

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 or TeXlive.

This package can be used with `xelatex`, `lualatex`, `pdflatex` but also by the classical workflow `latex-dvips-ps2pdf` (or Adobe Distiller).

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**.

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).

Important

Since the version 5.0 of `nicematrix`, one must use the letters `l`, `c` and `r` in the preambles of the environments and no longer the letters `L`, `C` and `R`.

For sake of compatibility with the previous versions, there exists an option `define-L-C-R` which must be used when loading `nicematrix`.

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

*This document corresponds to the version 5.7 of `nicematrix`, at the date of 2020/11/23.

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.

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}
```

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`. 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`.¹

```
\NiceMatrixOptions{cell-space-top-limit = 1pt,cell-space-bottom-limit = 1pt}

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

¹One 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`.

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

2.	n	0	1	2	3	4	5
	u_n	1	2	4	8	16	32

However, it's also possible to use the tools of `booktabs`: `\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

2.	n	0	1	2	3	4	5
	u_n	1	2	4	8	16	32

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-top-limit=1pt,cell-space-bottom-limit=1pt}
```

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

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

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.

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.

New 5.6 If this argument is empty, its default value is 1-1. If the number of rows is not specified, 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.

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

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

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.²

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

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

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

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

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

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`).

²This 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{NiceTabular}{cwc{2cm}wc{3cm}c}
rose      & tulipe & marguerite & dahlia \\
violette  &         &             &         \\
& \Block[draw=red,fill=red!15]{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

New 5.7 As we can see on this example, it's possible to fill the block by using the key `fill` and to draw the frame with the key `draw`³. It's also possible to change the width (thickness) of that rules with the key `line-width`.

4.2 The mono-column blocks

New 5.4 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).

```

\begin{NiceTabular}{@{}>{\bfseries}lr@{}} \hline
\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}

```

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

4.3 The mono-row blocks

New 5.6 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.

³If the key `draw` is used without value, the default color the rules of the tabulars is used

- 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`.⁴

```
\begin{NiceTabular}{cc}
\toprule
Write & \Block[1]{year of birth} \\
\midrule
Hugo & 1802 \\
Balzac & 1799 \\
\bottomrule
\end{NiceTabular}
```

Write	year of birth
Hugo	1802
Balzac	1799

We recall that if the first mandatory argument of `\Block` is left blank, the block is mono-cell.⁵

4.5 A small remark

One should remark that the horizontal centering of the contents of the blocks is correct even when an instruction such as `!\qqquad` has been used in the preamble of the array in order to increase the space between two columns (this is not the case with `\multicolumn`). In the following example, the header “First group” is correctly centered.

```
\begin{NiceTabular}{@{c!{\qqquad}ccc!{\qqquad}ccc@{}}
\toprule
& \Block{1-3}{First group} & & \Block{1-3}{Second group} \\
Rank & 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}
```

	First group			Second group		
Rank	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

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.

⁴If one wishes to color the background of a unique celle, there is no point using the command `\Block`: it's possible to use the command `\cellcolor` (when the key `colortbl`-like is used).

⁵One may consider that the default value of the first mandatory argument of `\Block` is 1-1.

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`).⁶

```
\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.

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`.

```
\newcolumnntype{I}{!{\vrule}}
```

However, in this case, it is probably more clever to add a command `\OnlyMainNiceMatrix` (cf. p. 33):

```
\newcolumnntype{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	B	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	B	C	D
A	B	C	D

⁶This is the behaviour since the version 5.1 of `nicematrix`. Prior to that version, the behaviour was the standard behaviour of `array`.

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.

```
\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 33.

5.3 The keys `hlines` and `vlines`

The key `hlines` draws all the horizontal rules and the key `vlines` draws all the vertical rules excepted in the blocks (and the virtual blocks determined by dotted lines). In fact, in the environments with delimiters (as `{pNiceMatrix}` or `{bNiceArray}`) the exteriors rules are not drawn (as expected).

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

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

5.4 The key `hvlines`

The key `hvlines` draws all the vertical and horizontal rules (excepted in the blocks and the virtual blocks determined by dotted lines and excepted the rules corresponding of the frame of the blocks using the key `draw` which are drawn with their own characteristics).

```
\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

5.5 The key `hvlines-except-corners`

The key `hvlines-except-corners` draws all the horizontal and vertical rules, excepted in the blocks (and the virtual blocks determined by dotted lines) and excepted in the empty corners.

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

As we can see, an “empty corner” is composed by the reunion of all the empty rectangles starting from the cell actually in the corner of the array.

It’s possible to give as value to the key `hvlines-except-corners` a list of the corners to take into consideration. The corners are designed by NW, SW, NE and SE (*north west*, *south west*, *north east* and *south east*).

```
\begin{NiceTabular}{*{6}{c}}%
[hvlines-except-corners=NE,cell-space-top-limit=3pt]
1\\
1&1\\
1&2&1\\
1&3&3&1\\
1&4&6&4&1\\
1&5&10&10&5&1
\end{NiceTabular}
```

1					
1	1				
1	2	1			
1	3	3	1		
1	4	6	4	1	
1	5	10	10	5	1

5.6 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.⁷

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

$\begin{smallmatrix} y \\ \diagdown \\ x \end{smallmatrix}$	<i>e</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>e</i>	<i>e</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>a</i>	<i>a</i>	<i>e</i>	<i>c</i>	<i>b</i>
<i>b</i>	<i>b</i>	<i>c</i>	<i>e</i>	<i>a</i>
<i>c</i>	<i>c</i>	<i>b</i>	<i>a</i>	<i>e</i>

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

⁷The author of this document considers that type of construction as graphically poor.

5.7 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`.

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 rule⁸. 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:

- The package `colortbl` patches `array`, leading to some incompatibilities (for example 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.

⁸In fact, this is true only for `\hline` and “|” but not for `\cline`: cf p. 7

6.2 The tools of nicematrix in the code-before

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.

The extension `nicematrix` provides a key `code-before` for some code that will be executed before the drawing of the tabular. In this `code-before`, new commands are available: `\cellcolor`, `\rectanglecolor`, `\rowcolor`, `\columncolor`, `\rowcolors` and `\chessboardcolors`.

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.

- 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 row and j the number of column of the cell.

```
\begin{NiceTabular}{|c|c|c|}[code-before =
\cellcolor{red!15}{3-1,2-2,1-3}]
\hline
a & b & c \\ \hline
e & f & g \\ \hline
h & i & j \\ \hline
\end{NiceTabular}
```

a	b	c
e	f	g
h	i	j

A command `\cellcolor` generates only one instruction `fill` (coded `f`) in the resulting PDF.

- 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|}[code-before =
\rectanglecolor{blue!15}{2-2}{3-3}]
\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 `\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).

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

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}

A command `\rowcolor` generates only one instruction `fill` (coded `f`) in the resulting PDF.

- 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`⁹. The *s* emphasizes the fact that there is *two* colors. This command colors alternately the rows of the tabular, beginning with the row whose number is given in first (mandatory) argument. The two other (mandatory) arguments are the colors.

```
\begin{NiceTabular}{@{}lr@{}}[hlines,code-before = \rowcolors{1}{blue!10}{}]
John & 12 \\
Stephen & 8 \\
Sarah & 18 \\
Ashley & 20 \\
Henry & 14 \\
Madison & 15
\end{NiceTabular}
```

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

There is a key `respect-blocks` for the instruction `\rowcolors`. With that key, the “rows” alternately colored may extend over several rows if they have to incorporate blocks.

```
\begin{NiceTabular}{lr}[hvlines,code-before =
\rowcolors{1}{blue!10}{}[respect-blocks]]
\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

- The command `\chessboardcolors` takes in as mandatory arguments two colors and it colors the cells of the tabular in quincunx with these colors.

```
$\begin{pNiceMatrix}[r,margin, code-before=\chessboardcolors{red!15}{blue!15}]
1 & -1 & 1 \\
-1 & 1 & -1 \\
1 & -1 & 1
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$$

We have used the key `r` which aligns all the columns rightwards (cf. p. 26).

One should remark that these commands are compatible with the commands of `booktabs` (`\toprule`, `\midrule`, `\bottomrule`, etc).

⁹The command `\rowcolors` of `xcolor` is available when `xcolor` is loaded with the option `table`.

```

\begin{NiceTabular}[c]{lSSSS}%
[code-before = \rowcolor{red!15}{1-2} \rowcolors{3}{blue!15}{}]
\toprule
\Block{2-1}{Product} &
\Block{1-3}{dimensions (cm)} & & &
\Block{2-1}{\rotate Price} \\
\cmidrule{rl}{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.¹⁰

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).

```

\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

Each instruction `\cellcolor`, `\rowcolor` or `\columncolor` will generate an instruction `fill` (coded **f**) in the resulting PDF. In cases of juxtaposed colored rectangles, one may have a thin

¹⁰As of now, this key is not available in `\NiceMatrixOptions`.

white color line in some PDF viewers¹¹ (between the two first columns in the above example). In you want to avoid this problem, you should use the tools in the `code-before`. That's what we do with the following code.

```
\begin{NiceTabular}[colortbl-like]{ccc}%
  [code-before = \columncolor{blue!15}{1,2}]
\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 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.¹²

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

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

¹¹For example SumatraPDF, which uses MuPDF of Artifex Software, or PDF.js used by Firefox.

¹²The 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).

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`.

```
\NiceMatrixOptions{columns-width=10mm}
$\begin{pNiceMatrix}
a & b & \backslash c & d
\end{pNiceMatrix}
=
\begin{pNiceMatrix}
1 & 1245 & \backslash 345 & 2
\end{pNiceMatrix}$
```

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

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`¹³. The environment `{NiceMatrixBlock}` has no direct link with the command `\Block` presented previously in this document (cf. p. 4).

```
\begin{NiceMatrixBlock}[auto-columns-width]
$\begin{array}{c}
\begin{bNiceMatrix}
9 & 17 & \backslash -2 & 5
\end{bNiceMatrix} & \backslash \backslash
\begin{bNiceMatrix}
1 & 1245345 & \backslash 345 & 2
\end{bNiceMatrix}
\end{array}$
\end{NiceMatrixBlock}
```

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

Several compilations may be necessary to achieve the job.

8 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{pNiceMatrix}[first-row,last-row,first-col,last-col]
$\begin{pNiceMatrix}[first-row,last-row,first-col,last-col,nullify-dots]
& C_1 & & \backslash Cdots & & C_4 & & \backslash \\
L_1 & a_{11} & a_{12} & a_{13} & a_{14} & L_1 & \backslash \\
\backslash Vdots & a_{21} & a_{22} & a_{23} & a_{24} & \backslash Vdots & \backslash \\
& a_{31} & a_{32} & a_{33} & a_{34} & & \backslash \\
L_4 & a_{41} & a_{42} & a_{43} & a_{44} & L_4 & \backslash \\
& C_1 & & \backslash Cdots & & C_4 & & \backslash \\
\end{pNiceMatrix}$
\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. 17.

¹³At this time, this is the only usage of the environment `{NiceMatrixBlock}` but it may have other usages in the future.

We have several remarks to do.

- For the environments with an explicit preamble (i.e. `{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.
- 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. 28) 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}}
$\begin{pNiceArray}{cc|cc}[first-row,last-row=5,first-col,last-col,nullify-dots]
    & C_1 & & \Cdots & & C_4 & & \\
L_1 & & a_{11} & & a_{12} & & a_{13} & & a_{14} & & L_1 \\
\vdots & & a_{21} & & a_{22} & & a_{23} & & a_{24} & & \vdots \\
\hline
    & & a_{31} & & a_{32} & & a_{33} & & a_{34} & & \\
L_4 & & a_{41} & & a_{42} & & a_{43} & & a_{44} & & L_4 \\
    & & C_1 & & \Cdots & & C_4 & & \\
\end{pNiceArray}$
```

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

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 33.
- 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.

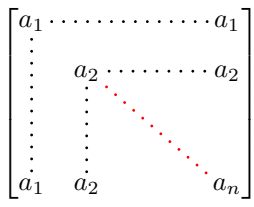
- Logically, the potential option `columns-width` (described p. 14) doesn't apply to the “first column” and “last column”.
- For technical reasons, it's not possible to use the option of the command `\` after the “first row” or before the “last row” (the placement of the delimiters would be wrong).

9 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`.¹⁴

Each of them must be used alone in the cell of the array and it draws a dotted line between the first non-empty cells¹⁵ 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`.¹⁶

```
\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}
```



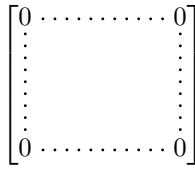
In order to represent the null matrix, one can use the following code:

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



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`:

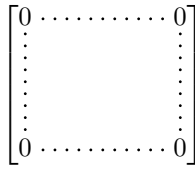
```
\begin{bNiceMatrix}
0      & \Cdots & \Cdots & 0      & \\
\Vdots &      &      & \Vdots & \\
\Vdots &      &      & \Vdots & \\
0      & \Cdots & \Cdots & 0      & \\
\end{bNiceMatrix}
```



In the first column of this example, 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 & \\
0      &      & \Cdots & 0      & \\
\end{bNiceMatrix}
```



¹⁴The 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`.

¹⁵The precise definition of a “non-empty cell” is given below (cf. p. 34).

¹⁶It's also possible to change the color of all these dotted lines with the option `xdots/color` (`xdots` to remind that it works for `\Cdots`, `\Ldots`, `\Vdots`, etc.): cf. p. 20.

There are also other means to change the size of the matrix. Someone might want to use the optional argument of the command `\l` for the vertical dimension and a command `\hspace*` in a cell for the horizontal dimension.¹⁷

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}
```

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

9.1 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.

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

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

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.

9.2 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.

¹⁷In `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. 14

```

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

```

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

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}

```

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

Remark: Unlike the command `\hdotsfor` of `amsmath`, the command `\Hdotsfor` may be used when the package `colortbl` 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} & \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}

```

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

9.3 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`.¹⁸

¹⁸The 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.

- The option `renew-dots`

With this option, the commands `\ldots`, `\cdots`, `\vdots`, `\ddots`, `\iddots`¹⁴ 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 & & \ddots & & \vdots & \\
0 & & \cdots & & 0 & & & & 1 & \\
\end{pmatrix}
```

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

9.4 The labels of the dotted lines

The commands `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` (and the command `\line` in the `code-after` which is described p. 22) 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`.

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

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

9.5 Customization of the dotted lines

The dotted lines drawn by `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` (and by the command `\line` in the `code-after` which is described p. 22) 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` 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. 15.

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).¹⁹

```
\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`:

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

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

9.6 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 and by the keys `hlines`, `vlines`, `hvlines` and `hvlines-except-corners` are not drawn within the blocks).

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

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

10 The code-after

The option `code-after` may be used to give some code that will be executed after the construction of the matrix.²⁰

¹⁹The 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.

²⁰There is also a key `code-before` described p. 11.

A special command, called `\line`, is available to draw directly dotted lines between nodes. It takes two arguments for the two cells to rely, both of the form i - j where i is the number of row and j is the number of column. It may be used, for example, to draw a dotted line between two adjacent cells.

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

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

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` (for an example, cf. p. 39). **New 5.5** Before the version 5.5, it was necessary, in some circumstances, to put the keyword `\omit` before `\CodeAfter`. Since version 5.5, one must never put `\omit`.

11 The notes in the tabulars

11.1 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`.

11.2 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`).
- **New 5.4** 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. 24. 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.}\\
Touquet & Marie & 89 \\
Wallis & John & 87 \\
\bottomrule
\end{NiceTabular}
\end{table}
```

Table 1: Use of `\tabularnote`^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.

11.3 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.

- 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. 24).

- 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` est une 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 customization of the tabular notes, see p. 35.

11.4 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
```

12 Other features

12.1 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`.

12.2 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).

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

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

12.3 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`.

```

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

```

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

12.4 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`).

```

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

```

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

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.

12.5 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 column²¹. Of course, the user must not

²¹We 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.

change the value of these counters which are used internally by `nicematrix`.

In the `code-before` (cf. p. 11) and in the `code-after` (cf. p. 21), `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).

```

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

```

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

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).

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

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

12.6 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.²²

²²The 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.

12.7 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`.

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

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

12.8 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.

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

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

13 Use of Tikz with `nicematrix`

13.1 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.

New 5.6 However, it's possible to impose the creation of a node with the command `\NotEmpty`. ²³

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) ;
```

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

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

²³One should note that, with that command, the cell is considered as non-empty, which has consequences for the continuous dotted lines (cf. p. 17).

In the **code-after**, 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. 39).

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

13.2 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`.²⁴

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.²⁵

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

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`.²⁶

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

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

²⁴There is also an option `create-extra-nodes` which is an alias for the conjunction of `create-medium-nodes` and `create-large-nodes`.

²⁵There is no “large nodes” created in the exterior rows and columns (for these rows and columns, cf. p. 15).

²⁶The 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.

fix both values with the option `extra-margin` and, in the following example, we use `extra-margin` with the value 3 pt.

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

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 \\[1ex]
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`.

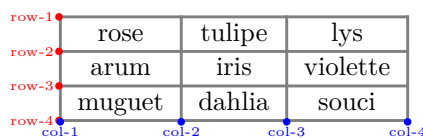
fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

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

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

13.3 The “row-nodes” and the “col-nodes”

The package `nicematrix` creates a PGF/Tikz node indicating the potential position of each horizontal rule (with the names `row-i`) and each vertical rule (with the names `col-j`), as described in the following figure. These nodes are available in the `code-before` and the `code-after`.



If we use Tikz (we remind that `nicematrix` does not load Tikz by default), we can access (in the `code-before` and the `code-after`) to the intersection of the horizontal rule *i* and the vertical rule *j* with the syntax `(row-i-|col-j)`.

```
\[\begin{NiceMatrix}[
  code-before =
  {
    \tikz \draw [fill = red!15]
      (row-7-|col-4) -- (row-8-|col-4) -- (row-8-|col-5) --
      (row-9-|col-5) -- (row-9-|col-6) |- cycle ;
  }
]
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

```

14 API for the developpers

The package `nicematrix` provides two variables which are internal but public²⁷:

- `\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, explicetely using the public variable `\g_nicematrix_code_before_tl` (this code requires the Tikz library `patterns`: `\usetikzlibrary{patterns}`).

```

ExplSyntaxOn
\cs_new_protected:Nn \__pantigny_hatchcell:nnn
{
  \begin { tikzpicture }
  \fill [ pattern = north-west-lines , pattern-color = #3 ]
    ( row - #1 -| col - #2 )
    rectangle
    ( row - \int_eval:n { #1 + 1 } -| col - \int_eval:n { #2 + 1 } ) ;
  \end { tikzpicture }
}

\NewDocumentCommand \hatchcell { ! 0 { black } }
{
  \tl_gput_right:Nx \g_nicematrix_code_before_tl
  {
    \__pantigny_hatchcell:nnn
    { \int_use:c { c@iRow } }
    { \int_use:c { c@jCol } }
  }
}

```

²⁷According 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.


```

    { #1 }
  }
}
\ExplSyntaxOff

```

Here is an example of use:

```

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

```

Tokyo	Paris	London
Lima	Oslo	Miami
Los Angeles	Madrid	Roma

15 Technical remarks

15.1 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 an 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 job²⁸:

```

\newcolumntype{?}{!{\OnlyMainNiceMatrix{\vrule width 1 pt}}}

```

The heavy vertical rule won't extend in the exterior rows.²⁹

```

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

```

$$\begin{array}{cc|cc}
 C_1 & C_2 & C_3 & C_4 \\
 \left(\begin{array}{cc|cc}
 a & b & c & d \\
 e & f & g & h \\
 C_1 & C_2 & C_3 & C_4
 \end{array} \right)$$

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.

15.2 Diagonal lines

By default, all the diagonal lines³⁰ 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):

```

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

```

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

²⁸The command `\vrule` is a TeX (and not LaTeX) command.

²⁹Of course, such rule is defined by the classical technics of `nicematrix` and, for this reason, won't cross the double rules of `\hline\hline`.

³⁰We speak of the lines created by `\Ddots` and not the lines created by a command `\line` in `code-after`.

```

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

```

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

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

The same example without parallelization:

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

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]`.

15.3 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:

```

\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`.

15.4 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 idea³¹. The environment `{matrix}` of `amsmath` and its variants (`{pmatrix}`, `{vmatrix}`, etc.) of `amsmath` prefer to delete these spaces with explicit instructions `\hskip -\arraycolsep`³². 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}` of `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).

³¹In 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).*

³²And 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

15.5 Incompatibilities

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

16 Examples

16.1 Notes in the tabulars

The tools provided by `nicematrix` for the composition of the tabular notes have been presented in the section 11 p. 22.

Let's consider that we wish to number the notes of a tabular with stars.³³

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 ³⁴

```
\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}
```

³³Of course, it's realistic only when there is very few notes in the tabular.

³⁴In 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.

16.2 Dotted lines

A permutation matrix (as an example, we have raised the value of `xdots/shorten`).

```

 $\begin{pNiceMatrix}[xdots/shorten=0.6em]$ 
0 & 1 & 0 & & & \Cdots & 0 & \\
\Vdots & & & & \Ddots & & & \Vdots \\
& & & & \Ddots & & & \\
& & & & \Ddots & & 0 & \\
0 & 0 & & & & & 1 & \\
1 & 0 & & & \Cdots & & 0 & \\
\end{pNiceMatrix}

```

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

An example with `\Iddots` (we have raised again the value of `xdots/shorten`).

```

 $\begin{pNiceMatrix}[xdots/shorten=0.9em]$ 
1 & & \Cdots & & 1 & \\
\Vdots & & & & 0 & \\
& & \Iddots & & \Iddots & \Vdots \\
1 & 0 & & \Cdots & 0 & \\
\end{pNiceMatrix}

```

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

An example with `\multicolumn`:

```

 $\begin{BNiceMatrix}[nullify-dots]$ 
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
\Cdots & & \multicolumn{6}{C}{10 \text{ other rows}} & & \Cdots \\
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
\end{BNiceMatrix}

```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{pmatrix}$$

An example with `\Hdotsfor`:

```
\begin{pNiceMatrix}[nullify-dots]
0 & 1 & 1 & 1 & 1 & 0 & \\
0 & 1 & 1 & 1 & 1 & 0 & \\
\Vdots & & \Hdotsfor{4} & & \Vdots & & \\
& & \Hdotsfor{4} & & & & \\
& & \Hdotsfor{4} & & & & \\
& & \Hdotsfor{4} & & & & \\
0 & 1 & 1 & 1 & 1 & 0 & \\
\end{pNiceMatrix}
```

$$\begin{pmatrix} 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ \vdots & \dots & \dots & \dots & \dots & \vdots \\ & \dots & \dots & \dots & \dots & \\ & \dots & \dots & \dots & \dots & \\ & \dots & \dots & \dots & \dots & \\ 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

An example for the resultant of two polynoms:

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

$$\left| \begin{array}{ccccccc} a_0 & & & & b_0 & & \\ a_1 & & \dots & & b_1 & & \dots \\ \vdots & & \dots & & \vdots & & \dots \\ a_p & & & a_0 & & & b_1 \\ & & \dots & & a_1 & & \vdots \\ & & & \vdots & & b_q & \\ & & & a_p & & & b_q \end{array} \right|$$

An example for a linear system:

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

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

16.3 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
  {nullify-dots,code-for-first-col = \color{blue},code-for-first-col=\color{blue}}
$\begin{pNiceMatrix}[first-row,first-col]
  & & \Ldots[line-style={solid,<->},shorten=0pt]^{n \text{ columns}} \\\
  & 1 & 1 & 1 & \Ldots & 1 \\\
  & 1 & 1 & 1 & & 1 \\\
  \Vdots[line-style={solid,<->}]_{n \text{ rows}} & 1 & 1 & 1 & & 1 \\\
  & 1 & 1 & 1 & & 1 \\\
  & 1 & 1 & 1 & \Ldots & 1
\end{pNiceMatrix}$
```

$$\begin{array}{c} \xrightarrow{n \text{ columns}} \\ \begin{pmatrix} 1 & 1 & 1 & \dots & 1 \\ 1 & 1 & 1 & & 1 \\ 1 & 1 & 1 & & 1 \\ 1 & 1 & 1 & & 1 \\ 1 & 1 & 1 & \dots & 1 \end{pmatrix} \\ \xleftarrow{n \text{ rows}} \end{array}$$

16.4 Width of the columns

In the following example, we use `{NiceMatrixBlock}` with the option `auto-columns-width` because we want the same automatic width for all the columns of the matrices.

```
\begin{NiceMatrixBlock}[auto-columns-width]
\NiceMatrixOptions
  { last-col,code-for-last-col = \color{blue}\scriptstyle,light-syntax}
\setlength{\extrarowheight}{1mm}
$\begin{pNiceArray}{cccc:c}
  1 1 1 1 1 {} ;
  2 4 8 16 9 ;
  3 9 27 81 36 ;
  4 16 64 256 100
\end{pNiceArray}$
\medskip
$\begin{pNiceArray}{cccc:c}
  1 1 1 1 1 ;
  0 2 6 14 7 { L_2 \gets -2 L_1 + L_2 } ;
  0 6 24 78 33 { L_3 \gets -3 L_1 + L_3 } ;
  0 12 60 252 96 { L_4 \gets -4 L_1 + L_4 }
\end{pNiceArray}$
...
\end{NiceMatrixBlock}
```

$$\begin{array}{c}
\begin{pmatrix} 1 & 1 & 1 & 1 & \vdots & 1 \\ 2 & 4 & 8 & 16 & \vdots & 9 \\ 3 & 9 & 27 & 81 & \vdots & 36 \\ 4 & 16 & 64 & 256 & \vdots & 100 \end{pmatrix} \\
\begin{pmatrix} 1 & 1 & 1 & 1 & \vdots & 1 \\ 0 & 2 & 6 & 14 & \vdots & 7 \\ 0 & 6 & 24 & 78 & \vdots & 33 \\ 0 & 12 & 60 & 252 & \vdots & 96 \end{pmatrix} \begin{array}{l} L_2 \leftarrow -2L_1 + L_2 \\ L_3 \leftarrow -3L_1 + L_3 \\ L_4 \leftarrow -4L_1 + L_4 \end{array} \\
\begin{pmatrix} 1 & 1 & 1 & 1 & \vdots & 1 \\ 0 & 1 & 3 & 7 & \vdots & \frac{7}{2} \\ 0 & 3 & 12 & 39 & \vdots & \frac{33}{2} \\ 0 & 1 & 5 & 21 & \vdots & 8 \end{pmatrix} \begin{array}{l} L_2 \leftarrow \frac{1}{2}L_2 \\ L_3 \leftarrow \frac{1}{2}L_3 \\ L_4 \leftarrow \frac{1}{12}L_4 \end{array}
\end{array}
\quad \left| \quad
\begin{array}{c}
\begin{pmatrix} 1 & 1 & 1 & 1 & \vdots & 1 \\ 0 & 1 & 3 & 7 & \vdots & \frac{7}{2} \\ 0 & 0 & 3 & 18 & \vdots & 6 \\ 0 & 0 & -2 & -14 & \vdots & -\frac{9}{2} \end{pmatrix} \begin{array}{l} L_3 \leftarrow -3L_2 + L_3 \\ L_4 \leftarrow L_2 - L_4 \end{array} \\
\begin{pmatrix} 1 & 1 & 1 & 1 & \vdots & 1 \\ 0 & 1 & 3 & 7 & \vdots & \frac{7}{2} \\ 0 & 0 & 1 & 6 & \vdots & 2 \\ 0 & 0 & -2 & -14 & \vdots & -\frac{9}{2} \end{pmatrix} \begin{array}{l} L_3 \leftarrow \frac{1}{3}L_3 \\ L_4 \leftarrow -L_3 + L_4 \end{array} \\
\begin{pmatrix} 1 & 1 & 1 & 1 & \vdots & 1 \\ 0 & 1 & 3 & 7 & \vdots & \frac{7}{2} \\ 0 & 0 & 1 & 6 & \vdots & 2 \\ 0 & 0 & 0 & -2 & \vdots & -\frac{1}{2} \end{pmatrix} \begin{array}{l} L_4 \leftarrow L_3 + L_4 \end{array}
\end{array}$$

16.5 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 block³⁵).

```

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

```

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

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 command `\hline`, the specifier “|” and the options `hlines`, `vlines` and `hvlines` spread the cells.³⁶

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). 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`.

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

```

\usepackage{tikz}
\usetikzlibrary{fit}

```

³⁵We recall that, if the first mandatory argument of the command `\Block` is left empty, that means that the block is a mono-cell block

³⁶For the command `\cline`, see the remark p. 7.

```

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

$\begin{bNiceMatrix}
0 & \Cdots & 0 \\
1 & \Cdots & 1 \\
0 & \Cdots & 0 \\
\CodeAfter \tikz \node [highlight = (2-1) (2-3)] {} ;
\end{bNiceMatrix}$

```

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

We recall that, for a rectangle of merged cells (with the command `\Block`), a Tikz node is created for the set of merged cells with the name *i-j-block* where *i* and *j* are the number of the row and the number of the column of the upper left cell (where the command `\Block` has been issued). If the user has required the creation of the `medium` nodes, a node of this type is also created with a name suffixed by `-medium`.

```

$\begin{pNiceMatrix}[margin,create-medium-nodes]
\Block{3-3}<\Large>\{A\} & & 0 \\
& \hspace*{1cm} & & \Vdots \\
& & & 0 \\
0 & \Cdots & 0 & 0 \\
\CodeAfter
\tikz \node [highlight = (1-1-block-medium)] {} ;
\end{pNiceMatrix}$

```

$$\left(\begin{array}{c|c} \boxed{A} & \begin{matrix} 0 \\ \vdots \\ 0 \end{matrix} \\ \hline 0 \cdots \cdots 0 & 0 \end{array} \right)$$

Consider now the following matrix which we have named `example`.

```

$\begin{pNiceArray}{ccc}[name=example,last-col,create-medium-nodes]
a & a + b & a + b + c & L_1 \\
a & a & a + b & L_2 \\
a & a & a & L_3 \\
\end{pNiceArray}$

```

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

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

```

\tikzset{mes-options/.style={remember picture,
    overlay,
    name prefix = exemple-,
    highlight/.style = {fill = red!15,
        blend mode = multiply,
        inner sep = 0pt,
        fit = #1}}}

```



```
\begin{tikzpicture}[mes-options]
\node [highlight = (1-1) (1-3)] {};
\node [highlight = (2-1) (2-3)] {};
\node [highlight = (3-1) (3-3)] {};
\end{tikzpicture}
```

We obtain the following matrix.

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

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

```
\begin{tikzpicture}[mes-options, name suffix = -medium]
\node [highlight = (1-1) (1-3)] {};
\node [highlight = (2-1) (2-3)] {};
\node [highlight = (3-1) (3-3)] {};
\end{tikzpicture}
```

We obtain the following matrix.

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

In the following example, we use the “large nodes” to highlight a zone of the matrix.

```
\begin{pNiceArray}{>{\strut}cccc}[create-large-nodes,margin,extra-margin=2pt]
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} \\
\CodeAfter
\tikz \path [name suffix = -large,fill = red!15, blend mode = multiply]
(1-1.north west)
|- (2-2.north west)
|- (3-3.north west)
|- (4-4.north west)
|- (4-4.south east)
|- (1-1.north west) ;
\end{pNiceArray}
```

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

16.6 Direct use of the Tikz nodes

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

The use of `\NiceMatrixBlock` with the option `auto-columns-width` gives the same width for all the columns and, therefore, a perfect alignment of the two superposed matrices.

```
\begin{NiceMatrixBlock}[auto-columns-width]
```

```
\NiceMatrixOptions{nullify-dots}
```

The three matrices will be displayed using an environment `{array}` (an environment `{tabular}` may also be possible).

```

 $\begin{array}{cc}$ 
 $\&$ 

```

The matrix B has a “first row” (for C_j) and that’s why we use the key `first-row`.

```

\begin{bNiceArray}{c>\strut}cccc[name=B,first-row]
      & & & C_j & \\
b_{11} & \& \cdots & \& b_{1j} & \& \cdots & \& b_{1n} & \\
\vdots & & & \vdots & & & \vdots & \\
      & & & b_{kj} & & & \\
      & & & \vdots & & & \\
b_{n1} & \& \cdots & \& b_{nj} & \& \cdots & \& b_{nn} \\
\end{bNiceArray} \& \&

```

The matrix A has a “first column” (for L_i) and that’s why we use the key `first-col`.

```

\begin{bNiceArray}{cc>\strut}ccc[name=A,first-col]
      & a_{11} & \& \cdots & \& & & a_{1n} & \\
      & \vdots & & & & & & \vdots & \\
L_i & a_{i1} & \& \cdots & \& a_{ik} & \& \cdots & \& a_{in} & \\
      & \vdots & & & & & & \vdots & \\
      & a_{n1} & \& \cdots & \& & & a_{nn} & \\
\end{bNiceArray}
\&

```

In the matrix product, the two dotted lines have an open extremity.

```

\begin{bNiceArray}{cc>\strut}ccc
      & \& & & \& \& \\
      & \& \vdots & & \& \& \\
\cdots & \& c_{ij} & & \& \& \\
\& \& \\
\& \& \\
\end{bNiceArray}
\end{array}$

```

```
\end{NiceMatrixBlock}
```

```

\begin{tikzpicture}[remember picture, overlay]
\node [highlight = (A-3-1) (A-3-5) ] {} ;
\node [highlight = (B-1-3) (B-5-3) ] {} ;
\draw [color = gray] (A-3-3) to [bend left] (B-3-3) ;
\end{tikzpicture}

```

$$L_i \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & & \vdots \\ a_{i1} & \cdots & a_{in} \\ \vdots & & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} \begin{bmatrix} b_{11} & \cdots & b_{1j} & \cdots & b_{1n} \\ \vdots & & \vdots & & \vdots \\ b_{n1} & \cdots & b_{nj} & \cdots & b_{nn} \end{bmatrix} = \begin{bmatrix} \vdots & & \vdots \\ \cdots & c_{ij} & \cdots \end{bmatrix}$$

17 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: 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.

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

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_@@_booktabs_loaded_bool
25 \bool_new:N \c_@@_enumitem_loaded_bool
26 \bool_new:N \c_@@_tikz_loaded_bool
27 \AtBeginDocument
28 {
29   \ifpackageloaded { booktabs }
30     { \bool_set_true:N \c_@@_booktabs_loaded_bool }
31     { }
32   \ifpackageloaded { enumitem }
33     { \bool_set_true:N \c_@@_enumitem_loaded_bool }
34     { }
35   \ifpackageloaded { tikz }
36     {

```

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.

```

37   \bool_set_true:N \c_@@_tikz_loaded_bool
38   \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \tikzpicture }
39   \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endtikzpicture }
40 }
41 {
42   \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \pgfpicture }
43   \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endpgfpicture }
44 }
45 }

```

We test whether the current class is `revtex4-1` or `revtex4-2` because these classes redefines `\array` (of `array`) in a way incompatible with our programming.

```

46 \bool_new:N \c_@@_revtex_bool
47 \ifclassloaded { revtex4-1 }
48 { \bool_set_true:N \c_@@_revtex_bool }
49 { }
50 \ifclassloaded { revtex4-2 }
51 { \bool_set_true:N \c_@@_revtex_bool }
52 { }

```

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.

```

53 \ProvideDocumentCommand \iddots { }
54 {
55   \mathinner
56   {
57     \tex_mkern:D 1 mu
58     \box_move_up:nn { 1 pt } { \hbox:n { . } }
59     \tex_mkern:D 2 mu
60     \box_move_up:nn { 4 pt } { \hbox:n { . } }
61     \tex_mkern:D 2 mu
62     \box_move_up:nn { 7 pt }
63     { \vbox:n { \kern 7 pt \hbox:n { . } } }
64     \tex_mkern:D 1 mu
65   }
66 }

```

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.

```

67 \AtBeginDocument
68 {
69   \@ifpackageloaded { booktabs }
70   { \iow_now:Nn \@mainaux \nicematrix@redefine@check@rerun }
71   { }
72 }
73 \cs_set_protected:Npn \nicematrix@redefine@check@rerun
74 {
75   \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`).

```

76   \cs_set_protected:Npn \pgfutil@check@rerun ##1 ##2
77   {
78     \str_if_eq:eeF { nm- } { \tl_range:nnn { ##1 } 1 3 }
79     { \@_old_pgful@check@rerun { ##1 } { ##2 } }
80   }
81 }

```

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

```

82 \bool_new:N \c_@@_colortbl_loaded_bool
83 \AtBeginDocument
84 {
85   \@ifpackageloaded { colortbl }
86   { \bool_set_true:N \c_@@_colortbl_loaded_bool }
87   {

```

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. Idem for

```

88   \cs_set_protected:Npn \CT@arc@ { }
89   \cs_set:Npn \arrayrulecolor #1 # { \CT@arc@ { #1 } }
90   \cs_set:Npn \CT@arc@ #1 #2
91   {
92     \dim_compare:nNt \baselineskip = \c_zero_dim \noalign
93     { \cs_gset:Npn \CT@arc@ { \color #1 { #2 } } }
94   }

```

Idem for `\CT@drs@`.

```

95   \cs_set_protected:Npn \CT@drsc@ { }
96   \cs_set:Npn \doublerulesepcolor #1 # { \CT@drs@ { #1 } }
97   \cs_set:Npn \CT@drs@ #1 #2
98   {
99     \dim_compare:nNt \baselineskip = \c_zero_dim \noalign
100    { \cs_gset:Npn \CT@drsc@ { \color #1 { #2 } } }
101  }
102  \cs_set:Npn \hline
103  {
104    \noalign { \ifnum 0 = ` } \fi
105    \cs_set_eq:NN \hskip \vskip
106    \cs_set_eq:NN \vrule \hrule
107    \cs_set_eq:NN \@width \@height
108    { \CT@arc@ \vline }
109    \futurelet \reserved@a
110    \@xhline
111  }
112 }
113 }

```

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.

```

114 \cs_set:Npn \@@_standard_cline #1 { \@@_standard_cline:w #1 \q_stop }
115 \cs_set:Npn \@@_standard_cline:w #1-#2 \q_stop
116 {
117   \int_compare:nNnT \l_@@_first_col_int = 0 { \omit & }
118   \int_compare:nNnT { #1 } > 1 { \multispan { \@@_pred:n { #1 } } & }
119   \multispan { \int_eval:n { #2 - #1 + 1 } }
120   {
121     \CT@arc@
122     \leaders \hrule \@height \arrayrulewidth \hfill

```

The following `\skip_horizontal:N \c_zero_dim` is to prevent a potential `\unskip` to delete the `\leaders`³⁷

```

123   \skip_horizontal:N \c_zero_dim
124 }

```

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`.

```

125   \everycr { }
126   \cr
127   \noalign { \skip_vertical:N -\arrayrulewidth }
128 }

```

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.

```

129 \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`.

```

130 { \@@_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*.

```

131 \cs_set:Npn \@@_cline_i:nn #1 #2 { \@@_cline_i:w #1-#2 \q_stop }
132 \cs_set:Npn \@@_cline_i:w #1-#2-#3 \q_stop
133 {

```

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).

```

134   \int_compare:nNnT { #1 } < { #2 }
135   { \multispan { \int_eval:n { #2 - #1 } } & }
136   \multispan { \int_eval:n { #3 - #2 + 1 } }
137   {
138     \CT@arc@
139     \leaders \hrule \@height \arrayrulewidth \hfill
140     \skip_horizontal:N \c_zero_dim
141   }

```

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

```

142   \peek_meaning_remove_ignore_spaces:NTF \cline
143   { & \@@_cline_i:en { \@@_succ:n { #3 } } }
144   { \everycr { } \cr }
145 }
146 \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.

```

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

```

The following command is a small shortcut.

```

149 \cs_new:Npn \@@_math_toggle_token:

```

³⁷See question 99041 on TeX StackExchange.

```

150 { \bool_if:NF \l_@@_NiceTabular_bool \c_math_toggle_token }

151 \cs_new_protected:Npn \@@_set_CT@arc@:
152 { \peek_meaning:NTF [ \@@_set_CT@arc@_i: \@@_set_CT@arc@_ii: }
153 \cs_new_protected:Npn \@@_set_CT@arc@_i: [ #1 ] #2 \q_stop
154 { \cs_set:Npn \CT@arc@ { \color [ #1 ] { #2 } } }
155 \cs_new_protected:Npn \@@_set_CT@arc@_ii: #1 \q_stop
156 { \cs_set:Npn \CT@arc@ { \color { #1 } } }

```

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.

```

157 \bool_new:N \c_@@_siunitx_loaded_bool
158 \AtBeginDocument
159 {
160   \ifpackageloaded { siunitx }
161     { \bool_set_true:N \c_@@_siunitx_loaded_bool }
162     { }
163 }

```

The command \NC@rewrite@S is a LaTeX command created by siunitx in connection with the S column. In the code of siunitx, this command is defined by:

```

\renewcommand*{\NC@rewrite@S}[1] []
{
  \@temptokena \exp_after:wN
  {
    \tex_the:D \@temptokena
    > { \__siunitx_table_collect_begin: S {#1} }
    c
    < { \__siunitx_table_print: }
  }
  \NC@find
}

```

We want to patch this command (in the environments of nicematrix) in order to have:

```

\renewcommand*{\NC@rewrite@S}[1] []
{
  \@temptokena \exp_after:wN
  {
    \tex_the:D \@temptokena
    > { \@@_Cell: \__siunitx_table_collect_begin: S {#1} }
    \@@_true_c:
    < { \__siunitx_table_print: \@@_end_Cell: }
  }
  \NC@find
}

```

However, we don't want to use explicitly any private command of siunitx. That's why we will extract the name of the two __siunitx... commands by their position in the code of \NC@rewrite@S.

Since the command \NC@rewrite@S appends some tokens to the *toks* list \@temptokena, we use the LaTeX command \NC@rewrite@S in a group (\group_begin:–\group_end:) and we extract the two command names which are in the toks \@temptokena. However, this extraction can be done only when siunitx is loaded (and it may be loaded after nicematrix) and, in fact, after the beginning of the document — because some instructions of siunitx are executed in a \AtBeginDocument). That's why this extraction will be done only at the first use of an environment of nicematrix with the command \@@_adapt_S_column:.

```

164 \cs_set_protected:Npn \@@_adapt_S_column:
165 {
166   \bool_if:NT \c_@@_siunitx_loaded_bool
167   {
168     \group_begin:
169     \@temptokena = { }

```

We protect `\NC@find` which is at the end of `\NC@rewrite@S`.

```
170 \cs_set_eq:NN \NC@find \prg_do_nothing:
171 \NC@rewrite@S { }
```

Conversion of the *toks* `@temptokena` in a token list of `expl3` (the *toks* are not supported by `expl3` but we can, nevertheless, use the option `V` for `\tl_gset:NV`).

```
172 \tl_gset:NV \g_tmpa_tl \@temptokena
173 \group_end:
174 \tl_new:N \c_@@_table_collect_begin_tl
175 \tl_set:Nx \l_tmpa_tl { \tl_item:Nn \g_tmpa_tl 2 }
176 \tl_gset:Nx \c_@@_table_collect_begin_tl { \tl_item:Nn \l_tmpa_tl 1 }
177 \tl_new:N \c_@@_table_print_tl
178 \tl_gset:Nx \c_@@_table_print_tl { \tl_item:Nn \g_tmpa_tl { -1 } }
```

The token lists `\c_@@_table_collect_begin_tl` and `\c_@@_table_print_tl` contain now the two commands of `siunitx`.

If the adaptation has been done, the command `\@@_adapt_S_column:` becomes no-op (globally).

```
179 \cs_gset_eq:NN \@@_adapt_S_column: \prg_do_nothing:
180 }
181 }
```

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

```
182 \AtBeginDocument
183 {
184 \bool_if:nTF { ! \c_@@_siunitx_loaded_bool }
185 { \cs_set_eq:NN \@@_renew_NC@rewrite@S: \prg_do_nothing: }
186 {
187 \cs_new_protected:Npn \@@_renew_NC@rewrite@S:
188 {
189 \renewcommand*{\NC@rewrite@S}[1] []
190 {
191 \@temptokena \exp_after:wN
192 {
193 \tex_the:D \@temptokena
194 > { \c_@@_table_collect_begin_tl S {##1} }

```

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

```
195 \@@_true_c:
196 < { \c_@@_table_print_tl \@@_end_Cell: }
197 }
198 \NC@find
199 }
200 }
201 }
202 }
```

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

```
203 \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 avoid that situation.

```
204 \cs_new_protected:Npn \@@_provide_pgfsyspdfmark:
205 {
206 \iow_now:Nn \@mainaux
207 {
208 \ExplSyntaxOn
209 \cs_if_free:NT \pgfsyspdfmark
210 { \cs_set_eq:NN \pgfsyspdfmark \@gobblethree }
```



```

211     \ExplSyntaxOff
212   }
213   \cs_gset_eq:NN \@@_provide_pgfsyspdfmark: \prg_do_nothing:
214 }

```

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 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.

```

215 \bool_new:N \c_@@_define_L_C_R_bool
216 \cs_new_protected:Npn \@@_define_L_C_R:
217 {
218   \newcolumntype L l
219   \newcolumntype C c
220   \newcolumntype R r
221 }

```

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.

```

222 \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).

```

223 \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.

```

224 \NewExpandableDocumentCommand \NiceMatrixLastEnv { }
225 { \int_use:N \g_@@_env_int }

```

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

```

226 \cs_new_protected:Npn \@@_qpoint:n #1
227 { \pgfpointanchor { \@@_env: - #1 } { center } }

```

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

```

228 \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).

```

229 \dim_new:N \l_@@_columns_width_dim

```

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

```

230 \tl_new:N \l_@@_cell_type_tl
231 \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`.

```

232 \dim_new:N \g_@@_blocks_wd_dim

```

Idem pour the blocks mono-row.

```
233 \dim_new:N \g_@@_blocks_ht_dim
234 \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`.

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

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

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

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

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

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

```
238 \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.

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

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

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

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

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

```
242 \cs_new_protected:Npn \@@_test_if_math_mode:
243 {
244   \if_mode_math: \else:
245     \@@_fatal:n { Outside-math-mode }
246   \fi:
247 }
```

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

```
248 \colorlet { nicematrix-last-col } { . }
249 \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`).

```
250 \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*.

```
251 \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.

```

252 \cs_new:Npn \@@_full_name_env:
253 {
254   \str_if_eq:VnTF \g_@@_com_or_env_str { command }
255     { command \space \c_backslash_str \g_@@_name_env_str }
256     { environment \space \{ \g_@@_name_env_str \} }
257 }
```

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`).

```

258 \tl_new:N \g_nicematrix_code_after_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.

```

259 \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.

```

260 \int_new:N \l_@@_old_iRow_int
261 \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.

```

262 \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.

```

263 \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).

```

264 \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).

```

265 \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`.

```

266 \tl_new:N \l_@@_code_before_tl
267 \bool_new:N \l_@@_code_before_bool
```

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

```

268 \dim_new:N \l_@@_x_initial_dim
269 \dim_new:N \l_@@_y_initial_dim
270 \dim_new:N \l_@@_x_final_dim
271 \dim_new:N \l_@@_y_final_dim

```

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

```

272 \dim_zero_new:N \l_tmpc_dim
273 \dim_zero_new:N \l_tmpd_dim

```

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

```

274 \bool_new:N \g_@@_empty_cell_bool

```

The following dimension will be used to save the current value of `\arraycolsep`.

```

275 \dim_new:N \@@_old_arraycolsep_dim

```

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

```

276 \dim_new:N \g_@@_width_last_col_dim
277 \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 braces: `{imin}{jmin}{imax}{jmax}{options}{contents}`.

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

```

278 \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}`.

```

279 \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}`.

```

280 \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 `color=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.

```

281 \seq_new:N \g_@@_pos_of_stroken_blocks_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).

```

282 \int_new:N \g_@@_static_num_of_col_int

```

The following token lists correspond to the keys `fill` and `draw` of a command `\Block`.

```

283 \tl_new:N \l_@@_fill_tl
284 \tl_new:N \l_@@_draw_tl

```

The following token list correspond to the key `color` of the command `\Block`. However, as of now (v. 5.7 of `nicematrix`), the key `color` linked to `fill` with an error. We will give to the key `color` of `\Block` its new meaning in a few months (with its new definition, the key `color` will draw the frame with the given color but also color the content of the block (that is to say the text) as does the key `color` of a Tikz node).

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

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

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

The parameter of position of the label of a block (`c`, `r` or `l`).

```
287 \tl_new:N \l_@@_pos_of_block_tl
288 \tl_set:Nn \l_@@_pos_of_block_tl { c }
```

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

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

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

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

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.

```
291 \int_new:N \l_@@_first_row_int
292 \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.

```
293 \int_new:N \l_@@_first_col_int
294 \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).

```
295 \int_new:N \l_@@_last_row_int
296 \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”.³⁸

```
297 \bool_new:N \l_@@_last_row_without_value_bool
```

³⁸We 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.

Idem for `\l_@@_last_col_without_value_bool`

```
298 \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.

```
299 \int_new:N \l_@@_last_col_int
300 \int_set:Nn \l_@@_last_col_int { -2 }
```

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.

```
301 \bool_new:N \g_@@_last_col_found_bool
```

This boolean is set to `false` at the end of `\@@_pre_array:`.

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.

```
302 \newcounter { tabularnote }
```

We will store in the following sequence the tabular notes of a given array.

```
303 \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.

```
304 \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).

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

The following function can be redefined by using the key `notes/style`.

```
306 \cs_new:Npn \@@_notes_style:n #1 { \textit { \alph { #1 } } }
```

The following fonction can be redefined by using the key `notes/label-in-tabular`.

```
307 \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`.

```
308 \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`.

```
309 \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`).

```
310 \AtBeginDocument
311 {
312   \bool_if:nTF { ! \c_@@_enumitem_loaded_bool }
313   {
314     \NewDocumentCommand \tabularnote { m }
315     { \@@_error:n { enumitem-not-loaded } }
316   }
317 }
```

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.

```
318   \newlist { tabularnotes } { enumerate } { 1 }
319   \setlist [ tabularnotes ]
320   {
321     topsep = 0pt ,
322     noitemsep ,
323     leftmargin = * ,
324     align = left ,
325     labelsep = 0pt ,
326     label =
327     \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotesi } } ,
328   }
329   \newlist { tabularnotes* } { enumerate* } { 1 }
330   \setlist [ tabularnotes* ]
331   {
332     afterlabel = \nobreak ,
333     itemjoin = \quad ,
334     label =
335     \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotes*i } }
336   }
```

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.³⁹

```
337   \NewDocumentCommand \tabularnote { m }
338   {
339     \bool_if:nTF { ! \l_@@_NiceArray_bool && \l_@@_in_env_bool }
340     { \@@_error:n { tabularnote-forbidden } }
341     {
```

³⁹We should try to find a solution to that problem.

`\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 these notes as a comma separated list (e.g. a,b,c).

```
342 \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`.

```
343 \seq_gput_right:Nn \g_@@_tabularnotes_seq { #1 }
344 \peek_meaning:NF \tabularnote
345 {
```

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.

```
346 \hbox_set:Nn \l_tmpa_box
347 {
```

We remind that it is the command `\@@_notes_label_in_tabular:n` that will (most of the time) put the labels in a `\textsuperscript`.

```
348 \@@_notes_label_in_tabular:n
349 {
350 \stepcounter { tabularnote }
351 \@@_notes_style:n { tabularnote }
352 \prg_replicate:nn { \l_@@_number_of_notes_int - 1 }
353 {
354 ,
355 \stepcounter { tabularnote }
356 \@@_notes_style:n { tabularnote }
357 }
358 }
359 }
```

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.

```
360 \addtocounter { tabularnote } { -1 }
361 \refstepcounter { tabularnote }
362 \int_zero:N \l_@@_number_of_notes_int
363 \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).

```
364 \skip_horizontal:n { \box_wd:N \l_tmpa_box }
365 }
366 }
367 }
368 }
369 }
```

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.

```
370 \cs_new_protected:Npn \@@_pgf_rect_node:nnnnn #1 #2 #3 #4 #5
371 {
372 \begin { pgfscope }
373 \pgfset
374 {
375 outer~sep = \c_zero_dim ,
376 inner~sep = \c_zero_dim ,
```



```

377     minimum~size = \c_zero_dim
378   }
379   \pgftransformshift { \pgfpoint { 0.5 * ( #2 + #4 ) } { 0.5 * ( #3 + #5 ) } }
380   \pgfnode
381   { rectangle }
382   { center }
383   {
384     \vbox_to_ht:nn
385     { \dim_abs:n { #5 - #3 } }
386     {
387       \vfill
388       \hbox_to_wd:nn { \dim_abs:n { #4 - #2 } } { }
389     }
390   }
391   { #1 }
392   { }
393   \end { pgfscope }
394 }

```

The command `\@@_pgf_rect_node:nnn` is a variant of `\@@_pgr_rect_node:nnnn`: it takes two PGF points as arguments instead of the four dimensions which are the coordinates.

```

395 \cs_new_protected:Npn \@@_pgf_rect_node:nnn #1 #2 #3
396 {
397   \begin { pgfscope }
398   \pgfset
399   {
400     outer~sep = \c_zero_dim ,
401     inner~sep = \c_zero_dim ,
402     minimum~size = \c_zero_dim
403   }
404   \pgftransformshift { \pgfpointscale { 0.5 } { \pgfpointadd { #2 } { #3 } } }
405   \pgfpointdiff { #3 } { #2 }
406   \pgfgetlastxy \l_tmpa_dim \l_tmpb_dim
407   \pgfnode
408   { rectangle }
409   { center }
410   {
411     \vbox_to_ht:nn
412     { \dim_abs:n \l_tmpb_dim }
413     { \vfill \hbox_to_wd:nn { \dim_abs:n \l_tmpa_dim } { } }
414   }
415   { #1 }
416   { }
417   \end { pgfscope }
418 }

```

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.

```

419 \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`.

```

420 \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`).

```
421 \dim_new:N \l_@@_cell_space_top_limit_dim
422 \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.

```
423 \dim_new:N \l_@@_inter_dots_dim
424 \dim_set:Nn \l_@@_inter_dots_dim { 0.45 em }
```

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).

```
425 \dim_new:N \l_@@_xdots_shorten_dim
426 \dim_set:Nn \l_@@_xdots_shorten_dim { 0.3 em }
```

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.

```
427 \dim_new:N \l_@@_radius_dim
428 \dim_set:Nn \l_@@_radius_dim { 0.53 pt }
```

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.

```
429 \tl_new:N \l_@@_xdots_line_style_tl
430 \tl_const:Nn \c_@@_standard_tl { standard }
431 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
```

The boolean `\l_@@_light_syntax_bool` corresponds to the option `light-syntax`.

```
432 \bool_new:N \l_@@_light_syntax_bool
```

The string `\l_@@_baseline_str` 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).

```
433 \str_new:N \l_@@_baseline_str
434 \tl_set:Nn \l_@@_baseline_str 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`).

```
435 \bool_new:N \l_@@_exterior_arraycolsep_bool
```

The flag `\l_@@_parallelize_diags_bool` controls whether the diagonals are parallelized. The initial value is `true`.

```
436 \bool_new:N \l_@@_parallelize_diags_bool
437 \bool_set_true:N \l_@@_parallelize_diags_bool
```

If the flag `\l_@@_vlines_bool` is raised, horizontal space will be reserved in the the preamble of the array (for the vertical rules) and, after the construction of the array, the vertical rules will be drawn.

```
438 \bool_new:N \l_@@_vlines_bool
```

If the flag `\l_@@_hlines_bool` is raised, vertical space will be reserved between the rows of the array (for the horizontal rules) and, after the construction of the array, the vertical rules will be drawn.

```
439 \bool_new:N \l_@@_hlines_bool
```

The flag `\l_@@_except_corners_bool` will be raised when the key `except-corners` will be used. In that case, the corners will be computed before we draw rules and the rules won't be drawn in the corners. As expected, the key `hvlines-except-corners` raises the key `except-corners`.

```
440 \clist_new:N \l_@@_except_corners_clist
441 \dim_new:N \l_@@_notes_above_space_dim
442 \dim_set:Nn \l_@@_notes_above_space_dim { 1 mm }
```

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.).

```
443 \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).

```
444 \bool_new:N \l_@@_auto_columns_width_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.

```
445 \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”.

```
446 \bool_new:N \l_@@_medium_nodes_bool
447 \bool_new:N \l_@@_large_nodes_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`).

```
448 \dim_new:N \l_@@_left_margin_dim
449 \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`.

```
450 \dim_new:N \l_@@_extra_left_margin_dim
451 \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.

```
452 \tl_new:N \l_@@_end_of_row_tl
453 \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 “:”.

```
454 \tl_new:N \l_@@_xdots_color_tl
```

The following token list corresponds to the key `delimiters-color`.

```
455 \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 `max-delimiter-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.

```
456 \bool_new:N \l_@@_max_delimiter_width_bool
```

```

457 \keys_define:nn { NiceMatrix / xdots }
458 {
459   line-style .code:n =
460   {
461     \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.

```

462     { \cs_if_exist_p:N \tikzpicture }
463     { \str_if_eq_p:nn { #1 } { standard } }
464     { \tl_set:Nn \l_@@xdots_line_style_tl { #1 } }
465     { \@@_error:n { bad-option-for-line-style } }
466   } ,
467   line-style .value_required:n = true ,
468   color .tl_set:N = \l_@@xdots_color_tl ,
469   color .value_required:n = true ,
470   shorten .dim_set:N = \l_@@xdots_shorten_dim ,
471   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 `_`.

```

472   down .tl_set:N = \l_@@xdots_down_tl ,
473   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).

```

474   draw-first .code:n = \prg_do_nothing: ,
475   unknown .code:n = \@@_error:n { Unknown-option-for-xdots }
476 }

```

```

477 \keys_define:nn { NiceMatrix / rules }
478 {
479   color .tl_set:N = \l_@@_rules_color_tl ,
480   color .value_required:n = true ,
481   width .dim_set:N = \arrayrulewidth ,
482   width .value_required:n = true
483 }

```

First, we define a set of keys “NiceMatrix / Global” which will be used (with the mechanism of `.inherit:n`) by other sets of keys.

```

484 \keys_define:nn { NiceMatrix / Global }
485 {
486   standard-cline .bool_set:N = \l_@@_standard_cline_bool ,
487   standard-cline .default:n = true ,
488   cell-space-top-limit .dim_set:N = \l_@@_cell_space_top_limit_dim ,
489   cell-space-top-limit .value_required:n = true ,
490   cell-space-bottom-limit .dim_set:N = \l_@@_cell_space_bottom_limit_dim ,
491   cell-space-bottom-limit .value_required:n = true ,
492   xdots .code:n = \keys_set:nn { NiceMatrix / xdots } { #1 } ,
493   max-delimiter-width .bool_set:N = \l_@@_max_delimiter_width_bool ,
494   light-syntax .bool_set:N = \l_@@_light_syntax_bool ,
495   light-syntax .default:n = true ,
496   end-of-row .tl_set:N = \l_@@_end_of_row_tl ,
497   end-of-row .value_required:n = true ,
498   first-col .code:n = \int_zero:N \l_@@_first_col_int ,
499   first-row .code:n = \int_zero:N \l_@@_first_row_int ,
500   last-row .int_set:N = \l_@@_last_row_int ,
501   last-row .default:n = -1 ,
502   code-for-first-col .tl_set:N = \l_@@_code_for_first_col_tl ,
503   code-for-first-col .value_required:n = true ,
504   code-for-last-col .tl_set:N = \l_@@_code_for_last_col_tl ,

```

```

505 code-for-last-col .value_required:n = true ,
506 code-for-first-row .tl_set:N = \l_@@_code_for_first_row_tl ,
507 code-for-first-row .value_required:n = true ,
508 code-for-last-row .tl_set:N = \l_@@_code_for_last_row_tl ,
509 code-for-last-row .value_required:n = true ,
510 hlines .bool_set:N = \l_@@_hlines_bool ,
511 vlines .bool_set:N = \l_@@_vlines_bool ,
512 hvlines .code:n =
513 {
514   \bool_set_true:N \l_@@_vlines_bool
515   \bool_set_true:N \l_@@_hlines_bool
516 } ,
517 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.

```

518 renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
519 renew-dots .value_forbidden:n = true ,
520 nullify-dots .bool_set:N = \l_@@_nullify_dots_bool ,
521 create-medium-nodes .bool_set:N = \l_@@_medium_nodes_bool ,
522 create-large-nodes .bool_set:N = \l_@@_large_nodes_bool ,
523 create-extra-nodes .meta:n =
524 { create-medium-nodes , create-large-nodes } ,
525 left-margin .dim_set:N = \l_@@_left_margin_dim ,
526 left-margin .default:n = \arraycolsep ,
527 right-margin .dim_set:N = \l_@@_right_margin_dim ,
528 right-margin .default:n = \arraycolsep ,
529 margin .meta:n = { left-margin = #1 , right-margin = #1 } ,
530 margin .default:n = \arraycolsep ,
531 extra-left-margin .dim_set:N = \l_@@_extra_left_margin_dim ,
532 extra-right-margin .dim_set:N = \l_@@_extra_right_margin_dim ,
533 extra-margin .meta:n =
534 { extra-left-margin = #1 , extra-right-margin = #1 } ,
535 extra-margin .value_required:n = true ,
536 }

```

We define a set of keys used by the environments of `nicematrix` (but not by the command `\NiceMatrixOptions`).

```

537 \keys_define:nn { NiceMatrix / Env }
538 {
539   except-corners .clist_set:N = \l_@@_except_corners_clist ,
540   except-corners .default:n = { NW , SW , NE , SE } ,
541   hvlines-except-corners .code:n =
542   {
543     \clist_set:Nn \l_@@_except_corners_clist { #1 }
544     \bool_set_true:N \l_@@_vlines_bool
545     \bool_set_true:N \l_@@_hlines_bool
546   } ,
547   hvlines-except-corners .default:n = { NW , SW , NE , SE } ,
548   code-before .code:n =
549   {
550     \tl_if_empty:nF { #1 }
551     {
552       \tl_put_right:Nn \l_@@_code_before_tl { #1 }
553       \bool_set_true:N \l_@@_code_before_bool
554     }
555   } ,

```

The options `c`, `t` and `b` of the environment `{NiceArray}` have the same meaning as the option of the classical environment `{array}`.

```

556 c .code:n = \tl_set:Nn \l_@@_baseline_str c ,

```

```

557 t .code:n = \tl_set:Nn \l_@@_baseline_str t ,
558 b .code:n = \tl_set:Nn \l_@@_baseline_str b ,
559 baseline .tl_set:N = \l_@@_baseline_str ,
560 baseline .value_required:n = true ,
561 columns-width .code:n =
562   \tl_if_eq:nnTF { #1 } { auto }
563     { \bool_set_true:N \l_@@_auto_columns_width_bool }
564     { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,
565 columns-width .value_required:n = true ,
566 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.

```

567   \legacy_if:nF { measuring@ }
568   {
569     \str_set:Nn \l_tmpa_str { #1 }
570     \seq_if_in:NVTF \g_@@_names_seq \l_tmpa_str
571       { \@@_error:nn { Duplicate~name } { #1 } }
572       { \seq_gput_left:NV \g_@@_names_seq \l_tmpa_str }
573     \str_set_eq:NN \l_@@_name_str \l_tmpa_str
574   } ,
575 name .value_required:n = true ,
576 code-after .tl_gset:N = \g_nicematrix_code_after_tl ,
577 code-after .value_required:n = true ,
578 colortbl-like .code:n =
579   \bool_set_true:N \l_@@_colortbl_like_bool
580   \bool_set_true:N \l_@@_code_before_bool ,
581 colortbl-like .value_forbidden:n = true
582 }
583 \keys_define:nn { NiceMatrix / notes }
584 {
585   para .bool_set:N = \l_@@_notes_para_bool ,
586   para .default:n = true ,
587   code-before .tl_set:N = \l_@@_notes_code_before_tl ,
588   code-before .value_required:n = true ,
589   code-after .tl_set:N = \l_@@_notes_code_after_tl ,
590   code-after .value_required:n = true ,
591   bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
592   bottomrule .default:n = true ,
593   style .code:n = \cs_set:Nn \@@_notes_style:n { #1 } ,
594   style .value_required:n = true ,
595   label-in-tabular .code:n =
596     \cs_set:Nn \@@_notes_label_in_tabular:n { #1 } ,
597   label-in-tabular .value_required:n = true ,
598   label-in-list .code:n =
599     \cs_set:Nn \@@_notes_label_in_list:n { #1 } ,
600   label-in-list .value_required:n = true ,
601   enumitem-keys .code:n =
602     {
603       \bool_if:NTF \c_@@_in_preamble_bool
604       {
605         \AtBeginDocument
606         {
607           \bool_if:NT \c_@@_enumitem_loaded_bool
608             { \setlist* [ tabularnotes ] { #1 } }
609         }
610       }
611       {
612         \bool_if:NT \c_@@_enumitem_loaded_bool
613           { \setlist* [ tabularnotes ] { #1 } }
614       }
615     } ,
616   enumitem-keys .value_required:n = true ,
617   enumitem-keys-para .code:n =

```

```

618 {
619   \bool_if:NTF \c_@@_in_preamble_bool
620   {
621     \AtBeginDocument
622     {
623       \bool_if:NT \c_@@_enumitem_loaded_bool
624       { \setlist* [ tabularnotes* ] { #1 } }
625     }
626   }
627   {
628     \bool_if:NT \c_@@_enumitem_loaded_bool
629     { \setlist* [ tabularnotes* ] { #1 } }
630   }
631 } ,
632 enumitem-keys-para .value_required:n = true ,
633 unknown .code:n = \@@_error:n { Unknown~key~for~notes }
634 }

```

We begin the construction of the major sets of keys (used by the different user commands and environments).

```

635 \keys_define:nn { NiceMatrix }
636 {
637   NiceMatrixOptions .inherit:n =
638   { NiceMatrix / Global } ,
639   NiceMatrixOptions / xdots .inherit:n = NiceMatrix / xdots ,
640   NiceMatrixOptions / rules .inherit:n = NiceMatrix / rules ,
641   NiceMatrixOptions / notes .inherit:n = NiceMatrix / notes ,
642   NiceMatrix .inherit:n =
643   {
644     NiceMatrix / Global ,
645     NiceMatrix / Env ,
646   } ,
647   NiceMatrix / xdots .inherit:n = NiceMatrix / xdots ,
648   NiceMatrix / rules .inherit:n = NiceMatrix / rules ,
649   NiceTabular .inherit:n =
650   {
651     NiceMatrix / Global ,
652     NiceMatrix / Env
653   } ,
654   NiceTabular / xdots .inherit:n = NiceMatrix / xdots ,
655   NiceTabular / rules .inherit:n = NiceMatrix / rules ,
656   NiceArray .inherit:n =
657   {
658     NiceMatrix / Global ,
659     NiceMatrix / Env ,
660   } ,
661   NiceArray / xdots .inherit:n = NiceMatrix / xdots ,
662   NiceArray / rules .inherit:n = NiceMatrix / rules ,
663   pNiceArray .inherit:n =
664   {
665     NiceMatrix / Global ,
666     NiceMatrix / Env ,
667   } ,
668   pNiceArray / xdots .inherit:n = NiceMatrix / xdots ,
669   pNiceArray / rules .inherit:n = NiceMatrix / rules ,
670 }

```

We finalise the definition of the set of keys “NiceMatrix / NiceMatrixOptions” with the options specific to \NiceMatrixOptions.

```

671 \keys_define:nn { NiceMatrix / NiceMatrixOptions }
672 {
673   delimiters-color .tl_set:N = \l_@@_delimiters_color_tl ,

```

```

674 delimiters-color .value_required:n = true ,
675 last-col .code:n = \tl_if_empty:nF { #1 }
676       { \@@_error:n { last-col~non-empty~for~NiceMatrixOptions } }
677       \int_zero:N \l_@@_last_col_int ,
678 small .bool_set:N = \l_@@_small_bool ,
679 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.

```

680 renew-matrix .code:n = \@@_renew_matrix: ,
681 renew-matrix .value_forbidden:n = true ,

```

The key `transparent` is now considered as obsolete (because its name is ambiguous).

```

682 transparent .meta:n = { renew-dots , renew-matrix } ,
683 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}`.

```

684 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.

```

685 columns-width .code:n =
686   \tl_if_eq:nnTF { #1 } { auto }
687   { \@@_error:n { Option~auto~for~columns-width } }
688   { \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` (theses names are global and not local to the current TeX scope). However, the option `allow-duplicate-names` disables this feature.

```

689 allow-duplicate-names .code:n =
690   \@@_msg_redirect_name:nn { Duplicate-name } { none } ,
691 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`).

```

692 letter-for-dotted-lines .code:n =
693   {
694     \tl_if_single_token:nTF { #1 }
695     { \str_set:Nx \l_@@_letter_for_dotted_lines_str { #1 } }
696     { \@@_error:n { Bad-value~for~letter~for~dotted~lines } }
697   } ,
698 letter-for-dotted-lines .value_required:n = true ,
699 notes .code:n = \keys_set:nn { NiceMatrix / notes } { #1 } ,
700 notes .value_required:n = true ,
701 unknown .code:n = \@@_error:n { Unknown-key~for~NiceMatrixOptions }
702 }
703 \str_new:N \l_@@_letter_for_dotted_lines_str
704 \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.

```

705 \NewDocumentCommand \NiceMatrixOptions { m }
706   { \keys_set:nn { NiceMatrix / NiceMatrixOptions } { #1 } }

```


We finalise the definition of the set of keys “NiceMatrix / NiceMatrix” with the options specific to {NiceMatrix}.

```

707 \keys_define:nn { NiceMatrix / NiceMatrix }
708 {
709   last-col .code:n = \tl_if_empty:nTF {#1}
710     {
711       \bool_set_true:N \l_@@_last_col_without_value_bool
712       \int_set:Nn \l_@@_last_col_int { -1 }
713     }
714     { \int_set:Nn \l_@@_last_col_int { #1 } } ,
715   l .code:n = \tl_set:Nn \l_@@_type_of_col_tl l ,
716   r .code:n = \tl_set:Nn \l_@@_type_of_col_tl r ,
717   small .bool_set:N = \l_@@_small_bool ,
718   small .value_forbidden:n = true ,
719   delimiters-color .tl_set:N = \l_@@_delimiters_color_tl ,
720   delimiters-color .value_required:n = true ,
721   unknown .code:n = \@@_error:n { Unknown-option-for-NiceMatrix }
722 }

```

We finalise the definition of the set of keys “NiceMatrix / NiceArray” with the options specific to {NiceArray}.

```

723 \keys_define:nn { NiceMatrix / NiceArray }
724 {

```

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.

```

725   small .bool_set:N = \l_@@_small_bool ,
726   small .value_forbidden:n = true ,
727   last-col .code:n = \tl_if_empty:nF { #1 }
728     { \@@_error:n { last-col-non-empty-for-NiceArray } }
729     \int_zero:N \l_@@_last_col_int ,
730   notes / para .bool_set:N = \l_@@_notes_para_bool ,
731   notes / para .default:n = true ,
732   notes / bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
733   notes / bottomrule .default:n = true ,
734   tabularnote .tl_set:N = \l_@@_tabularnote_tl ,
735   tabularnote .value_required:n = true ,
736   delimiters-color .tl_set:N = \l_@@_delimiters_color_tl ,
737   delimiters-color .value_required:n = true ,
738   unknown .code:n = \@@_error:n { Unknown-option-for-NiceArray }
739 }

740 \keys_define:nn { NiceMatrix / pNiceArray }
741 {
742   first-col .code:n = \int_zero:N \l_@@_first_col_int ,
743   last-col .code:n = \tl_if_empty:nF {#1}
744     { \@@_error:n { last-col-non-empty-for-NiceArray } }
745     \int_zero:N \l_@@_last_col_int ,
746   first-row .code:n = \int_zero:N \l_@@_first_row_int ,
747   small .bool_set:N = \l_@@_small_bool ,
748   small .value_forbidden:n = true ,
749   unknown .code:n = \@@_error:n { Unknown-option-for-NiceMatrix }
750 }

```

We finalise the definition of the set of keys “NiceMatrix / NiceTabular” with the options specific to {NiceTabular}.

```

751 \keys_define:nn { NiceMatrix / NiceTabular }
752 {
753   notes / para .bool_set:N = \l_@@_notes_para_bool ,
754   notes / para .default:n = true ,
755   notes / bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
756   notes / bottomrule .default:n = true ,

```

```

757   tabularnote .tl_set:N = \l_@@_tabularnote_tl ,
758   tabularnote .value_required:n = true ,
759   last-col .code:n = \tl_if_empty:nF {#1}
760                   { \@@_error:n { last-col~non~empty~for~NiceArray } }
761                   \int_zero:N \l_@@_last_col_int ,
762   unknown .code:n = \@@_error:n { Unknown~option~for~NiceTabular }
763 }

```

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}`).

```

764 \cs_new_protected:Npn \@@_Cell:
765 {

```

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`).

```

766   \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:n

```

We increment `\c@jCol`, which is the counter of the columns.

```

767   \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.

```

768   \int_compare:nNnT \c@jCol = 1
769     { \int_compare:nNnT \l_@@_first_col_int = 1 \@@_begin_of_row: }
770   \int_gset:Nn \g_@@_col_total_int { \int_max:nn \g_@@_col_total_int \c@jCol }

```

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).

```

771   \hbox_set:Nw \l_@@_cell_box
772   \bool_if:NF \l_@@_NiceTabular_bool
773   {
774     \c_math_toggle_token
775     \bool_if:NT \l_@@_small_bool \scriptstyle
776   }

```

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.

```

777   \int_compare:nNnTF \c@iRow = 0
778   {
779     \int_compare:nNnT \c@jCol > 0
780     {
781       \l_@@_code_for_first_row_tl
782       \xglobal \colorlet { nicematrix-first-row } { . }
783     }
784   }
785   {
786     \int_compare:nNnT \c@iRow = \l_@@_last_row_int
787     {
788       \l_@@_code_for_last_row_tl
789       \xglobal \colorlet { nicematrix-last-row } { . }
790     }
791   }
792 }

```

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.

```

793 \cs_new_protected:Npn \@@_begin_of_row:
794 {
795   \refstepcounter { iRow }
796   \dim_gset_eq:NN \g_@@_dp_ante_last_row_dim \g_@@_dp_last_row_dim
797   \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \@arstrutbox }
798   \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
799   \pgfpicture
800   \pgfrememberpicturepositiononpagetrue
801   \pgfcoordinate
802   { \@@_env: - row - \int_use:N \c@iRow - base }
803   { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
804   \str_if_empty:NF \l_@@_name_str
805   {
806     \pgfnodealias
807     { \l_@@_name_str - row - \int_use:N \c@iRow - base }
808     { \@@_env: - row - \int_use:N \c@iRow - base }
809   }
810   \endpgfpicture
811 }

```

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.

```

812 \cs_new_protected:Npn \@@_update_for_first_and_last_row:
813 {
814   \int_compare:nNnTF \c@iRow = 0
815   {
816     \dim_gset:Nn \g_@@_dp_row_zero_dim
817     { \dim_max:nn \g_@@_dp_row_zero_dim { \box_dp:N \l_@@_cell_box } }
818     \dim_gset:Nn \g_@@_ht_row_zero_dim
819     { \dim_max:nn \g_@@_ht_row_zero_dim { \box_ht:N \l_@@_cell_box } }
820   }
821   {
822     \int_compare:nNnT \c@iRow = 1
823     {
824       \dim_gset:Nn \g_@@_ht_row_one_dim
825       { \dim_max:nn \g_@@_ht_row_one_dim { \box_ht:N \l_@@_cell_box } }
826     }
827   }
828 }

829 \cs_new_protected:Npn \@@_rotate_cell_box:
830 {
831   \box_rotate:Nn \l_@@_cell_box { 90 }
832   \int_compare:nNnT \c@iRow = \l_@@_last_row_int
833   {
834     \vbox_set_top:Nn \l_@@_cell_box
835     {
836       \vbox_to_zero:n { }
837       \skip_vertical:n { - \box_ht:N \@arstrutbox + 0.8 ex }
838       \box_use:N \l_@@_cell_box
839     }
840   }
841   \bool_gset_false:N \g_@@_rotate_bool
842 }

843 \cs_new_protected:Npn \@@_adjust_size_box:
844 {
845   \dim_compare:nNnT \g_@@_blocks_wd_dim > \c_zero_dim
846   {
847     \box_set_wd:Nn \l_@@_cell_box

```

```

848         { \dim_max:nn { \box_wd:N \l_@@_cell_box } \g_@@_blocks_wd_dim }
849         \dim_gzero:N \g_@@_blocks_wd_dim
850     }
851     \dim_compare:nNnT \g_@@_blocks_dp_dim > \c_zero_dim
852     {
853         \box_set_dp:Nn \l_@@_cell_box
854         { \dim_max:nn { \box_dp:N \l_@@_cell_box } \g_@@_blocks_dp_dim }
855         \dim_gzero:N \g_@@_blocks_dp_dim
856     }
857     \dim_compare:nNnT \g_@@_blocks_ht_dim > \c_zero_dim
858     {
859         \box_set_ht:Nn \l_@@_cell_box
860         { \dim_max:nn { \box_ht:N \l_@@_cell_box } \g_@@_blocks_ht_dim }
861         \dim_gzero:N \g_@@_blocks_ht_dim
862     }
863 }
864 \cs_new_protected:Npn \@@_end_Cell:
865 {
866     \@@_math_toggle_token:
867     \hbox_set_end:
868     \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
869     \@@_adjust_size_box:
870     \box_set_ht:Nn \l_@@_cell_box
871     { \box_ht:N \l_@@_cell_box + \l_@@_cell_space_top_limit_dim }
872     \box_set_dp:Nn \l_@@_cell_box
873     { \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”).

```

874     \dim_gset:Nn \g_@@_max_cell_width_dim
875     { \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”.

```

876     \@@_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. As of 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 `code-after`); 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.

```

877     \bool_if:NTF \g_@@_empty_cell_bool
878     { \box_use_drop:N \l_@@_cell_box }
879     {
880         \bool_lazy_or:nnTF
881         \g_@@_not_empty_cell_bool
882         { \dim_compare_p:nNn { \box_wd:N \l_@@_cell_box } > \c_zero_dim }
883         \@@_node_for_the_cell:
884         { \box_use_drop:N \l_@@_cell_box }
885     }

```

```

886 \bool_gset_false:N \g_@@_empty_cell_bool
887 \bool_gset_false:N \g_@@_not_empty_cell_bool
888 }

```

The following command creates the PGF name of the node with, of course, `\l_@@_cell_box` as the content.

```

889 \cs_new_protected:Npn \@@_node_for_the_cell:
890 {
891   \pgfpicture
892   \pgfsetbaseline \c_zero_dim
893   \pgfrememberpicturepositiononpagetrue
894   \pgfset
895   {
896     inner~sep = \c_zero_dim ,
897     minimum~width = \c_zero_dim
898   }
899   \pgfnode
900   { rectangle }
901   { base }
902   { \box_use_drop:N \l_@@_cell_box }
903   { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
904   { }
905   \str_if_empty:NF \l_@@_name_str
906   {
907     \pgfnodealias
908     { \l_@@_name_str - \int_use:N \c@iRow - \int_use:N \c@jCol }
909     { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
910   }
911   \endpgfpicture
912 }

```

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.

```

913 \cs_new_protected:Npn \@@_instruction_of_type:nnn #1 #2 #3
914 {

```

It's important to use a `\tl_gput_right:cx` and not a `\tl_gput_left:cx` because we want the `\Ddots` lines to be drawn in the order of appearance in the array (for parallelisation).

```

915   \bool_if:nTF { #1 } \tl_gput_left:cx \tl_gput_right:cx
916   { g_@@_ #2 _ lines _ tl }
917   {
918     \use:c { @@ _ draw _ #2 : nnn }
919     { \int_use:N \c@iRow }
920     { \int_use:N \c@jCol }
921     { \exp_not:n { #3 } }
922   }
923 }

```

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`.

```

924 \cs_new_protected:Npn \@@_revtex_array:
925 {
926   \cs_set_eq:NN \@acol1 \@arrayacol
927   \cs_set_eq:NN \@acolr \@arrayacol
928   \cs_set_eq:NN \@acol \@arrayacol
929   \cs_set_nopar:Npn \@halignto { }
930   \@array@array
931 }
932 \cs_new_protected:Npn \@@_array:
933 {
934   \bool_if:NTF \c_@@_revtex_bool
935     \@@_revtex_array:
936     {
937       \bool_if:NTF \l_@@_NiceTabular_bool
938       { \dim_set_eq:NN \col@sep \tabcolsep }
939       { \dim_set_eq:NN \col@sep \arraycolsep }
940       \dim_compare:nNnTF \l_@@_tabular_width_dim = \c_zero_dim
941       { \cs_set_nopar:Npn \@halignto { } }
942       { \cs_set_nopar:Npx \@halignto { to \dim_use:N \l_@@_tabular_width_dim } }

```

It `colortbl` is loaded, `\@tabarray` has been redefined to incorporate `\CT@start`.

```

943   \@tabarray
944 }

```

`\l_@@_baseline_str` 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.

```

945 [ \str_if_eq:VnTF \l_@@_baseline_str c c t ]
946 ]

```

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.

```

947 \cs_set_eq:NN \@@_old_ialign: \ialign

```

The following command creates a `row` node (and not a row of nodes!).

```

948 \cs_new_protected:Npn \@@_create_row_node:
949 {

```

The `\hbox:n` (or `\hbox`) is mandatory.

```

950   \hbox
951   {
952     \bool_if:NT \l_@@_code_before_bool
953     {
954       \vtop
955       {
956         \skip_vertical:N 0.5\arrayrulewidth
957         \pgfsys@markposition { \@@_env: - row - \@@_succ:n \c@iRow }
958         \skip_vertical:N -0.5\arrayrulewidth
959       }
960     }
961     \pgfpicture
962     \pgfrememberpicturerepositiononpagetrue
963     \pgfcoordinate { \@@_env: - row - \@@_succ:n \c@iRow }
964     { \pgfpoint \c_zero_dim { - 0.5 \arrayrulewidth } }
965     \str_if_empty:NF \l_@@_name_str
966     {
967       \pgfnodealias
968       { \l_@@_name_str - row - \int_use:N \c@iRow }
969       { \@@_env: - row - \int_use:N \c@iRow }
970     }
971     \endpgfpicture
972   }
973 }

```

The following must *not* be protected because it begins with `\noalign`.

```

974 \cs_new:Npn \@@_everycr: { \noalign { \@@_everycr_i: } }
975 \cs_new_protected:Npn \@@_everycr_i:
976 {
977   \int_gzero:N \c@jCol
978   \bool_gset_false:N \g_@@_after_col_zero_bool
979   \bool_if:NF \g_@@_row_of_col_done_bool
980   {
981     \@@_create_row_node:

```

We don't draw the rules of the key `hlines` (or `hvlines`) but we reserve the vertical space for theses rules.

```

982     \bool_if:NT \l_@@_hlines_bool
983     {

```

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.

```

984       \int_compare:nNnT \c@iRow > { -1 }
985       {
986         \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@`.

```

987         { \hrule height \arrayrulewidth width \c_zero_dim }
988       }
989     }
990   }
991 }

```

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`).

```

992 \cs_set_protected:Npn \@@_newcolumntype #1
993 {
994   \cs_set:cpn { NC @ find @ #1 } ##1 #1 { \NC@ { ##1 } }
995   \peek_meaning:NTF [
996     { \newcol@ #1 }
997     { \newcol@ #1 [ 0 ] }
998   }

```

When the key `renew-dots` is used, the following code will be executed.

```

999 \cs_set_protected:Npn \@@_renew_dots:
1000 {
1001   \cs_set_eq:NN \ldots \@@_Ldots
1002   \cs_set_eq:NN \cdots \@@_Cdots
1003   \cs_set_eq:NN \vdots \@@_Vdots
1004   \cs_set_eq:NN \ddots \@@_Ddots
1005   \cs_set_eq:NN \iddots \@@_Iddots
1006   \cs_set_eq:NN \dots \@@_Ldots
1007   \cs_set_eq:NN \hdotsfor \@@_Hdotsfor:
1008 }

```

When the key `colortbl-like` is used, the following code will be executed.

```

1009 \cs_new_protected:Npn \@@_colortbl_like:
1010 {
1011   \cs_set_eq:NN \cellcolor \@@_cellcolor_tabular
1012   \cs_set_eq:NN \rowcolor \@@_rowcolor_tabular
1013   \cs_set_eq:NN \columncolor \@@_columncolor_preamble
1014 }

```

The following code `\@@_pre_array:` is used in `{NiceArrayWithDelims}`. It exists as a standalone macro only for legibility.

```
1015 \cs_new_protected:Npn \@@_pre_array:
1016 {
```

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's 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 redefinition⁴⁰.

```
1017   \bool_if:NT \c_@@_booktabs_loaded_bool
1018   { \tl_put_left:Nn \@BTnormal \@@_create_row_node: }
1019   \box_clear_new:N \l_@@_cell_box
1020   \cs_if_exist:NT \theiRow
1021   { \int_set_eq:NN \l_@@_old_iRow_int \c@iRow }
1022   \int_gzero_new:N \c@iRow
1023   \cs_if_exist:NT \thejCol
1024   { \int_set_eq:NN \l_@@_old_jCol_int \c@jCol }
1025   \int_gzero_new:N \c@jCol
1026   \normalbaselines
```

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}`).

```
1027   \bool_if:NT \l_@@_small_bool
1028   {
1029     \cs_set_nopar:Npn \arraystretch { 0.47 }
1030     \dim_set:Nn \arraycolsep { 1.45 pt }
1031   }
```

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`.

```
1032   \cs_set_nopar:Npn \ialign
1033   {
1034     \bool_if:NTF \c_@@_colortbl_loaded_bool
1035     {
1036       \CT@everycr
1037       {
1038         \noalign { \cs_gset_eq:NN \CT@row@color \prg_do_nothing: }
1039         \@@_everycr:
1040       }
1041     }
1042     { \everycr { \@@_everycr: } }
1043     \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 values of `\arraystretch`⁴¹ 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`.

```
1044   \dim_gzero_new:N \g_@@_dp_row_zero_dim
1045   \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \@arstrutbox }
1046   \dim_gzero_new:N \g_@@_ht_row_zero_dim
1047   \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \@arstrutbox }
```

⁴⁰cf. `\nicematrix@redefine@check@rerun`

⁴¹The option `small` of `nicematrix` changes (among other) the value of `\arraystretch`. This is done, of course, before the call of `{array}`.


```

1048 \dim_gzero_new:N \g_@@_ht_row_one_dim
1049 \dim_gset:Nn \g_@@_ht_row_one_dim { \box_ht:N \@arstrutbox }
1050 \dim_gzero_new:N \g_@@_dp_ante_last_row_dim
1051 \dim_gzero_new:N \g_@@_ht_last_row_dim
1052 \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
1053 \dim_gzero_new:N \g_@@_dp_last_row_dim
1054 \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`.

```

1055 \cs_set_eq:NN \ialign \@@_old_ialign:
1056 \halign
1057 }

```

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).

```

1058 \cs_set_eq:NN \@@_old_ldots \ldots
1059 \cs_set_eq:NN \@@_old_cdots \cdots
1060 \cs_set_eq:NN \@@_old_vdots \vdots
1061 \cs_set_eq:NN \@@_old_ddots \ddots
1062 \cs_set_eq:NN \@@_old_iddots \iddots
1063 \bool_if:NTF \l_@@_standard_cline_bool
1064 { \cs_set_eq:NN \cline \@@_standard_cline }
1065 { \cs_set_eq:NN \cline \@@_cline }
1066 \cs_set_eq:NN \Ldots \@@_Ldots
1067 \cs_set_eq:NN \Cdots \@@_Cdots
1068 \cs_set_eq:NN \Vdots \@@_Vdots
1069 \cs_set_eq:NN \Ddots \@@_Ddots
1070 \cs_set_eq:NN \Iddots \@@_Iddots
1071 \cs_set_eq:NN \hdottedline \@@_hdottedline:
1072 \cs_set_eq:NN \Hline \@@_Hline:
1073 \cs_set_eq:NN \Hspace \@@_Hspace:
1074 \cs_set_eq:NN \Hdotsfor \@@_Hdotsfor:
1075 \cs_set_eq:NN \Vdotsfor \@@_Vdotsfor:
1076 \cs_set_eq:NN \multicolumn \@@_multicolumn:nnn
1077 \cs_set_eq:NN \Block \@@_Block:
1078 \cs_set_eq:NN \rotate \@@_rotate:
1079 \cs_set_eq:NN \OnlyMainNiceMatrix \@@_OnlyMainNiceMatrix:n
1080 \cs_set_eq:NN \dotfill \@@_old_dotfill:
1081 \cs_set_eq:NN \CodeAfter \@@_CodeAfter:
1082 \cs_set_eq:NN \diagbox \@@_diagbox:nn
1083 \cs_set_eq:NN \NotEmpty \@@_NotEmpty:
1084 \bool_if:NT \l_@@_colortbl_like_bool \@@_colortbl_like:
1085 \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) correspondant will be stored. These lists will be used for the creation of the “medium nodes” (if they are created).

```

1086 \seq_gclear_new:N \g_@@_multicolumn_cells_seq
1087 \seq_gclear_new: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).

```

1088 \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 of rows excepted the last row (if `\l_@@_last_row_bool` has been raised with the option `last-row`).

```

1089 \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.

```

1090 \int_gzero_new:N \g_@@_col_total_int

```

```

1091 \cs_set_eq:NN \@ifnextchar \new@ifnextchar
1092 \@@_renew_NC@rewrite@S:
1093 \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.

```

1094 \tl_gclear_new:N \g_@@_Cdots_lines_tl
1095 \tl_gclear_new:N \g_@@_Ldots_lines_tl
1096 \tl_gclear_new:N \g_@@_Vdots_lines_tl
1097 \tl_gclear_new:N \g_@@_Ddots_lines_tl
1098 \tl_gclear_new:N \g_@@_Iddots_lines_tl
1099 \tl_gclear_new:N \g_@@_HVDotsfor_lines_tl

1100 \tl_gclear_new:N \g_nicematrix_code_before_tl
1101 }

```

This is the end of `\@@_pre_array:`.

The environment `{NiceArrayWithDelims}`

```

1102 \NewDocumentEnvironment { NiceArrayWithDelims } { m m O { } m ! O { } }
1103 {
1104   \@@_provide_pgfsyspdfmark:
1105   \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.

```

1106 \bgroup
1107 \tl_set:Nn \l_@@_left_delim_tl { #1 }
1108 \tl_set:Nn \l_@@_right_delim_tl { #2 }
1109 \int_gzero:N \g_@@_block_box_int
1110 \dim_zero:N \g_@@_width_last_col_dim
1111 \dim_zero:N \g_@@_width_first_col_dim
1112 \bool_gset_false:N \g_@@_row_of_col_done_bool
1113 \str_if_empty:NT \g_@@_name_env_str
1114 { \str_gset:Nn \g_@@_name_env_str { NiceArrayWithDelims } }
1115 \@@_adapt_S_column:
1116 \bool_if:NTF \l_@@_NiceTabular_bool
1117   \mode_leave_vertical:
1118   \@@_test_if_math_mode:
1119   \bool_if:NT \l_@@_in_env_bool { \@@_fatal:n { Yet~in~env } }
1120   \bool_set_true:N \l_@@_in_env_bool

```

The command `\CT@arc@` contains the instruction of color for the rules of the array⁴². 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.

```

1121 \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.

```

1122 \cs_if_exist:NT \tikz@library@external@loaded
1123 {
1124   \tikzexternaldisable
1125   \cs_if_exist:NT \ifstandalone
1126   { \tikzset { external / optimize = false } }
1127 }

```

We increment the counter `\g_@@_env_int` which counts the environments of the package.

⁴²e.g. `\color[rgb]{0.5,0.5,0}`

```

1128 \int_gincr:N \g_@@_env_int
1129 \bool_if:NF \l_@@_block_auto_columns_width_bool
1130 { \dim_gzero_new:N \g_@@_max_cell_width_dim }

```

The sequence `\g_@@_blocks_seq` will contain the characteristics 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.

```

1131 \seq_gclear:N \g_@@_blocks_seq
1132 \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`.

```

1133 \seq_gclear:N \g_@@_pos_of_stroken_blocks_seq
1134 \seq_gclear:N \g_@@_pos_of_xdots_seq

1135 \tl_if_exist:cT { g_@@_code_before_ \int_use:N \g_@@_env_int _ tl }
1136 {
1137   \bool_set_true:N \l_@@_code_before_bool
1138   \exp_args:NNv \tl_put_right:Nn \l_@@_code_before_tl
1139     { g_@@_code_before_ \int_use:N \g_@@_env_int _ tl }
1140 }

```

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`.

```

1141 \bool_if:NTF \l_@@_NiceArray_bool
1142 { \keys_set:nn { NiceMatrix / NiceArray } }
1143 { \keys_set:nn { NiceMatrix / pNiceArray } }
1144 { #3 , #5 }

1145 \tl_if_empty:NF \l_@@_rules_color_tl
1146 { \exp_after:wN \@@_set_CT@arc@: \l_@@_rules_color_tl \q_stop }

```

If the key `code-before` is used, we have to create the `col` nodes and the `row` nodes before the creation of the array. First, we have to test whether the size of the array has been written in the `aux` file in a previous run. In this case, a command `\@@_size_nb_of_env:` has been created.

```

1147 \bool_if:NT \l_@@_code_before_bool
1148 {
1149   \seq_if_exist:cT { @@_size_ \int_use:N \g_@@_env_int _ seq }
1150   {

```

First, we give values to the LaTeX counters `iRow` and `jCol`. We remind that, in the `code-before` (and in the `code-after`) they represent the numbers of rows and columns of the array (without the potential last row and last column).

```

1151 \int_zero_new:N \c@iRow
1152 \int_set:Nn \c@iRow
1153   { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 2 }
1154 \int_zero_new:N \c@jCol
1155 \int_set:Nn \c@jCol
1156   { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 4 }

```

We have to adjust the values of `\c@iRow` and `\c@jCol` to take into account the potential last row and last column. A value of `-2` for `\l_@@_last_row_int` means that there is no last row. Idem for the columns.

```

1157 \int_compare:nNnF \l_@@_last_row_int = { -2 }
1158 { \int_decr:N \c@iRow }
1159 \int_compare:nNnF \l_@@_last_col_int = { -2 }
1160 { \int_decr:N \c@jCol }

```

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.

```

1161 \pgfsys@markposition { \@@_env: - position }
1162 \pgfsys@getposition { \@@_env: - position } \@@_picture_position:
1163 \pgfpicture

```

First, the creation of the row nodes.

```

1164 \int_step_inline:nnn

```

```

1165 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 1 }
1166 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 2 + 1 }
1167 {
1168   \pgfsys@getposition { \@@_env: - row - ##1 } \@@_node_position:
1169   \pgfcoordinate { \@@_env: - row - ##1 }
1170   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1171 }

```

Now, the creation of the col nodes.

```

1172 \int_step_inline:nnn
1173 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 3 }
1174 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 4 + 1 }
1175 {
1176   \pgfsys@getposition { \@@_env: - col - ##1 } \@@_node_position:
1177   \pgfcoordinate { \@@_env: - col - ##1 }
1178   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1179 }
1180 \endpgfpicture
1181 \group_begin:
1182 \bool_if:NT \c_@@_tikz_loaded_bool
1183 {
1184   \tikzset
1185   {
1186     every~picture / .style =
1187     { overlay , name~prefix = \@@_env: - }
1188   }
1189 }
1190 \cs_set_eq:NN \cellcolor \@@_cellcolor
1191 \cs_set_eq:NN \rectanglecolor \@@_rectanglecolor
1192 \cs_set_eq:NN \rowcolor \@@_rowcolor
1193 \cs_set_eq:NN \rowcolors \@@_rowcolors
1194 \cs_set_eq:NN \columncolor \@@_columncolor
1195 \cs_set_eq:NN \chessboardcolors \@@_chessboardcolors

```

We compose the code-before in math mode in order to nullify the spaces put by the user between instructions in the code-before.

```

1196 \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
1197 \l_@@_code_before_tl
1198 \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
1199 \group_end:
1200 }
1201 }

```

A value of -1 for the counter `\l_@@_last_row_int` means that the user has used the option `last-row` without value, that is to say without specifying the number of that last row. In this case, we try to read that value from the aux file (if it has been written on a previous run).

```

1202 \int_compare:nNnT \l_@@_last_row_int > { -2 }
1203 {
1204   \tl_put_right:Nn \@@_update_for_first_and_last_row:
1205   {
1206     \dim_gset:Nn \g_@@_ht_last_row_dim
1207     { \dim_max:nn \g_@@_ht_last_row_dim { \box_ht:N \l_@@_cell_box } }
1208     \dim_gset:Nn \g_@@_dp_last_row_dim
1209     { \dim_max:nn \g_@@_dp_last_row_dim { \box_dp:N \l_@@_cell_box } }
1210   }
1211 }
1212 \int_compare:nNnT \l_@@_last_row_int = { -1 }
1213 {
1214   \bool_set_true:N \l_@@_last_row_without_value_bool

```

A value based on the name is more reliable than a value based on the number of the environment.

```

1215 \str_if_empty:NTF \l_@@_name_str
1216 {
1217   \cs_if_exist:cT { @@_last_row_ \int_use:N \g_@@_env_int }
1218   {
1219     \int_set:Nn \l_@@_last_row_int

```

```

1220         { \use:c { @@_last_row_ \int_use:N \g_@@_env_int } }
1221     }
1222 }
1223 {
1224     \cs_if_exist:cT { @@_last_row_ \l_@@_name_str }
1225     {
1226         \int_set:Nn \l_@@_last_row_int
1227         { \use:c { @@_last_row_ \l_@@_name_str } }
1228     }
1229 }
1230 }

```

A value of -1 for the counter `\l_@@_last_col_int` means that the user has used the option `last-col` without value, that is to say without specifying the number of that last column. In this case, we try to read that value from the aux file (if it has been written on a previous run).

```

1231     \int_compare:nNnT \l_@@_last_col_int = { -1 }
1232     {
1233         \str_if_empty:NTF \l_@@_name_str
1234         {
1235             \cs_if_exist:cT { @@_last_col_ \int_use:N \g_@@_env_int }
1236             {
1237                 \int_set:Nn \l_@@_last_col_int
1238                 { \use:c { @@_last_col_ \int_use:N \g_@@_env_int } }
1239             }
1240         }
1241         {
1242             \cs_if_exist:cT { @@_last_col_ \l_@@_name_str }
1243             {
1244                 \int_set:Nn \l_@@_last_col_int
1245                 { \use:c { @@_last_col_ \l_@@_name_str } }
1246             }
1247         }
1248     }

```

The code in `\@@_pre_array:` is used only by `{NiceArrayWithDelims}`.

```

1249     \@@_pre_array:

```

We compute the width of the two delimiters.

```

1250     \dim_zero_new:N \l_@@_left_delim_dim
1251     \dim_zero_new:N \l_@@_right_delim_dim
1252     \bool_if:NTF \l_@@_NiceArray_bool
1253     {
1254         \dim_gset:Nn \l_@@_left_delim_dim { 2 \arraycolsep }
1255         \dim_gset:Nn \l_@@_right_delim_dim { 2 \arraycolsep }
1256     }
1257     {

```

The command `\bBigg@` is a command of `amsmath`.

```

1258     \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 #1 $ }
1259     \dim_set:Nn \l_@@_left_delim_dim { \box_wd:N \l_tmpa_box }
1260     \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 #2 $ }
1261     \dim_set:Nn \l_@@_right_delim_dim { \box_wd:N \l_tmpa_box }
1262 }

```

The array will be composed in a box (named `\l_@@_the_array_box`) because we have to do manipulations concerning the potential exterior rows.

```

1263     \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).

```

1264     \bool_if:NT \c_@@_define_L_C_R_bool \@@_define_L_C_R:

```

The preamble will be constructed in `\g_@@_preamble_tl`.

```
1265 \@@_construct_preamble:n { #4 }
```

Now, the preamble is constructed in `\g_@@_preamble_tl`

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).

```
1266 \hbox_set:Nw \l_@@_the_array_box
1267 \skip_horizontal:N \l_@@_left_margin_dim
1268 \skip_horizontal:N \l_@@_extra_left_margin_dim
1269 \c_math_toggle_token
1270 \bool_if:NTF \l_@@_light_syntax_bool
1271 { \use:c { @@-light-syntax } }
1272 { \use:c { @@-normal-syntax } }
1273 }
1274 {
1275 \bool_if:NTF \l_@@_light_syntax_bool
1276 { \use:c { end @@-light-syntax } }
1277 { \use:c { end @@-normal-syntax } }
1278 \c_math_toggle_token
1279 \skip_horizontal:N \l_@@_right_margin_dim
1280 \skip_horizontal:N \l_@@_extra_right_margin_dim
1281 \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).

```
1282 \int_compare:nNnT \l_@@_last_row_int > { -2 }
1283 {
1284 \bool_if:NF \l_@@_last_row_without_value_bool
1285 {
1286 \int_compare:nNnF \l_@@_last_row_int = \c@iRow
1287 {
1288 \@@_error:n { Wrong~last~row }
1289 \int_gset_eq:NN \l_@@_last_row_int \c@iRow
1290 }
1291 }
1292 }
```

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”.⁴³

```
1293 \int_gset_eq:NN \c@jCol \g_@@_col_total_int
1294 \bool_if:nTF \g_@@_last_col_found_bool
1295 { \int_gdecr:N \c@jCol }
1296 {
1297 \int_compare:nNnT \l_@@_last_col_int > { -1 }
1298 { \@@_error:n { last~col~not~used } }
1299 }
1300 \bool_if:NF \l_@@_Matrix_bool
1301 {
1302 \int_compare:nNnT \c@jCol < \g_@@_static_num_of_col_int
1303 { \@@_error:n { columns~not~used } }
1304 }
```

We fix also the value of `\c@iRow` and `\g_@@_row_total_int` with the same principle.

```
1305 \int_gset_eq:NN \g_@@_row_total_int \c@iRow
1306 \int_compare:nNnT \l_@@_last_row_int > { -1 } { \int_gdecr:N \c@iRow }
```

⁴³We remind that the potential “first column” (exterior) has the number 0.

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. 93).

```

1307   \int_compare:nNnT \l_@@_first_col_int = 0
1308   {
1309     \skip_horizontal:N \col@sep
1310     \skip_horizontal:N \g_@@_width_first_col_dim
1311   }

```

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.

Remark that, in all cases, `@@_use_arraybox_with_notes_c:` is used.

```

1312   \bool_if:NTF \l_@@_NiceArray_bool
1313   {
1314     \str_case:VnF \l_@@_baseline_str
1315     {
1316       b \@@_use_arraybox_with_notes_b:
1317       c \@@_use_arraybox_with_notes_c:
1318     }
1319     \@@_use_arraybox_with_notes:
1320   }

```

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).

```

1321   {
1322     \int_compare:nNnTF \l_@@_first_row_int = 0
1323     {
1324       \dim_set_eq:NN \l_tmpa_dim \g_@@_dp_row_zero_dim
1325       \dim_add:Nn \l_tmpa_dim \g_@@_ht_row_zero_dim
1326     }
1327     { \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”.⁴⁴

```

1328     \int_compare:nNnTF \l_@@_last_row_int > { -2 }
1329     {
1330       \dim_set_eq:NN \l_tmpb_dim \g_@@_ht_last_row_dim
1331       \dim_add:Nn \l_tmpb_dim \g_@@_dp_last_row_dim
1332     }
1333     { \dim_zero:N \l_tmpb_dim }
1334     \hbox_set:Nn \l_tmpa_box
1335     {
1336       \c_math_toggle_token
1337       \tl_if_empty:NF \l_@@_delimiters_color_tl
1338       { \color { \l_@@_delimiters_color_tl } }
1339       \left #1
1340       \vcenter
1341       {

```

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.

```

1342         \skip_vertical:N -\l_tmpa_dim
1343         \skip_vertical:N -\arrayrulewidth
1344         \hbox
1345         {
1346           \bool_if:NTF \l_@@_NiceTabular_bool
1347           { \skip_horizontal:N -\tabcolsep }
1348           { \skip_horizontal:N -\arraycolsep }
1349           \@@_use_arraybox_with_notes_c:
1350           \bool_if:NTF \l_@@_NiceTabular_bool
1351           { \skip_horizontal:N -\tabcolsep }

```

⁴⁴A 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).

```

1352         { \skip_horizontal:N -\arraycolsep }
1353     }
We take into account the “last row” (we have previously computed its total height in \l_tmpb_dim).
1354     \skip_vertical:N -\l_tmpb_dim
1355     \skip_vertical:N \arrayrulewidth
1356 }
1357 \right #2
1358 \c_math_toggle_token
1359 }

```

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 `max-delimiter-width` is used.

```

1360     \bool_if:NTF \l_@@_max_delimiter_width_bool
1361     { \@@_put_box_in_flow_bis:nn { #1 } { #2 } }
1362     \@@_put_box_in_flow:
1363 }

```

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. 94).

```

1364     \bool_if:NT \g_@@_last_col_found_bool
1365     {
1366         \skip_horizontal:N \g_@@_width_last_col_dim
1367         \skip_horizontal:N \col@sep
1368     }
1369     \@@_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.

```

1370     \egroup
1371     \bool_if:NT \c_@@_footnote_bool \endsavenotes
1372 }

```

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 argument of `\@@_construct_preamble:n` is the preamble as given by the final user to the environment `{NiceTabular}` (or a variant). The preamble will be constructed in `\g_@@_preamble_tl`.

```

1373 \cs_new_protected:Npn \@@_construct_preamble:n #1
1374 {

```

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 programming 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.

```

1375     \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).

```

1376     \bool_if:NTF \l_@@_Matrix_bool
1377     { \tl_gset:Nn \g_@@_preamble_tl { #1 } }
1378     {
1379         \@@_newcolumntype w [ 2 ] { \@@_w: { ##1 } { ##2 } }
1380         \@@_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`).

```
1381 \temptokena { #1 }
```

Initialisation of a flag used by `array` to detect the end of the expansion.

```
1382 \tempswatrue
```

The following line actually does the expansion (it’s has been copied from `array.sty`).

```
1383 \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`.

```
1384 \int_gzero_new:N \c@jCol
1385 \bool_if:NTF \l_@@_vlines_bool
1386 {
1387   \tl_gset:Nn \g_@@_preamble_tl
1388     { ! { \skip_horizontal:N \arrayrulewidth } }
1389 }
1390 { \tl_gclear:N \g_@@_preamble_tl }
```

The counter `\l_tmpa_int` will count the number of consecutive occurrences of the symbole `!`.

```
1391 \int_zero:N \l_tmpa_int
```

Now, we actually patch the preamble (and it is constructed in `\g_@@_preamble_tl`).

```
1392 \exp_after:wN \@@_patch_preamble:n \the \@temptokena \q_stop
1393 \int_gset_eq:NN \g_@@_static_num_of_col_int \c@jCol
1394 }
```

Now, we replace `\columncolor` by `\@@_columncolor_preamble`.

```
1395 \bool_if:NT \l_@@_colortbl_like_bool
1396 {
1397   \regex_replace_all:NnN
1398     \c_@@_columncolor_regex
1399     { \c { @@_columncolor_preamble } }
1400     \g_@@_preamble_tl
1401 }
```

We complete the preamble with the potential “exterior columns”.

```
1402 \int_compare:nNnTF \l_@@_first_col_int = 0
1403 { \tl_gput_left:NV \g_@@_preamble_tl \c_@@_preamble_first_col_tl }
1404 {
1405   \bool_lazy_all:nT
1406   {
1407     \l_@@_NiceArray_bool
1408     { \bool_not_p:n \l_@@_NiceTabular_bool }
1409     { \bool_not_p:n \l_@@_vlines_bool }
1410     { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
1411   }
1412   { \tl_gput_left:Nn \g_@@_preamble_tl { @ { } } }
1413 }
1414 \int_compare:nNnTF \l_@@_last_col_int > { -1 }
1415 { \tl_gput_right:NV \g_@@_preamble_tl \c_@@_preamble_last_col_tl }
1416 {
1417   \bool_lazy_all:nT
1418   {
1419     \l_@@_NiceArray_bool
1420     { \bool_not_p:n \l_@@_NiceTabular_bool }
1421     { \bool_not_p:n \l_@@_vlines_bool }
1422     { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
1423   }
1424 }
```

```

1424     { \tl_gput_right:Nn \g_@@_preamble_tl { @ { } } }
1425   }

```

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`).

```

1426   \dim_compare:nNnT \l_@@_tabular_width_dim = \c_zero_dim
1427   {
1428     \tl_gput_right:Nn
1429     \g_@@_preamble_tl
1430     { > { \@@_error_too_much_cols: } 1 }
1431   }

```

Now, we have to close the TeX group which was opened for the redefinition of the columns of type `w` and `W`.

```

1432   \group_end:
1433 }

```

```

1434 \cs_new_protected:Npn \@@_patch_preamble:n #1
1435 {
1436   \str_case:nnF { #1 }
1437   {
1438     c { \@@_patch_preamble_i:n #1 }
1439     l { \@@_patch_preamble_i:n #1 }
1440     r { \@@_patch_preamble_i:n #1 }
1441     > { \@@_patch_preamble_ii:nn #1 }
1442     ! { \@@_patch_preamble_ii:nn #1 }
1443     @ { \@@_patch_preamble_ii:nn #1 }
1444     | { \@@_patch_preamble_iii:n #1 }
1445     p { \@@_patch_preamble_iv:nnn t #1 }
1446     m { \@@_patch_preamble_iv:nnn c #1 }
1447     b { \@@_patch_preamble_iv:nnn b #1 }
1448     \@@_w: { \@@_patch_preamble_v:nnnn { } #1 }
1449     \@@_W: { \@@_patch_preamble_v:nnnn { \cs_set_eq:NN \hss \hfil } #1 }
1450     \@@_true_c: { \@@_patch_preamble_vi:n #1 }
1451     C { \@@_error:nn { old~column~type } C }
1452     L { \@@_error:nn { old~column~type } L }
1453     R { \@@_error:nn { old~column~type } R }
1454     \q_stop { }
1455   }
1456   {
1457     \str_if_eq:VnTF \l_@@_letter_for_dotted_lines_str { #1 }
1458     { \@@_patch_preamble_vii:n #1 }
1459     { \@@_fatal:nn { unknown~column~type } { #1 } }
1460   }
1461 }

```

For `c`, `l` and `r`

```

1462 \cs_new_protected:Npn \@@_patch_preamble_i:n #1
1463 {
1464   \tl_gput_right:Nn \g_@@_preamble_tl
1465   {
1466     > { \@@_Cell: \tl_set:Nn \l_@@_cell_type_tl { #1 } }
1467     #1
1468     < \@@_end_Cell:
1469   }

```

We increment the counter of columns.

```

1470   \int_gincr:N \c@jCol
1471   \@@_patch_preamble_viii:n
1472 }

```

For >, ! and @

```

1473 \cs_new_protected:Npn \@@_patch_preamble_ii:nn #1 #2
1474 {
1475   \tl_gput_right:Nn \g_@@_preamble_tl { #1 { #2 } }
1476   \@@_patch_preamble:n
1477 }

```

For |

```

1478 \cs_new_protected:Npn \@@_patch_preamble_iii:n #1
1479 {
\l_tmpa_int is the number of successive occurrences of |
1480   \int_incr:N \l_tmpa_int
1481   \@@_patch_preamble_iii_i:n
1482 }

1483 \cs_new_protected:Npn \@@_patch_preamble_iii_i:n #1
1484 {
1485   \str_if_eq:nnTF { #1 } |
1486   { \@@_patch_preamble_iii:n | }
1487   {
1488     \tl_gput_right:Nx \g_@@_preamble_tl
1489     {
1490       \exp_not:N !
1491       {
1492         \skip_horizontal:n
1493         {
1494           \dim_eval:n
1495           {
1496             \arrayrulewidth * \l_tmpa_int
1497             + \doublerulesep * ( \l_tmpa_int - 1)
1498           }
1499         }
1500       }
1501     }
1502     \tl_gput_right:Nx \g_@@_internal_code_after_tl
1503     { \@@_vline:nn { \@@_succ:n \c@jCol } { \int_use:N \l_tmpa_int } }
1504     \int_zero:N \l_tmpa_int
1505     \@@_patch_preamble:n #1
1506   }
1507 }

```

For p, m and b

```

1508 \cs_new_protected:Npn \@@_patch_preamble_iv:nnn #1 #2 #3
1509 {
1510   \tl_gput_right:Nn \g_@@_preamble_tl
1511   {
1512     > {
1513       \@@_Cell:
1514       \begin { minipage } [ #1 ] { #3 }
1515       \mode_leave_vertical:
1516       \box_use:N \@arstrutbox
1517     }
1518     c
1519     < { \box_use:N \@arstrutbox \end { minipage } \@@_end_Cell: }
1520   }

```

We increment the counter of columns.

```

1521   \int_gincr:N \c@jCol
1522   \@@_patch_preamble_viii:n
1523 }

```

For w and W

```

1524 \cs_new_protected:Npn \@@_patch_preamble_v:nnnn #1 #2 #3 #4
1525 {
1526   \tl_gput_right:Nn \g_@@_preamble_tl
1527   {
1528     > {
1529       \hbox_set:Nw \l_@@_cell_box
1530       \@@_Cell:
1531       \tl_set:Nn \l_@@_cell_type_tl { #3 }
1532     }
1533     c
1534     < {
1535       \@@_end_Cell:
1536       #1
1537       \hbox_set_end:
1538       \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
1539       \@@_adjust_size_box:
1540       \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
1541     }
1542   }

```

We increment the counter of columns.

```

1543   \int_gincr:N \c@jCol
1544   \@@_patch_preamble_viii:n
1545 }

```

For \@@_true_c: which will appear in our redefinition of the columns of type S (of siunitx).

```

1546 \cs_new_protected:Npn \@@_patch_preamble_vi:n #1
1547 {
1548   \tl_gput_right:Nn \g_@@_preamble_tl { c }

```

We increment the counter of columns.

```

1549   \int_gincr:N \c@jCol
1550   \@@_patch_preamble_viii:n
1551 }

1552 \cs_new_protected:Npn \@@_patch_preamble_vii:n #1
1553 {
1554   \tl_gput_right:Nn \g_@@_preamble_tl
1555   { ! { \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.

```

1556   \tl_gput_right:Nx \g_@@_internal_code_after_tl
1557   { \@@_vdottedline:n { \int_use:N \c@jCol } }
1558   \@@_patch_preamble:n
1559 }

```

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.

```

1560 \cs_new_protected:Npn \@@_patch_preamble_viii:n #1
1561 {
1562   \str_if_eq:nnTF { #1 } { < }
1563   \@@_patch_preamble_ix:n
1564   {
1565     \bool_if:NT \l_@@_vlines_bool
1566     {
1567       \tl_gput_right:Nn \g_@@_preamble_tl
1568       { ! { \skip_horizontal:N \arrayrulewidth } }
1569     }
1570     \@@_patch_preamble:n { #1 }
1571   }
1572 }

```

```

1573 \cs_new_protected:Npn \@@_patch_preamble_ix:n #1
1574 {
1575     \tl_gput_right:Nn \g_@@_preamble_tl { < { #1 } }
1576     \@@_patch_preamble_viii:n
1577 }

```

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`).

```

1578 \cs_new_protected:Npn \@@_put_box_in_flow:
1579 {
1580     \box_set_ht:Nn \l_tmpa_box { \box_ht:N \l_tmpa_box + \l_tmpa_dim }
1581     \box_set_dp:Nn \l_tmpa_box { \box_dp:N \l_tmpa_box + \l_tmpb_dim }
1582     \str_if_eq:VnTF \l_@@_baseline_str { c }
1583     { \box_use_drop:N \l_tmpa_box }
1584     \@@_put_box_in_flow_i:
1585 }

```

The command `\@@_put_box_in_flow_i:` is used when the value of `\l_@@_baseline_str` is different of `c` (which is the initial value and the most used).

```

1586 \cs_new_protected:Npn \@@_put_box_in_flow_i:
1587 {
1588     \pgfpicture
1589     \@@_qpoint:n { row - 1 }
1590     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
1591     \@@_qpoint:n { row - \@@_succ:n \c@iRow }
1592     \dim_gadd:Nn \g_tmpa_dim \pgf@y
1593     \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).

```

1594     \str_if_in:NnTF \l_@@_baseline_str { line- }
1595     {
1596         \int_set:Nn \l_tmpa_int
1597         {
1598             \str_range:Nnn
1599             \l_@@_baseline_str
1600             6
1601             { \str_count:N \l_@@_baseline_str }
1602         }
1603         \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
1604     }
1605     {
1606         \str_case:VnF \l_@@_baseline_str
1607         {
1608             { t } { \int_set:Nn \l_tmpa_int 1 }
1609             { b } { \int_set_eq:NN \l_tmpa_int \c@iRow }
1610         }
1611         { \int_set:Nn \l_tmpa_int \l_@@_baseline_str }
1612         \bool_lazy_or:nnT
1613         { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
1614         { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
1615         {
1616             \@@_error:n { bad~value~for~baseline }
1617             \int_set:Nn \l_tmpa_int 1
1618         }
1619         \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }

```

We take into account the position of the mathematical axis.

```

1620     \dim_gsub:Nn \g_tmpa_dim { \fontdimen22 \textfont2 }
1621 }
1622 \dim_gsub:Nn \g_tmpa_dim \pgf@y

```

Now, `\g_tmpa_dim` contains the value of the y translation we have to to.

```

1623   \endpgfpicture
1624   \box_move_up:nn \g_tmpa_dim { \box_use_drop:N \l_tmpa_box }
1625   \box_use_drop:N \l_tmpa_box
1626 }

```

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).

```

1627 \cs_new_protected:Npn \@@_use_arraybox_with_notes_c:
1628 {

```

We need a `{minipage}` because we will insert a LaTeX list for the tabular notes (that means that a `\vtop{\hsize=...}` is not enough).

```

1629   \begin { minipage } [ t ] { \box_wd:N \l_@@_the_array_box }
1630   \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.

```

1631   \@@_create_extra_nodes:
1632   \seq_if_empty:NF \g_@@_blocks_seq \@@_draw_blocks:
1633   \bool_lazy_or:nnT
1634     { \int_compare_p:nNn \c@tabularnote > 0 }
1635     { ! \tl_if_empty_p:V \l_@@_tabularnote_tl }
1636   \@@_insert_tabularnotes:
1637   \end { minipage }
1638 }

```

```

1639 \cs_new_protected:Npn \@@_insert_tabularnotes:
1640 {
1641   \skip_vertical:N 0.65ex

```

The TeX group is for potential specifications in the `\l_@@_notes_code_before_tl`.

```

1642   \group_begin:
1643   \l_@@_notes_code_before_tl
1644   \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.

```

1645   \int_compare:nNnT \c@tabularnote > 0
1646   {
1647     \bool_if:NTF \l_@@_notes_para_bool
1648     {
1649       \begin { tabularnotes* }
1650       \seq_map_inline:Nn \g_@@_tabularnotes_seq { \item ##1 } \strut
1651       \end { tabularnotes* }

```

The following `\par` is mandatory for the event that the user has put `\footnotesize` (for example) in the `notes/code-before`.

```

1652       \par
1653     }
1654     {
1655       \tabularnotes
1656       \seq_map_inline:Nn \g_@@_tabularnotes_seq { \item ##1 } \strut
1657       \endtabularnotes
1658     }
1659   }
1660   \unskip
1661   \group_end:
1662   \bool_if:NT \l_@@_notes_bottomrule_bool
1663   {
1664     \bool_if:NTF \c_@@_booktabs_loaded_bool
1665     {

```

The two dimensions `\aboverulesep` et `\heavyrulewidth` are parameters defined by `booktabs`.

```

1666         \skip_vertical:N \aboverulesep
\CT@arc@ is the specification of color defined by colortbl but you use it even if colortbl is not loaded.
1667         { \CT@arc@ \hrule height \heavyrulewidth }
1668     }
1669     { @@_error:n { bottomule~without~booktabs } }
1670 }
1671 \l_@@_notes_code_after_tl
1672 \seq_gclear:N \g_@@_tabularnotes_seq
1673 \int_gzero:N \c@tabularnote
1674 }

```

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`.

```

1675 \cs_new_protected:Npn \@@_use_arraybox_with_notes_b:
1676 {
1677     \pgfpicture
1678     \@@_qpoint:n { row - 1 }
1679     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
1680     \@@_qpoint:n { row - \int_use:N \c@iRow - base }
1681     \dim_gsub:Nn \g_tmpa_dim \pgf@y
1682     \endpgfpicture
1683     \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
1684     \int_compare:nNnT \l_@@_first_row_int = 0
1685     {
1686         \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
1687         \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
1688     }
1689     \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
1690 }

```

Now, the general case.

```

1691 \cs_new_protected:Npn \@@_use_arraybox_with_notes:
1692 {

```

We convert a value of `t` to a value of 1.

```

1693     \str_if_eq:VnT \l_@@_baseline_str { t }
1694     { \tl_set:Nn \l_@@_baseline_str { 1 } }

```

Now, we convert the value of `\l_@@_baseline_str` (which should represent an integer) to an integer stored in `\l_tmpa_int`.

```

1695     \pgfpicture
1696     \@@_qpoint:n { row - 1 }
1697     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
1698     \str_if_in:NnTF \l_@@_baseline_str { line- }
1699     {
1700         \int_set:Nn \l_tmpa_int
1701         {
1702             \str_range:Nnn
1703             \l_@@_baseline_str
1704             6
1705             { \str_count:N \l_@@_baseline_str }
1706         }
1707         \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
1708     }
1709     {
1710         \int_set:Nn \l_tmpa_int \l_@@_baseline_str
1711         \bool_lazy_or:nnT
1712         { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
1713         { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
1714         {
1715             \@@_error:n { bad~value~for~baseline }

```

```

1716         \int_set:Nn \l_tmpa_int 1
1717     }
1718     \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }
1719 }
1720 \dim_gsub:Nn \g_tmpa_dim \pgf@y
1721 \endpgfpicture
1722 \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
1723 \int_compare:nNnT \l_@@_first_row_int = 0
1724 {
1725     \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
1726     \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
1727 }
1728 \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
1729 }

```

The command `\@@_put_box_in_flow_bis:` is used when the option `max-delimiter-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.

```

1730 \cs_new_protected:Npn \@@_put_box_in_flow_bis:nn #1 #2
1731 {

```

We will compute the real width of both delimiters used.

```

1732     \dim_zero_new:N \l_@@_real_left_delim_dim
1733     \dim_zero_new:N \l_@@_real_right_delim_dim
1734     \hbox_set:Nn \l_tmpb_box
1735     {
1736         \c_math_toggle_token
1737         \left #1
1738         \vcenter
1739         {
1740             \vbox_to_ht:nn
1741             { \box_ht:N \l_tmpa_box + \box_dp:N \l_tmpa_box }
1742             { }
1743         }
1744         \right .
1745         \c_math_toggle_token
1746     }
1747     \dim_set:Nn \l_@@_real_left_delim_dim
1748     { \box_wd:N \l_tmpb_box - \nullldelimiterspace }
1749     \hbox_set:Nn \l_tmpb_box
1750     {
1751         \c_math_toggle_token
1752         \left .
1753         \vbox_to_ht:nn
1754         { \box_ht:N \l_tmpa_box + \box_dp:N \l_tmpa_box }
1755         { }
1756         \right #2
1757         \c_math_toggle_token
1758     }
1759     \dim_set:Nn \l_@@_real_right_delim_dim
1760     { \box_wd:N \l_tmpb_box - \nullldelimiterspace }

```

Now, we can put the box in the TeX flow with the horizontal adjustments on both sides.

```

1761     \skip_horizontal:N \l_@@_left_delim_dim
1762     \skip_horizontal:N -\l_@@_real_left_delim_dim
1763     \@@_put_box_in_flow:
1764     \skip_horizontal:N \l_@@_right_delim_dim
1765     \skip_horizontal:N -\l_@@_real_right_delim_dim
1766 }

```

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).

```
1767 \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).

```
1768 {
1769   \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`).

```
1770   { \exp_args:NV \@@_array: \g_@@_preamble_tl }
1771 }
1772 {
1773   \@@_create_col_nodes:
1774   \endarray
1775 }
```

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`).

```
1776 \NewDocumentEnvironment { @@-light-syntax } { b }
1777 {
```

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`.

```
1778   \tl_if_empty:nT { #1 } { \@@_fatal:n { empty-environment } }
1779   \tl_map_inline:nn { #1 }
1780   {
1781     \tl_if_eq:nnT { ##1 } { & }
1782     { \@@_fatal:n { ampersand-in-light-syntax } }
1783     \tl_if_eq:nnT { ##1 } { \ }
1784     { \@@_fatal:n { double-backslash-in-light-syntax } }
1785   }
```

Now, you extract the `code-after` 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`.

```
1786   \@@_light_syntax_i #1 \CodeAfter \q_stop
1787 }
```

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`.

```
1788 { }

1789 \cs_new_protected:Npn \@@_light_syntax_i #1\CodeAfter #2\q_stop
1790 {
1791   \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).

```
1792   \seq_gclear_new:N \g_@@_rows_seq
1793   \tl_set_rescan:Nno \l_@@_end_of_row_tl { } \l_@@_end_of_row_tl
1794   \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.

```
1795   \int_compare:nNnT \l_@@_last_row_int = { -1 }
1796   { \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`).

```

1797 \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.
1798 \seq_gpop_left:NN \g_@@_rows_seq \l_tmpa_tl
1799 \exp_args:NV \@@_line_with_light_syntax_i:n \l_tmpa_tl
1800 \seq_map_function:NN \g_@@_rows_seq \@@_line_with_light_syntax:n
1801 \@@_create_col_nodes:
1802 \endarray
1803 }
1804 \cs_new_protected:Npn \@@_line_with_light_syntax:n #1
1805 { \tl_if_empty:nF { #1 } { \ \ \@@_line_with_light_syntax_i:n { #1 } } }
1806 \cs_new_protected:Npn \@@_line_with_light_syntax_i:n #1
1807 {
1808 \seq_gclear_new:N \g_@@_cells_seq
1809 \seq_gset_split:Nnn \g_@@_cells_seq { ~ } { #1 }
1810 \seq_gpop_left:NN \g_@@_cells_seq \l_tmpa_tl
1811 \l_tmpa_tl
1812 \seq_map_inline:Nn \g_@@_cells_seq { & ##1 }
1813 }

```

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).

```

1814 \cs_new_protected:Npn \@@_analyze_end:Nn #1 #2
1815 {
1816 \str_if_eq:VnT \g_@@_name_env_str { #2 }
1817 { \@@_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.

```

1818 \end { #2 }
1819 }

```

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 specify the width of the columns).

```

1820 \cs_new:Npn \@@_create_col_nodes:
1821 {
1822 \crrc
1823 \int_compare:nNnT \l_@@_first_col_int = 0
1824 {
1825 \omit
1826 \hbox_overlap_left:n
1827 {
1828 \bool_if:NT \l_@@_code_before_bool
1829 { \pgfsys@markposition { \@@_env: - col - 0 } }
1830 \pgfpicture
1831 \pgfrememberpicturepositiononpagetrue
1832 \pgfcoordinate { \@@_env: - col - 0 } \pgfpintorigin
1833 \str_if_empty:NF \l_@@_name_str
1834 { \pgfnodelalias { \l_@@_name_str - col - 0 } { \@@_env: - col - 0 } }
1835 \endpgfpicture
1836 \skip_horizontal:N 2\col@sep
1837 \skip_horizontal:N \g_@@_width_first_col_dim
1838 }
1839 &
1840 }
1841 \omit

```

The following instruction must be put after the instruction `\omit`.

```
1842 \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`).

```
1843 \int_compare:nNnTF \l_@@_first_col_int = 0
1844 {
1845   \bool_if:NT \l_@@_code_before_bool
1846   {
1847     \hbox
1848     {
1849       \skip_horizontal:N -0.5\arrayrulewidth
1850       \pgfsys@markposition { \@@_env: - col - 1 }
1851       \skip_horizontal:N 0.5\arrayrulewidth
1852     }
1853   }
1854   \pgfpicture
1855   \pgfrememberpicturepositiononpagetrue
1856   \pgfcoordinate { \@@_env: - col - 1 }
1857   { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
1858   \str_if_empty:NF \l_@@_name_str
1859   { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
1860   \endpgfpicture
1861 }
1862 {
1863   \bool_if:NT \l_@@_code_before_bool
1864   {
1865     \hbox
1866     {
1867       \skip_horizontal:N 0.5 \arrayrulewidth
1868       \pgfsys@markposition { \@@_env: - col - 1 }
1869       \skip_horizontal:N -0.5\arrayrulewidth
1870     }
1871   }
1872   \pgfpicture
1873   \pgfrememberpicturepositiononpagetrue
1874   \pgfcoordinate { \@@_env: - col - 1 }
1875   { \pgfpoint { 0.5 \arrayrulewidth } \c_zero_dim }
1876   \str_if_empty:NF \l_@@_name_str
1877   { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
1878   \endpgfpicture
1879 }
```

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.

```
1880 \skip_gset:Nn \g_tmpa_skip { 0 pt~plus 1 fill }
1881 \bool_if:NF \l_@@_auto_columns_width_bool
1882 { \dim_compare:nNnT \l_@@_columns_width_dim > \c_zero_dim }
1883 {
1884   \bool_lazy_and:nnTF
1885   \l_@@_auto_columns_width_bool
1886   { \bool_not_p:n \l_@@_block_auto_columns_width_bool }
1887   { \skip_gset_eq:NN \g_tmpa_skip \g_@@_max_cell_width_dim }
1888   { \skip_gset_eq:NN \g_tmpa_skip \l_@@_columns_width_dim }
1889   \skip_gadd:Nn \g_tmpa_skip { 2 \col@sep }
1890 }
1891 \skip_horizontal:N \g_tmpa_skip
1892 \hbox
1893 {
```

```

1894 \bool_if:NT \l_@@_code_before_bool
1895 {
1896     \hbox
1897     {
1898         \skip_horizontal:N -0.5\arrayrulewidth
1899         \pgfsys@markposition { \@@_env: - col - 2 }
1900         \skip_horizontal:N 0.5\arrayrulewidth
1901     }
1902 }
1903 \pgfpicture
1904 \pgfrememberpicturepositiononpagetrue
1905 \pgfcoordinate { \@@_env: - col - 2 }
1906 { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
1907 \str_if_empty:NF \l_@@_name_str
1908 { \pgfnodealias { \l_@@_name_str - col - 2 } { \@@_env: - col - 2 } }
1909 \endpgfpicture
1910 }

```

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.

```

1911 \int_gset:Nn \g_tmpa_int 1
1912 \bool_if:NTF \g_@@_last_col_found_bool
1913 { \prg_replicate:nn { \g_@@_col_total_int - 2 } }
1914 { \prg_replicate:nn { \g_@@_col_total_int - 1 } }
1915 {
1916     &
1917     \omit
1918     \int_gincr:N \g_tmpa_int

```

The incrementation of the counter `\g_tmpa_int` must be done after the `\omit` of the cell.

```

1919 \skip_horizontal:N \g_tmpa_skip
1920 \bool_if:NT \l_@@_code_before_bool
1921 {
1922     \hbox
1923     {
1924         \skip_horizontal:N -0.5\arrayrulewidth
1925         \pgfsys@markposition { \@@_env: - col - \@@_succ:n \g_tmpa_int }
1926         \skip_horizontal:N 0.5\arrayrulewidth
1927     }
1928 }

```

We create the col node on the right of the current column.

```

1929 \pgfpicture
1930 \pgfrememberpicturepositiononpagetrue
1931 \pgfcoordinate { \@@_env: - col - \@@_succ:n \g_tmpa_int }
1932 { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
1933 \str_if_empty:NF \l_@@_name_str
1934 {
1935     \pgfnodealias
1936     { \l_@@_name_str - col - \@@_succ:n \g_tmpa_int }
1937     { \@@_env: - col - \@@_succ:n \g_tmpa_int }
1938 }
1939 \endpgfpicture
1940 }
1941 \bool_if:NT \g_@@_last_col_found_bool
1942 {
1943     \hbox_overlap_right:n
1944     {
1945         % \skip_horizontal:N \colsep
1946         \skip_horizontal:N \g_@@_width_last_col_dim
1947         \bool_if:NT \l_@@_code_before_bool
1948         {
1949             \pgfsys@markposition
1950             { \@@_env: - col - \@@_succ:n \g_@@_col_total_int }
1951         }

```

```

1952         \pgfpicture
1953         \pgfrememberpicturerepositiononpagetrue
1954         \pgfcoordinate { \l_@@_env: - col - \l_@@_succ:n \g_@@_col_total_int }
1955         \pgfpointorigin
1956         \str_if_empty:NF \l_@@_name_str
1957         {
1958             \pgfnodealias
1959             { \l_@@_name_str - col - \l_@@_succ:n \g_@@_col_total_int }
1960             { \l_@@_env: - col - \l_@@_succ:n \g_@@_col_total_int }
1961         }
1962         \endpgfpicture
1963     }
1964 }
1965 \cr
1966 }

```

Here is the preamble for the “first column” (if the user uses the key `first-col`)

```

1967 \tl_const:Nn \c_@@_preamble_first_col_tl
1968 {
1969     >
1970     {
1971         \bool_gset_true:N \g_@@_after_col_zero_bool
1972         \l_@@_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.

```

1973         \hbox_set:Nw \l_@@_cell_box
1974         \l_@@_math_toggle_token:
1975         \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”.

```

1976         \bool_lazy_and:nnT
1977         { \int_compare_p:nNn \c@iRow > 0 }
1978         {
1979             \bool_lazy_or_p:nn
1980             { \int_compare_p:nNn \l_@@_last_row_int < 0 }
1981             { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
1982         }
1983         {
1984             \l_@@_code_for_first_col_tl
1985             \xglobal \colorlet { nicematrix-first-col } { . }
1986         }
1987     }

```

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`.

```

1988     l
1989     <
1990     {
1991         \l_@@_math_toggle_token:
1992         \hbox_set_end:
1993         \bool_if:NT \g_@@_rotate_bool \l_@@_rotate_cell_box:
1994         \l_@@_adjust_size_box:
1995         \l_@@_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.

```

1996         \dim_gset:Nn \g_@@_width_first_col_dim
1997         { \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.

```

1998         \hbox_overlap_left:n
1999         {

```

```

2000         \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \c_zero_dim
2001         \@@_node_for_the_cell:
2002         { \box_use_drop:N \l_@@_cell_box }
2003         \skip_horizontal:N \l_@@_left_delim_dim
2004         \skip_horizontal:N \l_@@_left_margin_dim
2005         \skip_horizontal:N \l_@@_extra_left_margin_dim
2006     }
2007     \bool_gset_false:N \g_@@_empty_cell_bool
2008     \skip_horizontal:N -2\col@sep
2009 }
2010 }

```

Here is the preamble for the “last column” (if the user uses the key `last-col`).

```

2011 \tl_const:Nn \c_@@_preamble_last_col_tl
2012 {
2013     >
2014     {

```

With the flag `\g_@@_last_col_found_bool`, we will know that the “last column” is really used.

```

2015     \bool_gset_true:N \g_@@_last_col_found_bool
2016     \int_gincr:N \c@jCol
2017     \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.

```

2018     \hbox_set:Nw \l_@@_cell_box
2019     \@@_math_toggle_token:
2020     \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”.

```

2021     \int_compare:nNnT \c@iRow > 0
2022     {
2023         \bool_lazy_or:nnT
2024         { \int_compare_p:nNn \l_@@_last_row_int < 0 }
2025         { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
2026         {
2027             \l_@@_code_for_last_col_tl
2028             \xglobal \colorlet { nicematrix-last-col } { . }
2029         }
2030     }
2031 }
2032 1
2033 <
2034 {
2035     \@@_math_toggle_token:
2036     \hbox_set_end:
2037     \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
2038     \@@_adjust_size_box:
2039     \@@_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.

```

2040     \dim_gset:Nn \g_@@_width_last_col_dim
2041     { \dim_max:nn \g_@@_width_last_col_dim { \box_wd:N \l_@@_cell_box } }
2042     \skip_horizontal:N -2\col@sep

```

The content of the cell is inserted in an overlapping position.

```

2043     \hbox_overlap_right:n
2044     {
2045         \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } > \c_zero_dim
2046         {
2047             \skip_horizontal:N \l_@@_right_delim_dim
2048             \skip_horizontal:N \l_@@_right_margin_dim
2049             \skip_horizontal:N \l_@@_extra_right_margin_dim
2050             \@@_node_for_the_cell:

```

```

2051     }
2052   }
2053   \bool_gset_false:N \g_@@_empty_cell_bool
2054 }
2055 }

```

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.

```

2056 \NewDocumentEnvironment { NiceArray } { }
2057 {
2058   \bool_set_true:N \l_@@_NiceArray_bool
2059   \str_if_empty:NT \g_@@_name_env_str
2060     { \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).

```

2061   \NiceArrayWithDelims . .
2062 }
2063 { \endNiceArrayWithDelims }

```

We create the variants of the environment `{NiceArrayWithDelims}`.

```

2064 \cs_new_protected:Npn \@@_def_env:nnn #1 #2 #3
2065 {
2066   \NewDocumentEnvironment { #1 NiceArray } { }
2067   {
2068     \str_if_empty:NT \g_@@_name_env_str
2069       { \str_gset:Nn \g_@@_name_env_str { #1 NiceArray } }
2070     \@@_test_if_math_mode:
2071     \NiceArrayWithDelims #2 #3
2072   }
2073   { \endNiceArrayWithDelims }
2074 }
2075 \@@_def_env:nnn p ( )
2076 \@@_def_env:nnn b [ ]
2077 \@@_def_env:nnn B \{ \}
2078 \@@_def_env:nnn v | |
2079 \@@_def_env:nnn V \| \|

```

The environment `{NiceMatrix}` and its variants

```

2080 \cs_new_protected:Npn \@@_begin_of_NiceMatrix:nn #1 #2
2081 {
2082   \bool_set_true:N \l_@@_Matrix_bool
2083   \use:c { #1 NiceArray }
2084   {
2085     *
2086     {
2087       \int_compare:nNnTF \l_@@_last_col_int < 0
2088         \c@MaxMatrixCols
2089         { \@@_pred:n \l_@@_last_col_int }
2090     }
2091     { > \@@_Cell: #2 < \@@_end_Cell: }
2092   }
2093 }
2094 \clist_map_inline:nn { { } , p , b , B , v , V }
2095 {
2096   \NewDocumentEnvironment { #1 NiceMatrix } { ! O { } }

```

```

2097 {
2098   \str_gset:Nn \g_@@_name_env_str { #1 NiceMatrix }
2099   \tl_set:Nn \l_@@_type_of_col_tl c
2100   \keys_set:nn { NiceMatrix / NiceMatrix } { ##1 }
2101   \exp_args:Nne \@@_begin_of_NiceMatrix:nn { #1 } \l_@@_type_of_col_tl
2102 }
2103 { \use:c { end #1 NiceArray } }
2104 }

```

The following command will be linked to `\NotEmpty` in the environments of `nicematrix`.

```

2105 \cs_new_protected:Npn \@@_NotEmpty:
2106 { \bool_gset_true:N \g_@@_not_empty_cell_bool }

```

The environments `{NiceTabular}` and `{NiceTabular*}`

```

2107 \NewDocumentEnvironment { NiceTabular } { 0 { } m ! 0 { } }
2108 {
2109   \str_gset:Nn \g_@@_name_env_str { NiceTabular }
2110   \keys_set:nn { NiceMatrix / NiceTabular } { #1 , #3 }
2111   \bool_set_true:N \l_@@_NiceTabular_bool
2112   \NiceArray { #2 }
2113 }
2114 { \endNiceArray }

2115 \NewDocumentEnvironment { NiceTabular* } { m 0 { } m ! 0 { } }
2116 {
2117   \str_gset:Nn \g_@@_name_env_str { NiceTabular* }
2118   \dim_set:Nn \l_@@_tabular_width_dim { #1 }
2119   \keys_set:nn { NiceMatrix / NiceTabular } { #2 , #4 }
2120   \bool_set_true:N \l_@@_NiceTabular_bool
2121   \NiceArray { #3 }
2122 }
2123 { \endNiceArray }

```

After the construction of the array

```

2124 \cs_new_protected:Npn \@@_after_array:
2125 {
2126   \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.

```

2127   \bool_if:NT \g_@@_last_col_found_bool
2128   { \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 fix the real value of `\l_@@_last_col_int`.

```

2129   \bool_if:NT \l_@@_last_col_without_value_bool
2130   {
2131     \dim_set_eq:NN \l_@@_last_col_int \g_@@_col_total_int
2132     \iow_shipout:Nn \@mainaux \ExplSyntaxOn
2133     \iow_shipout:Nx \@mainaux
2134     {
2135       \cs_gset:cpn { @@_last_col_ \int_use:N \g_@@_env_int }
2136       { \int_use:N \g_@@_col_total_int }
2137     }
2138     \str_if_empty:NF \l_@@_name_str
2139     {

```



```

2140         \iow_shipout:Nx \@mainaux
2141         {
2142             \cs_gset:cpn { @@_last_col_ \l_@@_name_str }
2143             { \int_use:N \g_@@_col_total_int }
2144         }
2145     }
2146     \iow_shipout:Nn \@mainaux \ExplSyntaxOff
2147 }

```

It's also time to give to `\l_@@_last_row_int` its real value. But, if the user had used the option `last-row` without value, we write in the aux file the number of that last row for the next run.

```

2148     \bool_if:NT \l_@@_last_row_without_value_bool
2149     {
2150         \dim_set_eq:NN \l_@@_last_row_int \g_@@_row_total_int

```

If the option `light-syntax` is used, we have nothing to write since, in this case, the number of rows is directly determined.

```

2151     \bool_if:NF \l_@@_light_syntax_bool
2152     {
2153         \iow_shipout:Nn \@mainaux \ExplSyntaxOn
2154         \iow_shipout:Nx \@mainaux
2155         {
2156             \cs_gset:cpn { @@_last_row_ \int_use:N \g_@@_env_int }
2157             { \int_use:N \g_@@_row_total_int }
2158         }

```

If the environment has a name, we also write a value based on the name because it's more reliable than a value based on the number of the environment.

```

2159         \str_if_empty:NF \l_@@_name_str
2160         {
2161             \iow_shipout:Nx \@mainaux
2162             {
2163                 \cs_gset:cpn { @@_last_row_ \l_@@_name_str }
2164                 { \int_use:N \g_@@_row_total_int }
2165             }
2166         }
2167     \iow_shipout:Nn \@mainaux \ExplSyntaxOff
2168 }
2169 }

```

If the key `code-before` is used, we have to write on the aux file the actual size of the array.

```

2170     \bool_if:NT \l_@@_code_before_bool
2171     {
2172         \iow_now:Nn \@mainaux \ExplSyntaxOn
2173         \iow_now:Nx \@mainaux
2174         { \seq_clear_new:c { @@_size _ \int_use:N \g_@@_env_int _ seq } }
2175         \iow_now:Nx \@mainaux
2176         {
2177             \seq_gset_from_clist:cn { @@_size _ \int_use:N \g_@@_env_int _ seq }
2178             {
2179                 \int_use:N \l_@@_first_row_int ,
2180                 \int_use:N \g_@@_row_total_int ,
2181                 \int_use:N \l_@@_first_col_int ,

```

If the user has used a key `last-row` in an environment with preamble (like `{pNiceArray}`) and that that last row has not been found, we have to increment the value because it will be decreased when used in the `code-before`.

```

2182         \bool_lazy_and:nnTF
2183         { \int_compare_p:nNn \l_@@_last_col_int > { -2 } }
2184         { \bool_not_p:n \g_@@_last_col_found_bool }
2185         \@@_succ:n
2186         \int_use:N
2187         \g_@@_col_total_int
2188     }

```

We write also the potential content of `\g_@@_pos_of_blocks_seq` (it will be useful if the commands `\rowcolors` is used with the key `respect-blocks`).

```

2189         \seq_gset_from_clist:cn
2190         { c_@@_pos_of_blocks_ \int_use:N \g_@@_env_int _ seq }
2191         { \seq_use:Nnnn \g_@@_pos_of_blocks_seq , , , }
2192     }
2193     \iow_now:Nn \@mainaux \ExplSyntaxOff
2194 }

```

By default, the diagonal lines will be parallelized⁴⁵. 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.

```

2195     \bool_if:NT \l_@@_parallelize_diags_bool
2196     {
2197         \int_gzero_new:N \g_@@_ddots_int
2198         \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.

```

2199         \dim_gzero_new:N \g_@@_delta_x_one_dim
2200         \dim_gzero_new:N \g_@@_delta_y_one_dim
2201         \dim_gzero_new:N \g_@@_delta_x_two_dim
2202         \dim_gzero_new:N \g_@@_delta_y_two_dim
2203     }
2204     \int_zero_new:N \l_@@_initial_i_int
2205     \int_zero_new:N \l_@@_initial_j_int
2206     \int_zero_new:N \l_@@_final_i_int
2207     \int_zero_new:N \l_@@_final_j_int
2208     \bool_set_false:N \l_@@_initial_open_bool
2209     \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.

```

2210     \bool_if:NT \l_@@_small_bool
2211     {
2212         \dim_set:Nn \l_@@_radius_dim { 0.37 pt }
2213         \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.

```

2214         \dim_set:Nn \l_@@_xdots_shorten_dim { 0.6 \l_@@_xdots_shorten_dim }
2215     }

```

Now, we actually draw the dotted lines (specified by `\Cdots`, `\Vdots`, etc.).

```

2216     \@@_draw_dotted_lines:

```

The following computes the “corners” (made up of empty cells) but if there is no corner to compute, it will do nothing.

```

2217     \@@_compute_corners:

```

The sequence `\g_@@_pos_of_blocks_seq` must be “adjusted” (for the case where the user have written something like `\Block{1-}`).

```

2218     \@@_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`.

```

2219     \bool_lazy_all:nT

```

⁴⁵It's possible to use the option `parallelize-diags` to disable this parallelization.

```

2220 {
2221   { \seq_if_empty_p:N \g_@@_pos_of_blocks_seq }
2222   { \seq_if_empty_p:N \g_@@_pos_of_xdots_seq }
2223   { \seq_if_empty_p:N \l_@@_empty_corner_cells_seq }
2224 }
2225 {
2226   \cs_set_eq:NN \@@_vline_i:nn \@@_vline_i_complete:nn
2227   \cs_set_eq:NN \@@_hline_i:nn \@@_hline_i_complete:nn
2228 }
2229 \bool_if:NT \l_@@_hlines_bool \@@_draw_hlines:
2230 \bool_if:NT \l_@@_vlines_bool \@@_draw_vlines:
2231 \g_@@_internal_code_after_tl
2232 \tl_gclear:N \g_@@_internal_code_after_tl

```

Now, the code-after.

```

2233 \bool_if:NT \c_@@_tikz_loaded_bool
2234 {
2235   \tikzset
2236   {
2237     every~picture / .style =
2238     {
2239       overlay ,
2240       remember~picture ,
2241       name~prefix = \@@_env: -
2242     }
2243   }
2244 }
2245 \cs_set_eq:NN \line \@@_line

```

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.

```

2246 \cs_set_eq:NN \CodeAfter \prg_do_nothing:

```

And here's the code-after:

```

2247 \g_nicematrix_code_after_tl
2248 \tl_gclear:N \g_nicematrix_code_after_tl
2249 \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.

```

2250 \tl_if_empty:NF \g_nicematrix_code_before_tl
2251 {

```

The command `\rowcolor` in `tabular` will in fact use `\rectanglecolor` in order to follow the behaviour 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`.

```

2252 \cs_set_protected:Npn \rectanglecolor { }
2253 \cs_set_protected:Npn \columncolor { }
2254 \iow_now:Nn \@mainaux \ExplSyntaxOn
2255 \iow_now:Nx \@mainaux
2256 {
2257   \tl_gset:cn
2258   { g_@@_code_before_ \int_use:N \g_@@_env_int _ tl }
2259   { \g_nicematrix_code_before_tl }
2260 }
2261 \iow_now:Nn \@mainaux \ExplSyntaxOff
2262 \bool_set_true:N \l_@@_code_before_bool
2263 }

2264 \str_gclear:N \g_@@_name_env_str
2265 \@@_restore_iRow_jCol:

```

The command `\CT@arc@` contains the instruction of color for the rules of the array⁴⁶. 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`.

```
2266 \cs_gset_eq:NN \CT@arc@ \@@_old_CT@arc@
2267 }
```

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).

```
2268 \cs_new_protected:Npn \@@_adjust_pos_of_blocks_seq:
2269 {
2270   \seq_gclear:N \g_tmpa_seq
2271   \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
2272     { \@@_adjust_pos_of_blocks_seq_i:nnnn #1 }
2273   \seq_gset_eq:NN \g_@@_pos_of_blocks_seq \g_tmpa_seq
2274 }
2275 \cs_new_protected:Npn \@@_adjust_pos_of_blocks_seq_i:nnnn #1 #2 #3 #4
2276 {
2277   \int_compare:nNnTF { #3 } > { 99 }
2278     { \int_set_eq:NN \l_tmpa_int \c@iRow }
2279     { \int_set:Nn \l_tmpa_int { #3 } }
2280   \int_compare:nNnTF { #4 } > { 99 }
2281     { \int_set_eq:NN \l_tmpb_int \c@jCol }
2282     { \int_set:Nn \l_tmpb_int { #4 } }
2283   \seq_gput_right:Nx \g_tmpa_seq
2284     { { #1 } { #2 } { \int_use:N \l_tmpa_int } { \int_use:N \l_tmpb_int } }
2285 }
```

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).

```
2286 \AtBeginDocument
2287 {
2288   \cs_new_protected:Npx \@@_draw_dotted_lines:
2289     {
2290       \c_@@_pgfortikzpicture_tl
2291       \@@_draw_dotted_lines_i:
2292       \c_@@_endpgfortikzpicture_tl
2293     }
2294 }
```

The following command *must* be protected because it will appear in the construction of the command `\@@_draw_dotted_lines:`.

```
2295 \cs_new_protected:Npn \@@_draw_dotted_lines_i:
2296 {
2297   \pgfrememberpicturepositiononpagetrue
2298   \pgf@relevantforpicturesizefalse
2299   \g_@@_HVdotsfor_lines_tl
2300   \g_@@_Vdots_lines_tl
2301   \g_@@_Ddots_lines_tl
2302   \g_@@_Idots_lines_tl
2303   \g_@@_Cdots_lines_tl
2304   \g_@@_Ldots_lines_tl
2305 }
```

⁴⁶e.g. `\color[rgb]{0.5,0.5,0}`

```

2306 \cs_new_protected:Npn \@@_restore_iRow_jCol:
2307 {
2308   \cs_if_exist:NT \theiRow { \int_gset_eq:NN \c@iRow \l_@@_old_iRow_int }
2309   \cs_if_exist:NT \thejCol { \int_gset_eq:NN \c@jCol \l_@@_old_jCol_int }
2310 }

```

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.

```

2311 \cs_new_protected:Npn \@@_find_extremities_of_line:nnnn #1 #2 #3 #4
2312 {

```

First, we declare the current cell as “dotted” because we forbid intersections of dotted lines.

```

2313   \cs_set:cpn { @@ _ dotted _ #1 - #2 } { }

```

Initialization of variables.

```

2314   \int_set:Nn \l_@@_initial_i_int { #1 }
2315   \int_set:Nn \l_@@_initial_j_int { #2 }
2316   \int_set:Nn \l_@@_final_i_int { #1 }
2317   \int_set:Nn \l_@@_final_j_int { #2 }

```

We will do two loops: one when determining the initial cell and the other when determining 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.

```

2318   \bool_set_false:N \l_@@_stop_loop_bool
2319   \bool_do_until:Nn \l_@@_stop_loop_bool
2320   {
2321     \int_add:Nn \l_@@_final_i_int { #3 }
2322     \int_add:Nn \l_@@_final_j_int { #4 }

```

We test if we are still in the matrix.

```

2323     \bool_set_false:N \l_@@_final_open_bool
2324     \int_compare:nNnTF \l_@@_final_i_int > \c@iRow
2325     {
2326       \int_compare:nNnTF { #3 } = 1
2327       { \bool_set_true:N \l_@@_final_open_bool }
2328     }

```

```

2329         \int_compare:nNnT \l_@@_final_j_int > \c@jCol
2330         { \bool_set_true:N \l_@@_final_open_bool }
2331     }
2332 }
2333 {
2334     \int_compare:nNnTF \l_@@_final_j_int < 1
2335     {
2336         \int_compare:nNnT { #4 } = { -1 }
2337         { \bool_set_true:N \l_@@_final_open_bool }
2338     }
2339     {
2340         \int_compare:nNnT \l_@@_final_j_int > \c@jCol
2341         {
2342             \int_compare:nNnT { #4 } = 1
2343             { \bool_set_true:N \l_@@_final_open_bool }
2344         }
2345     }
2346 }
2347 \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.

```

2348     {

```

We do a step backwards.

```

2349         \int_sub:Nn \l_@@_final_i_int { #3 }
2350         \int_sub:Nn \l_@@_final_j_int { #4 }
2351         \bool_set_true:N \l_@@_stop_loop_bool
2352     }

```

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`.

```

2353     {
2354         \cs_if_exist:cTF
2355         {
2356             @@ _ dotted _
2357             \int_use:N \l_@@_final_i_int -
2358             \int_use:N \l_@@_final_j_int
2359         }
2360         {
2361             \int_sub:Nn \l_@@_final_i_int { #3 }
2362             \int_sub:Nn \l_@@_final_j_int { #4 }
2363             \bool_set_true:N \l_@@_final_open_bool
2364             \bool_set_true:N \l_@@_stop_loop_bool
2365         }
2366         {
2367             \cs_if_exist:cTF
2368             {
2369                 pgf @ sh @ ns @ \@@_env:
2370                 - \int_use:N \l_@@_final_i_int
2371                 - \int_use:N \l_@@_final_j_int
2372             }
2373             { \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 environnement), 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.

```

2374         {
2375             \cs_set:cpn
2376             {
2377                 @@ _ dotted _
2378                 \int_use:N \l_@@_final_i_int -
2379                 \int_use:N \l_@@_final_j_int

```

```

2380         }
2381     { }
2382 }
2383 }
2384 }
2385 }

```

For `\l_@@_initial_i_int` and `\l_@@_initial_j_int` the programming is similar to the previous one.

```

2386 \bool_set_false:N \l_@@_stop_loop_bool
2387 \bool_do_until:Nn \l_@@_stop_loop_bool
2388 {
2389     \int_sub:Nn \l_@@_initial_i_int { #3 }
2390     \int_sub:Nn \l_@@_initial_j_int { #4 }
2391     \bool_set_false:N \l_@@_initial_open_bool
2392     \int_compare:nNnTF \l_@@_initial_i_int < 1
2393     {
2394         \int_compare:nNnTF { #3 } = 1
2395         { \bool_set_true:N \l_@@_initial_open_bool }
2396         {
2397             \int_compare:nNnT \l_@@_initial_j_int = 0
2398             { \bool_set_true:N \l_@@_initial_open_bool }
2399         }
2400     }
2401     {
2402         \int_compare:nNnTF \l_@@_initial_j_int < 1
2403         {
2404             \int_compare:nNnT { #4 } = 1
2405             { \bool_set_true:N \l_@@_initial_open_bool }
2406         }
2407         {
2408             \int_compare:nNnT \l_@@_initial_j_int > \c@jCol
2409             {
2410                 \int_compare:nNnT { #4 } = { -1 }
2411                 { \bool_set_true:N \l_@@_initial_open_bool }
2412             }
2413         }
2414     }
2415     \bool_if:NTF \l_@@_initial_open_bool
2416     {
2417         \int_add:Nn \l_@@_initial_i_int { #3 }
2418         \int_add:Nn \l_@@_initial_j_int { #4 }
2419         \bool_set_true:N \l_@@_stop_loop_bool
2420     }
2421     {
2422         \cs_if_exist:cTF
2423         {
2424             @@ _ dotted _
2425             \int_use:N \l_@@_initial_i_int -
2426             \int_use:N \l_@@_initial_j_int
2427         }
2428         {
2429             \int_add:Nn \l_@@_initial_i_int { #3 }
2430             \int_add:Nn \l_@@_initial_j_int { #4 }
2431             \bool_set_true:N \l_@@_initial_open_bool
2432             \bool_set_true:N \l_@@_stop_loop_bool
2433         }
2434         {
2435             \cs_if_exist:cTF
2436             {
2437                 pgf @ sh @ ns @ \@@_env:
2438                 - \int_use:N \l_@@_initial_i_int

```

```

2439         - \int_use:N \l_@@_initial_j_int
2440     }
2441     { \bool_set_true:N \l_@@_stop_loop_bool }
2442     {
2443         \cs_set:cpn
2444         {
2445             @@_dotted_
2446             \int_use:N \l_@@_initial_i_int -
2447             \int_use:N \l_@@_initial_j_int
2448         }
2449         { }
2450     }
2451 }
2452 }
2453 }

```

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.

```

2454 \seq_gput_right:Nx \g_@@_pos_of_xdots_seq
2455 {
2456     { \int_use:N \l_@@_initial_i_int }
2457     { \int_use:N \l_@@_initial_j_int }
2458     { \int_use:N \l_@@_final_i_int }
2459     { \int_use:N \l_@@_final_j_int }
2460 }
2461 }

2462 \cs_new_protected:Npn \@@_set_initial_coords:
2463 {
2464     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2465     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2466 }
2467 \cs_new_protected:Npn \@@_set_final_coords:
2468 {
2469     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2470     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2471 }
2472 \cs_new_protected:Npn \@@_set_initial_coords_from_anchor:n #1
2473 {
2474     \pgfpointanchor
2475     {
2476         \@@_env:
2477         - \int_use:N \l_@@_initial_i_int
2478         - \int_use:N \l_@@_initial_j_int
2479     }
2480     { #1 }
2481     \@@_set_initial_coords:
2482 }
2483 \cs_new_protected:Npn \@@_set_final_coords_from_anchor:n #1
2484 {
2485     \pgfpointanchor
2486     {
2487         \@@_env:
2488         - \int_use:N \l_@@_final_i_int
2489         - \int_use:N \l_@@_final_j_int
2490     }
2491     { #1 }
2492     \@@_set_final_coords:
2493 }

```

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.


```

2494 \cs_new_protected:Npn \@@_draw_Ldots:nnn #1 #2 #3
2495 {
2496   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2497   {
2498     \@@_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.

```

2499   \group_begin:
2500   \int_compare:nNnTF { #1 } = 0
2501     { \color { nicematrix-first-row } }
2502     {

```

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.

```

2503       \int_compare:nNnT { #1 } = \l_@@_last_row_int
2504       { \color { nicematrix-last-row } }
2505     }
2506     \keys_set:nn { NiceMatrix / xdots } { #3 }
2507     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2508     \@@_actually_draw_Ldots:
2509   \group_end:
2510 }
2511 }

```

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`.

```

2512 \cs_new_protected:Npn \@@_actually_draw_Ldots:
2513 {
2514   \bool_if:NTF \l_@@_initial_open_bool
2515   {
2516     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2517     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2518     \dim_add:Nn \l_@@_x_initial_dim \col@sep
2519     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
2520     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2521   }
2522   { \@@_set_initial_coords_from_anchor:n { base-east } }
2523   \bool_if:NTF \l_@@_final_open_bool
2524   {
2525     \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
2526     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2527     \dim_sub:Nn \l_@@_x_final_dim \col@sep
2528     \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
2529     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2530   }
2531   { \@@_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 (?).

```

2532   \dim_add:Nn \l_@@_y_initial_dim \l_@@_radius_dim
2533   \dim_add:Nn \l_@@_y_final_dim \l_@@_radius_dim
2534   \@@_draw_line:
2535 }

```

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.

```

2536 \cs_new_protected:Npn \@@_draw_Cdots:nnn #1 #2 #3
2537 {
2538   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2539   {
2540     \@@_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.

```

2541     \group_begin:
2542     \int_compare:nNnTF { #1 } = 0
2543     { \color { nicematrix-first-row } }
2544     {

```

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.

```

2545         \int_compare:nNnT { #1 } = \l_@@_last_row_int
2546         { \color { nicematrix-last-row } }
2547     }
2548     \keys_set:nn { NiceMatrix / xdots } { #3 }
2549     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2550     \@@_actually_draw_Cdots:
2551   \group_end:
2552 }
2553 }

```

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`.

```

2554 \cs_new_protected:Npn \@@_actually_draw_Cdots:
2555 {
2556   \bool_if:NTF \l_@@_initial_open_bool
2557   {
2558     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2559     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2560     \dim_add:Nn \l_@@_x_initial_dim \col@sep
2561   }
2562   { \@@_set_initial_coords_from_anchor:n { mid~east } }
2563   \bool_if:NTF \l_@@_final_open_bool
2564   {
2565     \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
2566     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2567     \dim_sub:Nn \l_@@_x_final_dim \col@sep
2568   }
2569   { \@@_set_final_coords_from_anchor:n { mid~west } }
2570   \bool_lazy_and:nnTF
2571   \l_@@_initial_open_bool
2572   \l_@@_final_open_bool
2573   {
2574     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2575     \dim_set_eq:NN \l_tmpa_dim \pgf@y
2576     \@@_qpoint:n { row - \@@_succ:n \l_@@_initial_i_int }
2577     \dim_set:Nn \l_@@_y_initial_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
2578     \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim

```

```

2579     }
2580     {
2581         \bool_if:NT \l_@@_initial_open_bool
2582         { \dim_set_eq:NN \l_@@_y_initial_dim \l_@@_y_final_dim }
2583         \bool_if:NT \l_@@_final_open_bool
2584         { \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim }
2585     }
2586     \@@_draw_line:
2587 }

```

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.

```

2588 \cs_new_protected:Npn \@@_draw_Vdots:nnn #1 #2 #3
2589 {
2590     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2591     {
2592         \@@_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.

```

2593         \group_begin:
2594         \int_compare:nNnTF { #2 } = 0
2595         { \color { nicematrix-first-col } }
2596         {
2597             \int_compare:nNnT { #2 } = \l_@@_last_col_int
2598             { \color { nicematrix-last-col } }
2599         }
2600         \keys_set:nn { NiceMatrix / xdots } { #3 }
2601         \tl_if_empty:VF \l_@@_xdots_color_tl
2602         { \color { \l_@@_xdots_color_tl } }
2603         \@@_actually_draw_Vdots:
2604     \group_end:
2605 }
2606 }

```

The command `\@@_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`.

```

2607 \cs_new_protected:Npn \@@_actually_draw_Vdots:
2608 {

```

The boolean `\l_tmpa_bool` indicates whether the column is of type 1 or may be considered as if.

```

2609     \bool_set_false:N \l_tmpa_bool
2610     \bool_lazy_or:nnF \l_@@_initial_open_bool \l_@@_final_open_bool
2611     {
2612         \@@_set_initial_coords_from_anchor:n { south-west }
2613         \@@_set_final_coords_from_anchor:n { north-west }
2614         \bool_set:Nn \l_tmpa_bool
2615         { \dim_compare_p:nNn \l_@@_x_initial_dim = \l_@@_x_final_dim }
2616     }

```

Now, we try to determine whether the column is of type `c` or may be considered as if.

```

2617 \bool_if:NTF \l_@@_initial_open_bool
2618 {
2619   \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2620   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2621 }
2622 { \@@_set_initial_coords_from_anchor:n { south } }
2623 \bool_if:NTF \l_@@_final_open_bool
2624 {
2625   \@@_qpoint:n { row - \@@_succ:n \l_@@_final_i_int }
2626   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2627 }
2628 { \@@_set_final_coords_from_anchor:n { north } }
2629 \bool_if:NTF \l_@@_initial_open_bool
2630 {
2631   \bool_if:NTF \l_@@_final_open_bool
2632   {
2633     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2634     \dim_set_eq:NN \l_tmpa_dim \pgf@x
2635     \@@_qpoint:n { col - \@@_succ:n \l_@@_initial_j_int }
2636     \dim_set:Nn \l_@@_x_initial_dim { ( \pgf@x + \l_tmpa_dim ) / 2 }
2637     \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.

```

2638 \int_compare:nNnT \l_@@_last_col_int > { -2 }
2639 {
2640   \int_compare:nNnT \l_@@_initial_j_int = \g_@@_col_total_int
2641   {
2642     \dim_set_eq:NN \l_tmpa_dim \l_@@_right_margin_dim
2643     \dim_add:Nn \l_tmpa_dim \l_@@_extra_right_margin_dim
2644     \dim_add:Nn \l_@@_x_initial_dim \l_tmpa_dim
2645     \dim_add:Nn \l_@@_x_final_dim \l_tmpa_dim
2646   }
2647 }
2648 { \dim_set_eq:NN \l_@@_x_initial_dim \l_@@_x_final_dim }
2649 }
2650 {
2651   \bool_if:NTF \l_@@_final_open_bool
2652   { \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim }
2653   {

```

Now the case where both extremities are closed. The first conditional tests whether the column is of type `c` (`C` of `{NiceArray}`) or may be considered as if.

```

2655 \dim_compare:nNnF \l_@@_x_initial_dim = \l_@@_x_final_dim
2656 {
2657   \dim_set:Nn \l_@@_x_initial_dim
2658   {
2659     \bool_if:NTF \l_tmpa_bool \dim_min:nn \dim_max:nn
2660     \l_@@_x_initial_dim \l_@@_x_final_dim
2661   }
2662   \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
2663 }
2664 }
2665 }
2666 \@@_draw_line:
2667 }

```

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.

```

2668 \cs_new_protected:Npn \@@_draw_Ddots:nnn #1 #2 #3
2669 {
2670   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2671   {
2672     \@@_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.

```

2673     \group_begin:
2674       \keys_set:nn { NiceMatrix / xdots } { #3 }
2675       \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2676       \@@_actually_draw_Ddots:
2677     \group_end:
2678   }
2679 }

```

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`.

```

2680 \cs_new_protected:Npn \@@_actually_draw_Ddots:
2681 {
2682   \bool_if:NTF \l_@@_initial_open_bool
2683   {
2684     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2685     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2686     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2687     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2688   }
2689   { \@@_set_initial_coords_from_anchor:n { south-east } }
2690   \bool_if:NTF \l_@@_final_open_bool
2691   {
2692     \@@_qpoint:n { row - \@@_succ:n \l_@@_final_i_int }
2693     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2694     \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
2695     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2696   }
2697   { \@@_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.

```

2698   \bool_if:NT \l_@@_parallelize_diags_bool
2699   {
2700     \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).

```

2701     \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.

```

2702     {
2703       \dim_gset:Nn \g_@@_delta_x_one_dim

```

```

2704         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
2705         \dim_gset:Nn \g_@@_delta_y_one_dim
2706         { \l_@@_y_final_dim - \l_@@_y_initial_dim }
2707     }

```

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`.

```

2708     {
2709         \dim_set:Nn \l_@@_y_final_dim
2710         {
2711             \l_@@_y_initial_dim +
2712             ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2713             \dim_ratio:nn \g_@@_delta_y_one_dim \g_@@_delta_x_one_dim
2714         }
2715     }
2716 }
2717 \@@_draw_line:
2718 }

```

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.

```

2719 \cs_new_protected:Npn \@@_draw_Iddots:nnn #1 #2 #3
2720 {
2721     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2722     {
2723         \@@_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.

```

2724         \group_begin:
2725         \keys_set:nn { NiceMatrix / xdots } { #3 }
2726         \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2727         \@@_actually_draw_Iddots:
2728         \group_end:
2729     }
2730 }

```

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`.

```

2731 \cs_new_protected:Npn \@@_actually_draw_Iddots:
2732 {
2733     \bool_if:NTF \l_@@_initial_open_bool
2734     {
2735         \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2736         \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2737         \@@_qpoint:n { col - \@@_succ:n \l_@@_initial_j_int }
2738         \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2739     }
2740     { \@@_set_initial_coords_from_anchor:n { south-west } }
2741     \bool_if:NTF \l_@@_final_open_bool
2742     {
2743         \@@_qpoint:n { row - \@@_succ:n \l_@@_final_i_int }

```

```

2744     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2745     \@@_qpoint:n { col - \int_use:N \l_@@_final_j_int }
2746     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2747   }
2748   { \@@_set_final_coords_from_anchor:n { north-east } }
2749   \bool_if:NT \l_@@_parallelize_diags_bool
2750   {
2751     \int_gincr:N \g_@@_iddots_int
2752     \int_compare:nNnTF \g_@@_iddots_int = 1
2753     {
2754       \dim_gset:Nn \g_@@_delta_x_two_dim
2755       { \l_@@_x_final_dim - \l_@@_x_initial_dim }
2756       \dim_gset:Nn \g_@@_delta_y_two_dim
2757       { \l_@@_y_final_dim - \l_@@_y_initial_dim }
2758     }
2759     {
2760       \dim_set:Nn \l_@@_y_final_dim
2761       {
2762         \l_@@_y_initial_dim +
2763         ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2764         \dim_ratio:nn \g_@@_delta_y_two_dim \g_@@_delta_x_two_dim
2765       }
2766     }
2767   }
2768   \@@_draw_line:
2769 }

```

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`

```

2770 \cs_new_protected:Npn \@@_draw_line:
2771 {
2772   \pgfrememberpicturepositiononpagetrue
2773   \pgf@relevantforpicturesizefalse
2774   \tl_if_eq:NNTF \l_@@_xdots_line_style_tl \c_@@_standard_tl
2775     \@@_draw_standard_dotted_line:
2776     \@@_draw_non_standard_dotted_line:
2777 }

```

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.

```

2778 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:
2779 {
2780   \begin { scope }
2781   \exp_args:No \@@_draw_non_standard_dotted_line:n
2782     { \l_@@_xdots_line_style_tl , \l_@@_xdots_color_tl }
2783 }

```

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.

```

2784 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:n #1
2785 {
2786   \draw
2787   [
2788     #1 ,
2789     shorten~> = \l_@@_xdots_shorten_dim ,
2790     shorten~< = \l_@@_xdots_shorten_dim ,
2791   ]
2792     ( \l_@@_x_initial_dim , \l_@@_y_initial_dim )
2793   -- node [ sloped , above ]
2794     { \c_math_toggle_token \scriptstyle \l_@@_xdots_up_tl \c_math_toggle_token }
2795     node [ sloped , below ]
2796     {
2797       \c_math_toggle_token
2798       \scriptstyle \l_@@_xdots_down_tl
2799       \c_math_toggle_token
2800     }
2801     ( \l_@@_x_final_dim , \l_@@_y_final_dim ) ;
2802   \end { scope }
2803 }

```

The command `\@@_draw_standard_dotted_line:` draws the line with our system of points (which give a dotted line with real round points).

```

2804 \cs_new_protected:Npn \@@_draw_standard_dotted_line:
2805 {

```

First, we put the labels.

```

2806   \bool_lazy_and:nnF
2807     { \tl_if_empty_p:N \l_@@_xdots_up_tl }
2808     { \tl_if_empty_p:N \l_@@_xdots_down_tl }
2809   {
2810     \pgfscope
2811     \pgftransformshift
2812     {
2813       \pgfpointlineattime { 0.5 }
2814       { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
2815       { \pgfpoint \l_@@_x_final_dim \l_@@_y_final_dim }
2816     }
2817     \pgftransformrotate
2818     {
2819       \fp_eval:n
2820       {
2821         atand
2822         (
2823           \l_@@_y_final_dim - \l_@@_y_initial_dim ,
2824           \l_@@_x_final_dim - \l_@@_x_initial_dim
2825         )
2826       }
2827     }
2828     \pgfnode
2829     { rectangle }
2830     { south }
2831     {
2832       \c_math_toggle_token
2833       \scriptstyle \l_@@_xdots_up_tl
2834       \c_math_toggle_token
2835     }
2836     { }
2837     { \pgfusepath { } }
2838   \pgfnode

```



```

2839     { rectangle }
2840     { north }
2841     {
2842         \c_math_toggle_token
2843         \scriptstyle \l_@@_xdots_down_tl
2844         \c_math_toggle_token
2845     }
2846     { }
2847     { \pgfusepath { } }
2848     \endpgfscope
2849 }
2850 \pgfrememberpicturepositiononpagetrue
2851 \pgf@relevantforpicturesizefalse
2852 \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.

```

2853     \dim_zero_new:N \l_@@_l_dim
2854     \dim_set:Nn \l_@@_l_dim
2855     {
2856         \fp_to_dim:n
2857         {
2858             sqrt
2859             (
2860                 ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) ^ 2
2861                 +
2862                 ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) ^ 2
2863             )
2864         }
2865     }

```

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.

```

2866     \bool_lazy_or:nnF
2867     { \dim_compare_p:nNn { \dim_abs:n \l_@@_l_dim } > \c_@@_max_l_dim }
2868     { \dim_compare_p:nNn \l_@@_l_dim = \c_zero_dim }
2869     \@@_draw_standard_dotted_line_i:
2870 \group_end:
2871 }
2872 \dim_const:Nn \c_@@_max_l_dim { 50 cm }
2873 \cs_new_protected:Npn \@@_draw_standard_dotted_line_i:
2874 {

```

The integer `\l_tmpa_int` is the number of dots of the dotted line.

```

2875     \bool_if:NTF \l_@@_initial_open_bool
2876     {
2877         \bool_if:NTF \l_@@_final_open_bool
2878         {
2879             \int_set:Nn \l_tmpa_int
2880             { \dim_ratio:nn \l_@@_l_dim \l_@@_inter_dots_dim }
2881         }
2882         {
2883             \int_set:Nn \l_tmpa_int
2884             {
2885                 \dim_ratio:nn
2886                 { \l_@@_l_dim - \l_@@_xdots_shorten_dim }
2887                 \l_@@_inter_dots_dim
2888             }
2889         }
2890     }
2891     {

```

```

2892 \bool_if:NTF \l_@@_final_open_bool
2893 {
2894   \int_set:Nn \l_tmpa_int
2895   {
2896     \dim_ratio:nn
2897     { \l_@@_l_dim - \l_@@_xdots_shorten_dim }
2898     \l_@@_inter_dots_dim
2899   }
2900 }
2901 {
2902   \int_set:Nn \l_tmpa_int
2903   {
2904     \dim_ratio:nn
2905     { \l_@@_l_dim - 2 \l_@@_xdots_shorten_dim }
2906     \l_@@_inter_dots_dim
2907   }
2908 }
2909 }

```

The dimensions `\l_tmpa_dim` and `\l_tmpb_dim` are the coordinates of the vector between two dots in the dotted line.

```

2910 \dim_set:Nn \l_tmpa_dim
2911 {
2912   ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2913   \dim_ratio:nn \l_@@_inter_dots_dim \l_@@_l_dim
2914 }
2915 \dim_set:Nn \l_tmpb_dim
2916 {
2917   ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
2918   \dim_ratio:nn \l_@@_inter_dots_dim \l_@@_l_dim
2919 }

```

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`.

```

2920 \int_set:Nn \l_tmpb_int
2921 {
2922   \bool_if:NTF \l_@@_initial_open_bool
2923   { \bool_if:NTF \l_@@_final_open_bool 1 0 }
2924   { \bool_if:NTF \l_@@_final_open_bool 2 1 }
2925 }

```

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.

```

2926 \dim_gadd:Nn \l_@@_x_initial_dim
2927 {
2928   ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2929   \dim_ratio:nn
2930   { \l_@@_l_dim - \l_@@_inter_dots_dim * \l_tmpa_int }
2931   { 2 \l_@@_l_dim }
2932   * \l_tmpb_int
2933 }
2934 \dim_gadd:Nn \l_@@_y_initial_dim
2935 {
2936   ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
2937   \dim_ratio:nn
2938   { \l_@@_l_dim - \l_@@_inter_dots_dim * \l_tmpa_int }
2939   { 2 \l_@@_l_dim }
2940   * \l_tmpb_int
2941 }
2942 \pgf@relevantforpicturesizefalse
2943 \int_step_inline:nnn 0 \l_tmpa_int
2944 {

```

```

2945 \pgfpathcircle
2946 { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
2947 { \l_@@_radius_dim }
2948 \dim_add:Nn \l_@@_x_initial_dim \l_tmpa_dim
2949 \dim_add:Nn \l_@@_y_initial_dim \l_tmpb_dim
2950 }
2951 \pgfusepathqfill
2952 }

```

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 starred versions of these commands are deprecated since version 3.1 but, as of now, they are still available with an error.

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.

```

2953 \AtBeginDocument
2954 {
2955   \tl_set:Nn \l_@@_argspec_tl { 0 { } E { _ ^ } { { } { } } }
2956   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
2957   \exp_args:NNV \NewDocumentCommand \@@_Ldots \l_@@_argspec_tl
2958   {
2959     \int_compare:nNnTF \c@jCol = 0
2960     { \@@_error:nn { in~first~col } \Ldots }
2961     {
2962       \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
2963       { \@@_error:nn { in~last~col } \Ldots }
2964       {
2965         \@@_instruction_of_type:nnn \c_false_bool { Ldots }
2966         { #1 , down = #2 , up = #3 }
2967       }
2968     }
2969     \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_ldots }
2970     \bool_gset_true:N \g_@@_empty_cell_bool
2971   }

2972   \exp_args:NNV \NewDocumentCommand \@@_Cdots \l_@@_argspec_tl
2973   {
2974     \int_compare:nNnTF \c@jCol = 0
2975     { \@@_error:nn { in~first~col } \Cdots }
2976     {
2977       \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
2978       { \@@_error:nn { in~last~col } \Cdots }
2979       {
2980         \@@_instruction_of_type:nnn \c_false_bool { Cdots }
2981         { #1 , down = #2 , up = #3 }
2982       }
2983     }
2984     \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_cdots }
2985     \bool_gset_true:N \g_@@_empty_cell_bool
2986   }

```

```

2987 \exp_args:NNV \NewDocumentCommand \@@_Vdots \l_@@_argspec_tl
2988 {
2989   \int_compare:nNnTF \c@iRow = 0
2990   { \@@_error:nn { in~first~row } \Vdots }
2991   {
2992     \int_compare:nNnTF \c@iRow = \l_@@_last_row_int
2993     { \@@_error:nn { in~last~row } \Vdots }
2994     {
2995       \@@_instruction_of_type:nnn \c_false_bool { Vdots }
2996       { #1 , down = #2 , up = #3 }
2997     }
2998   }
2999   \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_vdots }
3000   \bool_gset_true:N \g_@@_empty_cell_bool
3001 }

3002 \exp_args:NNV \NewDocumentCommand \@@_Ddots \l_@@_argspec_tl
3003 {
3004   \int_case:nnF \c@iRow
3005   {
3006     0 { \@@_error:nn { in~first~row } \Ddots }
3007     \l_@@_last_row_int { \@@_error:nn { in~last~row } \Ddots }
3008   }
3009   {
3010     \int_case:nnF \c@jCol
3011     {
3012       0 { \@@_error:nn { in~first~col } \Ddots }
3013       \l_@@_last_col_int { \@@_error:nn { in~last~col } \Ddots }
3014     }
3015     {
3016       \keys_set_known:nn { NiceMatrix / Ddots } { #1 }
3017       \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Ddots }
3018       { #1 , down = #2 , up = #3 }
3019     }
3020   }
3021 }
3022 \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_ddots }
3023 \bool_gset_true:N \g_@@_empty_cell_bool
3024 }

3025 \exp_args:NNV \NewDocumentCommand \@@_Iddots \l_@@_argspec_tl
3026 {
3027   \int_case:nnF \c@iRow
3028   {
3029     0 { \@@_error:nn { in~first~row } \Iddots }
3030     \l_@@_last_row_int { \@@_error:nn { in~last~row } \Iddots }
3031   }
3032   {
3033     \int_case:nnF \c@jCol
3034     {
3035       0 { \@@_error:nn { in~first~col } \Iddots }
3036       \l_@@_last_col_int { \@@_error:nn { in~last~col } \Iddots }
3037     }
3038     {
3039       \keys_set_known:nn { NiceMatrix / Ddots } { #1 }
3040       \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Iddots }
3041       { #1 , down = #2 , up = #3 }
3042     }
3043   }
3044 }
3045 \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_iddots }
3046 \bool_gset_true:N \g_@@_empty_cell_bool

```

```

3047     }
3048 }

```

End of the \AtBeginDocument.

Despite its name, the following set of keys will be used for \Ddots but also for \Iddots.

```

3049 \keys_define:nn { NiceMatrix / Ddots }
3050 {
3051   draw-first .bool_set:N = \l_@@_draw_first_bool ,
3052   draw-first .default:n = true ,
3053   draw-first .value_forbidden:n = true
3054 }

```

The command \@@_Hspace: will be linked to \hspace in {NiceArray}.

```

3055 \cs_new_protected:Npn \@@_Hspace:
3056 {
3057   \bool_gset_true:N \g_@@_empty_cell_bool
3058   \hspace
3059 }

```

In the environment {NiceArray}, the command \multicolumn will be linked to the following command \@@_multicolumn:nnn.

```

3060 \cs_set_eq:NN \@@_old_multicolumn \multicolumn
3061 \cs_new:Npn \@@_multicolumn:nnn #1 #2 #3
3062 {
3063   % \begin{macrocode}
3064   % We have to act in an expandable way since it will begin by a |\multicolumn|.
3065   % \end{macrocode}
3066   \exp_args:NNe
3067   \@@_old_multicolumn
3068   { #1 }

```

We will have to replace \tl_lower_case:n in the future since it seems to be deprecated.

```

3069 {
3070   \exp_args:Ne \str_case:nn { \tl_lower_case:n { #2 } }
3071   {
3072     l { > \@@_Cell: l < \@@_end_Cell: }
3073     r { > \@@_Cell: r < \@@_end_Cell: }
3074     c { > \@@_Cell: c < \@@_end_Cell: }
3075     { l | } { > \@@_Cell: l < \@@_end_Cell: | }
3076     { r | } { > \@@_Cell: r < \@@_end_Cell: | }
3077     { c | } { > \@@_Cell: c < \@@_end_Cell: | }
3078     { | l } { | > \@@_Cell: l < \@@_end_Cell: }
3079     { | r } { | > \@@_Cell: r < \@@_end_Cell: }
3080     { | c } { | > \@@_Cell: c < \@@_end_Cell: }
3081     { | l | } { | > \@@_Cell: l < \@@_end_Cell: | }
3082     { | r | } { | > \@@_Cell: r < \@@_end_Cell: | }
3083     { | c | } { | > \@@_Cell: c < \@@_end_Cell: | }
3084   }
3085 }
3086 { #3 }

```

The \peek_remove_spaces:n is mandatory.

```

3087 \peek_remove_spaces:n
3088 {
3089   \int_compare:nNnT #1 > 1
3090   {
3091     \seq_gput_left:Nx \g_@@_multicolumn_cells_seq
3092     { \int_use:N \c@iRow - \int_use:N \c@jCol }
3093     \seq_gput_left:Nn \g_@@_multicolumn_sizes_seq { #1 }
3094     \seq_gput_right:Nx \g_@@_pos_of_blocks_seq
3095     {
3096       { \int_use:N \c@iRow }

```

```

3097         { \int_use:N \c@jCol }
3098         { \int_use:N \c@iRow }
3099         { \int_eval:n { \c@jCol + #1 - 1 } }
3100     }
3101 }
3102 \int_gadd:Nn \c@jCol { #1 - 1 }
3103 \int_compare:nNnT \c@jCol > \g_@@_col_total_int
3104 { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
3105 }
3106 }

```

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`.

```

3107 \cs_new:Npn \@@_Hdotsfor:
3108 {
3109     \int_compare:nNnTF \c@jCol = 0
3110     {
3111         \bool_if:NTF \g_@@_after_col_zero_bool
3112         {
3113             \multicolumn { 1 } { c } { }
3114             \@@_Hdotsfor_i
3115         }
3116         { \@@_fatal:n { Hdotsfor~in~col~0 } }
3117     }
3118     {
3119         \multicolumn { 1 } { c } { }
3120         \@@_Hdotsfor_i
3121     }
3122 }

```

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:`).

```

3123 \AtBeginDocument
3124 {
3125     \tl_set:Nn \l_@@_argspec_tl { 0 { } m 0 { } E { _ ^ } { { } { } } }
3126     \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.

```

3127     \exp_args:NNV \NewDocumentCommand \@@_Hdotsfor_i \l_@@_argspec_tl
3128     {
3129         \tl_gput_right:Nx \g_@@_HVDotsfor_lines_tl
3130         {
3131             \@@_Hdotsfor:nnnn
3132             { \int_use:N \c@iRow }
3133             { \int_use:N \c@jCol }
3134             { #2 }
3135             {
3136                 #1 , #3 ,
3137                 down = \exp_not:n { #4 } , up = \exp_not:n { #5 }
3138             }
3139         }
3140         \prg_replicate:nn { #2 - 1 } { & \multicolumn { 1 } { c } { } }
3141     }
3142 }

```

Enf of `\AtBeginDocument`.

```

3143 \cs_new_protected:Npn \@@_Hdotsfor:nnnn #1 #2 #3 #4
3144 {
3145     \bool_set_false:N \l_@@_initial_open_bool
3146     \bool_set_false:N \l_@@_final_open_bool

```

For the row, it's easy.

```

3147 \int_set:Nn \l_@@_initial_i_int { #1 }
3148 \int_set_eq:NN \l_@@_final_i_int \l_@@_initial_i_int

```

For the column, it's a bit more complicated.

```

3149 \int_compare:nNnTF #2 = 1
3150 {
3151   \int_set:Nn \l_@@_initial_j_int 1
3152   \bool_set_true:N \l_@@_initial_open_bool
3153 }
3154 {
3155   \cs_if_exist:cTF
3156   {
3157     pgf @ sh @ ns @ \@@_env:
3158     - \int_use:N \l_@@_initial_i_int
3159     - \int_eval:n { #2 - 1 }
3160   }
3161   { \int_set:Nn \l_@@_initial_j_int { #2 - 1 } }
3162   {
3163     \int_set:Nn \l_@@_initial_j_int { #2 }
3164     \bool_set_true:N \l_@@_initial_open_bool
3165   }
3166 }
3167 \int_compare:nNnTF { #2 + #3 - 1 } = \c@jCol
3168 {
3169   \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
3170   \bool_set_true:N \l_@@_final_open_bool
3171 }
3172 {
3173   \cs_if_exist:cTF
3174   {
3175     pgf @ sh @ ns @ \@@_env:
3176     - \int_use:N \l_@@_final_i_int
3177     - \int_eval:n { #2 + #3 }
3178   }
3179   { \int_set:Nn \l_@@_final_j_int { #2 + #3 } }
3180   {
3181     \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
3182     \bool_set_true:N \l_@@_final_open_bool
3183   }
3184 }
3185 \group_begin:
3186 \int_compare:nNnTF { #1 } = 0
3187 { \color { nicematrix-first-row } }
3188 {
3189   \int_compare:nNnT { #1 } = \g_@@_row_total_int
3190   { \color { nicematrix-last-row } }
3191 }
3192 \keys_set:nn { NiceMatrix / xdots } { #4 }
3193 \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3194 \@@_actually_draw_Ldots:
3195 \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).

```

3196 \int_step_inline:nnn { #2 } { #2 + #3 - 1 }
3197 { \cs_set:cpn { @@ _ dotted _ #1 - ##1 } { } }
3198 }

```

```

3199 \AtBeginDocument
3200 {

```

```

3201 \tl_set:Nn \l_@@_argspec_tl { 0 { } m 0 { } E { _ ^ } { { } { } } }
3202 \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
3203 \exp_args:NNV \NewDocumentCommand \@@_Vdotsfor: \l_@@_argspec_tl
3204 {
3205   \tl_gput_right:Nx \g_@@_HVDotsfor_lines_tl
3206   {
3207     \@@_Vdotsfor:nnnn
3208     { \int_use:N \c@iRow }
3209     { \int_use:N \c@jCol }
3210     { #2 }
3211     {
3212       #1 , #3 ,
3213       down = \exp_not:n { #4 } , up = \exp_not:n { #5 }
3214     }
3215   }
3216 }
3217 }

```

Enf of \AtBeginDocument.

```

3218 \cs_new_protected:Npn \@@_Vdotsfor:nnnn #1 #2 #3 #4
3219 {
3220   \bool_set_false:N \l_@@_initial_open_bool
3221   \bool_set_false:N \l_@@_final_open_bool

```

For the column, it's easy.

```

3222 \int_set:Nn \l_@@_initial_j_int { #2 }
3223 \int_set_eq:NN \l_@@_final_j_int \l_@@_initial_j_int

```

For the row, it's a bit more complicated.

```

3224 \int_compare:nNnTF #1 = 1
3225 {
3226   \int_set:Nn \l_@@_initial_i_int 1
3227   \bool_set_true:N \l_@@_initial_open_bool
3228 }
3229 {
3230   \cs_if_exist:cTF
3231   {
3232     pgf @ sh @ ns @ \@@_env:
3233     - \int_eval:n { #1 - 1 }
3234     - \int_use:N \l_@@_initial_j_int
3235   }
3236   { \int_set:Nn \l_@@_initial_i_int { #1 - 1 } }
3237   {
3238     \int_set:Nn \l_@@_initial_i_int { #1 }
3239     \bool_set_true:N \l_@@_initial_open_bool
3240   }
3241 }
3242 \int_compare:nNnTF { #1 + #3 - 1 } = \c@iRow
3243 {
3244   \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
3245   \bool_set_true:N \l_@@_final_open_bool
3246 }
3247 {
3248   \cs_if_exist:cTF
3249   {
3250     pgf @ sh @ ns @ \@@_env:
3251     - \int_eval:n { #1 + #3 }
3252     - \int_use:N \l_@@_final_j_int
3253   }
3254   { \int_set:Nn \l_@@_final_i_int { #1 + #3 } }
3255   {
3256     \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
3257     \bool_set_true:N \l_@@_final_open_bool
3258   }
3259 }

```



```

3260 \group_begin:
3261 \int_compare:nNnTF { #2 } = 0
3262 { \color { nicematrix-first-col } }
3263 {
3264   \int_compare:nNnT { #2 } = \g_@@_col_total_int
3265   { \color { nicematrix-last-col } }
3266 }
3267 \keys_set:nn { NiceMatrix / xdots } { #4 }
3268 \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3269 \@@_actually_draw_Vdots:
3270 \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).

```

3271 \int_step_inline:nnn { #1 } { #1 + #3 - 1 }
3272 { \cs_set:cpn { @@ _ dotted _ ##1 - #2 } { } }
3273 }

```

The command `\@@_rotate:` will be linked to `\rotate` in `{NiceArrayWithDelims}`.

```

3274 \cs_new_protected:Npn \@@_rotate: { \bool_gset_true:N \g_@@_rotate_bool }

```

The command `\line` accessible in code-after

In the `code-after`, 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).⁴⁷

```

3275 \cs_new:Npn \@@_double_int_eval:n #1-#2 \q_stop
3276 { \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).

```

3277 \AtBeginDocument
3278 {
3279   \tl_set:Nn \l_@@_argspec_tl { 0 { } m m ! 0 { } E { _ ^ } { { } { } } }
3280   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
3281   \exp_args:NNV \NewDocumentCommand \@@_line \l_@@_argspec_tl
3282   {
3283     \group_begin:
3284     \keys_set:nn { NiceMatrix / xdots } { #1 , #4 , down = #5 , up = #6 }
3285     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3286     \use:e
3287     {
3288       \@@_line_i:nn
3289       { \@@_double_int_eval:n #2 \q_stop }
3290       { \@@_double_int_eval:n #3 \q_stop }
3291     }
3292     \group_end:
3293   }
3294 }

```

⁴⁷Indeed, we want that the user may use the command `\line` in `code-after` with LaTeX counters in the arguments — with the command `\value`.

```

3295 \cs_new_protected:Npn \@@_line_i:nn #1 #2
3296 {
3297   \bool_set_false:N \l_@@_initial_open_bool
3298   \bool_set_false:N \l_@@_final_open_bool
3299   \bool_if:nTF
3300   {
3301     \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #1 }
3302     ||
3303     \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #2 }
3304   }
3305   {
3306     \@@_error:nnn { unknown~cell~for~line~in~code~after } { #1 } { #2 }
3307   }
3308   { \@@_draw_line_ii:nn { #1 } { #2 } }
3309 }
3310 \AtBeginDocument
3311 {
3312   \cs_new_protected:Npx \@@_draw_line_ii:nn #1 #2
3313   {

```

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:.`

```

3314   \c_@@_pgfortikzpicture_tl
3315   \@@_draw_line_iii:nn { #1 } { #2 }
3316   \c_@@_endpgfortikzpicture_tl
3317 }
3318 }

```

The following command *must* be protected (it’s used in the construction of `\@@_draw_line_ii:nn`).

```

3319 \cs_new_protected:Npn \@@_draw_line_iii:nn #1 #2
3320 {
3321   \pgfrememberpicturepositiononpagetrue
3322   \pgfpointshapeborder { \@@_env: - #1 } { \@@_qpoint:n { #2 } }
3323   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
3324   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
3325   \pgfpointshapeborder { \@@_env: - #2 } { \@@_qpoint:n { #1 } }
3326   \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
3327   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
3328   \@@_draw_line:
3329 }

```

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

In the beginning of the code-before, the command `\@@_rowcolor:nn` will be linked to `\rowcolor` and the command `\@@_columncolor:nn` to `\columncolor`.

```

3330 \cs_set_protected:Npn \@@_cut_on_hyphen:w #1-#2\q_stop
3331 {
3332   \tl_set:Nn \l_tmpa_tl { #1 }
3333   \tl_set:Nn \l_tmpb_tl { #2 }
3334 }

```

Here an example : `\@@_rowcolor {red!15} {1,3,5-7,10-}`

```

3335 \NewDocumentCommand \@@_rowcolor { 0 { } m m }
3336 {
3337   \tl_if_blank:nF { #2 }
3338   {

```

```

3339 \pgfpicture
3340 \pgf@relevantforpicturesizefalse
3341 \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
\l_tmpa_dim is the x-value of the right side of the rows.
3342 \@@_qpoint:n { col - 1 }
3343 \int_compare:nNnTF \l_@@_first_col_int = 0
3344 { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3345 { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3346 \@@_qpoint:n { col - \@@_succ:n \c@jCol }
3347 \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }
3348 \clist_map_inline:nn { #3 }
3349 {
3350 \tl_set:Nn \l_tmpa_tl { ##1 }
3351 \tl_if_in:NnTF \l_tmpa_tl { - }
3352 { \@@_cut_on_hyphen:w ##1 \q_stop }
3353 { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
3354 \tl_if_empty:NT \l_tmpa_tl { \tl_set:Nn \l_tmpa_tl { 1 } }
3355 \tl_if_empty:NT \l_tmpb_tl
3356 { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@iRow } }
3357 \int_compare:nNnT \l_tmpb_tl > \c@iRow
3358 { \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.

```

3359 \@@_qpoint:n { row - \@@_succ:n \l_tmpb_tl }
3360 \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3361 \@@_qpoint:n { row - \l_tmpa_tl }
3362 \dim_set:Nn \l_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
3363 \pgfpathrectanglecorners
3364 { \pgfpoint \l_tmpc_dim \l_tmpd_dim }
3365 { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3366 }
3367 \pgfusepathqfill
3368 \endpgfpicture
3369 }
3370 }

```

Here an example : \@@_columncolor:nn {red!15} {1,3,5-7,10-}

```

3371 \NewDocumentCommand \@@_columncolor { 0 { } m m }
3372 {
3373 \tl_if_blank:nF { #2 }
3374 {
3375 \pgfpicture
3376 \pgf@relevantforpicturesizefalse
3377 \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
3378 \@@_qpoint:n { row - 1 }

```

\l_tmpa_dim is the y-value of the top of the columns et \l_tmpb_dim is the y-value of the bottom.

```

3379 \dim_set:Nn \l_tmpa_dim { \pgf@y + 0.5 \arrayrulewidth }
3380 \@@_qpoint:n { row - \@@_succ:n \c@iRow }
3381 \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3382 \clist_map_inline:nn { #3 }
3383 {
3384 \tl_set:Nn \l_tmpa_tl { ##1 }
3385 \tl_if_in:NnTF \l_tmpa_tl { - }
3386 { \@@_cut_on_hyphen:w ##1 \q_stop }
3387 { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
3388 \tl_if_empty:NT \l_tmpa_tl { \tl_set:Nn \l_tmpa_tl { 1 } }
3389 \tl_if_empty:NT \l_tmpb_tl
3390 { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
3391 \int_compare:nNnT \l_tmpb_tl > \c@jCol
3392 { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }

```

Now, the numbers of both columns are in \l_tmpa_tl and \l_tmpb_tl.

```

3393         \@@_qpoint:n { col - \l_tmpa_tl }
3394         \int_compare:nNnTF \l_@@_first_col_int = \l_tmpa_tl
3395             { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3396             { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3397         \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
3398         \dim_set:Nn \l_tmpd_dim { \pgf@x + 0.5 \arrayrulewidth }
3399         \pgfpathrectanglecorners
3400             { \pgfpoint \l_tmpc_dim \l_tmpa_dim }
3401             { \pgfpoint \l_tmpd_dim \l_tmpb_dim }
3402     }
3403     \pgfusepathqfill
3404     \endpgfpicture
3405 }
3406 }
```

Here an example : \@@_cellcolor[rgb]{0.5,0.5,0}{2-3,3-4,4-5,5-6}

```

3407 \NewDocumentCommand \@@_cellcolor { 0 { } m m }
3408 {
3409     \tl_if_blank:nF { #2 }
3410     {
3411         \pgfpicture
3412         \pgf@relevantforpicturesizefalse
3413         \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
3414         \clist_map_inline:nn { #3 }
3415         {
3416             \@@_cut_on_hyphen:w ##1 \q_stop
3417             \@@_qpoint:n { row - \l_tmpa_tl }
3418             \bool_lazy_and:nnT
3419                 { \int_compare_p:n { \l_tmpa_tl <= \c@iRow } }
3420                 { \int_compare_p:n { \l_tmpb_tl <= \c@jCol } }
3421             {
3422                 \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3423                 \@@_qpoint:n { row - \@@_succ:n \l_tmpa_tl }
3424                 \dim_set:Nn \l_tmpa_dim { \pgf@y + 0.5 \arrayrulewidth }
3425                 \@@_qpoint:n { col - \l_tmpb_tl }
3426                 \int_compare:nNnTF \l_@@_first_col_int = \l_tmpb_tl
3427                     { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3428                     { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3429                 \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
3430                 \dim_set:Nn \l_tmpd_dim { \pgf@x + 0.5 \arrayrulewidth }
3431                 \pgfpathrectanglecorners
3432                     { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3433                     { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
3434             }
3435         }
3436         \pgfusepathqfill
3437         \endpgfpicture
3438     }
3439 }
```

Here an example : \@@_rectanglecolor{red!15}{2-3}{5-6}

```

3440 \NewDocumentCommand \@@_rectanglecolor { 0 { } m m m }
3441 {
3442     \tl_if_blank:nF { #2 }
3443     {
3444         \pgfpicture
3445         \pgf@relevantforpicturesizefalse
3446         \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
3447         \@@_cut_on_hyphen:w #3 \q_stop
3448         \bool_lazy_and:nnT
3449             { \int_compare_p:n { \l_tmpa_tl <= \c@iRow } }
```

```

3450 { \int_compare:n { \l_tmpb_tl <= \c@jCol } }
3451 {
3452   \@@_qpoint:n { row - \l_tmpa_tl }
3453   \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3454   \@@_qpoint:n { col - \l_tmpb_tl }
3455   \int_compare:nNnTF \l_@@_first_col_int = \l_tmpb_tl
3456     { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3457     { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3458   \@@_cut_on_hyphen:w #4 \q_stop
3459   \int_compare:nNnT \l_tmpa_tl > \c@iRow
3460     { \tl_set:Nx \l_tmpa_tl { \int_use:N \c@iRow } }
3461   \int_compare:nNnT \l_tmpb_tl > \c@jCol
3462     { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
3463   \@@_qpoint:n { row - \@@_succ:n \l_tmpa_tl }
3464   \dim_set:Nn \l_tmpa_dim { \pgf@y + 0.5 \arrayrulewidth }
3465   \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
3466   \dim_set:Nn \l_tmpd_dim { \pgf@x + 0.5 \arrayrulewidth }
3467   \pgfpathrectanglecorners
3468     { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3469     { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
3470   \pgfusepathqfill
3471 }
3472 \endpgfpicture
3473 }
3474 }

```

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]`.

The last optional argument is for options. As of now, there is only one key available : `respect-blocks`.

```

3475 \keys_define:nn { NiceMatrix / rowcolors }
3476 {
3477   respect-blocks .bool_set:N = \l_@@_respect_blocks_bool ,
3478   respect-blocks .default:n = true ,
3479   unknown .code:n = \@@_error:n { Unknown-option-for-rowcolors }
3480 }
3481 \NewDocumentCommand \@@_rowcolors { 0 { } m m m 0 { } }
3482 {
3483   \keys_set:nn { NiceMatrix / rowcolors } { #5 }
3484   \bool_lazy_and:nnTF
3485     \l_@@_respect_blocks_bool
3486     { \cs_if_exist_p:c { c_@@_pos_of_blocks_ \int_use:N \g_@@_env_int _ seq } }
3487     { \@@_rowcolors_i:nnnn { #1 } { #2 } { #3 } { #4 } }
3488     {
3489       \int_step_inline:nnn { #2 } { \int_use:N \c@iRow }
3490       {
3491         \int_if_odd:nTF { ##1 }
3492           { \@@_rowcolor [ #1 ] { #3 } }
3493           { \@@_rowcolor [ #1 ] { #4 } }
3494         { ##1 }
3495       }
3496     }
3497 }
3498 \cs_new_protected:Npn \@@_rowcolors_i:nnnn #1 #2 #3 #4
3499 {
3500   \seq_set_eq:Nc \l_tmpb_seq
3501   { c_@@_pos_of_blocks_ \int_use:N \g_@@_env_int _ seq }

```

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”.

```

3502 \seq_set_filter:NNn \l_tmpa_seq \l_tmpb_seq
3503 { \@@_not_in_exterior_p:nnnn ##1 }

```

The counter `\l_tmpa_int` will be the index of the loop.

```

3504 \int_set:Nn \l_tmpa_int { #2 }

```

The boolean `\l_tmpa_bool` will indicate whereas we are in a row of the first color or of the second color.

```

3505 \bool_set_false:N \l_tmpa_bool

```

We recall that, in the code-before, `\c@iRow` is the total number of rows of the array (excepted the potential exterior rows).

```

3506 \int_do_until:nNnn \l_tmpa_int > \c@iRow
3507 {
3508   \seq_set_filter:NNn \l_tmpb_seq \l_tmpa_seq
3509   { \@@_intersect_our_row_p:nnnn ##1 }

```

We compute in `\l_tmpb_int` the last row covered by a block.

```

3510   \int_set_eq:NN \l_tmpb_int \l_tmpa_int
3511   \seq_map_inline:Nn \l_tmpb_seq { \@@_rowcolors_ii:nnnn ##1 }
3512   \bool_if:NTF \l_tmpa_bool
3513   {
3514     \@@_rowcolor [ #1 ] { #4 }
3515     { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }
3516     \bool_set_false:N \l_tmpa_bool
3517   }
3518   {
3519     \@@_rowcolor [ #1 ] { #3 }
3520     { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }
3521     \bool_set_true:N \l_tmpa_bool
3522   }
3523   \int_set:Nn \l_tmpa_int { \l_tmpb_int + 1 }
3524 }
3525 }

```

```

3526 \cs_new_protected:Npn \@@_rowcolors_ii:nnnn #1 #2 #3 #4
3527 {
3528   \int_compare:nNnT { #3 } > \l_tmpb_int
3529   { \int_set:Nn \l_tmpb_int { #3 } }
3530 }

```

```

3531 \prg_new_conditional:Nnn \@@_not_in_exterior:nnnn p
3532 {
3533   \bool_lazy_or:nnTF
3534   { \int_compare_p:nNn { #4 } = \c_zero_int }
3535   { \int_compare_p:nNn { #2 } = { \@@_succ:n { \c@jCol } } } }
3536   \prg_return_false:
3537   \prg_return_true:
3538 }

```

The following command return true when the block intersects the row `\l_tmpa_int`.

```

3539 \prg_new_conditional:Nnn \@@_intersect_our_row:nnnn p
3540 {
3541   \bool_if:nTF
3542   {
3543     \int_compare_p:n { #1 <= \l_tmpa_int }
3544     &&
3545     \int_compare_p:n { \l_tmpa_int <= #3 }
3546   }
3547   \prg_return_true:
3548   \prg_return_false:
3549 }

```

```

3550 \NewDocumentCommand \@@_chessboardcolors { 0 { } m m }
3551 {
3552   \int_step_inline:nn { \int_use:N \c@iRow }
3553   {
3554     \int_step_inline:nn { \int_use:N \c@jCol }
3555     {
3556       \int_if_even:nTF { ####1 + ##1 }
3557       { \@@_cellcolor [ #1 ] { #2 } }
3558       { \@@_cellcolor [ #1 ] { #3 } }
3559       { ##1 - ####1 }
3560     }
3561   }
3562 }

```

When the user uses the key `colortbl`-like, the following command will be linked to `\cellcolor` in the tabular.

```

3563 \NewDocumentCommand \@@_cellcolor_tabular { 0 { } m }
3564 {
3565   \tl_gput_right:Nx \g_nicematrix_code_before_tl
3566   { \cellcolor [ #1 ] { #2 } { \int_use:N \c@iRow - \int_use:N \c@jCol } }
3567 }

```

When the user uses the key `rowcolor-in-tabular`, the following command will be linked to `\rowcolor` in the tabular.

```

3568 \NewDocumentCommand \@@_rowcolor_tabular { 0 { } m }
3569 {
3570   \tl_gput_right:Nx \g_nicematrix_code_before_tl
3571   {
3572     \exp_not:N \rectanglecolor [ #1 ] { #2 }
3573     { \int_use:N \c@iRow - \int_use:N \c@jCol }
3574     { \int_use:N \c@iRow - \exp_not:n { \int_use:N \c@jCol } }
3575   }
3576 }

```

```

3577 \NewDocumentCommand \@@_columncolor_preamble { 0 { } m }
3578 {
3579   \int_compare:nNnT \c@iRow = 1
3580   {

```

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).

```

3581     \tl_gput_left:Nx \g_nicematrix_code_before_tl
3582     { \exp_not:N \columncolor [ #1 ] { #2 } { \int_use:N \c@jCol } }
3583   }
3584 }

```

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`.

```

3585 \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`.

```

3586 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix:n #1
3587 {
3588   \int_compare:nNnTF \l_@@_first_col_int = 0
3589   { \@@_OnlyMainNiceMatrix_i:n { #1 } }
3590   {
3591     \int_compare:nNnTF \c@jCol = 0
3592     {
3593       \int_compare:nNnF \c@iRow = { -1 }
3594       { \int_compare:nNnF \c@iRow = { \l_@@_last_row_int - 1 } { #1 } }
3595     }
3596     { \@@_OnlyMainNiceMatrix_i:n { #1 } }
3597   }
3598 }

```

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* an 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.

```

3599 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix_i:n #1
3600 {
3601   \int_compare:nNnF \c@iRow = 0
3602   { \int_compare:nNnF \c@iRow = \l_@@_last_row_int { #1 } }
3603 }

```

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`. `#2` is the number of consecutive occurrences of `|`.

```

3604 \cs_new_protected:Npn \@@_vline:nn #1 #2
3605 {

```

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).

```

3606   \int_compare:nNnT { #1 } < { \c@jCol + 2 }
3607   {
3608     \pgfpicture
3609     \@@_vline_i:nn { #1 } { #2 }
3610     \endpgfpicture
3611   }
3612 }
3613 \cs_new_protected:Npn \@@_vline_i:nn #1 #2
3614 {

```

`\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_tmpc_tl`.

```

3615   \tl_set:Nx \l_tmpb_tl { #1 }
3616   \tl_clear_new:N \l_tmpc_tl
3617   \int_step_variable:nNn \c@iRow \l_tmpa_tl
3618   {

```

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.

```

3619     \bool_gset_true:N \g_tmpa_bool
3620     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
3621     { \@@_test_if_vline_in_block:nnnn ##1 }
3622     \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
3623     { \@@_test_if_vline_in_block:nnnn ##1 }

```



```

3624 \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
3625 { \@@_test_if_vline_in_stroken_block:nnnn ##1 }
3626 \clist_if_empty:NF \l_@@_except_corners_clist
3627 \@@_test_in_corner_v:
3628 \bool_if:NTF \g_tmpa_bool
3629 {
3630   \tl_if_empty:NT \l_tmpc_tl

```

We keep in memory that we have a rule to draw.

```

3631   { \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl }
3632 }
3633 {
3634   \tl_if_empty:NF \l_tmpc_tl
3635   {
3636     \@@_vline_ii:nnnn
3637     { #1 }
3638     { #2 }
3639     \l_tmpc_tl
3640     { \int_eval:n { \l_tmpa_tl - 1 } }
3641     \tl_clear:N \l_tmpc_tl
3642   }
3643 }
3644 }
3645 \tl_if_empty:NF \l_tmpc_tl
3646 {
3647   \@@_vline_ii:nnnn
3648   { #1 }
3649   { #2 }
3650   \l_tmpc_tl
3651   { \int_use:N \c@iRow }
3652   \tl_clear:N \l_tmpc_tl
3653 }
3654 }

```

```

3655 \cs_new_protected:Npn \@@_test_in_corner_v:
3656 {
3657   \int_compare:nNnTF \l_tmpb_tl = { \@@_succ:n \c@jCol }
3658   {
3659     \seq_if_in:NxT
3660     \l_@@_empty_corner_cells_seq
3661     { \l_tmpa_tl - \@@_pred:n \l_tmpb_tl }
3662     { \bool_set_false:N \g_tmpa_bool }
3663   }
3664   {
3665     \seq_if_in:NxT
3666     \l_@@_empty_corner_cells_seq
3667     { \l_tmpa_tl - \l_tmpb_tl }
3668     {
3669       \int_compare:nNnTF \l_tmpb_tl = 1
3670       { \bool_set_false:N \g_tmpa_bool }
3671       {
3672         \seq_if_in:NxT
3673         \l_@@_empty_corner_cells_seq
3674         { \l_tmpa_tl - \@@_pred:n \l_tmpb_tl }
3675         { \bool_set_false:N \g_tmpa_bool }
3676       }
3677     }
3678   }
3679 }

```

#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 number of the rows between which the rule has to be drawn.

```

3680 \cs_new_protected:Npn \@@_vline_ii:nnnn #1 #2 #3 #4
3681 {
3682   \pgfrememberpicturepositiononpagetrue
3683   \pgf@relevantforpicturesizefalse
3684   \@@_qpoint:n { row - #3 }
3685   \dim_set_eq:NN \l_tmpa_dim \pgf@y
3686   \@@_qpoint:n { col - #1 }
3687   \dim_set_eq:NN \l_tmpb_dim \pgf@x
3688   \@@_qpoint:n { row - \@@_succ:n { #4 } }
3689   \dim_set_eq:NN \l_tmpc_dim \pgf@y
3690   \bool_lazy_and:nnT
3691     { \int_compare_p:nNn { #2 } > 1 }
3692     { ! \tl_if_blank_p:V \CT@drsc@ }
3693     {
3694       \group_begin:
3695       \CT@drsc@
3696       \dim_add:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }
3697       \dim_sub:Nn \l_tmpc_dim { 0.5 \arrayrulewidth }
3698       \dim_set:Nn \l_tmpd_dim
3699         { \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth ) * ( #2 - 1 ) }
3700       \pgfpathrectanglecorners
3701         { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
3702         { \pgfpoint \l_tmpd_dim \l_tmpc_dim }
3703       \pgfusepathqfill
3704       \group_end:
3705     }
3706   \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
3707   \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
3708   \prg_replicate:nn { #2 - 1 }
3709   {
3710     \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
3711     \dim_sub:Nn \l_tmpb_dim \doublerulesep
3712     \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
3713     \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
3714   }
3715   \CT@arc@
3716   \pgfsetlinewidth { 1.1 \arrayrulewidth }
3717   \pgfsetrectcap
3718   \pgfusepathqstroke
3719 }

```

The following 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 `except-corners` is not used).

```

3720 \cs_new_protected:Npn \@@_vline_i_complete:nn #1 #2
3721 { \@@_vline_ii:nnnn { #1 } { #2 } 1 { \int_use:N \c@iRow } }

```

The command `\@@_draw_hlines:` 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 `except-corners` is used).

```

3722 \cs_new_protected:Npn \@@_draw_vlines:
3723 {
3724   \int_step_inline:nnn
3725     { \bool_if:NTF \l_@@_NiceArray_bool 1 2 }
3726     { \bool_if:NTF \l_@@_NiceArray_bool { \@@_succ:n \c@jCol } \c@jCol }
3727     { \@@_vline:nn { ##1 } 1 }
3728 }

```

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`.

```

3729 \cs_new_protected:Npn \@@_hline:nn #1 #2
3730 {
3731   \pgfpicture
3732   \@@_hline_i:nn { #1 } { #2 }
3733   \endpgfpicture
3734 }
3735 \cs_new_protected:Npn \@@_hline_i:nn #1 #2
3736 {

```

`\l_tmpa_tl` is the number of row and `\l_tmpb_tl` the number of column. Whe, we have found a column corresponding to a rule to draw, we note its number in `\l_tmpc_tl`.

```

3737   \tl_set:Nn \l_tmpa_tl { #1 }
3738   \tl_clear_new:N \l_tmpc_tl
3739   \int_step_variable:nNn \c@jCol \l_tmpb_tl
3740   {

```

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.

```

3741     \bool_gset_true:N \g_tmpa_bool
3742     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
3743     { \@@_test_if_hline_in_block:nnnn ##1 }
3744     \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
3745     { \@@_test_if_hline_in_block:nnnn ##1 }
3746     \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
3747     { \@@_test_if_hline_in_stroken_block:nnnn ##1 }
3748     \clist_if_empty:NF \l_@@_except_corners_clist \@@_test_in_corner_h:
3749     \bool_if:NTF \g_tmpa_bool
3750     {
3751       \tl_if_empty:NT \l_tmpc_tl

```

We keep in memory that we have a rule to draw.

```

3752       { \tl_set_eq:NN \l_tmpc_tl \l_tmpb_tl }
3753     }
3754     {
3755       \tl_if_empty:NF \l_tmpc_tl
3756       {
3757         \@@_hline_ii:nnnn
3758         { #1 }
3759         { #2 }
3760         \l_tmpc_tl
3761         { \int_eval:n { \l_tmpb_tl - 1 } }
3762         \tl_clear:N \l_tmpc_tl
3763       }
3764     }
3765   }
3766   \tl_if_empty:NF \l_tmpc_tl
3767   {
3768     \@@_hline_ii:nnnn
3769     { #1 }
3770     { #2 }
3771     \l_tmpc_tl
3772     { \int_use:N \c@jCol }
3773     \tl_clear:N \l_tmpc_tl
3774   }
3775 }

```

```

3776 \cs_new_protected:Npn \@@_test_in_corner_h:
3777 {
3778   \int_compare:nNnTF \l_tmpa_tl = { \@@_succ:n \c@iRow }
3779   {
3780     \seq_if_in:NxT
3781     \l_@@_empty_corner_cells_seq
3782     { \@@_pred:n \l_tmpa_tl - \l_tmpb_tl }
3783     { \bool_set_false:N \g_tmpa_bool }
3784   }
3785   {
3786     \seq_if_in:NxT
3787     \l_@@_empty_corner_cells_seq
3788     { \l_tmpa_tl - \l_tmpb_tl }
3789     {
3790       \int_compare:nNnTF \l_tmpa_tl = 1
3791       { \bool_set_false:N \g_tmpa_bool }
3792       {
3793         \seq_if_in:NxT
3794         \l_@@_empty_corner_cells_seq
3795         { \@@_pred:n \l_tmpa_tl - \l_tmpb_tl }
3796         { \bool_set_false:N \g_tmpa_bool }
3797       }
3798     }
3799   }
3800 }

```

#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.

```

3801 \cs_new_protected:Npn \@@_hline_ii:nnnn #1 #2 #3 #4
3802 {
3803   \pgfrememberpicturepositiononpagetrue
3804   \pgf@relevantforpicturesizefalse
3805   \@@_qpoint:n { col - #3 }
3806   \dim_set_eq:NN \l_tmpa_dim \pgf@x
3807   \@@_qpoint:n { row - #1 }
3808   \dim_set_eq:NN \l_tmpb_dim \pgf@y
3809   \@@_qpoint:n { col - \@@_succ:n { #4 } }
3810   \dim_set_eq:NN \l_tmpc_dim \pgf@x
3811   \bool_lazy_and:nnT
3812   { \int_compare_p:nNn { #2 } > 1 }
3813   { ! \tl_if_blank_p:V \CT@drsc@ }
3814   {
3815     \group_begin:
3816     \CT@drsc@
3817     \dim_set:Nn \l_tmpd_dim
3818     { \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth ) * ( #2 - 1 ) }
3819     \pgfpathrectanglecorners
3820     { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3821     { \pgfpoint \l_tmpc_dim \l_tmpd_dim }
3822     \pgfusepathqfill
3823     \group_end:
3824   }
3825   \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3826   \pgfpathlineto { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3827   \prg_replicate:nn { #2 - 1 }
3828   {
3829     \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
3830     \dim_sub:Nn \l_tmpb_dim \doublerulesep
3831     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3832     \pgfpathlineto { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3833   }
3834   \CT@arc@
3835   \pgfsetlinewidth { 1.1 \arrayrulewidth }

```

```

3836 \pgfsetrectcap
3837 \pgfusepathqstroke
3838 }

```

```

3839 \cs_new_protected:Npn \@@_hline_i_complete:nn #1 #2
3840 { \@@_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 `except-corners` is used).

```

3841 \cs_new_protected:Npn \@@_draw_hlines:
3842 {
3843   \int_step_inline:nnn
3844   { \bool_if:NTF \l_@@_NiceArray_bool 1 2 }
3845   { \bool_if:NTF \l_@@_NiceArray_bool { \@@_succ:n \c@iRow } \c@iRow }
3846   { \@@_hline:nn { ##1 } 1 }
3847 }

```

The command `\@@_Hline:` will be linked to `\Hline` in the environments of `nicematrix`.

```

3848 \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.

```

3849 \cs_set:Npn \@@_Hline_i:n #1
3850 {
3851   \peek_meaning_ignore_spaces:NTF \Hline
3852   { \@@_Hline_ii:nn { #1 + 1 } }
3853   { \@@_Hline_iii:n { #1 } }
3854 }
3855 \cs_set:Npn \@@_Hline_ii:nn #1 #2 { \@@_Hline_i:n { #1 } }
3856 \cs_set:Npn \@@_Hline_iii:n #1
3857 {
3858   \skip_vertical:n
3859   {
3860     \arrayrulewidth * ( #1 )
3861     + \doublerulesep * ( \int_max:nn 0 { #1 - 1 } )
3862   }
3863   \tl_gput_right:Nx \g_@@_internal_code_after_tl
3864   { \@@_hline:nn { \@@_succ:n { \c@iRow } } { #1 } }
3865   \ifnum 0 = ` { \fi }
3866 }

```

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 col) 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`.

```

3867 \cs_new_protected:Npn \@@_test_if_hline_in_block:nnnn #1 #2 #3 #4
3868 {
3869   \bool_lazy_all:nT
3870   {
3871     { \int_compare_p:nNn \l_tmpa_tl > { #1 } }
3872     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
3873     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
3874     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
3875   }
3876   { \bool_gset_false:N \g_tmpa_bool }
3877 }

```

The same for vertical rules.

```

3878 \cs_new_protected:Npn \@@_test_if_vline_in_block:nnnn #1 #2 #3 #4
3879 {
3880   \bool_lazy_all:nT
3881   {
3882     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
3883     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
3884     { \int_compare_p:nNn \l_tmpb_tl > { #2 } }
3885     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
3886   }
3887   { \bool_gset_false:N \g_tmpa_bool }
3888 }
3889
3889 \cs_new_protected:Npn \@@_test_if_hline_in_stroken_block:nnnn #1 #2 #3 #4
3890 {
3891   \bool_lazy_all:nT
3892   {
3893     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
3894     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 2 } }
3895     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
3896     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
3897   }
3898   { \bool_gset_false:N \g_tmpa_bool }
3899 }
3900
3900 \cs_new_protected:Npn \@@_test_if_vline_in_stroken_block:nnnn #1 #2 #3 #4
3901 {
3902   \bool_lazy_all:nT
3903   {
3904     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
3905     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
3906     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
3907     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 2 } }
3908   }
3909   { \bool_gset_false:N \g_tmpa_bool }
3910 }

```

The key except-corners

When the key `except-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.

```

3911 \cs_new_protected:Npn \@@_compute_corners:
3912 {

```

The sequence `\l_@@_empty_corner_cells_seq` will be the sequence of all the empty cells (and not in a block) considered in the corners of the array.

```

3913   \seq_clear_new:N \l_@@_empty_corner_cells_seq
3914   \clist_map_inline:Nn \l_@@_except_corners_clist
3915   {
3916     \str_case:nnF { ##1 }
3917     {
3918       { NW }
3919       { \@@_compute_a_corner:nnnnnn 1 1 1 1 \c@iRow \c@jCol }
3920       { NE }
3921       { \@@_compute_a_corner:nnnnnn 1 \c@jCol 1 { -1 } \c@iRow 1 }
3922       { SW }
3923       { \@@_compute_a_corner:nnnnnn \c@iRow 1 { -1 } 1 1 \c@jCol }
3924       { SE }
3925       { \@@_compute_a_corner:nnnnnn \c@iRow \c@jCol { -1 } { -1 } 1 1 }
3926     }
3927     { \@@_error:nn { bad~corner } { ##1 } }
3928   }
3929 }

```

“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_@@_empty_corner_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.

```
3930 \cs_new_protected:Npn \@@_compute_a_corner:nnnnnn #1 #2 #3 #4 #5 #6
3931 {
```

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.

```
3932   \bool_set_false:N \l_tmpa_bool
3933   \int_zero_new:N \l_@@_last_empty_row_int
3934   \int_set:Nn \l_@@_last_empty_row_int { #1 }
3935   \int_step_inline:nnnn { #1 } { #3 } { #5 }
3936   {
3937     \@@_test_if_cell_in_a_block:nn { ##1 } { \int_eval:n { #2 } }
3938     \bool_lazy_or:nnTF
3939     {
3940       \cs_if_exist_p:c
3941       { pgf @ sh @ ns @ \@@_env: - ##1 - \int_eval:n { #2 } }
3942     }
3943     \l_tmpb_bool
3944     { \bool_set_true:N \l_tmpa_bool }
3945     {
3946       \bool_if:NF \l_tmpa_bool
3947       { \int_set:Nn \l_@@_last_empty_row_int { ##1 } }
3948     }
3949   }
```

Now, you determine the last empty cell in the row of number 1.

```
3950   \bool_set_false:N \l_tmpa_bool
3951   \int_zero_new:N \l_@@_last_empty_column_int
3952   \int_set:Nn \l_@@_last_empty_column_int { #2 }
3953   \int_step_inline:nnnn { #2 } { #4 } { #6 }
3954   {
3955     \@@_test_if_cell_in_a_block:nn { \int_eval:n { #1 } } { ##1 }
3956     \bool_lazy_or:nnTF
3957     \l_tmpb_bool
3958     {
3959       \cs_if_exist_p:c
3960       { pgf @ sh @ ns @ \@@_env: - \int_eval:n { #1 } - ##1 }
3961     }
3962     { \bool_set_true:N \l_tmpa_bool }
3963     {
3964       \bool_if:NF \l_tmpa_bool
3965       { \int_set:Nn \l_@@_last_empty_column_int { ##1 } }
3966     }
3967   }
```

Now, we loop over the rows.

```
3968   \int_step_inline:nnnn { #1 } { #3 } \l_@@_last_empty_row_int
3969   {
```

We treat the row number ##1 with another loop.

```

3970     \bool_set_false:N \l_tmpa_bool
3971     \int_step_inline:nnnn { #2 } { #4 } \l_@@_last_empty_column_int
3972     {
3973         \@@_test_if_cell_in_a_block:nn { ##1 } { ####1 }
3974         \bool_lazy_or:nnTF
3975             \l_tmpb_bool
3976             {
3977                 \cs_if_exist_p:c
3978                     { pgf @ sh @ ns @ \@@_env: - ##1 - ####1 }
3979             }
3980         { \bool_set_true:N \l_tmpa_bool }
3981         {
3982             \bool_if:NF \l_tmpa_bool
3983             {
3984                 \int_set:Nn \l_@@_last_empty_column_int { ####1 }
3985                 \seq_put_right:Nn
3986                     \l_@@_empty_corner_cells_seq
3987                     { ##1 - ####1 }
3988             }
3989         }
3990     }
3991 }
3992 }
```

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`).

```

3993 \cs_new_protected:Npn \@@_test_if_cell_in_a_block:nn #1 #2
3994 {
3995     \int_set:Nn \l_tmpa_int { #1 }
3996     \int_set:Nn \l_tmpb_int { #2 }
3997     \bool_set_false:N \l_tmpb_bool
3998     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
3999         { \@@_test_if_cell_in_block:nnnnnnn \l_tmpa_int \l_tmpb_int ##1 }
4000 }
4001 \cs_new_protected:Npn \@@_test_if_cell_in_block:nnnnnnn #1 #2 #3 #4 #5 #6
4002 {
4003     \int_compare:nNnT { #3 } < { \@@_succ:n { #1 } }
4004     {
4005         \int_compare:nNnT { #1 } < { \@@_succ:n { #5 } }
4006         {
4007             \int_compare:nNnT { #4 } < { \@@_succ:n { #2 } }
4008             {
4009                 \int_compare:nNnT { #2 } < { \@@_succ:n { #6 } }
4010                 { \bool_set_true:N \l_tmpb_bool }
4011             }
4012         }
4013     }
4014 }
```

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`.

```

4015 \cs_new:Npn \@@_hdottedline:
4016 {
```



```

4017 \noalign { \skip_vertical:N 2\l_@@_radius_dim }
4018 \@@_hdottedline_i:
4019 }

```

On the other side, the following command should be protected.

```

4020 \cs_new_protected:Npn \@@_hdottedline_i:
4021 {

```

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).

```

4022 \tl_gput_right:Nx \g_@@_internal_code_after_tl
4023 { \@@_hdottedline:n { \int_use:N \c@iRow } }
4024 }

```

The command `\@@_hdottedline:n` is the command written in the code-after that will actually draw the dotted line. Its argument is the number of the row *before* which we will draw the row.

```

4025 \AtBeginDocument
4026 {

```

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}`).

```

4027 \cs_new_protected:Npx \@@_hdottedline:n #1
4028 {
4029 \bool_set_true:N \exp_not:N \l_@@_initial_open_bool
4030 \bool_set_true:N \exp_not:N \l_@@_final_open_bool
4031 \c_@@_pgfortikzpicture_tl
4032 \@@_hdottedline_i:n { #1 }
4033 \c_@@_endpgfortikzpicture_tl
4034 }
4035 }

```

The following command *must* be protected since it is used in the construction of `\@@_hdottedline:n`.

```

4036 \cs_new_protected:Npn \@@_hdottedline_i:n #1
4037 {
4038 \pgfrememberpicturepositiononpagetrue
4039 \@@_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).

```

4040 \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4041 \dim_sub:Nn \l_@@_y_initial_dim \l_@@_radius_dim
4042 \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}

```

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

```

4043 \@@_qpoint:n { col - 1 }
4044 \dim_set:Nn \l_@@_x_initial_dim
4045 {
4046   \pgf@x +

```

We do a reduction by `\arraycolsep` for the environments with delimiters (and not for the other).

```

4047   \bool_if:NTF \l_@@_NiceArray_bool \c_zero_dim \arraycolsep
4048   - \l_@@_left_margin_dim
4049 }
4050 \@@_qpoint:n { col - \@@_succ:n \c@jCol }
4051 \dim_set:Nn \l_@@_x_final_dim
4052 {
4053   \pgf@x -
4054   \bool_if:NTF \l_@@_NiceArray_bool \c_zero_dim \arraycolsep
4055   + \l_@@_right_margin_dim
4056 }

```

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.

```

4057 \tl_set:Nn \l_tmpa_tl { ( }
4058 \tl_if_eq:NMF \l_@@_left_delim_tl \l_tmpa_tl
4059 { \dim_gadd:Nn \l_@@_x_initial_dim { 0.5 \l_@@_inter_dots_dim } }
4060 \tl_set:Nn \l_tmpa_tl { ) }
4061 \tl_if_eq:NMF \l_@@_right_delim_tl \l_tmpa_tl
4062 { \dim_gsub:Nn \l_@@_x_final_dim { 0.5 \l_@@_inter_dots_dim } }

```

As of 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`.

```

4063 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
4064 \@@_draw_line:
4065 }

```

Vertical dotted lines

```

4066 \cs_new_protected:Npn \@@_vdottedline:n #1
4067 {
4068   \bool_set_true:N \l_@@_initial_open_bool
4069   \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”.

```

4070   \bool_if:NTF \c_@@_tikz_loaded_bool
4071   {
4072     \tikzpicture
4073     \@@_vdottedline_i:n { #1 }
4074     \endtikzpicture
4075   }
4076   {
4077     \pgfpicture
4078     \@@_vdottedline_i:n { #1 }
4079     \endpgfpicture
4080   }
4081 }

```

```

4082 \cs_new_protected:Npn \@@_vdottedline_i:n #1
4083 {

```

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.

```

4084 \CT@arc@
4085 \pgfrememberpicturepositiononpagetrue
4086 \@@_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).

```
4087 \dim_set:Nn \l_@@_x_initial_dim { \pgf@x - \l_@@_radius_dim }
4088 \dim_set:Nn \l_@@_x_final_dim { \pgf@x - \l_@@_radius_dim }
4089 \@@_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.

```
4090 \dim_set:Nn \l_@@_y_initial_dim { \pgf@y - 0.5 \l_@@_inter_dots_dim }
4091 \@@_qpoint:n { row - \@@_succ:n \c@iRow }
4092 \dim_set:Nn \l_@@_y_final_dim { \pgf@y + 0.5 \l_@@_inter_dots_dim }
```

As of 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`.

```
4093 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
4094 \@@_draw_line:
4095 }
```

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.

```
4096 \bool_new:N \l_@@_block_auto_columns_width_bool
```

As of now, there is only one option available for the environment `{NiceMatrixBlock}`.

```
4097 \keys_define:nn { NiceMatrix / NiceMatrixBlock }
4098 {
4099   auto-columns-width .code:n =
4100   {
4101     \bool_set_true:N \l_@@_block_auto_columns_width_bool
4102     \dim_gzero_new:N \g_@@_max_cell_width_dim
4103     \bool_set_true:N \l_@@_auto_columns_width_bool
4104   }
4105 }

4106 \NewDocumentEnvironment { NiceMatrixBlock } { ! 0 { } }
4107 {
4108   \int_gincr:N \g_@@_NiceMatrixBlock_int
4109   \dim_zero:N \l_@@_columns_width_dim
4110   \keys_set:nn { NiceMatrix / NiceMatrixBlock } { #1 }
4111   \bool_if:NT \l_@@_block_auto_columns_width_bool
4112   {
4113     \cs_if_exist:cT { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
4114     {
4115       \exp_args:NNc \dim_set:Nn \l_@@_columns_width_dim
4116       { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
4117     }
4118   }
4119 }
```

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`).

```
4120 {
4121   \bool_if:NT \l_@@_block_auto_columns_width_bool
4122   {
4123     \iow_shipout:Nn \@mainaux \ExplSyntaxOn
4124     \iow_shipout:Nx \@mainaux
```

```

4125     {
4126         \cs_gset:cpn
4127         { @@ _ 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.

```

4128         { \dim_eval:n { \g_@@_max_cell_width_dim + \arrayrulewidth } }
4129     }
4130     \iow_shipout:Nn \@mainaux \ExplSyntaxOff
4131 }
4132 }

```

The extra nodes

First, two variants of the functions `\dim_min:nn` and `\dim_max:nn`.

```

4133 \cs_generate_variant:Nn \dim_min:nn { v n }
4134 \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 dans that construction uses the standard medium nodes).

```

4135 \cs_new_protected:Npn \@@_create_extra_nodes:
4136 {
4137     \bool_if:nTF \l_@@_medium_nodes_bool
4138     {
4139         \bool_if:nTF \l_@@_large_nodes_bool
4140         \@@_create_medium_and_large_nodes:
4141         \@@_create_medium_nodes:
4142     }
4143     { \bool_if:NT \l_@@_large_nodes_bool \@@_create_large_nodes: }
4144 }

```

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`.

```

4145 \cs_new_protected:Npn \@@_computations_for_medium_nodes:
4146 {
4147     \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4148     {
4149         \dim_zero_new:c { l_@@_row_\@@_i: _min_dim }
4150         \dim_set_eq:cn { l_@@_row_\@@_i: _min_dim } \c_max_dim
4151         \dim_zero_new:c { l_@@_row_\@@_i: _max_dim }
4152         \dim_set:cn { l_@@_row_\@@_i: _max_dim } { - \c_max_dim }
4153     }
4154     \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:

```

```

4155 {
4156   \dim_zero_new:c { l_@@_column_\@@_j: _min_dim }
4157   \dim_set_eq:cn { l_@@_column_\@@_j: _min_dim } \c_max_dim
4158   \dim_zero_new:c { l_@@_column_\@@_j: _max_dim }
4159   \dim_set:cn { l_@@_column_\@@_j: _max_dim } { - \c_max_dim }
4160 }

```

We begin the two nested loops over the rows and the columns of the array.

```

4161 \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4162 {
4163   \int_step_variable:nnNn
4164   \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.

```

4165 {
4166   \cs_if_exist:cT
4167   { 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.

```

4168 {
4169   \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { south-west }
4170   \dim_set:cn { l_@@_row_\@@_i: _min_dim }
4171   { \dim_min:vn { l_@@_row _ \@@_i: _min_dim } \pgf@y }
4172   \seq_if_in:NxF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
4173   {
4174     \dim_set:cn { l_@@_column _ \@@_j: _min_dim }
4175     { \dim_min:vn { l_@@_column _ \@@_j: _min_dim } \pgf@x }
4176   }

```

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.

```

4177   \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { north-east }
4178   \dim_set:cn { l_@@_row _ \@@_i: _ max_dim }
4179   { \dim_max:vn { l_@@_row _ \@@_i: _ max_dim } \pgf@y }
4180   \seq_if_in:NxF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
4181   {
4182     \dim_set:cn { l_@@_column _ \@@_j: _ max_dim }
4183     { \dim_max:vn { l_@@_column _ \@@_j: _ max_dim } \pgf@x }
4184   }
4185 }
4186 }
4187 }

```

Now, we have to deal with empty rows or empty columns since we don't have created nodes in such rows and columns.

```

4188 \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4189 {
4190   \dim_compare:nnNt
4191   { \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } } = \c_max_dim
4192   {
4193     \@@_qpoint:n { row - \@@_i: - base }
4194     \dim_set:cn { l_@@_row _ \@@_i: _ max _ dim } \pgf@y
4195     \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim } \pgf@y
4196   }
4197 }
4198 \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
4199 {
4200   \dim_compare:nnNt
4201   { \dim_use:c { l_@@_column _ \@@_j: _ min _ dim } } = \c_max_dim
4202   {
4203     \@@_qpoint:n { col - \@@_j: }
4204     \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim } \pgf@y
4205     \dim_set:cn { l_@@_column _ \@@_j: _ min _ dim } \pgf@y

```

```

4206     }
4207   }
4208 }

```

Here is the command `\@@_create_medium_nodes:`. When this command is used, the “medium nodes” are created.

```

4209 \cs_new_protected:Npn \@@_create_medium_nodes:
4210 {
4211   \pgfpicture
4212     \pgfrememberpicturepositiononpagetrue
4213     \pgf@relevantforpicturesizefalse
4214     \@@_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”.

```

4215     \tl_set:Nn \l_@@_suffix_tl { -medium }
4216     \@@_create_nodes:
4217   \endpgfpicture
4218 }

```

The command `\@@_create_large_nodes:` must be used when we want to create only the “large nodes” and not the medium ones⁴⁸. 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:`.

```

4219 \cs_new_protected:Npn \@@_create_large_nodes:
4220 {
4221   \pgfpicture
4222     \pgfrememberpicturepositiononpagetrue
4223     \pgf@relevantforpicturesizefalse
4224     \@@_computations_for_medium_nodes:
4225     \@@_computations_for_large_nodes:
4226     \tl_set:Nn \l_@@_suffix_tl { - large }
4227     \@@_create_nodes:
4228   \endpgfpicture
4229 }

4230 \cs_new_protected:Npn \@@_create_medium_and_large_nodes:
4231 {
4232   \pgfpicture
4233     \pgfrememberpicturepositiononpagetrue
4234     \pgf@relevantforpicturesizefalse
4235     \@@_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”.

```

4236     \tl_set:Nn \l_@@_suffix_tl { - medium }
4237     \@@_create_nodes:
4238     \@@_computations_for_large_nodes:
4239     \tl_set:Nn \l_@@_suffix_tl { - large }
4240     \@@_create_nodes:
4241   \endpgfpicture
4242 }

```

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.

```

4243 \cs_new_protected:Npn \@@_computations_for_large_nodes:
4244 {
4245   \int_set:Nn \l_@@_first_row_int 1
4246   \int_set:Nn \l_@@_first_col_int 1

```

⁴⁸If we want to create both, we have to use `\@@_create_medium_and_large_nodes:`

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`.

```

4247 \int_step_variable:nNn { \c@iRow - 1 } \@@_i:
4248 {
4249   \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim }
4250   {
4251     (
4252       \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } +
4253       \dim_use:c { l_@@_row _ \@@_succ:n \@@_i: _ max _ dim }
4254     )
4255     / 2
4256   }
4257   \dim_set_eq:cc { l_@@_row _ \@@_succ:n \@@_i: _ max _ dim }
4258   { l_@@_row_\@@_i: _ min_dim }
4259 }
4260 \int_step_variable:nNn { \c@jCol - 1 } \@@_j:
4261 {
4262   \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim }
4263   {
4264     (
4265       \dim_use:c { l_@@_column _ \@@_j: _ max _ dim } +
4266       \dim_use:c
4267       { l_@@_column _ \@@_succ:n \@@_j: _ min _ dim }
4268     )
4269     / 2
4270   }
4271   \dim_set_eq:cc { l_@@_column _ \@@_succ:n \@@_j: _ min _ dim }
4272   { l_@@_column _ \@@_j: _ max _ dim }
4273 }

```

Here, we have to use `\dim_sub:cn` because of the number 1 in the name.

```

4274 \dim_sub:cn
4275 { l_@@_column _ 1 _ min _ dim }
4276 \l_@@_left_margin_dim
4277 \dim_add:cn
4278 { l_@@_column _ \int_use:N \c@jCol _ max _ dim }
4279 \l_@@_right_margin_dim
4280 }

```

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).

```

4281 \cs_new_protected:Npn \@@_create_nodes:
4282 {
4283   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4284   {
4285     \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
4286     {

```

We draw the rectangular node for the cell $(\@@_i-\@@_j)$.

```

4287 \@@_pgf_rect_node:nnnnn
4288 { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
4289 { \dim_use:c { l_@@_column _ \@@_j: _ min_dim } }
4290 { \dim_use:c { l_@@_row _ \@@_i: _ min_dim } }
4291 { \dim_use:c { l_@@_column _ \@@_j: _ max_dim } }
4292 { \dim_use:c { l_@@_row _ \@@_i: _ max_dim } }
4293 \str_if_empty:NF \l_@@_name_str
4294 {
4295   \pgfnodealias
4296   { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }

```

```

4297         { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
4298     }
4299 }
4300 }

```

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 .

```

4301 \seq_mapthread_function:NNN
4302   \g_@@_multicolumn_cells_seq
4303   \g_@@_multicolumn_sizes_seq
4304   \@@_node_for_multicolumn:nn
4305 }

4306 \cs_new_protected:Npn \@@_extract_coords_values: #1 - #2 \q_stop
4307 {
4308   \cs_set_nopar:Npn \@@_i: { #1 }
4309   \cs_set_nopar:Npn \@@_j: { #2 }
4310 }

```

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”).

```

4311 \cs_new_protected:Npn \@@_node_for_multicolumn:nn #1 #2
4312 {
4313   \@@_extract_coords_values: #1 \q_stop
4314   \@@_pgf_rect_node:nnnnn
4315     { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
4316     { \dim_use:c { l_@@_column _ \@@_j: _ min _ dim } }
4317     { \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } }
4318     { \dim_use:c { l_@@_column _ \int_eval:n { \@@_j: +#2-1 } _ max _ dim } }
4319     { \dim_use:c { l_@@_row _ \@@_i: _ max _ dim } }
4320   \str_if_empty:NF \l_@@_name_str
4321   {
4322     \pgfnodealias
4323       { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
4324       { \int_use:N \g_@@_env_int - \@@_i: - \@@_j: \l_@@_suffix_tl }
4325   }
4326 }

```

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.

```

4327 \keys_define:nn { NiceMatrix / Block / FirstPass }
4328 {
4329   l .code:n = \tl_set:Nn \l_@@_pos_of_block_tl l ,
4330   l .value_forbidden:n = true ,
4331   r .code:n = \tl_set:Nn \l_@@_pos_of_block_tl r ,
4332   r .value_forbidden:n = true ,
4333   c .code:n = \tl_set:Nn \l_@@_pos_of_block_tl c ,
4334   c .value_forbidden:n = true ,

```

The two following lines will be uncommented when we will give to the key `color` its new definition.

```

4335   % color .tl_set:N = \l_@@_color_tl ,
4336   % color .value_required:n = true ,
4337 }

```


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.

```
4338 \NewExpandableDocumentCommand \@@_Block: { 0 { } m D < > { } m }
4339 {
```

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).

```
4340 \tl_if_blank:nTF { #2 } { \@@_Block_i 1-1 \q_stop } { \@@_Block_i #2 \q_stop }
4341 { #1 } { #3 } { #4 }
4342 }
```

With the following construction, we extract the values of i and j in the first mandatory argument of the command.

```
4343 \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.

```
4344 \cs_new_protected:Npn \@@_Block_ii:nnnnn #1 #2 #3 #4 #5
4345 {
4346   \int_compare:nNnTF { #2 } = 1
4347   {
4348     \tl_if_empty:nTF \l_@@_cell_type_tl
4349     { \tl_set:Nn \l_@@_pos_of_block_tl c }
4350     { \tl_set_eq:NN \l_@@_pos_of_block_tl \l_@@_cell_type_tl }
4351   }
4352   { \tl_set:Nn \l_@@_pos_of_block_tl c }

4353   \keys_set:known:n { NiceMatrix / Block / FirstPass } { #3 }
```

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*).

```
4354 \tl_if_empty:nTF { #1 }
4355 { \int_set:Nn \l_tmpa_int { 100 } }
4356 { \int_set:Nn \l_tmpa_int { #1 } }
4357 \tl_if_empty:nTF { #2 }
4358 { \int_set:Nn \l_tmpb_int { 100 } }
4359 { \int_set:Nn \l_tmpb_int { #2 } }

4360 \tl_set:Nx \l_tmpa_tl
4361 {
4362   { \int_use:N \c@iRow }
4363   { \int_use:N \c@jCol }
4364   { \int_eval:n { \c@iRow + \l_tmpa_int - 1 } }
4365   { \int_eval:n { \c@jCol + \l_tmpb_int - 1 } }
4366 }
```

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}`.

We store this information in the sequence `\g_@@_pos_of_blocks_seq`.

```
4367 \seq_gput_left:Nv \g_@@_pos_of_blocks_seq \l_tmpa_tl
```

We also store a complete description of the block in the sequence `\g_@@_blocks_seq`. Of course, the sequences `\g_@@_pos_of_blocks_seq` and `\g_@@_blocks_seq` are redundant, but it's for efficiency. In `\g_@@_blocks_seq`, each block is represented by an “object” with six components: `{imin}{jmin}{imax}{jmax}{options}{contents}`.

If the block is mono-column or mono-row, we have a special treatment. That's why we have two macros: `\@@_Block_iii:nnnnn` and `\@@_Block_iv:nnnnn` (the five arguments of those macros are provided by curryfication).

```

4368 \bool_lazy_or:nnTF
4369 { \int_compare_p:nNn { \l_tmpa_int } = 1 }
4370 { \int_compare_p:nNn { \l_tmpb_int } = 1 }
4371 { \exp_args:Nxx \@@_Block_iii:nnnnn }
4372 { \exp_args:Nxx \@@_Block_iv:nnnnn }
4373 { \l_tmpa_int } { \l_tmpb_int } { #3 } { #4 } { #5 }
4374 }

```

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).

```

4375 \cs_new_protected:Npn \@@_Block_iii:nnnnn #1 #2 #3 #4 #5
4376 {
4377   \int_gincr:N \g_@@_block_box_int
4378   \cs_set_protected_nopar:Npn \diagbox ##1 ##2
4379   {
4380     \tl_gput_right:Nx \g_@@_internal_code_after_tl
4381     {
4382       \@@_actually_diagbox:nnnnnn
4383       { \int_use:N \c@iRow }
4384       { \int_use:N \c@jCol }
4385       { \int_eval:n { \c@iRow + #1 - 1 } }
4386       { \int_eval:n { \c@jCol + #2 - 1 } }
4387       { \exp_not:n { ##1 } } { \exp_not:n { ##2 } }
4388     }
4389   }
4390   \box_gclear_new:c
4391   { g_@@_block_box_int \int_use:N \g_@@_block_box_int _box }
4392   \hbox_gset:cn
4393   { g_@@_block_box_int \int_use:N \g_@@_block_box_int _box }
4394   {

```

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.

```

4395 \tl_if_empty:NTF \l_@@_color_tl
4396 { \int_compare:nNnT { #2 } = 1 \set@color }
4397 { \color { \l_@@_color_tl } }
4398 \group_begin:
4399 \cs_set:Npn \arraystretch { 1 }
4400 \dim_set_eq:NN \extrarowheight \c_zero_dim
4401 #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).

```

4402 \bool_if:NT \g_@@_rotate_bool { \tl_set:Nn \l_@@_pos_of_block_tl c }
4403 \bool_if:NTF \l_@@_NiceTabular_bool
4404 {

```

```

4405         \exp_args:Nnx \begin { tabular }
4406         { @ { } \l_@@_pos_of_block_tl @ { } }
4407         #5
4408     \end { tabular }
4409 }
4410 {
4411     \c_math_toggle_token
4412     \exp_args:Nnx \begin { array }
4413     { @ { } \l_@@_pos_of_block_tl @ { } }
4414     #5
4415     \end { array }
4416     \c_math_toggle_token
4417 }
4418 \group_end:
4419 }
4420 \bool_if:NT \g_@@_rotate_bool
4421 {
4422     \box_grotate:cn
4423     { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
4424     { 90 }
4425     \bool_gset_false:N \g_@@_rotate_bool
4426 }

```

If we are in a mono-column block, we take into account the width of that block for the width of the column.

```

4427     \int_compare:nNnT { #2 } = 1
4428     {
4429         \dim_gset:Nn \g_@@_blocks_wd_dim
4430         {
4431             \dim_max:nn
4432             \g_@@_blocks_wd_dim
4433             {
4434                 \box_wd:c
4435                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
4436             }
4437         }
4438     }

```

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.

```

4439     \int_compare:nNnT { #1 } = 1
4440     {
4441         \dim_gset:Nn \g_@@_blocks_ht_dim
4442         {
4443             \dim_max:nn
4444             \g_@@_blocks_ht_dim
4445             {
4446                 \box_ht:c
4447                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
4448             }
4449         }
4450         \dim_gset:Nn \g_@@_blocks_dp_dim
4451         {
4452             \dim_max:nn
4453             \g_@@_blocks_dp_dim
4454             {
4455                 \box_dp:c
4456                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
4457             }
4458         }
4459     }
4460     \seq_gput_right:Nx \g_@@_blocks_seq
4461     {
4462         \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_@@_pos_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_@@_pos_of_block_tl, which is fixed by the type of current column.

```

4463     { #3 , \l_@@_pos_of_block_tl }
4464     {
4465         \box_use_drop:c
4466         { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
4467     }
4468 }
4469 }
```

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.

```

4470 \cs_new_protected:Npn \@@_Block_iv:nnnnn #1 #2 #3 #4 #5
4471 {
4472     \seq_gput_right:Nx \g_@@_blocks_seq
4473     {
4474         \l_tmpa_tl
4475         { #3 }
4476         \exp_not:n
4477         {
4478             {
4479                 \bool_if:NTF \l_@@_NiceTabular_bool
4480                 {
4481                     \group_begin:
4482                     \cs_set:Npn \arraystretch { 1 }
4483                     \dim_set_eq:NN \extrarowheight \c_zero_dim
4484                     #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).

```

4485         \bool_if:NT \g_@@_rotate_bool
4486         { \tl_set:Nn \l_@@_pos_of_block_tl c }
4487         \exp_args:Nnx \begin { tabular }
4488         { @ { } \l_@@_pos_of_block_tl @ { } }
4489         #5
4490         \end { tabular }
4491         \group_end:
4492     }
4493     {
4494         \group_begin:
4495         \cs_set:Npn \arraystretch { 1 }
4496         \dim_set_eq:NN \extrarowheight \c_zero_dim
4497         #4
4498         \bool_if:NT \g_@@_rotate_bool
4499         { \tl_set:Nn \l_@@_pos_of_block_tl c }
4500         \c_math_toggle_token
4501         \exp_args:Nnx \begin { array }
4502         { @ { } \l_@@_pos_of_block_tl @ { } } #5 \end { array }
4503         \c_math_toggle_token
4504         \group_end:
4505     }
4506 }
4507 }
4508 }
4509 }
```

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).

```

4510 \keys_define:nn { NiceMatrix / Block / SecondPass }
4511 {
4512   fill .tl_set:N = \l_@@_fill_tl ,
4513   fill .value_required:n = true ,
4514   draw .tl_set:N = \l_@@_draw_tl ,
4515   draw .default:n = default ,

```

The following definition for the key `color` will be deleted when we will give to the key `color` of the command `\Block` its new definition. It will be replaced by the line which is commented.

```

4516   color .code:n =
4517     \@@_error:n { Key-color-for-Block }
4518     \tl_set:Nn \l_@@_fill_tl { #1 } ,
4519     % color .code:n = \color { #1 } \tl_set:Nn \l_@@_draw_tl { #1 } ,
4520     color .value_required:n = true ,
4521     line-width .dim_set:N = \l_@@_line_width_dim ,
4522     line-width .value_required:n = true ,
4523     l .code:n = \tl_set:Nn \l_@@_pos_of_block_tl l ,
4524     l .value_forbidden:n = true ,
4525     r .code:n = \tl_set:Nn \l_@@_pos_of_block_tl r ,
4526     r .value_forbidden:n = true ,
4527     c .code:n = \tl_set:Nn \l_@@_pos_of_block_tl c ,
4528     c .value_forbidden:n = true ,
4529     unknown .code:n = \@@_error:n { Unknown-key-for-Block }
4530 }

```

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.

```

4531 \cs_new_protected:Npn \@@_draw_blocks:
4532 {
4533   \cs_set_eq:NN \ialign \@@_old_ialign:
4534   \seq_map_inline:Nn \g_@@_blocks_seq { \@@_Block_iii:nnnnnn ##1 }
4535 }
4536 \cs_new_protected:Npn \@@_Block_iii:nnnnnn #1 #2 #3 #4 #5 #6
4537 {

```

The group is for the keys.

```

4538   \group_begin:
4539   \keys_set:nn { NiceMatrix / Block / SecondPass } { #5 }

```

The integer `\l_@@_last_row_int` will be the last row of the block and `\l_@@_last_col_int` its last column.

```

4540   \int_zero_new:N \l_@@_last_row_int
4541   \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.

```

4542   \int_compare:nNnTF { #3 } > { 99 }
4543     { \int_set_eq:NN \l_@@_last_row_int \c{iRow} }
4544     { \int_set:Nn \l_@@_last_row_int { #3 } }
4545   \int_compare:nNnTF { #4 } > { 99 }
4546     { \int_set_eq:NN \l_@@_last_col_int \c{jCol} }
4547     { \int_set:Nn \l_@@_last_col_int { #4 } }

```

```

4548 \bool_lazy_or:nnT
4549 { ! \tl_if_empty_p:N \l_@@_draw_tl }
4550 { \dim_compare_p:nNn \l_@@_line_width_dim > \c_zero_dim }
4551 {
4552   \tl_gput_right:Nx \g_nicematrix_code_after_tl
4553   {
4554     \@@_stroke_block:nnn
4555     { #5 }
4556     { #1 - #2 }
4557     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
4558   }
4559   \seq_gput_right:Nn \g_@@_pos_of_stroken_blocks_seq
4560   { { #1 } { #2 } { #3 } { #4 } }
4561 }
4562 \tl_if_empty:NF \l_@@_fill_tl
4563 {
4564   \tl_gput_right:Nx \g_nicematrix_code_before_tl
4565   {
4566     \exp_not:N \rectanglecolor
4567     { \l_@@_fill_tl }
4568     { #1 - #2 }
4569     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
4570   }
4571 }
4572 \cs_set_protected_nopar:Npn \diagbox ##1 ##2
4573 {
4574   \tl_gput_right:Nx \g_@@_internal_code_after_tl
4575   {
4576     \@@_actually_diagbox:nnnnnn
4577     { #1 }
4578     { #2 }
4579     { \int_use:N \l_@@_last_row_int }
4580     { \int_use:N \l_@@_last_col_int }
4581     { \exp_not:n { ##1 } } { \exp_not:n { ##2 } }
4582   }
4583 }
4584 \bool_lazy_or:nnTF
4585 { \int_compare_p:nNn \l_@@_last_row_int > \g_@@_row_total_int }
4586 { \int_compare_p:nNn \l_@@_last_col_int > \g_@@_col_total_int }
4587 { \msg_error:nnnn { nicematrix } { Block~too~large } { #1 } { #2 } }
4588 {
4589   \hbox_set:Nn \l_@@_cell_box { #6 }
4590   \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`. The latter will be used by `nicematrix` to put the label of the node. The first one won't be used explicitly.

```

\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.

```

4591 \pgfpicture
4592 \pgfrememberpicturepositiononpagetrue
4593 \pgf@relevantforpicturesizefalse
4594 \@@_qpoint:n { row - #1 }
4595 \dim_set_eq:NN \l_tmpa_dim \pgf@y
4596 \@@_qpoint:n { col - #2 }
4597 \dim_set_eq:NN \l_tmpb_dim \pgf@x
4598 \@@_qpoint:n { row - \@@_succ:n { \l_@@_last_row_int } }
4599 \dim_set_eq:NN \l_tmpc_dim \pgf@y
4600 \@@_qpoint:n { col - \@@_succ:n { \l_@@_last_col_int } }
4601 \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.

```

4602 \begin { pgfscope }
4603 \@@_pgf_rect_node:nnnnn
4604 { \@@_env: - #1 - #2 - block }
4605 \l_tmpb_dim \l_tmpa_dim \l_tmpd_dim \l_tmpc_dim
4606 \end { pgfscope }

```

We construct the short node.

```

4607 \dim_set_eq:NN \l_tmpb_dim \c_max_dim
4608 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
4609 {

```

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.

```

4610 \cs_if_exist:cT
4611 { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
4612 {
4613 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
4614 {
4615 \pgfpointanchor { \@@_env: - ##1 - #2 } { west }
4616 \dim_set:Nn \l_tmpb_dim { \dim_min:nn \l_tmpb_dim \pgf@x }
4617 }
4618 }
4619 }

```

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.

```

4620 \dim_compare:nNtT \l_tmpb_dim = \c_max_dim
4621 {
4622 \@@_qpoint:n { col - #2 }
4623 \dim_set_eq:NN \l_tmpb_dim \pgf@x
4624 }
4625 \dim_set:Nn \l_tmpd_dim { - \c_max_dim }
4626 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
4627 {
4628 \cs_if_exist:cT
4629 { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
4630 {
4631 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
4632 {
4633 \pgfpointanchor
4634 { \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }

```

```

4635         { east }
4636         \dim_set:Nn \l_tmpd_dim { \dim_max:nn \l_tmpd_dim \pgf@x }
4637     }
4638 }
4639 }
4640 \dim_compare:nNnT \l_tmpd_dim = { - \c_max_dim }
4641 {
4642     \@@_qpoint:n { col - \@@_succ:n { \l_@@_last_col_int } }
4643     \dim_set_eq:NN \l_tmpd_dim \pgf@x
4644 }
4645 \@@_pgf_rect_node:nnnnn
4646 { \@@_env: - #1 - #2 - block - short }
4647 \l_tmpb_dim \l_tmpa_dim \l_tmpd_dim \l_tmpc_dim

```

If the creation of the “medium nodes” is required, we create a “medium node” for the block. The function `\@@_pgf_rect_node:nnnnn` takes in as arguments the name of the node and two PGF points.

```

4648 \bool_if:NT \l_@@_medium_nodes_bool
4649 {
4650     \@@_pgf_rect_node:nnn
4651     { \@@_env: - #1 - #2 - block - medium }
4652     { \pgfpointanchor { \@@_env: - #1 - #2 - medium } { north-west } }
4653     {
4654         \pgfpointanchor
4655         { \@@_env:
4656             - \int_use:N \l_@@_last_row_int
4657             - \int_use:N \l_@@_last_col_int - medium
4658         }
4659         { south-east }
4660     }
4661 }

```

Now, we will put the label of the block beginning with the case of a `\Block` of one row.

```

4662 \int_compare:nNnTF { #1 } = { #3 }
4663 {

```

We take into account the case of a block of one row in the “first row” or the “last row”.

```

4664     \int_compare:nNnTF { #1 } = 0
4665     { \l_@@_code_for_first_row_tl }
4666     {
4667         \int_compare:nNnT { #1 } = \l_@@_last_row_int
4668         \l_@@_code_for_last_row_tl
4669     }

```

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`.

```

4670     \pgfextracty \l_tmpa_dim { \@@_qpoint:n { row - #1 - base } }

```

We retrieve (in `\pgf@x`) the x -value of the center of the block.

```

4671     \pgfpointanchor
4672     { \@@_env: - #1 - #2 - block - short }
4673     {
4674         \str_case:Vn \l_@@_pos_of_block_tl
4675         {
4676             c { center }
4677             l { west }
4678             r { east }
4679         }
4680     }

```

We put the label of the block which has been composed in `\l_@@_cell_box`.

```

4681     \pgftransformshift { \pgfpoint \pgf@x \l_tmpa_dim }
4682     \pgfset { inner~sep = \c_zero_dim }
4683     \pgfnode
4684     { rectangle }

```



```

4685         {
4686             \str_case:Vn \l_@@_pos_of_block_tl
4687             {
4688                 c { base }
4689                 l { base-west }
4690                 r { base-east }
4691             }
4692         }
4693     { \box_use_drop:N \l_@@_cell_box } { } { }
4694 }

```

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`).

```

4695     {

```

If we are in the first column, we must put the block as if it was with the key `r`.

```

4696         \int_compare:nNtT { #2 } = 0
4697         { \tl_set:Nn \l_@@_pos_of_block_tl r }
4698     \bool_if:nT \g_@@_last_col_found_bool
4699     {
4700         \int_compare:nNtT { #2 } = \g_@@_col_total_int
4701         { \tl_set:Nn \l_@@_pos_of_block_tl l }
4702     }
4703     \pgftransformshift
4704     {
4705         \pgfpointanchor
4706         { \@@_env: - #1 - #2 - block - short }
4707         {
4708             \str_case:Vn \l_@@_pos_of_block_tl
4709             {
4710                 c { center }
4711                 l { west }
4712                 r { east }
4713             }
4714         }
4715     }
4716     \pgfset { inner~sep = \c_zero_dim }
4717     \pgfnode
4718     { rectangle }
4719     {
4720         \str_case:Vn \l_@@_pos_of_block_tl
4721         {
4722             c { center }
4723             l { west }
4724             r { east }
4725         }
4726     }
4727     { \box_use_drop:N \l_@@_cell_box } { } { }
4728 }
4729 \endpgfpicture
4730 }
4731 \group_end:
4732 }

```

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).

```

4733 \cs_new_protected:Npn \@@_stroke_block:nnn #1 #2 #3
4734 {
4735     \group_begin:
4736     \tl_clear:N \l_@@_draw_tl
4737     \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
4738     \keys_set_known:nn { NiceMatrix / BlockStroke } { #1 }

```

```

4739 \pgfpicture
4740 \pgfrememberpicturepositiononpagetrue
4741 \pgf@relevantforpicturesizefalse
4742 \tl_if_empty:NF \l_@@_draw_tl
4743 {

```

If the user has used the key `color` of the command `\Block` without value, the color fixed by `\arrayrulecolor` is used.

```

4744     \str_if_eq:VnTF \l_@@_draw_tl { default }
4745     { \CT@arc@ }
4746     { \pgfsetstrokecolor { \l_@@_draw_tl } }
4747 }
4748 \@@_cut_on_hyphen:w #2 \q_stop
4749 \bool_lazy_and:nnT
4750 { \int_compare_p:n { \l_tmpa_tl <= \c@iRow } }
4751 { \int_compare_p:n { \l_tmpb_tl <= \c@jCol } }
4752 {
4753     \@@_qpoint:n { row - \l_tmpa_tl }
4754     \dim_set:Nn \l_tmpb_dim { \pgf@y }
4755     \@@_qpoint:n { col - \l_tmpb_tl }
4756     \dim_set:Nn \l_tmpc_dim { \pgf@x }
4757     \@@_cut_on_hyphen:w #3 \q_stop
4758     \int_compare:nNnT \l_tmpa_tl > \c@iRow
4759     { \tl_set:Nx \l_tmpa_tl { \int_use:N \c@iRow } }
4760     \int_compare:nNnT \l_tmpb_tl > \c@jCol
4761     { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
4762     \@@_qpoint:n { row - \@@_succ:n \l_tmpa_tl }
4763     \dim_set:Nn \l_tmpa_dim { \pgf@y }
4764     \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
4765     \dim_set:Nn \l_tmpd_dim { \pgf@x }
4766     \pgfpathrectanglecorners
4767     { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
4768     { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
4769     \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }
4770     \pgfusepathqstroke
4771 }
4772 \endpgfpicture
4773 \group_end:
4774 }

```

Here is the set of keys for the command `\@@_stroke_block:nnn`.

```

4775 \keys_define:nn { NiceMatrix / BlockStroke }
4776 {

```

We will uncomment the following line when we will give to the key `color` of the command `\Block` its new definition.

```

4777     % color .tl_set:N = \l_@@_draw_tl ,
4778     draw .tl_set:N = \l_@@_draw_tl ,
4779     draw .default:n = default ,
4780     line-width .dim_set:N = \l_@@_line_width_dim ,
4781 }

```

How to draw the dotted lines transparently

```

4782 \cs_set_protected:Npn \@@_renew_matrix:
4783 {
4784     \RenewDocumentEnvironment { pmatrix } { } {
4785         { \pNiceMatrix }
4786         { \endpNiceMatrix }
4787     } \RenewDocumentEnvironment { vmatrix } { } {
4788         { \vNiceMatrix }
4789         { \endvNiceMatrix }

```

```

4790 \RenewDocumentEnvironment { Vmatrix } { }
4791 { \VNiceMatrix }
4792 { \endVNiceMatrix }
4793 \RenewDocumentEnvironment { bmatrix } { }
4794 { \bNiceMatrix }
4795 { \endbNiceMatrix }
4796 \RenewDocumentEnvironment { Bmatrix } { }
4797 { \BNiceMatrix }
4798 { \endBNiceMatrix }
4799 }

```

Automatic arrays

```

4800 \cs_new_protected:Npn \@@_set_size:n #1-#2 \q_stop
4801 {
4802   \int_set:Nn \l_@@_nb_rows_int { #1 }
4803   \int_set:Nn \l_@@_nb_cols_int { #2 }
4804 }
4805 \NewDocumentCommand \AutoNiceMatrixWithDelims { m m O { } m O { } m ! O { } }
4806 {
4807   \int_zero_new:N \l_@@_nb_rows_int
4808   \int_zero_new:N \l_@@_nb_cols_int
4809   \@@_set_size:n #4 \q_stop
4810   \begin { NiceArrayWithDelims } { #1 } { #2 }
4811     { * { \l_@@_nb_cols_int } { c } } [ #3 , #5 , #7 ]
4812   \int_compare:nNnT \l_@@_first_row_int = 0
4813     {
4814       \int_compare:nNnT \l_@@_first_col_int = 0 { & }
4815       \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { & }
4816       \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
4817     }
4818   \prg_replicate:nn \l_@@_nb_rows_int
4819     {
4820       \int_compare:nNnT \l_@@_first_col_int = 0 { & }
4821       \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { { } #6 & } #6
4822       \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
4823     }
4824   \int_compare:nNnT \l_@@_last_row_int > { -2 }
4825     {
4826       \int_compare:nNnT \l_@@_first_col_int = 0 { & }
4827       \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { & }
4828       \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
4829     }
4830   \end { NiceArrayWithDelims }
4831 }
4832 \cs_set_protected:Npn \@@_define_com:nnn #1 #2 #3
4833 {
4834   \cs_set_protected:cpn { #1 AutoNiceMatrix }
4835   {
4836     \str_gset:Nx \g_@@_name_env_str { #1 AutoNiceMatrix }
4837     \AutoNiceMatrixWithDelims { #2 } { #3 }
4838   }
4839 }
4840 \@@_define_com:nnn p ( )
4841 \@@_define_com:nnn b [ ]
4842 \@@_define_com:nnn v | |
4843 \@@_define_com:nnn V \l \l
4844 \@@_define_com:nnn B \{ \}

```

We define also an command `\AutoNiceMatrix` similar to the environment `{NiceMatrix}`.

```

4845 \NewDocumentCommand \AutoNiceMatrix { 0 { } m 0 { } m ! 0 { } }
4846 {
4847   \group_begin:
4848     \bool_set_true:N \l_@@_NiceArray_bool
4849     \AutoNiceMatrixWithDelims . . { #2 } { #4 } [ #1 , #3 , #5 ]
4850   \group_end:
4851 }

```

The redefinition of the command `\dotfill`

```

4852 \cs_set_eq:NN \@@_old_dotfill \dotfill
4853 \cs_new_protected:Npn \@@_dotfill:
4854 {

```

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}`).

```

4855   \@@_old_dotfill
4856   \bool_if:NT \l_@@_NiceTabular_bool
4857     { \group_insert_after:N \@@_dotfill_ii: }
4858     { \group_insert_after:N \@@_dotfill_i: }
4859 }
4860 \cs_new_protected:Npn \@@_dotfill_i: { \group_insert_after:N \@@_dotfill_ii: }
4861 \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`.

```

4862 \cs_new_protected:Npn \@@_dotfill_iii:
4863 { \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`.

```

4864 \cs_new_protected:Npn \@@_diagbox:nn #1 #2
4865 {
4866   \tl_gput_right:Nx \g_@@_internal_code_after_tl
4867   {
4868     \@@_actually_diagbox:nnnnnn
4869     { \int_use:N \c@iRow }
4870     { \int_use:N \c@jCol }
4871     { \int_use:N \c@iRow }
4872     { \int_use:N \c@jCol }
4873     { \exp_not:n { #1 } }
4874     { \exp_not:n { #2 } }
4875   }

```

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 `except-corners`.

```

4876   \seq_gput_right:Nx \g_@@_pos_of_blocks_seq
4877   {
4878     { \int_use:N \c@iRow }
4879     { \int_use:N \c@jCol }
4880     { \int_use:N \c@iRow }
4881     { \int_use:N \c@jCol }
4882   }
4883 }

```

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.

```

4884 \cs_new_protected:Npn \@@_actually_diagbox:nnnnnn #1 #2 #3 #4 #5 #6
4885 {
4886   \pgfpicture
4887   \pgf@relevantforpicturesizefalse
4888   \pgfrememberpicturepositiononpagetrue
4889   \@@_qpoint:n { row - #1 }
4890   \dim_set_eq:NN \l_tmpa_dim \pgf@y
4891   \@@_qpoint:n { col - #2 }
4892   \dim_set_eq:NN \l_tmpb_dim \pgf@x
4893   \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
4894   \@@_qpoint:n { row - \@@_succ:n { #3 } }
4895   \dim_set_eq:NN \l_tmpc_dim \pgf@y
4896   \@@_qpoint:n { col - \@@_succ:n { #4 } }
4897   \dim_set_eq:NN \l_tmpd_dim \pgf@x
4898   \pgfpathlineto { \pgfpoint \l_tmpd_dim \l_tmpc_dim }
4899   {

```

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.

```

4900   \CT@arc@
4901   \pgfsetroundcap
4902   \pgfusepathqstroke
4903 }
4904 \pgfset { inner~sep = 1 pt }
4905 \pgfscope
4906 \pgftransformshift { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
4907 \pgfnode { rectangle } { south-west }
4908 { \@@_math_toggle_token: #5 \@@_math_toggle_token: } { } { }
4909 \endpgfscope
4910 \pgftransformshift { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
4911 \pgfnode { rectangle } { north-east }
4912 { \@@_math_toggle_token: #6 \@@_math_toggle_token: } { } { }
4913 \endpgfpicture
4914 }

```

The keyword `\CodeAfter`

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. 89.

In the environments of `nicematrix`, `\CodeAfter` will be linked to the following command `\@@_CodeAfter:`. That macro must *not* be protected since it begins with `\omit`.

```

4915 \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* begins 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`.

```

4916 \cs_new_protected:Npn \@@_CodeAfter_i:n #1 \end
4917 {
4918   \tl_gput_right:Nn \g_nicematrix_code_after_tl { #1 }
4919   \@@_CodeAfter_ii:n
4920 }

```

We catch the argument of the command `\end` (in `#1`).

```

4921 \cs_new_protected:Npn \@@_CodeAfter_ii:n #1
4922 {

```

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.

```
4923 \str_if_eq:eeTF \@currentenvir { #1 }
4924 { \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`.

```
4925 {
4926   \tl_gput_right:Nn \g_nicematrix_code_after_tl { \end { #1 } }
4927   \@@_CodeAfter_i:n
4928 }
4929 }
```

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.

```
4930 \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.

```
4931 \bool_new:N \c_@@_footnote_bool
4932 \@@_msg_new:nnn { Unknown~option~for~package }
4933 {
4934   The~option~'\l_keys_key_tl'~is~unknown. \\
4935   If~you~go~on,~it~will~be~ignored. \\
4936   For~a~list~of~the~available~options,~type~H~<return>.
4937 }
4938 {
4939   The~available~options~are~(in~alphabetic~order):~
4940   define-L-C-R,~
4941   footnote,~
4942   footnotehyper,~
4943   renew-dots,~
4944   renew-matrix~and~
4945   transparent.
4946 }
4947 \keys_define:nn { NiceMatrix / Package }
4948 {
4949   define-L-C-R .bool_set:N = \c_@@_define_L_C_R_bool ,
4950   define-L-C-R .default:n = true ,
4951   renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
4952   renew-dots .value_forbidden:n = true ,
4953   renew-matrix .code:n = \@@_renew_matrix: ,
4954   renew-matrix .value_forbidden:n = true ,
4955   transparent .meta:n = { renew-dots , renew-matrix } ,
4956   transparent .value_forbidden:n = true ,
4957   footnote .bool_set:N = \c_@@_footnote_bool ,
4958   footnotehyper .bool_set:N = \c_@@_footnotehyper_bool ,
4959   unknown .code:n = \@@_error:n { Unknown~option~for~package }
4960 }
4961 \ProcessKeysOptions { NiceMatrix / Package }
```

```

4962 \@@_msg_new:nn { footnote-with-footnotehyper-package }
4963 {
4964   You~can't~use~the~option~'footnote'~because~the~package~
4965   footnotehyper~has~already~been~loaded.~
4966   If~you~want,~you~can~use~the~option~'footnotehyper'~and~the~footnotes~
4967   within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~
4968   of~the~package~footnotehyper.\\
4969   If~you~go~on,~the~package~footnote~won't~be~loaded.
4970 }
4971 \@@_msg_new:nn { footnotehyper-with-footnote-package }
4972 {
4973   You~can't~use~the~option~'footnotehyper'~because~the~package~
4974   footnote~has~already~been~loaded.~
4975   If~you~want,~you~can~use~the~option~'footnote'~and~the~footnotes~
4976   within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~
4977   of~the~package~footnote.\\
4978   If~you~go~on,~the~package~footnotehyper~won't~be~loaded.
4979 }

4980 \bool_if:NT \c_@@_footnote_bool
4981 {
4982   \@ifclassloaded { beamer }
4983     { \msg_info:nn { nicematrix } { Option~incompatible~with~Beamer } }
4984     {
4985       \@ifpackageloaded { footnotehyper }
4986         { \@@_error:n { footnote-with-footnotehyper-package } }
4987         { \usepackage { footnote } }
4988     }
4989 }
4990 \bool_if:NT \c_@@_footnotehyper_bool
4991 {
4992   \@ifclassloaded { beamer }
4993     { \@@_info:n { Option~incompatible~with~Beamer } }
4994     {
4995       \@ifpackageloaded { footnote }
4996         { \@@_error:n { footnotehyper-with-footnote-package } }
4997         { \usepackage { footnotehyper } }
4998     }
4999   \bool_set_true:N \c_@@_footnote_bool
5000 }

```

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 command converts all the elements of a sequence (which are token lists) into strings.

```

5001 \cs_new_protected:Npn \@@_convert_to_str_seq:N #1
5002 {
5003   \seq_clear:N \l_tmpa_seq
5004   \seq_map_inline:Nn #1
5005     {
5006       \seq_put_left:Nx \l_tmpa_seq { \tl_to_str:n { ##1 } }
5007     }
5008   \seq_set_eq:NN #1 \l_tmpa_seq
5009 }

```

The following command creates a sequence of strings (`str`) from a `clist`.

```

5010 \cs_new_protected:Npn \@@_set_seq_of_str_from_clist:Nn #1 #2
5011 {
5012   \seq_set_from_clist:Nn #1 { #2 }

```

```

5013 \@@_convert_to_str_seq:N #1
5014 }
5015 \@@_set_seq_of_str_from_clist:Nn \c_@@_types_of_matrix_seq
5016 {
5017   NiceMatrix ,
5018   pNiceMatrix , bNiceMatrix , vNiceMatrix, BNiceMatrix, VNiceMatrix
5019 }

```

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`.

```

5020 \cs_new_protected:Npn \@@_error_too_much_cols:
5021 {
5022   \seq_if_in:NVTF \c_@@_types_of_matrix_seq \g_@@_name_env_str
5023   {
5024     \int_compare:nNnTF \l_@@_last_col_int = { -2 }
5025     { \@@_fatal:n { too~much~cols~for~matrix } }
5026     {
5027       \bool_if:NF \l_@@_last_col_without_value_bool
5028       { \@@_fatal:n { too~much~cols~for~matrix~with~last~col } }
5029     }
5030   }
5031   { \@@_fatal:n { too~much~cols~for~array } }
5032 }

```

The following command must *not* be protected since it's used in an error message.

```

5033 \cs_new:Npn \@@_message_hdotsfor:
5034 {
5035   \tl_if_empty:VF \g_@@_HVdotsfor_lines_tl
5036   { ~Maybe~your~use~of~\token_to_str:N \Hdotsfor\ is~incorrect.}
5037 }
5038 \@@_msg_new:nn { too~much~cols~for~matrix~with~last~col }
5039 {
5040   You~try~to~use~more~columns~than~allowed~by~your~
5041   \@@_full_name_env:.\@@_message_hdotsfor:\ The~maximal~number~of~
5042   columns~is~\int_eval:n { \l_@@_last_col_int - 1 }~(plus~the~
5043   exterior~columns).~This~error~is~fatal.
5044 }
5045 \@@_msg_new:nn { too~much~cols~for~matrix }
5046 {
5047   You~try~to~use~more~columns~than~allowed~by~your~
5048   \@@_full_name_env:.\@@_message_hdotsfor:\ Recall~that~the~maximal~
5049   number~of~columns~for~a~matrix~is~fixed~by~the~LaTeX~counter~
5050   'MaxMatrixCols'.~Its~actual~value~is~\int_use:N \c@MaxMatrixCols.~
5051   This~error~is~fatal.
5052 }

```

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`.

```

5053 \@@_msg_new:nn { too~much~cols~for~array }
5054 {
5055   You~try~to~use~more~columns~than~allowed~by~your~
5056   \@@_full_name_env:.\@@_message_hdotsfor:\ The~maximal~number~of~columns~is~
5057   \int_use:N \g_@@_static_num_of_col_int\
5058   ~(plus~the~potential~exterior~ones).~
5059   This~error~is~fatal.
5060 }
5061 \@@_msg_new:nn { last~col~not~used }
5062 {
5063   The~key~'last~col'~is~in~force~but~you~have~not~used~that~last~column~

```



```

5064     in~your~\@@_full_name_env:~.~However,~you~can~go~on.
5065 }
5066 \@@_msg_new:nn { columns~not~used }
5067 {
5068     The~preamble~of~your~\@@_full_name_env:\ announces~\int_use:N
5069     \g_@@_static_num_of_col_int\
5070     columns~but~you~use~only~\int_use:N \c@jCol.\
5071     However,~you~can~go~on.
5072 }
5073 \@@_msg_new:nn { in~first~col }
5074 {
5075     You~can't~use~the~command~\#1 in~the~first~column~(number~0)~of~the~array.\
5076     If~you~go~on,~this~command~will~be~ignored.
5077 }
5078 \@@_msg_new:nn { in~last~col }
5079 {
5080     You~can't~use~the~command~\#1 in~the~last~column~(exterior)~of~the~array.\
5081     If~you~go~on,~this~command~will~be~ignored.
5082 }
5083 \@@_msg_new:nn { in~first~row }
5084 {
5085     You~can't~use~the~command~\#1 in~the~first~row~(number~0)~of~the~array.\
5086     If~you~go~on,~this~command~will~be~ignored.
5087 }
5088 \@@_msg_new:nn { in~last~row }
5089 {
5090     You~can't~use~the~command~\#1 in~the~last~row~(exterior)~of~the~array.\
5091     If~you~go~on,~this~command~will~be~ignored.
5092 }
5093 \@@_msg_new:nn { bad~option~for~line~style }
5094 {
5095     Since~you~haven't~loaded~Tikz,~the~only~value~you~can~give~to~'line~style'~
5096     is~'standard'.~If~you~go~on,~this~option~will~be~ignored.
5097 }
5098 \@@_msg_new:nn { Unknown~option~for~xdots }
5099 {
5100     As~for~now~there~is~only~three~options~available~here:~'color',~'line~style'~
5101     and~'shorten'~(and~you~try~to~use~'\l_keys_key_tl').~If~you~go~on,~
5102     this~option~will~be~ignored.
5103 }
5104 \@@_msg_new:nn { Unknown~option~for~rowcolors }
5105 {
5106     As~for~now~there~is~only~one~option~available~here:~'respect~blocks'~
5107     (and~you~try~to~use~'\l_keys_key_tl').~If~you~go~on,~
5108     this~option~will~be~ignored.
5109 }
5110 \@@_msg_new:nn { Key~color~for~Block }
5111 {
5112     The~key~'color'~for~the~command~\token_to_str:N \Block\
5113     is~deprecated:~you~should~use~'fill'~instead.\
5114     You~can~go~on~for~this~time~but~remember~that~that~key~
5115     will~be~deleted~in~a~future~version.
5116 }
5117 \@@_msg_new:nn { ampersand~in~light~syntax }
5118 {
5119     You~can't~use~an~ampersand~(\token_to_str &)~to~separate~columns~because
5120     ~you~have~used~the~option~'light~syntax'.~This~error~is~fatal.
5121 }

```

```

5122 \@@_msg_new:nn { double-backslash-in~light-syntax }
5123 {
5124     You~can't~use~\token_to_str:N \~to~separate~rows~because~you~have~used~
5125     the~option~'light-syntax'.~You~must~use~the~character~'\l_@@_end_of_row_tl'~
5126     (set~by~the~option~'end-of-row').~This~error~is~fatal.
5127 }
5128 \@@_msg_new:nn { standard-cline-in~document }
5129 {
5130     The~key~'standard-cline'~is~available~only~in~the~preamble.\\
5131     If~you~go~on~this~command~will~be~ignored.
5132 }
5133 \@@_msg_new:nn { old~column~type }
5134 {
5135     The~column~type~'#1'~is~no~longer~defined~in~'nicematrix'.~
5136     Since~version~5.0,~you~have~to~use~'l',~'c'~and~'r'~instead~of~'L',~
5137     'C'~and~'R'.~You~can~also~use~the~key~'define-L-C-R'.\\
5138     This~error~is~fatal.
5139 }
5140 \@@_msg_new:nn { bad~value~for~baseline }
5141 {
5142     The~value~given~to~'baseline'~(\int_use:N \l_tmpa_int)~is~not~
5143     valid.~The~value~must~be~between~\int_use:N \l_@@_first_row_int\ and~
5144     \int_use:N \g_@@_row_total_int\ or~equal~to~'t',~'c'~or~'b'.\\
5145     If~you~go~on,~a~value~of~1~will~be~used.
5146 }
5147 \@@_msg_new:nn { empty~environment }
5148 { Your~\@@_full_name_env:\ is~empty.~This~error~is~fatal. }
5149 \@@_msg_new:nn { unknown~cell~for~line~in~code~after }
5150 {
5151     Your~command~\token_to_str:N\line\{#1\}\{#2\}~in~the~'code~after'~
5152     can't~be~executed~because~a~cell~doesn't~exist.\\
5153     If~you~go~on~this~command~will~be~ignored.
5154 }
5155 \@@_msg_new:nn { Hdotsfor~in~col-0 }
5156 {
5157     You~can't~use~\token_to_str:N \Hdotsfor\ in~an~exterior~column~of~
5158     the~array.~This~error~is~fatal.
5159 }
5160 \@@_msg_new:nn { bad~corner }
5161 {
5162     #1~is~an~incorrect~specification~for~a~corner~(in~the~keys~
5163     'except-corners'~and~'hvlines-except-corners').~The~available~
5164     values~are:~NW,~SW,~NE~and~SE.\\
5165     If~you~go~on,~this~specification~of~corner~will~be~ignored.
5166 }
5167 \@@_msg_new:nn { last-col~non-empty~for~NiceArray }
5168 {
5169     In~the~\@@_full_name_env:,~you~must~use~the~option~
5170     'last-col'~without~value.\\
5171     However,~you~can~go~on~for~this~time~
5172     (the~value~'\l_keys_value_tl'~will~be~ignored).
5173 }
5174 \@@_msg_new:nn { last-col~non-empty~for~NiceMatrixOptions }
5175 {
5176     In~\NiceMatrixoptions,~you~must~use~the~option~
5177     'last-col'~without~value.\\
5178     However,~you~can~go~on~for~this~time~
5179     (the~value~'\l_keys_value_tl'~will~be~ignored).
5180 }

```

```

5181 \@@_msg_new:nn { Block-too-large }
5182 {
5183   You~try~to~draw~a~block~in~the~cell~#1~#2~of~your~matrix~but~the~matrix~is~
5184   too~small~for~that~block. \\
5185 }
5186 \@@_msg_new:nn { unknown-column-type }
5187 {
5188   The~column~type~'#1'~in~your~\@@_full_name_env:\
5189   is~unknown. \\
5190   This~error~is~fatal.
5191 }
5192 \@@_msg_new:nn { tabularnote-forbidden }
5193 {
5194   You~can't~use~the~command~\token_to_str:N\tabularnote\
5195   ~in~a~\@@_full_name_env:~This~command~is~available~only~in~
5196   \{NiceTabular\},~\{NiceArray\}~and~\{NiceMatrix\}. \\
5197   If~you~go~on,~this~command~will~be~ignored.
5198 }
5199 \@@_msg_new:nn { bottomule~without~booktabs }
5200 {
5201   You~can't~use~the~option~'tabular/bottomrule'~because~you~haven't~
5202   loaded~'booktabs'. \\
5203   If~you~go~on,~this~option~will~be~ignored.
5204 }
5205 \@@_msg_new:nn { enumitem~not~loaded }
5206 {
5207   You~can't~use~the~command~\token_to_str:N\tabularnote\
5208   ~because~you~haven't~loaded~'enumitem'. \\
5209   If~you~go~on,~this~command~will~be~ignored.
5210 }
5211 \@@_msg_new:nn { Wrong~last~row }
5212 {
5213   You~have~used~'last-row=\int_use:N \l_@@_last_row_int'~but~your~
5214   \@@_full_name_env:\ seems~to~have~\int_use:N \c@iRow \ rows.~
5215   If~you~go~on,~the~value~of~\int_use:N \c@iRow \ will~be~used~for~
5216   last~row.~You~can~avoid~this~problem~by~using~'last-row'~
5217   without~value~(more~compilations~might~be~necessary).
5218 }
5219 \@@_msg_new:nn { Yet~in~env }
5220 { Environments~of~nicematrix~can't~be~nested.\\ This~error~is~fatal. }
5221 \@@_msg_new:nn { Outside~math~mode }
5222 {
5223   The~\@@_full_name_env:\ can~be~used~only~in~math~mode~
5224   (and~not~in~\token_to_str:N \vcenter). \\
5225   This~error~is~fatal.
5226 }
5227 \@@_msg_new:nn { Bad~value~for~letter~for~dotted~lines }
5228 {
5229   The~value~of~key~'\l_keys_key_tl'~must~be~of~length~1. \\
5230   If~you~go~on,~it~will~be~ignored.
5231 }
5232 \@@_msg_new:nnn { Unknown~key~for~Block }
5233 {
5234   The~key~'\l_keys_key_tl'~is~unknown~for~the~command~\token_to_str:N
5235   \Block.\\ If~you~go~on,~it~will~be~ignored. \\
5236   For~a~list~of~the~available~keys,~type~H<return>.
5237 }
5238 {
5239   The~available~options~are~(in~alphabetic~order):~,~,~c,~
5240   color,~l,~and~r.
5241 }

```

```

5242 \@@_msg_new:nnn { Unknown~key~for~notes }
5243 {
5244   The~key~'\l_keys_key_tl'~is~unknown.\\
5245   If~you~go~on,~it~will~be~ignored. \\
5246   For~a~list~of~the~available~keys~about~notes,~type~H~<return>.
5247 }
5248 {
5249   The~available~options~are~(in~alphabetic~order):~
5250   bottomrule,~
5251   code~after,~
5252   code~before,~
5253   enumitem~keys,~
5254   enumitem~keys~para,~
5255   para,~
5256   label~in~list,~
5257   label~in~tabular~and~
5258   style.
5259 }
5260 \@@_msg_new:nnn { Unknown~key~for~NiceMatrixOptions }
5261 {
5262   The~key~'\l_keys_key_tl'~is~unknown~for~the~command~
5263   \token_to_str:N \NiceMatrixOptions. \\
5264   If~you~go~on,~it~will~be~ignored. \\
5265   For~a~list~of~the~*principal*~available~keys,~type~H~<return>.
5266 }
5267 {
5268   The~available~options~are~(in~alphabetic~order):~
5269   allow~duplicate~names,~
5270   cell~space~bottom~limit,~
5271   cell~space~top~limit,~
5272   code~for~first~col,~
5273   code~for~first~row,~
5274   code~for~last~col,~
5275   code~for~last~row,~
5276   create~extra~nodes,~
5277   create~medium~nodes,~
5278   create~large~nodes,~
5279   delimiters~color,~
5280   end~of~row,~
5281   first~col,~
5282   first~row,~
5283   hlines,~
5284   hvlines,~
5285   hvlines~except~corners,~
5286   last~col,~
5287   last~row,~
5288   left~margin,~
5289   letter~for~dotted~lines,~
5290   light~syntax,~
5291   notes~(several~subkeys),~
5292   nullify~dots,~
5293   renew~dots,~
5294   renew~matrix,~
5295   right~margin,~
5296   small,~
5297   transparent,~
5298   vlines,~
5299   xdots/color,~
5300   xdots/shorten~and~
5301   xdots/line~style.
5302 }
5303 \@@_msg_new:nnn { Unknown~option~for~NiceArray }
5304 {

```

```

5305 The~option~'\l_keys_key_tl'~is~unknown~for~the~environment~
5306 \{NiceArray\}. \\
5307 If~you~go~on,~it~will~be~ignored. \\
5308 For~a~list~of~the~*principal*~available~options,~type~H~<return>.
5309 }
5310 {
5311 The~available~options~are~(in~alphabetic~order):~
5312 b,~
5313 baseline,~
5314 c,~
5315 cell-space-bottom-limit,~
5316 cell-space-top-limit,~
5317 code-after,~
5318 code-for-first-col,~
5319 code-for-first-row,~
5320 code-for-last-col,~
5321 code-for-last-row,~
5322 colortbl-like,~
5323 columns-width,~
5324 create-extra-nodes,~
5325 create-medium-nodes,~
5326 create-large-nodes,~
5327 delimiters-color,~
5328 extra-left-margin,~
5329 extra-right-margin,~
5330 first-col,~
5331 first-row,~
5332 hlines,~
5333 hvlines,~
5334 hvlines-except-corners,~
5335 last-col,~
5336 last-row,~
5337 left-margin,~
5338 light-syntax,~
5339 name,~
5340 notes/bottomrule,~
5341 notes/para,~
5342 nullify-dots,~
5343 renew-dots,~
5344 right-margin,~
5345 rules/color,~
5346 rules/width,~
5347 small,~
5348 t,~
5349 vl原因,~
5350 xdots/color,~
5351 xdots/shorten~and~
5352 xdots/line-style.
5353 }

```

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 options t, c and b).

```

5354 \@@_msg_new:nnn { Unknown~option~for~NiceMatrix }
5355 {
5356 The~option~'\l_keys_key_tl'~is~unknown~for~the~
5357 \@@_full_name_env:. \\
5358 If~you~go~on,~it~will~be~ignored. \\
5359 For~a~list~of~the~*principal*~available~options,~type~H~<return>.
5360 }
5361 {
5362 The~available~options~are~(in~alphabetic~order):~
5363 b,~
5364 baseline,~

```

```

5365 c,~
5366 cell-space-bottom-limit,~
5367 cell-space-top-limit,~
5368 code-after,~
5369 code-for-first-col,~
5370 code-for-first-row,~
5371 code-for-last-col,~
5372 code-for-last-row,~
5373 colortbl-like,~
5374 columns-width,~
5375 create-extra-nodes,~
5376 create-medium-nodes,~
5377 create-large-nodes,~
5378 delimiters-color,~
5379 extra-left-margin,~
5380 extra-right-margin,~
5381 first-col,~
5382 first-row,~
5383 hlines,~
5384 hvlines,~
5385 hvlines-except-corners,~
5386 l,~
5387 last-col,~
5388 last-row,~
5389 left-margin,~
5390 light-syntax,~
5391 name,~
5392 nullify-dots,~
5393 r,~
5394 renew-dots,~
5395 right-margin,~
5396 rules/color,~
5397 rules/width,~
5398 small,~
5399 t,~
5400 vlines,~
5401 xdots/color,~
5402 xdots/shorten-and~
5403 xdots/line-style.
5404 }

5405 \@@_msg_new:nnn { Unknown~option~for~NiceTabular }
5406 {
5407   The~option~'\l_keys_key_tl'~is~unknown~for~the~environment~
5408   \{NiceTabular\}. \\
5409   If~you~go~on,~it~will~be~ignored. \\
5410   For~a~list~of~the~*principal*~available~options,~type~H~<return>.
5411 }
5412 {
5413   The~available~options~are~(in~alphabetic~order):~
5414   b,~
5415   baseline,~
5416   c,~
5417   cell-space-bottom-limit,~
5418   cell-space-top-limit,~
5419   code-after,~
5420   code-for-first-col,~
5421   code-for-first-row,~
5422   code-for-last-col,~
5423   code-for-last-row,~
5424   colortbl-like,~
5425   columns-width,~
5426   create-extra-nodes,~
5427   create-medium-nodes,~

```

```

5428   create-large-nodes,~
5429   extra-left-margin,~
5430   extra-right-margin,~
5431   first-col,~
5432   first-row,~
5433   hlines,~
5434   hvlines,~
5435   hvlines-except-corners,~
5436   last-col,~
5437   last-row,~
5438   left-margin,~
5439   light-syntax,~
5440   name,~
5441   notes/bottomrule,~
5442   notes/para,~
5443   nullify-dots,~
5444   renew-dots,~
5445   right-margin,~
5446   rules/color,~
5447   rules/width,~
5448   t,~
5449   vlines,~
5450   xdots/color,~
5451   xdots/shorten-and~
5452   xdots/line-style.
5453 }

5454 \@@_msg_new:nnn { Duplicate-name }
5455 {
5456   The~name~'\l_keys_value_tl'~is~already~used~and~you~shouldn't~use~
5457   the~same~environment~name~twice.~You~can~go~on,~but,~
5458   maybe,~you~will~have~incorrect~results~especially~
5459   if~you~use~'columns-width=auto'.~If~you~don't~want~to~see~this~
5460   message~again,~use~the~option~'allow-duplicate-names'~in~
5461   '\token_to_str:N \NiceMatrixOptions'.\\
5462   For~a~list~of~the~names~already~used,~type~H~<return>. \\
5463 }
5464 {
5465   The~names~already~defined~in~this~document~are:~
5466   \seq_use:Nnnn \g_@@_names_seq { ,~ } { ,~ } { ~and~ }.
5467 }

5468 \@@_msg_new:nn { Option-auto-for-columns-width }
5469 {
5470   You~can't~give~the~value~'auto'~to~the~option~'columns-width'~here.~
5471   If~you~go~on,~the~option~will~be~ignored.
5472 }

```

18 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 StackExchange⁴⁹, Tikz externalization is now deactivated in the environments of the package `nicematrix`.⁵⁰

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`).

$$\begin{pmatrix} & C_j & \\ 0 & \vdots & 0 \\ & a & \cdots \\ 0 & & 0 \end{pmatrix} L_i$$

⁴⁹cf. tex.stackexchange.com/questions/450841/tikz-externalize-and-nicematrix-package

⁵⁰Before 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 2.1.3 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`).

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 StackExchange⁵¹, 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.

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.

⁵¹cf. tex.stackexchange.com/questions/510841/nicematrix-and-tikz-external-optimize

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 try 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 customization 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, row 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 `!\qqquad` 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` can take in as value 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`.

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<code>\CT@arc</code>	89, 90

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