

The package `nicematrix`*

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September 3, 2020

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.

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

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`, `xparse`, `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 5.3 of `nicematrix`, at the date of 2020/09/03.

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

New 5.2 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}
```

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

$$A = \begin{pmatrix} \frac{1}{A} & \frac{1}{B} & 0 & 0 \\ \frac{1}{C} & \frac{1}{D} & 0 & 0 \\ 0 & 0 & A & B \\ 0 & 0 & D & D \end{pmatrix}$$

4 The blocks

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` don't create space by itself.

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. The second argument is the content of the block.

In `{NiceTabular}` the content of the block is composed in text mode. In the other environments, it is composed in math mode.

```
\begin{NiceTabular}{cccc}
rose      & tulipe & marguerite & dahlia \\
violette  & \Block{2-2}{\LARGE\color{blue} fleurs} & & souci \\
pervenche & & lys \\
arum      & iris   & jacinthe  & muguet
\end{NiceTabular}
```

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

One should remark that the horizontal centering of the contents of the blocks is correct even when an instruction such as `!\qquad` 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!\qquadccc!\qquadccc@{}}
\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

New 5.3

It's possible to use with the command `\Block` the options `l`, `r` and `c` for the horizontal positionning.

It's also possible to use the command `\Block` in mathematical matrices.

```


$$\begin{array}{ccc|c} & & & 0 \\ & & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array}$$


```

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

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.

```


$$\begin{array}{ccc|c} & & & 0 \\ & & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array}$$


```

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

5 The rules

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

5.1 Some differences with the classical environments

5.1.1 The vertical rules

In the environments of `nicematrix`, the vertical rules specified by `|` in the preambles of the environments are never broken, even by an incomplete row or by a double horizontal rule specified by `\hline\hline` (there is no need to use `hhline`).²

```

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

```

First	Second
Peter	
Mary	George

New 5.2 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`.

```


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


```

<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`.

²This is the behaviour since the version 5.1 of `nicematrix`. Prior to that version, the behaviour was the standard behaviour of `array`.

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

However, in this case, it is probably more clever to add a command `\OnlyMainNiceMatrix` (cf. p. 32):

```
\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	<u>B</u>	C	D

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

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

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

5.2 The thickness and the color of the rules

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

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

With `nicematrix`, it’s possible to specify the color of the rules even when `colortbl` is not loaded. For sake of compatibility, the command is also named `\arrayrulecolor`. The environments of `nicematrix` also provide a key `rules/color` to fix the color of the rules in the current environment.

```
\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 32.

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).

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

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

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).

```
\setlength{\arrayrulewidth}{1pt}
\begin{NiceTabular}{cccc}[hvlines, rules/color=blue]
rose      & tulipe & marguerite & dahlia \\
violette  & \Block{2-2}{\LARGE\color{blue} 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.

New 5.2 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.³

```

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

```

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

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

5.7 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 rule⁴. In `nicematrix`, the dotted lines drawn by `\hdottedline` and “:” do likewise.

³The author of this document considers that type of construction as graphically poor.

⁴In fact, this is true only for `\hline` and “|” but not for `\cline`: cf p. 6

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.

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).

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

<i>a</i> ₁	<i>b</i> ₁	<i>c</i> ₁
<i>a</i> ₂	<i>b</i> ₂	<i>c</i> ₂
<i>a</i> ₃	<i>b</i> ₃	<i>c</i> ₃
<i>a</i> ₄	<i>b</i> ₄	<i>c</i> ₄
<i>a</i> ₅	<i>b</i> ₅	<i>c</i> ₅
<i>a</i> ₆	<i>b</i> ₆	<i>c</i> ₆
<i>a</i> ₇	<i>b</i> ₇	<i>c</i> ₇
<i>a</i> ₈	<i>b</i> ₈	<i>c</i> ₈
<i>a</i> ₉	<i>b</i> ₉	<i>c</i> ₉
<i>a</i> ₁₀	<i>b</i> ₁₀	<i>c</i> 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`⁵. 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

New 5.2 There is a key `respect-blocks` for the instruction `\rowcolors`. With that key, the “rows” alternately colored may extend over several row if they have to incorporate blocks.

⁵The command `\rowcolors` of `xcolor` is available when `xcolor` is loaded with the option `table`.

```

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

```

John	12
	13
Stephen	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. 25).

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

```

\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{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.⁶ 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;

⁶As of now, this key is not available in `\NiceMatrixOptions`.

- `\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 white color line in some PDF viewers⁷ (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

⁷For example SumatraPDF, which uses MuPDF of Artifex Software, or PDF.js used by Firefox.

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.⁸

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

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

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

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

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`⁹. The environment `{NiceMatrixBlock}` has no direct link with the command `\Block` presented previously in this document (cf. p. 4).

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

$$\begin{bmatrix} 9 & 17 \\ -2 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1245345 \\ 345 & 2 \end{bmatrix}$$

⁸The 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).

⁹At this time, this is the only usage of the environment `{NiceMatrixBlock}` but it may have other usages in the future.

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

```

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

The dotted lines have been drawn with the tools presented p. 15.

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. 27) 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}}
$\begin{pNiceArray}{cc|cc}[first-row,last-row=5,first-col,last-col,nullify-dots]
    & C_1 & & \Cdots & & & C_4 & & \\
L_1 & & a_{11} & a_{12} & a_{13} & a_{14} & & L_1 & \\
\vdots & & a_{21} & a_{22} & a_{23} & a_{24} & & \vdots & \\
\hline
    & & a_{31} & a_{32} & a_{33} & a_{34} & & & \\
L_4 & & a_{41} & a_{42} & a_{43} & a_{44} & & L_4 & \\
    & & C_1 & & \Cdots & & C_4 & & \\
\end{pNiceArray}$

```

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

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 32.
- 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. 13) 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`.¹⁰

Each of them must be used alone in the cell of the array and it draws a dotted line between the first non-empty cells¹¹ 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

¹⁰The 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`.

¹¹The precise definition of a “non-empty cell” is given below (cf. p. 33).

to change the color of these lines with the option `color`.¹²

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

$$\begin{bmatrix} a_1 & \cdots & & & a_1 \\ \vdots & a_2 & \cdots & & a_2 \\ & \vdots & \ddots[\textcolor{red}{color=red}] & & \\ \\ a_1 & a_2 & & & a_n \end{bmatrix}$$

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

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

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

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

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

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

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

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

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

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

There are also other means to change the size of the matrix. Someone might want to use the optional argument of the command `\\` for the vertical dimension and a command `\hspace*` in a cell for the horizontal dimension.¹³

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

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

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

¹²It's also possible to change the color of all theses dotted lines with the option `xdots/color` (`xdots` to remind that it works for `\Cdots`, `\Ldots`, `\Vdots`, etc.): cf. p. 19.

¹³In `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. 13.

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.

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

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

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).

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

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

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.

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

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

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}
```

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

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`.¹⁴

- The option `renew-dots`

With this option, the commands `\ldots`, `\cdots`, `\vdots`, `\ddots`, `\iddots`¹⁰ 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

¹⁴The 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.

nicematrix.

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

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

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. 20) 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 \\
& \Ddots^{n \text{ times}} & & \\
0 & & & 1
\end{bNiceMatrix}
```

$$\begin{bmatrix} 1 & & & 0 \\ \vdots & \ddots & & \\ 0 & & & 1 \end{bmatrix}$$

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. 20) 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. 14.

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).¹⁵

¹⁵The 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.

```
\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 & \\
\Vdots & & & & & & & b      \\
0      & \Cdots & & & 0      & b      & a      & \\
\end{pNiceMatrix}
```

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

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.¹⁶

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}
```

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

¹⁶There is also a key `code-before` described p. 9.

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`¹⁷. For an example, cf. p. 38.

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.

¹⁷In some circumstances, one must put `\omit \CodeAfter`. `\omit` is a keyword of TeX which cancels the pattern of the current cell.

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

^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.

- 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`).
- 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. 22. 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]
\toprule
Last name & First name & Length of life \\
\midrule
Churchill & Wiston & 91\\
Nightingale\tabularnote{Considered as the first nurse of
history.}\tabularnote{Nicknamed ``the Lady with the Lamp''.}
& Florence & 90 \\
Schoelcher & Victor & 89\tabularnote{The label of the note is overlapping.}\\
Touchet & Marie & 89 \\
Wallis & John & 87 \\
\bottomrule
\end{NiceTabular}
\end{table}

```

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 = 0pt`

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. 22).

- 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. 34.

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:


```
\makeatletter
\AtBeginEnvironment{threeparttable}
  {\TPT@hookin{NiceTabular}\TPT@hookin{NiceTabular*}}
\makeatother
```

The command `\AtBeginEnvironment` is a command of the package `etoolbox` which must have been loaded previously.

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

```

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

image of e_1 e_2 e_3

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 column¹⁸. Of course, the user must not change the value of these counters which are used internally by `nicematrix`.

In the `code-before` (cf. p. 9) and in the `code-after` (cf. p. 20), `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).

¹⁸We 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.

```

 $\begin{pNiceMatrix}$ % 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}

```

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

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.

The following example has been composed with XeLaTeX with `unicode-math`, which allows the use of greek letters directly in the TeX source.

```

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

```

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

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.¹⁹

¹⁹The 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 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.

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

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

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).

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.

```
$\begin{pNiceMatrix}[name=mymatrix]
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9
\end{pNiceMatrix}$
\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`.

In the `code-after`, and if Tikz is loaded, the things are easier. One may design the nodes with the form $i-j$: there is no need 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. 38).

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

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`.²⁰

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.

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

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.²¹

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

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`.²²

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

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

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

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

Here is an array composed with the following code:

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

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

²⁰There is also an option `create-extra-nodes` which is an alias for the conjunction of `create-medium-nodes` and `create-large-nodes`.

²¹There is no “large nodes” created in the exterior rows and columns (for these rows and columns, cf. p. 14).

²²The 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.

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`.

row-1	rose	tulipe	lys	
row-2	arum	iris	violette	
row-3	muguet	dahlia	souci	
row-4				
	col-1	col-2	col-3	col-4

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 public²³:

- **New 5.2** `\g_nicematrix_code_before_tl` ;
- `\g_nicematrix_code_after_tl`.

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

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

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

```
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 } }
    { #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

²³According 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.

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 job²⁴:

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

The heavy vertical rule won't extend in the exterior rows.²⁵

```
\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}$
```

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

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 lines²⁶ 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):

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

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

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

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

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

The same example without parallelization:

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

²⁴The command `\vrule` is a TeX (and not LaTeX) command.

²⁵Of course, such rule is defined by the classical technics of `nicematrix` and, for this reason, won't cross the double rules of `\hline\hline`.

²⁶We speak of the lines created by `\Ddots` and not the lines created by a command `\line` in `code-after`.

New 5.3 It's possible to specify the instruction `\Ddots` which will be drawn first (and which will be used to draw the other diagonal dotted line 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 cells 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 `&`). Indeed, a cell which only contains `\hspace*{1cm}` may be considered as empty.

For `nicematrix`, 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 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 idea²⁷. The environment `{matrix}` of `amsmath` and its variants (`{pmatrix}`, `{vmatrix}`, etc.) of `amsmath` prefer to delete these spaces with explicit instructions `\hspace -\arraycolsep`²⁸. 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).

15.5 Incompatibilities

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

²⁷In 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).*

²⁸And 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

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. 21.

Let's consider that we wish to number the notes of a tabular with stars.²⁹

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 ³⁰

```
\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}
```

²⁹Of course, it's realistic only when there is very few notes in the tabular.

³⁰In 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 polynomials:

```
\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 & & & \Ddots & \\
& & & a_p & & & & b_q \\
\end{vNiceArray}
```

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

An example for a linear system:

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

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

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}
```

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

16.5 How to highlight cells of the matrix

The following examples 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}
```

In order to highlight a cell of a matrix, it's possible to “draw” one of the correspondent nodes (the “normal node”, the “medium node” or the “large node”). In the following example, we use the “large nodes” of the diagonal of the matrix (with the Tikz key “`name suffix`”, it's easy to use the “large nodes”).

We redraw the nodes with other nodes by using the Tikz library `fit`. Since we want to redraw the nodes exactly, we have to set `inner sep = 0 pt` (if we don't do that, the new nodes will be larger than the nodes created by `nicematrix`).

```
$\begin{pNiceArray}{>{\strut}cccc}[create-large-nodes,margin,extra-margin = 2pt]
  a_{11} & a_{12} & a_{13} & a_{14} \\\
  a_{21} & a_{22} & a_{23} & a_{24} \\\
  a_{31} & a_{32} & a_{33} & a_{34} \\\
  a_{41} & a_{42} & a_{43} & a_{44} \\
\CodeAfter
  \begin{tikzpicture}[name suffix = -large,
    every node/.style = {draw,inner sep = 0 pt}]
    \node [fit = (1-1)] {};
    \node [fit = (2-2)] {};
    \node [fit = (3-3)] {};
    \node [fit = (4-4)] {};
  \end{tikzpicture}
\end{pNiceArray}$
```

$$\left(\begin{array}{cccc} \boxed{a_{11}} & a_{12} & a_{13} & a_{14} \\ a_{21} & \boxed{a_{22}} & a_{23} & a_{24} \\ a_{31} & a_{32} & \boxed{a_{33}} & a_{34} \\ a_{41} & a_{42} & a_{43} & \boxed{a_{44}} \end{array} \right)$$

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.³¹

³¹For the command `\cline`, see the remark p. 6.

It's possible to color a row with `\rowcolor` in the `code-before` (or with `\rowcolor` of `colortbl` in the first cell of the row). However, it's not possible to do a fine tuning. That's why we describe now 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`.

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

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

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

This code fails with `latex-dvips-ps2pdf` because Tikz for `dvips`, as for now, doesn't support blend modes. However, the following code, in the preamble, should activate blend modes in this way of compilation.

```
\ExplSyntaxOn
\makeatletter
\tl_set:Nn \l_tmpa_tl {pgfsys-dvips.def}
\tl_if_eq:NNT \l_tmpa_tl \pgfsysdriver
  {\cs_set:Npn \pgfsys@blend@mode#1{\special{ps:~/\tl_upper_case:n #1~.setblendmode}}}
\makeatother
\ExplSyntaxOff
```

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`.

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

$$\left(\begin{array}{ccc|c} \text{A} & & & 0 \\ & & & \vdots \\ & & & 0 \\ 0 & \cdots & 0 & 0 \end{array} \right)$$

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} \quad \quad
```

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}
```

$$L_i \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & & \vdots \\ a_{i1} & \dots & a_{in} \\ \vdots & & \vdots \\ a_{n1} & \dots & a_{nn} \end{bmatrix} \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} \begin{matrix} C_j \\ \begin{bmatrix} b_{11} & \dots & b_{1j} & \dots & b_{1n} \\ \vdots & & \vdots & & \vdots \\ & & b_{kj} & & \\ \vdots & & \vdots & & \vdots \\ b_{n1} & \dots & b_{nj} & \dots & b_{nn} \end{bmatrix} \end{matrix}$$

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` of `xparse`, 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_pgfulil@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_pgfulil@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`³²

```

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`).

³²See question 99041 on TeX StackExchange.

```

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:
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 } } }

157 \cs_new:Npn \@@_tab_or_array_colsep:
158 { \bool_if:NTF \l_@@_NiceTabular_bool \tabcolsep \arraycolsep }

```

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.

```

159 \bool_new:N \c_@@_siunitx_loaded_bool
160 \AtBeginDocument
161 {
162   \ifpackageloaded { siunitx }
163     { \bool_set_true:N \c_@@_siunitx_loaded_bool }
164     { }
165 }

```

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:`.

```

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

```

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

```

172   \cs_set_eq:NN \NC@find \prg_do_nothing:
173   \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`).

```

174   \tl_gset:NV \g_tmpa_tl \@temptokena
175   \group_end:
176   \tl_new:N \c_@@_table_collect_begin_tl
177   \tl_set:Nx \l_tmpa_tl { \tl_item:Nn \g_tmpa_tl 2 }
178   \tl_gset:Nx \c_@@_table_collect_begin_tl { \tl_item:Nn \l_tmpa_tl 1 }
179   \tl_new:N \c_@@_table_print_tl
180   \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).

```

181   \cs_gset_eq:NN \@@_adapt_S_column: \prg_do_nothing:
182   }
183 }

```

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

```

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

```

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

```

197       \@@_true_c:
198       < { \c_@@_table_print_tl \@@_end_Cell: }
199     }
200     \NC@find
201   }
202 }
203 }
204 }

```

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

```
205 \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.

```
206 \cs_new_protected:Npn \@@_provide_pgfsyspdfmark:
207 {
208   \iow_now:Nn \@mainaux
209   {
210     \ExplSyntaxOn
211     \cs_if_free:NT \pgfsyspdfmark
212     { \cs_set_eq:NN \pgfsyspdfmark \@gobblethree }
213     \ExplSyntaxOff
214   }
215   \cs_gset_eq:NN \@@_provide_pgfsyspdfmark: \prg_do_nothing:
216 }
```

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.

```
217 \bool_new:N \c_@@_define_L_C_R_bool
218 \cs_new_protected:Npn \@@_define_L_C_R:
219 {
220   \newcolumntype L l
221   \newcolumntype C c
222   \newcolumntype R r
223 }
```

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.

```
224 \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).

```
225 \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.

```
226 \NewExpandableDocumentCommand \NiceMatrixLastEnv { }
227 { \int_use:N \g_@@_env_int }
```

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

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

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

```
230 \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).

```
231 \dim_new:N \l_@@_columns_width_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`.

```
232 \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.

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

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

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

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

```
235 \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.

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

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

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

```
238 \cs_new_protected:Npn \@@_test_if_math_mode:
239 {
240   \if_mode_math: \else:
241     \@@_fatal:n { Outside~math~mode }
242   \fi:
243 }
```

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

```
244 \colorlet { nicematrix-last-col } { . }
245 \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`).

```
246 \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*.

```
247 \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.

```
248 \cs_new:Npn \@@_full_name_env:
249 {
250   \str_if_eq:VnTF \g_@@_com_or_env_str { command }
251     { command \space \c_backslash_str \g_@@_name_env_str }
252     { environment \space \{ \g_@@_name_env_str \} }
253 }
```

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

```
254 \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.

```
255 \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.

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

```
257 \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.

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

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).

```
259 \bool_new:N \g_@@_row_of_col_done_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`.

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

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

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

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

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

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

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

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

```
266 \dim_zero_new:N \l_tmpc_dim
```

```
267 \dim_zero_new:N \l_tmpd_dim
```

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

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

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

```
269 \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”.

```
270 \dim_new:N \g_@@_width_last_col_dim
271 \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.

```
272 \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}`.

```
273 \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}`.

```
274 \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).

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).

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

Used for the color of the blocks.

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

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

```
277 \tl_new:N \l_@@_pos_of_block_tl
278 \tl_set:Nn \l_@@_pos_of_block_tl { c }
```

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

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

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.

```
280 \int_new:N \l_@@_first_row_int
281 \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.

```
282 \int_new:N \l_@@_first_col_int
283 \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).

```
284 \int_new:N \l_@@_last_row_int
285 \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”.³³

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

Idem for `\l_@@_last_col_without_value_bool`

```
287 \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.

```
288 \int_new:N \l_@@_last_col_int
289 \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.

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

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

The command `\tablarnote`

The LaTeX counter `tablarnote` 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.

```
291 \newcounter { tablarnote }
```

³³We 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.

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

```
292 \seq_new:N \g_@@_tabularnotes_seq
```

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).

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

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

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

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

```
295 \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`.

```
296 \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`.

```
297 \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`).

```
298 \AtBeginDocument
299 {
300   \bool_if:nTF { ! \c_@@_enumitem_loaded_bool }
301   {
302     \NewDocumentCommand \tabularnote { m }
303     { \@@_error:n { enumitem-not-loaded } }
304   }
305   {
```

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.

```
306     \newlist { tabularnotes } { enumerate } { 1 }
307     \setlist [ tabularnotes ]
308     {
309       noitemsep , leftmargin = * , align = left , labelsep = Opt ,
310       label =
311       \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotesi } } ,
312     }
313     \newlist { tabularnotes* } { enumerate* } { 1 }
314     \setlist [ tabularnotes* ]
315     {
316       afterlabel = \nobreak ,
317       itemjoin = \quad ,
318       label =
319       \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotes*i } }
320     }
```

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.³⁴

```

321     \NewDocumentCommand \tabularnote { m }
322     {
323         \bool_if:nTF { ! \l_@@_NiceArray_bool && \l_@@_in_env_bool }
324         { \@@_error:n { tabularnote~forbidden } }
325         {

```

`\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).

```

326         \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`.

```

327         \seq_gput_right:Nx \g_@@_tabularnotes_seq { #1 }
328         \peek_meaning:NF \tabularnote
329         {

```

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.

```

330         \hbox_set:Nn \l_tmpa_box
331         {

```

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

```

332         \@@_notes_label_in_tabular:n
333         {
334             \stepcounter { tabularnote }
335             \@@_notes_style:n { tabularnote }
336             \prg_replicate:nn { \l_@@_number_of_notes_int - 1 }
337             {
338                 ,
339                 \stepcounter { tabularnote }
340                 \@@_notes_style:n { tabularnote }
341             }
342         }
343     }

```

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.

```

344         \addtocounter { tabularnote } { -1 }
345         \refstepcounter { tabularnote }
346         \int_zero:N \l_@@_number_of_notes_int
347         \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).

```

348         \skip_horizontal:n { \box_wd:N \l_tmpa_box }
349     }
350 }
351 }
352 }
353 }

```

³⁴We should try to find a solution to that problem.

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.

```

354 \cs_new_protected:Npn \@@_pgf_rect_node:nnnn #1 #2 #3 #4 #5
355 {
356   \begin { pgfscope }
357   \pgfset
358   {
359     outer~sep = \c_zero_dim ,
360     inner~sep = \c_zero_dim ,
361     minimum~size = \c_zero_dim
362   }
363   \pgftransformshift { \pgfpoint { 0.5 * ( #2 + #4 ) } { 0.5 * ( #3 + #5 ) } }
364   \pgfnode
365   { rectangle }
366   { center }
367   {
368     \vbox_to_ht:nn
369     { \dim_abs:n { #5 - #3 } }
370     {
371       \vfill
372       \hbox_to_wd:nn { \dim_abs:n { #4 - #2 } } { }
373     }
374   }
375   { #1 }
376   { }
377   \end { pgfscope }
378 }
```

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.

```

379 \cs_new_protected:Npn \@@_pgf_rect_node:nnn #1 #2 #3
380 {
381   \begin { pgfscope }
382   \pgfset
383   {
384     outer~sep = \c_zero_dim ,
385     inner~sep = \c_zero_dim ,
386     minimum~size = \c_zero_dim
387   }
388   \pgftransformshift { \pgfpointscale { 0.5 } { \pgfpointadd { #2 } { #3 } } }
389   \pgfpointdiff { #3 } { #2 }
390   \pgfgetlastxy \l_tmpa_dim \l_tmpb_dim
391   \pgfnode
392   { rectangle }
393   { center }
394   {
395     \vbox_to_ht:nn
396     { \dim_abs:n \l_tmpb_dim }
397     { \vfill \hbox_to_wd:nn { \dim_abs:n \l_tmpa_dim } { } }
398   }
399   { #1 }
400   { }
401   \end { pgfscope }
402 }
```

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.

```
403 \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`.

```
404 \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`).

```
405 \dim_new:N \l_@@_cell_space_top_limit_dim
406 \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.

```
407 \dim_new:N \l_@@_inter_dots_dim
408 \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).

```
409 \dim_new:N \l_@@_xdots_shorten_dim
410 \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.

```
411 \dim_new:N \l_@@_radius_dim
412 \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.

```
413 \tl_new:N \l_@@_xdots_line_style_tl
414 \tl_const:Nn \c_@@_standard_tl { standard }
415 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
```

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

```
416 \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).

```
417 \str_new:N \l_@@_baseline_str
418 \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`).

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


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

```
420 \bool_new:N \l_@@_parallelize_diags_bool
421 \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.

```
422 \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.

```
423 \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`.

```
424 \clist_new:N \l_@@_except_corners_clist
425 \dim_new:N \l_@@_notes_above_space_dim
426 \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.).

```
427 \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).

```
428 \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.

```
429 \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”.

```
430 \bool_new:N \l_@@_medium_nodes_bool
431 \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`).

```
432 \dim_new:N \l_@@_left_margin_dim
433 \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`.

```
434 \dim_new:N \l_@@_extra_left_margin_dim
435 \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.

```
436 \tl_new:N \l_@@_end_of_row_tl
437 \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 “:”.

```
438 \tl_new:N \l_@@_xdots_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 function 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.

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

```
440 \keys_define:nn { NiceMatrix / xdots }
441 {
442   line-style .code:n =
443   {
444     \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.

```
445     { \cs_if_exist_p:N \tikzpicture }
446     { \str_if_eq_p:nn { #1 } { standard } }
447     { \tl_set:Nn \l_@@_xdots_line_style_tl { #1 } }
448     { \@@_error:n { bad-option-for-line-style } }
449   } ,
450   line-style .value_required:n = true ,
451   color .tl_set:N = \l_@@_xdots_color_tl ,
452   color .value_required:n = true ,
453   shorten .dim_set:N = \l_@@_xdots_shorten_dim ,
454   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 `_`.

```
455   down .tl_set:N = \l_@@_xdots_down_tl ,
456   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).

```
457   draw-first .code:n = \prg_do_nothing: ,
458   unknown .code:n = \@@_error:n { Unknown-option-for-~xdots }
459 }
```

```
460 \keys_define:nn { NiceMatrix / rules }
461 {
462   color .tl_set:N = \l_@@_rules_color_tl ,
463   color .value_required:n = true ,
464   width .dim_set:N = \arrayrulewidth ,
465   width .value_required:n = true
466 }
```

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

```
467 \keys_define:nn { NiceMatrix / Global }
468 {
469   standard-cline .bool_set:N = \l_@@_standard_cline_bool ,
470   standard-cline .default:n = true ,
471   cell-space-top-limit .dim_set:N = \l_@@_cell_space_top_limit_dim ,
472   cell-space-top-limit .value_required:n = true ,
473   cell-space-bottom-limit .dim_set:N = \l_@@_cell_space_bottom_limit_dim ,
```

```

474 cell-space-bottom-limit .value_required:n = true ,
475 xdots .code:n = \keys_set:nn { NiceMatrix / xdots } { #1 } ,
476 max-delimiter-width .bool_set:N = \l_@@_max_delimiter_width_bool ,
477 light-syntax .bool_set:N = \l_@@_light_syntax_bool ,
478 light-syntax .default:n = true ,
479 end-of-row .tl_set:N = \l_@@_end_of_row_tl ,
480 end-of-row .value_required:n = true ,
481 first-col .code:n = \int_zero:N \l_@@_first_col_int ,
482 first-row .code:n = \int_zero:N \l_@@_first_row_int ,
483 last-row .int_set:N = \l_@@_last_row_int ,
484 last-row .default:n = -1 ,
485 code-for-first-col .tl_set:N = \l_@@_code_for_first_col_tl ,
486 code-for-first-col .value_required:n = true ,
487 code-for-last-col .tl_set:N = \l_@@_code_for_last_col_tl ,
488 code-for-last-col .value_required:n = true ,
489 code-for-first-row .tl_set:N = \l_@@_code_for_first_row_tl ,
490 code-for-first-row .value_required:n = true ,
491 code-for-last-row .tl_set:N = \l_@@_code_for_last_row_tl ,
492 code-for-last-row .value_required:n = true ,
493 hlines .bool_set:N = \l_@@_hlines_bool ,
494 vlines .bool_set:N = \l_@@_vlines_bool ,
495 hvlines .code:n =
496 {
497   \bool_set_true:N \l_@@_vlines_bool
498   \bool_set_true:N \l_@@_hlines_bool
499 } ,
500 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.

```

501 renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
502 renew-dots .value_forbidden:n = true ,
503 nullify-dots .bool_set:N = \l_@@_nullify_dots_bool ,
504 create-medium-nodes .bool_set:N = \l_@@_medium_nodes_bool ,
505 create-large-nodes .bool_set:N = \l_@@_large_nodes_bool ,
506 create-extra-nodes .meta:n =
507 { create-medium-nodes , create-large-nodes } ,
508 left-margin .dim_set:N = \l_@@_left_margin_dim ,
509 left-margin .default:n = \arraycolsep ,
510 right-margin .dim_set:N = \l_@@_right_margin_dim ,
511 right-margin .default:n = \arraycolsep ,
512 margin .meta:n = { left-margin = #1 , right-margin = #1 } ,
513 margin .default:n = \arraycolsep ,
514 extra-left-margin .dim_set:N = \l_@@_extra_left_margin_dim ,
515 extra-right-margin .dim_set:N = \l_@@_extra_right_margin_dim ,
516 extra-margin .meta:n =
517 { extra-left-margin = #1 , extra-right-margin = #1 } ,
518 extra-margin .value_required:n = true ,
519 }

```

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

```

520 \keys_define:nn { NiceMatrix / Env }
521 {
522   except-corners .clist_set:N = \l_@@_except_corners_clist ,
523   except-corners .default:n = { NW , SW , NE , SE } ,
524   hvlines-except-corners .code:n =
525   {
526     \clist_set:Nn \l_@@_except_corners_clist { #1 }
527     \bool_set_true:N \l_@@_vlines_bool
528     \bool_set_true:N \l_@@_hlines_bool
529   } ,

```

```

530 hvlines-except-corners .default:n = { NW , SW , NE , SE } ,
531 code-before .code:n =
532 {
533   \tl_if_empty:nF { #1 }
534   {
535     \tl_put_right:Nn \l_@@_code_before_tl { #1 }
536     \bool_set_true:N \l_@@_code_before_bool
537   }
538 } ,

```

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

```

539 c .code:n = \tl_set:Nn \l_@@_baseline_str c ,
540 t .code:n = \tl_set:Nn \l_@@_baseline_str t ,
541 b .code:n = \tl_set:Nn \l_@@_baseline_str b ,
542 baseline .tl_set:N = \l_@@_baseline_str ,
543 baseline .value_required:n = true ,
544 columns-width .code:n =
545   \tl_if_eq:nnTF { #1 } { auto }
546   { \bool_set_true:N \l_@@_auto_columns_width_bool }
547   { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,
548 columns-width .value_required:n = true ,
549 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.

```

550 \legacy_if:nF { measuring@ }
551 {
552   \str_set:Nn \l_tmpa_str { #1 }
553   \seq_if_in:NVTF \g_@@_names_seq \l_tmpa_str
554   { \@@_error:nn { Duplicate-name } { #1 } }
555   { \seq_gput_left:NV \g_@@_names_seq \l_tmpa_str }
556   \str_set_eq:NN \l_@@_name_str \l_tmpa_str
557 } ,
558 name .value_required:n = true ,
559 code-after .tl_gset:N = \g_nicematrix_code_after_tl ,
560 code-after .value_required:n = true ,
561 colortbl-like .code:n =
562   \bool_set_true:N \l_@@_colortbl_like_bool
563   \bool_set_true:N \l_@@_code_before_bool ,
564 colortbl-like .value_forbidden:n = true
565 }
566 \keys_define:nn { NiceMatrix / notes }
567 {
568   para .bool_set:N = \l_@@_notes_para_bool ,
569   para .default:n = true ,
570   code-before .tl_set:N = \l_@@_notes_code_before_tl ,
571   code-before .value_required:n = true ,
572   code-after .tl_set:N = \l_@@_notes_code_after_tl ,
573   code-after .value_required:n = true ,
574   bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
575   bottomrule .default:n = true ,
576   style .code:n = \cs_set:Nn \@@_notes_style:n { #1 } ,
577   style .value_required:n = true ,
578   label-in-tabular .code:n =
579     \cs_set:Nn \@@_notes_label_in_tabular:n { #1 } ,
580   label-in-tabular .value_required:n = true ,
581   label-in-list .code:n =
582     \cs_set:Nn \@@_notes_label_in_list:n { #1 } ,
583   label-in-list .value_required:n = true ,
584   enumitem-keys .code:n =
585     {
586       \bool_if:NTF \c_@@_in_preamble_bool

```

```

587     {
588         \AtBeginDocument
589         {
590             \bool_if:NT \c_@@_enumitem_loaded_bool
591             { \setlist* [ tabularnotes ] { #1 } }
592         }
593     }
594     {
595         \bool_if:NT \c_@@_enumitem_loaded_bool
596         { \setlist* [ tabularnotes ] { #1 } }
597     }
598 },
599 enumitem-keys .value_required:n = true ,
600 enumitem-keys-para .code:n =
601 {
602     \bool_if:NTF \c_@@_in_preamble_bool
603     {
604         \AtBeginDocument
605         {
606             \bool_if:NT \c_@@_enumitem_loaded_bool
607             { \setlist* [ tabularnotes* ] { #1 } }
608         }
609     }
610     {
611         \bool_if:NT \c_@@_enumitem_loaded_bool
612         { \setlist* [ tabularnotes* ] { #1 } }
613     }
614 },
615 enumitem-keys-para .value_required:n = true ,
616 unknown .code:n = \@_error:n { Unknown-key-for-notes }
617 }

```

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

```

618 \keys_define:nn { NiceMatrix }
619 {
620     NiceMatrixOptions .inherit:n =
621     { NiceMatrix / Global } ,
622     NiceMatrixOptions / xdots .inherit:n = NiceMatrix / xdots ,
623     NiceMatrixOptions / rules .inherit:n = NiceMatrix / rules ,
624     NiceMatrixOptions / notes .inherit:n = NiceMatrix / notes ,
625     NiceMatrix .inherit:n =
626     {
627         NiceMatrix / Global ,
628         NiceMatrix / Env ,
629     } ,
630     NiceMatrix / xdots .inherit:n = NiceMatrix / xdots ,
631     NiceMatrix / rules .inherit:n = NiceMatrix / rules ,
632     NiceTabular .inherit:n =
633     {
634         NiceMatrix / Global ,
635         NiceMatrix / Env
636     } ,
637     NiceTabular / xdots .inherit:n = NiceMatrix / xdots ,
638     NiceTabular / rules .inherit:n = NiceMatrix / rules ,
639     NiceArray .inherit:n =
640     {
641         NiceMatrix / Global ,
642         NiceMatrix / Env ,
643     } ,
644     NiceArray / xdots .inherit:n = NiceMatrix / xdots ,
645     NiceArray / rules .inherit:n = NiceMatrix / rules ,
646     pNiceArray .inherit:n =

```

```

647     {
648         NiceMatrix / Global ,
649         NiceMatrix / Env ,
650     } ,
651     pNiceArray / xdots .inherit:n = NiceMatrix / xdots ,
652     pNiceArray / rules .inherit:n = NiceMatrix / rules ,
653 }

```

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

```

654 \keys_define:nn { NiceMatrix / NiceMatrixOptions }
655 {
656     last-col .code:n = \tl_if_empty:nF { #1 }
657                 { \@@_error:n { last-col~non-empty~for~NiceMatrixOptions } }
658                 \int_zero:N \l_@@_last_col_int ,
659     small .bool_set:N = \l_@@_small_bool ,
660     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.

```

661     renew-matrix .code:n = \@@_renew_matrix: ,
662     renew-matrix .value_forbidden:n = true ,

```

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

```

663     transparent .meta:n = { renew-dots , renew-matrix } ,
664     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}`.

```

665     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.

```

666     columns-width .code:n =
667         \tl_if_eq:nnTF { #1 } { auto }
668         { \@@_error:n { Option~auto~for~columns-width } }
669         { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,

```

Usually, an error is raised when the user tries to give the same name to two distincts environments of `nicematrix` (theses names are global and not local to the current TeX scope). However, the option `allow-duplicate-names` disables this feature.

```

670     allow-duplicate-names .code:n =
671         \@@_msg_redirect_name:nn { Duplicate-name } { none } ,
672     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`).

```

673     letter-for-dotted-lines .code:n =
674     {
675         \tl_if_single_token:nTF { #1 }
676         { \str_set:Nx \l_@@_letter_for_dotted_lines_str { #1 } }
677         { \@@_error:n { Bad-value-for-letter-for-dotted-lines } }
678     } ,
679     letter-for-dotted-lines .value_required:n = true ,
680     notes .code:n = \keys_set:nn { NiceMatrix / notes } { #1 } ,
681     notes .value_required:n = true ,
682     unknown .code:n = \@@_error:n { Unknown~key~for~NiceMatrixOptions }
683 }

```

```

684 \str_new:N \l_@@_letter_for_dotted_lines_str
685 \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.

```

686 \NewDocumentCommand \NiceMatrixOptions { m }
687 { \keys_set:nn { NiceMatrix / NiceMatrixOptions } { #1 } }

```

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

```

688 \keys_define:nn { NiceMatrix / NiceMatrix }
689 {
690   last-col .code:n = \tl_if_empty:nTF {#1}
691     {
692       \bool_set_true:N \l_@@_last_col_without_value_bool
693       \int_set:Nn \l_@@_last_col_int { -1 }
694     }
695     { \int_set:Nn \l_@@_last_col_int { #1 } } ,
696   l .code:n = \tl_set:Nn \l_@@_type_of_col_tl l ,
697   r .code:n = \tl_set:Nn \l_@@_type_of_col_tl r ,
698   small .bool_set:N = \l_@@_small_bool ,
699   small .value_forbidden:n = true ,
700   unknown .code:n = \@@_error:n { Unknown~option~for~NiceMatrix }
701 }

```

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

```

702 \keys_define:nn { NiceMatrix / NiceArray }
703 {

```

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.

```

704   small .bool_set:N = \l_@@_small_bool ,
705   small .value_forbidden:n = true ,
706   last-col .code:n = \tl_if_empty:nF { #1 }
707     { \@@_error:n { last-col~non-empty~for~NiceArray } }
708     \int_zero:N \l_@@_last_col_int ,
709   notes / para .bool_set:N = \l_@@_notes_para_bool ,
710   notes / para .default:n = true ,
711   notes / bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
712   notes / bottomrule .default:n = true ,
713   unknown .code:n = \@@_error:n { Unknown~option~for~NiceArray }
714 }
715 \keys_define:nn { NiceMatrix / pNiceArray }
716 {
717   first-col .code:n = \int_zero:N \l_@@_first_col_int ,
718   last-col .code:n = \tl_if_empty:nF {#1}
719     { \@@_error:n { last-col~non-empty~for~NiceArray } }
720     \int_zero:N \l_@@_last_col_int ,
721   first-row .code:n = \int_zero:N \l_@@_first_row_int ,
722   small .bool_set:N = \l_@@_small_bool ,
723   small .value_forbidden:n = true ,
724   unknown .code:n = \@@_error:n { Unknown~option~for~NiceMatrix }
725 }

```

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

```

726 \keys_define:nn { NiceMatrix / NiceTabular }
727 {

```

```

728 notes / para .bool_set:N = \l_@@_notes_para_bool ,
729 notes / para .default:n = true ,
730 notes / bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
731 notes / bottomrule .default:n = true ,
732 last-col .code:n = \tl_if_empty:nF {#1}
733 { \@@_error:n { last-col~non-empty~for~NiceArray } }
734 \int_zero:N \l_@@_last_col_int ,
735 unknown .code:n = \@@_error:n { Unknown~option~for~NiceTabular }
736 }

```

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}`).

```

737 \cs_new_protected:Npn \@@_Cell:
738 {

```

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

```

739 \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.

```

740 \int_compare:nNnT \c@jCol = 1
741 { \int_compare:nNnT \l_@@_first_col_int = 1 \@@_begin_of_row: }
742 \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).

```

743 \hbox_set:Nw \l_@@_cell_box
744 \bool_if:NF \l_@@_NiceTabular_bool
745 {
746   \c_math_toggle_token
747   \bool_if:NT \l_@@_small_bool \scriptstyle
748 }

```

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.

```

749 \int_compare:nNnTF \c@iRow = 0
750 {
751   \int_compare:nNnT \c@jCol > 0
752   {
753     \l_@@_code_for_first_row_tl
754     \xglobal \colorlet { nicematrix-first-row } { . }
755   }
756 }
757 {
758   \int_compare:nNnT \c@iRow = \l_@@_last_row_int
759   {
760     \l_@@_code_for_last_row_tl
761     \xglobal \colorlet { nicematrix-last-row } { . }
762   }
763 }
764 }

```

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.


```

765 \cs_new_protected:Npn \@@_begin_of_row:
766 {
767   \int_gincr:N \c@iRow
768   \dim_gset_eq:NN \g_@@_dp_ante_last_row_dim \g_@@_dp_last_row_dim
769   \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \@arstrutbox }
770   \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
771   \pgfpicture
772   \pgfrememberpicturerepositiononpagetrue
773   \pgfcoordinate
774   { \@@_env: - row - \int_use:N \c@iRow - base }
775   { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
776   \str_if_empty:NF \l_@@_name_str
777   {
778     \pgfnodealias
779     { \l_@@_name_str - row - \int_use:N \c@iRow - base }
780     { \@@_env: - row - \int_use:N \c@iRow - base }
781   }
782   \endpgfpicture
783 }

```

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.

```

784 \cs_new_protected:Npn \@@_update_for_first_and_last_row:
785 {
786   \int_compare:nNnTF \c@iRow = 0
787   {
788     \dim_gset:Nn \g_@@_dp_row_zero_dim
789     { \dim_max:nn \g_@@_dp_row_zero_dim { \box_dp:N \l_@@_cell_box } }
790     \dim_gset:Nn \g_@@_ht_row_zero_dim
791     { \dim_max:nn \g_@@_ht_row_zero_dim { \box_ht:N \l_@@_cell_box } }
792   }
793   {
794     \int_compare:nNnT \c@iRow = 1
795     {
796       \dim_gset:Nn \g_@@_ht_row_one_dim
797       { \dim_max:nn \g_@@_ht_row_one_dim { \box_ht:N \l_@@_cell_box } }
798     }
799   }
800 }

801 \cs_new_protected:Npn \@@_end_Cell:
802 {
803   \@@_math_toggle_token:
804   \hbox_set_end:
805   \box_set_ht:Nn \l_@@_cell_box
806   { \box_ht:N \l_@@_cell_box + \l_@@_cell_space_top_limit_dim }
807   \box_set_dp:Nn \l_@@_cell_box
808   { \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”).

```

809   \dim_gset:Nn \g_@@_max_cell_width_dim
810   { \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”.

```

811   \@@_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.

```

812 \bool_if:NTF \g_@@_empty_cell_bool
813 { \box_use_drop:N \l_@@_cell_box }
814 {
815   \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \c_zero_dim
816     \@@_node_for_the_cell:
817     { \box_use_drop:N \l_@@_cell_box }
818   }
819 \bool_gset_false:N \g_@@_empty_cell_bool
820 }

```

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

```

821 \cs_new_protected:Npn \@@_node_for_the_cell:
822 {
823   \pgfpicture
824   \pgfsetbaseline \c_zero_dim
825   \pgfrememberpicturepositiononpagetrue
826   \pgfset
827   {
828     inner~sep = \c_zero_dim ,
829     minimum~width = \c_zero_dim
830   }
831   \pgfnode
832   { rectangle }
833   { base }
834   { \box_use_drop:N \l_@@_cell_box }
835   { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
836   { }
837   \str_if_empty:NF \l_@@_name_str
838   {
839     \pgfnodealias
840     { \l_@@_name_str - \int_use:N \c@iRow - \int_use:N \c@jCol }
841     { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
842   }
843   \endpgfpicture
844 }

```

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.

```

845 \cs_new_protected:Npn \@@_instruction_of_type:nnn #1 #2 #3
846 {

```

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).

```

847 \bool_if:NTF { #1 } \tl_gput_left:cx \tl_gput_right:cx
848 { g_@@_ #2 _ lines _ tl }
849 {
850   \use:c { @@ _ draw _ #2 : nnn }
851   { \int_use:N \c@iRow }
852   { \int_use:N \c@jCol }
853   { \exp_not:n { #3 } }
854 }
855 }

```

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`.

```

856 \cs_new_protected:Npn \@@_revtex_array:
857 {
858   \cs_set_eq:NN \@acoll \@arrayacol
859   \cs_set_eq:NN \@acolr \@arrayacol
860   \cs_set_eq:NN \@acol \@arrayacol
861   \cs_set_nopar:Npn \@halignto { }
862   \@array@array
863 }
864 \cs_new_protected:Npn \@@_array:
865 {
866   \bool_if:NTF \c_@@_revtex_bool
867   \@@_revtex_array:
868   {
869     \bool_if:NTF \l_@@_NiceTabular_bool
870     { \dim_set_eq:NN \col@sep \tabcolsep }
871     { \dim_set_eq:NN \col@sep \arraycolsep }
872     \dim_compare:nNnTF \l_@@_tabular_width_dim = \c_zero_dim
873     { \cs_set_nopar:Npn \@halignto { } }
874     { \cs_set_nopar:Npx \@halignto { to \dim_use:N \l_@@_tabular_width_dim } }

```

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

```

875   \@tabarray
876 }

```

`\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.

```

877 [ \str_if_eq:VnTF \l_@@_baseline_str c c t ]
878 }

```

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.

```

879 \cs_set_eq:NN \@@_old_ialign: \ialign

```

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

```

880 \cs_new_protected:Npn \@@_create_row_node:
881 {

```

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

```

882   \hbox
883   {
884     \bool_if:NT \l_@@_code_before_bool
885     {
886       \vtop
887       {
888         \skip_vertical:N 0.5\arrayrulewidth
889         \pgfsys@markposition { \@@_env: - row - \@@_succ:n \c@iRow }
890         \skip_vertical:N -0.5\arrayrulewidth
891       }
892     }
893     \pgfpicture
894     \pgfrememberpicturerepositiononpagetrue
895     \pgfcoordinate { \@@_env: - row - \@@_succ:n \c@iRow }
896     { \pgfpoint \c_zero_dim { - 0.5 \arrayrulewidth } }
897     \str_if_empty:NF \l_@@_name_str
898     {
899       \pgfnodealias
900       { \l_@@_name_str - row - \int_use:N \c@iRow }
901       { \@@_env: - row - \int_use:N \c@iRow }
902     }
903     \endpgfpicture
904   }
905 }

```

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

```

906 \cs_new:Npn \@@_everycr: { \noalign { \@@_everycr_i: } }
907 \cs_new_protected:Npn \@@_everycr_i:
908 {
909   \int_gzero:N \c@jCol
910   \bool_if:NF \g_@@_row_of_col_done_bool
911   {
912     \@@_create_row_node:

```

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

```

913   \bool_if:NT \l_@@_hlines_bool
914   {

```

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.

```

915     \int_compare:nNnT \c@iRow > { -1 }
916     {
917       \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@`.

```

918       { \hrule height \arrayrulewidth width \c_zero_dim }
919     }
920   }
921 }
922 }

```

The command `\@@_newcolumnntype` is the command `\newcolumnntype` of `array` without the warnings for redefinitions of columns types (we will use it to redefine the columns types `w` and `W`).

```

923 \cs_set_protected:Npn \@@_newcolumnntype #1
924 {
925   \cs_set:cpn { NC @ find @ #1 } ##1 #1 { \NC@ { ##1 } }
926   \peek_meaning:NTF [
927     { \newcol@ #1 }

```

```

928     { \newcol@ #1 [ 0 ] }
929 }

```

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

```

930 \cs_set_protected:Npn \@@_renew_dots:
931 {
932   \cs_set_eq:NN \ldots \@@_Ldots
933   \cs_set_eq:NN \cdots \@@_Cdots
934   \cs_set_eq:NN \vdots \@@_Vdots
935   \cs_set_eq:NN \ddots \@@_Ddots
936   \cs_set_eq:NN \iddots \@@_Iddots
937   \cs_set_eq:NN \dots \@@_Ldots
938   \cs_set_eq:NN \hdotsfor \@@_Hdotsfor:
939 }

```

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

```

940 \cs_new_protected:Npn \@@_colortbl_like:
941 {
942   \cs_set_eq:NN \cellcolor \@@_cellcolor_tabular
943   \cs_set_eq:NN \rowcolor \@@_rowcolor_tabular
944   \cs_set_eq:NN \columncolor \@@_columncolor_preamble
945 }

```

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

```

946 \cs_new_protected:Npn \@@_pre_array:
947 {

```

If `booktabs` is loaded, we have to patch the macro `\@BTnormal` which is a macro of `booktabs`. The macro `\@BTnormal` draws an horizontal rule but it occurs after a vertical skip done by a low level TeX command. When this macro `\@BTnormal` occurs, the `row` node has yet been inserted by `nicematrix` *before* the vertical skip (and thus, at a wrong place). That why we decide to create a new `row` node (for the same row). We patch the macro `\@BTnormal` to create this `row` node. This new `row` node will overwrite the previous definition of that `row` node and we have managed to avoid the error messages of that redefinition ³⁵.

```

948   \bool_if:NT \c_@@_booktabs_loaded_bool
949     { \tl_put_left:Nn \@BTnormal \@@_create_row_node: }
950   \box_clear_new:N \l_@@_cell_box
951   \cs_if_exist:NT \theiRow
952     { \int_set_eq:NN \l_@@_old_iRow_int \c@iRow }
953   \int_gzero_new:N \c@iRow
954   \cs_if_exist:NT \thejCol
955     { \int_set_eq:NN \l_@@_old_jCol_int \c@jCol }
956   \int_gzero_new:N \c@jCol
957   \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}`).

```

958   \bool_if:NT \l_@@_small_bool
959     {
960       \cs_set_nopar:Npn \arraystretch { 0.47 }
961       \dim_set:Nn \arraycolsep { 1.45 pt }
962     }

```

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`.

³⁵cf. `\nicematrix@redefine@check@rerun`

```

963 \cs_set_nopar:Npn \ialign
964 {
965   \bool_if:NTF \c_@@_colortbl_loaded_bool
966   {
967     \CT@everycr
968     {
969       \noalign { \cs_gset_eq:NN \CT@row@color \prg_do_nothing: }
970       \@@_everycr:
971     }
972   }
973   { \everycr { \@@_everycr: } }
974   \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`³⁶ 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`.

```

975   \dim_gzero_new:N \g_@@_dp_row_zero_dim
976   \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \@arstrutbox }
977   \dim_gzero_new:N \g_@@_ht_row_zero_dim
978   \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \@arstrutbox }
979   \dim_gzero_new:N \g_@@_ht_row_one_dim
980   \dim_gset:Nn \g_@@_ht_row_one_dim { \box_ht:N \@arstrutbox }
981   \dim_gzero_new:N \g_@@_dp_ante_last_row_dim
982   \dim_gzero_new:N \g_@@_ht_last_row_dim
983   \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
984   \dim_gzero_new:N \g_@@_dp_last_row_dim
985   \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`.

```

986   \cs_set_eq:NN \ialign \@@_old_ialign:
987   \halign
988   }

```

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).

```

989   \cs_set_eq:NN \@@_old_ldots \ldots
990   \cs_set_eq:NN \@@_old_cdots \cdots
991   \cs_set_eq:NN \@@_old_vdots \vdots
992   \cs_set_eq:NN \@@_old_ddots \ddots
993   \cs_set_eq:NN \@@_old_iddots \iddots
994   \bool_if:NTF \l_@@_standard_cline_bool
995   { \cs_set_eq:NN \cline \@@_standard_cline }
996   { \cs_set_eq:NN \cline \@@_cline }
997   \cs_set_eq:NN \Ldots \@@_Ldots
998   \cs_set_eq:NN \Cdots \@@_Cdots
999   \cs_set_eq:NN \Vdots \@@_Vdots
1000  \cs_set_eq:NN \Ddots \@@_Ddots
1001  \cs_set_eq:NN \Iddots \@@_Iddots
1002  \cs_set_eq:NN \hdottedline \@@_hdottedline:
1003  \cs_set_eq:NN \Hline \@@_Hline:
1004  \cs_set_eq:NN \Hspace \@@_Hspace:
1005  \cs_set_eq:NN \Hdotsfor \@@_Hdotsfor:
1006  \cs_set_eq:NN \Vdotsfor \@@_Vdotsfor:
1007  \cs_set_eq:NN \multicolumn \@@_multicolumn:nnn
1008  \cs_set_eq:NN \Block \@@_Block:
1009  \cs_set_eq:NN \rotate \@@_rotate:
1010  \cs_set_eq:NN \OnlyMainNiceMatrix \@@_OnlyMainNiceMatrix:n

```

³⁶The option `small` of `nicematrix` changes (among other) the value of `\arraystretch`. This is done, of course, before the call of `{array}`.

```

1011 \cs_set_eq:NN \dotfill \@@_old_dotfill:
1012 \cs_set_eq:NN \CodeAfter \@@_CodeAfter:n
1013 \cs_set_eq:NN \diagbox \@@_diagbox:nn
1014 \bool_if:NT \l_@@_colortbl_like_bool \@@_colortbl_like:
1015 \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).

```

1016 \seq_gclear_new:N \g_@@_multicolumn_cells_seq
1017 \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).

```

1018 \int_gset:Nn \c@iRow { \l_@@_first_row_int - 1 }

```

At the end of the environment `{array}`, `\c@iRow` will be the total number de rows.

`\g_@@_row_total_int` will be the number or rows excepted the last row (if `\l_@@_last_row_bool` has been raised with the option `last-row`).

```

1019 \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.

```

1020 \int_gzero_new:N \g_@@_col_total_int
1021 \cs_set_eq:NN \@ifnextchar \new@ifnextchar
1022 \@@_renew_NC@rewrite@S:
1023 \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.

```

1024 \tl_gclear_new:N \g_@@_Cdots_lines_tl
1025 \tl_gclear_new:N \g_@@_Ldots_lines_tl
1026 \tl_gclear_new:N \g_@@_Vdots_lines_tl
1027 \tl_gclear_new:N \g_@@_Ddots_lines_tl
1028 \tl_gclear_new:N \g_@@_Iddots_lines_tl
1029 \tl_gclear_new:N \g_@@_HVDotsfor_lines_tl

1030 \tl_gclear_new:N \g_nicematrix_code_before_tl
1031 }

```

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

The environment `{NiceArrayWithDelims}`

```

1032 \NewDocumentEnvironment { NiceArrayWithDelims } { m m O { } m ! O { } }
1033 {
1034 \@@_provide_pgfsyspdfmark:
1035 \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.

```

1036 \bgroup
1037 \tl_set:Nn \l_@@_left_delim_tl { #1 }
1038 \tl_set:Nn \l_@@_right_delim_tl { #2 }
1039 \dim_zero:N \g_@@_width_last_col_dim
1040 \dim_zero:N \g_@@_width_first_col_dim
1041 \bool_gset_false:N \g_@@_row_of_col_done_bool
1042 \str_if_empty:NT \g_@@_name_env_str
1043 { \str_gset:Nn \g_@@_name_env_str { NiceArrayWithDelims } }
1044 \@@_adapt_S_column:

```

```

1045 \bool_if:NTF \l_@@_NiceTabular_bool
1046 \mode_leave_vertical:
1047 \@@_test_if_math_mode:
1048 \bool_if:NT \l_@@_in_env_bool { \@@_fatal:n { Yet~in~env } }
1049 \bool_set_true:N \l_@@_in_env_bool

```

The command `\CT@arc@` contains the instruction of color for the rules of the array³⁷. 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.

```

1050 \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).

```

1051 \cs_if_exist:NT \tikz@library@external@loaded
1052 {
1053 \tikzset { external / export = false }
1054 \cs_if_exist:NT \ifstandalone
1055 { \tikzset { external / optimize = false } }
1056 }

```

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

```

1057 \int_gincr:N \g_@@_env_int
1058 \bool_if:NF \l_@@_block_auto_columns_width_bool
1059 { \dim_gzero_new:N \g_@@_max_cell_width_dim }

```

The sequence `\g_@@_blocks_seq` will contain the carateristics of the blocks (specified by `\Block`) of the array. The sequence `\g_@@_pos_of_blocks_seq` will contain only the position of the blocks. Of course, this is redundant but it's for efficiency.

```

1060 \seq_gclear:N \g_@@_blocks_seq
1061 \seq_gclear:N \g_@@_pos_of_blocks_seq
1062 \seq_gclear:N \g_@@_pos_of_xdots_seq

```

In fact, the sequence `\g_@@_pos_of_blocks_seq` will also contain the positions of the cells with a `\diagbox`.

```

1063 \tl_if_exist:cT { g_@@_code_before_ \int_use:N \g_@@_env_int _ tl }
1064 {
1065 \bool_set_true:N \l_@@_code_before_bool
1066 \exp_args:NNv \tl_put_right:Nn \l_@@_code_before_tl
1067 { g_@@_code_before_ \int_use:N \g_@@_env_int _ tl }
1068 }

```

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`.

```

1069 \bool_if:NTF \l_@@_NiceArray_bool
1070 { \keys_set:nn { NiceMatrix / NiceArray } }
1071 { \keys_set:nn { NiceMatrix / pNiceArray } }
1072 { #3 , #5 }

1073 \tl_if_empty:NF \l_@@_rules_color_tl
1074 { \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.

```

1075 \bool_if:NT \l_@@_code_before_bool
1076 {
1077 \seq_if_exist:cT { @@_size_ \int_use:N \g_@@_env_int _ seq }
1078 {

```

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).

³⁷e.g. `\color[rgb]{0.5,0.5,0}`


```

1079 \int_zero_new:N \c@iRow
1080 \int_set:Nn \c@iRow
1081 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 2 }
1082 \int_zero_new:N \c@jCol
1083 \int_set:Nn \c@jCol
1084 { \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.

```

1085 \int_compare:nNnF \l_@@_last_row_int = { -2 }
1086 { \int_decr:N \c@iRow }
1087 \int_compare:nNnF \l_@@_last_col_int = { -2 }
1088 { \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.

```

1089 \pgfsys@markposition { \@@_env: - position }
1090 \pgfsys@getposition { \@@_env: - position } \@@_picture_position:
1091 \pgfpicture

```

First, the creation of the `row` nodes.

```

1092 \int_step_inline:nnn
1093 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 1 }
1094 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 2 + 1 }
1095 {
1096   \pgfsys@getposition { \@@_env: - row - ##1 } \@@_node_position:
1097   \pgfcoordinate { \@@_env: - row - ##1 }
1098   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1099 }

```

Now, the creation of the `col` nodes.

```

1100 \int_step_inline:nnn
1101 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 3 }
1102 { \seq_item:cn { @@_size_ \int_use:N \g_@@_env_int _ seq } 4 + 1 }
1103 {
1104   \pgfsys@getposition { \@@_env: - col - ##1 } \@@_node_position:
1105   \pgfcoordinate { \@@_env: - col - ##1 }
1106   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1107 }
1108 \endpgfpicture
1109 \group_begin:
1110 \bool_if:NT \c_@@_tikz_loaded_bool
1111 {
1112   \tikzset
1113   {
1114     every~picture / .style =
1115     { overlay , name~prefix = \@@_env: - }
1116   }
1117 }
1118 \cs_set_eq:NN \cellcolor \@@_cellcolor
1119 \cs_set_eq:NN \rectanglecolor \@@_rectanglecolor
1120 \cs_set_eq:NN \rowcolor \@@_rowcolor
1121 \cs_set_eq:NN \rowcolors \@@_rowcolors
1122 \cs_set_eq:NN \columncolor \@@_columncolor
1123 \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.

```

1124 \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
1125 \l_@@_code_before_tl
1126 \bool_if:NT \l_@@_NiceTabular_bool \c_math_toggle_token
1127 \group_end:
1128 }
1129 }

```

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).

```

1130 \int_compare:nNnT \l_@@_last_row_int > { -2 }
1131 {
1132   \tl_put_right:Nn \@@_update_for_first_and_last_row:
1133   {
1134     \dim_gset:Nn \g_@@_ht_last_row_dim
1135     { \dim_max:nn \g_@@_ht_last_row_dim { \box_ht:N \l_@@_cell_box } }
1136     \dim_gset:Nn \g_@@_dp_last_row_dim
1137     { \dim_max:nn \g_@@_dp_last_row_dim { \box_dp:N \l_@@_cell_box } }
1138   }
1139 }
1140 \int_compare:nNnT \l_@@_last_row_int = { -1 }
1141 {
1142   \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.

```

1143 \str_if_empty:NTF \l_@@_name_str
1144 {
1145   \cs_if_exist:cT { @@_last_row_ \int_use:N \g_@@_env_int }
1146   {
1147     \int_set:Nn \l_@@_last_row_int
1148     { \use:c { @@_last_row_ \int_use:N \g_@@_env_int } }
1149   }
1150 }
1151 {
1152   \cs_if_exist:cT { @@_last_row_ \l_@@_name_str }
1153   {
1154     \int_set:Nn \l_@@_last_row_int
1155     { \use:c { @@_last_row_ \l_@@_name_str } }
1156   }
1157 }
1158 }

```

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).

```

1159 \int_compare:nNnT \l_@@_last_col_int = { -1 }
1160 {
1161   \str_if_empty:NTF \l_@@_name_str
1162   {
1163     \cs_if_exist:cT { @@_last_col_ \int_use:N \g_@@_env_int }
1164     {
1165       \int_set:Nn \l_@@_last_col_int
1166       { \use:c { @@_last_col_ \int_use:N \g_@@_env_int } }
1167     }
1168   }
1169   {
1170     \cs_if_exist:cT { @@_last_col_ \l_@@_name_str }
1171     {
1172       \int_set:Nn \l_@@_last_col_int
1173       { \use:c { @@_last_col_ \l_@@_name_str } }
1174     }
1175   }
1176 }

```

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

```

1177 \@@_pre_array:

```

We compute the width of the two delimiters.

```

1178 \dim_zero_new:N \l_@@_left_delim_dim
1179 \dim_zero_new:N \l_@@_right_delim_dim

```

```

1180 \bool_if:NTF \l_@@_NiceArray_bool
1181 {
1182   \dim_gset:Nn \l_@@_left_delim_dim { 2 \arraycolsep }
1183   \dim_gset:Nn \l_@@_right_delim_dim { 2 \arraycolsep }
1184 }
1185 {

```

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

```

1186   \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 #1 $ }
1187   \dim_set:Nn \l_@@_left_delim_dim { \box_wd:N \l_tmpa_box }
1188   \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 #2 $ }
1189   \dim_set:Nn \l_@@_right_delim_dim { \box_wd:N \l_tmpa_box }
1190 }

```

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

```

1191 \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).

```

1192 \bool_if:NT \c_@@_define_L_C_R_bool \@@_define_L_C_R:

```

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

```

1193 \@@_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).

```

1194 \hbox_set:Nw \l_@@_the_array_box
1195 \skip_horizontal:N \l_@@_left_margin_dim
1196 \skip_horizontal:N \l_@@_extra_left_margin_dim
1197 \c_math_toggle_token
1198 \bool_if:NTF \l_@@_light_syntax_bool
1199 { \use:c { @@-light-syntax } }
1200 { \use:c { @@-normal-syntax } }
1201 }
1202 {
1203   \bool_if:NTF \l_@@_light_syntax_bool
1204   { \use:c { end @@-light-syntax } }
1205   { \use:c { end @@-normal-syntax } }
1206   \c_math_toggle_token
1207   \skip_horizontal:N \l_@@_right_margin_dim
1208   \skip_horizontal:N \l_@@_extra_right_margin_dim
1209   \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).

```

1210 \int_compare:nNnT \l_@@_last_row_int > { -2 }
1211 {
1212   \bool_if:NF \l_@@_last_row_without_value_bool
1213   {
1214     \int_compare:nNnF \l_@@_last_row_int = \c@iRow
1215     {
1216       \@@_error:n { Wrong~last~row }
1217       \int_gset_eq:NN \l_@@_last_row_int \c@iRow
1218     }
1219   }
1220 }

```

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”.³⁸

```

1221 \int_gset_eq:NN \c@jCol \g_@@_col_total_int
1222 \bool_if:nTF \g_@@_last_col_found_bool
1223 { \int_gdecr:N \c@jCol }
1224 {
1225   \int_compare:nNnT \l_@@_last_col_int > { -1 }
1226   { \@@_error:n { last~col~not~used } }
1227 }
1228 \bool_if:NF \l_@@_Matrix_bool
1229 {
1230   \int_compare:nNnT \c@jCol < \g_@@_static_num_of_col_int
1231   { \@@_error:n { columns~not~used } }
1232 }

```

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

```

1233 \int_gset_eq:NN \g_@@_row_total_int \c@iRow
1234 \int_compare:nNnT \l_@@_last_row_int > { -1 } { \int_gdecr:N \c@iRow }

```

Now, we begin the real construction in the output flow of TeX. First, we take into account a potential “first column” (we remind that this “first column” has been constructed in an overlapping position and that we have computed its width in `\g_@@_width_first_col_dim`: see p. 90).

```

1235 \int_compare:nNnT \l_@@_first_col_int = 0
1236 {
1237   \skip_horizontal:N \arraycolsep
1238   \skip_horizontal:N \g_@@_width_first_col_dim
1239 }

```

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. We begin with this case.

```

1240 \bool_if:NTF \l_@@_NiceArray_bool
1241 {
1242   \str_case:VnF \l_@@_baseline_str
1243   {
1244     b \@@_use_arraybox_with_notes_b:
1245     c \@@_use_arraybox_with_notes_c:
1246   }
1247   \@@_use_arraybox_with_notes:
1248 }

```

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).

```

1249 {
1250   \int_compare:nNnTF \l_@@_first_row_int = 0
1251   {
1252     \dim_set_eq:NN \l_tmpa_dim \g_@@_dp_row_zero_dim
1253     \dim_add:Nn \l_tmpa_dim \g_@@_ht_row_zero_dim
1254   }
1255   { \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”.³⁹

```

1256 \int_compare:nNnTF \l_@@_last_row_int > { -2 }
1257 {
1258   \dim_set_eq:NN \l_tmpb_dim \g_@@_ht_last_row_dim
1259   \dim_add:Nn \l_tmpb_dim \g_@@_dp_last_row_dim
1260 }
1261 { \dim_zero:N \l_tmpb_dim }
1262 \hbox_set:Nn \l_tmpa_box

```

³⁸We remind that the potential “first column” (exterior) has the number 0.

³⁹A 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).

```

1263     {
1264         \c_math_toggle_token
1265         \left #1
1266         \vcenter
1267         {

```

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.

```

1268             \skip_vertical:N -\l_tmpa_dim
1269             \skip_vertical:N -\arrayrulewidth
1270             \hbox
1271             {
1272                 \bool_if:NTF \l_@@_NiceTabular_bool
1273                 { \skip_horizontal:N -\tabcolsep }
1274                 { \skip_horizontal:N -\arraycolsep }
1275                 \@@_use_arraybox_with_notes_c:
1276                 \bool_if:NTF \l_@@_NiceTabular_bool
1277                 { \skip_horizontal:N -\tabcolsep }
1278                 { \skip_horizontal:N -\arraycolsep }
1279             }

```

We take into account the “last row” (we have previously computed its total height in `\l_tmpb_dim`).

```

1280             \skip_vertical:N -\l_tmpb_dim
1281             \skip_vertical:N \arrayrulewidth
1282         }
1283         \right #2
1284         \c_math_toggle_token
1285     }

```

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.

```

1286         \bool_if:NTF \l_@@_max_delimiter_width_bool
1287         { \@@_put_box_in_flow_bis:nn { #1 } { #2 } }
1288         \@@_put_box_in_flow:
1289     }

```

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. 91).

```

1290     \bool_if:NT \g_@@_last_col_found_bool
1291     {
1292         \skip_horizontal:N \g_@@_width_last_col_dim
1293         \skip_horizontal:N \arraycolsep
1294     }
1295     \@@_after_array:
1296     \egroup
1297     \bool_if:NT \c_@@_footnote_bool \endsavenotes
1298 }

```

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`.

```

1299 \cs_new_protected:Npn \@@_construct_preamble:n #1
1300 {

```

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.

```
1301 \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).

```
1302 \bool_if:NTF \l_@@_Matrix_bool
1303 { \tl_gset:Nn \g_@@_preamble_tl { #1 } }
1304 {
1305   \@@_newcolumntype w [ 2 ] { \@@_w: { ##1 } { ##2 } }
1306   \@@_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`).

```
1307   \@temptokena { #1 }
```

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

```
1308   \@tempswatrue
```

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

```
1309   \@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`.

```
1310   \int_gzero_new:N \c@jCol
1311   \bool_if:NTF \l_@@_vlines_bool
1312   {
1313     \tl_gset:Nn \g_@@_preamble_tl
1314     { ! { \skip_horizontal:N \arrayrulewidth } }
1315   }
1316   { \tl_gclear:N \g_@@_preamble_tl }
```

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

```
1317   \int_zero:N \l_tmpa_int
```

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

```
1318   \exp_after:wN \@@_patch_preamble:n \the \@temptokena \q_stop
1319   \int_gset_eq:NN \g_@@_static_num_of_col_int \c@jCol
1320 }
```

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

```
1321 \bool_if:NT \l_@@_colortbl_like_bool
1322 {
1323   \regex_replace_all:NnN
1324   \c_@@_columncolor_regex
1325   { \c { @@_columncolor_preamble } }
1326   \g_@@_preamble_tl
1327 }
```

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

```
1328 \int_compare:nNnTF \l_@@_first_col_int = 0
1329 { \tl_gput_left:NV \g_@@_preamble_tl \c_@@_preamble_first_col_tl }
1330 {
1331   \bool_lazy_all:nT
1332   {
1333     \l_@@_NiceArray_bool
1334     { \bool_not_p:n \l_@@_NiceTabular_bool }
```

```

1335         { \bool_not_p:n \l_@@_vlines_bool }
1336         { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
1337     }
1338     { \tl_gput_left:Nn \g_@@_preamble_tl { @ { } } }
1339 }
1340 \int_compare:nNnTF \l_@@_last_col_int > { -1 }
1341 { \tl_gput_right:NV \g_@@_preamble_tl \c_@@_preamble_last_col_tl }
1342 {
1343     \bool_lazy_all:nT
1344     {
1345         \l_@@_NiceArray_bool
1346         { \bool_not_p:n \l_@@_NiceTabular_bool }
1347         { \bool_not_p:n \l_@@_vlines_bool }
1348         { \bool_not_p:n \l_@@_exterior_arraycolsep_bool }
1349     }
1350     { \tl_gput_right:Nn \g_@@_preamble_tl { @ { } } }
1351 }

```

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`).

```

1352     \dim_compare:nNnT \l_@@_tabular_width_dim = \c_zero_dim
1353     {
1354         \tl_gput_right:Nn
1355         \g_@@_preamble_tl
1356         { > { \@@_error_too_much_cols: } 1 }
1357     }

```

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

```

1358     \group_end:
1359 }

```

```

1360 \cs_new_protected:Npn \@@_patch_preamble:n #1
1361 {
1362     \str_case:nnF { #1 }
1363     {
1364         c { \@@_patch_preamble_i:n #1 }
1365         l { \@@_patch_preamble_i:n #1 }
1366         r { \@@_patch_preamble_i:n #1 }
1367         > { \@@_patch_preamble_ii:nn #1 }
1368         ! { \@@_patch_preamble_ii:nn #1 }
1369         @ { \@@_patch_preamble_ii:nn #1 }
1370         | { \@@_patch_preamble_iii:n #1 }
1371         p { \@@_patch_preamble_iv:nnn t #1 }
1372         m { \@@_patch_preamble_iv:nnn c #1 }
1373         b { \@@_patch_preamble_iv:nnn b #1 }
1374         \@@_w: { \@@_patch_preamble_v:nnnn { } #1 }
1375         \@@_W: { \@@_patch_preamble_v:nnnn { \cs_set_eq:NN \hss \hfil } #1 }
1376         \@@_true_c: { \@@_patch_preamble_vi:n #1 }
1377         \q_stop { }
1378     }
1379     {
1380         \str_if_eq:VnTF \l_@@_letter_for_dotted_lines_str { #1 }
1381         { \@@_patch_preamble_vii:n #1 }
1382         { \@@_fatal:nn { unknown~column~type } { #1 } }
1383     }
1384 }

```

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

```

1385 \cs_new_protected:Npn \@@_patch_preamble_i:n #1
1386 {
1387     \tl_gput_right:Nn \g_@@_preamble_tl { > \@@_Cell: #1 < \@@_end_Cell: }

```

We increment the counter of columns.

```

1388 \int_gincr:N \c@jCol
1389 \@@_patch_preamble_viii:n
1390 }

```

For >, ! and @

```

1391 \cs_new_protected:Npn \@@_patch_preamble_ii:nn #1 #2
1392 {
1393   \tl_gput_right:Nn \g_@@_preamble_tl { #1 { #2 } }
1394   \@@_patch_preamble:n
1395 }

```

For |

```

1396 \cs_new_protected:Npn \@@_patch_preamble_iii:n #1
1397 {

```

\l_tmpa_int is the number of successive occurrences of |

```

1398 \int_incr:N \l_tmpa_int
1399 \@@_patch_preamble_iii_i:n
1400 }

1401 \cs_new_protected:Npn \@@_patch_preamble_iii_i:n #1
1402 {
1403   \str_if_eq:nnTF { #1 } |
1404   { \@@_patch_preamble_iii:n | }
1405   {
1406     \tl_gput_right:Nx \g_@@_preamble_tl
1407     {
1408       \exp_not:N !
1409       {
1410         \skip_horizontal:n
1411         {
1412           \dim_eval:n
1413           {
1414             \arrayrulewidth * \l_tmpa_int
1415             + \doublerulesep * ( \l_tmpa_int - 1 )
1416           }
1417         }
1418       }
1419     }
1420     \tl_gput_right:Nx \g_@@_internal_code_after_tl
1421     { \@@_vline:nn { \@@_succ:n \c@jCol } { \int_use:N \l_tmpa_int } }
1422     \int_zero:N \l_tmpa_int
1423     \@@_patch_preamble:n #1
1424   }
1425 }

```

For p, m and b

```

1426 \cs_new_protected:Npn \@@_patch_preamble_iv:nnn #1 #2 #3
1427 {
1428   \tl_gput_right:Nn \g_@@_preamble_tl
1429   {
1430     > {
1431       \@@_Cell:
1432       \begin { minipage } [ #1 ] { #3 }
1433       \mode_leave_vertical:
1434       \box_use:N \@arstrutbox
1435     }
1436     c
1437     < { \box_use:N \@arstrutbox \end { minipage } \@@_end_Cell: }
1438   }

```


We increment the counter of columns.

```
1439 \int_gincr:N \c@jCol
1440 \@@_patch_preamble_viii:n
1441 }
```

For w and W

```
1442 \cs_new_protected:Npn \@@_patch_preamble_v:nnnn #1 #2 #3 #4
1443 {
1444   \tl_gput_right:Nn \g_@@_preamble_tl
1445   {
1446     > {
1447       \hbox_set:Nw \l_@@_cell_box
1448       \@@_Cell:
1449     }
1450     c
1451     < {
1452       \@@_end_Cell:
1453       #1
1454       \hbox_set_end:
1455       \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
1456     }
1457   }
```

We increment the counter of columns.

```
1458 \int_gincr:N \c@jCol
1459 \@@_patch_preamble_viii:n
1460 }
```

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

```
1461 \cs_new_protected:Npn \@@_patch_preamble_vi:n #1
1462 {
1463   \tl_gput_right:Nn \g_@@_preamble_tl { c }
```

We increment the counter of columns.

```
1464 \int_gincr:N \c@jCol
1465 \@@_patch_preamble_viii:n
1466 }

1467 \cs_new_protected:Npn \@@_patch_preamble_vii:n #1
1468 {
1469   \tl_gput_right:Nn \g_@@_preamble_tl
1470   { ! { \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.

```
1471 \tl_gput_right:Nx \g_@@_internal_code_after_tl
1472   { \@@_vdottedline:n { \int_use:N \c@jCol } }
1473 \@@_patch_preamble:n
1474 }
```

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 vlins is used.

```
1475 \cs_new_protected:Npn \@@_patch_preamble_viii:n #1
1476 {
1477   \str_if_eq:nnTF { #1 } { < }
1478   \@@_patch_preamble_ix:n
1479   {
1480     \bool_if:NT \l_@@_vlins_bool
1481     {
1482       \tl_gput_right:Nn \g_@@_preamble_tl
1483       { ! { \skip_horizontal:N \arrayrulewidth } }
1484     }
1485     \@@_patch_preamble:n { #1 }
1486   }
1487 }
```

```

1488 \cs_new_protected:Npn \@@_patch_preamble_ix:n #1
1489 {
1490   \tl_gput_right:Nn \g_@@_preamble_tl { < { #1 } }
1491   \@@_patch_preamble_viii:n
1492 }

```

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`).

```

1493 \cs_new_protected:Npn \@@_put_box_in_flow:
1494 {
1495   \box_set_ht:Nn \l_tmpa_box { \box_ht:N \l_tmpa_box + \l_tmpa_dim }
1496   \box_set_dp:Nn \l_tmpa_box { \box_dp:N \l_tmpa_box + \l_tmpb_dim }
1497   \str_if_eq:VnTF \l_@@_baseline_str { c }
1498     { \box_use_drop:N \l_tmpa_box }
1499   \@@_put_box_in_flow_i:
1500 }

```

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).

```

1501 \cs_new_protected:Npn \@@_put_box_in_flow_i:
1502 {
1503   \pgfpicture
1504     \@@_qpoint:n { row - 1 }
1505     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
1506     \@@_qpoint:n { row - \@@_succ:n \c@iRow }
1507     \dim_gadd:Nn \g_tmpa_dim \pgf@y
1508     \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).

```

1509   \str_if_in:NnTF \l_@@_baseline_str { line- }
1510   {
1511     \int_set:Nn \l_tmpa_int
1512     {
1513       \str_range:Nnn
1514         \l_@@_baseline_str
1515         6
1516       { \str_count:N \l_@@_baseline_str }
1517     }
1518     \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
1519   }
1520   {
1521     \str_case:VnF \l_@@_baseline_str
1522     {
1523       { t } { \int_set:Nn \l_tmpa_int 1 }
1524       { b } { \int_set_eq:NN \l_tmpa_int \c@iRow }
1525     }
1526     { \int_set:Nn \l_tmpa_int \l_@@_baseline_str }
1527     \bool_lazy_or:nnT
1528     { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
1529     { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
1530     {
1531       \@@_error:n { bad~value~for~baseline }
1532       \int_set:Nn \l_tmpa_int 1
1533     }
1534     \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }

```

We take into account the position of the mathematical axis.

```

1535     \dim_gsub:Nn \g_tmpa_dim { \fontdimen22 \textfont2 }
1536   }
1537   \dim_gsub:Nn \g_tmpa_dim \pgf@y

```

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

```

1538   \endpgfpicture
1539   \box_move_up:nn \g_tmpa_dim { \box_use_drop:N \l_tmpa_box }
1540   \box_use_drop:N \l_tmpa_box
1541 }

```

```

1542 \cs_new_protected:Npn \@@_use_arraybox_with_notes_c:
1543 {
1544   \int_compare:nNnTF \c@tabulernote = 0
1545   { \box_use_drop:N \l_@@_the_array_box }
1546   {
1547     \begin { minipage } { \box_wd:N \l_@@_the_array_box }
1548     \box_use_drop:N \l_@@_the_array_box
1549     \skip_vertical:N 0.65ex

```

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

```

1550   \group_begin:
1551   \l_@@_notes_code_before_tl

```

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.

```

1552   \bool_if:NTF \l_@@_notes_para_bool
1553   {
1554     \begin { tabularnotes* }
1555     \seq_map_inline:Nn \g_@@_tabularnotes_seq { \item ##1 } \strut
1556     \end { tabularnotes* }

```

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

```

1557   \par
1558 }
1559 {
1560   \tabularnotes
1561   \seq_map_inline:Nn \g_@@_tabularnotes_seq { \item ##1 } \strut
1562   \endtabularnotes
1563 }
1564 \unskip
1565 \group_end:
1566 \bool_if:NT \l_@@_notes_bottomrule_bool
1567 {
1568   \bool_if:NTF \c_@@_booktabs_loaded_bool
1569   {

```

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

```

1570   \skip_vertical:N \aboverulesep

```

`\CT@arc@` is the specification of color defined by `colortbl` but you use it even if `colortbl` is not loaded.

```

1571   { \CT@arc@ \hrule height \heavyrulewidth }
1572   }
1573   { \@@_error:n { bottomule~without~booktabs } }
1574 }
1575 \l_@@_notes_code_after_tl
1576 \end { minipage }
1577 \seq_gclear:N \g_@@_tabularnotes_seq
1578 \int_gzero:N \c@tabulernote
1579 }
1580 }

```

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`.

```

1581 \cs_new_protected:Npn \@@_use_arraybox_with_notes_b:
1582 {
1583   \pgfpicture

```

```

1584 \@@_qpoint:n { row - 1 }
1585 \dim_gset_eq:NN \g_tmpa_dim \pgf@y
1586 \@@_qpoint:n { row - \int_use:N \c@iRow - base }
1587 \dim_gsub:Nn \g_tmpa_dim \pgf@y
1588 \endpgfpicture
1589 \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
1590 \int_compare:nNnT \l_@@_first_row_int = 0
1591 {
1592   \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
1593   \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
1594 }
1595 \box_move_up:nn \g_tmpa_dim { \@@_use_arraybox_with_notes_c: }
1596 }

```

Now, the general case (hence the *g* in the name).

```

1597 \cs_new_protected:Npn \@@_use_arraybox_with_notes:
1598 {

```

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

```

1599 \str_if_eq:VnT \l_@@_baseline_str { t }
1600 { \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`.

```

1601 \int_set:Nn \l_tmpa_int \l_@@_baseline_str
1602 \bool_lazy_or:nnT
1603 { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
1604 { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
1605 {
1606   \@@_error:n { bad-value-for-baseline }
1607   \int_set:Nn \l_tmpa_int 1
1608 }
1609 \pgfpicture
1610 \@@_qpoint:n { row - 1 }
1611 \dim_gset_eq:NN \g_tmpa_dim \pgf@y
1612 \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }
1613 \dim_gsub:Nn \g_tmpa_dim \pgf@y
1614 \endpgfpicture
1615 \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
1616 \int_compare:nNnT \l_@@_first_row_int = 0
1617 {
1618   \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
1619   \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
1620 }
1621 \box_move_up:nn \g_tmpa_dim { \@@_use_arraybox_with_notes_c: }
1622 }

```

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.

```

1623 \cs_new_protected:Npn \@@_put_box_in_flow_bis:nn #1 #2
1624 {

```

We will compute the real width of both delimiters used.

```

1625 \dim_zero_new:N \l_@@_real_left_delim_dim
1626 \dim_zero_new:N \l_@@_real_right_delim_dim
1627 \hbox_set:Nn \l_tmpb_box
1628 {
1629   \c_math_toggle_token
1630   \left #1
1631   \vcenter
1632   {
1633     \vbox_to_ht:nn
1634     { \box_ht:N \l_tmpa_box + \box_dp:N \l_tmpa_box }

```

```

1635         { }
1636     }
1637     \right .
1638     \c_math_toggle_token
1639 }
1640 \dim_set:Nn \l_@@_real_left_delim_dim
1641 { \box_wd:N \l_tmpb_box - \nulldelimiterspace }
1642 \hbox_set:Nn \l_tmpb_box
1643 {
1644     \c_math_toggle_token
1645     \left .
1646     \vbox_to_ht:nn
1647     { \box_ht:N \l_tmpa_box + \box_dp:N \l_tmpa_box }
1648     { }
1649     \right #2
1650     \c_math_toggle_token
1651 }
1652 \dim_set:Nn \l_@@_real_right_delim_dim
1653 { \box_wd:N \l_tmpb_box - \nulldelimiterspace }

```

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

```

1654     \skip_horizontal:N \l_@@_left_delim_dim
1655     \skip_horizontal:N -\l_@@_real_left_delim_dim
1656     \@@_put_box_in_flow:
1657     \skip_horizontal:N \l_@@_right_delim_dim
1658     \skip_horizontal:N -\l_@@_real_right_delim_dim
1659 }

```

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).

```

1660 \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).

```

1661 {
1662     \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`).

```

1663     { \exp_args:NV \@@_array: \g_@@_preamble_tl }
1664 }
1665 {
1666     \@@_create_col_nodes:
1667     \endarray
1668 }

```

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`).

```

1669 \NewDocumentEnvironment { @@-light-syntax } { b }
1670 {

```

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`.

```

1671     \tl_if_empty:nT { #1 } { \@@_fatal:n { empty-environment } }
1672     \tl_map_inline:nn { #1 }
1673     {
1674         \tl_if_eq:nnT { ##1 } { & }

```

```

1675     { \@@_fatal:n { ampersand~in~light-syntax } }
1676     \tl_if_eq:nnT { ##1 } { \ }
1677     { \@@_fatal:n { double-backslash~in~light-syntax } }
1678 }

```

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`.

```

1679     \@@_light_syntax_i #1 \CodeAfter \q_stop
1680 }

```

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`.

```

1681 { }

1682 \cs_new_protected:Npn \@@_light_syntax_i #1\CodeAfter #2\q_stop
1683 {
1684     \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).

```

1685     \seq_gclear_new:N \g_@@_rows_seq
1686     \tl_set_rescan:Nno \l_@@_end_of_row_tl { } \l_@@_end_of_row_tl
1687     \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.

```

1688     \int_compare:nNnT \l_@@_last_row_int = { -1 }
1689     { \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`).

```

1690     \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.

```

1691     \seq_gpop_left:NN \g_@@_rows_seq \l_tmpa_tl
1692     \exp_args:NV \@@_line_with_light_syntax_i:n \l_tmpa_tl
1693     \seq_map_function:NN \g_@@_rows_seq \@@_line_with_light_syntax:n
1694     \@@_create_col_nodes:
1695     \endarray
1696 }

1697 \cs_new_protected:Npn \@@_line_with_light_syntax:n #1
1698 { \tl_if_empty:nF { #1 } { \ \ \@@_line_with_light_syntax_i:n { #1 } } }

1699 \cs_new_protected:Npn \@@_line_with_light_syntax_i:n #1
1700 {
1701     \seq_gclear_new:N \g_@@_cells_seq
1702     \seq_gset_split:Nnn \g_@@_cells_seq { ~ } { #1 }
1703     \seq_gpop_left:NN \g_@@_cells_seq \l_tmpa_tl
1704     \l_tmpa_tl
1705     \seq_map_inline:Nn \g_@@_cells_seq { & ##1 }
1706 }

```

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).

```

1707 \cs_new_protected:Npn \@@_analyze_end:Nn #1 #2
1708 {
1709     \str_if_eq:VnT \g_@@_name_env_str { #2 }
1710     { \@@_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.

```
1711   \end { #2 }
1712 }
```

The command `\@@_create_col_nodes:` will construct a special last row. That last row is a false row used to create the col nodes and to fix the width of the columns (when the array is constructed with an option which specifies the width of the columns).

```
1713 \cs_new:Npn \@@_create_col_nodes:
1714 {
1715   \crrc
1716   \int_compare:nNnT \l_@@_first_col_int = 0
1717   {
1718     \omit
1719     \skip_horizontal:N -2\col@sep
1720     \bool_if:NT \l_@@_code_before_bool
1721       { \pgfsys@markposition { \@@_env: - col - 0 } }
1722     \pgfpicture
1723     \pgfrememberpicturepositiononpagetrue
1724     \pgfcoordinate { \@@_env: - col - 0 } \pgfpintorigin
1725     \str_if_empty:NF \l_@@_name_str
1726       { \pgfnodealias { \l_@@_name_str - col - 0 } { \@@_env: - col - 0 } }
1727     \endpgfpicture
1728     &
1729   }
1730   \omit
```

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

```
1731   \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`).

```
1732   \int_compare:nNnTF \l_@@_first_col_int = 0
1733   {
1734     \bool_if:NT \l_@@_code_before_bool
1735     {
1736       \hbox
1737       {
1738         \skip_horizontal:N -0.5\arrayrulewidth
1739         \pgfsys@markposition { \@@_env: - col - 1 }
1740         \skip_horizontal:N 0.5\arrayrulewidth
1741       }
1742     }
1743     \pgfpicture
1744     \pgfrememberpicturepositiononpagetrue
1745     \pgfcoordinate { \@@_env: - col - 1 }
1746       { \pgfpint { - 0.5 \arrayrulewidth } \c_zero_dim }
1747     \str_if_empty:NF \l_@@_name_str
1748       { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
1749     \endpgfpicture
1750   }
1751   {
1752     \bool_if:NT \l_@@_code_before_bool
1753     {
1754       \hbox
1755       {
1756         \skip_horizontal:N 0.5 \arrayrulewidth
1757         \pgfsys@markposition { \@@_env: - col - 1 }
1758         \skip_horizontal:N -0.5\arrayrulewidth
1759       }
1760     }
1761     \pgfpicture
1762     \pgfrememberpicturepositiononpagetrue
```

```

1763 \pgfcoordinate { \@@_env: - col - 1 }
1764 { \pgfpoint { 0.5 \arrayrulewidth } \c_zero_dim }
1765 \str_if_empty:NF \l_@@_name_str
1766 { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
1767 \endpgfpicture
1768 }

```

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.

```

1769 \skip_gset:Nn \g_tmpa_skip { 0 pt+plus 1 fill }
1770 \bool_if:NF \l_@@_auto_columns_width_bool
1771 { \dim_compare:nNnT \l_@@_columns_width_dim > \c_zero_dim }
1772 {
1773   \bool_lazy_and:nnTF
1774     \l_@@_auto_columns_width_bool
1775     { \bool_not_p:n \l_@@_block_auto_columns_width_bool }
1776     { \skip_gset_eq:NN \g_tmpa_skip \g_@@_max_cell_width_dim }
1777     { \skip_gset_eq:NN \g_tmpa_skip \l_@@_columns_width_dim }
1778   \skip_gadd:Nn \g_tmpa_skip { 2 \col@sep }
1779 }
1780 \skip_horizontal:N \g_tmpa_skip
1781 \hbox
1782 {
1783   \bool_if:NT \l_@@_code_before_bool
1784   {
1785     \hbox
1786     {
1787       \skip_horizontal:N -0.5\arrayrulewidth
1788       \pgfsys@markposition { \@@_env: - col - 2 }
1789       \skip_horizontal:N 0.5\arrayrulewidth
1790     }
1791   }
1792   \pgfpicture
1793   \pgfrememberpicturepositiononpagetrue
1794   \pgfcoordinate { \@@_env: - col - 2 }
1795   { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
1796   \str_if_empty:NF \l_@@_name_str
1797   { \pgfnodealias { \l_@@_name_str - col - 2 } { \@@_env: - col - 2 } }
1798   \endpgfpicture
1799 }

```

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.

```

1800 \int_gset:Nn \g_tmpa_int 1
1801 \bool_if:NTF \g_@@_last_col_found_bool
1802 { \prg_replicate:nn { \g_@@_col_total_int - 2 } }
1803 { \prg_replicate:nn { \g_@@_col_total_int - 1 } }
1804 {
1805   &
1806   \omit

```

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

```

1807 \int_gincr:N \g_tmpa_int
1808 \skip_horizontal:N \g_tmpa_skip
1809 \bool_if:NT \l_@@_code_before_bool
1810 {
1811   \hbox
1812   {
1813     \skip_horizontal:N -0.5\arrayrulewidth
1814     \pgfsys@markposition { \@@_env: - col - \@@_succ:n \g_tmpa_int }

```



```

1815         \skip_horizontal:N 0.5\arrayrulewidth
1816     }
1817 }

```

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

```

1818     \pgfpicture
1819     \pgfrememberpicturepositiononpagetrue
1820     \pgfcoordinate { \l_@@_env: - col - \l_@@_succ:n \g_tmpa_int }
1821     { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
1822     \str_if_empty:NF \l_@@_name_str
1823     {
1824         \pgfnodealias
1825         { \l_@@_name_str - col - \l_@@_succ:n \g_tmpa_int }
1826         { \l_@@_env: - col - \l_@@_succ:n \g_tmpa_int }
1827     }
1828     \endpgfpicture
1829 }
1830 \bool_if:NT \g_@@_last_col_found_bool
1831 {
1832     \bool_if:NT \l_@@_code_before_bool
1833     {
1834         \pgfsys@markposition { \l_@@_env: - col - \l_@@_succ:n \g_@@_col_total_int }
1835     }
1836     \skip_horizontal:N 2\col@sep
1837     \pgfpicture
1838     \pgfrememberpicturepositiononpagetrue
1839     \pgfcoordinate { \l_@@_env: - col - \l_@@_succ:n \g_@@_col_total_int }
1840     \pgfpointorigin
1841     \str_if_empty:NF \l_@@_name_str
1842     {
1843         \pgfnodealias
1844         { \l_@@_name_str - col - \l_@@_succ:n \g_@@_col_total_int }
1845         { \l_@@_env: - col - \l_@@_succ:n \g_@@_col_total_int }
1846     }
1847     \endpgfpicture
1848     \skip_horizontal:N -2\col@sep
1849 }
1850 \cr
1851 }

```

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

```

1852 \tl_const:Nn \c_@@_preamble_first_col_tl
1853 {
1854     >
1855     {
1856         \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.

```

1857     \hbox_set:Nw \l_@@_cell_box
1858     \l_@@_math_toggle_token:
1859     \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”.

```

1860     \bool_lazy_and:nnT
1861     { \int_compare_p:nNn \c@iRow > 0 }
1862     {
1863         \bool_lazy_or_p:nn
1864         { \int_compare_p:nNn \l_@@_last_row_int < 0 }
1865         { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
1866     }
1867     {

```

```

1868         \l_@@_code_for_first_col_tl
1869         \xglobal \colorlet { nicematrix-first-col } { . }
1870     }
1871 }

```

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`.

```

1872     l
1873     <
1874     {
1875         \@@_math_toggle_token:
1876         \hbox_set_end:
1877         \@@_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.

```

1878         \dim_gset:Nn \g_@@_width_first_col_dim
1879         { \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.

```

1880         \hbox_overlap_left:n
1881         {
1882             \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \c_zero_dim
1883             \@@_node_for_the_cell:
1884             { \box_use_drop:N \l_@@_cell_box }
1885             \skip_horizontal:N \l_@@_left_delim_dim
1886             \skip_horizontal:N \l_@@_left_margin_dim
1887             \skip_horizontal:N \l_@@_extra_left_margin_dim
1888         }
1889         \bool_gset_false:N \g_@@_empty_cell_bool
1890         \skip_horizontal:N -2\col@sep
1891     }
1892 }

```

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

```

1893 \tl_const:Nn \c_@@_preamble_last_col_tl
1894 {
1895     >
1896     {

```

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

```

1897         \bool_gset_true:N \g_@@_last_col_found_bool
1898         \int_gincr:N \c@jCol
1899         \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.

```

1900         \hbox_set:Nw \l_@@_cell_box
1901         \@@_math_toggle_token:
1902         \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”.

```

1903         \int_compare:nNnT \c@iRow > 0
1904         {
1905             \bool_lazy_or:nnT
1906             { \int_compare_p:nNn \l_@@_last_row_int < 0 }
1907             { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
1908             {
1909                 \l_@@_code_for_last_col_tl
1910                 \xglobal \colorlet { nicematrix-last-col } { . }
1911             }
1912         }
1913     }
1914     l
1915     <

```

```

1916 {
1917   \@@_math_toggle_token:
1918   \hbox_set_end:
1919   \@@_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.

```

1920   \dim_gset:Nn \g_@@_width_last_col_dim
1921   { \dim_max:nn \g_@@_width_last_col_dim { \box_wd:N \l_@@_cell_box } }
1922   \skip_horizontal:N -2\col@sep

```

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

```

1923   \hbox_overlap_right:n
1924   {
1925     \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } > \c_zero_dim
1926     {
1927       \skip_horizontal:N \l_@@_right_delim_dim
1928       \skip_horizontal:N \l_@@_right_margin_dim
1929       \skip_horizontal:N \l_@@_extra_right_margin_dim
1930       \@@_node_for_the_cell:
1931     }
1932   }
1933   \bool_gset_false:N \g_@@_empty_cell_bool
1934 }
1935 }

```

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.

```

1936 \NewDocumentEnvironment { NiceArray } { }
1937 {
1938   \bool_set_true:N \l_@@_NiceArray_bool
1939   \str_if_empty:NT \g_@@_name_env_str
1940   { \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).

```

1941   \NiceArrayWithDelims . .
1942 }
1943 { \endNiceArrayWithDelims }

```

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

```

1944 \cs_new_protected:Npn \@@_def_env:nnn #1 #2 #3
1945 {
1946   \NewDocumentEnvironment { #1 NiceArray } { }
1947   {
1948     \str_if_empty:NT \g_@@_name_env_str
1949     { \str_gset:Nn \g_@@_name_env_str { #1 NiceArray } }
1950     \@@_test_if_math_mode:
1951     \NiceArrayWithDelims #2 #3
1952   }
1953   { \endNiceArrayWithDelims }
1954 }
1955 \@@_def_env:nnn p ( )
1956 \@@_def_env:nnn b [ ]
1957 \@@_def_env:nnn B \{ \}
1958 \@@_def_env:nnn v | |
1959 \@@_def_env:nnn V \| \|

```

The environment `{NiceMatrix}` and its variants

```

1960 \cs_new_protected:Npn \@@_begin_of_NiceMatrix:nn #1 #2
1961 {
1962   \bool_set_true:N \l_@@_Matrix_bool
1963   \use:c { #1 NiceArray }
1964   {
1965     *
1966     {
1967       \int_compare:nNnTF \l_@@_last_col_int < 0
1968         \c@MaxMatrixCols
1969         { \@@_pred:n \l_@@_last_col_int }
1970     }
1971     { > \@@_Cell: #2 < \@@_end_Cell: }
1972   }
1973 }
1974 \clist_map_inline:nn { { } , p , b , B , v , V }
1975 {
1976   \NewDocumentEnvironment { #1 NiceMatrix } { ! 0 { } }
1977   {
1978     \str_gset:Nn \g_@@_name_env_str { #1 NiceMatrix }
1979     \tl_set:Nn \l_@@_type_of_col_tl c
1980     \keys_set:nn { NiceMatrix / NiceMatrix } { ##1 }
1981     \exp_args:Nne \@@_begin_of_NiceMatrix:nn { #1 } \l_@@_type_of_col_tl
1982   }
1983   { \use:c { end #1 NiceArray } }
1984 }

```

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

```

1985 \NewDocumentEnvironment { NiceTabular } { 0 { } m ! 0 { } }
1986 {
1987   \str_gset:Nn \g_@@_name_env_str { NiceTabular }
1988   \keys_set:nn { NiceMatrix / NiceTabular } { #1 , #3 }
1989   \bool_set_true:N \l_@@_NiceTabular_bool
1990   \NiceArray { #2 }
1991 }
1992 { \endNiceArray }

1993 \NewDocumentEnvironment { NiceTabular* } { m 0 { } m ! 0 { } }
1994 {
1995   \str_gset:Nn \g_@@_name_env_str { NiceTabular* }
1996   \dim_set:Nn \l_@@_tabular_width_dim { #1 }
1997   \keys_set:nn { NiceMatrix / NiceTabular } { #2 , #4 }
1998   \bool_set_true:N \l_@@_NiceTabular_bool
1999   \NiceArray { #3 }
2000 }
2001 { \endNiceArray }

```

After the construction of the array

```

2002 \cs_new_protected:Npn \@@_after_array:
2003 {
2004   \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.

```

2005 \bool_if:NT \g_@@_last_col_found_bool
2006 { \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`.

```

2007 \bool_if:NT \l_@@_last_col_without_value_bool
2008 {
2009   \dim_set_eq:NN \l_@@_last_col_int \g_@@_col_total_int
2010   \iow_shipout:Nn \@mainaux \ExplSyntaxOn
2011   \iow_shipout:Nx \@mainaux
2012   {
2013     \cs_gset:cpn { @@_last_col_ \int_use:N \g_@@_env_int }
2014     { \int_use:N \g_@@_col_total_int }
2015   }
2016   \str_if_empty:NF \l_@@_name_str
2017   {
2018     \iow_shipout:Nx \@mainaux
2019     {
2020       \cs_gset:cpn { @@_last_col_ \l_@@_name_str }
2021       { \int_use:N \g_@@_col_total_int }
2022     }
2023   }
2024   \iow_shipout:Nn \@mainaux \ExplSyntaxOff
2025 }

```

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.

```

2026 \bool_if:NT \l_@@_last_row_without_value_bool
2027 {
2028   \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.

```

2029 \bool_if:NF \l_@@_light_syntax_bool
2030 {
2031   \iow_shipout:Nn \@mainaux \ExplSyntaxOn
2032   \iow_shipout:Nx \@mainaux
2033   {
2034     \cs_gset:cpn { @@_last_row_ \int_use:N \g_@@_env_int }
2035     { \int_use:N \g_@@_row_total_int }
2036   }

```

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.

```

2037 \str_if_empty:NF \l_@@_name_str
2038 {
2039   \iow_shipout:Nx \@mainaux
2040   {
2041     \cs_gset:cpn { @@_last_row_ \l_@@_name_str }
2042     { \int_use:N \g_@@_row_total_int }
2043   }
2044 }
2045 \iow_shipout:Nn \@mainaux \ExplSyntaxOff
2046 }
2047 }

```

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

```

2048 \bool_if:NT \l_@@_code_before_bool
2049 {
2050   \iow_now:Nn \@mainaux \ExplSyntaxOn
2051   \iow_now:Nx \@mainaux
2052   { \seq_clear_new:c { @@_size _ \int_use:N \g_@@_env_int _ seq } }
2053   \iow_now:Nx \@mainaux
2054   {
2055     \seq_gset_from_clist:cn { @@_size _ \int_use:N \g_@@_env_int _ seq }
2056     {

```

```

2057         \int_use:N \l_@@_first_row_int ,
2058         \int_use:N \g_@@_row_total_int ,
2059         \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.

```

2060         \bool_lazy_and:nnTF
2061         { \int_compare_p:nNn \l_@@_last_col_int > { -2 } }
2062         { \bool_not_p:n \g_@@_last_col_found_bool }
2063         \@@_succ:n
2064         \int_use:N
2065         \g_@@_col_total_int
2066     }

```

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`).

```

2067         \seq_gset_from_clist:cn
2068         { c_@@_pos_of_blocks_ \int_use:N \g_@@_env_int _ seq }
2069         { \seq_use:Nnnn \g_@@_pos_of_blocks_seq , , , }
2070     }
2071     \iow_now:Nn \@mainaux \ExplSyntaxOff
2072 }

```

By default, the diagonal lines will be parallelized⁴⁰. 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.

```

2073     \bool_if:NT \l_@@_parallelize_diags_bool
2074     {
2075         \int_gzero_new:N \g_@@_ddots_int
2076         \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.

```

2077         \dim_gzero_new:N \g_@@_delta_x_one_dim
2078         \dim_gzero_new:N \g_@@_delta_y_one_dim
2079         \dim_gzero_new:N \g_@@_delta_x_two_dim
2080         \dim_gzero_new:N \g_@@_delta_y_two_dim
2081     }
2082     \bool_if:nTF \l_@@_medium_nodes_bool
2083     {
2084         \bool_if:NTF \l_@@_large_nodes_bool
2085         \@@_create_medium_and_large_nodes:
2086         \@@_create_medium_nodes:
2087     }
2088     { \bool_if:NT \l_@@_large_nodes_bool \@@_create_large_nodes: }
2089     \int_zero_new:N \l_@@_initial_i_int
2090     \int_zero_new:N \l_@@_initial_j_int
2091     \int_zero_new:N \l_@@_final_i_int
2092     \int_zero_new:N \l_@@_final_j_int
2093     \bool_set_false:N \l_@@_initial_open_bool
2094     \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.

```

2095     \bool_if:NT \l_@@_small_bool
2096     {
2097         \dim_set:Nn \l_@@_radius_dim { 0.37 pt }
2098         \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.

⁴⁰It's possible to use the option `parallelize-diags` to disable this parallelization.

```

2099     \dim_set:Nn \l_@@_xdots_shorten_dim { 0.6 \l_@@_xdots_shorten_dim }
2100 }

```

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

```

2101 \@@_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.

```

2102 \@@_compute_corners:

```

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`.

```

2103 \bool_lazy_all:nT
2104 {
2105     { \seq_if_empty_p:N \g_@@_pos_of_blocks_seq }
2106     { \seq_if_empty_p:N \g_@@_pos_of_xdots_seq }
2107     { \seq_if_empty_p:N \l_@@_empty_corner_cells_seq }
2108 }
2109 {
2110     \cs_set_eq:NN \@@_vline_i:nn \@@_vline_i_complete:nn
2111     \cs_set_eq:NN \@@_hline_i:nn \@@_hline_i_complete:nn
2112 }
2113 \bool_if:NT \l_@@_hlines_bool \@@_draw_hlines:
2114 \bool_if:NT \l_@@_vlines_bool \@@_draw_vlines:
2115 \g_@@_internal_code_after_tl
2116 \tl_gclear:N \g_@@_internal_code_after_tl

```

We draw the blocks. We have to revert to a clean version of `\ialign` because there may be tabulars in the `\Block` instructions that will be composed now.

```

2117 \cs_set_eq:NN \ialign \@@_old_ialign:
2118 \seq_if_empty:NF \g_@@_blocks_seq \@@_draw_blocks:

```

Now, the code-after.

```

2119 \bool_if:NT \c_@@_tikz_loaded_bool
2120 {
2121     \tikzset
2122     {
2123         every~picture / .style =
2124         {
2125             overlay ,
2126             remember~picture ,
2127             name~prefix = \@@_env: -
2128         }
2129     }
2130 }
2131 \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.

```

2132 \cs_set_eq:NN \CodeAfter \prg_do_nothing:

```

And here’s the code-after:

```

2133 \g_nicematrix_code_after_tl
2134 \tl_gclear:N \g_nicematrix_code_after_tl
2135 \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.

```

2136 \tl_if_empty:NF \g_nicematrix_code_before_tl
2137 {

```

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`.

```

2138 \cs_set_protected:Npn \rectanglecolor { }
2139 \cs_set_protected:Npn \columncolor { }
2140 \iow_now:Nn \@mainaux \ExplSyntaxOn
2141 \iow_now:Nx \@mainaux
2142 {
2143   \tl_gset:cn
2144     { g_@@_code_before_ \int_use:N \g_@@_env_int _ tl }
2145     { \g_nicematrix_code_before_tl }
2146   }
2147   \iow_now:Nn \@mainaux \ExplSyntaxOff
2148   \bool_set_true:N \l_@@_code_before_bool
2149 }

2150 \str_gclear:N \g_@@_name_env_str
2151 \@@_restore_iRow_jCol:

```

The command `\CT@arc@` contains the instruction of color for the rules of the array⁴¹. 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`.

```

2152 \cs_gset_eq:NN \CT@arc@ \@@_old_CT@arc@
2153 }

```

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).

```

2154 \AtBeginDocument
2155 {
2156   \cs_new_protected:Npx \@@_draw_dotted_lines:
2157   {
2158     \c_@@_pgfortikzpicture_tl
2159     \@@_draw_dotted_lines_i:
2160     \c_@@_endpgfortikzpicture_tl
2161   }
2162 }

```

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

```

2163 \cs_new_protected:Npn \@@_draw_dotted_lines_i:
2164 {
2165   \pgfrememberpicturepositiononpagetrue
2166   \pgf@relevantforpicturesizefalse
2167   \g_@@_HVdotsfor_lines_tl
2168   \g_@@_Vdots_lines_tl
2169   \g_@@_Ddots_lines_tl
2170   \g_@@_Iddots_lines_tl
2171   \g_@@_Cdots_lines_tl
2172   \g_@@_Ldots_lines_tl
2173 }

2174 \cs_new_protected:Npn \@@_restore_iRow_jCol:
2175 {
2176   \cs_if_exist:NT \theiRow { \int_gset_eq:NN \c@iRow \l_@@_old_iRow_int }
2177   \cs_if_exist:NT \thejCol { \int_gset_eq:NN \c@jCol \l_@@_old_jCol_int }
2178 }

```

⁴¹e.g. `\color[rgb]{0.5,0.5,0}`

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 `\l_@@_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.

```
2179 \cs_new_protected:Npn \l_@@_find_extremities_of_line:nnnn #1 #2 #3 #4
2180 {
```

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

```
2181 \cs_set:cpn { @@ _ dotted _ #1 - #2 } { }
```

Initialization of variables.

```
2182 \int_set:Nn \l_@@_initial_i_int { #1 }
2183 \int_set:Nn \l_@@_initial_j_int { #2 }
2184 \int_set:Nn \l_@@_final_i_int { #1 }
2185 \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.

```
2186 \bool_set_false:N \l_@@_stop_loop_bool
2187 \bool_do_until:Nn \l_@@_stop_loop_bool
2188 {
2189   \int_add:Nn \l_@@_final_i_int { #3 }
2190   \int_add:Nn \l_@@_final_j_int { #4 }
```

We test if we are still in the matrix.

```
2191   \bool_set_false:N \l_@@_final_open_bool
2192   \int_compare:nNnTF \l_@@_final_i_int > \c@iRow
2193   {
2194     \int_compare:nNnTF { #3 } = 1
2195     { \bool_set_true:N \l_@@_final_open_bool }
2196     {
2197       \int_compare:nNnT \l_@@_final_j_int > \c@jCol
2198       { \bool_set_true:N \l_@@_final_open_bool }
2199     }
2200   }
2201   {
2202     \int_compare:nNnTF \l_@@_final_j_int < 1
2203     {
```

```

2204         \int_compare:nNt { #4 } = { -1 }
2205         { \bool_set_true:N \l_@@_final_open_bool }
2206     }
2207     {
2208         \int_compare:nNt \l_@@_final_j_int > \c@jCol
2209         {
2210             \int_compare:nNt { #4 } = 1
2211             { \bool_set_true:N \l_@@_final_open_bool }
2212         }
2213     }
2214 }
2215 \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.

```

2216 {

```

We do a step backwards.

```

2217     \int_sub:Nn \l_@@_final_i_int { #3 }
2218     \int_sub:Nn \l_@@_final_j_int { #4 }
2219     \bool_set_true:N \l_@@_stop_loop_bool
2220 }

```

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`.

```

2221 {
2222     \cs_if_exist:cTF
2223     {
2224         @@ _ dotted _
2225         \int_use:N \l_@@_final_i_int -
2226         \int_use:N \l_@@_final_j_int
2227     }
2228     {
2229         \int_sub:Nn \l_@@_final_i_int { #3 }
2230         \int_sub:Nn \l_@@_final_j_int { #4 }
2231         \bool_set_true:N \l_@@_final_open_bool
2232         \bool_set_true:N \l_@@_stop_loop_bool
2233     }
2234     {
2235         \cs_if_exist:cTF
2236         {
2237             pgf @ sh @ ns @ \@@_env:
2238             - \int_use:N \l_@@_final_i_int
2239             - \int_use:N \l_@@_final_j_int
2240         }
2241         { \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.

```

2242     {
2243         \cs_set:cpn
2244         {
2245             @@ _ dotted _
2246             \int_use:N \l_@@_final_i_int -
2247             \int_use:N \l_@@_final_j_int
2248         }
2249         { }
2250     }
2251 }
2252 }
2253 }

```

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

```

2254 \bool_set_false:N \l_@@_stop_loop_bool
2255 \bool_do_until:Nn \l_@@_stop_loop_bool
2256 {
2257   \int_sub:Nn \l_@@_initial_i_int { #3 }
2258   \int_sub:Nn \l_@@_initial_j_int { #4 }
2259   \bool_set_false:N \l_@@_initial_open_bool
2260   \int_compare:nNnTF \l_@@_initial_i_int < 1
2261   {
2262     \int_compare:nNnTF { #3 } = 1
2263     { \bool_set_true:N \l_@@_initial_open_bool }
2264     {
2265       \int_compare:nNnT \l_@@_initial_j_int = 0
2266       { \bool_set_true:N \l_@@_initial_open_bool }
2267     }
2268   }
2269   {
2270     \int_compare:nNnTF \l_@@_initial_j_int < 1
2271     {
2272       \int_compare:nNnT { #4 } = 1
2273       { \bool_set_true:N \l_@@_initial_open_bool }
2274     }
2275     {
2276       \int_compare:nNnT \l_@@_initial_j_int > \c@jCol
2277       {
2278         \int_compare:nNnT { #4 } = { -1 }
2279         { \bool_set_true:N \l_@@_initial_open_bool }
2280       }
2281     }
2282   }
2283   \bool_if:NTF \l_@@_initial_open_bool
2284   {
2285     \int_add:Nn \l_@@_initial_i_int { #3 }
2286     \int_add:Nn \l_@@_initial_j_int { #4 }
2287     \bool_set_true:N \l_@@_stop_loop_bool
2288   }
2289   {
2290     \cs_if_exist:cTF
2291     {
2292       @@ _ dotted _
2293       \int_use:N \l_@@_initial_i_int -
2294       \int_use:N \l_@@_initial_j_int
2295     }
2296     {
2297       \int_add:Nn \l_@@_initial_i_int { #3 }
2298       \int_add:Nn \l_@@_initial_j_int { #4 }
2299       \bool_set_true:N \l_@@_initial_open_bool
2300       \bool_set_true:N \l_@@_stop_loop_bool
2301     }
2302     {
2303       \cs_if_exist:cTF
2304       {
2305         pgf @ sh @ ns @ \@@_env:
2306         - \int_use:N \l_@@_initial_i_int
2307         - \int_use:N \l_@@_initial_j_int
2308       }
2309       { \bool_set_true:N \l_@@_stop_loop_bool }
2310       {
2311         \cs_set:cpn
2312         {
2313           @@ _ dotted _
2314           \int_use:N \l_@@_initial_i_int -

```

```

2315             \int_use:N \l_@@_initial_j_int
2316         }
2317     { }
2318 }
2319 }
2320 }
2321 }

```

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.

```

2322 \seq_gput_right:Nx \g_@@_pos_of_xdots_seq
2323 {
2324     { \int_use:N \l_@@_initial_i_int }
2325     { \int_use:N \l_@@_initial_j_int }
2326     { \int_use:N \l_@@_final_i_int }
2327     { \int_use:N \l_@@_final_j_int }
2328 }
2329 }

2330 \cs_new_protected:Npn \@@_set_initial_coords:
2331 {
2332     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2333     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2334 }
2335 \cs_new_protected:Npn \@@_set_final_coords:
2336 {
2337     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2338     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2339 }
2340 \cs_new_protected:Npn \@@_set_initial_coords_from_anchor:n #1
2341 {
2342     \pgfpointanchor
2343     {
2344         \@@_env:
2345         - \int_use:N \l_@@_initial_i_int
2346         - \int_use:N \l_@@_initial_j_int
2347     }
2348     { #1 }
2349     \@@_set_initial_coords:
2350 }
2351 \cs_new_protected:Npn \@@_set_final_coords_from_anchor:n #1
2352 {
2353     \pgfpointanchor
2354     {
2355         \@@_env:
2356         - \int_use:N \l_@@_final_i_int
2357         - \int_use:N \l_@@_final_j_int
2358     }
2359     { #1 }
2360     \@@_set_final_coords:
2361 }

```

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.

```

2362 \cs_new_protected:Npn \@@_draw_Ldots:nnn #1 #2 #3
2363 {
2364     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2365     {
2366         \@@_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.

```

2367 \group_begin:
2368 \int_compare:nNnTF { #1 } = 0
2369 { \color { nicematrix-first-row } }
2370 {
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.
2371 \int_compare:nNnT { #1 } = \l_@@_last_row_int
2372 { \color { nicematrix-last-row } }
2373 }
2374 \keys_set:nn { NiceMatrix / xdots } { #3 }
2375 \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2376 \@@_actually_draw_Ldots:
2377 \group_end:
2378 }
2379 }

```

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.

```

2380 \cs_new_protected:Npn \@@_actually_draw_Ldots:
2381 {
2382   \bool_if:NTF \l_@@_initial_open_bool
2383   {
2384     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2385     \dim_set_eq:NN \l_@@_x_initial_dim \pgf{x}
2386     \dim_add:Nn \l_@@_x_initial_dim \@@_tab_or_array_colsep:
2387     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
2388     \dim_set_eq:NN \l_@@_y_initial_dim \pgf{y}
2389   }
2390   { \@@_set_initial_coords_from_anchor:n { base-east } }
2391   \bool_if:NTF \l_@@_final_open_bool
2392   {
2393     \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
2394     \dim_set_eq:NN \l_@@_x_final_dim \pgf{x}
2395     \dim_sub:Nn \l_@@_x_final_dim \@@_tab_or_array_colsep:
2396     \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
2397     \dim_set_eq:NN \l_@@_y_final_dim \pgf{y}
2398   }
2399   { \@@_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 (?).

```

2400 \dim_add:Nn \l_@@_y_initial_dim \l_@@_radius_dim
2401 \dim_add:Nn \l_@@_y_final_dim \l_@@_radius_dim
2402 \@@_draw_line:
2403 }

```

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.

```

2404 \cs_new_protected:Npn \@@_draw_Cdots:nnn #1 #2 #3
2405 {

```

```

2406 \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2407 {
2408     \@@_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.

```

2409     \group_begin:
2410     \int_compare:nNnTF { #1 } = 0
2411     { \color { nicematrix-first-row } }
2412     {

```

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.

```

2413         \int_compare:nNnT { #1 } = \l_@@_last_row_int
2414         { \color { nicematrix-last-row } }
2415     }
2416     \keys_set:nn { NiceMatrix / xdots } { #3 }
2417     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2418     \@@_actually_draw_Cdots:
2419     \group_end:
2420 }
2421 }

```

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`.

```

2422 \cs_new_protected:Npn \@@_actually_draw_Cdots:
2423 {
2424     \bool_if:NTF \l_@@_initial_open_bool
2425     {
2426         \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2427         \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2428         \dim_add:Nn \l_@@_x_initial_dim
2429         { \bool_if:NTF \l_@@_NiceTabular_bool \tabcolsep \arraycolsep }
2430     }
2431     { \@@_set_initial_coords_from_anchor:n { mid-east } }
2432     \bool_if:NTF \l_@@_final_open_bool
2433     {
2434         \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
2435         \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2436         \dim_sub:Nn \l_@@_x_final_dim
2437         { \bool_if:NTF \l_@@_NiceTabular_bool \tabcolsep \arraycolsep }
2438     }
2439     { \@@_set_final_coords_from_anchor:n { mid-west } }
2440     \bool_lazy_and:nnTF
2441     \l_@@_initial_open_bool
2442     \l_@@_final_open_bool
2443     {
2444         \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2445         \dim_set_eq:NN \l_tmpa_dim \pgf@y
2446         \@@_qpoint:n { row - \@@_succ:n \l_@@_initial_i_int }
2447         \dim_set:Nn \l_@@_y_initial_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
2448         \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim
2449     }
2450     {

```

```

2451     \bool_if:NT \l_@@_initial_open_bool
2452     { \dim_set_eq:NN \l_@@_y_initial_dim \l_@@_y_final_dim }
2453     \bool_if:NT \l_@@_final_open_bool
2454     { \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim }
2455   }
2456   \@@_draw_line:
2457 }

```

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.

```

2458 \cs_new_protected:Npn \@@_draw_Vdots:nnn #1 #2 #3
2459 {
2460   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2461   {
2462     \@@_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.

```

2463     \group_begin:
2464     \int_compare:nNnTF { #2 } = 0
2465     { \color { nicematrix-first-col } }
2466     {
2467       \int_compare:nNnT { #2 } = \l_@@_last_col_int
2468       { \color { nicematrix-last-col } }
2469     }
2470     \keys_set:nn { NiceMatrix / xdots } { #3 }
2471     \tl_if_empty:VF \l_@@_xdots_color_tl
2472     { \color { \l_@@_xdots_color_tl } }
2473     \@@_actually_draw_Vdots:
2474   \group_end:
2475 }
2476 }

```

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`.

```

2477 \cs_new_protected:Npn \@@_actually_draw_Vdots:
2478 {

```

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

```

2479   \bool_set_false:N \l_tmpa_bool
2480   \bool_lazy_or:nnF \l_@@_initial_open_bool \l_@@_final_open_bool
2481   {
2482     \@@_set_initial_coords_from_anchor:n { south-west }
2483     \@@_set_final_coords_from_anchor:n { north-west }
2484     \bool_set:Nn \l_tmpa_bool
2485     { \dim_compare_p:nNn \l_@@_x_initial_dim = \l_@@_x_final_dim }
2486   }

```

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

```

2487   \bool_if:NTF \l_@@_initial_open_bool
2488   {
2489     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2490     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y

```

```

2491     }
2492     { \@@_set_initial_coords_from_anchor:n { south } }
2493     \bool_if:NTF \l_@@_final_open_bool
2494     {
2495         \@@_qpoint:n { row - \@@_succ:n \l_@@_final_i_int }
2496         \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2497     }
2498     { \@@_set_final_coords_from_anchor:n { north } }
2499     \bool_if:NTF \l_@@_initial_open_bool
2500     {
2501         \bool_if:NTF \l_@@_final_open_bool
2502         {
2503             \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2504             \dim_set_eq:NN \l_tmpa_dim \pgf@x
2505             \@@_qpoint:n { col - \@@_succ:n \l_@@_initial_j_int }
2506             \dim_set:Nn \l_@@_x_initial_dim { ( \pgf@x + \l_tmpa_dim ) / 2 }
2507             \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.

```

2508         \int_compare:nNnT \l_@@_last_col_int > { -2 }
2509         {
2510             \int_compare:nNnT \l_@@_initial_j_int = \g_@@_col_total_int
2511             {
2512                 \dim_set_eq:NN \l_tmpa_dim \l_@@_right_margin_dim
2513                 \dim_add:Nn \l_tmpa_dim \l_@@_extra_right_margin_dim
2514                 \dim_add:Nn \l_@@_x_initial_dim \l_tmpa_dim
2515                 \dim_add:Nn \l_@@_x_final_dim \l_tmpa_dim
2516             }
2517         }
2518     }
2519     { \dim_set_eq:NN \l_@@_x_initial_dim \l_@@_x_final_dim }
2520 }
2521 {
2522     \bool_if:NTF \l_@@_final_open_bool
2523     { \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim }
2524 }

```

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.

```

2525     \dim_compare:nNnF \l_@@_x_initial_dim = \l_@@_x_final_dim
2526     {
2527         \dim_set:Nn \l_@@_x_initial_dim
2528         {
2529             \bool_if:NTF \l_tmpa_bool \dim_min:nn \dim_max:nn
2530             \l_@@_x_initial_dim \l_@@_x_final_dim
2531         }
2532         \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
2533     }
2534 }
2535 }
2536 \@@_draw_line:
2537 }

```

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.

```

2538 \cs_new_protected:Npn \@@_draw_Ddots:nnn #1 #2 #3
2539 {

```



```

2540 \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2541 {
2542     \@@_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.

```

2543     \group_begin:
2544     \keys_set:nn { NiceMatrix / xdots } { #3 }
2545     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2546     \@@_actually_draw_Ddots:
2547     \group_end:
2548 }
2549 }

```

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`.

```

2550 \cs_new_protected:Npn \@@_actually_draw_Ddots:
2551 {
2552     \bool_if:NTF \l_@@_initial_open_bool
2553     {
2554         \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2555         \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2556         \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
2557         \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2558     }
2559     { \@@_set_initial_coords_from_anchor:n { south-east } }
2560     \bool_if:NTF \l_@@_final_open_bool
2561     {
2562         \@@_qpoint:n { row - \@@_succ:n \l_@@_final_i_int }
2563         \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2564         \@@_qpoint:n { col - \@@_succ:n \l_@@_final_j_int }
2565         \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2566     }
2567     { \@@_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.

```

2568     \bool_if:NT \l_@@_parallelize_diags_bool
2569     {
2570         \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).

```

2571     \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.

```

2572     {
2573         \dim_gset:Nn \g_@@_delta_x_one_dim
2574         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
2575         \dim_gset:Nn \g_@@_delta_y_one_dim
2576         { \l_@@_y_final_dim - \l_@@_y_initial_dim }
2577     }

```

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`.

```

2578     {
2579         \dim_set:Nn \l_@@_y_final_dim
2580         {
2581             \l_@@_y_initial_dim +
2582             ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2583             \dim_ratio:nn \g_@@_delta_y_one_dim \g_@@_delta_x_one_dim
2584         }
2585     }
2586 }
2587 \@@_draw_line:
2588 }

```

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.

```

2589 \cs_new_protected:Npn \@@_draw_Iddots:nnn #1 #2 #3
2590 {
2591     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
2592     {
2593         \@@_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.

```

2594         \group_begin:
2595         \keys_set:nn { NiceMatrix / xdots } { #3 }
2596         \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
2597         \@@_actually_draw_Iddots:
2598         \group_end:
2599     }
2600 }

```

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`.

```

2601 \cs_new_protected:Npn \@@_actually_draw_Iddots:
2602 {
2603     \bool_if:NTF \l_@@_initial_open_bool
2604     {
2605         \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
2606         \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
2607         \@@_qpoint:n { col - \@@_succ:n \l_@@_initial_j_int }
2608         \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
2609     }
2610     { \@@_set_initial_coords_from_anchor:n { south-west } }
2611     \bool_if:NTF \l_@@_final_open_bool
2612     {
2613         \@@_qpoint:n { row - \@@_succ:n \l_@@_final_i_int }
2614         \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
2615         \@@_qpoint:n { col - \int_use:N \l_@@_final_j_int }
2616         \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
2617     }

```

```

2618     { \@@_set_final_coords_from_anchor:n { north-east } }
2619 \bool_if:NT \l_@@_parallelize_diags_bool
2620 {
2621     \int_gincr:N \g_@@_iddots_int
2622     \int_compare:nNnTF \g_@@_iddots_int = 1
2623     {
2624         \dim_gset:Nn \g_@@_delta_x_two_dim
2625         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
2626         \dim_gset:Nn \g_@@_delta_y_two_dim
2627         { \l_@@_y_final_dim - \l_@@_y_initial_dim }
2628     }
2629     {
2630         \dim_set:Nn \l_@@_y_final_dim
2631         {
2632             \l_@@_y_initial_dim +
2633             ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2634             \dim_ratio:nn \g_@@_delta_y_two_dim \g_@@_delta_x_two_dim
2635         }
2636     }
2637 }
2638 \@@_draw_line:
2639 }

```

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`

```

2640 \cs_new_protected:Npn \@@_draw_line:
2641 {
2642     \pgfrememberpicturepositiononpagetrue
2643     \pgf@relevantforpicturesizefalse
2644     \tl_if_eq:NNTF \l_@@_xdots_line_style_tl \c_@@_standard_tl
2645         \@@_draw_standard_dotted_line:
2646         \@@_draw_non_standard_dotted_line:
2647 }

```

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.

```

2648 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:
2649 {
2650     \begin { scope }
2651     \exp_args:No \@@_draw_non_standard_dotted_line:n
2652     { \l_@@_xdots_line_style_tl , \l_@@_xdots_color_tl }
2653 }

```

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.

```

2654 \cs_new_protected:Npn \@@_draw_non_standard_dotted_line:n #1
2655 {

```

```

2656 \draw
2657 [
2658     #1 ,
2659     shorten~> = \l_@@_xdots_shorten_dim ,
2660     shorten~< = \l_@@_xdots_shorten_dim ,
2661 ]
2662     ( \l_@@_x_initial_dim , \l_@@_y_initial_dim )
2663     -- node [ sloped , above ]
2664         { \c_math_toggle_token \scriptstyle \l_@@_xdots_up_tl \c_math_toggle_token }
2665     node [ sloped , below ]
2666         {
2667             \c_math_toggle_token
2668             \scriptstyle \l_@@_xdots_down_tl
2669             \c_math_toggle_token
2670         }
2671     ( \l_@@_x_final_dim , \l_@@_y_final_dim ) ;
2672 \end { scope }
2673 }

```

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

```

2674 \cs_new_protected:Npn \@@_draw_standard_dotted_line:
2675 {

```

First, we put the labels.

```

2676 \bool_lazy_and:nnF
2677 { \tl_if_empty_p:N \l_@@_xdots_up_tl }
2678 { \tl_if_empty_p:N \l_@@_xdots_down_tl }
2679 {
2680     \pgfscope
2681     \pgftransformshift
2682     {
2683         \pgfpointlineattime { 0.5 }
2684         { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
2685         { \pgfpoint \l_@@_x_final_dim \l_@@_y_final_dim }
2686     }
2687     \pgftransformrotate
2688     {
2689         \fp_eval:n
2690         {
2691             atand
2692             (
2693                 \l_@@_y_final_dim - \l_@@_y_initial_dim ,
2694                 \l_@@_x_final_dim - \l_@@_x_initial_dim
2695             )
2696         }
2697     }
2698     \pgfnode
2699     { rectangle }
2700     { south }
2701     {
2702         \c_math_toggle_token
2703         \scriptstyle \l_@@_xdots_up_tl
2704         \c_math_toggle_token
2705     }
2706     { }
2707     { \pgfusepath { } }
2708     \pgfnode
2709     { rectangle }
2710     { north }
2711     {
2712         \c_math_toggle_token
2713         \scriptstyle \l_@@_xdots_down_tl

```

```

2714         \c_math_toggle_token
2715     }
2716     { }
2717     { \pgfusepath { } }
2718 \endpgfscope
2719 }
2720 \pgfrememberpicturepositiononpagetrue
2721 \pgf@relevantforpicturesizefalse
2722 \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.

```

2723     \dim_zero_new:N \l_@@_l_dim
2724     \dim_set:Nn \l_@@_l_dim
2725     {
2726         \fp_to_dim:n
2727         {
2728             sqrt
2729             (
2730                 ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) ^ 2
2731                 +
2732                 ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) ^ 2
2733             )
2734         }
2735     }

```

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.

```

2736     \bool_lazy_or:nnF
2737     { \dim_compare_p:nNn { \dim_abs:n \l_@@_l_dim } > \c_@@_max_l_dim }
2738     { \dim_compare_p:nNn \l_@@_l_dim = \c_zero_dim }
2739     \@@_draw_standard_dotted_line_i:
2740 \group_end:
2741 }
2742 \dim_const:Nn \c_@@_max_l_dim { 50 cm }
2743 \cs_new_protected:Npn \@@_draw_standard_dotted_line_i:
2744 {

```

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

```

2745     \bool_if:NTF \l_@@_initial_open_bool
2746     {
2747         \bool_if:NTF \l_@@_final_open_bool
2748         {
2749             \int_set:Nn \l_tmpa_int
2750             { \dim_ratio:nn \l_@@_l_dim \l_@@_inter_dots_dim }
2751         }
2752         {
2753             \int_set:Nn \l_tmpa_int
2754             {
2755                 \dim_ratio:nn
2756                 { \l_@@_l_dim - \l_@@_xdots_shorten_dim }
2757                 \l_@@_inter_dots_dim
2758             }
2759         }
2760     }
2761     {
2762         \bool_if:NTF \l_@@_final_open_bool
2763         {
2764             \int_set:Nn \l_tmpa_int
2765             {
2766                 \dim_ratio:nn

```

```

2767         { \l_@@_l_dim - \l_@@_xdots_shorten_dim }
2768         \l_@@_inter_dots_dim
2769     }
2770 }
2771 {
2772     \int_set:Nn \l_tmpa_int
2773     {
2774         \dim_ratio:nn
2775         { \l_@@_l_dim - 2 \l_@@_xdots_shorten_dim }
2776         \l_@@_inter_dots_dim
2777     }
2778 }
2779 }

```

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

```

2780 \dim_set:Nn \l_tmpa_dim
2781 {
2782     ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2783     \dim_ratio:nn \l_@@_inter_dots_dim \l_@@_l_dim
2784 }
2785 \dim_set:Nn \l_tmpb_dim
2786 {
2787     ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
2788     \dim_ratio:nn \l_@@_inter_dots_dim \l_@@_l_dim
2789 }

```

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`.

```

2790 \int_set:Nn \l_tmpb_int
2791 {
2792     \bool_if:NTF \l_@@_initial_open_bool
2793     { \bool_if:NTF \l_@@_final_open_bool 1 0 }
2794     { \bool_if:NTF \l_@@_final_open_bool 2 1 }
2795 }

```

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.

```

2796 \dim_gadd:Nn \l_@@_x_initial_dim
2797 {
2798     ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
2799     \dim_ratio:nn
2800     { \l_@@_l_dim - \l_@@_inter_dots_dim * \l_tmpa_int }
2801     { 2 \l_@@_l_dim }
2802     * \l_tmpb_int
2803 }
2804 \dim_gadd:Nn \l_@@_y_initial_dim
2805 {
2806     ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
2807     \dim_ratio:nn
2808     { \l_@@_l_dim - \l_@@_inter_dots_dim * \l_tmpa_int }
2809     { 2 \l_@@_l_dim }
2810     * \l_tmpb_int
2811 }
2812 \pgf@relevantforpicturesizefalse
2813 \int_step_inline:nnn 0 \l_tmpa_int
2814 {
2815     \pgfpathcircle
2816     { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
2817     { \l_@@_radius_dim }
2818     \dim_add:Nn \l_@@_x_initial_dim \l_tmpa_dim
2819     \dim_add:Nn \l_@@_y_initial_dim \l_tmpb_dim

```

```

2820     }
2821     \pgfusepathqfill
2822 }

```

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.

```

2823 \AtBeginDocument
2824 {
2825   \tl_set:Nn \l_@@_argspec_tl { 0 { } E { _ ^ } { { } { } } }
2826   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
2827   \exp_args:NNV \NewDocumentCommand \@@_Ldots \l_@@_argspec_tl
2828   {
2829     \int_compare:nNnTF \c@jCol = 0
2830     { \@@_error:nn { in~first~col } \Ldots }
2831     {
2832       \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
2833       { \@@_error:nn { in~last~col } \Ldots }
2834       {
2835         \@@_instruction_of_type:nnn \c_false_bool { \Ldots }
2836         { #1 , down = #2 , up = #3 }
2837       }
2838     }
2839     \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_ldots }
2840     \bool_gset_true:N \g_@@_empty_cell_bool
2841   }

2842   \exp_args:NNV \NewDocumentCommand \@@_Cdots \l_@@_argspec_tl
2843   {
2844     \int_compare:nNnTF \c@jCol = 0
2845     { \@@_error:nn { in~first~col } \Cdots }
2846     {
2847       \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
2848       { \@@_error:nn { in~last~col } \Cdots }
2849       {
2850         \@@_instruction_of_type:nnn \c_false_bool { \Cdots }
2851         { #1 , down = #2 , up = #3 }
2852       }
2853     }
2854     \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_cdots }
2855     \bool_gset_true:N \g_@@_empty_cell_bool
2856   }

2857   \exp_args:NNV \NewDocumentCommand \@@_Vdots \l_@@_argspec_tl
2858   {
2859     \int_compare:nNnTF \c@iRow = 0
2860     { \@@_error:nn { in~first~row } \Vdots }

```

```

2861 {
2862   \int_compare:nNnTF \c@iRow = \l_@@_last_row_int
2863   { \@@_error:nn { in~last~row } \Vdots }
2864   {
2865     \@@_instruction_of_type:nnn \c_false_bool { Vdots }
2866     { #1 , down = #2 , up = #3 }
2867   }
2868 }
2869 \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_vdots }
2870 \bool_gset_true:N \g_@@_empty_cell_bool
2871 }

2872 \exp_args:NNV \NewDocumentCommand \@@_Ddots \l_@@_argspec_tl
2873 {
2874   \int_case:nnF \c@iRow
2875   {
2876     0 { \@@_error:nn { in~first~row } \Ddots }
2877     \l_@@_last_row_int { \@@_error:nn { in~last~row } \Ddots }
2878   }
2879   {
2880     \int_case:nnF \c@jCol
2881     {
2882       0 { \@@_error:nn { in~first~col } \Ddots }
2883       \l_@@_last_col_int { \@@_error:nn { in~last~col } \Ddots }
2884     }
2885     {
2886       \keys_set_known:nn { NiceMatrix / Ddots } { #1 }
2887       \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Ddots }
2888       { #1 , down = #2 , up = #3 }
2889     }
2890   }
2891 }
2892 \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_ddots }
2893 \bool_gset_true:N \g_@@_empty_cell_bool
2894 }

2895 \exp_args:NNV \NewDocumentCommand \@@_Iddots \l_@@_argspec_tl
2896 {
2897   \int_case:nnF \c@iRow
2898   {
2899     0 { \@@_error:nn { in~first~row } \Iddots }
2900     \l_@@_last_row_int { \@@_error:nn { in~last~row } \Iddots }
2901   }
2902   {
2903     \int_case:nnF \c@jCol
2904     {
2905       0 { \@@_error:nn { in~first~col } \Iddots }
2906       \l_@@_last_col_int { \@@_error:nn { in~last~col } \Iddots }
2907     }
2908     {
2909       \keys_set_known:nn { NiceMatrix / Ddots } { #1 }
2910       \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Iddots }
2911       { #1 , down = #2 , up = #3 }
2912     }
2913   }
2914 }
2915 \bool_if:NF \l_@@_nullify_dots_bool { \phantom \@@_old_iddots }
2916 \bool_gset_true:N \g_@@_empty_cell_bool
2917 }
2918 }

```

End of the \AtBeginDocument.

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

```

2919 \keys_define:nn { NiceMatrix / Ddots }
2920 {
2921   draw-first .bool_set:N = \l_@@_draw_first_bool ,
2922   draw-first .default:n = true ,
2923   draw-first .value_forbidden:n = true
2924 }

```

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

```

2925 \cs_new_protected:Npn \@@_Hspace:
2926 {
2927   \bool_gset_true:N \g_@@_empty_cell_bool
2928   \hspace
2929 }

```

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

```

2930 \cs_set_eq:NN \@@_old_multicolumn \multicolumn
2931 \cs_new:Npn \@@_multicolumn:nnn #1 #2 #3
2932 {
2933   % \begin{macrocode}
2934   % We have to act in an expandable way since it will begin by a |\multicolumn|.
2935   % \end{macrocode}
2936   \exp_args:NNe
2937   \@@_old_multicolumn
2938   { #1 }

```

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

```

2939 {
2940   \exp_args:Ne \str_case:nn { \tl_lower_case:n { #2 } }
2941   {
2942     l { > \@@_Cell: l < \@@_end_Cell: }
2943     r { > \@@_Cell: r < \@@_end_Cell: }
2944     c { > \@@_Cell: c < \@@_end_Cell: }
2945     { l | } { > \@@_Cell: l < \@@_end_Cell: | }
2946     { r | } { > \@@_Cell: r < \@@_end_Cell: | }
2947     { c | } { > \@@_Cell: c < \@@_end_Cell: | }
2948     { | l } { | > \@@_Cell: l < \@@_end_Cell: }
2949     { | r } { | > \@@_Cell: r < \@@_end_Cell: }
2950     { | c } { | > \@@_Cell: c < \@@_end_Cell: }
2951     { | l | } { | > \@@_Cell: l < \@@_end_Cell: | }
2952     { | r | } { | > \@@_Cell: r < \@@_end_Cell: | }
2953     { | c | } { | > \@@_Cell: c < \@@_end_Cell: | }
2954   }
2955 }
2956 { #3 }

```

The `\peek_remove_spaces:n` is mandatory.

```

2957 \peek_remove_spaces:n
2958 {
2959   \int_compare:nNnT #1 > 1
2960   {
2961     \seq_gput_left:Nx \g_@@_multicolumn_cells_seq
2962     { \int_use:N \c@iRow - \int_use:N \c@jCol }
2963     \seq_gput_left:Nn \g_@@_multicolumn_sizes_seq { #1 }
2964     \seq_gput_right:Nx \g_@@_pos_of_blocks_seq
2965     {
2966       { \int_use:N \c@iRow }
2967       { \int_use:N \c@jCol }
2968       { \int_use:N \c@iRow }
2969       { \int_eval:n { \c@jCol + #1 - 1 } }
2970     }
2971   }

```

```

2972 \int_gadd:Nn \c@jCol { #1 - 1 }
2973 \int_compare:nNnT \c@jCol > \g_@@_col_total_int
2974 { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
2975 }
2976 }

```

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`.

```

2977 \cs_new:Npn \@@_Hdotsfor:
2978 {
2979   \int_compare:nNnTF \c@jCol = 0
2980   { \@@_error:n { Hdotsfor~in~col~0 } }
2981   {
2982     \multicolumn { 1 } { c } { }
2983     \@@_Hdotsfor_i
2984   }
2985 }

```

The command `\@@_Hdotsfor_i` is defined with the tools of `xparse` 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:`).

```

2986 \AtBeginDocument
2987 {
2988   \tl_set:Nn \l_@@_argspec_tl { 0 { } m 0 { } E { _ ^ } { { } { } } }
2989   \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.

```

2990   \exp_args:NNV \NewDocumentCommand \@@_Hdotsfor_i \l_@@_argspec_tl
2991   {
2992     \tl_gput_right:Nx \g_@@_HVdotsfor_lines_tl
2993     {
2994       \@@_Hdotsfor:nnnn
2995       { \int_use:N \c@iRow }
2996       { \int_use:N \c@jCol }
2997       { #2 }
2998       {
2999         #1 , #3 ,
3000         down = \exp_not:n { #4 } , up = \exp_not:n { #5 }
3001       }
3002     }
3003     \prg_replicate:nn { #2 - 1 } { & \multicolumn { 1 } { c } { } }
3004   }
3005 }

```

Enf of `\AtBeginDocument`.

```

3006 \cs_new_protected:Npn \@@_Hdotsfor:nnnn #1 #2 #3 #4
3007 {
3008   \bool_set_false:N \l_@@_initial_open_bool
3009   \bool_set_false:N \l_@@_final_open_bool

```

For the row, it's easy.

```

3010   \int_set:Nn \l_@@_initial_i_int { #1 }
3011   \int_set_eq:NN \l_@@_final_i_int \l_@@_initial_i_int

```

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

```

3012   \int_compare:nNnTF #2 = 1
3013   {
3014     \int_set:Nn \l_@@_initial_j_int 1
3015     \bool_set_true:N \l_@@_initial_open_bool
3016   }
3017   {

```

```

3018 \cs_if_exist:cTF
3019 {
3020     pgf @ sh @ ns @ \@@_env:
3021     - \int_use:N \l_@@_initial_i_int
3022     - \int_eval:n { #2 - 1 }
3023 }
3024 { \int_set:Nn \l_@@_initial_j_int { #2 - 1 } }
3025 {
3026     \int_set:Nn \l_@@_initial_j_int { #2 }
3027     \bool_set_true:N \l_@@_initial_open_bool
3028 }
3029 }
3030 \int_compare:nNnTF { #2 + #3 - 1 } = \c@jCol
3031 {
3032     \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
3033     \bool_set_true:N \l_@@_final_open_bool
3034 }
3035 {
3036     \cs_if_exist:cTF
3037     {
3038         pgf @ sh @ ns @ \@@_env:
3039         - \int_use:N \l_@@_final_i_int
3040         - \int_eval:n { #2 + #3 }
3041     }
3042     { \int_set:Nn \l_@@_final_j_int { #2 + #3 } }
3043     {
3044         \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
3045         \bool_set_true:N \l_@@_final_open_bool
3046     }
3047 }
3048 \group_begin:
3049 \int_compare:nNnTF { #1 } = 0
3050 { \color { nicematrix-first-row } }
3051 {
3052     \int_compare:nNnT { #1 } = \g_@@_row_total_int
3053     { \color { nicematrix-last-row } }
3054 }
3055 \keys_set:nn { NiceMatrix / xdots } { #4 }
3056 \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3057 \@@_actually_draw_Ldots:
3058 \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).

```

3059 \int_step_inline:nnn { #2 } { #2 + #3 - 1 }
3060 { \cs_set:cpn { @@ _ dotted _ #1 - ##1 } { } }
3061 }

3062 \AtBeginDocument
3063 {
3064     \tl_set:Nn \l_@@_argspec_tl { 0 { } m 0 { } E { _ ^ } { { } { } } }
3065     \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
3066     \exp_args:NNV \NewDocumentCommand \@@_Vdotsfor: \l_@@_argspec_tl
3067     {
3068         \tl_gput_right:Nx \g_@@_HVdotsfor_lines_tl
3069         {
3070             \@@_Vdotsfor:nnnn
3071             { \int_use:N \c@iRow }
3072             { \int_use:N \c@jCol }
3073             { #2 }
3074             {

```

```

3075         #1 , #3 ,
3076         down = \exp_not:n { #4 } , up = \exp_not:n { #5 }
3077     }
3078 }
3079 }
3080 }

```

Enf of \AtBeginDocument.

```

3081 \cs_new_protected:Npn \@@_Vdotsfor:nnnn #1 #2 #3 #4
3082 {
3083     \bool_set_false:N \l_@@_initial_open_bool
3084     \bool_set_false:N \l_@@_final_open_bool

```

For the column, it's easy.

```

3085     \int_set:Nn \l_@@_initial_j_int { #2 }
3086     \int_set_eq:NN \l_@@_final_j_int \l_@@_initial_j_int

```

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

```

3087     \int_compare:nNnTF #1 = 1
3088     {
3089         \int_set:Nn \l_@@_initial_i_int 1
3090         \bool_set_true:N \l_@@_initial_open_bool
3091     }
3092     {
3093         \cs_if_exist:cTF
3094         {
3095             pgf @ sh @ ns @ \@@_env:
3096             - \int_eval:n { #1 - 1 }
3097             - \int_use:N \l_@@_initial_j_int
3098         }
3099         { \int_set:Nn \l_@@_initial_i_int { #1 - 1 } }
3100         {
3101             \int_set:Nn \l_@@_initial_i_int { #1 }
3102             \bool_set_true:N \l_@@_initial_open_bool
3103         }
3104     }
3105     \int_compare:nNnTF { #1 + #3 - 1 } = \c@iRow
3106     {
3107         \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
3108         \bool_set_true:N \l_@@_final_open_bool
3109     }
3110     {
3111         \cs_if_exist:cTF
3112         {
3113             pgf @ sh @ ns @ \@@_env:
3114             - \int_eval:n { #1 + #3 }
3115             - \int_use:N \l_@@_final_j_int
3116         }
3117         { \int_set:Nn \l_@@_final_i_int { #1 + #3 } }
3118         {
3119             \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
3120             \bool_set_true:N \l_@@_final_open_bool
3121         }
3122     }
3123     \group_begin:
3124     \int_compare:nNnTF { #2 } = 0
3125     { \color { nicematrix-first-col } }
3126     {
3127         \int_compare:nNnT { #2 } = \g_@@_col_total_int
3128         { \color { nicematrix-last-col } }
3129     }
3130     \keys_set:nn { NiceMatrix / xdots } { #4 }
3131     \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3132     \@@_actually_draw_Vdots:

```

```
3133 \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).

```
3134 \int_step_inline:nnn { #1 } { #1 + #3 - 1 }
3135 { \cs_set:cpn { @@ _ dotted _ ##1 - #2 } { } }
3136 }
```

The command `\@@_rotate:` will be linked to `\rotate` in `{NiceArrayWithDelims}`. The command will exit three levels of groups (only two in `{NiceTabular}` because there is not the group of the math mode to exit) in order to execute the command

“`\box_rotate:Nn \l_@@_cell_box { 90 }`”

just after the construction of the box `\l_@@_cell_box`.

```
3137 \cs_new_protected:Npn \@@_rotate:
3138 {
3139   \bool_if:NTF \l_@@_NiceTabular_bool
3140   { \group_insert_after:N \@@_rotate_ii: }
3141   { \group_insert_after:N \@@_rotate_i: }
3142 }
3143 \cs_new_protected:Npn \@@_rotate_i: { \group_insert_after:N \@@_rotate_ii: }
3144 \cs_new_protected:Npn \@@_rotate_ii: { \group_insert_after:N \@@_rotate_iii: }
3145 \cs_new_protected:Npn \@@_rotate_iii:
3146 {
3147   \box_rotate:Nn \l_@@_cell_box { 90 }
```

If we are in the last row, we want all the boxes composed with the command `\rotate` aligned upwards.

```
3148 \int_compare:nNnT \c@iRow = \l_@@_last_row_int
3149 {
3150   \vbox_set_top:Nn \l_@@_cell_box
3151   {
3152     \vbox_to_zero:n { }
```

0.8 `ex` will be the distance between the principal part of the array and our element (which is composed with `\rotate`).

```
3153 \skip_vertical:n { - \box_ht:N \@arstrutbox + 0.8 ex }
3154 \box_use:N \l_@@_cell_box
3155 }
3156 }
3157 }
```

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).⁴²

```
3158 \cs_new:Npn \@@_double_int_eval:n #1-#2 \q_stop
3159 { \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).

```
3160 \AtBeginDocument
```

⁴²Indeed, we want that the user may use the command `\line` in `code-after` with LaTeX counters in the arguments — with the command `\value`.

```

3161 {
3162   \tl_set:Nn \l_@@_argspec_tl { 0 { } m m ! 0 { } E { _ ^ } { { } { } } }
3163   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
3164   \exp_args:NNV \NewDocumentCommand \@@_line \l_@@_argspec_tl
3165     {
3166       \group_begin:
3167       \keys_set:nn { NiceMatrix / xdots } { #1 , #4 , down = #5 , up = #6 }
3168       \tl_if_empty:VF \l_@@_xdots_color_tl { \color { \l_@@_xdots_color_tl } }
3169       \use:e
3170       {
3171         \@@_line_i:nn
3172         { \@@_double_int_eval:n #2 \q_stop }
3173         { \@@_double_int_eval:n #3 \q_stop }
3174       }
3175       \group_end:
3176     }
3177   }
3178   \cs_new_protected:Npn \@@_line_i:nn #1 #2
3179   {
3180     \bool_set_false:N \l_@@_initial_open_bool
3181     \bool_set_false:N \l_@@_final_open_bool
3182     \bool_if:nTF
3183     {
3184       \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #1 }
3185       ||
3186       \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #2 }
3187     }
3188     {
3189       \@@_error:nnn { unknown~cell~for~line~in~code~after } { #1 } { #2 }
3190     }
3191     { \@@_draw_line_ii:nn { #1 } { #2 } }
3192   }
3193   \AtBeginDocument
3194   {
3195     \cs_new_protected:Npx \@@_draw_line_ii:nn #1 #2
3196     {

```

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:`.

```

3197     \c_@@_pgfortikzpicture_tl
3198     \@@_draw_line_iii:nn { #1 } { #2 }
3199     \c_@@_endpgfortikzpicture_tl
3200   }
3201 }

```

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

```

3202 \cs_new_protected:Npn \@@_draw_line_iii:nn #1 #2
3203 {
3204   \pgfrememberpicturepositiononpagetrue
3205   \pgfpointshapeborder { \@@_env: - #1 } { \@@_qpoint:n { #2 } }
3206   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
3207   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
3208   \pgfpointshapeborder { \@@_env: - #2 } { \@@_qpoint:n { #1 } }
3209   \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
3210   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
3211   \@@_draw_line:
3212 }

```

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`.

```

3213 \cs_set_protected:Npn \@@_cut_on_hyphen:w #1-#2\q_stop
3214 {
3215   \tl_set:Nn \l_tmpa_tl { #1 }
3216   \tl_set:Nn \l_tmpb_tl { #2 }
3217 }

```

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

```

3218 \NewDocumentCommand \@@_rowcolor { 0 { } m m }
3219 {
3220   \tl_if_blank:nF { #2 }
3221   {
3222     \pgfpicture
3223     \pgf@relevantforpicturesizefalse
3224     \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }

```

`\l_tmpa_dim` is the x -value of the right side of the rows.

```

3225     \@@_qpoint:n { col - 1 }
3226     \int_compare:nNnTF \l_@@_first_col_int = 0
3227     { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3228     { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3229     \@@_qpoint:n { col - \@@_succ:n \c@jCol }
3230     \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }
3231     \clist_map_inline:nn { #3 }
3232     {
3233       \tl_set:Nn \l_tmpa_tl { ##1 }
3234       \tl_if_in:NnTF \l_tmpa_tl { - }
3235       { \@@_cut_on_hyphen:w ##1 \q_stop }
3236       { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
3237       \tl_if_empty:NT \l_tmpa_tl { \tl_set:Nn \l_tmpa_tl { 1 } }
3238       \tl_if_empty:NT \l_tmpb_tl
3239       { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@iRow } }
3240       \int_compare:nNnT \l_tmpb_tl > \c@iRow
3241       { \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`.

```

3242     \@@_qpoint:n { row - \@@_succ:n \l_tmpb_tl }
3243     \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3244     \@@_qpoint:n { row - \l_tmpa_tl }
3245     \dim_set:Nn \l_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
3246     \pgfpathrectanglecorners
3247     { \pgfpoint \l_tmpc_dim \l_tmpd_dim }
3248     { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3249   }
3250   \pgfusepathqfill
3251   \endpgfpicture
3252 }
3253 }

```

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

```

3254 \NewDocumentCommand \@@_columncolor { 0 { } m m }
3255 {
3256   \tl_if_blank:nF { #2 }
3257   {
3258     \pgfpicture
3259     \pgf@relevantforpicturesizefalse
3260     \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
3261     \@@_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.

```

3262 \dim_set:Nn \l_tmpa_dim { \pgf@y + 0.5 \arrayrulewidth }
3263 \@@_qpoint:n { row - \@@_succ:n \c@iRow }
3264 \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3265 \clist_map_inline:nn { #3 }
3266 {
3267   \tl_set:Nn \l_tmpa_tl { ##1 }
3268   \tl_if_in:NnTF \l_tmpa_tl { - }
3269   { \@@_cut_on_hyphen:w ##1 \q_stop }
3270   { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
3271   \tl_if_empty:NT \l_tmpa_tl { \tl_set:Nn \l_tmpa_tl { 1 } }
3272   \tl_if_empty:NT \l_tmpb_tl
3273   { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
3274   \int_compare:nNnT \l_tmpb_tl > \c@jCol
3275   { \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`.

```

3276 \@@_qpoint:n { col - \l_tmpa_tl }
3277 \int_compare:nNnTF \l_@@_first_col_int = \l_tmpa_tl
3278 { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3279 { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3280 \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
3281 \dim_set:Nn \l_tmpd_dim { \pgf@x + 0.5 \arrayrulewidth }
3282 \pgfpathrectanglecorners
3283 { \pgfpoint \l_tmpc_dim \l_tmpa_dim }
3284 { \pgfpoint \l_tmpd_dim \l_tmpb_dim }
3285 }
3286 \pgfusepathqfill
3287 \endpgfpicture
3288 }
3289 }

```

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

```

3290 \NewDocumentCommand \@@_cellcolor { 0 { } m m }
3291 {
3292   \tl_if_blank:nF { #2 }
3293   {
3294     \pgfpicture
3295     \pgf@relevantforpicturesizefalse
3296     \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
3297     \clist_map_inline:nn { #3 }
3298     {
3299       \@@_cut_on_hyphen:w ##1 \q_stop
3300       \@@_qpoint:n { row - \l_tmpa_tl }
3301       \bool_lazy_and:nnT
3302       { \int_compare_p:n { \l_tmpa_tl <= \c@iRow } }
3303       { \int_compare_p:n { \l_tmpb_tl <= \c@jCol } }
3304       {
3305         \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3306         \@@_qpoint:n { row - \@@_succ:n \l_tmpa_tl }
3307         \dim_set:Nn \l_tmpa_dim { \pgf@y + 0.5 \arrayrulewidth }
3308         \@@_qpoint:n { col - \l_tmpb_tl }
3309         \int_compare:nNnTF \l_@@_first_col_int = \l_tmpb_tl
3310         { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3311         { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3312         \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
3313         \dim_set:Nn \l_tmpd_dim { \pgf@x + 0.5 \arrayrulewidth }
3314         \pgfpathrectanglecorners
3315         { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3316         { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
3317       }
3318     }
3319     \pgfusepathqfill

```



```

3320 \endpgfpicture
3321 }
3322 }

```

Here an example : `\@@_rectanglecolor{red!15}{2-3}{5-6}`

```

3323 \NewDocumentCommand \@@_rectanglecolor { 0 { } m m m }
3324 {
3325   \tl_if_blank:nF { #2 }
3326   {
3327     \pgfpicture
3328     \pgf@relevantforpicturesizefalse
3329     \tl_if_empty:nTF { #1 } \color { \color [ #1 ] } { #2 }
3330     \@@_cut_on_hyphen:w #3 \q_stop
3331     \bool_lazy_and:nnT
3332       { \int_compare_p:n { \l_tmpa_tl <= \c@iRow } }
3333       { \int_compare_p:n { \l_tmpb_tl <= \c@jCol } }
3334     {
3335       \@@_qpoint:n { row - \l_tmpa_tl }
3336       \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
3337       \@@_qpoint:n { col - \l_tmpb_tl }
3338       \int_compare:nNnTF \l_@@_first_col_int = \l_tmpb_tl
3339         { \dim_set:Nn \l_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
3340         { \dim_set:Nn \l_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
3341       \@@_cut_on_hyphen:w #4 \q_stop
3342       \int_compare:nNnT \l_tmpa_tl > \c@iRow
3343         { \tl_set:Nx \l_tmpa_tl { \int_use:N \c@iRow } }
3344       \int_compare:nNnT \l_tmpb_tl > \c@jCol
3345         { \tl_set:Nx \l_tmpb_tl { \int_use:N \c@jCol } }
3346       \@@_qpoint:n { row - \@@_succ:n \l_tmpa_tl }
3347       \dim_set:Nn \l_tmpa_dim { \pgf@y + 0.5 \arrayrulewidth }
3348       \@@_qpoint:n { col - \@@_succ:n \l_tmpb_tl }
3349       \dim_set:Nn \l_tmpd_dim { \pgf@x + 0.5 \arrayrulewidth }
3350       \pgfpathrectanglecorners
3351         { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3352         { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
3353       \pgfusepathqfill
3354     }
3355   \endpgfpicture
3356 }
3357 }

```

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`.

```

3358 \keys_define:nn { NiceMatrix / rowcolors }
3359 {
3360   respect-blocks .bool_set:N = \l_@@_respect_blocks_bool ,
3361   respect-blocks .default:n = true ,
3362   unknown .code:n = \@@_error:n { Unknown-option-for-rowcolors }
3363 }
3364 \NewDocumentCommand \@@_rowcolors { 0 { } m m m 0 { } }
3365 {
3366   \keys_set:nn { NiceMatrix / rowcolors } { #5 }
3367   \bool_lazy_and:nnTF
3368     \l_@@_respect_blocks_bool
3369     { \cs_if_exist_p:c { c_@@_pos_of_blocks_ \int_use:N \g_@@_env_int _ seq } }
3370     { \@@_rowcolors_i:nnnn { #1 } { #2 } { #3 } { #4 } }
3371   {

```

```

3372     \int_step_inline:nnn { #2 } { \int_use:N \c@iRow }
3373     {
3374         \int_if_odd:nTF { ##1 }
3375         { \@@_rowcolor [ #1 ] { #3 } }
3376         { \@@_rowcolor [ #1 ] { #4 } }
3377         { ##1 }
3378     }
3379 }
3380 }
3381 \cs_new_protected:Npn \@@_rowcolors_i:nnnn #1 #2 #3 #4
3382 {
3383     \seq_set_eq:Nc \l_tmpb_seq
3384     { 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”.

```

3385     \seq_set_filter:Nn \l_tmpa_seq \l_tmpb_seq
3386     { \@@_not_in_exterior_p:nnnn ##1 }

```

The counter `\l_tmpa_int` will be the index of the loop.

```

3387     \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.

```

3388     \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).

```

3389     \int_do_until:nNnn \l_tmpa_int > \c@iRow
3390     {
3391         \seq_set_filter:Nn \l_tmpb_seq \l_tmpa_seq
3392         { \@@_intersect_our_row_p:nnnn ##1 }

```

We compute in `\l_tmpb_int` the last row covered by a block.

```

3393     \int_set_eq:NN \l_tmpb_int \l_tmpa_int
3394     \seq_map_inline:Nn \l_tmpb_seq { \@@_rowcolors_ii:nnnn ##1 }
3395     \bool_if:NTF \l_tmpa_bool
3396     {
3397         \@@_rowcolor [ #1 ] { #4 }
3398         { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }
3399         \bool_set_false:N \l_tmpa_bool
3400     }
3401     {
3402         \@@_rowcolor [ #1 ] { #3 }
3403         { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }
3404         \bool_set_true:N \l_tmpa_bool
3405     }
3406     \int_set:Nn \l_tmpa_int { \l_tmpb_int + 1 }
3407 }
3408 }

```

```

3409 \cs_new_protected:Npn \@@_rowcolors_ii:nnnn #1 #2 #3 #4
3410 {
3411     \int_compare:nNnT { #3 } > \l_tmpb_int
3412     { \int_set:Nn \l_tmpb_int { #3 } }
3413 }

```

```

3414 \prg_new_conditional:Nnn \@@_not_in_exterior:nnnn p
3415 {
3416     \bool_lazy_or:nnTF
3417     { \int_compare_p:nNn { #4 } = \c_zero_int }
3418     { \int_compare_p:nNn { #2 } = { \@@_succ:n { \c@jCol } } }
3419     \prg_return_false:
3420     \prg_return_true:
3421 }

```

The following command return true when the block intersects the row \l_tmpa_int.

```

3422 \prg_new_conditional:Nnn \@@_intersect_our_row:nnnn p
3423 {
3424   \bool_if:nTF
3425   {
3426     \int_compare_p:n { #1 <= \l_tmpa_int }
3427     &&
3428     \int_compare_p:n { \l_tmpa_int <= #3 }
3429   }
3430   \prg_return_true:
3431   \prg_return_false:
3432 }

3433 \NewDocumentCommand \@@_chessboardcolors { 0 { } m m }
3434 {
3435   \int_step_inline:nn { \int_use:N \c@iRow }
3436   {
3437     \int_step_inline:nn { \int_use:N \c@jCol }
3438     {
3439       \int_if_even:nTF { ####1 + ##1 }
3440       { \@@_cellcolor [ #1 ] { #2 } }
3441       { \@@_cellcolor [ #1 ] { #3 } }
3442       { ##1 - ####1 }
3443     }
3444   }
3445 }

```

When the user uses the key colortbl-like, the following command will be linked to \cellcolor in the tabular.

```

3446 \NewDocumentCommand \@@_cellcolor_tabular { 0 { } m }
3447 {
3448   \tl_gput_right:Nx \g_nicematrix_code_before_tl
3449   { \cellcolor [ #1 ] { #2 } { \int_use:N \c@iRow - \int_use:N \c@jCol } }
3450 }

```

When the user uses the key rowcolor-in-tabular, the following command will be linked to \rowcolor in the tabular.

```

3451 \NewDocumentCommand \@@_rowcolor_tabular { 0 { } m }
3452 {
3453   \tl_gput_right:Nx \g_nicematrix_code_before_tl
3454   {
3455     \exp_not:N \rectanglecolor [ #1 ] { #2 }
3456     { \int_use:N \c@iRow - \int_use:N \c@jCol }
3457     { \int_use:N \c@iRow - \exp_not:n { \int_use:N \c@jCol } }
3458   }
3459 }

```

```

3460 \NewDocumentCommand \@@_columncolor_preamble { 0 { } m }
3461 {
3462   \int_compare:nNnT \c@iRow = 1
3463   {

```

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).

```

3464   \tl_gput_left:Nx \g_nicematrix_code_before_tl
3465   { \exp_not:N \columncolor [ #1 ] { #2 } { \int_use:N \c@jCol } }
3466 }
3467 }

```

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`.

```
3468 \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`.

```
3469 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix:n #1
3470 {
3471   \int_compare:nNnTF \l_@@_first_col_int = 0
3472   { \@@_OnlyMainNiceMatrix_i:n { #1 } }
3473   {
3474     \int_compare:nNnTF \c@jCol = 0
3475     {
3476       \int_compare:nNnF \c@iRow = { -1 }
3477       { \int_compare:nNnF \c@iRow = { \l_@@_last_row_int - 1 } { #1 } }
3478     }
3479     { \@@_OnlyMainNiceMatrix_i:n { #1 } }
3480   }
3481 }
```

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.

```
3482 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix_i:n #1
3483 {
3484   \int_compare:nNnF \c@iRow = 0
3485   { \int_compare:nNnF \c@iRow = \l_@@_last_row_int { #1 } }
3486 }
```

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 `|`.

```
3487 \cs_new_protected:Npn \@@_vline:nn #1 #2
3488 {
```

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).

```
3489   \int_compare:nNnT { #1 } < { \c@jCol + 2 }
3490   {
3491     \pgfpicture
3492     \@@_vline_i:nn { #1 } { #2 }
3493     \endpgfpicture
3494   }
3495 }
```

```
3496 \cs_new_protected:Npn \@@_vline_i:nn #1 #2
3497 {
```

`\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_tmppc_tl`.

```
3498   \tl_set:Nx \l_tmpb_tl { #1 }
3499   \tl_clear_new:N \l_tmppc_tl
```

```

3500 \int_step_variable:nNn \c@iRow \l_tmpa_tl
3501 {

```

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.

```

3502 \bool_gset_true:N \g_tmpa_bool
3503 \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
3504 { \@@_test_if_vline_in_block:nnnn ##1 }
3505 \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
3506 { \@@_test_if_vline_in_block:nnnn ##1 }
3507 \clist_if_empty:NF \l_@@_except_corners_clist
3508 \@@_test_in_corner_v:
3509 \bool_if:NTF \g_tmpa_bool
3510 {
3511 \tl_if_empty:NT \l_tmpc_tl

```

We keep in memory that we have a rule to draw.

```

3512 { \tl_set_eq:NN \l_tmpc_tl \l_tmpa_tl }
3513 }
3514 {
3515 \tl_if_empty:NF \l_tmpc_tl
3516 {
3517 \@@_vline_ii:nnnn
3518 { #1 }
3519 { #2 }
3520 \l_tmpc_tl
3521 { \int_eval:n { \l_tmpa_tl - 1 } }
3522 \tl_clear:N \l_tmpc_tl
3523 }
3524 }
3525 }
3526 \tl_if_empty:NF \l_tmpc_tl
3527 {
3528 \@@_vline_ii:nnnn
3529 { #1 }
3530 { #2 }
3531 \l_tmpc_tl
3532 { \int_use:N \c@iRow }
3533 \tl_clear:N \l_tmpc_tl
3534 }
3535 }

```

```

3536 \cs_new_protected:Npn \@@_test_in_corner_v:
3537 {
3538 \int_compare:nNnTF \l_tmpb_tl = { \@@_succ:n \c@jCol }
3539 {
3540 \seq_if_in:NxT
3541 \l_@@_empty_corner_cells_seq
3542 { \l_tmpa_tl - \@@_pred:n \l_tmpb_tl }
3543 { \bool_set_false:N \g_tmpa_bool }
3544 }
3545 {
3546 \seq_if_in:NxT
3547 \l_@@_empty_corner_cells_seq
3548 { \l_tmpa_tl - \l_tmpb_tl }
3549 {
3550 \int_compare:nNnTF \l_tmpb_tl = 1
3551 { \bool_set_false:N \g_tmpa_bool }
3552 {
3553 \seq_if_in:NxT
3554 \l_@@_empty_corner_cells_seq

```

```

3555         { \l_tmpa_tl - \@@_pred:n \l_tmpb_tl }
3556         { \bool_set_false:N \g_tmpa_bool }
3557     }
3558 }
3559 }
3560 }

```

#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.

```

3561 \cs_new_protected:Npn \@@_vline_ii:nnnn #1 #2 #3 #4
3562 {
3563     \pgfrememberpicturepositiononpagetrue
3564     \pgf@relevantforpicturesizefalse
3565     \@@_qpoint:n { row - #3 }
3566     \dim_set_eq:NN \l_tmpa_dim \pgf@y
3567     \@@_qpoint:n { col - #1 }
3568     \dim_set_eq:NN \l_tmpb_dim \pgf@x
3569     \@@_qpoint:n { row - \@@_succ:n { #4 } }
3570     \dim_set_eq:NN \l_tmpc_dim \pgf@y
3571     \bool_lazy_and:nnT
3572     { \int_compare_p:nNn { #2 } > 1 }
3573     { ! \tl_if_blank_p:V \CT@drsc@ }
3574     {
3575         \group_begin:
3576         \CT@drsc@
3577         \dim_add:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }
3578         \dim_sub:Nn \l_tmpc_dim { 0.5 \arrayrulewidth }
3579         \dim_set:Nn \l_tmpd_dim
3580         { \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth ) * ( #2 - 1 ) }
3581         \pgfpathrectanglecorners
3582         { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
3583         { \pgfpoint \l_tmpd_dim \l_tmpc_dim }
3584         \pgfusepathqfill
3585         \group_end:
3586     }
3587     \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
3588     \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
3589     \prg_replicate:nn { #2 - 1 }
3590     {
3591         \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
3592         \dim_sub:Nn \l_tmpb_dim \doublerulesep
3593         \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
3594         \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
3595     }
3596     \CT@arc@
3597     \pgfsetlinewidth { 1.1 \arrayrulewidth }
3598     \pgfsetrectcap
3599     \pgfusepathqstroke
3600 }

```

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).

```

3601 \cs_new_protected:Npn \@@_vline_i_complete:nn #1 #2
3602 { \@@_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).

```

3603 \cs_new_protected:Npn \@@_draw_vlines:
3604 {

```

```

3605 \int_step_inline:nnn
3606 { \bool_if:NTF \l_@@_NiceArray_bool 1 2 }
3607 { \bool_if:NTF \l_@@_NiceArray_bool { \@@_succ:n \c@jCol } \c@jCol }
3608 { \@@_vline:nn { ##1 } 1 }
3609 }

```

The horizontal rules

The following command will be executed in the `internal-code-after`. The row will be drawn *before* the row #1. #2 is the number of consecutive occurrences of \Hline.

```

3610 \cs_new_protected:Npn \@@_hline:nn #1 #2
3611 {
3612   \pgfpicture
3613   \@@_hline_i:nn { #1 } { #2 }
3614   \endpgfpicture
3615 }
3616 \cs_new_protected:Npn \@@_hline_i:nn #1 #2
3617 {

```

\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 numver in \l_tmpc_tl.

```

3618   \tl_set:Nn \l_tmpa_tl { #1 }
3619   \tl_clear_new:N \l_tmpc_tl
3620   \int_step_variable:nNn \c@jCol \l_tmpb_tl
3621   {

```

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.

```

3622   \bool_gset_true:N \g_tmpa_bool
3623   \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
3624   { \@@_test_if_hline_in_block:nnnn ##1 }
3625   \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
3626   { \@@_test_if_hline_in_block:nnnn ##1 }
3627   \clist_if_empty:NF \l_@@_except_corners_clist \@@_test_in_corner_h:
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_tmpb_tl }
3632   }
3633   {
3634     \tl_if_empty:NF \l_tmpc_tl
3635     {
3636       \@@_hline_ii:nnnn
3637       { #1 }
3638       { #2 }
3639       \l_tmpc_tl
3640       { \int_eval:n { \l_tmpb_tl - 1 } }
3641       \tl_clear:N \l_tmpc_tl
3642     }
3643   }
3644 }
3645 \tl_if_empty:NF \l_tmpc_tl
3646 {
3647   \@@_hline_ii:nnnn
3648   { #1 }
3649   { #2 }
3650   \l_tmpc_tl

```

```

3651         { \int_use:N \c@jCol }
3652         \tl_clear:N \l_tmpc_tl
3653     }
3654 }

3655 \cs_new_protected:Npn \@@_test_in_corner_h:
3656 {
3657     \int_compare:nNnTF \l_tmpa_tl = { \@@_succ:n \c@iRow }
3658     {
3659         \seq_if_in:NxT
3660         \l_@@_empty_corner_cells_seq
3661         { \@@_pred:n \l_tmpa_tl - \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_tmpa_tl = 1
3670             { \bool_set_false:N \g_tmpa_bool }
3671             {
3672                 \seq_if_in:NxT
3673                 \l_@@_empty_corner_cells_seq
3674                 { \@@_pred:n \l_tmpa_tl - \l_tmpb_tl }
3675                 { \bool_set_false:N \g_tmpa_bool }
3676             }
3677         }
3678     }
3679 }

```

#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.

```

3680 \cs_new_protected:Npn \@@_hline_ii:nnnn #1 #2 #3 #4
3681 {
3682     \pgfrememberpicturepositiononpagetrue
3683     \pgf@relevantforpicturesizefalse
3684     \@@_qpoint:n { col - #3 }
3685     \dim_set_eq:NN \l_tmpa_dim \pgf@x
3686     \@@_qpoint:n { row - #1 }
3687     \dim_set_eq:NN \l_tmpb_dim \pgf@y
3688     \@@_qpoint:n { col - \@@_succ:n { #4 } }
3689     \dim_set_eq:NN \l_tmpc_dim \pgf@x
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_set:Nn \l_tmpd_dim
3697         { \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth ) * ( #2 - 1 ) }
3698         \pgfpathrectanglecorners
3699         { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3700         { \pgfpoint \l_tmpc_dim \l_tmpd_dim }
3701         \pgfusepathqfill
3702         \group_end:
3703     }
3704     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3705     \pgfpathlineto { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3706     \prg_replicate:nn { #2 - 1 }
3707     {
3708         \dim_sub:Nn \l_tmpb_dim \arrayrulewidth

```



```

3709     \dim_sub:Nn \l_tmpb_dim \doublerulesep
3710     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
3711     \pgfpathlineto { \pgfpoint \l_tmpc_dim \l_tmpb_dim }
3712   }
3713   \CT@arc@
3714   \pgfsetlinewidth { 1.1 \arrayrulewidth }
3715   \pgfsetrectcap
3716   \pgfusepathqstroke
3717 }

3718 \cs_new_protected:Npn \@@_hline_i_complete:nn #1 #2
3719 { \@@_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).

```

3720 \cs_new_protected:Npn \@@_draw_hlines:
3721 {
3722   \int_step_inline:nnn
3723   { \bool_if:NTF \l_@@_NiceArray_bool 1 2 }
3724   { \bool_if:NTF \l_@@_NiceArray_bool { \@@_succ:n \c@iRow } \c@iRow }
3725   { \@@_hline:nn { ##1 } 1 }
3726 }

```

The command `\@@_Hline:` will be linked to `\Hline` in the environments of `nicematrix`.

```

3727 \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.

```

3728 \cs_set:Npn \@@_Hline_i:n #1
3729 {
3730   \peek_meaning_ignore_spaces:NTF \Hline
3731   { \@@_Hline_ii:nn { #1 + 1 } }
3732   { \@@_Hline_iii:n { #1 } }
3733 }

3734 \cs_set:Npn \@@_Hline_ii:nn #1 #2 { \@@_Hline_i:n { #1 } }

3735 \cs_set:Npn \@@_Hline_iii:n #1
3736 {
3737   \skip_vertical:n
3738   {
3739     \arrayrulewidth * ( #1 )
3740     + \doublerulesep * ( \int_max:nn 0 { #1 - 1 } )
3741   }
3742   \tl_gput_right:Nx \g_@@_internal_code_after_tl
3743   { \@@_hline:nn { \@@_succ:n { \c@iRow } } { #1 } }
3744   \ifnum 0 = ` { \fi }
3745 }

```

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.

```

3746 \cs_new_protected:Npn \@@_test_if_hline_in_block:nnnn #1 #2 #3 #4
3747 {
3748   \bool_lazy_all:nT
3749   {
3750     { \int_compare_p:nNn \l_tmpa_tl > { #1 } }
3751     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }

```

```

3752     { \int_compare_p:nNn \l_tmpb_tl > { #2 - 1 } }
3753     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
3754   }
3755   { \bool_gset_false:N \g_tmpa_bool }
3756 }

```

The same for vertical rules.

```

3757 \cs_new_protected:Npn \@@_test_if_vline_in_block:nnnn #1 #2 #3 #4
3758 {
3759   \bool_lazy_all:nT
3760   {
3761     { \int_compare_p:nNn \l_tmpa_tl > { #1 - 1 } }
3762     { \int_compare_p:nNn \l_tmpa_tl < { #3 + 1 } }
3763     { \int_compare_p:nNn \l_tmpb_tl > { #2 } }
3764     { \int_compare_p:nNn \l_tmpb_tl < { #4 + 1 } }
3765   }
3766   { \bool_gset_false:N \g_tmpa_bool }
3767 }

```

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.

```

3768 \cs_new_protected:Npn \@@_compute_corners:
3769 {

```

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.

```

3770   \seq_clear_new:N \l_@@_empty_corner_cells_seq
3771   \clist_map_inline:Nn \l_@@_except_corners_clist
3772   {
3773     \str_case:nnF { ##1 }
3774     {
3775       { NW }
3776       { \@@_compute_a_corner:nnnnnn 1 1 1 1 \c@iRow \c@jCol }
3777       { NE }
3778       { \@@_compute_a_corner:nnnnnn 1 \c@jCol 1 { -1 } \c@iRow 1 }
3779       { SW }
3780       { \@@_compute_a_corner:nnnnnn \c@iRow 1 { -1 } 1 1 \c@jCol }
3781       { SE }
3782       { \@@_compute_a_corner:nnnnnn \c@iRow \c@jCol { -1 } { -1 } 1 1 }
3783     }
3784     { \@@_error:nn { bad~corner } { ##1 } }
3785   }
3786 }

```

“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.

```

3787 \cs_new_protected:Npn \@@_compute_a_corner:nnnnnn #1 #2 #3 #4 #5 #6
3788 {

```

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.

```

3789 \bool_set_false:N \l_tmpa_bool
3790 \int_zero_new:N \l_@@_last_empty_row_int
3791 \int_set:Nn \l_@@_last_empty_row_int { #1 }
3792 \int_step_inline:nnnn { #1 } { #3 } { #5 }
3793 {
3794   \@@_test_if_cell_in_a_block:nn { ##1 } { \int_eval:n { #2 } }
3795   \bool_lazy_or:nnTF
3796   {
3797     \cs_if_exist_p:c
3798     { pgf @ sh @ ns @ \@@_env: - ##1 - \int_eval:n { #2 } }
3799   }
3800   \l_tmpb_bool
3801   { \bool_set_true:N \l_tmpa_bool }
3802   {
3803     \bool_if:NF \l_tmpa_bool
3804     { \int_set:Nn \l_@@_last_empty_row_int { ##1 } }
3805   }
3806 }

```

Now, you determine the last empty cell in the row of number 1.

```

3807 \bool_set_false:N \l_tmpa_bool
3808 \int_zero_new:N \l_@@_last_empty_column_int
3809 \int_set:Nn \l_@@_last_empty_column_int { #2 }
3810 \int_step_inline:nnnn { #2 } { #4 } { #6 }
3811 {
3812   \@@_test_if_cell_in_a_block:nn { \int_eval:n { #1 } } { ##1 }
3813   \bool_lazy_or:nnTF
3814   \l_tmpb_bool
3815   {
3816     \cs_if_exist_p:c
3817     { pgf @ sh @ ns @ \@@_env: - \int_eval:n { #1 } - ##1 }
3818   }
3819   { \bool_set_true:N \l_tmpa_bool }
3820   {
3821     \bool_if:NF \l_tmpa_bool
3822     { \int_set:Nn \l_@@_last_empty_column_int { ##1 } }
3823   }
3824 }

```

Now, we loop over the rows.

```

3825 \int_step_inline:nnnn { #1 } { #3 } \l_@@_last_empty_row_int
3826 {

```

We treat the row number `##1` with another loop.

```

3827 \bool_set_false:N \l_tmpa_bool
3828 \int_step_inline:nnnn { #2 } { #4 } \l_@@_last_empty_column_int
3829 {
3830   \@@_test_if_cell_in_a_block:nn { ##1 } { ####1 }
3831   \bool_lazy_or:nnTF
3832   \l_tmpb_bool
3833   {
3834     \cs_if_exist_p:c
3835     { pgf @ sh @ ns @ \@@_env: - ##1 - ####1 }
3836   }
3837   { \bool_set_true:N \l_tmpa_bool }
3838   {
3839     \bool_if:NF \l_tmpa_bool
3840     {
3841       \int_set:Nn \l_@@_last_empty_column_int { ####1 }

```

```

3842         \seq_put_right:Nn
3843         \l_@@_empty_corner_cells_seq
3844         { ##1 - #####1 }
3845     }
3846 }
3847 }
3848 }
3849 }

```

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`).

```

3850 \cs_new_protected:Npn \@@_test_if_cell_in_a_block:nn #1 #2
3851 {
3852     \int_set:Nn \l_tmpa_int { #1 }
3853     \int_set:Nn \l_tmpb_int { #2 }
3854     \bool_set_false:N \l_tmpb_bool
3855     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
3856     { \@@_test_if_cell_in_block:nnnnnnn \l_tmpa_int \l_tmpb_int ##1 }
3857 }
3858 \cs_new_protected:Npn \@@_test_if_cell_in_block:nnnnnnn #1 #2 #3 #4 #5 #6
3859 {
3860     \int_compare:nNnT { #3 } < { \@@_succ:n { #1 } }
3861     {
3862         \int_compare:nNnT { #1 } < { \@@_succ:n { #5 } }
3863         {
3864             \int_compare:nNnT { #4 } < { \@@_succ:n { #2 } }
3865             {
3866                 \int_compare:nNnT { #2 } < { \@@_succ:n { #6 } }
3867                 { \bool_set_true:N \l_tmpb_bool }
3868             }
3869         }
3870     }
3871 }

```

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`.

```

3872 \cs_new:Npn \@@_hdottedline:
3873 {
3874     \noalign { \skip_vertical:N 2\l_@@_radius_dim }
3875     \@@_hdottedline_i:
3876 }

```

On the other side, the following command should be protected.

```

3877 \cs_new_protected:Npn \@@_hdottedline_i:
3878 {

```

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).

```

3879     \tl_gput_right:Nx \g_@@_internal_code_after_tl
3880     { \@@_hdottedline:n { \int_use:N \c@iRow } }
3881 }

```

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.

```
3882 \AtBeginDocument
3883 {
```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible”.

```
3884 \cs_new_protected:Npx \@@_hdottedline:n #1
3885 {
3886   \bool_set_true:N \exp_not:N \l_@@_initial_open_bool
3887   \bool_set_true:N \exp_not:N \l_@@_final_open_bool
3888   \c_@@_pgfortikzpicture_tl
3889   \@@_hdottedline_i:n { #1 }
3890   \c_@@_endpgfortikzpicture_tl
3891 }
3892 }
```

The following command *must* be protected since it is used in the construction of `\@@_hdottedline:n`.

```
3893 \cs_new_protected:Npn \@@_hdottedline_i:n #1
3894 {
3895   \pgfrememberpicturepositiononpagetrue
3896   \@@_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).

```
3897   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
3898   \dim_sub:Nn \l_@@_y_initial_dim \l_@@_radius_dim
3899   \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}
```

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

```
3900   \@@_qpoint:n { col - 1 }
3901   \dim_set:Nn \l_@@_x_initial_dim
3902   {
3903     \pgf@x +
3904     \bool_if:NTF \l_@@_NiceTabular_bool \tabcolsep \arraycolsep
3905     - \l_@@_left_margin_dim
3906   }
3907   \@@_qpoint:n { col - \@@_succ:n \c@jCol }
3908   \dim_set:Nn \l_@@_x_final_dim
3909   {
3910     \pgf@x -
3911     \bool_if:NTF \l_@@_NiceTabular_bool \tabcolsep \arraycolsep
3912     + \l_@@_right_margin_dim
3913   }
```

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.

```

3914 \tl_set:Nn \l_tmpa_tl { ( }
3915 \tl_if_eq:NNF \l_@@_left_delim_tl \l_tmpa_tl
3916 { \dim_gadd:Nn \l_@@_x_initial_dim { 0.5 \l_@@_inter_dots_dim } }
3917 \tl_set:Nn \l_tmpa_tl { ) }
3918 \tl_if_eq:NNF \l_@@_right_delim_tl \l_tmpa_tl
3919 { \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`.

```

3920 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
3921 \@@_draw_line:
3922 }

```

Vertical dotted lines

```

3923 \cs_new_protected:Npn \@@_vdottedline:n #1
3924 {
3925   \bool_set_true:N \l_@@_initial_open_bool
3926   \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”.

```

3927   \bool_if:NTF \c_@@_tikz_loaded_bool
3928   {
3929     \tikzpicture
3930     \@@_vdottedline_i:n { #1 }
3931     \endtikzpicture
3932   }
3933   {
3934     \pgfpicture
3935     \@@_vdottedline_i:n { #1 }
3936     \endpgfpicture
3937   }
3938 }

```

```

3939 \cs_new_protected:Npn \@@_vdottedline_i:n #1
3940 {

```

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.

```

3941 \CT@arc@
3942 \pgfrememberpicturepositiononpagetrue
3943 \@@_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).

```

3944 \dim_set:Nn \l_@@_x_initial_dim { \pgf@x - \l_@@_radius_dim }
3945 \dim_set:Nn \l_@@_x_final_dim { \pgf@x - \l_@@_radius_dim }
3946 \@@_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.

```

3947 \dim_set:Nn \l_@@_y_initial_dim { \pgf@y - 0.5 \l_@@_inter_dots_dim }
3948 \@@_qpoint:n { row - \@@_succ:n \c@iRow }
3949 \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`.

```

3950 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
3951 \@@_draw_line:
3952 }

```

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.

```
3953 \bool_new:N \l_@@_block_auto_columns_width_bool
```

As of now, there is only one option available for the environment {NiceMatrixBlock}.

```
3954 \keys_define:nn { NiceMatrix / NiceMatrixBlock }
3955 {
3956   auto-columns-width .code:n =
3957   {
3958     \bool_set_true:N \l_@@_block_auto_columns_width_bool
3959     \dim_gzero_new:N \g_@@_max_cell_width_dim
3960     \bool_set_true:N \l_@@_auto_columns_width_bool
3961   }
3962 }

3963 \NewDocumentEnvironment { NiceMatrixBlock } { ! 0 { } }
3964 {
3965   \int_gincr:N \g_@@_NiceMatrixBlock_int
3966   \dim_zero:N \l_@@_columns_width_dim
3967   \keys_set:nn { NiceMatrix / NiceMatrixBlock } { #1 }
3968   \bool_if:NT \l_@@_block_auto_columns_width_bool
3969   {
3970     \cs_if_exist:cT { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
3971     {
3972       \exp_args:NNc \dim_set:Nn \l_@@_columns_width_dim
3973       { @@_max_cell_width _ \int_use:N \g_@@_NiceMatrixBlock_int }
3974     }
3975   }
3976 }
```

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).

```
3977 {
3978   \bool_if:NT \l_@@_block_auto_columns_width_bool
3979   {
3980     \iow_shipout:Nn \@mainaux \ExplSyntaxOn
3981     \iow_shipout:Nx \@mainaux
3982     {
3983       \cs_gset:cpn
3984       { @@ _ 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.

```
3985       { \dim_eval:n { \g_@@_max_cell_width_dim + \arrayrulewidth } }
3986     }
3987     \iow_shipout:Nn \@mainaux \ExplSyntaxOff
3988   }
3989 }
```

The extra nodes

First, two variants of the functions \dim_min:nn and \dim_max:nn.

```
3990 \cs_generate_variant:Nn \dim_min:nn { v n }
3991 \cs_generate_variant:Nn \dim_max:nn { v n }
```

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`.

```

3992 \cs_new_protected:Npn \@@_computations_for_medium_nodes:
3993 {
3994   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
3995   {
3996     \dim_zero_new:c { l_@@_row_\@@_i: _min_dim }
3997     \dim_set_eq:cN { l_@@_row_\@@_i: _min_dim } \c_max_dim
3998     \dim_zero_new:c { l_@@_row_\@@_i: _max_dim }
3999     \dim_set:cn { l_@@_row_\@@_i: _max_dim } { - \c_max_dim }
4000   }
4001   \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
4002   {
4003     \dim_zero_new:c { l_@@_column_\@@_j: _min_dim }
4004     \dim_set_eq:cN { l_@@_column_\@@_j: _min_dim } \c_max_dim
4005     \dim_zero_new:c { l_@@_column_\@@_j: _max_dim }
4006     \dim_set:cn { l_@@_column_\@@_j: _max_dim } { - \c_max_dim }
4007   }

```

We begin the two nested loops over the rows and the columns of the array.

```

4008   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4009   {
4010     \int_step_variable:nnNn
4011     \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.

```

4012     {
4013       \cs_if_exist:cT
4014       { 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`.

```

4015     {
4016       \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { south-west }
4017       \dim_set:cn { l_@@_row_\@@_i: _min_dim }
4018       { \dim_min:vn { l_@@_row _ \@@_i: _min_dim } \pgf@y }
4019       \seq_if_in:NxF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
4020       {
4021         \dim_set:cn { l_@@_column _ \@@_j: _min_dim }
4022         { \dim_min:vn { l_@@_column _ \@@_j: _min_dim } \pgf@x }
4023       }

```

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`.

```

4024       \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { north-east }
4025       \dim_set:cn { l_@@_row _ \@@_i: _max_dim }
4026       { \dim_max:vn { l_@@_row _ \@@_i: _max_dim } \pgf@y }

```



```

4027         \seq_if_in:NxF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
4028         {
4029             \dim_set:cn { l_@@_column _ \@@_j: _ max_dim }
4030             { \dim_max:vn { l_@@_column _ \@@_j: _ max_dim } \pgf@x }
4031         }
4032     }
4033 }
4034 }

```

Now, we have to deal with empty rows or empty columns since we don't have created nodes in such rows and columns.

```

4035 \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4036 {
4037     \dim_compare:nNnT
4038     { \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } } = \c_max_dim
4039     {
4040         \@@_qpoint:n { row - \@@_i: - base }
4041         \dim_set:cn { l_@@_row _ \@@_i: _ max _ dim } \pgf@y
4042         \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim } \pgf@y
4043     }
4044 }
4045 \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
4046 {
4047     \dim_compare:nNnT
4048     { \dim_use:c { l_@@_column _ \@@_j: _ min _ dim } } = \c_max_dim
4049     {
4050         \@@_qpoint:n { col - \@@_j: }
4051         \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim } \pgf@x
4052         \dim_set:cn { l_@@_column _ \@@_j: _ min _ dim } \pgf@x
4053     }
4054 }
4055 }

```

Here is the command `\@@_create_medium_nodes:`. When this command is used, the “medium nodes” are created.

```

4056 \cs_new_protected:Npn \@@_create_medium_nodes:
4057 {
4058     \pgfpicture
4059     \pgfrememberpicturepositiononpagetrue
4060     \pgf@relevantforpicturesizefalse
4061     \@@_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”.

```

4062     \tl_set:Nn \l_@@_suffix_tl { -medium }
4063     \@@_create_nodes:
4064     \endpgfpicture
4065 }

```

The command `\@@_create_large_nodes:` must be used when we want to create only the “large nodes” and not the medium ones⁴³. 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:`.

```

4066 \cs_new_protected:Npn \@@_create_large_nodes:
4067 {
4068     \pgfpicture
4069     \pgfrememberpicturepositiononpagetrue
4070     \pgf@relevantforpicturesizefalse
4071     \@@_computations_for_medium_nodes:
4072     \@@_computations_for_large_nodes:

```

⁴³If we want to create both, we have to use `\@@_create_medium_and_large_nodes:`

```

4073     \tl_set:Nn \l_@@_suffix_tl { - large }
4074     \@@_create_nodes:
4075     \endpgfpicture
4076   }

4077 \cs_new_protected:Npn \@@_create_medium_and_large_nodes:
4078 {
4079   \pgfpicture
4080   \pgfrememberpicturepositiononpagetrue
4081   \pgf@relevantforpicturesizefalse
4082   \@@_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”.

```

4083     \tl_set:Nn \l_@@_suffix_tl { - medium }
4084     \@@_create_nodes:
4085     \@@_computations_for_large_nodes:
4086     \tl_set:Nn \l_@@_suffix_tl { - large }
4087     \@@_create_nodes:
4088     \endpgfpicture
4089   }

```

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.

```

4090 \cs_new_protected:Npn \@@_computations_for_large_nodes:
4091 {
4092   \int_set:Nn \l_@@_first_row_int 1
4093   \int_set:Nn \l_@@_first_col_int 1

```

We have to change the values of all the dimensions `l_@@_row_i_min_dim`, `l_@@_row_i_max_dim`, `l_@@_column_j_min_dim` and `l_@@_column_j_max_dim`.

```

4094   \int_step_variable:nNn { \c@iRow - 1 } \@@_i:
4095   {
4096     \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim }
4097     {
4098       (
4099         \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } +
4100         \dim_use:c { l_@@_row _ \@@_succ:n \@@_i: _ max _ dim }
4101       )
4102       / 2
4103     }
4104     \dim_set_eq:cc { l_@@_row _ \@@_succ:n \@@_i: _ max _ dim }
4105     { l_@@_row _ \@@_i: _ min _ dim }
4106   }
4107   \int_step_variable:nNn { \c@jCol - 1 } \@@_j:
4108   {
4109     \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim }
4110     {
4111       (
4112         \dim_use:c { l_@@_column _ \@@_j: _ max _ dim } +
4113         \dim_use:c
4114         { l_@@_column _ \@@_succ:n \@@_j: _ min _ dim }
4115       )
4116       / 2
4117     }
4118     \dim_set_eq:cc { l_@@_column _ \@@_succ:n \@@_j: _ min _ dim }
4119     { l_@@_column _ \@@_j: _ max _ dim }
4120   }

```

Here, we have to use `\dim_sub:cn` because of the number 1 in the name.

```

4121   \dim_sub:cn
4122   { l_@@_column _ 1 _ min _ dim }
4123   \l_@@_left_margin_dim
4124   \dim_add:cn

```

```

4125     { l_@@_column _ \int_use:N \c@jCol _ max _ dim }
4126     \l_@@_right_margin_dim
4127 }

```

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).

```

4128 \cs_new_protected:Npn \@@_create_nodes:
4129 {
4130     \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
4131     {
4132         \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
4133         {

```

We draw the rectangular node for the cell (`\@@_i-\@@_j`).

```

4134         \@@_pgf_rect_node:nnnnn
4135         { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
4136         { \dim_use:c { l_@@_column _ \@@_j: _min_dim } }
4137         { \dim_use:c { l_@@_row _ \@@_i: _min_dim } }
4138         { \dim_use:c { l_@@_column _ \@@_j: _max_dim } }
4139         { \dim_use:c { l_@@_row _ \@@_i: _max_dim } }
4140         \str_if_empty:NF \l_@@_name_str
4141         {
4142             \pgfnodealias
4143             { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
4144             { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
4145         }
4146     }
4147 }

```

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 .

```

4148 \seq_mapthread_function:NNN
4149     \g_@@_multicolumn_cells_seq
4150     \g_@@_multicolumn_sizes_seq
4151     \@@_node_for_multicolumn:nn
4152 }

```

```

4153 \cs_new_protected:Npn \@@_extract_coords_values: #1 - #2 \q_stop
4154 {
4155     \cs_set_nopar:Npn \@@_i: { #1 }
4156     \cs_set_nopar:Npn \@@_j: { #2 }
4157 }

```

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”).

```

4158 \cs_new_protected:Npn \@@_node_for_multicolumn:nn #1 #2
4159 {
4160     \@@_extract_coords_values: #1 \q_stop
4161     \@@_pgf_rect_node:nnnnn
4162     { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
4163     { \dim_use:c { l_@@_column _ \@@_j: _min_dim } }
4164     { \dim_use:c { l_@@_row _ \@@_i: _min_dim } }
4165     { \dim_use:c { l_@@_column _ \int_eval:n { \@@_j: +#2-1 } _ max _ dim } }
4166     { \dim_use:c { l_@@_row _ \@@_i: _ max _ dim } }
4167     \str_if_empty:NF \l_@@_name_str
4168     {

```

```

4169 \pgfnodealias
4170 { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
4171 { \int_use:N \g_@@_env_int - \@@_i: - \@@_j: \l_@@_suffix_tl}
4172 }
4173 }

```

The blocks

The code deals with the command `\Block`. This command has no direct link with the environment `{NiceMatrixBlock}`.

The following command will be linked to `\Block` in the environments of `nicematrix`. We define it with `\NewDocumentCommand` of `xparse` because it has an optional argument between `<` and `>` (for TeX instructions put before the math mode of the label)

It's mandatory to use an expandable command (probably because of the first optional argument?).

```

4174 \NewExpandableDocumentCommand \@@_Block: { 0 { } m D < > { } m }
4175 { \@@_Block_i #2 \q_stop { #1 } { #3 } { #4 } }

```

The first mandatory argument of `\@@_Block:` has a special syntax. It must be of the form i - j where i and j are the size (in rows and columns) of the block.

```

4176 \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 `#5` is the label of the block.

```

4177 \cs_new_protected:Npn \@@_Block_ii:nnnnn #1 #2 #3 #4 #5
4178 {
4179   \bool_if:NT \l_@@_NiceTabular_bool
4180   { \tl_if_empty:nF { #4 } { \@@_error:n { angle-option~in~NiceTabular } } }

4181   \tl_set:Nx \l_tmpa_tl
4182   {
4183     { \int_use:N \c@iRow }
4184     { \int_use:N \c@jCol }
4185     { \int_eval:n { \c@iRow + #1 - 1 } }
4186     { \int_eval:n { \c@jCol + #2 - 1 } }
4187   }

```

Now, `\l_tmpa_tl` contains an “object” corresponding to the position of the block with four components surrounded by curly brackets:

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

We store this information in the sequence `\g_@@_pos_of_blocks_seq`.

```

4188 \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}`.

```

4189 \seq_gput_left:Nx \g_@@_blocks_seq
4190 {
4191   \l_tmpa_tl
4192   { #3 }
4193   \exp_not:n { { #4 \@@_math_toggle_token: #5 \@@_math_toggle_token: } }
4194 }
4195 }

```

The key `tikz` is for Tikz options used when the PGF node of the block is created (the “normal” block node and not the “short” one nor the “medium” one). **In fact, as of now, it is *not* documented.** Is it really a good idea to provide such a key?

```

4196 \keys_define:nn { NiceMatrix / Block }

```

```

4197 {
4198   tikz .tl_set:N = \l_@@_tikz_tl ,
4199   tikz .value_required:n = true ,
4200   color .tl_set:N = \l_@@_color_tl ,
4201   color .value_required:n = true ,
4202   l .code:n = \tl_set:Nn \l_@@_pos_of_block_tl l ,
4203   l .value_forbidden:n = true ,
4204   r .code:n = \tl_set:Nn \l_@@_pos_of_block_tl r ,
4205   r .value_forbidden:n = true ,
4206   c .code:n = \tl_set:Nn \l_@@_pos_of_block_tl c ,
4207   c .value_forbidden:n = true ,
4208   unknown .code:n = \@@_error:n { Unknown-key-for-Block }
4209 }

```

The command `\@@_draw_blocks:` will draw all the blocks. This command is used after the construction of the array.

```

4210 \cs_new_protected:Npn \@@_draw_blocks:
4211 { \seq_map_inline:Nn \g_@@_blocks_seq { \@@_Block_iii:nnnnnn ##1 } }
4212 \cs_new_protected:Npn \@@_Block_iii:nnnnnn #1 #2 #3 #4 #5 #6
4213 {

```

The group is for the keys.

```

4214   \group_begin:
4215   \keys_set:nn { NiceMatrix / Block } { #5 }
4216   \tl_if_empty:NF \l_@@_color_tl
4217   {
4218     \tl_gput_right:Nx \g_nicematrix_code_before_tl
4219     {
4220       \exp_not:N \rectanglecolor
4221       { \l_@@_color_tl }
4222       { #1 - #2 }
4223       { #3 - #4 }
4224     }
4225   }

4226   \cs_set_protected_nopar:Npn \diagbox ##1 ##2
4227   {
4228     \tl_gput_right:Nx \g_@@_internal_code_after_tl
4229     {
4230       \@@_actually_diagbox:nnnnnn
4231       { #1 } { #2 } { #3 } { #4 }
4232       { \exp_not:n { ##1 } } { \exp_not:n { ##2 } }
4233     }
4234   }

4235   \bool_lazy_or:nnTF
4236   { \int_compare_p:nNn { #3 } > \g_@@_row_total_int }
4237   { \int_compare_p:nNn { #4 } > \g_@@_col_total_int }
4238   { \msg_error:nnnn { nicematrix } { Block-too-large } { #1 } { #2 } }
4239   {

```

We put the contents of the cell in the box `\l_@@_cell_box` because we want the command `\rotate` used in the content to be able to rotate the box.

```

4240   \hbox_set:Nn \l_@@_cell_box { #6 }

```

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.

```

4241 \pgfpicture
4242 \pgfrememberpicturepositiononpagetrue
4243 \pgf@relevantforpicturesizefalse
4244 \@@_qpoint:n { row - #1 }
4245 \dim_set_eq:NN \l_tmpa_dim \pgf@y
4246 \@@_qpoint:n { col - #2 }
4247 \dim_set_eq:NN \l_tmpb_dim \pgf@x
4248 \@@_qpoint:n { row - \@@_succ:n { #3 } }
4249 \dim_set_eq:NN \l_tmpc_dim \pgf@y
4250 \@@_qpoint:n { col - \@@_succ:n { #4 } }
4251 \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.

```

4252 \begin { pgfscope }
4253 \exp_args:Nx \pgfset { \l_@@_tikz_tl }
4254 \@@_pgf_rect_node:nnnnn
4255 { \@@_env: - #1 - #2 - block }
4256 \l_tmpb_dim \l_tmpa_dim \l_tmpd_dim \l_tmpc_dim
4257 \end { pgfscope }

```

We construct the short node.

```

4258 \dim_set_eq:NN \l_tmpb_dim \c_max_dim
4259 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
4260 {

```

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.

```

4261 \cs_if_exist:cT
4262 { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
4263 {
4264 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
4265 {
4266 \pgfpointanchor { \@@_env: - ##1 - #2 } { west }
4267 \dim_set:Nn \l_tmpb_dim { \dim_min:nn \l_tmpb_dim \pgf@x }
4268 }
4269 }
4270 }

```

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.

```

4271 \dim_compare:nNnT \l_tmpb_dim = \c_max_dim
4272 {
4273 \@@_qpoint:n { col - #2 }
4274 \dim_set_eq:NN \l_tmpb_dim \pgf@x
4275 }
4276 \dim_set:Nn \l_tmpd_dim { - \c_max_dim }

```

```

4277 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
4278 {
4279     \cs_if_exist:cT
4280     { \pgf @ sh @ ns @ \@@_env: - ##1 - #4 }
4281     {
4282         \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
4283         {
4284             \pgfpointanchor { \@@_env: - ##1 - #4 } { east }
4285             \dim_set:Nn \l_tmpd_dim { \dim_max:nn \l_tmpd_dim \pgf@x }
4286         }
4287     }
4288 }
4289 \dim_compare:nNnT \l_tmpd_dim = { - \c_max_dim }
4290 {
4291     \@@_qpoint:n { col - \@@_succ:n { #4 } }
4292     \dim_set_eq:NN \l_tmpd_dim \pgf@x
4293 }
4294 \@@_pgf_rect_node:nnnnn
4295 { \@@_env: - #1 - #2 - block - short }
4296 \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.

```

4297 \bool_if:NT \l_@@_medium_nodes_bool
4298 {
4299     \@@_pgf_rect_node:nnn
4300     { \@@_env: - #1 - #2 - block - medium }
4301     { \pgfpointanchor { \@@_env: - #1 - #2 - medium } { north-west } }
4302     { \pgfpointanchor { \@@_env: - #3 - #4 - medium } { south-east } }
4303 }

```

Now, we will put the label of the block beginning with the case of a `\Block` of one row.

```

4304 \int_compare:nNnTF { #1 } = { #3 }
4305 {

```

We take into account the case of a block of one row in the “first row” or the “end row”.

```

4306 \int_compare:nNnTF { #1 } = 0
4307 { \l_@@_code_for_first_row_tl }
4308 {
4309     \int_compare:nNnT { #1 } = \l_@@_last_row_int
4310     \l_@@_code_for_last_row_tl
4311 }

```

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`.

```

4312 \pgfextracty \l_tmpa_dim { \@@_qpoint:n { row - #1 - base } }

```

We retrieve (in `\pgf@x`) the x -value of the center of the block.

```

4313 \pgfpointanchor
4314 { \@@_env: - #1 - #2 - block - short }
4315 {
4316     \str_case:Vn \l_@@_pos_of_block_tl
4317     {
4318         c { center }
4319         l { west }
4320         r { east }
4321     }
4322 }

```

We put the label of the block which has been composed in `\l_@@_cell_box`.

```

4323 \pgftransformshift { \pgfpoint \pgf@x \l_tmpa_dim }
4324 \pgfset { inner~sep = \c_zero_dim }
4325 \pgfnode
4326 { rectangle }

```

```

4327         {
4328             \str_case:Vn \l_@@_pos_of_block_tl
4329             {
4330                 c { base }
4331                 l { base-west }
4332                 r { base-east }
4333             }
4334         }
4335         { \box_use_drop:N \l_@@_cell_box } { } { }
4336     }

```

If the number of rows is different of 1, we put the label of the block in using the short node (the label of the block has been composed in `\l_@@_cell_box`).

```

4337     {
4338         \pgftransformshift
4339         {
4340             \pgfpointanchor
4341             { \@@_env: - #1 - #2 - block - short }
4342             {
4343                 \str_case:Vn \l_@@_pos_of_block_tl
4344                 {
4345                     c { center }
4346                     l { west }
4347                     r { east }
4348                 }
4349             }
4350         }
4351         \pgfset { inner~sep = \c_zero_dim }
4352         \pgfnode
4353         { rectangle }
4354         {
4355             \str_case:Vn \l_@@_pos_of_block_tl
4356             {
4357                 c { center }
4358                 l { west }
4359                 r { east }
4360             }
4361         }
4362         { \box_use_drop:N \l_@@_cell_box } { } { }
4363     }
4364     \endpgfpicture
4365 }
4366 \group_end:
4367 }

```

How to draw the dotted lines transparently

```

4368 \cs_set_protected:Npn \@@_renew_matrix:
4369 {
4370     \RenewDocumentEnvironment { pmatrix } { } {
4371         { \pNiceMatrix }
4372         { \endpNiceMatrix }
4373     }
4374     \RenewDocumentEnvironment { vmatrix } { } {
4375         { \vNiceMatrix }
4376         { \endvNiceMatrix }
4377     }
4378     \RenewDocumentEnvironment { Vmatrix } { } {
4379         { \VNiceMatrix }
4380         { \endVNiceMatrix }
4381     }
4382     \RenewDocumentEnvironment { bmatrix } { } {
4383         { \bNiceMatrix }
4384         { \endbNiceMatrix }
4385     }

```



```

4382 \RenewDocumentEnvironment { Bmatrix } { }
4383 { \BNiceMatrix }
4384 { \endBNiceMatrix }
4385 }

```

Automatic arrays

```

4386 \cs_new_protected:Npn \@@_set_size:n #1-#2 \q_stop
4387 {
4388   \int_set:Nn \l_@@_nb_rows_int { #1 }
4389   \int_set:Nn \l_@@_nb_cols_int { #2 }
4390 }
4391 \NewDocumentCommand \AutoNiceMatrixWithDelims { m m O { } m O { } m ! O { } }
4392 {
4393   \int_zero_new:N \l_@@_nb_rows_int
4394   \int_zero_new:N \l_@@_nb_cols_int
4395   \@@_set_size:n #4 \q_stop
4396   \begin { NiceArrayWithDelims } { #1 } { #2 }
4397     { * { \l_@@_nb_cols_int } { c } } [ #3 , #5 , #7 ]
4398   \int_compare:nNnT \l_@@_first_row_int = 0
4399     {
4400       \int_compare:nNnT \l_@@_first_col_int = 0 { & }
4401       \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { & }
4402       \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
4403     }
4404   \prg_replicate:nn \l_@@_nb_rows_int
4405     {
4406       \int_compare:nNnT \l_@@_first_col_int = 0 { & }

```

You put { } before #6 to avoid a hasty expansion of a potential `\arabic{iRow}` at the beginning of the row which would result in an incorrect value of that `iRow` (since `iRow` is incremented in the first cell of the row of the `\halign`).

```

4407   \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { { } #6 & } #6
4408   \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
4409 }
4410 \int_compare:nNnT \l_@@_last_row_int > { -2 }
4411 {
4412   \int_compare:nNnT \l_@@_first_col_int = 0 { & }
4413   \prg_replicate:nn { \l_@@_nb_cols_int - 1 } { & }
4414   \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
4415 }
4416 \end { NiceArrayWithDelims }
4417 }
4418 \cs_set_protected:Npn \@@_define_com:nnn #1 #2 #3
4419 {
4420   \cs_set_protected:cpn { #1 AutoNiceMatrix }
4421   {
4422     \str_gset:Nx \g_@@_name_env_str { #1 AutoNiceMatrix }
4423     \AutoNiceMatrixWithDelims { #2 } { #3 }
4424   }
4425 }
4426 \@@_define_com:nnn p ( )
4427 \@@_define_com:nnn b [ ]
4428 \@@_define_com:nnn v | |
4429 \@@_define_com:nnn V \l \l
4430 \@@_define_com:nnn B \{ \}

```

We define also an command `\AutoNiceMatrix` similar to the environment `{NiceMatrix}`.

```

4431 \NewDocumentCommand \AutoNiceMatrix { O { } m O { } m ! O { } }
4432 {
4433   \group_begin:
4434   \bool_set_true:N \l_@@_NiceArray_bool

```

```

4435     \AutoNiceMatrixWithDelims . . { #2 } { #4 } [ #1 , #3 , #5 ]
4436     \group_end:
4437 }

```

The redefinition of the command `\dotfill`

```

4438 \cs_set_eq:NN \@@_old_dotfill \dotfill
4439 \cs_new_protected:Npn \@@_dotfill:
4440 {

```

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}`).

```

4441     \@@_old_dotfill
4442     \bool_if:NT \l_@@_NiceTabular_bool
4443     { \group_insert_after:N \@@_dotfill_ii: }
4444     { \group_insert_after:N \@@_dotfill_i: }
4445 }
4446 \cs_new_protected:Npn \@@_dotfill_i: { \group_insert_after:N \@@_dotfill_ii: }
4447 \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`.

```

4448 \cs_new_protected:Npn \@@_dotfill_iii:
4449 { \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`.

```

4450 \cs_new_protected:Npn \@@_diagbox:nn #1 #2
4451 {
4452     \tl_gput_right:Nx \g_@@_internal_code_after_tl
4453     {
4454         \@@_actually_diagbox:nnnnnn
4455         { \int_use:N \c@iRow }
4456         { \int_use:N \c@jCol }
4457         { \int_use:N \c@iRow }
4458         { \int_use:N \c@jCol }
4459         { \exp_not:n { #1 } }
4460         { \exp_not:n { #2 } }
4461     }

```

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`.

```

4462     \seq_gput_right:Nx \g_@@_pos_of_blocks_seq
4463     {
4464         { \int_use:N \c@iRow }
4465         { \int_use:N \c@jCol }
4466         { \int_use:N \c@iRow }
4467         { \int_use:N \c@jCol }
4468     }
4469 }

```

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.

```

4470 \cs_new_protected:Npn \@@_actually_diagbox:nnnnnn #1 #2 #3 #4 #5 #6
4471 {
4472     \pgfpicture
4473     \pgf@relevantforpicturesizefalse
4474     \pgfrememberpicturepositiononpagetrue

```

```

4475 \@@_qpoint:n { row - #1 }
4476 \dim_set_eq:NN \l_tmpa_dim \pgf@y
4477 \@@_qpoint:n { col - #2 }
4478 \dim_set_eq:NN \l_tmpb_dim \pgf@x
4479 \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
4480 \@@_qpoint:n { row - \@@_succ:n { #3 } }
4481 \dim_set_eq:NN \l_tmpc_dim \pgf@y
4482 \@@_qpoint:n { col - \@@_succ:n { #4 } }
4483 \dim_set_eq:NN \l_tmpd_dim \pgf@x
4484 \pgfpathlineto { \pgfpoint \l_tmpd_dim \l_tmpc_dim }
4485 {

```

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.

```

4486 \CT@arc@
4487 \pgfsetroundcap
4488 \pgfusepathqstroke
4489 }
4490 \pgfset { inner~sep = 1 pt }
4491 \pgfscope
4492 \pgftransformshift { \pgfpoint \l_tmpb_dim \l_tmpc_dim }
4493 \pgfnode { rectangle } { south-west }
4494 { \@@_math_toggle_token: #5 \@@_math_toggle_token: } { } { }
4495 \endpgfscope
4496 \pgftransformshift { \pgfpoint \l_tmpd_dim \l_tmpa_dim }
4497 \pgfnode { rectangle } { north-east }
4498 { \@@_math_toggle_token: #6 \@@_math_toggle_token: } { } { }
4499 \endpgfpicture
4500 }

```

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. 85.

The command `\CodeAfter` catches everything until the end of the current environment (of `nicematrix`). First, we go until the next command `\end`.

```

4501 \cs_new_protected:Npn \@@_CodeAfter:n #1 \end
4502 {
4503   \tl_gput_right:Nn \g_nicematrix_code_after_tl { #1 }
4504   \@@_CodeAfter_i:n
4505 }

```

We catch the argument of the command `\end` (in `#1`).

```

4506 \cs_new_protected:Npn \@@_CodeAfter_i:n #1
4507 {

```

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.

```

4508 \str_if_eq:eeTF \currenenv { #1 }
4509 { \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`.

```

4510 {
4511   \tl_gput_right:Nn \g_nicematrix_code_after_tl { \end { #1 } }
4512   \@@_CodeAfter:n
4513 }
4514 }

```

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.

```
4515 \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.

```
4516 \bool_new:N \c_@@_footnote_bool
```

```
4517 \@@_msg_new:nnn { Unknown-option-for-package }
4518 {
4519   The-option-'\l_keys_key_tl'-is-unknown. \\
4520   If-you-go-on,-it-will-be-ignored. \\
4521   For-a-list-of-the-available-options,~type-H-<return>.
4522 }
4523 {
4524   The-available-options-are~(in-alphabetic-order):~
4525   define-L-C-R,~
4526   footnote,~
4527   footnotehyper,~
4528   renew-dots,~
4529   renew-matrix-and~
4530   transparent.
4531 }
4532 \keys_define:nn { NiceMatrix / Package }
4533 {
4534   define-L-C-R .bool_set:N = \c_@@_define_L_C_R_bool ,
4535   define-L-C-R .default:n = true ,
4536   renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
4537   renew-dots .value_forbidden:n = true ,
4538   renew-matrix .code:n = \@@_renew_matrix: ,
4539   renew-matrix .value_forbidden:n = true ,
4540   transparent .meta:n = { renew-dots , renew-matrix } ,
4541   transparent .value_forbidden:n = true ,
4542   footnote .bool_set:N = \c_@@_footnote_bool ,
4543   footnotehyper .bool_set:N = \c_@@_footnotehyper_bool ,
4544   unknown .code:n = \@@_error:n { Unknown-option-for-package }
4545 }
4546 \ProcessKeysOptions { NiceMatrix / Package }
```

```
4547 \@@_msg_new:nn { footnote-with-footnotehyper-package }
4548 {
4549   You-can't-use-the-option-'footnote'~because-the-package~
4550   footnotehyper~has~already~been~loaded.~
4551   If-you-want,~you-can-use-the-option-'footnotehyper'~and-the-footnotes~
4552   within-the-environments-of-nicematrix-will-be-extracted-with-the-tools~
4553   of-the-package-footnotehyper.\\
4554   If-you-go-on,~the-package-footnote-won't-be-loaded.
4555 }
4556 \@@_msg_new:nn { footnotehyper-with-footnote-package }
4557 {
4558   You-can't-use-the-option-'footnotehyper'~because-the-package~
4559   footnote~has~already~been~loaded.~
4560   If-you-want,~you-can-use-the-option-'footnote'~and-the-footnotes~
4561   within-the-environments-of-nicematrix-will-be-extracted-with-the-tools~
4562   of-the-package-footnote.\\
```

```

4563   If-you-go-on,~the-package-footnotehyper~won't~be-loaded.
4564 }

4565 \bool_if:NT \c_@@_footnote_bool
4566 {
4567   \@ifclassloaded { beamer }
4568   { \msg_info:nn { nicematrix } { Option~incompatible-with-Beamer } }
4569   {
4570     \@ifpackageloaded { footnotehyper }
4571     { \@@_error:n { footnote~with~footnotehyper~package } }
4572     { \usepackage { footnote } }
4573   }
4574 }

4575 \bool_if:NT \c_@@_footnotehyper_bool
4576 {
4577   \@ifclassloaded { beamer }
4578   { \@@_info:n { Option~incompatible-with-Beamer } }
4579   {
4580     \@ifpackageloaded { footnote }
4581     { \@@_error:n { footnotehyper~with~footnote~package } }
4582     { \usepackage { footnotehyper } }
4583   }
4584   \bool_set_true:N \c_@@_footnote_bool
4585 }

```

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.

```

4586 \cs_new_protected:Npn \@@_convert_to_str_seq:N #1
4587 {
4588   \seq_clear:N \l_tmpa_seq
4589   \seq_map_inline:Nn #1
4590   {
4591     \seq_put_left:Nx \l_tmpa_seq { \tl_to_str:n { ##1 } }
4592   }
4593   \seq_set_eq:NN #1 \l_tmpa_seq
4594 }

```

The following command creates a sequence of strings (`str`) from a `clist`.

```

4595 \cs_new_protected:Npn \@@_set_seq_of_str_from_clist:Nn #1 #2
4596 {
4597   \seq_set_from_clist:Nn #1 { #2 }
4598   \@@_convert_to_str_seq:N #1
4599 }

4600 \@@_set_seq_of_str_from_clist:Nn \c_@@_types_of_matrix_seq
4601 {
4602   NiceMatrix ,
4603   pNiceMatrix , bNiceMatrix , vNiceMatrix, BNiceMatrix, VNiceMatrix
4604 }

```

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`.

```

4605 \cs_new_protected:Npn \@@_error_too_much_cols:
4606 {
4607   \seq_if_in:NVTF \c_@@_types_of_matrix_seq \g_@@_name_env_str

```

```

4608     {
4609         \int_compare:nNnTF \l_@@_last_col_int = { -2 }
4610         { \@@_fatal:n { too-much-cols-for-matrix } }
4611         {
4612             \bool_if:NF \l_@@_last_col_without_value_bool
4613             { \@@_fatal:n { too-much-cols-for-matrix-with-last-col } }
4614         }
4615     }
4616     { \@@_fatal:n { too-much-cols-for-array } }
4617 }

```

The following command must *not* be protected since it's used in an error message.

```

4618 \cs_new:Npn \@@_message_hdotsfor:
4619 {
4620     \tl_if_empty:VF \g_@@_HVdotsfor_lines_tl
4621     { ~Maybe-your-use-of~\token_to_str:N \Hdotsfor\ is~incorrect.}
4622 }
4623 \@@_msg_new:nn { too-much-cols-for-matrix-with-last-col }
4624 {
4625     You-try-to-use-more-columns-than-allowed-by-your~
4626     \@@_full_name_env:.\@@_message_hdotsfor:\ The~maximal~number~of~
4627     columns~is~\int_eval:n { \l_@@_last_col_int - 1 }~(plus~the~
4628     exterior~columns).~This~error~is~fatal.
4629 }
4630 \@@_msg_new:nn { too-much-cols-for-matrix }
4631 {
4632     You-try-to-use-more-columns-than-allowed-by-your~
4633     \@@_full_name_env:.\@@_message_hdotsfor:\ Recall~that~the~maximal~
4634     number~of~columns~for~a~matrix~is~fixed~by~the~LaTeX~counter~
4635     'MaxMatrixCols'.~Its~actual~value~is~\int_use:N \c@MaxMatrixCols.~
4636     This~error~is~fatal.
4637 }

```

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`.

```

4638 \@@_msg_new:nn { too-much-cols-for-array }
4639 {
4640     You-try-to-use-more-columns-than-allowed-by-your~
4641     \@@_full_name_env:.\@@_message_hdotsfor:\ The~maximal~number~of~columns~is~
4642     \int_use:N \g_@@_static_num_of_col_int\
4643     ~~~~~(plus~the~potential~exterior~ones).~
4644     This~error~is~fatal.
4645 }
4646 \@@_msg_new:nn { last-col-not-used }
4647 {
4648     The~key~'last-col'~is~in~force~but~you~have~not~used~that~last~column~
4649     in~your~\@@_full_name_env:~.~However,~you~can~go~on.
4650 }
4651 \@@_msg_new:nn { columns-not-used }
4652 {
4653     The~preamble~of~your~\@@_full_name_env:\ announces~\int_use:N
4654     \g_@@_static_num_of_col_int\
4655     columns~but~you~use~only~\int_use:N \c@jCol.\
4656     However,~you~can~go~on.
4657 }
4658 \@@_msg_new:nn { in-first-col }
4659 {
4660     You~can't~use~the~command~#1~in~the~first~column~(number~0)~of~the~array.\
4661     If~you~go~on,~this~command~will~be~ignored.
4662 }

```

```

4663 \@@_msg_new:nn { in-last-col }
4664 {
4665     You~can't~use~the~command~#1~in~the~last~column~(exterior)~of~the~array.\\
4666     If~you~go~on,~this~command~will~be~ignored.
4667 }
4668 \@@_msg_new:nn { in-first-row }
4669 {
4670     You~can't~use~the~command~#1~in~the~first~row~(number~0)~of~the~array.\\
4671     If~you~go~on,~this~command~will~be~ignored.
4672 }
4673 \@@_msg_new:nn { in-last-row }
4674 {
4675     You~can't~use~the~command~#1~in~the~last~row~(exterior)~of~the~array.\\
4676     If~you~go~on,~this~command~will~be~ignored.
4677 }
4678 \@@_msg_new:nn { bad-option-for-line-style }
4679 {
4680     Since~you~haven't~loaded~Tikz,~the~only~value~you~can~give~to~'line-style'~
4681     is~'standard'.~If~you~go~on,~this~option~will~be~ignored.
4682 }
4683 \@@_msg_new:nn { Unknown-option-for-xdots }
4684 {
4685     As~for~now~there~is~only~three~options~available~here:~'color',~'line-style'~
4686     and~'shorten'~(and~you~try~to~use~'\l_keys_key_tl').~If~you~go~on,~
4687     this~option~will~be~ignored.
4688 }
4689 \@@_msg_new:nn { Unknown-option-for-rowcolors }
4690 {
4691     As~for~now~there~is~only~one~option~available~here:~'respect-blocks'~
4692     (and~you~try~to~use~'\l_keys_key_tl').~If~you~go~on,~
4693     this~option~will~be~ignored.
4694 }
4695 \@@_msg_new:nn { ampersand-in-light-syntax }
4696 {
4697     You~can't~use~an~ampersand~(\token_to_str &)~to~separate~columns~because
4698     ~you~have~used~the~option~'light-syntax'.~This~error~is~fatal.
4699 }
4700 \@@_msg_new:nn { double-backslash-in-light-syntax }
4701 {
4702     You~can't~use~\token_to_str:N~\\~to~separate~rows~because~you~have~used~
4703     the~option~'light-syntax'.~You~must~use~the~character~'\l_@@_end_of_row_tl'~
4704     (set~by~the~option~'end-of-row').~This~error~is~fatal.
4705 }
4706 \@@_msg_new:nn { standard-cline-in-document }
4707 {
4708     The~key~'standard-cline'~is~available~only~in~the~preamble.\\
4709     If~you~go~on~this~command~will~be~ignored.
4710 }
4711 \@@_msg_new:nn { bad-value-for-baseline }
4712 {
4713     The~value~given~to~'baseline'~(\int_use:N \l_tmpa_int)~is~not~
4714     valid.~The~value~must~be~between~\int_use:N \l_@@_first_row_int\ and~
4715     \int_use:N \g_@@_row_total_int\ or~equal~to~'t',~'c'~or~'b'.\\
4716     If~you~go~on,~a~value~of~1~will~be~used.
4717 }
4718 \@@_msg_new:nn { empty-environment }
4719 { Your~\@@_full_name_env:\ is~empty.~This~error~is~fatal. }
4720 \@@_msg_new:nn { unknown-cell-for-line-in-code-after }
4721 {

```

```

4722 Your~command~\token_to_str:N\line\{#1\}\{#2\}~in-the~'code-after'~
4723 can't-be-executed~because~a~cell~doesn't~exist.\\
4724 If~you-go-on~this~command~will-be-ignored.
4725 }

4726 \@@_msg_new:nn { Hdotsfor~in~col-0 }
4727 {
4728   You~can't-use~\token_to_str:N \Hdotsfor\ in~an~exterior~column~of~
4729   the~array.~If~you-go-on,~the~corresponding~dotted~line~won't~be~drawn.
4730 }

4731 \@@_msg_new:nn { bad~corner }
4732 {
4733   #1~is~an~incorrect~specification~for~a~corner~(in~the~keys~
4734   'except~corners'~and~'hlines~except~corners').~The~available~
4735   values~are:~NW,~SW,~NE~and~SE.\\
4736   If~you-go-on,~this~specification~of~corner~will~be~ignored.
4737 }

4738 \@@_msg_new:nn { last~col~non~empty~for~NiceArray }
4739 {
4740   In~the~\@@_full_name_env:,~you~must~use~the~option~
4741   'last~col'~without~value.\\
4742   However,~you~can~go~on~for~this~time~
4743   (the~value~'\l_keys_value_tl'~will~be~ignored).
4744 }

4745 \@@_msg_new:nn { last~col~non~empty~for~NiceMatrixOptions }
4746 {
4747   In~\NiceMatrixoptions,~you~must~use~the~option~
4748   'last~col'~without~value.\\
4749   However,~you~can~go~on~for~this~time~
4750   (the~value~'\l_keys_value_tl'~will~be~ignored).
4751 }

4752 \@@_msg_new:nn { Block~too~large }
4753 {
4754   You~try~to~draw~a~block~in~the~cell~#1~#2~of~your~matrix~but~the~matrix~is~
4755   too~small~for~that~block. \\
4756 }

4757 \@@_msg_new:nn { unknown~column~type }
4758 {
4759   The~column~type~'#1'~in~your~\@@_full_name_env:\
4760   is~unknown. \\
4761   This~error~is~fatal.
4762 }

4763 \@@_msg_new:nn { angle~option~in~NiceTabular }
4764 {
4765   You~should~not~the~option~between~angle~brackets~(<~and~>)~for~a~command~
4766   \token_to_str:N \Block\ in~\{NiceTabular\}.~However,~you~can~go~on.
4767 }

4768 \@@_msg_new:nn { tabularnote~forbidden }
4769 {
4770   You~can't~use~the~command~\token_to_str:N\tabularnote\
4771   ~in~a~\@@_full_name_env:~This~command~is~available~only~in~
4772   \{NiceTabular\},~\{NiceArray\}~and~\{NiceMatrix\}. \\
4773   If~you-go-on,~this~command~will~be~ignored.
4774 }

4775 \@@_msg_new:nn { bottomule~without~booktabs }
4776 {
4777   You~can't~use~the~option~'tabular/bottomrule'~because~you~haven't~
4778   loaded~'booktabs'.\\
4779   If~you-go-on,~this~option~will~be~ignored.
4780 }

```



```

4781 \@@_msg_new:nn { enumitem~not~loaded }
4782 {
4783   You~can't~use~the~command~\token_to_str:N\tabularnote\
4784   ~because~you~haven't~loaded~'enumitem'.\\
4785   If~you~go~on,~this~command~will~be~ignored.
4786 }
4787 \@@_msg_new:nn { Wrong~last~row }
4788 {
4789   You~have~used~'last-row=\int_use:N \l_@@_last_row_int'~but~your~
4790   \@@_full_name_env:\ seems~to~have~\int_use:N \c@iRow \ rows.~
4791   If~you~go~on,~the~value~of~\int_use:N \c@iRow \ will~be~used~for~
4792   last~row.~You~can~avoid~this~problem~by~using~'last-row'~
4793   without~value~(more~compilations~might~be~necessary).
4794 }
4795 \@@_msg_new:nn { Yet~in~env }
4796 { Environments~of~nicematrix~can't~be~nested.\\ This~error~is~fatal. }
4797 \@@_msg_new:nn { Outside~math~mode }
4798 {
4799   The~\@@_full_name_env:\ can~be~used~only~in~math~mode~
4800   (and~not~in~\token_to_str:N \vcenter).\\
4801   This~error~is~fatal.
4802 }
4803 \@@_msg_new:nn { Bad~value~for~letter~for~dotted~lines }
4804 {
4805   The~value~of~key~'\l_keys_key_tl'~must~be~of~length~1.\\
4806   If~you~go~on,~it~will~be~ignored.
4807 }
4808 \@@_msg_new:nnn { Unknown~key~for~Block }
4809 {
4810   The~key~'\l_keys_key_tl'~is~unknown~for~the~command~\token_to_str:N
4811   \Block.\\ If~you~go~on,~it~will~be~ignored. \\
4812   For~a~list~of~the~available~keys,~type~H~<return>.
4813 }
4814 {
4815   The~available~options~are~(in~alphabetic~order):~c,~
4816   color,~l,~and~r.
4817 }
4818 \@@_msg_new:nnn { Unknown~key~for~notes }
4819 {
4820   The~key~'\l_keys_key_tl'~is~unknown.\\
4821   If~you~go~on,~it~will~be~ignored. \\
4822   For~a~list~of~the~available~keys~about~notes,~type~H~<return>.
4823 }
4824 {
4825   The~available~options~are~(in~alphabetic~order):~
4826   bottomrule,~
4827   code~after,~
4828   code~before,~
4829   enumitem~keys,~
4830   enumitem~keys~para,~
4831   para,~
4832   label~in~list,~
4833   label~in~tabular~and~
4834   style.
4835 }
4836 \@@_msg_new:nnn { Unknown~key~for~NiceMatrixOptions }
4837 {
4838   The~key~'\l_keys_key_tl'~is~unknown~for~the~command~
4839   \token_to_str:N \NiceMatrixOptions. \\
4840   If~you~go~on,~it~will~be~ignored. \\
4841   For~a~list~of~the~*principal*~available~keys,~type~H~<return>.

```

```

4842 }
4843 {
4844   The~available~options~are~(in~alphabetic~order):~
4845   allow-duplicate-names,~
4846   cell-space-bottom-limit,~
4847   cell-space-top-limit,~
4848   code-for-first-col,~
4849   code-for-first-row,~
4850   code-for-last-col,~
4851   code-for-last-row,~
4852   create-extra-nodes,~
4853   create-medium-nodes,~
4854   create-large-nodes,~
4855   end-of-row,~
4856   first-col,~
4857   first-row,~
4858   hlines,~
4859   hvlines,~
4860   hvlines-except-corners,~
4861   last-col,~
4862   last-row,~
4863   left-margin,~
4864   letter-for-dotted-lines,~
4865   light-syntax,~
4866   notes~(several subkeys),~
4867   nullify-dots,~
4868   renew-dots,~
4869   renew-matrix,~
4870   right-margin,~
4871   small,~
4872   transparent,~
4873   vlines,~
4874   xdots/color,~
4875   xdots/shorten~and~
4876   xdots/line-style.
4877 }
4878 \@_msg_new:nnn { Unknown~option~for~NiceArray }
4879 {
4880   The~option~'\l_keys_key_tl'~is~unknown~for~the~environment~
4881   \{NiceArray\}. \\
4882   If~you~go~on,~it~will~be~ignored. \\
4883   For~a~list~of~the~*principal*~available~options,~type~H~<return>.
4884 }
4885 {
4886   The~available~options~are~(in~alphabetic~order):~
4887   b,~
4888   baseline,~
4889   c,~
4890   cell-space-bottom-limit,~
4891   cell-space-top-limit,~
4892   code-after,~
4893   code-for-first-col,~
4894   code-for-first-row,~
4895   code-for-last-col,~
4896   code-for-last-row,~
4897   colortbl-like,~
4898   columns-width,~
4899   create-extra-nodes,~
4900   create-medium-nodes,~
4901   create-large-nodes,~
4902   extra-left-margin,~
4903   extra-right-margin,~
4904   first-col,~

```

```

4905 first-row,~
4906 hlines,~
4907 hvlines,~
4908 last-col,~
4909 last-row,~
4910 left-margin,~
4911 light-syntax,~
4912 name,~
4913 notes/bottomrule,~
4914 notes/para,~
4915 nullify-dots,~
4916 renew-dots,~
4917 right-margin,~
4918 rules/color,~
4919 rules/width,~
4920 small,~
4921 t,~
4922 vlines,~
4923 xdots/color,~
4924 xdots/shorten~and~
4925 xdots/line-style.
4926 }

```

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).

```

4927 \@@_msg_new:nnn { Unknown~option~for~NiceMatrix }
4928 {
4929   The~option~'\l_keys_key_tl'~is~unknown~for~the~
4930   \@@_full_name_env:. \\\
4931   If~you~go~on,~it~will~be~ignored. \\\
4932   For~a~list~of~the~*principal*~available~options,~type~H~<return>.
4933 }
4934 {
4935   The~available~options~are~(in~alphabetic~order):~
4936   b,~
4937   baseline,~
4938   c,~
4939   cell-space-bottom-limit,~
4940   cell-space-top-limit,~
4941   code-after,~
4942   code-for-first-col,~
4943   code-for-first-row,~
4944   code-for-last-col,~
4945   code-for-last-row,~
4946   colortbl-like,~
4947   columns-width,~
4948   create-extra-nodes,~
4949   create-medium-nodes,~
4950   create-large-nodes,~
4951   extra-left-margin,~
4952   extra-right-margin,~
4953   first-col,~
4954   first-row,~
4955   hlines,~
4956   hvlines,~
4957   l,~
4958   last-col,~
4959   last-row,~
4960   left-margin,~
4961   light-syntax,~
4962   name,~
4963   nullify-dots,~
4964   r,~

```

```

4965 renew-dots,~
4966 right-margin,~
4967 rules/color,~
4968 rules/width,~
4969 small,~
4970 t,~
4971 vlines,~
4972 xdots/color,~
4973 xdots/shorten~and~
4974 xdots/line-style.
4975 }

4976 \@@_msg_new:nnn { Unknown~option~for~NiceTabular }
4977 {
4978   The~option~'\l_keys_key_tl'~is~unknown~for~the~environment~
4979   \{NiceTabular\}. \\
4980   If~you~go~on,~it~will~be~ignored. \\
4981   For~a~list~of~the~*principal*~available~options,~type~H~<return>.
4982 }
4983 {
4984   The~available~options~are~(in~alphabetic~order):~
4985   b,~
4986   baseline,~
4987   c,~
4988   cell-space-bottom-limit,~
4989   cell-space-top-limit,~
4990   code-after,~
4991   code-for-first-col,~
4992   code-for-first-row,~
4993   code-for-last-col,~
4994   code-for-last-row,~
4995   colortbl-like,~
4996   columns-width,~
4997   create-extra-nodes,~
4998   create-medium-nodes,~
4999   create-large-nodes,~
5000   extra-left-margin,~
5001   extra-right-margin,~
5002   first-col,~
5003   first-row,~
5004   hlines,~
5005   hvlines,~
5006   last-col,~
5007   last-row,~
5008   left-margin,~
5009   light-syntax,~
5010   name,~
5011   notes/bottomrule,~
5012   notes/para,~
5013   nullify-dots,~
5014   renew-dots,~
5015   right-margin,~
5016   rules/color,~
5017   rules/width,~
5018   t,~
5019   vlines,~
5020   xdots/color,~
5021   xdots/shorten~and~
5022   xdots/line-style.
5023 }

5024 \@@_msg_new:nnn { Duplicate~name }
5025 {
5026   The~name~'\l_keys_value_tl'~is~already~used~and~you~shouldn't~use~
5027   the~same~environment~name~twice.~You~can~go~on,~but,~

```

```

5028 maybe,~you-will-have-incorrect-results-especially~
5029 if~you-use~'columns-width=auto'.~If-you-don't-want-to-see-this~
5030 message~again,~use~the~option~'allow-duplicate-names'~in~
5031 '\token_to_str:N \NiceMatrixOptions'.\\
5032 For~a~list~of~the~names~already~used,~type~H~<return>. \\
5033 }
5034 {
5035 The~names~already~defined~in~this~document~are:~
5036 \seq_use:Nnnn \g_@@_names_seq { ,~ } { ,~ } { ~and~ }.
5037 }
5038 \@@_msg_new:nn { Option~auto~for~columns~width }
5039 {
5040 You~can't~give~the~value~'auto'~to~the~option~'columns-width'~here.~
5041 If~you~go~on,~the~option~will~be~ignored.
5042 }

```

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 StackExchange⁴⁴, Tikz externalization is now deactivated in the environments of the package `nicematrix`.⁴⁵

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`).

$$\begin{pmatrix} & C_j & \\ 0 & \vdots & 0 \\ & a & \cdots \\ 0 & & 0 \end{pmatrix} L_i$$

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`.

⁴⁴cf. tex.stackexchange.com/questions/450841/tikz-externalize-and-nicematrix-package

⁴⁵Before this version, there was an error when using `nicematrix` with Tikz externalization. In any case, it’s not possible to externalize the Tikz elements constructed by `nicematrix` because they use the options `overlay` and `remember picture`.

Changes between version 2.2.1 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 StackExchange⁴⁶, 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.

⁴⁶cf. tex.stackexchange.com/questions/510841/nicematrix-and-tikz-external-optimize

Changes between version 3.5 and 3.6

LaTeX counters `iRow` and `jCol` available in the cells of the array.

Addition of `\normalbaselines` before the construction of the array: in environments like `{align}` of `amsmath` the value of `\baselineskip` is changed and if the options `first-row` and `last-row` were used in an environment of `nicematrix`, the position of the delimiters was wrong.

A warning is written in the `.log` file if an obsolete environment is used.

There is no longer artificial errors `Duplicate~name` in the environments of `amsmath`.

Changes between version 3.6 and 3.7

The four “corners” of the matrix are correctly protected against the four codes: `code-for-first-col`, `code-for-last-col`, `code-for-first-row` and `code-for-last-row`.

New command `\pAutoNiceMatrix` and its variants (suggestion of Christophe Bal).

Changes between version 3.7 and 3.8

New programming for the command `\Block` when the block has only one row. With this programming, the vertical rules drawn by the specifier “|” at the end of the block is actually drawn. In previous versions, they were not because the block of one row was constructed with `\multicolumn`. An error is raised when an obsolete environment is used.

Changes between version 3.8 and 3.9

New commands `\NiceMatrixLastEnv` and `\OnlyMainNiceMatrix`.

New options `create-medium-nodes` and `create-large-nodes`.

Changes between version 3.9 and 3.10

New option `light-syntax` (and `end-of-row`).

New option `dotted-lines-margin` for fine tuning of the dotted lines.

Changes between versions 3.10 and 3.11

Correction of a bug linked to `first-row` and `last-row`.

Changes between versions 3.11 and 3.12

Command `\rotate` in the cells of the array.

Options `vlines`, `hlines` and `hvlines`.

Option `baseline` pour `{NiceArray}` (not for the other environments).

The name of the Tikz nodes created by the command `\Block` has changed: when the command has been issued in the cell $i-j$, the name is $i-j$ -`block` and, if the creation of the “medium nodes” is required, a node $i-j$ -`block-medium` is created.

If the user 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 `!\quad` is used in the preamble of the array.

It’s now possible to use the command `\Block` in the “last row”.

Changes between versions 4.3 and 4.4

New key `hvlines-except-corners`.

Changes between versions 4.4 and 5.0

Use of the standard column types `l`, `c` and `r` instead of `L`, `C` and `R`.

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

Command `\tabularnote`

Changes between versions 5.0 and 5.1

The vertical rules specified by `|` in the preamble are not broken by `\hline\hline` (and other).

Environment `{NiceTabular*}`

Command `\Vdotsfor` similar to `\Hdotsfor`

The variable `\g_nicematrix_code_after_tl` is now public.

Changes between versions 5.1 and 5.2

The vertical rules specified by `|` or `||` in the preamble respect the blocks.

Key `respect-blocks` for `\rowcolors` (with a `s`) in the `code-before`.

The variable `\g_nicematrix_code_before_tl` is now public.

The key `baseline` 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).

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