cs_new_protected:Npn \@@_compute_a_corner:nnnnnn #1 #2 #3 #4 #5 #6
4773 {
```

For the explanations and the name of the variables, we consider that we are computing the left-upper corner.

First, we try to determine which is the last empty cell (and not in a block: we won’t add that precision any longer) in the column of number 1. The flag `\l_tmpa_bool` will be raised when a non-empty cell is found.

```
4774 \bool_set_false:N \l_tmpa_bool
4775 \int_zero_new:N \l_@@_last_empty_row_int
4776 \int_set:Nn \l_@@_last_empty_row_int { #1 }
4777 \int_step_inline:nnnn { #1 } { #3 } { #5 }
4778 {
4779   \@@_test_if_cell_in_a_block:nn { ##1 } { \int_eval:n { #2 } }
4780   \bool_lazy_or:nnTF
4781   {
4782     \cs_if_exist_p:c
4783     { pgf @ sh @ ns @ \@@_env: - ##1 - \int_eval:n { #2 } }
4784   }
4785   \l_tmpb_bool
4786   { \bool_set_true:N \l_tmpa_bool }
4787   {
4788     \bool_if:NF \l_tmpa_bool
4789     { \int_set:Nn \l_@@_last_empty_row_int { ##1 } }
4790   }
4791 }
```

Now, you determine the last empty cell in the row of number 1.

```
4792 \bool_set_false:N \l_tmpa_bool
4793 \int_zero_new:N \l_@@_last_empty_column_int
4794 \int_set:Nn \l_@@_last_empty_column_int { #2 }
4795 \int_step_inline:nnnn { #2 } { #4 } { #6 }
4796 {
4797   \@@_test_if_cell_in_a_block:nn { \int_eval:n { #1 } } { ##1 }
4798   \bool_lazy_or:nnTF
```

```

4799     \l_tmpb_bool
4800     {
4801         \cs_if_exist_p:c
4802         { pgf @ sh @ ns @ \@@_env: - \int_eval:n { #1 } - ##1 }
4803     }
4804     { \bool_set_true:N \l_tmpa_bool }
4805     {
4806         \bool_if:NF \l_tmpa_bool
4807         { \int_set:Nn \l_@@_last_empty_column_int { ##1 } }
4808     }
4809 }

```

Now, we loop over the rows.

```

4810     \int_step_inline:nnnn { #1 } { #3 } \l_@@_last_empty_row_int
4811     {

```

We treat the row number ##1 with another loop.

```

4812         \bool_set_false:N \l_tmpa_bool
4813         \int_step_inline:nnnn { #2 } { #4 } \l_@@_last_empty_column_int
4814         {
4815             \@@_test_if_cell_in_a_block:nn { ##1 } { ####1 }
4816             \bool_lazy_or:nnTF
4817             \l_tmpb_bool
4818             {
4819                 \cs_if_exist_p:c
4820                 { pgf @ sh @ ns @ \@@_env: - ##1 - ####1 }
4821             }
4822             { \bool_set_true:N \l_tmpa_bool }
4823             {
4824                 \bool_if:NF \l_tmpa_bool
4825                 {
4826                     \int_set:Nn \l_@@_last_empty_column_int { ####1 }
4827                     \seq_put_right:Nn
4828                     \l_@@_corners_cells_seq
4829                     { ##1 - ####1 }
4830                 }
4831             }
4832         }
4833     }
4834 }

```

The following macro tests whether a cell is in (at least) one of the blocks of the array (or in a cell with a `\diagbox`).

The flag `\l_tmpb_bool` will be raised if the cell #1-#2 is in a block (or in a cell with a `\diagbox`).

```

4835 \cs_new_protected:Npn \@@_test_if_cell_in_a_block:nn #1 #2
4836 {
4837     \int_set:Nn \l_tmpa_int { #1 }
4838     \int_set:Nn \l_tmpb_int { #2 }
4839     \bool_set_false:N \l_tmpb_bool
4840     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
4841     { \@@_test_if_cell_in_block:nnnnnn \l_tmpa_int \l_tmpb_int ##1 }
4842 }
4843 \cs_new_protected:Npn \@@_test_if_cell_in_block:nnnnnn #1 #2 #3 #4 #5 #6
4844 {
4845     \int_compare:nNnT { #3 } < { \@@_succ:n { #1 } }
4846     {
4847         \int_compare:nNnT { #1 } < { \@@_succ:n { #5 } }
4848         {
4849             \int_compare:nNnT { #4 } < { \@@_succ:n { #2 } }
4850             {
4851                 \int_compare:nNnT { #2 } < { \@@_succ:n { #6 } }
4852                 { \bool_set_true:N \l_tmpb_bool }
4853             }
4854         }
4855     }

```

```

4854     }
4855   }
4856 }

```

The commands to draw dotted lines to separate columns and rows

These commands don't use the normal nodes, the medium nor the large nodes. They only use the `col` nodes and the `row` nodes.

Horizontal dotted lines

The following command must *not* be protected because it's meant to be expanded in a `\noalign`.

```

4857 \cs_new:Npn \@@_hdottedline:
4858 {
4859   \noalign { \skip_vertical:N 2\l_@@_radius_dim }
4860   \@@_hdottedline_i:
4861 }

```

On the other side, the following command should be protected.

```

4862 \cs_new_protected:Npn \@@_hdottedline_i:
4863 {

```

We write in the code-after the instruction that will actually draw the dotted line. It's not possible to draw this dotted line now because we don't know the length of the line (we don't even know the number of columns).

```

4864   \tl_gput_right:Nx \g_@@_internal_code_after_tl
4865   { \@@_hdottedline:n { \int_use:N \c@iRow } }
4866 }

```

The command `\@@_hdottedline:n` is the command written in the `\CodeAfter` that will actually draw the dotted line. Its argument is the number of the row *before* which we will draw the row.

```

4867 \AtBeginDocument
4868 {

```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible”. That's why we construct now a version of `\@@_hdottedline:n` with the right environment (`\begin{pgfpicture}\end{pgfpicture}` or `\begin{tikzpicture}...\end{tikzpicture}`).

```

4869   \cs_new_protected:Npx \@@_hdottedline:n #1
4870   {
4871     \bool_set_true:N \exp_not:N \l_@@_initial_open_bool
4872     \bool_set_true:N \exp_not:N \l_@@_final_open_bool
4873     \c_@@_pgfortikzpicture_tl
4874     \@@_hdottedline_i:n { #1 }
4875     \c_@@_endpgfortikzpicture_tl
4876   }
4877 }

```

The following command *must* be protected since it is used in the construction of `\@@_hdottedline:n`.

```

4878 \cs_new_protected:Npn \@@_hdottedline_i:n #1
4879 {
4880   \pgfrememberpicturepositiononpagetrue
4881   \@@_qpoint:n { row - #1 }

```

We do a translation `par -\l_@@_radius_dim` because we want the dotted line to have exactly the same position as a vertical rule drawn by “|” (considering the rule having a width equal to the diameter of the dots).

```

4882   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4883   \dim_sub:Nn \l_@@_y_initial_dim \l_@@_radius_dim
4884   \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim

```

The dotted line will be extended if the user uses `margin` (or `left-margin` and `right-margin`). The aim is that, by standard the dotted line fits between square brackets (`\hline` doesn't).

```
\begin{bNiceMatrix}
1 & 2 & 3 & 4 \\
\hline
1 & 2 & 3 & 4 \\
\hdottedline
1 & 2 & 3 & 4
\end{bNiceMatrix}
```

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \\ \hdottedline 1 & 2 & 3 & 4 \end{bmatrix}$$

But, if the user uses `margin`, the dotted line extends to have the same width as a `\hline`.

```
\begin{bNiceMatrix}[margin]
1 & 2 & 3 & 4 \\
\hline
1 & 2 & 3 & 4 \\
\hdottedline
1 & 2 & 3 & 4
\end{bNiceMatrix}
```

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \\ \hdottedline 1 & 2 & 3 & 4 \end{bmatrix}$$

```
4885 \@@_qpoint:n { col - 1 }
4886 \dim_set:Nn \l_@@_x_initial_dim
4887 {
4888 \pgf@x +
```

We do a reduction by `\arraycolsep` for the environments with delimiters (and not for the other).

```
4889 \bool_if:NTF \l_@@_NiceArray_bool \c_zero_dim \arraycolsep
4890 - \l_@@_left_margin_dim
4891 }
4892 \@@_qpoint:n { col - \@@_succ:n \c@jCol }
4893 \dim_set:Nn \l_@@_x_final_dim
4894 {
4895 \pgf@x -
4896 \bool_if:NTF \l_@@_NiceArray_bool \c_zero_dim \arraycolsep
4897 + \l_@@_right_margin_dim
4898 }
```

For reasons purely aesthetic, we do an adjustment in the case of a rounded bracket. The correction by `0.5 \l_@@_inter_dots_dim` is *ad hoc* for a better result.

```
4899 \tl_if_eq:NnF \g_@@_left_delim_tl (
4900 { \dim_gadd:Nn \l_@@_x_initial_dim { 0.5 \l_@@_inter_dots_dim } }
4901 \tl_if_eq:NnF \g_@@_right_delim_tl )
4902 { \dim_gsub:Nn \l_@@_x_final_dim { 0.5 \l_@@_inter_dots_dim } }
```

Up to now, we have no option to control the style of the lines drawn by `\hdottedline` and the specifier “.” in the preamble. That’s why we impose the style `standard`.

```
4903 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
4904 \@@_draw_line:
4905 }
```

Vertical dotted lines

```
4906 \cs_new_protected:Npn \@@_vdottedline:n #1
4907 {
4908 \bool_set_true:N \l_@@_initial_open_bool
4909 \bool_set_true:N \l_@@_final_open_bool
```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible”.

```
4910 \bool_if:NTF \c_@@_tikz_loaded_bool
4911 {
4912 \tikzpicture
4913 \@@_vdottedline_i:n { #1 }
4914 \endtikzpicture
```

```

4915     }
4916     {
4917         \pgfpicture
4918         \@@_vdottedline_i:n { #1 }
4919         \endpgfpicture
4920     }
4921 }

```

```

4922 \cs_new_protected:Npn \@@_vdottedline_i:n #1
4923 {

```

The command `\CT@arc@` is a command of `colortbl` which sets the color of the rules in the array. The package `nicematrix` uses it even if `colortbl` is not loaded.

```

4924     \CT@arc@
4925     \pgfrememberpicturepositiononpagetrue
4926     \@@_qpoint:n { col - \int_eval:n { #1 + 1 } }

```

We do a translation `par -\l_@@_radius_dim` because we want the dotted line to have exactly the same position as a vertical rule drawn by “|” (considering the rule having a width equal to the diameter of the dots).

```

4927     \dim_set:Nn \l_@@_x_initial_dim { \pgf@x - \l_@@_radius_dim }
4928     \dim_set:Nn \l_@@_x_final_dim { \pgf@x - \l_@@_radius_dim }
4929     \@@_qpoint:n { row - 1 }

```

We arbitrary decrease the height of the dotted line by a quantity equal to `\l_@@_inter_dots_dim` in order to improve the visual impact.

```

4930     \dim_set:Nn \l_@@_y_initial_dim { \pgf@y - 0.5 \l_@@_inter_dots_dim }
4931     \@@_qpoint:n { row - \@@_succ:n \c@iRow }
4932     \dim_set:Nn \l_@@_y_final_dim { \pgf@y + 0.5 \l_@@_inter_dots_dim }

```

Up to now, we have no option to control the style of the lines drawn by `\hdottedline` and the specifier “:” in the preamble. That’s why we impose the style `standard`.

```

4933     \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
4934     \@@_draw_line:
4935 }

```

The environment `{NiceMatrixBlock}`

The following flag will be raised when all the columns of the environments of the block must have the same width in “auto” mode.

```

4936 \bool_new:N \l_@@_block_auto_columns_width_bool

```

Up to now, there is only one option available for the environment `{NiceMatrixBlock}`.

```

4937 \keys_define:nn { NiceMatrix / NiceMatrixBlock }
4938 {
4939     auto-columns-width .code:n =
4940     {
4941         \bool_set_true:N \l_@@_block_auto_columns_width_bool
4942         \dim_gzero_new:N \g_@@_max_cell_width_dim
4943         \bool_set_true:N \l_@@_auto_columns_width_bool
4944     }
4945 }

```

```

4946 \NewDocumentEnvironment { NiceMatrixBlock } { ! 0 { } }
4947 {
4948     \int_gincr:N \g_@@_NiceMatrixBlock_int
4949     \dim_zero:N \l_@@_columns_width_dim
4950     \keys_set:nn { NiceMatrix / NiceMatrixBlock } { #1 }
4951     \bool_if:NT \l_@@_block_auto_columns_width_bool
4952     {

```

```

4953 \cs_if_exist:cT { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
4954 {
4955     \exp_args:NNc \dim_set:Nn \l_@@_columns_width_dim
4956     { @@_max_cell_width _ \int_use:N \g_@@_NiceMatrixBlock_int }
4957 }
4958 }
4959 }

```

At the end of the environment {NiceMatrixBlock}, we write in the main .aux file instructions for the column width of all the environments of the block (that’s why we have stored the number of the first environment of the block in the counter \l_@@_first_env_block_int).

```

4960 {
4961     \bool_if:NT \l_@@_block_auto_columns_width_bool
4962     {
4963         \iow_shipout:Nn \@mainaux \ExplSyntaxOn
4964         \iow_shipout:Nx \@mainaux
4965         {
4966             \cs_gset:cpn
4967             { @@ _ max _ cell _ width _ \int_use:N \g_@@_NiceMatrixBlock_int }

```

For technical reasons, we have to include the width of a potential rule on the right side of the cells.

```

4968         { \dim_eval:n { \g_@@_max_cell_width_dim + \arrayrulewidth } }
4969     }
4970     \iow_shipout:Nn \@mainaux \ExplSyntaxOff
4971 }
4972 }

```

The extra nodes

First, two variants of the functions \dim_min:nn and \dim_max:nn.

```

4973 \cs_generate_variant:Nn \dim_min:nn { v n }
4974 \cs_generate_variant:Nn \dim_max:nn { v n }

```

The following command is called in \@@_use_arraybox_with_notes_c: just before the construction of the blocks (if the creation of medium nodes is required, medium nodes are also created for the blocks and that construction uses the standard medium nodes).

```

4975 \cs_new_protected:Npn \@@_create_extra_nodes:
4976 {
4977     \bool_if:nTF \l_@@_medium_nodes_bool
4978     {
4979         \bool_if:NTF \l_@@_large_nodes_bool
4980         \@@_create_medium_and_large_nodes:
4981         \@@_create_medium_nodes:
4982     }
4983     { \bool_if:NT \l_@@_large_nodes_bool \@@_create_large_nodes: }
4984 }

```

We have three macros of creation of nodes: \@@_create_medium_nodes:, \@@_create_large_nodes: and \@@_create_medium_and_large_nodes:.

We have to compute the mathematical coordinates of the “medium nodes”. These mathematical coordinates are also used to compute the mathematical coordinates of the “large nodes”. That’s why we write a command \@@_computations_for_medium_nodes: to do these computations.

The command \@@_computations_for_medium_nodes: must be used in a {pgfpicture}.

For each row i , we compute two dimensions $l_@@_row_i_min_dim$ and $l_@@_row_i_max_dim$. The dimension $l_@@_row_i_min_dim$ is the minimal y -value of all the cells of the row i . The dimension $l_@@_row_i_max_dim$ is the maximal y -value of all the cells of the row i .

Similarly, for each column j , we compute two dimensions $l_@@_column_j_min_dim$ and $l_@@_column_j_max_dim$. The dimension $l_@@_column_j_min_dim$ is the minimal x -value of all the cells

of the column j . The dimension `l_@@_column_j_max_dim` is the maximal x -value of all the cells of the column j .

Since these dimensions will be computed as maximum or minimum, we initialize them to `\c_max_dim` or `-\c_max_dim`.

```

4985 \cs_new_protected:Npn \@@_computations_for_medium_nodes:
4986 {
4987   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4988   {
4989     \dim_zero_new:c { l_@@_row_\@@_i: _min_dim }
4990     \dim_set_eq:cN { l_@@_row_\@@_i: _min_dim } \c_max_dim
4991     \dim_zero_new:c { l_@@_row_\@@_i: _max_dim }
4992     \dim_set:cn { l_@@_row_\@@_i: _max_dim } { - \c_max_dim }
4993   }
4994   \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
4995   {
4996     \dim_zero_new:c { l_@@_column_\@@_j: _min_dim }
4997     \dim_set_eq:cN { l_@@_column_\@@_j: _min_dim } \c_max_dim
4998     \dim_zero_new:c { l_@@_column_\@@_j: _max_dim }
4999     \dim_set:cn { l_@@_column_\@@_j: _max_dim } { - \c_max_dim }
5000   }

```

We begin the two nested loops over the rows and the columns of the array.

```

5001   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
5002   {
5003     \int_step_variable:nnNn
5004       \l_@@_first_col_int \g_@@_col_total_int \@@_j:

```

If the cell $(i-j)$ is empty or an implicit cell (that is to say a cell after implicit ampersands `&`) we don't update the dimensions we want to compute.

```

5005     {
5006       \cs_if_exist:cT
5007       { pgf @ sh @ ns @ \@@_env: - \@@_i: - \@@_j: }

```

We retrieve the coordinates of the anchor south west of the (normal) node of the cell $(i-j)$. They will be stored in `\pgf@x` and `\pgf@y`.

```

5008     {
5009       \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { south-west }
5010       \dim_set:cn { l_@@_row_\@@_i: _min_dim }
5011       { \dim_min:vn { l_@@_row _ \@@_i: _min_dim } \pgf@y }
5012       \seq_if_in:NxF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
5013       {
5014         \dim_set:cn { l_@@_column _ \@@_j: _min_dim }
5015         { \dim_min:vn { l_@@_column _ \@@_j: _min_dim } \pgf@x }
5016       }

```

We retrieve the coordinates of the anchor north east of the (normal) node of the cell $(i-j)$. They will be stored in `\pgf@x` and `\pgf@y`.

```

5017       \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { north-east }
5018       \dim_set:cn { l_@@_row _ \@@_i: _ max_dim }
5019       { \dim_max:vn { l_@@_row _ \@@_i: _ max_dim } \pgf@y }
5020       \seq_if_in:NxF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
5021       {
5022         \dim_set:cn { l_@@_column _ \@@_j: _ max_dim }
5023         { \dim_max:vn { l_@@_column _ \@@_j: _ max_dim } \pgf@x }
5024       }
5025     }
5026   }
5027 }

```

Now, we have to deal with empty rows or empty columns since we don't have created nodes in such rows and columns.

```

5028   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
5029   {
5030     \dim_compare:nNnT
5031     { \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } } = \c_max_dim

```

```

5032     {
5033         \@@_qpoint:n { row - \@@_i: - base }
5034         \dim_set:cn { l_@@_row _ \@@_i: _ max _ dim } \pgf@y
5035         \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim } \pgf@y
5036     }
5037 }
5038 \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
5039 {
5040     \dim_compare:nNnT
5041     { \dim_use:c { l_@@_column _ \@@_j: _ min _ dim } } = \c_max_dim
5042     {
5043         \@@_qpoint:n { col - \@@_j: }
5044         \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim } \pgf@y
5045         \dim_set:cn { l_@@_column _ \@@_j: _ min _ dim } \pgf@y
5046     }
5047 }
5048 }

```

Here is the command `\@@_create_medium_nodes:`. When this command is used, the “medium nodes” are created.

```

5049 \cs_new_protected:Npn \@@_create_medium_nodes:
5050 {
5051     \pgfpicture
5052     \pgfrememberpicturepositiononpagetrue
5053     \pgf@relevantforpicturesizefalse
5054     \@@_computations_for_medium_nodes:

```

Now, we can create the “medium nodes”. We use a command `\@@_create_nodes:` because this command will also be used for the creation of the “large nodes”.

```

5055     \tl_set:Nn \l_@@_suffix_tl { -medium }
5056     \@@_create_nodes:
5057     \endpgfpicture
5058 }

```

The command `\@@_create_large_nodes:` must be used when we want to create only the “large nodes” and not the medium ones⁶³. However, the computation of the mathematical coordinates of the “large nodes” needs the computation of the mathematical coordinates of the “medium nodes”. Hence, we use first `\@@_computations_for_medium_nodes:` and then the command `\@@_computations_for_large_nodes:`.

```

5059 \cs_new_protected:Npn \@@_create_large_nodes:
5060 {
5061     \pgfpicture
5062     \pgfrememberpicturepositiononpagetrue
5063     \pgf@relevantforpicturesizefalse
5064     \@@_computations_for_medium_nodes:
5065     \@@_computations_for_large_nodes:
5066     \tl_set:Nn \l_@@_suffix_tl { - large }
5067     \@@_create_nodes:
5068     \endpgfpicture
5069 }
5070 \cs_new_protected:Npn \@@_create_medium_and_large_nodes:
5071 {
5072     \pgfpicture
5073     \pgfrememberpicturepositiononpagetrue
5074     \pgf@relevantforpicturesizefalse
5075     \@@_computations_for_medium_nodes:

```

Now, we can create the “medium nodes”. We use a command `\@@_create_nodes:` because this command will also be used for the creation of the “large nodes”.

⁶³If we want to create both, we have to use `\@@_create_medium_and_large_nodes:`

```

5076     \tl_set:Nn \l_@@_suffix_tl { - medium }
5077     \@@_create_nodes:
5078     \@@_computations_for_large_nodes:
5079     \tl_set:Nn \l_@@_suffix_tl { - large }
5080     \@@_create_nodes:
5081 \endpgfpicture
5082 }

```

For “large nodes”, the exterior rows and columns don’t interfere. That’s why the loop over the columns will start at 1 and stop at `\c@jCol` (and not `\g_@@_col_total_int`). Idem for the rows.

```

5083 \cs_new_protected:Npn \@@_computations_for_large_nodes:
5084 {
5085     \int_set:Nn \l_@@_first_row_int 1
5086     \int_set:Nn \l_@@_first_col_int 1

```

We have to change the values of all the dimensions `l_@@_row_i_min_dim`, `l_@@_row_i_max_dim`, `l_@@_column_j_min_dim` and `l_@@_column_j_max_dim`.

```

5087     \int_step_variable:nNn { \c@iRow - 1 } \@@_i:
5088     {
5089         \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim }
5090         {
5091             (
5092                 \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } +
5093                 \dim_use:c { l_@@_row _ \@@_succ:n \@@_i: _ max _ dim }
5094             )
5095             / 2
5096         }
5097         \dim_set_eq:cc { l_@@_row _ \@@_succ:n \@@_i: _ max _ dim }
5098         { l_@@_row _ \@@_i: _ min _ dim }
5099     }
5100     \int_step_variable:nNn { \c@jCol - 1 } \@@_j:
5101     {
5102         \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim }
5103         {
5104             (
5105                 \dim_use:c { l_@@_column _ \@@_j: _ max _ dim } +
5106                 \dim_use:c
5107                 { l_@@_column _ \@@_succ:n \@@_j: _ min _ dim }
5108             )
5109             / 2
5110         }
5111         \dim_set_eq:cc { l_@@_column _ \@@_succ:n \@@_j: _ min _ dim }
5112         { l_@@_column _ \@@_j: _ max _ dim }
5113     }

```

Here, we have to use `\dim_sub:cn` because of the number 1 in the name.

```

5114     \dim_sub:cn
5115     { l_@@_column _ 1 _ min _ dim }
5116     \l_@@_left_margin_dim
5117     \dim_add:cn
5118     { l_@@_column _ \int_use:N \c@jCol _ max _ dim }
5119     \l_@@_right_margin_dim
5120 }

```

The command `\@@_create_nodes:` is used twice: for the construction of the “medium nodes” and for the construction of the “large nodes”. The nodes are constructed with the value of all the dimensions `l_@@_row_i_min_dim`, `l_@@_row_i_max_dim`, `l_@@_column_j_min_dim` and `l_@@_column_j_max_dim`. Between the construction of the “medium nodes” and the “large nodes”, the values of these dimensions are changed.

The function also uses `\l_@@_suffix_tl` (-medium or -large).

```

5121 \cs_new_protected:Npn \@@_create_nodes:
5122 {

```

```

5123 \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
5124 {
5125     \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
5126     {

```

We draw the rectangular node for the cell ($\backslash\@@_i-\backslash\@@_j$).

```

5127         \@@_pgf_rect_node:nnnnn
5128         { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
5129         { \dim_use:c { l_@@_column_ \@@_j: _min_dim } }
5130         { \dim_use:c { l_@@_row_ \@@_i: _min_dim } }
5131         { \dim_use:c { l_@@_column_ \@@_j: _max_dim } }
5132         { \dim_use:c { l_@@_row_ \@@_i: _max_dim } }
5133     \str_if_empty:NF \l_@@_name_str
5134     {
5135         \pgfnodealias
5136         { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
5137         { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
5138     }
5139 }
5140 }

```

Now, we create the nodes for the cells of the `\multicolumn`. We recall that we have stored in `\g_@@_multicolumn_cells_seq` the list of the cells where a `\multicolumn{n}{...}{...}` with $n > 1$ was issued and in `\g_@@_multicolumn_sizes_seq` the correspondent values of n .

```

5141 \seq_mapthread_function:NNN
5142 \g_@@_multicolumn_cells_seq
5143 \g_@@_multicolumn_sizes_seq
5144 \@@_node_for_multicolumn:nn
5145 }

```

```

5146 \cs_new_protected:Npn \@@_extract_coords_values: #1 - #2 \q_stop
5147 {
5148     \cs_set_nopar:Npn \@@_i: { #1 }
5149     \cs_set_nopar:Npn \@@_j: { #2 }
5150 }

```

The command `\@@_node_for_multicolumn:nn` takes two arguments. The first is the position of the cell where the command `\multicolumn{n}{...}{...}` was issued in the format $i-j$ and the second is the value of n (the length of the “multi-cell”).

```

5151 \cs_new_protected:Npn \@@_node_for_multicolumn:nn #1 #2
5152 {
5153     \@@_extract_coords_values: #1 \q_stop
5154     \@@_pgf_rect_node:nnnnn
5155     { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
5156     { \dim_use:c { l_@@_column_ \@@_j: _min_dim } }
5157     { \dim_use:c { l_@@_row_ \@@_i: _min_dim } }
5158     { \dim_use:c { l_@@_column_ \int_eval:n { \@@_j: +#2-1 } _max_dim } }
5159     { \dim_use:c { l_@@_row_ \@@_i: _max_dim } }
5160     \str_if_empty:NF \l_@@_name_str
5161     {
5162         \pgfnodealias
5163         { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
5164         { \int_use:N \g_@@_env_int - \@@_i: - \@@_j: \l_@@_suffix_tl }
5165     }
5166 }

```

The blocks

The code deals with the command `\Block`. This command has no direct link with the environment `\NiceMatrixBlock`.

The options of the command `\Block` will be analyzed first in the cell of the array (and once again when the block will be put in the array). Here is the set of keys for the first pass.

```

5167 \keys_define:nn { NiceMatrix / Block / FirstPass }
5168 {
5169   l .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl l ,
5170   l .value_forbidden:n = true ,
5171   r .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl r ,
5172   r .value_forbidden:n = true ,
5173   c .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl c ,
5174   c .value_forbidden:n = true ,
5175   L .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl L ,
5176   L .value_forbidden:n = true ,
5177   R .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl R ,
5178   R .value_forbidden:n = true ,
5179   C .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl C ,
5180   C .value_forbidden:n = true ,
5181   t .code:n = \tl_set:Nn \l_@@_vpos_of_block_tl t ,
5182   t .value_forbidden:n = true ,
5183   b .code:n = \tl_set:Nn \l_@@_vpos_of_block_tl b ,
5184   b .value_forbidden:n = true ,
5185   color .tl_set:N = \l_@@_color_tl ,
5186   color .value_required:n = true ,
5187 }

```

The following command `\@@_Block:` will be linked to `\Block` in the environments of `nicematrix`. We define it with `\NewExpandableDocumentCommand` because it has an optional argument between `<` and `>` (for TeX instructions put before the math mode of the label and before the beginning of the small array of the block). It's mandatory to use an expandable command.

```

5188 \NewExpandableDocumentCommand \@@_Block: { 0 { } m D < > { } m }
5189 {

```

If the first mandatory argument of the command (which is the size of the block with the syntax $i-j$) has not been provided by the user, you use 1-1 (that is to say a block of only one cell).

```

5190   \peek_remove_spaces:n
5191   {
5192     \tl_if_blank:nTF { #2 }
5193     { \@@_Block_i 1-1 \q_stop }
5194     { \@@_Block_i #2 \q_stop }
5195     { #1 } { #3 } { #4 }
5196   }
5197 }

```

With the following construction, we extract the values of i and j in the first mandatory argument of the command.

```

5198 \cs_new:Npn \@@_Block_i #1-#2 \q_stop { \@@_Block_ii:nnnnn { #1 } { #2 } }

```

Now, the arguments have been extracted: `#1` is i (the number of rows of the block), `#2` is j (the number of columns of the block), `#3` is the list of key-values, `#4` are the tokens to put before the math mode and the beginning of the small array of the block and `#5` is the label of the block.

```

5199 \cs_new_protected:Npn \@@_Block_ii:nnnnn #1 #2 #3 #4 #5
5200 {

```

We recall that `#1` and `#2` have been extracted from the first mandatory argument of `\Block` (which is of the syntax $i-j$). However, the user is allowed to omit i or j (or both). We detect that situation by replacing a missing value by 100 (it's a convention: when the block will actually be drawn these values will be detected and interpreted as *maximal possible value* according to the actual size of the array).

```

5201   \bool_lazy_or:nnTF
5202   { \tl_if_blank_p:n { #1 } }
5203   { \str_if_eq_p:nn { #1 } { * } }
5204   { \int_set:Nn \l_tmpa_int { 100 } }
5205   { \int_set:Nn \l_tmpa_int { #1 } }

```

```

5206 \bool_lazy_or:nnTF
5207 { \tl_if_blank_p:n { #2 } }
5208 { \str_if_eq_p:nn { #2 } { * } }
5209 { \int_set:Nn \l_tmpb_int { 100 } }
5210 { \int_set:Nn \l_tmpb_int { #2 } }

```

If the block is mono-column.

```

5211 \int_compare:nNnTF \l_tmpb_int = 1
5212 {
5213   \tl_if_empty:NTF \l_@@_cell_type_tl
5214   { \tl_set:Nn \l_@@_hpos_of_block_tl c }
5215   { \tl_set_eq:NN \l_@@_hpos_of_block_tl \l_@@_cell_type_tl }
5216 }
5217 { \tl_set:Nn \l_@@_hpos_of_block_tl c }

```

The value of `\l_@@_hpos_of_block_tl` may be modified by the keys of the command `\Block` that we will analyze now.

```

5218 \keys_set_known:nn { NiceMatrix / Block / FirstPass } { #3 }
5219 \tl_set:Nx \l_tmpa_tl
5220 {
5221   { \int_use:N \c@iRow }
5222   { \int_use:N \c@jCol }
5223   { \int_eval:n { \c@iRow + \l_tmpa_int - 1 } }
5224   { \int_eval:n { \c@jCol + \l_tmpb_int - 1 } }
5225 }

```

Now, `\l_tmpa_tl` contains an “object” corresponding to the position of the block with four components, each of them surrounded by curly brackets:

`{imin}{jmin}{imax}{jmax}`.

If the block is mono-column or mono-row, we have a special treatment. That’s why we have two macros: `\@@_Block_iv:nnnnn` and `\@@_Block_v:nnnnn` (the five arguments of those macros are provided by curryfication).

```

5226 \bool_lazy_or:nnTF
5227 { \int_compare_p:nNn { \l_tmpa_int } = 1 }
5228 { \int_compare_p:nNn { \l_tmpb_int } = 1 }
5229 { \exp_args:Nxx \@@_Block_iv:nnnnn }
5230 { \exp_args:Nxx \@@_Block_v:nnnnn }
5231 { \l_tmpa_int } { \l_tmpb_int } { #3 } { #4 } { #5 }
5232 }

```

The following macro is for the case of a `\Block` which is mono-row or mono-column (or both). In that case, the content of the block is composed right now in a box (because we have to take into account the dimensions of that box for the width of the current column or the height and the depth of the current row). However, that box will be put in the array *after the construction of the array* (by using PGF).

```

5233 \cs_new_protected:Npn \@@_Block_iv:nnnnn #1 #2 #3 #4 #5
5234 {
5235   \int_gincr:N \g_@@_block_box_int
5236   \cs_set_protected_nopar:Npn \diagbox ##1 ##2
5237   {
5238     \tl_gput_right:Nx \g_@@_internal_code_after_tl
5239     {
5240       \@@_actually_diagbox:nnnnnn
5241       { \int_use:N \c@iRow }
5242       { \int_use:N \c@jCol }
5243       { \int_eval:n { \c@iRow + #1 - 1 } }
5244       { \int_eval:n { \c@jCol + #2 - 1 } }
5245       { \exp_not:n { ##1 } } { \exp_not:n { ##2 } }
5246     }
5247   }
5248   \box_gclear_new:c

```

```

5249 { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
5250 \hbox_gset:cn
5251 { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
5252 {

```

For a mono-column block, if the user has specified a color for the column in the preamble of the array, we want to fix that color in the box we construct. We do that with `\set@color` and not `\color_ensure_current`: because that command seems to be bugged: it doesn't work in XeLaTeX when `fontspec` is loaded.

```

5253 \tl_if_empty:NTF \l_@@_color_tl
5254 { \int_compare:nNnT { #2 } = 1 \set@color }
5255 { \color { \l_@@_color_tl } }

```

If the block is mono-row, we use `\g_@@_row_style_tl` even it has yet been used in the beginning of the cell where the command `\Block` has been issued because we want to be able to take into account a potential instruction of color of the font in `\g_@@_row_style_tl`.

```

5256 \int_compare:nNnT { #1 } = 1 \g_@@_row_style_tl
5257 \group_begin:
5258 \cs_set:Npn \arraystretch { 1 }
5259 \dim_set_eq:NN \extrarowheight \c_zero_dim
5260 #4

```

If the box is rotated (the key `\rotate` may be in the previous #4), the tabular used for the content of the cell will be constructed with a format `c`. In the other cases, the tabular will be constructed with a format equal to the key of position of the box. In other words: the alignment internal to the tabular is the same as the external alignment of the tabular (that is to say the position of the block in its zone of merged cells).

```

5261 \bool_if:NT \g_@@_rotate_bool { \tl_set:Nn \l_@@_hpos_of_block_tl c }
5262 \bool_if:NTF \l_@@_NiceTabular_bool
5263 {
5264   \use:x
5265   {
5266     \exp_not:N \begin { tabular } [ \l_@@_vpos_of_block_tl ]
5267       { @ { } \l_@@_hpos_of_block_tl @ { } }
5268   }
5269   #5
5270   \end { tabular }
5271 }
5272 {
5273   \c_math_toggle_token
5274   \use:x
5275   {
5276     \exp_not:N \begin { array } [ \l_@@_vpos_of_block_tl ]
5277       { @ { } \l_@@_hpos_of_block_tl @ { } }
5278   }
5279   #5
5280   \end { array }
5281   \c_math_toggle_token
5282 }
5283 \group_end:
5284 }
5285 \bool_if:NT \g_@@_rotate_bool
5286 {
5287   \box_grotate:cn
5288   { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
5289   { 90 }
5290   \bool_gset_false:N \g_@@_rotate_bool
5291 }

```

If we are in a mono-column block, we take into account the width of that block for the width of the column.

```

5292 \int_compare:nNnT { #2 } = 1
5293 {
5294   \dim_gset:Nn \g_@@_blocks_wd_dim

```

```

5295     {
5296         \dim_max:nn
5297         \g_@@_blocks_wd_dim
5298         {
5299             \box_wd:c
5300             { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
5301         }
5302     }
5303 }

```

If we are in a mono-row block, we take into account the height and the depth of that block for the height and the depth of the row.

```

5304     \int_compare:nNnT { #1 } = 1
5305     {
5306         \dim_gset:Nn \g_@@_blocks_ht_dim
5307         {
5308             \dim_max:nn
5309             \g_@@_blocks_ht_dim
5310             {
5311                 \box_ht:c
5312                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
5313             }
5314         }
5315         \dim_gset:Nn \g_@@_blocks_dp_dim
5316         {
5317             \dim_max:nn
5318             \g_@@_blocks_dp_dim
5319             {
5320                 \box_dp:c
5321                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
5322             }
5323         }
5324     }
5325     \seq_gput_right:Nx \g_@@_blocks_seq
5326     {
5327         \l_tmpa_tl

```

In the list of options #3, maybe there is a key for the horizontal alignment (l, r or c). In that case, that key has been read and stored in \l_@@_hpos_of_block_tl. However, maybe there were no key of the horizontal alignment and that's why we put a key corresponding to the value of \l_@@_hpos_of_block_tl, which is fixed by the type of current column.

```

5328         { \exp_not:n { #3 } , \l_@@_hpos_of_block_tl }
5329         {
5330             \box_use_drop:c
5331             { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
5332         }
5333     }
5334 }

```

The following macro is for the standard case, where the block is not mono-row and not mono-column. In that case, the content of the block is *not* composed right now in a box. The composition in a box will be done further, just after the construction of the array.

```

5335     \cs_new_protected:Npn \@@_Block_v:nnnnn #1 #2 #3 #4 #5
5336     {
5337         \seq_gput_right:Nx \g_@@_blocks_seq
5338         {
5339             \l_tmpa_tl
5340             { \exp_not:n { #3 } }
5341             \exp_not:n
5342             {
5343                 {
5344                     \bool_if:NTF \l_@@_NiceTabular_bool
5345                     {

```

```

5346         \group_begin:
5347         \cs_set:Npn \arraystretch { 1 }
5348         \dim_set_eq:NN \extrarowheight \c_zero_dim
5349         #4

```

If the box is rotated (the key `\rotate` may be in the previous #4), the tabular used for the content of the cell will be constructed with a format `c`. In the other cases, the tabular will be constructed with a format equal to the key of position of the box. In other words: the alignment internal to the tabular is the same as the external alignment of the tabular (that is to say the position of the block in its zone of merged cells).

```

5350         \bool_if:NT \g_@@_rotate_bool
5351         { \tl_set:Nn \l_@@_hpos_of_block_tl c }
5352         \use:x
5353         {
5354             \exp_not:N \begin { tabular } [ \l_@@_vpos_of_block_tl ]
5355             { @ { } \l_@@_hpos_of_block_tl @ { } }
5356         }
5357         #5
5358         \end { tabular }
5359         \group_end:
5360     }
5361 {
5362     \group_begin:
5363     \cs_set:Npn \arraystretch { 1 }
5364     \dim_set_eq:NN \extrarowheight \c_zero_dim
5365     #4
5366     \bool_if:NT \g_@@_rotate_bool
5367     { \tl_set:Nn \l_@@_hpos_of_block_tl c }
5368     \c_math_toggle_token
5369     \use:x
5370     {
5371         \exp_not:N \begin { array } [ \l_@@_vpos_of_block_tl ]
5372         { @ { } \l_@@_hpos_of_block_tl @ { } }
5373     }
5374     #5
5375     \end { array }
5376     \c_math_toggle_token
5377     \group_end:
5378 }
5379 }
5380 }
5381 }
5382 }

```

We recall that the options of the command `\Block` are analyzed twice: first in the cell of the array and once again when the block will be put in the array *after the construction of the array* (by using PGF).

```

5383 \keys_define:nn { NiceMatrix / Block / SecondPass }
5384 {
5385     fill .tl_set:N = \l_@@_fill_tl ,
5386     fill .value_required:n = true ,
5387     draw .tl_set:N = \l_@@_draw_tl ,
5388     draw .default:n = default ,
5389     rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
5390     rounded-corners .default:n = 4 pt ,
5391     color .code:n = \color { #1 } \tl_set:Nn \l_@@_draw_tl { #1 } ,
5392     color .value_required:n = true ,
5393     borders .clist_set:N = \l_@@_borders_clist ,
5394     borders .value_required:n = true ,
5395     hvlines .bool_set:N = \l_@@_hvlines_block_bool ,
5396     hvlines .default:n = true ,
5397     line-width .dim_set:N = \l_@@_line_width_dim ,

```

```

5398   line-width .value_required:n = true ,
5399   l .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl l ,
5400   l .value_forbidden:n = true ,
5401   r .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl r ,
5402   r .value_forbidden:n = true ,
5403   c .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl c ,
5404   c .value_forbidden:n = true ,
5405   L .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl l
5406             \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
5407   L .value_forbidden:n = true ,
5408   R .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl r
5409             \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
5410   R .value_forbidden:n = true ,
5411   C .code:n = \tl_set:Nn \l_@@_hpos_of_block_tl c
5412             \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
5413   C .value_forbidden:n = true ,
5414   t .code:n = \tl_set:Nn \l_@@_vpos_of_block_tl t ,
5415   t .value_forbidden:n = true ,
5416   b .code:n = \tl_set:Nn \l_@@_vpos_of_block_tl b ,
5417   b .value_forbidden:n = true ,
5418   unknown .code:n = \@@_error:n { Unknown~key~for~Block }
5419 }

```

The command `\@@_draw_blocks:` will draw all the blocks. This command is used after the construction of the array. We have to revert to a clean version of `\ialign` because there may be tabulars in the `\Block` instructions that will be composed now.

```

5420 \cs_new_protected:Npn \@@_draw_blocks:
5421 {
5422   \cs_set_eq:NN \ialign \@@_old_ialign:
5423   \seq_map_inline:Nn \g_@@_blocks_seq { \@@_Block_iv:nnnnnn ##1 }
5424 }
5425 \cs_new_protected:Npn \@@_Block_iv:nnnnnn #1 #2 #3 #4 #5 #6
5426 {

```

The integer `\l_@@_last_row_int` will be the last row of the block and `\l_@@_last_col_int` its last column.

```

5427   \int_zero_new:N \l_@@_last_row_int
5428   \int_zero_new:N \l_@@_last_col_int

```

We remind that the first mandatory argument of the command `\Block` is the size of the block with the special format *i-j*. However, the user is allowed to omit *i* or *j* (or both). This will be interpreted as: the last row (resp. column) of the block will be the last row (resp. column) of the block (without the potential exterior row—resp. column—of the array). By convention, this is stored in `\g_@@_blocks_seq` as a number of rows (resp. columns) for the block equal to 100. That's what we detect now.

```

5429   \int_compare:nNnTF { #3 } > { 99 }
5430   { \int_set_eq:NN \l_@@_last_row_int \c@iRow }
5431   { \int_set:Nn \l_@@_last_row_int { #3 } }
5432   \int_compare:nNnTF { #4 } > { 99 }
5433   { \int_set_eq:NN \l_@@_last_col_int \c@jCol }
5434   { \int_set:Nn \l_@@_last_col_int { #4 } }
5435   \int_compare:nNnTF \l_@@_last_col_int > \g_@@_col_total_int
5436   {
5437     \int_compare:nTF
5438     { \l_@@_last_col_int <= \g_@@_static_num_of_col_int }
5439     {
5440       \msg_error:nnnn { nicematrix } { Block~too~large~2 } { #1 } { #2 }
5441       \@@_msg_redirect_name:nn { Block~too~large~2 } { none }
5442       \group_begin:
5443       \globaldefs = 1
5444       \@@_msg_redirect_name:nn { columns~not~used } { none }
5445       \group_end:

```

```

5446     }
5447     { \msg_error:nnnn { nicematrix } { Block~too~large~1 } { #1 } { #2 } }
5448   }
5449   {
5450     \int_compare:nNnTF \l_@@_last_row_int > \g_@@_row_total_int
5451     { \msg_error:nnnn { nicematrix } { Block~too~large~1 } { #1 } { #2 } }
5452     { \@@_Block_v:nnnnnn { #1 } { #2 } { #3 } { #4 } { #5 } { #6 } }
5453   }
5454 }
5455 \cs_new_protected:Npn \@@_Block_v:nnnnnn #1 #2 #3 #4 #5 #6
5456 {

```

The sequence of the positions of the blocks will be used when drawing the rules (in fact, there is also the `\multicolumn` and the `\diagbox` in that sequence).

```

5457   \seq_gput_left:Nn \g_@@_pos_of_blocks_seq { { #1 } { #2 } { #3 } { #4 } }

```

The group is for the keys.

```

5458   \group_begin:
5459   \keys_set:nn { NiceMatrix / Block / SecondPass } { #5 }
5460   \bool_if:NT \l_@@_hvlines_block_bool
5461   {
5462     \tl_gput_right:Nx \g_nicematrix_code_after_tl
5463     {
5464       \@@_hvlines_block:nnn
5465       { \exp_not:n { #5 } }
5466       { #1 - #2 }
5467       { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
5468     }
5469   }
5470   \tl_if_empty:NF \l_@@_draw_tl
5471   {
5472     \tl_gput_right:Nx \g_nicematrix_code_after_tl
5473     {
5474       \@@_stroke_block:nnn
5475       { \exp_not:n { #5 } }
5476       { #1 - #2 }
5477       { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
5478     }
5479     \seq_gput_right:Nn \g_@@_pos_of_stroken_blocks_seq
5480     { { #1 } { #2 } { #3 } { #4 } }
5481   }
5482   \clist_if_empty:NF \l_@@_borders_clist
5483   {
5484     \tl_gput_right:Nx \g_nicematrix_code_after_tl
5485     {
5486       \@@_stroke_borders_block:nnn
5487       { \exp_not:n { #5 } }
5488       { #1 - #2 }
5489       { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
5490     }
5491   }
5492   \tl_if_empty:NF \l_@@_fill_tl
5493   {

```

The command `\@@_extract_brackets` will extract the potential specification of color space at the beginning of `\l_@@_fill_tl` and store it in `\l_tmpa_tl` and store the color itself in `\l_tmpb_tl`.

```

5494     \exp_last_unbraced:NV \@@_extract_brackets \l_@@_fill_tl \q_stop
5495     \tl_gput_right:Nx \g_nicematrix_code_before_tl
5496     {
5497       \exp_not:N \roundedrectanglecolor
5498       [ \l_tmpa_tl ]
5499       { \exp_not:V \l_tmpb_tl }

```

```

5500         { #1 - #2 }
5501         { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
5502         { \dim_use:N \l_@@_rounded_corners_dim }
5503     }
5504 }

5505 \cs_set_protected_nopar:Npn \diagbox ##1 ##2
5506 {
5507     \tl_gput_right:Nx \g_@@_internal_code_after_tl
5508     {
5509         \@@_actually_diagbox:nnnnnn
5510         { #1 }
5511         { #2 }
5512         { \int_use:N \l_@@_last_row_int }
5513         { \int_use:N \l_@@_last_col_int }
5514         { \exp_not:n { ##1 } } { \exp_not:n { ##2 } }
5515     }
5516 }

5517 \hbox_set:Nn \l_@@_cell_box { \set@color #6 }
5518 \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:

```

Let's consider the following `{NiceTabular}`. Because of the instruction `!\hspace{1cm}` in the preamble which increases the space between the columns (by adding, in fact, that space to the previous column, that is to say the second column of the tabular), we will create *two* nodes relative to the block: the node `1-1-block` and the node `1-1-block-short`.

```

\begin{NiceTabular}{cc!\hspace{1cm}}c}
\Block{2-2}{our block} &      & one      & \\
                        &      & two      & \\
three                  & four & five     & \\
six                    & seven & eight    & \\
\end{NiceTabular}

```

We highlight the node `1-1-block`

our block		one
		two
three	four	five
six	seven	eight

We highlight the node `1-1-block-short`

our block		one
		two
three	four	five
six	seven	eight

The construction of the node corresponding to the merged cells.

```

5519 \pgfpicture
5520 \pgfrememberpicturepositiononpagetrue
5521 \pgf@relevantforpicturesizefalse
5522 \@@_qpoint:n { row - #1 }
5523 \dim_set_eq:NN \l_tmpa_dim \pgf@y
5524 \@@_qpoint:n { col - #2 }
5525 \dim_set_eq:NN \l_tmpb_dim \pgf@x
5526 \@@_qpoint:n { row - \@@_succ:n { \l_@@_last_row_int } }
5527 \dim_set_eq:NN \l_tmpc_dim \pgf@y
5528 \@@_qpoint:n { col - \@@_succ:n { \l_@@_last_col_int } }
5529 \dim_set_eq:NN \l_tmpd_dim \pgf@x

```

We construct the node for the block with the name `(#1-#2-block)`.

The function `\@@_pgf_rect_node:nnnnn` takes in as arguments the name of the node and the four coordinates of two opposite corner points of the rectangle.

```

5530 \begin { pgfscope }
5531 \@@_pgf_rect_node:nnnnn
5532 { \@@_env: - #1 - #2 - block }
5533 \l_tmpb_dim \l_tmpa_dim \l_tmpd_dim \l_tmpc_dim
5534 \end { pgfscope }

```

Now, we create the “short node” which, in general, will be used to put the label (that is to say the content of the node). However, if one the keys L, C or R is used (that information is provided by the boolean `\l_@@_hpos_of_block_cap_bool`), we don’t need to create that node since the normal node is used to put the label.

```

5535     \bool_if:NF \l_@@_hpos_of_block_cap_bool
5536     {
5537         \dim_set_eq:NN \l_tmpb_dim \c_max_dim

```

The short node is constructed by taking into account the *contents* of the columns involved in at least one cell of the block. That’s why we have to do a loop over the rows of the array.

```

5538         \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
5539         {

```

We recall that, when a cell is empty, no (normal) node is created in that cell. That’s why we test the existence of the node before using it.

```

5540             \cs_if_exist:cT
5541             { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
5542             {
5543                 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
5544                 {
5545                     \pgfpointanchor { \@@_env: - ##1 - #2 } { west }
5546                     \dim_set:Nn \l_tmpb_dim { \dim_min:nn \l_tmpb_dim \pgf@x }
5547                 }
5548             }
5549         }

```

If all the cells of the column were empty, `\l_tmpb_dim` has still the same value `\c_max_dim`. In that case, you use for `\l_tmpb_dim` the value of the position of the vertical rule.

```

5550         \dim_compare:nNnT \l_tmpb_dim = \c_max_dim
5551         {
5552             \@@_qpoint:n { col - #2 }
5553             \dim_set_eq:NN \l_tmpb_dim \pgf@x
5554         }
5555         \dim_set:Nn \l_tmpd_dim { - \c_max_dim }
5556         \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
5557         {
5558             \cs_if_exist:cT
5559             { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
5560             {
5561                 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
5562                 {
5563                     \pgfpointanchor
5564                     { \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
5565                     { east }
5566                     \dim_set:Nn \l_tmpd_dim { \dim_max:nn \l_tmpd_dim \pgf@x }
5567                 }
5568             }
5569         }
5570         \dim_compare:nNnT \l_tmpd_dim = { - \c_max_dim }
5571         {
5572             \@@_qpoint:n { col - \@@_succ:n { \l_@@_last_col_int } }
5573             \dim_set_eq:NN \l_tmpd_dim \pgf@x
5574         }
5575         \@@_pgf_rect_node:nnnnn
5576         { \@@_env: - #1 - #2 - block - short }
5577         \l_tmpb_dim \l_tmpa_dim \l_tmpd_dim \l_tmpe_dim
5578     }

```

If the creation of the “medium nodes” is required, we create a “medium node” for the block. The function `\@@_pgf_rect_node:nnn` takes in as arguments the name of the node and two PGF points.

```

5579     \bool_if:NT \l_@@_medium_nodes_bool
5580     {
5581         \@@_pgf_rect_node:nnn

```

```

5582 { \@@_env: - #1 - #2 - block - medium }
5583 { \pgfpointanchor { \@@_env: - #1 - #2 - medium } { north-west } }
5584 {
5585   \pgfpointanchor
5586   { \@@_env:
5587     - \int_use:N \l_@@_last_row_int
5588     - \int_use:N \l_@@_last_col_int - medium
5589   }
5590   { south-east }
5591 }
5592 }

```

Now, we will put the label of the block beginning with the case of a \Block of one row.

```

5593 \int_compare:nNnTF { #1 } = { #3 }
5594 {

```

We take into account the case of a block of one row in the “first row” or the “last row”.

```

5595   \int_compare:nNnTF { #1 } = 0
5596   { \l_@@_code_for_first_row_tl }
5597   {
5598     \int_compare:nNnT { #1 } = \l_@@_last_row_int
5599     \l_@@_code_for_last_row_tl
5600   }

```

If the block has only one row, we want the label of the block perfectly aligned on the baseline of the row. That’s why we have constructed a \pgfcoordinate on the baseline of the row, in the first column of the array. Now, we retrieve the y -value of that node and we store it in \l_tmpa_dim.

```

5601   \pgfextracty \l_tmpa_dim { \@@_qpoint:n { row - #1 - base } }

```

We retrieve (in \pgf@x) the x -value of the center of the block.

```

5602   \pgfpointanchor
5603   {
5604     \@@_env: - #1 - #2 - block
5605     \bool_if:NF \l_@@_hpos_of_block_cap_bool { - short }
5606   }
5607   {
5608     \str_case:Vn \l_@@_hpos_of_block_tl
5609     {
5610       c { center }
5611       l { west }
5612       r { east }
5613     }
5614   }

```

We put the label of the block which has been composed in \l_@@_cell_box.

```

5615   \pgftransformshift { \pgfpoint \pgf@x \l_tmpa_dim }
5616   \pgfset { inner~sep = \c_zero_dim }
5617   \pgfnode
5618   { rectangle }
5619   {
5620     \str_case:Vn \l_@@_hpos_of_block_tl
5621     {
5622       c { base }
5623       l { base~west }
5624       r { base~east }
5625     }
5626   }
5627   { \box_use_drop:N \l_@@_cell_box } { } { }
5628 }

```

If the number of rows is different of 1, we will put the label of the block by using the short node (the label of the block has been composed in \l_@@_cell_box).

```

5629 {

```

If we are in the first column, we must put the block as if it was with the key `r`.

```

5630     \int_compare:nNnT { #2 } = 0
5631     { \tl_set:Nn \l_@@_hpos_of_block_tl r }
5632     \bool_if:nT \g_@@_last_col_found_bool
5633     {
5634         \int_compare:nNnT { #2 } = \g_@@_col_total_int
5635         { \tl_set:Nn \l_@@_hpos_of_block_tl 1 }
5636     }
5637     \pgftransformshift
5638     {
5639         \pgfpointanchor
5640         {
5641             \@@_env: - #1 - #2 - block
5642             \bool_if:NF \l_@@_hpos_of_block_cap_bool { - short }
5643         }
5644         {
5645             \str_case:Vn \l_@@_hpos_of_block_tl
5646             {
5647                 c { center }
5648                 l { west }
5649                 r { east }
5650             }
5651         }
5652     }
5653     \pgfset { inner-sep = \c_zero_dim }
5654     \pgfnode
5655     { rectangle }
5656     {
5657         \str_case:Vn \l_@@_hpos_of_block_tl
5658         {
5659             c { center }
5660             l { west }
5661             r { east }
5662         }
5663     }
5664     { \box_use_drop:N \l_@@_cell_box } { } { }
5665 }
5666 \endpgfpicture
5667 \group_end:
5668 }

```

```

5669 \NewDocumentCommand \@@_extract_brackets { 0 { } }
5670 {
5671     \tl_set:Nn \l_tmpa_tl { #1 }
5672     \@@_store_in_tmpb_tl
5673 }
5674 \cs_new_protected:Npn \@@_store_in_tmpb_tl #1 \q_stop
5675 { \tl_set:Nn \l_tmpb_tl { #1 } }

```

The first argument of `\@@_stroke_block:nnn` is a list of options for the rectangle that you will stroke. The second argument is the upper-left cell of the block (with, as usual, the syntax *i-j*) and the third is the last cell of the block (with the same syntax).

```

5676 \cs_new_protected:Npn \@@_stroke_block:nnn #1 #2 #3
5677 {
5678     \group_begin:
5679     \tl_clear:N \l_@@_draw_tl
5680     \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
5681     \keys_set_known:nn { NiceMatrix / BlockStroke } { #1 }
5682     \pgfpicture
5683     \pgfrememberpicturepositiononpagetrue
5684     \pgf@relevantforpicturesizefalse
5685     \tl_if_empty:NF \l_@@_draw_tl

```

```

5686 {
If the user has used the key color of the command \Block without value, the color fixed by
\arrayrulecolor is used.
5687 \str_if_eq:VnTF \l_@@_draw_tl { default }
5688 { \CT@arc@ }
5689 { \exp_args:NV \pgfsetstrokecolor \l_@@_draw_tl }
5690 }
5691 \pgfsetcornersarced
5692 {
5693 \pgfpoint
5694 { \dim_use:N \l_@@_rounded_corners_dim }
5695 { \dim_use:N \l_@@_rounded_corners_dim }
5696 }
5697 \@@_cut_on_hyphen:w #2 \q_stop
5698 \bool_lazy_and:nnT
5699 { \int_compare_p:n { \l_tmpa_tl <= \c@iRow } }
5700 { \int_compare_p:n { \l_tmpb_tl <= \c@jCol } }
5701 {
5702 \@@_qpoint:n { row - \l_tmpa_tl }
5703 \dim_set:Nn \l_tmpb_dim { \pgf@y }
5704 \@@_qpoint:n { col - \l_tmpb_tl }
5705 \dim_set:Nn \l_tmpc_dim { \pgf@x }
5706 \@@_cut_on_hyphen:w #3 \q_stop
5707 \int_compare:nNnT \l_tmpa_tl > \c@iRow
5708 { \tl_set:Nx \l_tmpa_tl { \int_use:N \c@iRow } }
5709 \int_compare:nNnT \l_tmpb_tl > \c@jCol
5710 { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
5711 \@@_qpoint:n { row - \@@_succ:n \l_tmpa_tl }
5712 \dim_set:Nn \l_tmpa_dim { \pgf@y }
5713 \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
5714 \dim_set:Nn \l_tmpd_dim { \pgf@x }
5715 \pgfpathrectanglecorners
5716 { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
5717 { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
5718 \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }

```

We can't use \pgfusepathqstroke because of the key rounded-corners.

```

5719 \pgfusepath { stroke }
5720 }
5721 \endpgfpicture
5722 \group_end:
5723 }

```

Here is the set of keys for the command \@@_stroke_block:nnn.

```

5724 \keys_define:nn { NiceMatrix / BlockStroke }
5725 {
5726 color .tl_set:N = \l_@@_draw_tl ,
5727 draw .tl_set:N = \l_@@_draw_tl ,
5728 draw .default:n = default ,
5729 line-width .dim_set:N = \l_@@_line_width_dim ,
5730 rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
5731 rounded-corners .default:n = 4 pt
5732 }

```

The first argument of \@@_hvlines_block:nnn is a list of options for the rules that we will draw. The second argument is the upper-left cell of the block (with, as usual, the syntax *i-j*) and the third is the last cell of the block (with the same syntax).

```

5733 \cs_new_protected:Npn \@@_hvlines_block:nnn #1 #2 #3
5734 {
5735 \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
5736 \keys_set_known:nn { NiceMatrix / BlockBorders } { #1 }
5737 \@@_cut_on_hyphen:w #2 \q_stop
5738 \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl

```

```

5739 \tl_set_eq:NN \l_tmpd_tl \l_tmpb_tl
5740 \@@_cut_on_hyphen:w #3 \q_stop
5741 \tl_set:Nx \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
5742 \tl_set:Nx \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
5743 \pgfpicture
5744 \pgfrememberpicturepositiononpagetrue
5745 \pgf@relevantforpicturesizefalse
5746 \CT@arc@
5747 \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }

```

First, the vertical rules.

```

5748 \@@_qpoint:n { row - \l_tmpa_tl }
5749 \dim_set_eq:NN \l_tmpa_dim \pgf@y
5750 \@@_qpoint:n { row - \l_tmpc_tl }
5751 \dim_set_eq:NN \l_tmpb_dim \pgf@y
5752 \int_step_inline:nnn \l_tmpd_tl \l_tmpb_tl
5753 {
5754   \@@_qpoint:n { col - ##1 }
5755   \pgfpathmoveto { \pgfpoint \pgf@x \l_tmpa_dim }
5756   \pgfpathlineto { \pgfpoint \pgf@x \l_tmpb_dim }
5757   \pgfusepathqstroke
5758 }

```

Now, the horizontal rules.

```

5759 \@@_qpoint:n { col - \l_tmpb_tl }
5760 \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }
5761 \@@_qpoint:n { col - \l_tmpd_tl }
5762 \dim_set:Nn \l_tmpb_dim { \pgf@x - 0.5 \arrayrulewidth }
5763 \int_step_inline:nnn \l_tmpc_tl \l_tmpa_tl
5764 {
5765   \@@_qpoint:n { row - ##1 }
5766   \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }
5767   \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
5768   \pgfusepathqstroke
5769 }
5770 \endpgfpicture
5771 }

```

The first argument of `\@@_stroke_borders_block:nnn` is a list of options for the borders that you will stroke. The second argument is the upper-left cell of the block (with, as usual, the syntax *i-j*) and the third is the last cell of the block (with the same syntax).

```

5772 \cs_new_protected:Npn \@@_stroke_borders_block:nnn #1 #2 #3
5773 {
5774   \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
5775   \keys_set_known:nn { NiceMatrix / BlockBorders } { #1 }
5776   \dim_compare:nNnTF \l_@@_rounded_corners_dim > \c_zero_dim
5777   { \@@_error:n { borders~forbidden } }
5778   {
5779     \clist_map_inline:Nn \l_@@_borders_clist
5780     {
5781       \clist_if_in:nnF { top , bottom , left , right } { ##1 }
5782       { \@@_error:nn { bad-border } { ##1 } }
5783     }
5784     \@@_cut_on_hyphen:w #2 \q_stop
5785     \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl
5786     \tl_set_eq:NN \l_tmpd_tl \l_tmpb_tl
5787     \@@_cut_on_hyphen:w #3 \q_stop
5788     \tl_set:Nx \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
5789     \tl_set:Nx \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
5790     \pgfpicture
5791     \pgfrememberpicturepositiononpagetrue
5792     \pgf@relevantforpicturesizefalse
5793     \CT@arc@
5794     \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }

```

```

5795 \clist_if_in:NnT \l_@@_borders_clist { right }
5796 { \@@_stroke_vertical:n \l_tmpb_tl }
5797 \clist_if_in:NnT \l_@@_borders_clist { left }
5798 { \@@_stroke_vertical:n \l_tmpd_tl }
5799 \clist_if_in:NnT \l_@@_borders_clist { bottom }
5800 { \@@_stroke_horizontal:n \l_tmpa_tl }
5801 \clist_if_in:NnT \l_@@_borders_clist { top }
5802 { \@@_stroke_horizontal:n \l_tmpc_tl }
5803 \endpgfpicture
5804 }
5805 }

```

The following command is used to stroke the left border and the right border. The argument #1 is the number of column (in the sense of the `col` node).

```

5806 \cs_new_protected:Npn \@@_stroke_vertical:n #1
5807 {
5808   \@@_qpoint:n \l_tmpc_tl
5809   \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \l_@@_line_width_dim }
5810   \@@_qpoint:n \l_tmpa_tl
5811   \dim_set:Nn \l_tmpc_dim { \pgf@y + 0.5 \l_@@_line_width_dim }
5812   \@@_qpoint:n { #1 }
5813   \pgfpathmoveto { \pgfpoint \pgf@x \l_tmpb_dim }
5814   \pgfpathlineto { \pgfpoint \pgf@x \l_tmpc_dim }
5815   \pgfusepathqstroke
5816 }

```

The following command is used to stroke the top border and the bottom border. The argument #1 is the number of row (in the sense of the `row` node).

```

5817 \cs_new_protected:Npn \@@_stroke_horizontal:n #1
5818 {
5819   \@@_qpoint:n \l_tmpd_tl
5820   \clist_if_in:NnTF \l_@@_borders_clist { left }
5821   { \dim_set:Nn \l_tmpa_dim { \pgf@x - 0.5 \l_@@_line_width_dim } }
5822   { \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \l_@@_line_width_dim } }
5823   \@@_qpoint:n \l_tmpb_tl
5824   \dim_set:Nn \l_tmpb_dim { \pgf@x + 0.5 \l_@@_line_width_dim }
5825   \@@_qpoint:n { #1 }
5826   \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }
5827   \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
5828   \pgfusepathqstroke
5829 }

```

Here is the set of keys for the command `\@@_stroke_borders_block:nnn`.

```

5830 \keys_define:nn { NiceMatrix / BlockBorders }
5831 {
5832   borders .clist_set:N = \l_@@_borders_clist ,
5833   rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
5834   rounded-corners .default:n = 4 pt ,
5835   line-width .dim_set:N = \l_@@_line_width_dim
5836 }

```

How to draw the dotted lines transparently

```

5837 \cs_set_protected:Npn \@@_renew_matrix:
5838 {
5839   \RenewDocumentEnvironment { pmatrix } { } {
5840     { \pNiceMatrix }
5841     { \endpNiceMatrix }
5842   \RenewDocumentEnvironment { vmatrix } { } {
5843     { \vNiceMatrix }
5844     { \endvNiceMatrix }
5845   \RenewDocumentEnvironment { Vmatrix } { } {

```

```

5846 { \VNiceMatrix }
5847 { \endVNiceMatrix }
5848 \RenewDocumentEnvironment { bmatrix } { }
5849 { \bNiceMatrix }
5850 { \endbNiceMatrix }
5851 \RenewDocumentEnvironment { Bmatrix } { }
5852 { \BNiceMatrix }
5853 { \endBNiceMatrix }
5854 }

```

Automatic arrays

```

5855 \cs_new_protected:Npn \@@_set_size:n #1-#2 \q_stop
5856 {
5857   \int_set:Nn \l_@@_nb_rows_int { #1 }
5858   \int_set:Nn \l_@@_nb_cols_int { #2 }
5859 }

```

We will extract the potential keys `l`, `r` and `c` and pass the other keys to the environment `{NiceArrayWithDelims}`.

```

5860 \keys_define:nn { NiceMatrix / Auto }
5861 {
5862   l .code:n = \tl_set:Nn \l_@@_type_of_col_tl l ,
5863   r .code:n = \tl_set:Nn \l_@@_type_of_col_tl r ,
5864   c .code:n = \tl_set:Nn \l_@@_type_of_col_tl c
5865 }
5866 \NewDocumentCommand \AutoNiceMatrixWithDelims { m m O { } m O { } m ! O { } }
5867 {
5868   \int_zero_new:N \l_@@_nb_rows_int
5869   \int_zero_new:N \l_@@_nb_cols_int
5870   \@@_set_size:n #4 \q_stop

```

The group is for the protection of `\l_@@_type_of_col_tl`.

```

5871 \group_begin:
5872 \tl_set:Nn \l_@@_type_of_col_tl c
5873 \keys_set_known:nnN { NiceMatrix / Auto } { #3, #5, #7 } \l_tmpa_tl
5874 \use:x
5875 {
5876   \exp_not:N \begin { NiceArrayWithDelims } { #1 } { #2 }
5877   { * { \int_use:N \l_@@_nb_cols_int } { \l_@@_type_of_col_tl } }
5878   [ \exp_not:N \l_tmpa_tl ]
5879 }
5880 \int_compare:nNnT \l_@@_first_row_int = 0
5881 {
5882   \int_compare:nNnT \l_@@_first_col_int = 0 { & }
5883   \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { & }
5884   \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
5885 }
5886 \prg_replicate:nn \l_@@_nb_rows_int
5887 {
5888   \int_compare:nNnT \l_@@_first_col_int = 0 { & }

```

We put `{ }` before `#6` to avoid a hasty expansion of a potential `\arabic{iRow}` at the beginning of the row which would result in an incorrect value of that `iRow` (since `iRow` is incremented in the first cell of the row of the `\halign`).

```

5889 \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { { } #6 & } #6
5890 \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
5891 }
5892 \int_compare:nNnT \l_@@_last_row_int > { -2 }
5893 {
5894   \int_compare:nNnT \l_@@_first_col_int = 0 { & }
5895   \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { & }
5896   \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\

```

```

5897     }
5898     \end { NiceArrayWithDelims }
5899     \group_end:
5900 }
5901 \cs_set_protected:Npn \@@_define_com:nnn #1 #2 #3
5902 {
5903     \cs_set_protected:cpn { #1 AutoNiceMatrix }
5904     {
5905         \str_gset:Nx \g_@@_name_env_str { #1 AutoNiceMatrix }
5906         \AutoNiceMatrixWithDelims { #2 } { #3 }
5907     }
5908 }
5909 \@@_define_com:nnn p ( )
5910 \@@_define_com:nnn b [ ]
5911 \@@_define_com:nnn v | |
5912 \@@_define_com:nnn V \| \|
5913 \@@_define_com:nnn B \{ \}

```

We define also a command `\AutoNiceMatrix` similar to the environment `{NiceMatrix}`.

```

5914 \NewDocumentCommand \AutoNiceMatrix { 0 { } m 0 { } m ! 0 { } }
5915 {
5916     \group_begin:
5917     \bool_set_true:N \l_@@_NiceArray_bool
5918     \AutoNiceMatrixWithDelims . . { #2 } { #4 } [ #1 , #3 , #5 ]
5919     \group_end:
5920 }

```

The redefinition of the command `\dotfill`

```

5921 \cs_set_eq:NN \@@_old_dotfill \dotfill
5922 \cs_new_protected:Npn \@@_dotfill:
5923 {

```

First, we insert `\@@_dotfill` (which is the saved version of `\dotfill`) in case of use of `\dotfill` “internally” in the cell (e.g. `\hbox to 1cm {\dotfill}`).

```

5924     \@@_old_dotfill
5925     \bool_if:NT \l_@@_NiceTabular_bool
5926     { \group_insert_after:N \@@_dotfill_ii: }
5927     { \group_insert_after:N \@@_dotfill_i: }
5928 }
5929 \cs_new_protected:Npn \@@_dotfill_i: { \group_insert_after:N \@@_dotfill_ii: }
5930 \cs_new_protected:Npn \@@_dotfill_ii: { \group_insert_after:N \@@_dotfill_iii: }

```

Now, if the box is not empty (unfortunately, we can’t actually test whether the box is empty and that’s why we only consider it’s width), we insert `\@@_dotfill` (which is the saved version of `\dotfill`) in the cell of the array, and it will extend, since it is no longer in `\l_@@_cell_box`.

```

5931 \cs_new_protected:Npn \@@_dotfill_iii:
5932 { \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } = \c_zero_dim \@@_old_dotfill }

```

The command `\diagbox`

The command `\diagbox` will be linked to `\diagbox:nn` in the environments of `nicematrix`.

```

5933 \cs_new_protected:Npn \@@_diagbox:nn #1 #2
5934 {
5935     \tl_gput_right:Nx \g_@@_internal_code_after_tl
5936     {
5937         \@@_actually_diagbox:nnnnnn
5938         { \int_use:N \c_iRow }
5939         { \int_use:N \c_jCol }
5940         { \int_use:N \c_iRow }
5941         { \int_use:N \c_jCol }
5942         { \exp_not:n { #1 } }

```

```

5943     { \exp_not:n { #2 } }
5944 }

```

We put the cell with `\diagbox` in the sequence `\g_@@_pos_of_blocks_seq` because a cell with `\diagbox` must be considered as non empty by the key corners.

```

5945 \seq_gput_right:Nx \g_@@_pos_of_blocks_seq
5946 {
5947   { \int_use:N \c@iRow }
5948   { \int_use:N \c@jCol }
5949   { \int_use:N \c@iRow }
5950   { \int_use:N \c@jCol }
5951 }
5952 }

```

The command `\diagbox` is also redefined locally when we draw a block.

The first four arguments of `\@@_actually_diagbox:nnnnnn` correspond to the rectangle (=block) to slash (we recall that it's possible to use `\diagbox` in a `\Block`). The two other are the elements to draw below and above the diagonal line.

```

5953 \cs_new_protected:Npn \@@_actually_diagbox:nnnnnn #1 #2 #3 #4 #5 #6
5954 {
5955   \pgfpicture
5956   \pgf@relevantforpicturesizefalse
5957   \pgfrememberpicturepositiononpagetrue
5958   \@@_qpoint:n { row - #1 }
5959   \dim_set_eq:NN \l_tmpa_dim \pgf@y
5960   \@@_qpoint:n { col - #2 }
5961   \dim_set_eq:NN \l_tmpb_dim \pgf@x
5962   \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
5963   \@@_qpoint:n { row - \@@_succ:n { #3 } }
5964   \dim_set_eq:NN \l_tmpc_dim \pgf@y
5965   \@@_qpoint:n { col - \@@_succ:n { #4 } }
5966   \dim_set_eq:NN \l_tmpd_dim \pgf@x
5967   \pgfpathlineto { \pgfpoint \l_tmpd_dim \l_tmpc_dim }
5968   {

```

The command `\CT@arc@` is a command of `colortbl` which sets the color of the rules in the array. The package `nicematrix` uses it even if `colortbl` is not loaded.

```

5969   \CT@arc@
5970   \pgfsetroundcap
5971   \pgfusepathqstroke
5972 }
5973 \pgfset { inner-sep = 1 pt }
5974 \pgfscope
5975 \pgftransformshift { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
5976 \pgfnode { rectangle } { south-west }
5977 { \@@_math_toggle_token: #5 \@@_math_toggle_token: } { } { }
5978 \endpgfscope
5979 \pgftransformshift { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
5980 \pgfnode { rectangle } { north-east }
5981 { \@@_math_toggle_token: #6 \@@_math_toggle_token: } { } { }
5982 \endpgfpicture
5983 }

```

The keyword `\CodeAfter`

The `\CodeAfter` (inserted with the key `code-after` or after the keyword `\CodeAfter`) may always begin with a list of pairs *key-value* between square brackets. Here is the corresponding set of keys.

```

5984 \keys_define:nn { NiceMatrix }
5985 {
5986   CodeAfter / rules .inherit:n = NiceMatrix / rules ,

```

```

5987   CodeAfter / sub-matrix .inherit:n = NiceMatrix / sub-matrix
5988 }
5989 \keys_define:nn { NiceMatrix / CodeAfter }
5990 {
5991   sub-matrix .code:n = \keys_set:nn { NiceMatrix / sub-matrix } { #1 } ,
5992   sub-matrix .value_required:n = true ,
5993   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
5994   delimiters / color .value_required:n = true ,
5995   rules .code:n = \keys_set:nn { NiceMatrix / rules } { #1 } ,
5996   rules .value_required:n = true ,
5997   unknown .code:n = \@@_error:n { Unknown-key-for-CodeAfter }
5998 }

```

In fact, in this subsection, we define the user command `\CodeAfter` for the case of the “normal syntax”. For the case of “light-syntax”, see the definition of the environment `{@@-light-syntax}` on p. 108.

In the environments of `nicematrix`, `\CodeAfter` will be linked to `\@@_CodeAfter:`. That macro must *not* be protected since it begins with `\omit`.

```

5999 \cs_new:Npn \@@_CodeAfter: { \omit \@@_CodeAfter_i:n }

```

However, in each cell of the environment, the command `\CodeAfter` will be linked to the following command `\@@_CodeAfter_i:n` which do *not* begin with `\omit` (and thus, the user will be able to use `\CodeAfter` without error and without the need to prefix by `\omit`).

We have to catch everything until the end of the current environment (of `nicematrix`). First, we go until the next command `\end`.

```

6000 \cs_new_protected:Npn \@@_CodeAfter_i:n #1 \end
6001 {
6002   \tl_gput_right:Nn \g_nicematrix_code_after_tl { #1 }
6003   \@@_CodeAfter_ii:n
6004 }

```

We catch the argument of the command `\end` (in `#1`).

```

6005 \cs_new_protected:Npn \@@_CodeAfter_ii:n #1
6006 {

```

If this is really the end of the current environment (of `nicematrix`), we put back the command `\end` and its argument in the TeX flow.

```

6007   \str_if_eq:eeTF \@@_currenvir { #1 } { \end { #1 } }

```

If this is not the `\end` we are looking for, we put those tokens in `\g_nicematrix_code_after_tl` and we go on searching for the next command `\end` with a recursive call to the command `\@@_CodeAfter:n`.

```

6008   {
6009     \tl_gput_right:Nn \g_nicematrix_code_after_tl { \end { #1 } }
6010     \@@_CodeAfter_i:n
6011   }
6012 }

```

The delimiters in the preamble

The command `\@@_delimiter:nnn` will be used to draw delimiters inside the matrix when delimiters are specified in the preamble of the array. It does *not* concern the exterior delimiters added by `{NiceArrayWithDelims}` (and `{pNiceArray}`, `{pNiceMatrix}`, etc.).

A delimiter in the preamble of the array will write an instruction `\@@_delimiter:nnn` in the `\g_@@_internal_code_after_tl` (and also potentially add instructions in the preamble provided to `\array` in order to add space between columns).

The first argument is the type of delimiter (`(`, `[`, `\{`, `)`, `]` or `\}`). The second argument is the number of columnn. The third argument is a boolean equal to `\c_true_bool` (resp. `\c_false_true`) when the delimiter must be put on the left (resp. right) side.

```

6013 \cs_new_protected:Npn \@@_delimiter:nnn #1 #2 #3

```

```

6014 {
6015   \pgfpicture
6016   \pgfrememberpicturepositiononpagetrue
6017   \pgf@relevantforpicturesizefalse

```

`\l_@@_y_initial_dim` and `\l_@@_y_final_dim` will be the y -values of the extremities of the delimiter we will have to construct.

```

6018   \@@_qpoint:n { row - 1 }
6019   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
6020   \@@_qpoint:n { row - \@@_succ:n \c@iRow }
6021   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y

```

We will compute in `\l_tmpa_dim` the x -value where we will have to put our delimiter (on the left side or on the right side).

```

6022   \bool_if:nTF { #3 }
6023     { \dim_set_eq:NN \l_tmpa_dim \c_max_dim }
6024     { \dim_set:Nn \l_tmpa_dim { - \c_max_dim } }
6025   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
6026     {
6027       \cs_if_exist:cT
6028         { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
6029         {
6030           \pgfpointanchor
6031             { \@@_env: - ##1 - #2 }
6032             { \bool_if:nTF { #3 } { west } { east } }
6033           \dim_set:Nn \l_tmpa_dim
6034             { \bool_if:nTF { #3 } \dim_min:nn \dim_max:nn \l_tmpa_dim \pgf@x }
6035         }
6036     }

```

Now we can put the delimiter with a node of PGF.

```

6037   \pgfset { inner~sep = \c_zero_dim }
6038   \dim_zero:N \nulldelimiterspace
6039   \pgftransformshift
6040     {
6041       \pgfpoint
6042         { \l_tmpa_dim }
6043         { ( \l_@@_y_initial_dim + \l_@@_y_final_dim + \arrayrulewidth ) / 2 }
6044     }
6045   \pgfnode
6046     { rectangle }
6047     { \bool_if:nTF { #3 } { east } { west } }
6048     {

```

Here is the content of the PGF node, that is to say the delimiter, constructed with its right size.

```

6049       \nullfont
6050       \c_math_toggle_token
6051       \tl_if_empty:NF \l_@@_delimiters_color_tl
6052       { \color { \l_@@_delimiters_color_tl } }
6053       \bool_if:nTF { #3 } { \left #1 } { \left . }
6054       \vcenter
6055       {
6056         \nullfont
6057         \hrule \@height
6058           \dim_eval:n { \l_@@_y_initial_dim - \l_@@_y_final_dim }
6059           \@depth \c_zero_dim
6060           \@width \c_zero_dim
6061       }
6062       \bool_if:nTF { #3 } { \right . } { \right #1 }
6063       \c_math_toggle_token
6064     }
6065     { }
6066     { }
6067   \endpgfpicture
6068 }

```

The command `\SubMatrix`

```

6069 \keys_define:nn { NiceMatrix / sub-matrix }
6070 {
6071   extra-height .dim_set:N = \l_@@_submatrix_extra_height_dim ,
6072   extra-height .value_required:n = true ,
6073   left-xshift .dim_set:N = \l_@@_submatrix_left_xshift_dim ,
6074   left-xshift .value_required:n = true ,
6075   right-xshift .dim_set:N = \l_@@_submatrix_right_xshift_dim ,
6076   right-xshift .value_required:n = true ,
6077   xshift .meta:n = { left-xshift = #1, right-xshift = #1 } ,
6078   xshift .value_required:n = true ,
6079   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
6080   delimiters / color .value_required:n = true ,
6081   slim .bool_set:N = \l_@@_submatrix_slim_bool ,
6082   slim .default:n = true ,
6083   hlines .clist_set:N = \l_@@_submatrix_hlines_clist ,
6084   hlines .default:n = all ,
6085   vlines .clist_set:N = \l_@@_submatrix_vlines_clist ,
6086   vlines .default:n = all ,
6087   hvlines .meta:n = { hlines, vlines } ,
6088   hvlines .value_forbidden:n = true ,
6089 }
6090 \keys_define:nn { NiceMatrix }
6091 {
6092   SubMatrix .inherit:n = NiceMatrix / sub-matrix ,
6093   CodeAfter / sub-matrix .inherit:n = NiceMatrix / sub-matrix ,
6094   NiceMatrix / sub-matrix .inherit:n = NiceMatrix / sub-matrix ,
6095   NiceArray / sub-matrix .inherit:n = NiceMatrix / sub-matrix ,
6096   pNiceArray / sub-matrix .inherit:n = NiceMatrix / sub-matrix ,
6097   NiceMatrixOptions / sub-matrix .inherit:n = NiceMatrix / sub-matrix ,
6098 }

```

The following keys set is for the command `\SubMatrix` itself (not the tuning of `\SubMatrix` that can be done elsewhere).

```

6099 \keys_define:nn { NiceMatrix / SubMatrix }
6100 {
6101   hlines .clist_set:N = \l_@@_submatrix_hlines_clist ,
6102   hlines .default:n = all ,
6103   vlines .clist_set:N = \l_@@_submatrix_vlines_clist ,
6104   vlines .default:n = all ,
6105   hvlines .meta:n = { hlines, vlines } ,
6106   hvlines .value_forbidden:n = true ,
6107   name .code:n =
6108     \tl_if_empty:nTF { #1 }
6109     { \@@_error:n { Invalid-name-format } }
6110     {
6111       \regex_match:nnTF { \A[A-Za-z][A-Za-z0-9]*\Z } { #1 }
6112       {
6113         \seq_if_in:NnTF \g_@@_submatrix_names_seq { #1 }
6114         { \@@_error:nn { Duplicate-name-for-SubMatrix } { #1 } }
6115         {
6116           \str_set:Nn \l_@@_submatrix_name_str { #1 }
6117           \seq_gput_right:Nn \g_@@_submatrix_names_seq { #1 }
6118         }
6119       }
6120       { \@@_error:n { Invalid-name-format } }
6121     } ,
6122   rules .code:n = \keys_set:nn { NiceMatrix / rules } { #1 } ,
6123   rules .value_required:n = true ,
6124   code .tl_set:N = \l_@@_code_tl ,
6125   code .value_required:n = true ,
6126   name .value_required:n = true ,
6127   unknown .code:n = \@@_error:n { Unknown-key-for-SubMatrix }

```

```

6128 }

6129 \NewDocumentCommand \@@_SubMatrix_in_code_before { m m m m ! 0 { } }
6130 {
6131   \peek_remove_spaces:n
6132   {
6133     \@@_cut_on_hyphen:w #3 \q_stop
6134     \tl_clear_new:N \l_tmpc_tl
6135     \tl_clear_new:N \l_tmpd_tl
6136     \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl
6137     \tl_set_eq:NN \l_tmpd_tl \l_tmpb_tl
6138     \@@_cut_on_hyphen:w #2 \q_stop
6139     \seq_gput_right:Nx \g_@@_submatrix_seq
6140     { { \l_tmpa_tl } { \l_tmpb_tl } { \l_tmpc_tl } { \l_tmpd_tl } }
6141     \tl_gput_right:Nn \g_@@_internal_code_after_tl
6142     { \SubMatrix { #1 } { #2 } { #3 } { #4 } [ #5 ] }
6143   }
6144 }

```

In the internal code-after and in the `\CodeAfter` the following command `\@@_SubMatrix` will be linked to `\SubMatrix`.

- #1 is the left delimiter;
- #2 is the upper-left cell of the matrix with the format $i-j$;
- #3 is the lower-right cell of the matrix with the format $i-j$;
- #4 is the right delimiter;
- #5 is the list of options of the command;
- #6 is the potential subscript;
- #7 is the potential superscript.

For explanations about the construction with rescanning of the preamble, see the documentation for the user command `\Cdots`.

```

6145 \AtBeginDocument
6146 {
6147   \tl_set:Nn \l_@@_argspec_tl { m m m m 0 { } E { _ ^ } { { } { } } }
6148   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
6149   \exp_args:NNV \NewDocumentCommand \@@_SubMatrix \l_@@_argspec_tl
6150   {
6151     \peek_remove_spaces:n
6152     { \@@_sub_matrix:nnnnnnn
6153       { #1 } { #2 } { #3 } { #4 } { #5 } { #6 } { #7 } }
6154   }
6155 }

6156 \cs_new_protected:Npn \@@_sub_matrix:nnnnnnn #1 #2 #3 #4 #5 #6 #7
6157 {
6158   \group_begin:

```

The four following token lists correspond to the position of the `\SubMatrix`.

```

6159   \tl_clear_new:N \l_@@_first_i_tl
6160   \tl_clear_new:N \l_@@_first_j_tl
6161   \tl_clear_new:N \l_@@_last_i_tl
6162   \tl_clear_new:N \l_@@_last_j_tl

6163   \@@_cut_on_hyphen:w #2 \q_stop
6164   \tl_set_eq:NN \l_@@_first_i_tl \l_tmpa_tl
6165   \tl_set_eq:NN \l_@@_first_j_tl \l_tmpb_tl
6166   \@@_cut_on_hyphen:w #3 \q_stop

```

```

6167 \tl_set_eq:NN \l_@@_last_i_tl \l_tmpa_tl
6168 \tl_set_eq:NN \l_@@_last_j_tl \l_tmpb_tl
6169 \bool_lazy_or:nnTF
6170 { \int_compare_p:nNn \l_@@_last_i_tl > \g_@@_row_total_int }
6171 { \int_compare_p:nNn \l_@@_last_j_tl > \g_@@_col_total_int }
6172 { \@@_error:n { SubMatrix~too~large } }
6173 {
6174   \str_clear_new:N \l_@@_submatrix_name_str
6175   \keys_set:nn { NiceMatrix / SubMatrix } { #5 }
6176   \pgfpicture
6177   \pgfrememberpicturepositiononpagetrue
6178   \pgf@relevantforpicturesizefalse
6179   \pgfset { inner~sep = \c_zero_dim }
6180   \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
6181   \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }

```

The last value of `\int_step_inline:nnn` is provided by currying.

```

6182 \bool_if:NTF \l_@@_submatrix_slim_bool
6183 { \int_step_inline:nnn \l_@@_first_i_tl \l_@@_last_i_tl }
6184 { \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int }
6185 {
6186   \cs_if_exist:cT
6187   { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_first_j_tl }
6188   {
6189     \pgfpointanchor { \@@_env: - ##1 - \l_@@_first_j_tl } { west }
6190     \dim_set:Nn \l_@@_x_initial_dim
6191     { \dim_min:nn \l_@@_x_initial_dim \pgf@x }
6192   }
6193   \cs_if_exist:cT
6194   { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_last_j_tl }
6195   {
6196     \pgfpointanchor { \@@_env: - ##1 - \l_@@_last_j_tl } { east }
6197     \dim_set:Nn \l_@@_x_final_dim
6198     { \dim_max:nn \l_@@_x_final_dim \pgf@x }
6199   }
6200 }
6201 \dim_compare:nNnTF \l_@@_x_initial_dim = \c_max_dim
6202 { \@@_error:nn { impossible~delimiter } { left } }
6203 {
6204   \dim_compare:nNnTF \l_@@_x_final_dim = { - \c_max_dim }
6205   { \@@_error:nn { impossible~delimiter } { right } }
6206   { \@@_sub_matrix_i:nnnn { #1 } { #4 } { #6 } { #7 } }
6207 }
6208 \endpgfpicture
6209 }
6210 \group_end:
6211 }

```

#1 is the left delimiter, #2 is the right one, #3 is the subscript and #4 is the superscript.

```

6212 \cs_new_protected:Npn \@@_sub_matrix_i:nnnn #1 #2 #3 #4
6213 {
6214   \@@_qpoint:n { row - \l_@@_first_i_tl - base }
6215   \dim_set:Nn \l_@@_y_initial_dim
6216   { \pgf@y + ( \box_ht:N \strutbox + \extrarowheight ) * \arraystretch }
6217   \@@_qpoint:n { row - \l_@@_last_i_tl - base }
6218   \dim_set:Nn \l_@@_y_final_dim
6219   { \pgf@y - ( \box_dp:N \strutbox ) * \arraystretch }
6220   \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
6221   {
6222     \cs_if_exist:cT
6223     { pgf @ sh @ ns @ \@@_env: - \l_@@_first_i_tl - ##1 }
6224     {
6225       \pgfpointanchor { \@@_env: - \l_@@_first_i_tl - ##1 } { north }

```

```

6226         \dim_set:Nn \l_@@_y_initial_dim
6227         { \dim_max:nn \l_@@_y_initial_dim \pgf@y }
6228     }
6229     \cs_if_exist:cT
6230     { \pgf @ sh @ ns @ \@@_env: - \l_@@_last_i_tl - ##1 }
6231     {
6232         \pgfpointanchor { \@@_env: - \l_@@_last_i_tl - ##1 } { south }
6233         \dim_set:Nn \l_@@_y_final_dim
6234         { \dim_min:nn \l_@@_y_final_dim \pgf@y }
6235     }
6236 }
6237 \dim_set:Nn \l_tmpa_dim
6238 {
6239     \l_@@_y_initial_dim - \l_@@_y_final_dim +
6240     \l_@@_submatrix_extra_height_dim - \arrayrulewidth
6241 }
6242 \dim_set_eq:NN \nulldelimiterspace \c_zero_dim

```

We will draw the rules in the `\SubMatrix`.

```

6243 \group_begin:
6244 \pgfsetlinewidth { 1.1 \arrayrulewidth }
6245 \tl_if_empty:NF \l_@@_rules_color_tl
6246 { \exp_after:wN \@@_set_CT@arc@: \l_@@_rules_color_tl \q_stop }
6247 \CT@arc@

```

Now, we draw the potential vertical rules specified in the preamble of the environments with the letter fixed with the key `vlines-in-sub-matrix`. The list of the columns where there is such rule to draw is in `\g_@@_cols_vlism_seq`.

```

6248 \seq_map_inline:Nn \g_@@_cols_vlism_seq
6249 {
6250     \int_compare:nNnT \l_@@_first_j_tl < { ##1 }
6251     {
6252         \int_compare:nNnT
6253         { ##1 } < { \int_eval:n { \l_@@_last_j_tl + 1 } }
6254         {

```

First, we extract the value of the abscissa of the rule we have to draw.

```

6255         \@@_qpoint:n { col - ##1 }
6256         \pgfpathmoveto { \pgfpoint \pgf@x \l_@@_y_initial_dim }
6257         \pgfpathlineto { \pgfpoint \pgf@x \l_@@_y_final_dim }
6258         \pgfusepathqstroke
6259     }
6260 }
6261 }

```

Now, we draw the vertical rules specified in the key `vlines` of `\SubMatrix`. The last argument of `\int_step_inline:nn` or `\clist_map_inline:Nn` is given by curryfication.

```

6262 \tl_if_eq:NnTF \l_@@_submatrix_vlines_clist { all }
6263 { \int_step_inline:nn { \l_@@_last_j_tl - \l_@@_first_j_tl } }
6264 { \clist_map_inline:Nn \l_@@_submatrix_vlines_clist }
6265 {
6266     \bool_lazy_and:nnTF
6267     { \int_compare_p:nNn { ##1 } > 0 }
6268     {
6269         \int_compare_p:nNn
6270         { ##1 } < { \l_@@_last_j_tl - \l_@@_first_j_tl + 1 } }
6271     {
6272         \@@_qpoint:n { col - \int_eval:n { ##1 + \l_@@_first_j_tl } }
6273         \pgfpathmoveto { \pgfpoint \pgf@x \l_@@_y_initial_dim }
6274         \pgfpathlineto { \pgfpoint \pgf@x \l_@@_y_final_dim }
6275         \pgfusepathqstroke
6276     }
6277     { \@@_error:nnn { Wrong-line-in-SubMatrix } { vertical } { ##1 } }
6278 }

```

Now, we draw the horizontal rules specified in the key `hlines` of `\SubMatrix`. The last argument of `\int_step_inline:n` or `\clist_map_inline:Nn` is given by curryfication.

```

6279 \tl_if_eq:NnTF \l_@@_submatrix_hlines_clist { all }
6280 { \int_step_inline:n { \l_@@_last_i_tl - \l_@@_first_i_tl } }
6281 { \clist_map_inline:Nn \l_@@_submatrix_hlines_clist }
6282 {
6283   \bool_lazy_and:nnTF
6284   { \int_compare_p:nNn { ##1 } > 0 }
6285   {
6286     \int_compare_p:nNn
6287     { ##1 } < { \l_@@_last_i_tl - \l_@@_first_i_tl + 1 } }
6288   {
6289     \@@_qpoint:n { row - \int_eval:n { ##1 + \l_@@_first_i_tl } }

```

We use a group to protect `\l_tmpa_dim` and `\l_tmpb_dim`.

```

6290   \group_begin:
We compute in \l_tmpa_dim the x-value of the left end of the rule.
6291   \dim_set:Nn \l_tmpa_dim
6292   { \l_@@_x_initial_dim - \l_@@_submatrix_left_xshift_dim }
6293   \str_case:nn { #1 }
6294   {
6295     ( { \dim_sub:Nn \l_tmpa_dim { 0.9 mm } }
6296     [ { \dim_sub:Nn \l_tmpa_dim { 0.2 mm } }
6297     \{ { \dim_sub:Nn \l_tmpa_dim { 0.9 mm } }
6298     }
6299   \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }

```

We compute in `\l_tmpb_dim` the *x*-value of the right end of the rule.

```

6300   \dim_set:Nn \l_tmpb_dim
6301   { \l_@@_x_final_dim + \l_@@_submatrix_right_xshift_dim }
6302   \str_case:nn { #2 }
6303   {
6304     ) { \dim_add:Nn \l_tmpb_dim { 0.9 mm } }
6305     ] { \dim_add:Nn \l_tmpb_dim { 0.2 mm } }
6306     \} { \dim_add:Nn \l_tmpb_dim { 0.9 mm } }
6307   }
6308   \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
6309   \pgfusepathqstroke
6310   \group_end:
6311 }
6312 { \@@_error:nnn { Wrong~line~in~SubMatrix } { horizontal } { ##1 } }
6313 }

```

If the key name has been used for the command `\SubMatrix`, we create a PGF node with that name for the submatrix (this node does not encompass the delimiters that we will put after).

```

6314 \str_if_empty:NF \l_@@_submatrix_name_str
6315 {
6316   \@@_pgf_rect_node:nnnnn \l_@@_submatrix_name_str
6317   \l_@@_x_initial_dim \l_@@_y_initial_dim
6318   \l_@@_x_final_dim \l_@@_y_final_dim
6319 }
6320 \group_end:

```

The group was for `\CT@arc@` (the color of the rules).

Now, we deal with the left delimiter. Of course, the environment `{pgfscope}` is for the `\pgftransformshift`.

```

6321 \begin { pgfscope }
6322 \pgftransformshift
6323 {
6324   \pgfpoint
6325   { \l_@@_x_initial_dim - \l_@@_submatrix_left_xshift_dim }
6326   { ( \l_@@_y_initial_dim + \l_@@_y_final_dim ) / 2 }
6327 }

```

```

6328 \str_if_empty:NTF \l_@@_submatrix_name_str
6329 { \@@_node_left:nn #1 { } }
6330 { \@@_node_left:nn #1 { \@@_env: - \l_@@_submatrix_name_str - left } }
6331 \end { pgfscope }

```

Now, we deal with the right delimiter.

```

6332 \pgftransformshift
6333 {
6334   \pgfpoint
6335   { \l_@@_x_final_dim + \l_@@_submatrix_right_xshift_dim }
6336   { ( \l_@@_y_initial_dim + \l_@@_y_final_dim ) / 2 }
6337 }
6338 \str_if_empty:NTF \l_@@_submatrix_name_str
6339 { \@@_node_right:nnnn #2 { } { #3 } { #4 } }
6340 {
6341   \@@_node_right:nnnn #2
6342   { \@@_env: - \l_@@_submatrix_name_str - right } { #3 } { #4 }
6343 }
6344 \cs_set_eq:NN \pgfpointanchor \@@_pgfpointanchor:n
6345 \flag_clear_new:n { nicematrix }
6346 \l_@@_code_tl
6347 }

```

In the key code of the command `\SubMatrix` there may be Tikz instructions. We want that, in these instructions, the i and j in specifications of nodes of the forms i - j , $\text{row-}i$, $\text{col-}j$ and i - $|j$ refer to the number of row and column *relative* of the current `\SubMatrix`. That's why we will patch (locally in the `\SubMatrix`) the command `\pgfpointanchor`.

```

6348 \cs_set_eq:NN \@@_old_pgfpointanchor \pgfpointanchor

```

The following command will be linked to `\pgfpointanchor` just before the execution of the option code of the command `\SubMatrix`. In this command, we catch the argument #1 of `\pgfpointanchor` and we apply to it the command `\@@_pgfpointanchor_i:nn` before passing it to the original `\pgfpointanchor`. We have to act in an expandable way because the command `\pgfpointanchor` is used in names of Tikz nodes which are computed in an expandable way.

```

6349 \cs_new_protected:Npn \@@_pgfpointanchor:n #1
6350 {
6351   \use:e
6352   { \exp_not:N \@@_old_pgfpointanchor { \@@_pgfpointanchor_i:nn #1 } }
6353 }

```

In fact, the argument of `\pgfpointanchor` is always of the form `\a_command { name_of_node }` where “name_of_node” is the name of the Tikz node without the potential prefix and suffix. That's why we catch two arguments and work only on the second by trying (first) to extract an hyphen -.

```

6354 \cs_new:Npn \@@_pgfpointanchor_i:nn #1 #2
6355 { #1 { \@@_pgfpointanchor_ii:w #2 - \q_stop } }

```

Since `\seq_if_in:NnTF` and `\clist_if_in:NnTF` are not expandable, we will use the following token list and `\str_case:nVTF` to test whether we have an integer or not.

```

6356 \tl_const:Nn \c_@@_integers_alist_tl
6357 {
6358   { 1 } { } { 2 } { } { 3 } { } { 4 } { } { 5 } { }
6359   { 6 } { } { 7 } { } { 8 } { } { 9 } { } { 10 } { }
6360   { 11 } { } { 12 } { } { 13 } { } { 14 } { } { 15 } { }
6361   { 16 } { } { 17 } { } { 18 } { } { 19 } { } { 20 } { }
6362 }

```

```

6363 \cs_new:Npn \@@_pgfpointanchor_ii:w #1-#2\q_stop
6364 {

```

If there is no hyphen, that means that the node is of the form of a single number (ex.: 5 or 11). In that case, we are in an analysis which result from a specification of node of the form $i-j$. In that case, the i of the number of row arrives first (and alone) in a `\pgfpointanchor` and, the, the j arrives (alone) in the following `\pgfpointanchor`. In order to know whether we have a number of row of a number of column, we keep track of the number of such treatments by the expandable flag called `nicematrix`.

```

6365 \tl_if_empty:nTF { #2 }
6366 {
6367   \str_case:nVTF { #1 } \c_@@_integers_alist_tl
6368   {
6369     \flag_raise:n { nicematrix }
6370     \int_if_even:nTF { \flag_height:n { nicematrix } }
6371     { \int_eval:n { #1 + \l_@@_first_i_tl - 1 } }
6372     { \int_eval:n { #1 + \l_@@_first_j_tl - 1 } }
6373   }
6374   { #1 }
6375 }

```

If there is an hyphen, we have to see whether we have a node of the form $i-j$, $\text{row-}i$ or $\text{col-}j$.

```

6376 { \c_@@_pgfpointanchor_iii:w { #1 } #2 }
6377 }

```

There was an hyphen in the name of the node and that's why we have to retrieve the extra hyphen we have put (cf. `\c_@@_pgfpointanchor_i:nn`).

```

6378 \cs_new:Npn \c_@@_pgfpointanchor_iii:w #1 #2 -
6379 {
6380   \str_case:nnF { #1 }
6381   {
6382     { row } { row - \int_eval:n { #2 + \l_@@_first_i_tl - 1 } }
6383     { col } { col - \int_eval:n { #2 + \l_@@_first_j_tl - 1 } }
6384   }

```

Now the case of a node of the form $i-j$.

```

6385 {
6386   \int_eval:n { #1 + \l_@@_first_i_tl - 1 }
6387   - \int_eval:n { #2 + \l_@@_first_j_tl - 1 }
6388 }
6389 }

```

The command `\c_@@_node_left:nn` puts the left delimiter with the correct size. The argument `#1` is the delimiter to put. The argument `#2` is the name we will give to this PGF node (if the key `name` has been used in `\SubMatrix`).

```

6390 \cs_new_protected:Npn \c_@@_node_left:nn #1 #2
6391 {
6392   \pgfnode
6393   { rectangle }
6394   { east }
6395   {
6396     \nullfont
6397     \c_math_toggle_token
6398     \tl_if_empty:NF \l_@@_delimiters_color_tl
6399     { \color { \l_@@_delimiters_color_tl } }
6400     \left #1
6401     \vcenter
6402     {
6403       \nullfont
6404       \hrule \@height \l_tmpa_dim
6405       \@depth \c_zero_dim
6406       \@width \c_zero_dim
6407     }
6408     \right .
6409     \c_math_toggle_token
6410   }

```

```

6411     { #2 }
6412     { }
6413 }

```

The command `\@@_node_right:nn` puts the right delimiter with the correct size. The argument `#1` is the delimiter to put. The argument `#2` is the name we will give to this PGF node (if the key `name` has been used in `\SubMatrix`). The argument `#3` is the subscript and `#4` is the superscript.

```

6414 \cs_new_protected:Npn \@@_node_right:nnnn #1 #2 #3 #4
6415 {
6416   \pgfnode
6417   { rectangle }
6418   { west }
6419   {
6420     \nullfont
6421     \c_math_toggle_token
6422     \tl_if_empty:NF \l_@@_delimiters_color_tl
6423     { \color { \l_@@_delimiters_color_tl } }
6424     \left .
6425     \vcenter
6426     {
6427       \nullfont
6428       \hrule \@height \l_tmpa_dim
6429       \@depth \c_zero_dim
6430       \@width \c_zero_dim
6431     }
6432     \right #1
6433     \tl_if_empty:NF { #3 } { _ { \smash { #3 } } }
6434     ^ { \smash { #4 } }
6435     \c_math_toggle_token
6436   }
6437   { #2 }
6438   { }
6439 }

```

We process the options at package loading

We process the options when the package is loaded (with `\usepackage`) but we recommend to use `\NiceMatrixOptions` instead.

We must process these options after the definition of the environment `{NiceMatrix}` because the option `renew-matrix` executes the code `\cs_set_eq:NN \env@matrix \NiceMatrix`.

Of course, the command `\NiceMatrix` must be defined before such an instruction is executed.

The boolean `\g_@@_footnotehyper_bool` will indicate if the option `footnotehyper` is used.

```

6440 \bool_new:N \c_@@_footnotehyper_bool

```

The boolean `\c_@@_footnote_bool` will indicate if the option `footnote` is used, but quickly, it will also be set to true if the option `footnotehyper` is used.

```

6441 \bool_new:N \c_@@_footnote_bool
6442 \@@_msg_new:nnn { Unknown~key~for~package }
6443 {
6444   The~key~'\l_keys_key_str'~is~unknown. \\
6445   If~you~go~on,~it~will~be~ignored. \\
6446   For~a~list~of~the~available~keys,~type~H~<return>.
6447 }
6448 {
6449   The~available~keys~are~(in~alphabetic~order):~
6450   define-L-C-R,~
6451   footnote,~
6452   footnotehyper,~
6453   renew-dots,~and

```

```

6454     renew-matrix.
6455 }

```

Maybe we will completely delete the key 'transparent' in a future version.

```

6456 \@@_msg_new:nn { Key~transparent }
6457 {
6458     The~key~'transparent'~is~now~obsolete~(because~it's~name~
6459     is~not~clear).~You~should~use~the~conjunction~of~'renew-dots'~
6460     and~'renew-matrix'.~However,~you~can~go~on.
6461 }
6462 \@@_msg_new:nn { define-L-C-R }
6463 {
6464     You~have~used~the~key~'define-L-C-R'.~Please~note~that~this~key~
6465     will~probably~be~deleted~in~a~future~version~of~'nicematrix'.\\
6466     However,~you~can~go~on.
6467 }
6468 \keys_define:nn { NiceMatrix / Package }
6469 {
6470     define-L-C-R .code:n =
6471         \@@_error:n { define-L-C-R }
6472     \bool_set_true:N \c_@@_define_L_C_R_bool ,
6473     renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
6474     renew-dots .value_forbidden:n = true ,
6475     renew-matrix .code:n = \@@_renew_matrix: ,
6476     renew-matrix .value_forbidden:n = true ,
6477     transparent .code:n =
6478         {
6479             \@@_renew_matrix:
6480             \bool_set_true:N \l_@@_renew_dots_bool
6481             \@@_error:n { Key~transparent }
6482         } ,
6483     transparent .value_forbidden:n = true,
6484     footnote .bool_set:N = \c_@@_footnote_bool ,
6485     footnotehyper .bool_set:N = \c_@@_footnotehyper_bool ,
6486     unknown .code:n = \@@_error:n { Unknown~key~for~package }
6487 }
6488 \ProcessKeysOptions { NiceMatrix / Package }
6489 \@@_msg_new:nn { footnote~with~footnotehyper~package }
6490 {
6491     You~can't~use~the~option~'footnote'~because~the~package~
6492     footnotehyper~has~already~been~loaded.~
6493     If~you~want,~you~can~use~the~option~'footnotehyper'~and~the~footnotes~
6494     within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~
6495     of~the~package~footnotehyper.\\
6496     If~you~go~on,~the~package~footnote~won't~be~loaded.
6497 }
6498 \@@_msg_new:nn { footnotehyper~with~footnote~package }
6499 {
6500     You~can't~use~the~option~'footnotehyper'~because~the~package~
6501     footnote~has~already~been~loaded.~
6502     If~you~want,~you~can~use~the~option~'footnote'~and~the~footnotes~
6503     within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~
6504     of~the~package~footnote.\\
6505     If~you~go~on,~the~package~footnotehyper~won't~be~loaded.
6506 }
6507 \bool_if:NT \c_@@_footnote_bool
6508 {

```

The class `beamer` has its own system to extract footnotes and that's why we have nothing to do if `beamer` is used.

```

6509 \ifclassloaded { beamer }
6510 { \bool_set_false:N \c_@@_footnote_bool }
6511 {
6512   \ifpackageloaded { footnotehyper }
6513     { \@@_error:n { footnote~with~footnotehyper~package } }
6514     { \usepackage { footnote } }
6515   }
6516 }
6517 \bool_if:NT \c_@@_footnotehyper_bool
6518 {

```

The class `beamer` has its own system to extract footnotes and that's why we have nothing to do if `beamer` is used.

```

6519 \ifclassloaded { beamer }
6520 { \bool_set_false:N \c_@@_footnote_bool }
6521 {
6522   \ifpackageloaded { footnote }
6523     { \@@_error:n { footnotehyper~with~footnote~package } }
6524     { \usepackage { footnotehyper } }
6525   }
6526   \bool_set_true:N \c_@@_footnote_bool
6527 }

```

The flag `\c_@@_footnote_bool` is raised and so, we will only have to test `\c_@@_footnote_bool` in order to know if we have to insert an environment `{savenotes}`.

Error messages of the package

The following message will be deleted when we will delete the key `except-corners` for the command `\arraycolor`.

```

6528 \@@_msg_new:nn { key except-corners }
6529 {
6530   The~key~'except-corners'~has~been~deleted~for~the~command~\token_to_str:N
6531   \arraycolor\ in~the~\token_to_str:N \CodeBefore.~You~should~instead~use~
6532   the~key~'corners'~in~your~\@@_full_name_env:.\
6533   If~you~go~on,~this~key~will~be~ignored.
6534 }
6535 \seq_new:N \c_@@_types_of_matrix_seq
6536 \seq_set_from_clist:Nn \c_@@_types_of_matrix_seq
6537 {
6538   NiceMatrix ,
6539   pNiceMatrix , bNiceMatrix , vNiceMatrix, BNiceMatrix, VNiceMatrix
6540 }
6541 \seq_set_map_x:NNn \c_@@_types_of_matrix_seq \c_@@_types_of_matrix_seq
6542 { \tl_to_str:n { #1 } }

```

If the user uses too much columns, the command `\@@_error_too_much_cols:` is executed. This command raises an error but try to give the best information to the user in the error message. The command `\seq_if_in:NVTF` is not expandable and that's why we can't put it in the error message itself. We have to do the test before the `\@@_fatal:n`.

```

6543 \cs_new_protected:Npn \@@_error_too_much_cols:
6544 {
6545   \seq_if_in:NVTF \c_@@_types_of_matrix_seq \g_@@_name_env_str
6546   {
6547     \int_compare:nNnTF \l_@@_last_col_int = { -2 }
6548     { \@@_fatal:n { too~much~cols~for~matrix } }
6549     {
6550       \bool_if:NF \l_@@_last_col_without_value_bool

```

```

6551         { \@@_fatal:n { too-much-cols-for-matrix-with-last-col } }
6552     }
6553 }
6554 { \@@_fatal:n { too-much-cols-for-array } }
6555 }

```

The following command must *not* be protected since it's used in an error message.

```

6556 \cs_new:Npn \@@_message_hdotsfor:
6557 {
6558     \tl_if_empty:VF \g_@@_HVdotsfor_lines_tl
6559     { ~Maybe-your-use-of~\token_to_str:N \Hdotsfor\ is-incorrect.}
6560 }
6561 \@@_msg_new:nn { too-much-cols-for-matrix-with-last-col }
6562 {
6563     You-try-to-use-more-columns-than-allowed-by-your~
6564     \@@_full_name_env:.\@@_message_hdotsfor:\ The-maximal-number-of~
6565     columns-is~\int_eval:n { \l_@@_last_col_int - 1 }~(plus-the~
6566     exterior-columns).~This-error-is-fatal.
6567 }
6568 \@@_msg_new:nn { too-much-cols-for-matrix }
6569 {
6570     You-try-to-use-more-columns-than-allowed-by-your~
6571     \@@_full_name_env:.\@@_message_hdotsfor:\ Recall-that-the-maximal~
6572     number-of-columns-for-a-matrix-is-fixed-by-the-LaTeX-counter~
6573     'MaxMatrixCols'.~Its-actual-value-is~\int_use:N \c@MaxMatrixCols.~
6574     This-error-is-fatal.
6575 }

```

For the following message, remind that the test is not done after the construction of the array but in each row. That's why we have to put `\c@jCol-1` and not `\c@jCol`.

```

6576 \@@_msg_new:nn { too-much-cols-for-array }
6577 {
6578     You-try-to-use-more-columns-than-allowed-by-your~
6579     \@@_full_name_env:.\@@_message_hdotsfor:\ The-maximal-number-of-columns-is~
6580     \int_use:N \g_@@_static_num_of_col_int\
6581     ~ (plus-the-potential-exterior-ones).~
6582     This-error-is-fatal.
6583 }
6584 \@@_msg_new:nn { last-col-not-used }
6585 {
6586     The-key~'last-col'~is~in-force-but-you-have-not-used-that-last-column~
6587     in-your~\@@_full_name_env:~.~However,~you-can-go-on.
6588 }
6589 \@@_msg_new:nn { columns-not-used }
6590 {
6591     The-preamble-of~your~\@@_full_name_env:\ announces~\int_use:N
6592     \g_@@_static_num_of_col_int\ columns-but-you-use-only~\int_use:N \c@jCol.\
6593     You-can-go-on-but-the-columns-you-did-not-used-won't-be-created.
6594 }
6595 \@@_msg_new:nn { in-first-col }
6596 {
6597     You-can't-use-the-command~#1 in-the-first-column-(number~0)-of-the-array.\
6598     If-you-go-on,~this-command-will-be-ignored.
6599 }
6600 \@@_msg_new:nn { in-last-col }
6601 {
6602     You-can't-use-the-command~#1 in-the-last-column-(exterior)-of-the-array.\
6603     If-you-go-on,~this-command-will-be-ignored.
6604 }

```

```

6605 \@@_msg_new:nn { in-first-row }
6606 {
6607     You~can't~use~the~command~#1~in~the~first~row~(number~0)~of~the~array.\\
6608     If~you~go~on,~this~command~will~be~ignored.
6609 }
6610 \@@_msg_new:nn { in-last-row }
6611 {
6612     You~can't~use~the~command~#1~in~the~last~row~(exterior)~of~the~array.\\
6613     If~you~go~on,~this~command~will~be~ignored.
6614 }
6615 \@@_msg_new:nn { double-closing-delimiter }
6616 {
6617     You~can't~put~a~second~closing~delimiter~"#1"~just~after~a~first~closing~
6618     delimiter.~This~delimiter~will~be~ignored.
6619 }
6620 \@@_msg_new:nn { delimiter~after~opening }
6621 {
6622     You~can't~put~a~second~delimiter~"#1"~just~after~a~first~opening~
6623     delimiter.~This~delimiter~will~be~ignored.
6624 }
6625 \@@_msg_new:nn { bad-option-for~line-style }
6626 {
6627     Since~you~haven't~loaded~Tikz,~the~only~value~you~can~give~to~'line-style'~
6628     is~'standard'.~If~you~go~on,~this~key~will~be~ignored.
6629 }
6630 \@@_msg_new:nn { Unknown~key~for~xdots }
6631 {
6632     As~for~now,~there~is~only~three~keys~available~here:~'color',~'line-style'~
6633     and~'shorten'~(and~you~try~to~use~'\l_keys_key_str').~If~you~go~on,~
6634     this~key~will~be~ignored.
6635 }
6636 \@@_msg_new:nn { Unknown~key~for~RowStyle }
6637 {
6638     As~for~now,~there~is~only~three~keys~available~here:~'cell-space-top-limit',~
6639     'cell-space-bottom-limit~and~'cell-space-limits'~(and~you~try~to~use~
6640     '\l_keys_key_str').~If~you~go~on,~this~key~will~be~ignored.
6641 }
6642 \@@_msg_new:nn { Unknown~key~for~rowcolors }
6643 {
6644     As~for~now,~there~is~only~two~keys~available~here:~'cols'~and~'respect-blocks'~
6645     (and~you~try~to~use~'\l_keys_key_str').~If~you~go~on,~
6646     this~key~will~be~ignored.
6647 }
6648 \@@_msg_new:nn { ampersand~in~light-syntax }
6649 {
6650     You~can't~use~an~ampersand~(\token_to_str:N &)~to~separate~columns~because~
6651     ~you~have~used~the~key~'light-syntax'.~This~error~is~fatal.
6652 }
6653 \@@_msg_new:nn { SubMatrix~too~large }
6654 {
6655     Your~command~\token_to_str:N \SubMatrix\
6656     can't~be~drawn~because~your~matrix~is~too~small.\\
6657     If~you~go~on,~this~command~will~be~ignored.
6658 }
6659 \@@_msg_new:nn { double-backslash~in~light-syntax }
6660 {
6661     You~can't~use~\token_to_str:N \\~to~separate~rows~because~you~have~used~
6662     the~key~'light-syntax'.~You~must~use~the~character~'\l_@@_end_of_row_tl'~
6663     (set~by~the~key~'end-of-row').~This~error~is~fatal.
6664 }

```

```

6665 \@@_msg_new:nn { standard-cline-in-document }
6666 {
6667     The~key~'standard-cline'~is~available~only~in~the~preamble.\\
6668     If~you~go~on~this~command~will~be~ignored.
6669 }
6670 \@@_msg_new:nn { old-column-type }
6671 {
6672     The~column~type~'#1'~is~no~longer~defined~in~'nicematrix'.~
6673     Since~version~5.0,~you~have~to~use~'l',~'c'~and~'r'~instead~of~'L',~
6674     'C'~and~'R'.~You~can~also~use~the~key~'define-L-C-R'.\\
6675     This~error~is~fatal.
6676 }
6677 \@@_msg_new:nn { bad-value-for-baseline }
6678 {
6679     The~value~given~to~'baseline'~(\int_use:N \l_tmpa_int)~is~not~
6680     valid.~The~value~must~be~between~\int_use:N \l_@@_first_row_int\ and~
6681     \int_use:N \g_@@_row_total_int\ or~equal~to~'t',~'c'~or~'b'.\\
6682     If~you~go~on,~a~value~of~1~will~be~used.
6683 }
6684 \@@_msg_new:nn { Invalid-name-format }
6685 {
6686     You~can't~give~the~name~'\l_keys_value_tl'~to~a~\token_to_str:N
6687     \SubMatrix.\\
6688     A~name~must~be~accepted~by~the~regular~expression~[A-Za-z][A-Za-z0-9]*.\\
6689     If~you~go~on,~this~key~will~be~ignored.
6690 }
6691 \@@_msg_new:nn { Wrong-line-in-SubMatrix }
6692 {
6693     You~try~to~draw~a~#1~line~of~number~'#2'~in~a~
6694     \token_to_str:N \SubMatrix\ of~your~\@@_full_name_env:\ but~that~
6695     number~is~not~valid.~If~you~go~on,~it~will~be~ignored.
6696 }
6697 \@@_msg_new:nn { impossible-delimiter }
6698 {
6699     It's~impossible~to~draw~the~#1~delimiter~of~your~
6700     \token_to_str:N \SubMatrix\ because~all~the~cells~are~empty~
6701     in~that~column.
6702     \bool_if:NT \l_@@_submatrix_slim_bool
6703     { ~Maybe~you~should~try~without~the~key~'slim'. } \\
6704     If~you~go~on,~this~\token_to_str:N \SubMatrix\ will~be~ignored.
6705 }
6706 \@@_msg_new:nn { empty-environment }
6707 { Your~\@@_full_name_env:\ is~empty.~This~error~is~fatal. }
6708 \@@_msg_new:nn { Delimiter-with-small }
6709 {
6710     You~can't~put~a~delimiter~in~the~preamble~of~your~\@@_full_name_env:\
6711     because~the~key~'small'~is~in~force.\\
6712     This~error~is~fatal.
6713 }
6714 \@@_msg_new:nn { unknown-cell-for-line-in-CodeAfter }
6715 {
6716     Your~command~\token_to_str:N\line\{#1\}\{#2\}~in~the~'code~after'~
6717     can't~be~executed~because~a~cell~doesn't~exist.\\
6718     If~you~go~on~this~command~will~be~ignored.
6719 }
6720 \@@_msg_new:nnn { Duplicate-name-for-SubMatrix }
6721 {
6722     The~name~'#1'~is~already~used~for~a~\token_to_str:N \SubMatrix\
6723     in~this~\@@_full_name_env:.\\
6724     If~you~go~on,~this~key~will~be~ignored.\\

```

```

6725     For~a~list~of~the~names~already~used,~type~H~<return>.
6726 }
6727 {
6728     The~names~already~defined~in~this~\@@_full_name_env:\ are:~
6729     \seq~use:Nnnn \g_@@_submatrix_names_seq { ~and~ } { ,~ } { ~and~ }.
6730 }
6731 \@@_msg_new:nn { r~or~l~with~preamble }
6732 {
6733     You~can't~use~the~key~'\l_keys_key_str'~in~your~\@@_full_name_env:~.~
6734     You~must~specify~the~alignment~of~your~columns~with~the~preamble~of~
6735     your~\@@_full_name_env:~.~\
6736     If~you~go~on,~this~key~will~be~ignored.
6737 }
6738 \@@_msg_new:nn { Hdotsfor~in~col~0 }
6739 {
6740     You~can't~use~\token_to_str:N \Hdotsfor\ in~an~exterior~column~of~
6741     the~array.~This~error~is~fatal.
6742 }
6743 \@@_msg_new:nn { bad~corner }
6744 {
6745     #1~is~an~incorrect~specification~for~a~corner~(in~the~keys~
6746     'corners'~and~'except-corners').~The~available~
6747     values~are:~NW,~SW,~NE~and~SE.~\
6748     If~you~go~on,~this~specification~of~corner~will~be~ignored.
6749 }
6750 \@@_msg_new:nn { bad~border }
6751 {
6752     #1~is~an~incorrect~specification~for~a~border~(in~the~key~
6753     'borders'~of~the~command~\token_to_str:N \Block).~The~available~
6754     values~are:~left,~right,~top~and~bottom.~\
6755     If~you~go~on,~this~specification~of~border~will~be~ignored.
6756 }
6757 \@@_msg_new:nn { last~col~non~empty~for~NiceArray }
6758 {
6759     In~the~\@@_full_name_env:,~you~must~use~the~key~
6760     'last~col'~without~value.~\
6761     However,~you~can~go~on~for~this~time~
6762     (the~value~'\l_keys_value_tl'~will~be~ignored).
6763 }
6764 \@@_msg_new:nn { last~col~non~empty~for~NiceMatrixOptions }
6765 {
6766     In~\NiceMatrixoptions,~you~must~use~the~key~
6767     'last~col'~without~value.~\
6768     However,~you~can~go~on~for~this~time~
6769     (the~value~'\l_keys_value_tl'~will~be~ignored).
6770 }
6771 \@@_msg_new:nn { Block~too~large~1 }
6772 {
6773     You~try~to~draw~a~block~in~the~cell~#1-#2~of~your~matrix~but~the~matrix~is~
6774     too~small~for~that~block.~\
6775 }
6776 \@@_msg_new:nn { Block~too~large~2 }
6777 {
6778     The~preamble~of~your~\@@_full_name_env:\ announces~\int~use:N
6779     \g_@@_static_num_of_col_int\
6780     columns~but~you~use~only~\int~use:N \c@jCol\ and~that's~why~a~block~
6781     specified~in~the~cell~#1-#2~can't~be~drawn.~You~should~add~some~ampersands~
6782     (&)~at~the~end~of~the~first~row~of~your~
6783     \@@_full_name_env:~.~\
6784     If~you~go~on,~this~block~and~maybe~others~will~be~ignored.
6785 }

```

```

6786 \@@_msg_new:nn { unknown-column-type }
6787 {
6788   The-column-type~'#1'~in~your~\@@_full_name_env:\
6789   is~unknown. \\
6790   This-error-is-fatal.
6791 }
6792 \@@_msg_new:nn { tabularnote-forbidden }
6793 {
6794   You~can't~use~the~command~\token_to_str:N\tabularnote\
6795   ~in~a~\@@_full_name_env:~This~command~is~available~only~in~
6796   \{NiceTabular\},~\{NiceArray\}~and~\{NiceMatrix\}. \\
6797   If~you~go~on,~this~command~will~be~ignored.
6798 }
6799 \@@_msg_new:nn { borders~forbidden }
6800 {
6801   You~can't~use~the~key~'borders'~of~the~command~\token_to_str:N \Block\
6802   because~the~option~'rounded-corners'~
6803   is~in~force~with~a~non-zero~value.\\
6804   If~you~go~on,~this~key~will~be~ignored.
6805 }
6806 \@@_msg_new:nn { bottomrule~without~booktabs }
6807 {
6808   You~can't~use~the~key~'tabular/bottomrule'~because~you~haven't~
6809   loaded~'booktabs'.\\
6810   If~you~go~on,~this~key~will~be~ignored.
6811 }
6812 \@@_msg_new:nn { enumitem~not~loaded }
6813 {
6814   You~can't~use~the~command~\token_to_str:N\tabularnote\
6815   ~because~you~haven't~loaded~'enumitem'.\\
6816   If~you~go~on,~this~command~will~be~ignored.
6817 }
6818 \@@_msg_new:nn { Wrong~last~row }
6819 {
6820   You~have~used~'last-row=\int_use:N \l_@@_last_row_int'~but~your~
6821   \@@_full_name_env:\ seems~to~have~\int_use:N \c@iRow \ rows.~
6822   If~you~go~on,~the~value~of~\int_use:N \c@iRow \ will~be~used~for~
6823   last~row.~You~can~avoid~this~problem~by~using~'last-row'~
6824   without~value~(more~compilations~might~be~necessary).
6825 }
6826 \@@_msg_new:nn { Yet~in~env }
6827 { Environments~of~nicematrix~can't~be~nested.\\ This~error~is~fatal. }
6828 \@@_msg_new:nn { Outside~math~mode }
6829 {
6830   The~\@@_full_name_env:\ can~be~used~only~in~math~mode~
6831   (and~not~in~\token_to_str:N \vcenter).\\
6832   This~error~is~fatal.
6833 }
6834 \@@_msg_new:nn { One~letter~allowed }
6835 {
6836   The~value~of~key~'\l_keys_key_str'~must~be~of~length~1.\\
6837   If~you~go~on,~it~will~be~ignored.
6838 }
6839 \@@_msg_new:nnn { Unknown~key~for~Block }
6840 {
6841   The~key~'\l_keys_key_str'~is~unknown~for~the~command~\token_to_str:N
6842   \Block.\\ If~you~go~on,~it~will~be~ignored. \\
6843   For~a~list~of~the~available~keys,~type~H<return>.
6844 }
6845 {

```

```

6846   The~available~keys~are~(in~alphabetic~order):~b,~borders,~c,~draw,~fill,~
6847   hvlines,~l,~line-width,~rounded-corners,~r~and~t.
6848 }

6849 \@_msg_new:nnn { Unknown~key~for~CodeAfter }
6850 {
6851   The~key~'\l_keys_key_str'~is~unknown.\\
6852   If~you~go~on,~it~will~be~ignored. \\
6853   For~a~list~of~the~available~keys~in~\token_to_str:N
6854   \CodeAfter,~type~H~<return>.
6855 }
6856 {
6857   The~available~keys~are~(in~alphabetic~order):~
6858   delimiters/color,~
6859   rules~(with~the~subkeys~'color'~and~'width'),~
6860   sub-matrix~(several~subkeys)~
6861   and~xdots~(several~subkeys).~
6862   The~latter~is~for~the~command~\token_to_str:N \line.
6863 }

6864 \@_msg_new:nnn { Unknown~key~for~SubMatrix }
6865 {
6866   The~key~'\l_keys_key_str'~is~unknown.\\
6867   If~you~go~on,~this~key~will~be~ignored. \\
6868   For~a~list~of~the~available~keys~in~\token_to_str:N
6869   \SubMatrix,~type~H~<return>.
6870 }
6871 {
6872   The~available~keys~are~(in~alphabetic~order):~
6873   'delimiters/color',~
6874   'extra-height',~
6875   'hlines',~
6876   'hvlines',~
6877   'left-xshift',~
6878   'name',~
6879   'right-xshift',~
6880   'rules'~(with~the~subkeys~'color'~and~'width'),~
6881   'slim',~
6882   'vlines'~and~'xshift'~(which~sets~both~'left-xshift'~
6883   and~'right-xshift').\\
6884 }

6885 \@_msg_new:nnn { Unknown~key~for~notes }
6886 {
6887   The~key~'\l_keys_key_str'~is~unknown.\\
6888   If~you~go~on,~it~will~be~ignored. \\
6889   For~a~list~of~the~available~keys~about~notes,~type~H~<return>.
6890 }
6891 {
6892   The~available~keys~are~(in~alphabetic~order):~
6893   bottomrule,~
6894   code-after,~
6895   code-before,~
6896   enumitem-keys,~
6897   enumitem-keys-para,~
6898   para,~
6899   label-in-list,~
6900   label-in-tabular~and~
6901   style.
6902 }

6903 \@_msg_new:nnn { Unknown~key~for~NiceMatrixOptions }
6904 {
6905   The~key~'\l_keys_key_str'~is~unknown~for~the~command~
6906   \token_to_str:N \NiceMatrixOptions. \\
6907   If~you~go~on,~it~will~be~ignored. \\

```

```

6908   For~a~list~of~the~*principal*~available~keys,~type~H~<return>.
6909 }
6910 {
6911   The~available~keys~are~(in~alphabetic~order):~
6912   allow~duplicate~names,~
6913   cell~space~bottom~limit,~
6914   cell~space~limits,~
6915   cell~space~top~limit,~
6916   code~for~first~col,~
6917   code~for~first~row,~
6918   code~for~last~col,~
6919   code~for~last~row,~
6920   corners,~
6921   create~extra~nodes,~
6922   create~medium~nodes,~
6923   create~large~nodes,~
6924   delimiters~(several~subkeys),~
6925   end~of~row,~
6926   first~col,~
6927   first~row,~
6928   hlines,~
6929   hvlines,~
6930   last~col,~
6931   last~row,~
6932   left~margin,~
6933   letter~for~dotted~lines,~
6934   light~syntax,~
6935   notes~(several~subkeys),~
6936   nullify~dots,~
6937   renew~dots,~
6938   renew~matrix,~
6939   right~margin,~
6940   rules~(with~the~subkeys~'color'~and~'width'),~
6941   small,~
6942   sub~matrix~(several~subkeys),~
6943   vlines,~
6944   xdots~(several~subkeys).
6945 }

6946 \@@_msg_new:nnn { Unknown~key~for~NiceArray }
6947 {
6948   The~key~'\l_keys_key_str'~is~unknown~for~the~environment~
6949   \{NiceArray\}.  \\\
6950   If~you~go~on,~it~will~be~ignored.  \\\
6951   For~a~list~of~the~*principal*~available~keys,~type~H~<return>.
6952 }
6953 {
6954   The~available~keys~are~(in~alphabetic~order):~
6955   b,~
6956   baseline,~
6957   c,~
6958   cell~space~bottom~limit,~
6959   cell~space~limits,~
6960   cell~space~top~limit,~
6961   code~after,~
6962   code~for~first~col,~
6963   code~for~first~row,~
6964   code~for~last~col,~
6965   code~for~last~row,~
6966   colortbl~like,~
6967   columns~width,~
6968   corners,~
6969   create~extra~nodes,~
6970   create~medium~nodes,~

```

```

6971 create-large-nodes,~
6972 delimiters/color,~
6973 extra-left-margin,~
6974 extra-right-margin,~
6975 first-col,~
6976 first-row,~
6977 hlines,~
6978 hvlines,~
6979 last-col,~
6980 last-row,~
6981 left-margin,~
6982 light-syntax,~
6983 name,~
6984 notes/bottomrule,~
6985 notes/para,~
6986 nullify-dots,~
6987 renew-dots,~
6988 right-margin,~
6989 rules~(with~the~subkeys~'color'~and~'width'),~
6990 small,~
6991 t,~
6992 tabularnote,~
6993 vlines,~
6994 xdots/color,~
6995 xdots/shorten~and~
6996 xdots/line-style.
6997 }

```

This error message is used for the set of keys NiceMatrix/NiceMatrix and NiceMatrix/pNiceArray (but not by NiceMatrix/NiceArray because, for this set of keys, there is also the keys t, c and b).

```

6998 \@@_msg_new:nnn { Unknown~key~for~NiceMatrix }
6999 {
7000   The~key~'\l_keys_key_str'~is~unknown~for~the~
7001   \@@_full_name_env:. \\\
7002   If~you~go~on,~it~will~be~ignored. \\\
7003   For~a~list~of~the~*principal*~available~keys,~type~H~<return>.
7004 }
7005 {
7006   The~available~keys~are~(in~alphabetic~order):~
7007   b,~
7008   baseline,~
7009   c,~
7010   cell-space-bottom-limit,~
7011   cell-space-limits,~
7012   cell-space-top-limit,~
7013   code-after,~
7014   code-for-first-col,~
7015   code-for-first-row,~
7016   code-for-last-col,~
7017   code-for-last-row,~
7018   colortbl-like,~
7019   columns-width,~
7020   corners,~
7021   create-extra-nodes,~
7022   create-medium-nodes,~
7023   create-large-nodes,~
7024   delimiters~(several~subkeys),~
7025   extra-left-margin,~
7026   extra-right-margin,~
7027   first-col,~
7028   first-row,~
7029   hlines,~
7030   hvlines,~

```

```

7031 l,~
7032 last-col,~
7033 last-row,~
7034 left-margin,~
7035 light-syntax,~
7036 name,~
7037 nullify-dots,~
7038 r,~
7039 renew-dots,~
7040 right-margin,~
7041 rules~(with~the~subkeys~'color'~and~'width'),~
7042 small,~
7043 t,~
7044 vlines,~
7045 xdots/color,~
7046 xdots/shorten~and~
7047 xdots/line-style.
7048 }
7049 \@_msg_new:nnn { Unknown~key~for~NiceTabular }
7050 {
7051   The~key~'\l_keys_key_str'~is~unknown~for~the~environment~
7052   \{NiceTabular\}. \\
7053   If~you~go~on,~it~will~be~ignored. \\
7054   For~a~list~of~the~*principal*~available~keys,~type~H~<return>.
7055 }
7056 {
7057   The~available~keys~are~(in~alphabetic~order):~
7058   b,~
7059   baseline,~
7060   c,~
7061   cell-space-bottom-limit,~
7062   cell-space-limits,~
7063   cell-space-top-limit,~
7064   code-after,~
7065   code-for-first-col,~
7066   code-for-first-row,~
7067   code-for-last-col,~
7068   code-for-last-row,~
7069   colortbl-like,~
7070   columns-width,~
7071   corners,~
7072   create-extra-nodes,~
7073   create-medium-nodes,~
7074   create-large-nodes,~
7075   extra-left-margin,~
7076   extra-right-margin,~
7077   first-col,~
7078   first-row,~
7079   hlines,~
7080   hvlines,~
7081   last-col,~
7082   last-row,~
7083   left-margin,~
7084   light-syntax,~
7085   name,~
7086   notes/bottomrule,~
7087   notes/para,~
7088   nullify-dots,~
7089   renew-dots,~
7090   right-margin,~
7091   rules~(with~the~subkeys~'color'~and~'width'),~
7092   t,~
7093   tabularnote,~

```

```

7094     vlines,~
7095     xdots/color,~
7096     xdots/shorten~and~
7097     xdots/line-style.
7098   }
7099   \@@_msg_new:nnn { Duplicate-name }
7100   {
7101     The~name~'\l_keys_value_tl'~is~already~used~and~you~shouldn't~use~
7102     the~same~environment~name~twice.~You~can~go~on,~but,~
7103     maybe,~you~will~have~incorrect~results~especially~
7104     if~you~use~'columns-width=auto'.~If~you~don't~want~to~see~this~
7105     message~again,~use~the~key~'allow-duplicate-names'~in~
7106     '\token_to_str:N \NiceMatrixOptions'.\\
7107     For~a~list~of~the~names~already~used,~type~H~<return>. \\
7108   }
7109   {
7110     The~names~already~defined~in~this~document~are:~
7111     \seq_use:Nnnn \g_@@_names_seq { ~and~ } { ,~ } { ~and~ }.
7112   }
7113   \@@_msg_new:nn { Option-auto-for-columns-width }
7114   {
7115     You~can't~give~the~value~'auto'~to~the~key~'columns-width'~here.~
7116     If~you~go~on,~the~key~will~be~ignored.
7117   }

```

19 History

The successive versions of the file `nicematrix.sty` provided by TeXLive are available on the SVN server of TeXLive:

<https://www.tug.org/svn/texlive/trunk/Master/texmf-dist/tex/latex/nicematrix/nicematrix.sty>

Changes between versions 1.0 and 1.1

The dotted lines are no longer drawn with Tikz nodes but with Tikz circles (for efficiency).
Modification of the code which is now twice faster.

Changes between versions 1.1 and 1.2

New environment `{NiceArray}` with column types L, C and R.

Changes between version 1.2 and 1.3

New environment `{pNiceArrayC}` and its variants.

Correction of a bug in the definition of `{BNiceMatrix}`, `{vNiceMatrix}` and `{VNiceMatrix}` (in fact, it was a typo).

Options are now available locally in `{pNiceMatrix}` and its variants.

The names of the options are changed. The old names were names in “camel style”.

Changes between version 1.3 and 1.4

The column types `w` and `W` can now be used in the environments `{NiceArray}`, `{pNiceArrayC}` and its variants with the same meaning as in the package `array`.

New option `columns-width` to fix the same width for all the columns of the array.

Changes between version 1.4 and 2.0

The versions 1.0 to 1.4 of `nicematrix` were focused on the continuous dotted lines whereas the version 2.0 of `nicematrix` provides different features to improve the typesetting of mathematical matrices.

Changes between version 2.0 and 2.1

New implementation of the environment `{pNiceArrayRC}`. With this new implementation, there is no restriction on the width of the columns.

The package `nicematrix` no longer loads `mathtools` but only `amsmath`.

Creation of “medium nodes” and “large nodes”.

Changes between version 2.1 and 2.1.1

Small corrections: for example, the option `code-for-first-row` is now available in the command `\NiceMatrixOptions`.

Following a discussion on TeX StackExchange⁶⁴, Tikz externalization is now deactivated in the environments of the package `nicematrix`.⁶⁵

Changes between version 2.1.2 and 2.1.3

When searching the end of a dotted line from a command like `\Cdots` issued in the “main matrix” (not in the exterior column), the cells in the exterior column are considered as outside the matrix. That means that it’s possible to do the following matrix with only a `\Cdots` command (and a single `\Vdots`).

$$\begin{pmatrix} & C_j & \\ 0 & \vdots & 0 \\ & \ddots & \\ 0 & \dots & 0 \end{pmatrix} L_i$$

Changes between version 2.1.3 and 2.1.4

Replacement of some options `0 { }` in commands and environments defined with `xparse` by `! 0 { }` (because a recent version of `xparse` introduced the specifier `!` and modified the default behaviour of the last optional arguments).

See www.texdev.net/2018/04/21/xparse-optional-arguments-at-the-end

Changes between version 2.1.4 and 2.1.5

Compatibility with the classes `revtex4-1` and `revtex4-2`.

Option `allow-duplicate-names`.

Changes between version 2.1.5 and 2.2

Possibility to draw horizontal dotted lines to separate rows with the command `\hdottedline` (similar to the classical command `\hline` and the command `\hdashline` of `arydshln`).

Possibility to draw vertical dotted lines to separate columns with the specifier “:” in the preamble (similar to the classical specifier “|” and the specifier “:” of `arydshln`).

⁶⁴cf. tex.stackexchange.com/questions/450841/tikz-externalize-and-nicematrix-package

⁶⁵Before this version, there was an error when using `nicematrix` with Tikz externalization. In any case, it’s not possible to externalize the Tikz elements constructed by `nicematrix` because they use the options `overlay` and `remember picture`.

Changes between version 2.2 and 2.2.1

Improvement of the vertical dotted lines drawn by the specifier “:” in the preamble.
Modification of the position of the dotted lines drawn by `\hdottedline`.

Changes between version 2.2.1 and 2.3

Compatibility with the column type `S` of `siunitx`.
Option `hlines`.

Changes between version 2.3 and 3.0

Modification of `\Hdotsfor`. Now `\Hdotsfor` erases the `\vlines` (of “|”) as `\hdotsfor` does.
Composition of exterior rows and columns on the four sides of the matrix (and not only on two sides) with the options `first-row`, `last-row`, `first-col` and `last-col`.

Changes between version 3.0 and 3.1

Command `\Block` to draw block matrices.
Error message when the user gives an incorrect value for `last-row`.
A dotted line can no longer cross another dotted line (excepted the dotted lines drawn by `\cdottedline`, the symbol “:” (in the preamble of the array) and `\line` in `code-after`).
The starred versions of `\Cdots`, `\Ldots`, etc. are now deprecated because, with the new implementation, they become pointless. These starred versions are no longer documented.
The vertical rules in the matrices (drawn by “|”) are now compatible with the color fixed by `colortbl`.
Correction of a bug: it was not possible to use the colon “:” in the preamble of an array when `pdflatex` was used with `french-babel` (because `french-babel` activates the colon in the beginning of the document).

Changes between version 3.1 and 3.2 (and 3.2a)

Option `small`.

Changes between version 3.2 and 3.3

The options `first-row`, `last-row`, `first-col` and `last-col` are now available in the environments `{NiceMatrix}`, `{pNiceMatrix}`, `{bNiceMatrix}`, etc.
The option `columns-width=auto` doesn’t need any more a second compilation.
The options `renew-dots`, `renew-matrix` and `transparent` are now available as package options (as said in the documentation).
The previous version of `nicematrix` was incompatible with a recent version of `expl3` (released 2019/09/30). This version is compatible.

Changes between version 3.3 and 3.4

Following a discussion on TeX StackExchange⁶⁶, optimization of Tikz externalization is disabled in the environments of `nicematrix` when the class `standalone` or the package `standalone` is used.

Changes between version 3.4 and 3.5

Correction on a bug on the two previous versions where the `code-after` was not executed.

⁶⁶cf. tex.stackexchange.com/questions/510841/nicematrix-and-tikz-external-optimize

Changes between version 3.5 and 3.6

LaTeX counters `iRow` and `jCol` available in the cells of the array.

Addition of `\normalbaselines` before the construction of the array: in environments like `{align}` of `amsmath` the value of `\baselineskip` is changed and if the options `first-row` and `last-row` were used in an environment of `nicematrix`, the position of the delimiters was wrong.

A warning is written in the `.log` file if an obsolete environment is used.

There is no longer artificial errors `Duplicate~name` in the environments of `amsmath`.

Changes between version 3.6 and 3.7

The four “corners” of the matrix are correctly protected against the four codes: `code-for-first-col`, `code-for-last-col`, `code-for-first-row` and `code-for-last-row`.

New command `\pAutoNiceMatrix` and its variants (suggestion of Christophe Bal).

Changes between version 3.7 and 3.8

New programming for the command `\Block` when the block has only one row. With this programming, the vertical rules drawn by the specifier “|” at the end of the block is actually drawn. In previous versions, they were not because the block of one row was constructed with `\multicolumn`. An error is raised when an obsolete environment is used.

Changes between version 3.8 and 3.9

New commands `\NiceMatrixLastEnv` and `\OnlyMainNiceMatrix`.

New options `create-medium-nodes` and `create-large-nodes`.

Changes between version 3.9 and 3.10

New option `light-syntax` (and `end-of-row`).

New option `dotted-lines-margin` for fine tuning of the dotted lines.

Changes between versions 3.10 and 3.11

Correction of a bug linked to `first-row` and `last-row`.

Changes between versions 3.11 and 3.12

Command `\rotate` in the cells of the array.

Options `vlines`, `hlines` and `hvlines`.

Option `baseline` pour `{NiceArray}` (not for the other environments).

The name of the Tikz nodes created by the command `\Block` has changed: when the command has been issued in the cell $i-j$, the name is $i-j$ -`block` and, if the creation of the “medium nodes” is required, a node $i-j$ -`block-medium` is created.

If the user tries to use more columns than allowed by its environment, an error is raised by `nicematrix` (instead of a low-level error).

The package must be loaded with the option `obsolete-environments` if we want to use the deprecated environments.

Changes between versions 3.12 and 3.13

The behaviour of the command `\rotate` is improved when used in the “last row”.

The option `dotted-lines-margin` has been renamed in `xdots/shorten` and the options `xdots/color` and `xdots/line-style` have been added for a complete customisation of the dotted lines.

In the environments without preamble (`{NiceMatrix}`, `{pNiceMatrix}`, etc.), it’s possible to use the options `l` (`=L`) or `r` (`=R`) to specify the type of the columns.

The starred versions of the commands `\Cdots`, `\Ldots`, `\Vdots`, `\Ddots` and `\Iddots` are deprecated since the version 3.1 of `nicematrix`. Now, one should load `nicematrix` with the option `starred-commands` to avoid an error at the compilation.

The code of `nicematrix` no longer uses Tikz but only PGF. By default, Tikz is *not* loaded by `nicematrix`.

Changes between versions 3.13 and 3.14

Correction of a bug (question 60761504 on [stackoverflow](#)).

Better error messages when the user uses `&` or `\\` when `light-syntax` is in force.

Changes between versions 3.14 and 3.15

It’s possible to put labels on the dotted lines drawn by `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots`, `\Hdotsfor` and the command `\line` in the `code-after` with the tokens `_` and `^`.

The option `baseline` is now available in all the environments of `nicematrix`. Before, it was available only in `{NiceArray}`.

New keyword `\CodeAfter` (in the environments of `nicematrix`).

Changes between versions 3.15 and 4.0

New environment `{NiceTabular}`

Commands to color cells, rows and columns with a perfect result in the PDF.

Changes between versions 4.0 and 4.1

New keys `cell-space-top-limit` and `cell-space-bottom-limit`

New command `\diagbox`

The key `hvline` don’t draw rules in the blocks (commands `\Block`) and in the virtual blocks corresponding to the dotted lines.

Changes between versions 4.1 and 4.2

It’s now possible to write `\begin{pNiceMatrix}a&b\\c&d\end{pNiceMatrix}^2` with the expected result.

Changes between versions 4.2 and 4.3

The horizontal centering of the content of a `\Block` is correct even when an instruction such as `!\quad` is used in the preamble of the array.

It’s now possible to use the command `\Block` in the “last row”.

Changes between versions 4.3 and 4.4

New key `hvlines-except-corners`.

Changes between versions 4.4 and 5.0

Use of the standard column types `l`, `c` and `r` instead of `L`, `C` and `R`.

It's now possible to use the command `\diagbox` in a `\Block`.

Command `\tabularnote`

Changes between versions 5.0 and 5.1

The vertical rules specified by `|` in the preamble are not broken by `\hline\hline` (and other).

Environment `{NiceTabular*}`

Command `\Vdotsfor` similar to `\Hdotsfor`

The variable `\g_nicematrix_code_after_tl` is now public.

Changes between versions 5.1 and 5.2

The vertical rules specified by `|` or `||` in the preamble respect the blocks.

Key `respect-blocks` for `\rowcolors` (with a `s`) in the `code-before`.

The variable `\g_nicematrix_code_before_tl` is now public.

The key `baseline` may take in as value an expression of the form `line-i` to align the `\hline` in the row `i`.

The key `hvlines-except-corners` may take in as value a list of corners (eg: `NW,SE`).

Changes between versions 5.2 and 5.3

Keys `c`, `r` and `l` for the command `\Block`.

It's possible to use the key `draw-first` with `\Ddots` and `\Iddots` to specify which dotted line will be drawn first (the other lines will be drawn parallel to that one if parallelization is activated).

Changes between versions 5.3 and 5.4

Key `tabularnote`.

Different behaviour for the mono-column blocks.

Changes between versions 5.4 and 5.5

The user must never put `\omit` before `\CodeAfter`.

Correction of a bug: the tabular notes `\tabularnotes` were not composed when present in a block (except a mono-column block).

Changes between versions 5.5 and 5.6

Different behaviour for the mono-row blocks.

New command `\NotEmpty`.

Changes between versions 5.6 and 5.7

New key `delimiters-color`

Keys `fill`, `draw` and `line-width` for the command `\Block`.

Changes between versions 5.7 and 5.8

Keys `cols` and `restart` of the command `\rowcolors` in the `code-before`.

Modification of the behaviour of `\\` in the columns of type `p`, `m` or `b` (for a behaviour similar to the environments of `array`).

Better error messages for the command `\Block`.

Changes between versions 5.8 and 5.9

Correction of a bug: in the previous versions, it was not possible to use the key `line-style` for the continuous dotted lines when the Tikz library `babel` was loaded.

New key `cell-space-limits`.

Changes between versions 5.9 and 5.10

New command `\SubMatrix` available in the `\CodeAfter`.

It's possible to provide options (between brackets) to the keyword `\CodeAfter`.

A (non fatal) error is raised when the key `transparent`, which is deprecated, is used.

Changes between versions 5.10 and 5.11

It's now possible, in the `code-before` and in the `\CodeAfter`, to use the syntax `|(i-|j)` for the Tikz node at the intersection of the (potential) horizontal rule number i and the (potential) vertical rule number j .

Changes between versions 5.11 and 5.12

Keywords `\CodeBefore` and `\Body` (alternative syntax to the key `code-before`).

New key `delimiters/max-width`.

New keys `hlines`, `vlines` and `hvlines` for the command `\SubMatrix` in the `\CodeAfter`.

New key `rounded-corners` for the command `\Block`.

Changes between versions 5.12 and 5.13

New command `\arraycolor` in the `\CodeBefore` (with its key `except-corners`).

New key `borders` for the command `\Block`.

New command `\Hline` (for horizontal rules not drawn in the blocks).

The keys `vlines` and `hlines` takes in as value a (comma-separated) list of numbers (for the rules to draw).

Changes between versions 5.13 and 5.14

Nodes of the form (1.5) , (2.5) , (3.5) , etc.

Keys `t` and `b` for the command `\Block`.

Key `corners`.

Changes between versions 5.14 and 5.15

Key `hvlines` for the command `\Block`.

The commands provided by `nicematrix` to color cells, rows and columns don't color the cells which are in the "corners" (when the key `corner` is used).

It's now possible to specify delimiters for submatrices in the preamble of an environment.

The version 5.15b is compatible with the version 3.0+ of `siunitx` (previous versions were not).

Changes between versions 5.15 and 5.16

It's now possible to use the cells corresponding to the contents of the nodes (of the form $i-j$) in the `\CodeBefore` when the key `create-cell-nodes` of that `\CodeBefore` is used. The medium and the large nodes are also available if the corresponding keys are used.

Changes between versions 5.16 and 5.17

The key `define-L-C-R` (only available at load-time) now raises a (non fatal) error (that key will probably be deleted in a future version of `nicematrix`).

Keys `L`, `C` and `R` for the command `\Block`.

Key `hvlines-except-borders`.

It's now possible to use a key `l`, `r` or `c` with the command `\pAutoNiceMatrix` (and the similar ones).

Changes between versions 5.17 and 5.18

New command `\RowStyle`

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The italic numbers denote the pages where the corresponding entry is described, numbers underlined point to the definition, all others indicate the places where it is used.

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@@ commands:	
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<code>\l_@@_last_col_without_value_bool</code>	364, 824, 2728, 6550
<code>\l_@@_last_empty_column_int</code>	4793, 4794, 4807, 4813, 4826
<code>\l_@@_last_empty_row_int</code>	4775, 4776, 4789, 4810
<code>\l_@@_last_i_tl</code>	6161, 6167, 6170, 6183, 6217, 6230, 6232, 6280, 6287
<code>\l_@@_last_j_tl</code>	6162, 6168, 6171, 6194, 6196, 6253, 6263, 6270
<code>\l_@@_last_row_int</code>	361, 362, 576, 902, 949, 1143, 1269, 1273, 1280, 1532, 1536, 1539, 1551, 1573, 2348, 2349, 2578, 2579, 2623, 2624, 2731, 3253, 3292, 3762, 3778, 3802, 4405, 4413, 5427, 5430, 5431, 5450, 5467, 5477, 5489, 5501, 5512, 5526, 5587, 5598, 5892, 6820
<code>\l_@@_last_row_without_value_bool</code>	363, 1271, 1534, 2730
<code>\l_@@_left_delim_dim</code>	1299, 1303, 1308, 2314, 2601
<code>\g_@@_left_delim_tl</code>	1307, 1472, 1584, 1608, 1676, 1866, 1868, 4899
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<code>\l_@@_letter_for_dotted_lines_str</code>	805, 816, 817, 1739
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341, 5397, 5680, 5718, 5729, 5735, 5747,	677, 841, 866, 2200
5774, 5794, 5809, 5811, 5821, 5822, 5824, 5835	<code>@@_notes_style:n</code>
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..... 2352, 2358, 2359 507, 611, 3737, 3753, 3769, 3793, 3816
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<code>@@_msg_new:nn</code>	5921, 5924, 5932
17,	<code>@@_old_dotfill:</code>
6456, 6462, 6489, 6498, 6528, 6561, 6568,	1240
6576, 6584, 6589, 6595, 6600, 6605, 6610,	<code>\l_@@_old_iRow_int</code>
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6697, 6706, 6708, 6714, 6731, 6738, 6743,	1096, 1215, 5422
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..... 19, 800, 1624, 5441, 5444	1218, 3738
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2667, 2668, 2697, 2708, 2716, 2840, 5905, 6545	<code>@@_open_x_initial_dim:</code>
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2486, 2489, 2532, 2535, 2553, 2556, 2968,	<code>\l_@@_parallelize_diags_bool</code>
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..... 5858, 5869, 5877, 5883, 5889, 5895 2014, 2015, 2016, 2034
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6329, 6330, 6390	<code>@@_patch_m_preamble_vi:n</code>
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