The arydshln package*

Hiroshi Nakashima
(Kyoto University)

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Abstract

This file gives LaTeX's `array` and `tabular` environments the capability to draw horizontal/vertical dash-lines.

Contents

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1 Introduction

In January 1993, Weimin Zhang kindly posted a style hvdashln written by the author, which draws horizontal/vertical dash-lines in LaTeX's `array` and `tabular` environments, to the news group comp.text.tex. The style, unfortunately, has a known problem that vertical lines are broken when an array contains tall rows.

In March of the year, Monty Hayes complained of this problem encouraging the author to make a new version arydshln to solve the problem. The new style also has new features, such as allowing '`:`' to specify a vertical dash-line in preamble, and `\cdashline` being a counterpart of `\cline`.

In March 1999, Sebastian Rahtz kindly invited the style, which had been improved following the bug report from Takahiro Kubota, to be included in TeX CTAN and also in the online catalogue compiled by Graham Williams. This invitation gave the style new users including Peter Ehrbar who wished to use it with array style in Standard LaTeX Tools Bundle and had trouble because these styles were incompatible with each other. Therefore, the style became compatible with array and got additional new features.

In February 2000, Zsuzsanna Nagy reported that arydshln is not compatible with colortab style to let the author work on the compatibility issue again.

In Feburary 2001, Craig Leech reported another compatibility problem with longtable. Although the author promised that the problem would be attacked some day, the issue had left long time[1] until three other complaints were made. Then the author attacked the problem hoping it is the last compatibility issue[2].

In May 2004, Klaus Dalinghaus found another incompatibility with colortbl. Although he was satisfied by a quick hack for cell painting, the author attacked a harder problem for line coloring to solve the problem[3].

2 Usage

2.1 Loading Package

The package is usable to both LaTeX 2_ε and LaTeX-2.09 users with their standard package loading declaration. If you use LaTeX 2_ε, simply do the following.

```
\usepackage{arydshln}
```

If you still love LaTeX-2.09, the following is what you have to do.

```
\documentstyle[..,arydshln,...]{⟨style⟩}
```

Only one caution given to users of array (v2.3m or later) and longtable (v4.10 or later) packages, included in Standard LaTeX Tools Bundle, and colortab and colortbl package is that arydshln has to be loaded *after* array, longtable, colortab and/or colortbl done. That is, the following is correct but reversing the order of `\usepackage` will cause some mysterious error.

[1] Two years and a half! Sorry Craig.
[2] But his hope was dashed as described below.
[3] Without dreaming it is the last compatibility issue.

```
\usepackage{array}     % and/or
\usepackage{longtable} % and/or
\usepackage{colortab}  % or
\usepackage{colortbl}
\usepackage{arydshln}
```

2.2 Basic Usage

array
tabular

You can simply use `array` or `tabular(*)` environments with standard preamble, such as `{r|c|ll}`, and standard commands `\\`, `\hline`, `\cline` and `\multicolumn`.

:

Drawing a vertical dash-line is quite simple. Use '`:`' in the preamble as the separator of columns separated by the dash-line, just like using '`|`' to draw a vertical solid-line. The *preamble* means not only that of the environment, but also the first argument of `\multicolumn`.

\hdashline
\cdashline

It is also simple to draw a horizontal dash-line. Use `\hdashline` and `\cdashline` as the counterparts of `\hline` and `\cline`.

For example;

```
\begin{tabular}{|l::c:r|}\hline
A&B&C\\\hdashline
AAA&BBB&CCC\\\cdashline{1-2}
\multicolumn{2}{|l:}{AB}&C\\\hdashline\hdashline
\end{tabular}
```

will produce the following result.

A	B	C
AAA	BBB	CCC
AB		C

Note that the intersections of leftmost/rightmost vertical lines and horizontal dash-lines are little bit different from those produced by ordinary `array/tabular`. That is, with very careful examination you will find that vertical lines of ordinary ones are *broken* with small white specks at intersections, while in the example above they have no specks. In addition, the four corners of outermost rectangular also have specks in ordinary ones, while those in the example above have perfect contacts of L-shape[4].

\firsthdashline
\lasthdashline

If you use array, the dashed version of `\firsthline` and `\lasthline` named `\firsthdashline` and `\lasthdashline` are available.

2.3 Style Parameters

\dashlinedash
\dashlinegap

You have two style parameters to control the shape of dash-lines: `\dashlinedash` is for the length of each dash segment in a dash line; `\dashlinegap` controls the amount of each gap between dash segments. Both parameters have a common default value, 4 pt.

[4] The top-left/right corners had specks before v1.73, the fix in which made the topmost dash segment of a vertical dash-line a little bit shorter.

2.4 Fine Tuning

; Although you can control the shape of dash-lines in an `array`/`tabular` environment as described in §2.3, you might want to draw a dash-line of a shape different from others. To specify the shape of a vertical dash-line explicitly, you may use;

`;{`⟨*dash*⟩`/`⟨*gap*⟩`}`

instead of ordinary '`:`' and will have a dash-line with dash segments of ⟨*dash*⟩ long separated by spaces of ⟨*gap*⟩.

`\hdashline` `\cdashline` As for horizontal dash-lines, explicit shape specifications may be given through optional arguments of `\hdashline` and `\cdashline` as follows.

`\hdashline[`⟨*dash*⟩`/`⟨*gap*⟩`]`
`\cdashline{`⟨*col1*⟩`-`⟨*col2*⟩`}[`⟨*dash*⟩`/`⟨*gap*⟩`]`

For example;

```
\begin{tabular}{|l::c;{2pt/2pt}r|}\hline
A&B&C\\\hdashline[1pt/1pt]
AAA&BBB&CCC\\\cdashline{1-2}[.4pt/1pt]
\multicolumn{2}{|l;{2pt/2pt}}{AB}&C\\\hdashline\hdashline
\end{tabular}
```

will produce the following result.

A	B	C
AAA	BBB	CCC
AB		C

`\ADLnullwide` `\ADLsomewide` The vertical solid and dashed lines are drawn as if their width is zero, as standard LaTeX's `array` and `tabular` do, if you don't use array package. Otherwise, they have *real* width of `\arrayrulewidth` as the authors of array prefers. However, you may explicitly tell arydshln to follow your own preference by `\ADLnullwide` if you love LaTeX standard, or `\ADLsomewide` if you second the preference of array authors.

2.5 Finer Tuning

To draw dash-lines, we use a powerful primitive of TeX called `\xleaders`. It replicates a segment that consist of a dash and gap so that a dash-line has as many segments as possible and distributes *remainder* space to make the spaces between adjacent dash segments (almost) equal to each other. Therefore, you will have dash-lines with consistent steps of gaps and spaces the lines in Figure 1(1) are.

However, because of a bug (or buggy feature) of `\xleaders`, there *had been* a small possibility that a dash segment near the right/bottom end drops, until it was fixed in the version of 3.141592[5]. Though the fix ultimately made any effort to cope with the problem unnecessary, the pacakge still gives you alternative *drawing modes* which you may specify by `\ADLdrawingmode{`⟨*m*⟩`}` as follows.

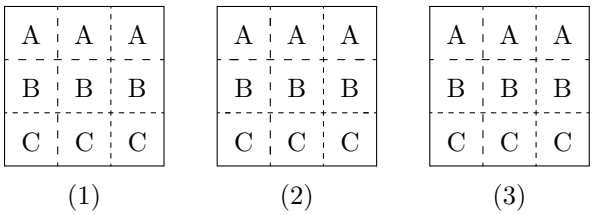


Figure 1: Drawing mode controlled by `\ADLdrawingmode`

`\ADLdrawingmode`

- $m = 1$
  As shown in Figure 1(1), it gives most beautiful result by `\xleaders`[6]. This is default.
- $m = 2$
  As shown in (2) of the figure, beautiful if dash-lines are not so sparse as right/lower lines, but dash segments near the both ends may be a little bit too long as left/upper lines, because in this mode the second first/last segments are drawn by a special mechanism.
- $m = 3$
  As shown in (3) of the figure, beautiful if dash-lines are not so sparse as right/lower lines, but gaps near the both ends may be considerably too large as left/upper lines, because in this mode the lines are drawn by `\cleaders`.

It is strongly recommended to use default mode 1 unless you want to have some special effect.

2.6 Performance Tuning

Since drawing dash-lines is a hard job, you have to be patient with the fact that the performance of typesetting `array`/`tabular` with dash-lines is poorer than that of ordinary ones. In fact, according to author's small performance evaluation with a `tabular` having nine vertical and ten horizontal dash-lines, typesetting the `tabular` is approximately ten times as slow as its ordinary counterpart with solid lines.

However, this is not a really bad news, unfortunately. The real one is that loading `arydshln` makes typesetting `array`/`tabular` slower even if they only have solid lines which the package treats as special ones of dash-lines. The evaluation result shows the degradation factor is about nine. Therefore, if your document has many `array`/`tabular` with solid lines, LaTeX will run slowly even with quite few (or no) `array`/`tabular` with dash-lines,

`\ADLinactivate`

To cope with this problem, you may inactivate dash-line functions by the command `\ADLinactivate` that replaces dash-lines with solid lines drawn by a faster (i.e. ordinary) mechanism. Although the inactivation does not completely solve the performance problem, the degradation factor will become much smaller and acceptable, approximately 1.5 in

[5] By pointing out this problem, the author got a check of $327.68 plus a significantly large amount of interest from DEK. Wow!!

[6] Until the fix of `\xleaders`, the second bottom/rightmost segments of right/lower lines were dropped.

the author's evaluation. For example, the draft version of your document will have the command in its preamble, which you will remove from your final version.

\ADLactivate Alternatively, you may do \ADLinactivate in the preamble, switch on by \ADLactivate before you really need dash-lines, and switch off again afterword. A wiser way could be surrounding array/tabular by \begin{ADLactivate} and \end{ADLactivate}.

Array Tabular If you feel it tiresome to type the long command/environment name for the activation, you may use Array and Tabular(*) environment in which dash-line functions are always active. Note that, however, since these environment names are too natural to keep them from being used by authors of other packages or yourself, name conflict could occur. If Array and/or Tabular have already been defined when arydshln is loaded, you will get a warning to show you have to define new environments, say dlarray and dltabular, as follows.

```
\newenvironment{dlarray}{\ADLactivate\begin{array}}%
                        {\end{array}}
\newenvironment{dltabular}{\ADLactivate\begin{tabular}}%
                          {\end{tabular}}
\newenvironment{dltabular*}{\ADLactivate\begin{tabular*}}%
                           {\end{tabular*}}
```

\ADLnoshorthanded On the other hand, if they are defined after arydshln is loaded, their definitions are silently replaced or LaTeX complains of multiple definitions. The error in the latter case will be avoided by putting \ADLnoshorthanded just after \usepackage{arydshln}.

2.7 Compatibility with Other Packages

Users of array package may use all of newly introduced preamble characters, such as '>', '<', 'm', 'b', and all the commands such as \extrarowheight, \firsthilne and \lasthline. The preamble characters given by arydshln may be included in the second argument of \newcolumntype.

Also users of colortab package may use \LCC/\ECC construct to color columns. A horizontal solid/dash line may be colored by, e.g. \NAC\hdashline\ENAC. The pair of \AC and \EAC may be used to color everything between them *but*, unfortunately, vertical lines are not. There are no ways to color vertical lines in a table having dash lines. You may color vertical lines of a ordinary table inactivating dash line functions by \ADLinactivate.

Another (and more convenient) table coloring tool colortbl may be also used simply by loading it before arydshln. Not only the painting commands \rowcolor, \columncolor and \cellcolor work well, but both solid and dash lines are also colored by the command \arrayrulecolor of colortbl[7]. One caution is that \arrayrulecolor defines the color of the dash-part of dash lines and thus gap-part has no color (i.e. color of the paper on which the line drawn). Therefore, if you have a tabular like;

```
\begin{tabular}{|>{\columncolor{red}}l:>{\colomncolor{green}}r|}
...
\end{tabular}
```

[7]The colortbl manual says \arrayrulecolor and \doublerulesepcolor may be in >{...} in a preamble but they cause an error with the original implementation. This bug is fixed in arydshln and they are now usable to specify the color of the vertical (dash) lines whose specifications occur after the commands.

you will find the vertical dash line is a sequence of black (or the color of `\arrayrulecolor`) and white segments. This problem is partly solved by declaring `\ADLnullwide`[8] to conjunct the red and blue columns and to draw the dash line on their border.

`\ADLnullwidehline` `\ADLsomewidehline` Unfortunately, however, `\ADLnullwide` does not affect the real width of horizontal (dash) lines and thus you will still see white gaps in `\hdashline` and `\cdashline`. A solution is to put `\ADLnullwidehline` before you start a `array`/`tabular`[9]. With this command, a horizontal (dash) line is drawn adjusting its bottom edge to that of the row above. The command `\ADLsomewidehline` turns the switch to default and the top edge of a horizontal (dash) line will be adjusted to the bottom edge of the row above.

`\dashgapcolor` `\nodashgapcolor` Another method to avoid white gaps is to give a color to gaps by `\dashgapcolor` with arguments same as `\color`. For example;

```
\arrayrulecolor{green}\dashgapcolor[rgb]{1,1,0}
```

makes colorful dash lines with green dashes and yellow gaps. The command can be placed outside of `array`/`tabular` for dash lines in the environment, in the argument of preamble character `>` for vertical dash lines following them, or at the beginning of a row for horizontal dash lines following the command. The commmand `\nodashgapcolor` (no arguments) nullifies the effect of `\dashgapcolor`. Note that `\nodashgapcolor` is different from `\dashgapcolor{white}` because the former makes gaps *transparent* while the later whiten them.

`longtable` `Longtable` Usage of longtable with arydshln is quite simple. Just loading arydshln after longtable is enough to make the `longtable` environment able to draw dash-lines. A shorthand activation of dash-line functions is also available by `Longtable` environment. One caution to longtable users is that the temporary results before the *convergence* of the column widths may be different from those without arydshln. For example, the following is the first pass result of the example shown in Table 3 of the longtable manual.

1	2	3
wide multicolumn spanning 1–3		
multicolumn 1–2		3
wide 1	2	3

Since `LTchunksize` is one in the example, columns of each row has their own widths and thus has vertical lines drawn at the edges of the columns. On the other hand, you will have the following as the first pass result with arydshln.

1	2	3
wide multicolumn spanning 1–3		
multicolumn 1–2		3
wide 1	2	3

As you see, the vertical lines are drawn at the column edges of the last row[10] because arydshln draws them when it see the last row. Anyway, you may ignore temporary results and will have a compatible result when the column widths are converged like the following.

[8] Since colortbl automatically loads array, the default is `\ADLsomewide`

[9] This command also makes `\cline` and `\cdashline` visisble even if the row below is painted.

[10] More precisely, drawn according to the column widths established by all the chunks preceding page output.

1	2	3
wide multicolumn spanning 1–3		
multicolumn 1–2		3
wide 1	2	3

3 Known Problems

There are following known problems.

1. The new preamble specifiers '`:`' and '`;{`⟨*dash*⟩`/`⟨*gap*⟩`}`' cannot be followed or preceded by '`@{`⟨*text*⟩`}`', or you will have an ugly result. More specifically, a specifier to draw a dash-line at the left edge of a column cannot be preceded by '`@{`⟨*text*⟩`}`', while that to draw at the right edge cannot be followed by '`@{`⟨*text*⟩`}`'.

2. If you use array package, the restriction of '`@`' shown above is also applied to '`!`'.

3. In order to make it sure that a dash-line always *touches* its both end, i.e. a dash-line always begins and ends with a dash segment, the amount of a gap will slightly vary depending on the dash-line length.

4. If a dash-line is too short, you will have an ugly result without overfull message. More specifically, in mode 1 or 3, a line will look to protrude beyond its column/row borders if it is shorter than a half of `\dashlinedash`. In mode 2, the minimum length to avoid the protrusion is 1.5 × `\dashlinedash` + `\dashlinegap`.

5. As described in §2.6, the processing speed for `array` and `tabular` environment will become slower even if dash-lines are not included.

6. As described in §2.7, `\AC` and `\EAC` pair of colortab such as `\AC&\EAC` cannot color the vertical line at `&`. Use `\ADLinactivate` if you want to have a ordinary table with colored vertical lines. Note that you may color vertical lines with colortbl package.

7. There should be a number of packages whose own `array`/`tabular` implementations are not compatible with arydshln, though the author has made efforts at the compatibility. One of them is plext package for Japanese typesetting but it has a style file named `plextarydshln.sty` to solve the compatibility issue. So if you use the functionality of arydshln with plext, do `\usepackage{plextarydshln}` instead of `\usepackage{arydshln}`.

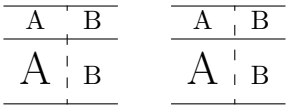
4 Implementation

4.1 Problems and Solutions

We have two different problems to solve; how to draw horizontal dash-lines and how to draw vertical dash-lines. The former problem is relatively easy because the technique for drawing `\cline`-s can be used. That is, if we know the number of columns, we can draw a dash-line across the `\multispan`-ed columns by `\xleaders` of dash. Modifying a preamble of `array`/`tabular` to count the number of columns is not hard. Since `\cdashline` is given beginning and ending columns, its implementation is also easy.

The latter problem, however, is much harder. Remember that `array`/`tabular` draws vertical solid lines by `\vrule`-s in each row without height/depth specification exploiting TEX's sophisticated mechanism of the rule extension in the surrounding box. Since TEX does not have such a mechanism for `\xleaders` unfortunately, we at least have to know the height and depth of a row which includes vertical dash-lines. Although the height and depth are often same as those of `\@arstrutbox`, we will have an exceptionally tall and/or deep row that makes dash-lines *broken* if we assume every row has the standard height and depth.

Moreover, even if we can measure the height/depth of each row (in fact we will do as described later), drawing dash-lines in each row will not produce a good result. Look at the following two examples closely.



In the left example, two dash-lines are individually drawn in two rows. Since the first row is not so tall and deep (8.4 pt/3.6 pt) as to contain enough number of default dash segments (4 pt dash and 4 pt gap) to keep `\xleaders` from inserting a large space, the dash-line in the first row is *sparse*. On the other hand, the second row is enough tall and deep (16.8 pt/ 7.2 pt) and thus the dash-line in the row looks better. Thus the resulting dash-line is awful because it does not have a continuous dash/gap sequence.

The right example, which we wish to produce, is much better than the left. In this example, the dash line is drawn across two rows keeping continuous steps of dashes and gaps. In order to have this result, we have to draw the dash-line *after* two rows are built because it is necessary to know the total height and depth of two rows. In general, if we know the total height and depth of rows and whether a column has a dash-line, we can draw dash-lines by adding an extra row containing dash-lines. For example, the result shown above is obtained by the following row.

`\omit\hss`⟨*dash-line of 36 pt high*⟩`&\omit\cr`

Note that ⟨*dash-line of 36 pt high*⟩ have to be `\smash`-ed.

In addition to this basic scheme, we have to take the following points into account.

- A dash-line drawn by the preamble character '`;`' will have non-default dash/gap specification.

- A column may have two or more dash-lines separated by spaces of `\doublerulesep`. Mixed sequence of solid- and dash-lines also have to be allowed.
- The first column may have dash-lines at both ends, while those of others will appear at right ends only. An exception of this rule is brought by `\multicolumn` that may have leading sequence of solid- and/or dash-line specifiers in its preamble.
- A `\multicolumn` may break or add a dash-line, or may change the dash/gap specification of a dash-line. A sequence of `\h(dash)line`-s also break dash-lines.
- If colortbl is in use, coloring dash/gap by `\arrayrulecolor` and `\dashgapcolor` gives another possibility of the variation of dash/gap specification.

In order to cope with them, the following data structure is constructed during rows are built.

1. The list of row information $R = \langle r_1, r_2, \ldots, r_N \rangle$.
2. The i^{th} element of R, r_i, is one of the following[11].
   (a) A triple $\langle C_i^L, C_i^R, h_i \rangle$, where C_i^L and C_i^R are the lists of solid- or dash-line segments drawn at the left and right edge of columns respectively, and h_i is the height plus depth of the i^{th} row.
   (b) *connect*(h_i) for a `\h(dash)line` of h_i wide meaning that r_i is an empty pseudo row of h_i high and dash-lines are not broken at the row.
   (c) In `longtable` environment, *discard*(h_i) for a negative vertical space inserted by `\\[`$\langle h_i \rangle$`]` or `\h(dash)line` meaning r_i is an empty pseudo row of h_i high and dash-lines are not broken but may be discarded by the page break at the row.
   (d) *disconnect*(h_i) for a vertical gap generated by a sequence of `\h(dash)line` meaning that r_i is an empty pseudo row of h_i high and dash-lines are broken at the row.
3. $C_i^L = \langle e_1^i, e_2^i, \ldots, e_m^i \rangle$ where e_j^i corresponds to the j^{th} (leftmost is first) solid- or dash-line segment. C_i^R is similar but its elements are ordered in reverse, i.e. the rightmost segment is the first element.
4. The j^{th} element of C_i^L or C_i^R, e_j^i, is a triple $\langle c_j^i, d_j^i, g_j^i \rangle$ where c_j^i is the column number in which the segment appears, and d_j^i and g_j^i are dash/gap specification, length and color, of the segment. For a solid line segment, the length attributes of both d_j^i and g_j^i are 0.

Then this data structure is processed to draw solid- and dash-lines at the end of the `array`/`tabular` as follows. Let $e_j^i = \langle c_j^i, d_j^i, g_j^i \rangle$ be the j^{th} element of C_i^L of r_i. The *position* p_j^i of e_j^i in the column c_j^i is defined as follows.

$$p_j^i = \begin{cases} 1 & \text{if } j = 1 \vee c_j^i \neq c_{j-1}^i \\ p_{j-1}^i + 1 & \text{otherwise} \end{cases} .$$

[11] In the real implementation, the structure of r_i is slightly different.

The following defines whether two elements e^i_j and $e^{i'}_{j'}$ are *connected*, or $e^i_j \sim e^{i'}_{j'}$.

$$\begin{aligned} e^i_j \sim e^{i'}_{j'} \leftrightarrow i < i' \wedge \\ & c^i_j = c^{i'}_{j'} \wedge d^i_j = d^{i'}_{j'} \wedge g^i_j = g^{i'}_{j'} \wedge p^i_j = p^{i'}_{j'} \wedge \\ & {}^\forall k(i < k < i' \rightarrow r_k \in \{connect(h_k), discard(h_k)\}). \end{aligned}$$

With these definitions, we can classify all e^i_j into ordered sets $S_1, S_2, \ldots S_n$ as follows.

$$\begin{aligned} k \neq k' &\leftrightarrow S_k \cap S_{k'} = \emptyset \\ e^i_j \sim e^{i'}_{j'} &\leftrightarrow {}^\exists k : e^i_j, e^{i'}_{j'} \in S_k \wedge S_k = \{\ldots, e^i_j, e^{i'}_{j'}, \ldots\} \\ k < k' &\leftrightarrow {}^\forall e^i_j \in S_k, \forall e^{i'}_{j'} \in S_{k'} : (c^i_j < c^{i'}_{j'}) \vee \\ & \qquad (c^i_j = c^{i'}_{j'} \wedge p^i_j < p^{i'}_{j'}) \vee \\ & \qquad (c^i_j = c^{i'}_{j'} \wedge p^i_j = p^{i'}_{j'} \wedge i < i'). \end{aligned}$$

Now we can draw a dash-line $L_k = \langle \gamma_k, \pi_k, \delta_k, \xi_k, \tau_k, \beta_k \rangle$ corresponding to $S_k = \{e^i_j, \ldots, e^{i'}_{j'}\}$ as follows.

- L_k is π^{th}_k line in the γ^{th}_k column where $\gamma_k = c^i_j = \ldots = c^{i'}_{j'}$ and $\pi_k = p^i_j = \ldots = p^{i'}_{j'}$.
- L_k has the dash specification (size and color) $\delta_k = d^i_j = \ldots = d^{i'}_{j'}$ and gap specification $\xi_k = g^i_j = \ldots = g^{i'}_{j'}$.
- The top and bottom ends of L_k are at τ_k and β_k above the bottom of the `array`/`tabular`, where;

  $$\eta_l = \begin{cases} h_l & r_l = connect(h_l) \\ 0 & \text{otherwise} \end{cases}, \quad \tau_k = \eta_{i-1} + \sum_{l=i}^{N} h_l, \quad \beta_k = -\eta_{i'+1} + \sum_{l=i'+1}^{N} h_l.$$

  Note that η_{i-1} and $\eta_{i'+1}$ are added/subtracted so that the top/bottom of L_k is at the top/bottom edge of the horizontal lines above/below the set S_k.

The row to draw $L_1, \ldots, L_n$ is;

$$\sigma_1 L_1 \sigma_2 L_2 \ldots L_{n-1} \sigma_n L_n \sigma_{n+1} \texttt{\textbackslash cr}$$

where;

$$\sigma_1 = \texttt{\textbackslash omit}[\texttt{\textbackslash hss\&\textbackslash omit}]^{\gamma_1 - 1}$$

$$\sigma_{1<k\leq n} = \begin{cases} \texttt{\textbackslash null} & \text{if } \gamma_{k-1} = \gamma_k \wedge \pi_{k-1} = \pi_k \\ \texttt{\textbackslash hskip\textbackslash doublerulesep} & \text{if } \gamma_{k-1} = \gamma_k \wedge \pi_{k-1} \neq \pi_k \\ [\texttt{\textbackslash hss\&\textbackslash omit}]^{\gamma_k - \gamma_{k-1}} & \text{if } \gamma_{k-1} \neq \gamma_k \end{cases}$$

$$\sigma_{n+1} = [\texttt{\textbackslash hss\&\textbackslash omit}]^{\Gamma - \gamma_n - 1}\texttt{\textbackslash hss}.$$

Note that $[x]^m$ means m-times iteration of x, and Γ is the number of columns specified in the preamble.

Dash-lines at the right edges of columns are similarly drawn by processing C_i^R with the following modifications.

$$\begin{aligned} k < k' \leftrightarrow {}^{\forall} e_j^i \in S_k, \forall e_{j'}^{i'} \in S_{k'} : (c_j^i < c_{j'}^{i'}) \vee \\ (c_j^i = c_{j'}^{i'} \wedge p_j^i > p_{j'}^{i'}) \vee \\ (c_j^i = c_{j'}^{i'} \wedge p_j^i = p_{j'}^{i'} \wedge i < i') \end{aligned}$$

$$\sigma_1 = \texttt{\textbackslash omit\textbackslash hss}[\texttt{\&\textbackslash omit\textbackslash hss}]^{\gamma_1 - 1}$$

$$\sigma_{k>1} = \begin{cases} \texttt{\textbackslash null} & \text{if } \gamma_{k-1} = \gamma_k \wedge \pi_{k-1} = \pi_k \\ \texttt{\textbackslash hskip\textbackslash doublerulesep} & \text{if } \gamma_{k-1} = \gamma_k \wedge \pi_{k-1} \neq \pi_k \\ [\texttt{\&\textbackslash omit\textbackslash hss}]^{\gamma_k - \gamma_{k-1}} & \text{if } \gamma_{k-1} \neq \gamma_k \end{cases}$$

$$\sigma_{n+1} = [\texttt{\&\textbackslash omit\textbackslash hss}]^{\Gamma - \gamma_n - 1}$$

4.2 Another Old Problem

In the default mode 1, we draw a dash line of dash size d and gap size g as follows. Let W be the length of the line plus $10\,\texttt{sp}$[12], which is unknown for us if horizontal but known for TEX, and assume $W \geq d/2$ (or the line protrude to the column/row boarder.) At the both ends of the columns, dashes of $d/2$ long are drawn to make the dash-line *touched* to the ends. Then $n = \lfloor (W - d - g)/(d + g) \rfloor$ dashes are equally distributed in the remaining space. Thus we will have;

$$D_0(d/2)G_0(g+\varepsilon')D_1(d)G_1(g+\varepsilon)\ldots G_{n-1}(g+\varepsilon)D_n(d)G_n(g+\varepsilon')D_{n+1}(d/2)$$

where $D_i(l)$ and $G_i(l)$ are dash and gap of l long, $\varepsilon = (W - (n+1)(d+g))/(n+1)$ (rounded), and $\varepsilon' = (W - (n+1)(d+g) - (n-1)\varepsilon)/2$ to compensate the rounding error on the calculation of ε. For a horizontal line, this result will be obtained by `\xleaders` as follows where $G_i^m(\varepsilon)$ and $G_i^m(\varepsilon')$ are the spaces inserted by `\xleaders`.

$$\begin{aligned} & D_0(d/2)G_0^l(g/2)\texttt{\textbackslash xleaders\textbackslash hbox\{}G^r(g/2)D(d)G^l(g/2)\texttt{\}\textbackslash hss}\ G_n^r(g)D_{n+1}(d/2) \\ &= D_0(d/2)G_0^l(g/2)G_0^m(\varepsilon')\left(G_0^r(g/2)D_1(d)G_1^l(g/2)\right)G_1^m(\varepsilon) \\ &\qquad \left(G_1^r(g/2)D_2(d)G_2^l(g/2)\right)G_2^m(\varepsilon) \\ &\qquad \ldots \\ &\qquad G_{n-1}^m(\varepsilon)\left(G_{n-1}^r(g/2)D_n(d)G_n^l(g/2)\right)G_n^m(\varepsilon')G_n^r(g/2)D_{n+1}(d/2) \\ &= D_0(d/2)G_0(g+\varepsilon')D_1(d)G_1(g+\varepsilon)\ldots G_{n-1}(g+\varepsilon)D_n(d)G_n(g+\varepsilon')D_{n+1}(d/2) \end{aligned}$$

The problem is that ε' could be negative and old TEX mistakingly ignored this possibility. That is, since the TEX older than 3.141592 did not put `\hbox` beyond the right edge of `\xleaders`, the rightmost `\hbox` was omitted if ε' is negative.

Since it is (almost) impossible to know the length of a horizontal line, we could not cope with this problem by adding or subtracting its length. Thus we introduced *drawing mode*

[12] This small amount is added by `\xleaders` in order to, according to the comment in `tex.web`, compensate floating point rounding error.

to have imperfect solutions. In the mode 2, we draw a line by the following sequence.

$$\begin{aligned} &D_0(d/2)G_0^l(g/2)G_{0'}^r(g/2)D_{1'}(d)G_{1'}^l(g/2)G(-d-g)\\ &\quad\texttt{\textbackslash xleaders\textbackslash hbox\{}G^r(g/2)D(d)G^l(g/2)\texttt{\}\textbackslash hss}\\ &G(-d-g)G_{n'}^r(g/2)D_{n'}(d)G_{n'}^l(g/2)G_n^r(g)D_{n+1}(d/2)\end{aligned}$$

That is, n^{th} `\hbox` that could be disappeared is put twice and the first one is also overlaid for symmetrization. Therefore the length of the first and n^{th} dashes is $d + |\varepsilon'|$ and thus could be a little bit longer than others.

On the other hand, we replace `\xleaders` of mode 1 with `\cleaders` for the drawing in mode 3. The result will be;

$$D_0(d/2)G_0(g+R)D_1(d)G_1(g)\ldots G_{n-1}(g)D_n(d)G_n(g+R)D_{n+1}(d/2)$$

where $R = (W-(n+1)(d+g))/2$ to make the first and last gaps considerably wider than others.

4.3 Register Declaration

Here registers and switches are declared.

`\dashlinedash` `\dashlinegap` `\hdashlinewidth` `\hdashlinegap`

First of all, two `\dimen` registers `\dashlinedash` and `\dashlinegap` to control the shape of dash-lines are declared, and their default values, 4 pt for both, are assigned to them. They have aliases, `\hdashlinewidth` and `\hdashlinegap` respectively, for the backward compatibility.

```
%% Register Declaration

\newdimen\dashlinedash \dashlinedash4pt %
\newdimen\dashlinegap \dashlinegap4pt %
\let\hdashlinewidth\dashlinedash
\let\hdashlinegap\dashlinegap

```

Next, the following six switches are declared.

`\ifadl@leftrule`

- `\ifadl@leftrule` is used in the preamble analysis macro `\@mkpream` and is true during it processes leading characters for solid- and dash-lines, i.e. '`|`', '`:`', and '`;`'.

`\ifadl@connected`

- `\ifadl@connected` is used to indicate the *connection* $e_j^i \sim e_{j'}^{i'}$. When we process $e_{j'}^{i'}$, the switch is true iff $^{\exists}e_j^i(e_j^i \sim e_{j'}^{i'})$.

`\ifadl@doublerule`

- `\ifadl@doublerule` is used to make σ_k. When we are to make $\sigma_k L_k$, it is true iff $\gamma_{k-1} = \gamma_k \wedge \pi_{k-1} \neq \pi_k$.

`\ifadl@zwvrule`

- `\ifadl@zwvrule` controls the *real* width of vertical lines. If it is true, lines are drawn as if their width is zero following LaTeX's standard. Otherwise, their width `\arrayrulewidth` contribute to the width of columns as `array` does.

\ifadl@zwhrule

- `\ifadl@zwhrule` controls the *real* width of horizontal lines. If it is true, a line is drawn as if its width is zero and its bottom edge is adjusted to that of the row above by inserting `\vskip-\arrayulewidth` before the drawing. Thus a horizontal dash line is included in the row above and its gaps look colored properly if the row is painted. If it is false, the width `\arrayrulewidth` contribute to the height of `array`/`tabular` as usual.

\ifadl@usingarypkg

- `\ifadl@usingarypkg` is true iff array has been loaded prior to arydshln. This switch shows us which definitions, by LaTeX or array, we have to modify. Its value is set by examining if `\extrarowheight`, which is introduced by array, is defined.

\ifadl@inactive

- `\ifadl@inactive` inactivates dash-line functions if it is true. Its default value is false.

We also use a working switch `\@tempswa`.

```
\newif\ifadl@leftrule
\newif\ifadl@connected
\newif\ifadl@doublerule
\newif\ifadl@zwvrule
\newif\ifadl@zwhrule
\newif\ifadl@usingarypkg
\ifx\extrarowheight\undefined \adl@usingarypkgfalse
\else                         \adl@usingarypkgtrue  \fi
\newif\ifadl@inactive \adl@inactivefalse

```

\ADLnullwide
\ADLsomewide

The switch `\ifadl@hwvrule` is turned on/off by user interface macros `\ADLnullwide` and `\ADLsomewide`. Its initial value is the complement of `\adl@usingarypkg`.

\ADLnullwidehline
\ADLsomewidehline

The switch `\ifadl@zwvrule` is turned on/off by user interface macros `\ADLnullwidehline` and `\ADLsomewidehline`. Its initial value is false.

\ADLactivate
\ADLinactivate

The switch `\ifadl@inactive` is also turned on/off by user interface macros `\ADL inactivate` and `\ADLactivate`.

```
\def\ADLnullwide{\adl@zwvruletrue}
\def\ADLsomewide{\adl@zwvrulefalse}
\ifadl@usingarypkg \ADLsomewide \else \ADLnullwide \fi
\def\ADLnullwidehline{\adl@zwhruletrue}
\def\ADLsomewidehline{\adl@zwhrulefalse}
\ADLsomewidehline

\def\ADLactivate{\adl@inactivefalse}
\def\ADLinactivate{\adl@inactivetrue}

```

The following `\box` register and three `\dimen` registers are used to measure the height and depth of a row.

\adl@box

- The contents of a column is packed into the `\box` register `\adl@box` to measure its height and depth.

\adl@height
\adl@depth

- The \dimen registers \adl@height and \adl@depth contain the height/depth of the tallest/deepest column in a row. When a column is processed, they are compared to the height and depth of \adl@box and are updated if they are less.

\adl@heightsave
\adl@depthsave

  Since we have to update these registers \global-ly to pass their values across & and we may have a column containing array/tabular, they are saved into \adl@heightsave/\adl@depthsave at the beginning of the environment and are restored at its end.

\adl@finaldepth

- The other \dimen register \adl@finaldepth is set to the depth of the last row, or zero if the last vertical item is a horizontal line. This value is used to shift array/tabular down because we add extra two \smash-ed rows which make the depth of array/tabular zero.

We also use working \dimen registers \@tempdima and \@tempdimb.

```
\newbox\adl@box
\newdimen\adl@height \newdimen\adl@heightsave
\newdimen\adl@depth \newdimen\adl@depthsave
\newdimen\adl@finaldepth
```

Then the following \count registers are declared. Note that some of them contain dimensions measured by the unit sp.

\adl@columns
\adl@ncol

- \adl@columns has the number of columns specified in the preamble of the environment. Because of a complicated reason related to the compatibility with array, we cannot count up \adl@columns directly but increment \adl@ncol when each column of preamble is built and move its value to \adl@columns after the preamble is constructed.

\adl@currentcolumn
\adl@currentcolumnsave

- To process \multicolumn, we have to know the column number where it appears. Thus we have a column counter \adl@currentcolumn which is \global-ly incremented when each column is built. Because of the \global assignment, the counter has to be saved/restored into/from \adl@currentcolumnsave.

\adl@totalheight

- In the real implementation, τ_k and β_k are calculated by the following equations rather than those shown in §4.1.

$$H = \sum_{l=1}^{N} h_l, \quad \tau_k = H + \eta_{i-1} - \sum_{l=1}^{i-1} h_l, \quad \beta_k = \tau_k - \eta_{i-1} - \eta_{i'-1} - \sum_{l=i'}^{i} h_l.$$

  \adl@totalheight contains $\sum_{l=1}^{i} h_l$ when the i^{th} row is built and thus its final value is H. Since the data structure R are represented by a text, we have to pay attention to the precision of its dimensional elements, such as h_i. That is, if we append h_i to R by expanding \the\dimen$n$ which has the height plus depth of i^{th} row, h_i will be an approximation of \dimen$n$ represented by a decimal fraction with pt. Although the error of the approximation is quite small and may be negligible, the error must be avoided because it is avoidable by simply using \number\dimen$n$. Therefore, h_i is an integer and thus \adl@totalheight is too.

\adl@totalheightsave

Because of the \global assignment to \adl@totalheight to pass its value across rows, it has to be saved/restored into/from \adl@totalheightsave.

\adl@dash
\adl@gap

- In order to check $e^i_j \sim e^{i'}_{j'}$, the size attributes of d^i_j and g^i_j are kept in the registers \adl@dash and \adl@gap when we process $e^{i'}_{j'}$. As explained above, d^i_j and g^i_j are integers and thus \adl@dash and \adl@gap are \count registers.

\adl@cla
\adl@clb

- The coding of \cdashline is similar to that of \cline in LaTeX-2.09 which uses two global \count registers \@cla and \@clb. These registers are omitted from LaTeX 2_ε because its \cline is completely recoded. We could adopt new coding but it requires some other macro definitions that LaTeX-2.09 does not have. Thus we simply introduce new global counters \adl@cla and \adl@clb for \cdashline in order to make \cdashline work in both LaTeX-2.09 and LaTeX 2_ε.

We also use working \count registers \@tempcnta and \@tempcntb.

```
\newcount\adl@columns \newcount\adl@ncol
\newcount\adl@currentcolumn \newcount\adl@currentcolumnsave
\newcount\adl@totalheight \newcount\adl@totalheightsave
\newcount\adl@dash \newcount\adl@gap
\newcount\adl@cla \newcount\adl@clb
```

\adl@everyvbox

The last register declaration is for a \toks register named \adl@everyvbox. In order to minimize the copy-and-modify of the codes in LaTeX and array, we need to use \everyvbox in our own definition of \@array. The register is used to save the contents of \everyvbox.

```
\newtoks\adl@everyvbox

```

\adl@org@arrayclassz
\adl@org@tabclassz
\adl@org@classz
\adl@org@@startpbox
\adl@org@@endpbox
\adl@org@startpbox
\adl@org@endpbox
\adl@org@cline

The other declarative stuff consists of the sequence of \let to capture the original definitions of macros that we will modify afterword. The main purpose of them is to nullify the modification when dash-line functions are inactive, while \adl@org@cline is also referred to in its modified version.

```
\let\adl@org@arrayclassz\@arrayclassz
\let\adl@org@tabclassz\@tabclassz
\let\adl@org@classz\@classz
\let\adl@org@@startpbox\@@startpbox
\let\adl@org@@endpbox\@@endpbox
\let\adl@org@startpbox\@startpbox
\let\adl@org@endpbox\@endpbox
\let\adl@org@cline\cline

%%^L
```

4.4 Initialization

\adl@array
\@array
\adl@noalign

LaTeX's macro \@array is modified to save and initialize registers and data structures which are \global-ly updated in order to allow nested array/tabular. This saving and initializing are performed by \adl@arrayinit as explained below. The problem in the

modification is that the code of \@array in array is completely different from that of LaTeX original.

The main difference is that LaTeX builds \@preamble locally, while array does globally exploiting the fact that the lifetime of \@preamble ends before another array/tabular appears in a column. The latter implementation will work well unless the building process in \@mkpream produces something referred to after \@preamble is thrown into TeX's *stomach*. In our implementation, unfortunately, the number of columns has to be counted in \@mkpream and will be referred to by \hdashline and the vertical line drawing procedure.

Thus we have to change the column counting mechanism depending on whether or not array is in use. The simplest way could be to copy the codes of LaTeX and array and modify them appropriately examining the value of \ifadl@usingarypkg. However this solution is vulnerable to the modification of the original version and thus we wish to refuse it as far as possible.

Therefore, we use a trick with \everyvbox in which \adl@arrayinit is temporarily included to initialize registers and locally set \adl@columns to the number of columns \global-ly counted by \adl@ncol. This trick works well so far because;

- the first \vbox, \vtop or \vcenter made by \@array is the vertical box surrounding \halign, and;
- in \@array of array the box is opened *after* the preamble is constructed;

and will hopefully work in future.

Next, if \ifadl@inactive is true, \adl@inactivate is invoked to inactivate dash-line functions. Otherwise, \adl@activate is invoked to activate them because an inactivated array/tabular may have active children in it. Finally, \adl@noalign is made \let-equal to \noalign so that \arrayrulecolor, \doublerulesepcolor and \dashgapcolor are expanded with \noalign in the environment.

\@@array Another stuff for the compatibility with array is to \let a control sequence \@@array be equal to \@array if it is made so by array and the equality is kept. That is, with array \@@array is invoked by \@tabarray and it is \let-equal to \@array by default, while \@@array can be made different from \@array by some other package, e.g., delarray, to do some special operations defined in the package. Therefore by the conditional equalization with \ifx, our own \@array is directly invoked through \@@array if the default equality is kept, while otherwise the package-dependent definition of \@@array is respected.

```
49
50 %% Initialization
51
52 \let\adl@array\@array
53 \def\@array{\adl@everyvbox\everyvbox
54         \everyvbox{\adl@arrayinit \the\adl@everyvbox \everyvbox\adl@everyvbox}%
55         \ifadl@inactive \adl@inactivate \else \adl@activate \fi
56         \let\adl@noalign\noalign
57         \adl@array}
58 \ifx\@@array\adl@array \let\@@array\@array \fi
59
```

\adl@arrayinit
\adl@arraysave

As described in §4.3, registers updated \global-ly, which are \adl@height, \adl@depth, \adl@currentcolumn and \adl@totalheight, are saved in \adl@arrayinit by calling \adl@arraysave, and also given initial values. The macro also saves the following data structures and initializes them to empty lists.

\adl@rowsL
\adl@rowsR
\adl@rowsLsave
\adl@rowsRsave
\adl@colsL
\adl@colsR
\adl@colsLsave
\adl@colsRsave

- In the real implementation, the data structure R is split into two lists;

$$\texttt{\adl@rowsL} = R^L = \langle\langle C_1^L, h_1\rangle, \ldots\rangle$$
$$\texttt{\adl@rowsR} = R^R = \langle\langle C_1^R, h_1\rangle, \ldots\rangle$$

  and they are saved into \adl@rowsLsave and \adl@rowsRsave.

- When the i^{th} row is building, C_i^L and C_i^R are constructed in the macros \adl@colsL and \adl@colsR. They are saved into \adl@colsLsave and \adl@colsRsave.

\adl@connect
\adl@discard

In the real implementation, e_j^i is represented by a control sequence \@elt, and *connect*(i) by \adl@connect. They are made \let-equal to \relax to keep them from expansion during R is constructed. In longtable environment, *connect*(i) for negative vertical space inserted by \\[$\langle h\rangle$] or a horizontal line has another representation \adl@discard to indicate it corresponds to a discardable item of page breaking. Since this representation, however, is nonsense in usural array/tabular even if they are included in \longtable, we define \adl@discard as \adl@connect so that it transforms itself into \adl@connect when it is added to \adl@rowsL/R by \xdef. Note that \adl@discard is made \let-equal to \relax to inhibit the transformation at the beginning of longtable environment.

Then, we set to \adl@columns to the value of \adl@ncol *locally*. As explained above, this has an effect with array because \adl@arrayinit is called *after* the preamble is generated. Without array, on the other hand, this assignment has no effect but safe because it is included in a group of \vbox etc.

```
\def\adl@arrayinit{%
        \adl@arraysave
        \global\adl@height\z@ \global\adl@depth\z@
        \global\adl@currentcolumn\@ne \global\adl@totalheight\z@
        \gdef\adl@rowsL{}\gdef\adl@rowsR{}\gdef\adl@colsL{}\gdef\adl@colsR{}%
        \let\@elt\relax \let\adl@connect\relax \def\adl@discard{\adl@connect}%
        \adl@columns\adl@ncol}
\def\adl@arraysave{%
        \adl@heightsave\adl@height
        \adl@depthsave\adl@depth
        \adl@currentcolumnsave\adl@currentcolumn
        \adl@totalheightsave\adl@totalheight
        \let\adl@rowsLsave\adl@rowsL
        \let\adl@rowsRsave\adl@rowsR
        \let\adl@colsLsave\adl@colsL
        \let\adl@colsRsave\adl@colsR}

```

\adl@inactivate If \ADLinactivate has effect and thus \ifadl@inactive is true, the macro \adl@inactivate is called from \@array[13]. This \let-s the following control sequences be equal to their counterparts in LaTeX and/or array package.

```
\@arrayclassz \@tabclassz \@classz \@@startpbox \@@endpbox
\@startpbox \@endpbox \adl@cr \adl@argcr \adl@endarray
```

Note that \@classz has to be \let-equal to \adl@org@classz only if array is in use, because LaTeX does not define \@classz but refers to it which is either \@arrayclassz or \@tabclassz. Yet another remark is that we have to conceal \cr for \adl@cr/\adl@argcr and \crcr for \adl@endarray by bracing them from TeX's \halign mechanism that searches them when an array/tabular has an nested array/tabular. This could be done by a tricky \let-assignment such as;

```
\iffalse{\let\adl@cr\cr \iffalse}\fi
```

but we simply use \def instead of \let because of clarity.

We also \let the following be *no-operation* or their inactive versions.

```
\adl@hline \adl@ihdashline \adl@cdline \adl@@vlineL \adl@@vlineR
\adl@vlineL \adl@vlineR
```

Note that we have to inactivate both \adl@@vlineL and \adl@vlineL, because the latter is referred to when array is in use while the former is done otherwise. Their R relatives are also inactivated by the same reason.

```
\def\adl@inactivate{%
        \let\@arrayclassz\adl@org@arrayclassz
        \let\@tabclassz\adl@org@tabclassz
        \ifadl@usingarypkg \let\@classz\adl@org@classz \fi
        \let\@@startpbox\adl@org@@startpbox
        \let\@@endpbox\adl@org@@endpbox
        \let\@startpbox\adl@org@startpbox
        \let\@endpbox\adl@org@endpbox
        \def\adl@cr{\cr}%
        \def\adl@argcr##1{\cr}%
        \def\adl@endarray{\crcr}%
        \let\adl@hline\@gobbletwo
        \let\adl@ihdashline\adl@inactivehdl
        \let\adl@cdline\adl@inactivecdl
        \let\adl@@vlineL\adl@inactivevl
        \let\adl@@vlineR\adl@inactivevl
        \let\adl@vlineL\adl@inactivevl
        \let\adl@vlineR\adl@inactivevl}
```

\adl@activate On the other hand, if \ifadl@inactive is false, the macro \adl@activate is called from \@array to make inactivated macros active again in order to cope with the case in which

[13] Before v1.53, \adl@inactivate was called from \adl@arrayinit and thus invokded *after* the preamble of array is built. This was incorrect of course and made inactive version of p, m and b produce nothing.

Table 1: Active and Inactive Operations

command	active	inactive
`l c r`		
with array	`\adl@act@classz`	`\adl@org@classz`
without array	`\adl@act@tabclassz`	`\adl@org@tabclassz`
	`\adl@act@arrayclassz`	`\adl@org@arrayclassz`
`p m b` (open)		
with array	`\adl@act@classz`	`\adl@org@classz`
without array	`\adl@act@@startpbox`	`\adl@org@@startpbox`
`p m b` (close)	`\adl@act@@endpbox`	`\adl@org@@endpbox`
`|/:/;`	`\adl@act@@vlineL/R`	`\adl@inactivevl`
`\\`	→`\adl@act@(arg)cr`	→`\cr`
`\hline`	→`\adl@act@hline`	→`\@gobbletwo`
`\hdashline`	→`\adl@act@ihdashline`	→`\adl@inactivehdl`
`\cdashline`	→`\adl@act@cdline`	→`\adl@inactivecdl`

an inactive array/tabular has active children in it[14]. To do that, `\adl@activate` makes `\@arrayclassz` etc. `\let`-equal to their active version `\adl@act@arrayclassz` etc. which will be defined (`\let`-equal to) as our own `\@arrayclassz` etc. in §4.13.

```
\def\adl@activate{%
        \let\@arrayclassz\adl@act@arrayclassz
        \let\@tabclassz\adl@act@tabclassz
        \ifadl@usingarypkg \let\@classz\adl@act@classz \fi
        \let\@@startpbox\adl@act@@startpbox
        \let\@@endpbox\adl@act@@endpbox
        \let\@startpbox\adl@act@startpbox
        \let\@endpbox\adl@act@endpbox
        \let\adl@cr\adl@act@cr
        \let\adl@argcr\adl@act@argcr
        \let\adl@endarray\adl@act@endarray
        \let\adl@hline\adl@act@hline
        \let\adl@ihdashline\adl@act@ihdashline
        \let\adl@cdline\adl@act@cdline
        \let\adl@@vlineL\adl@act@@vlineL
        \let\adl@@vlineR\adl@act@@vlineR
        \let\adl@vlineL\adl@act@@vlineL
        \let\adl@vlineR\adl@act@@vlineR}

%%^L
```

The summary of the activation and inactivation is shown in Table 1.

[14]Before v1.54, an active array/tabular in an inactive parent was not activated.

4.5 Making Preamble

Each preamble character is converted to a part of `\halign`'s preamble as follows.

`\adl@colhtdp`

- '`l`', '`r`' and '`c`' are converted to the following ⟨*lrc*⟩.

$$
\begin{aligned}
\langle \textit{lrc} \rangle &::= [\texttt{\textbackslash hfil}]\langle \textit{put-lrc} \rangle[\texttt{\textbackslash hfil}] \\
\langle \textit{put-lrc} \rangle &::= \texttt{\textbackslash setbox\textbackslash adl@box\textbackslash hbox\{}\langle \textit{lrc-contents} \rangle\texttt{\}} \\
&\quad\ \texttt{\textbackslash adl@colhtdp \textbackslash unhbox\textbackslash adl@box} \\
\langle \textit{lrc-contents} \rangle &::= \texttt{\$\textbackslash relax\#\$} \mid \\
&\quad\ \texttt{\#\textbackslash unskip}
\end{aligned}
$$

That is, the content of a column is at first packed into the `\box` register `\adl@box`, then its height and depth are compared to `\adl@height` and `\adl@depth` by the macro `\adl@colhtdp`, and finally the box is put with leading and/or trailing `\hfil`.

`\adl@vlineL`
`\adl@vlineR`

- '`|`', '`:`' and `;{`⟨*dash*⟩`/`⟨*gap*⟩`}` are converted to the following ⟨*vline*⟩.

$$
\begin{aligned}
\langle \textit{vline} \rangle &::= [\texttt{\textbackslash hskip\textbackslash doublerulesep}]\langle \textit{vline-LR} \rangle \\
\langle \textit{vline-LR} \rangle &::= \texttt{\textbackslash adl@vlineL\{}\langle \Gamma_d \rangle\texttt{\}\{}\langle \Gamma_g \rangle\texttt{\}\{}\langle c \rangle\texttt{\}\{}\langle d \rangle\texttt{/}\langle g \rangle\texttt{\}} \mid \\
&\quad\ \texttt{\textbackslash adl@vlineR\{}\langle \Gamma_d \rangle\texttt{\}\{}\langle \Gamma_g \rangle\texttt{\}\{}\langle c \rangle\texttt{\}\{}\langle d \rangle\texttt{/}\langle g \rangle\texttt{\}} \\
\langle d \rangle &::= 0 \mid && \ldots \text{ for '}\texttt{|}\text{'} \\
&\quad\ \texttt{\textbackslash dashlinedash} \mid && \ldots \text{ for '}\texttt{:}\text{'} \\
&\quad\ \langle \textit{dash} \rangle && \ldots \text{ for '}\texttt{;}\text{'} \\
\langle g \rangle &::= 0 \mid && \ldots \text{ for '}\texttt{|}\text{'} \\
&\quad\ \texttt{\textbackslash dashlinegap} \mid && \ldots \text{ for '}\texttt{:}\text{'} \\
&\quad\ \langle \textit{gap} \rangle && \ldots \text{ for '}\texttt{;}\text{'}
\end{aligned}
$$

Note that ⟨*c*⟩ is the column number (leftmost is 1) where the character appears, and $\langle \Gamma_d \rangle$ and $\langle \Gamma_g \rangle$ is the color of dashs and gaps specified in `\CT@arc@` and `\adl@dashgapcolor`.

Additionally, each column except for the last one has;

```
\global\advance\adl@currentcolumn\@ne
```

just before `&` to increment `\adl@currentcolumn`. Other features, such as inserting spaces of `\arraycolsep`/`\tabcolsep`, are as same as original scheme. This means that `@{`⟨*text*⟩`}` and `!{`⟨*text*⟩`}` of `array` are *not* handled specially although it could interfere with drawing vertical lines. Therefore, we have the problem 1 shown in §3, which is very hard to solve. Note that the measurement of the column of '`p`' of LaTeX original is done by (modified) `\@@startpbox` and `\@@endpbox` and thus the preamble for '`p`' is not modified. In the case with `array`, however, the preambles for '`p`' and its relatives '`m`' and '`b`' are modified to set `\adl@box` to the box for them.

\adl@mkpream
\@mkpream

To make the preamble shown above, \@mkpream is modified to \let control sequences \adl@colhtpd, \adl@vlineL and \adl@vlineR be \relax in order to keep them from being expanded by \edef/\xdef for the preamble construction. The control sequences \adl@startmbox and \adl@endmbox for m-columns of array are also made \let-equal to \relax.

Giving them their own definition is done by \adl@preaminit that is called using \afterassignment after \@preamble is made by \adl@mkpream, the original version of \@mkpream. If array is not in use, \@mkpream is followed by an \edef of \@preamble to add \ialign etc. and thus \adl@preaminit is properly called *after* this final *assignment* to make \@preamble.

With array, on the other hand, calling \adl@preaminit is safe because \@mkpream is followed by \xdef for \@preamble too, but has no effect because it is in the group for \@mkpream. This grouping, however, gives us an easier way to give those control sequences their own definition. That is, we simply initiate them with the definitions that will be regained when the group is closed.

The modified \@mkpream also initializes \adl@ncol and \ifadl@leftrule, and set \adl@columns to the value of \adl@ncol locally after the preamble is made. This has an effect in the case without array because the body of array/tabular is in the same grouping context of \@mkpream. With array, on the other hand, this assignment has no effect but safe because it is included in a group of \@mkpream's own.

```
%% Making Preamble

\let\adl@mkpream\@mkpream
\def\@mkpream#1{\let\adl@colhtdp\relax
        \let\adl@vlineL\relax \let\adl@vlineR\relax
        \let\adl@startmbox\relax \let\adl@endmbox\relax
        \global\adl@ncol\@ne \adl@leftruletrue
        \adl@mkpream{#1}\adl@columns\adl@ncol \afterassignment\adl@preaminit}

```

\@addamp

The macro \@addamp is also modified to add the code for incrementing the counter \adl@currentcolumn to \@preamble with &. The counter \adl@ncol is also incremented by \@addamp so that we can refer to its value as $\langle c \rangle$ of \adl@vlineL/R. This increment is done \global-ly in order that we locally set \adl@columns to the counting result outside of the group for \@mkpream of array. Therefore, whether or not array is in use, \adl@columns will have a correct value and will be correctly referred to by \hdashline to know how many columns are specified in the preamble. Note that this \global assignment is safe because the life time of \adl@ncol is same as that of \@preamble.

```
\def\@addamp{\if@firstamp\@firstampfalse \else
        \@addtopreamble{\global\advance\adl@currentcolumn\@ne &}%
        \global\advance\adl@ncol\@ne \fi}

```

Since the implementation of \@testpach and macros for class-0 characters (i.e. l, r and c) is completely different between LaTeX and array, we have to have two versions switched by \adl@usingarypkg.

With array

\@testpach Although we introduced two preamble characters ‘:’ and ‘;’, we did not introduce new character *class* because we want to minimize the modification of original codes. Therefore, ‘:’ and ‘;’ is classified into class-1 together with ‘|’. Since these characters obviously have their own appropriate operations, \@testpach is modified so that \@arrayrule, which is invoked from \@mkpream in the case of class-1 character, is \let-equal to the macro corresponding to each character.

```
\ifadl@usingarypkg
\def\@testpach{\@chclass
 \ifnum \@lastchclass=6 \@ne \@chnum \@ne \else
  \ifnum \@lastchclass=7 5 \else
   \ifnum \@lastchclass=8 \tw@ \else
    \ifnum \@lastchclass=9 \thr@@
   \else \z@
   \ifnum \@lastchclass = 10 \else
   \edef\@nextchar{\expandafter\string\@nextchar}%
   \@chnum
   \if \@nextchar c\z@ \else
    \if \@nextchar l\@ne \else
     \if \@nextchar r\tw@ \else
   \z@ \@chclass
   \if\@nextchar |\@ne \let\@arrayrule\adl@arrayrule \else
   \if\@nextchar :\@ne \let\@arrayrule\adl@arraydashrule \else
   \if\@nextchar ;\@ne \let\@arrayrule\adl@argarraydashrule \else
    \if \@nextchar !6 \else
     \if \@nextchar @7 \else
      \if \@nextchar <8 \else
       \if \@nextchar >9 \else
  10
  \@chnum
  \if \@nextchar m\thr@@\else
   \if \@nextchar p4 \else
    \if \@nextchar b5 \else
   \z@ \@chclass \z@ \@preamerr \z@ \fi \fi \fi \fi \fi \fi
   \fi \fi  \fi  \fi  \fi  \fi  \fi \fi \fi \fi \fi \fi}

```

\@classz In array, array and tabular share common macro for class-0 named \@classz, which also generates the preamble for ‘p’, ‘m’ and ‘b’. Thus we modify it to measure the height and depth of the class-0 column by the macro \adl@putlrc, and to set \adl@box to the box for ‘p’ and its relatives. Note that a m-type preamble (\@chnum = 3) has to be generated to have \adl@startmbox and \adl@endmbox in it because a \vcenter construct cannot be assigned to \adl@box by \setbox directly.

```
\def\@classz{\@classx
   \@tempcnta \count@
   \prepnext@tok
   \@addtopreamble{\ifcase \@chnum
```

```
      \hfil
      \adl@putlrc{\d@llarbegin \insert@column \d@llarend}\hfil \or
      \hskip1sp\adl@putlrc{\d@llarbegin \insert@column \d@llarend}\hfil \or
      \hfil\hskip1sp\adl@putlrc{\d@llarbegin \insert@column \d@llarend}\or
   \setbox\adl@box\hbox \adl@startmbox{\@nextchar}\insert@column
        \adl@endmbox\or
   \setbox\adl@box\vtop \@startpbox{\@nextchar}\insert@column \@endpbox \or
   \setbox\adl@box\vbox \@startpbox{\@nextchar}\insert@column \@endpbox
  \fi}\prepnext@tok}
```

`\adl@class@start` `\adl@class@iiiorvii` Another stuff for compatibility is to refer to the class number for the beginning of preamble which is different between LaTeX and array, and that for 'p' or '@' to get the argument of ';' as explained later. In the case with array, the former is class-4 and we use '@' (class-7) for the latter.

```
\def\adl@class@start{4}
\def\adl@class@iiiorvii{7}
```

Without array

`\@testpach` The reason why and how we modify `\@testpach` of LaTeX is same as those of array.

```
\else
\def\@testpach#1{\@chclass \ifnum \@lastchclass=\tw@ 4\relax \else
        \ifnum \@lastchclass=\thr@@ 5\relax \else
                \z@ \if #1c\@chnum \z@ \else
                    \if #1l\@chnum \@ne \else
                    \if #1r\@chnum \tw@ \else
                \@chclass
                    \if #1|\@ne \let\@arrayrule\adl@arrayrule \else
                    \if #1:\@ne \let\@arrayrule\adl@arraydashrule \else
                    \if #1;\@ne \let\@arrayrule\adl@argarraydashrule \else
                    \if #1@\tw@ \else
                    \if #1p\thr@@ \else \z@ \@preamerr 0\fi
        \fi  \fi  \fi  \fi  \fi  \fi  \fi  \fi  \fi}
```

`\@arrayclassz` `\@tabclassz` Since LaTeX has two macros for class-0, one for `array` and the other for `tabular`, we have to modify both. Since the box for 'p' is opened by `\@@startpbox`, however, we may not worry about it.

```
\def\@arrayclassz{\ifcase \@lastchclass \@acolampacol \or \@ampacol \or
                \or \or \@addamp \or
                \@acolampacol \or \@firstampfalse \@acol \fi
        \edef\@preamble{\@preamble
                \ifcase \@chnum
                    \hfil\adl@putlrc{$\relax\@sharp$}\hfil
                \or \adl@putlrc{$\relax\@sharp$}\hfil
                \or \hfil\adl@putlrc{$\relax\@sharp$}\fi}}
```

```
\def\@tabclassz{\ifcase \@lastchclass \@acolampacol \or \@ampacol \or
                \or \or \@addamp \or
                \@acolampacol \or \@firstampfalse \@acol \fi
        \edef\@preamble{\@preamble
        \ifcase \@chnum
                    \hfil\adl@putlrc{\@sharp\unskip}\hfil
                \or \adl@putlrc{\@sharp\unskip}\hfil
                \or \hfil\hskip\z@ \adl@putlrc{\@sharp\unskip}\fi}}
```

`\adl@class@start` `\adl@class@iiiorvii`

In LaTeX, the beginning of preamble is class-6 and we use '`p`' (class-3) to get the argument of '`;`'.

```
\def\adl@class@start{6}
\def\adl@class@iiiorvii{3}
\fi

```

Hereafter, codes for LaTeX and array are common again.

`\adl@putlrc`

The macro `\adl@putlrc` is for class-0 preamble characters to set `\adl@box` to the contents of a column, measure its height/depth by `\adl@colhtdp` and put the box by `\unhbox` (not by `\box`) in order to make the glues in the contents effective.

```
\def\adl@putlrc#1{\setbox\adl@box\hbox{#1}\adl@colhtdp \unhbox\adl@box}

```

`\adl@arrayrule` `\adl@arraydashrule` `\adl@argarraydashrule` `\adl@xarraydashrule`

The preamble parts for vertical solid- and dash-lines are constructed by the macros `\adl@arrayrule` for '`|`', `\adl@arraydashrule` for '`:`', and `\adl@argarraydashrule` for '`;`'. The macro;

`\adl@xarraydashrule{`$\langle c^L\rangle$`}{`$\langle c^R\rangle$`}{`$\langle d\rangle/\langle g\rangle$`}`

is invoked by them to perform common operations. It at first checks the preamble character is the first element of the preamble (`\@lastchclass` = `\adl@class@start`) or it follows another character for vertical line (`\@lastchclass` = 1). If this is not satisfied, the vertical line is put at the right edge of a column and thus `\ifadl@leftrule` is set to false. Then it adds `\adl@vlineL{`$\langle \Gamma_d\rangle$`}{`$\langle \Gamma_g\rangle$`}{`$\langle c^L\rangle$`}{`$\langle d\rangle/\langle g\rangle$`}` if `\ifadl@leftrule` is true indicating the vertical line will appear at the left edge of the column $\langle c^L\rangle$, or `\adl@vlineR{`$\langle \Gamma_d\rangle$`}{`$\langle \Gamma_g\rangle$`}{`$\langle c^R\rangle$`}{`$\langle d\rangle/\langle g\rangle$`}` otherwise. Note that $\langle c^L\rangle$ is always 1 for *main* preamble while $\langle c^R\rangle$ is the column number given by `\adl@ncol`, but $\langle c^L\rangle$ may not be 1 for the preamble of `\multicolumn` as described in §4.7. Also note that Γ_d and Γ_g are `\CT@arc@` and `\adl@dashgapcolor` respectively whose bodies are `\color` for dashes and gaps specified by `\arrayrulecolor` and `\dashgapcolor`, or `\relax` if they are not colored.

In addition, an invisible `\vrule` of `\arrayrulewidth` wide is added if both `\ADLsomewide` and `\ADLactivate` are in effect, i.e. both `\ifadl@zwrule` and `\ifadl@inactive` are false, to keep a space for the vertical line having *real* width.

`\adl@classv` `\adl@classvfordash`

The argument of '`;`' is not provided by `\adl@argarraydashrule` but is directly passed from the preamble text through `\@nextchar`. This direct passing is implemented by the following trick. The macro `\adl@argarraydashrule` set `\@chclass` to `\adl@class@iiiorvii` to

pretend it is for 'p' if array is not in use, or '@' otherwise. Then it temporally changes the definition of \@classv, which is incidentally for the argument of 'p' and '@' in the case without/with array respectively, to \adl@classvfordash to process the argument of ';' rather than that of 'p' or '@'. Then \adl@classvfordash is invoked by \@mkpream and it adds the argument to \@preamble. Finally, it restores the definition of \@classv and sets \@chclass to 1 to indicate that the last item is a vertical line specification.

```
\def\adl@arrayrule{%
        \adl@xarraydashrule
                {\@ne}{\adl@ncol}{{\z@/\z@}}}
\def\adl@arraydashrule{%
        \adl@xarraydashrule
                {\@ne}{\adl@ncol}%
                {{\dashlinedash/\dashlinegap}}}
\def\adl@argarraydashrule{%
        \adl@xarraydashrule
                {\@ne}{\adl@ncol}{}%
        \@chclass\adl@class@iiiorvii \let\@classv\adl@classvfordash}
\def\adl@xarraydashrule#1#2#3{%
        \ifnum\@lastchclass=\adl@class@start\else
        \ifnum\@lastchclass=\@ne\else
                \adl@leftrulefalse \fi\fi
        \ifadl@zwvrule\else \ifadl@inactive\else
                \@addtopreamble{\vrule\@width\arrayrulewidth
                        \@height\z@ \@depth\z@}\fi \fi
        \ifadl@leftrule
                \@addtopreamble{\adl@vlineL{\CT@arc@}{\adl@dashgapcolor}%
                        {\number#1}#3}%
        \else   \@addtopreamble{\adl@vlineR{\CT@arc@}{\adl@dashgapcolor}%
                        {\number#2}#3}\fi}
\let\adl@classv\@classv
\def\adl@classvfordash{\@addtopreamble{{\@nextchar}}\let\@classv\adl@classv
        \@chclass\@ne}

%%^L
```

4.6 Building Columns

\adl@preaminit
\adl@colhtdp
\adl@vlineL
\adl@vlineR

If array is not in use, after the \@preamble is completed, the control sequences for macros in it should regain their own definition. The macro \adl@preaminit performs this operation for macros we introduced, \adl@colhtdp, \adl@vlineL and \adl@vlineR. For the case with array, we will call \adl@preaminit in arydshln to initiate them with the definitions as described later.

```

%% Building Columns

\def\adl@preaminit{\let\adl@colhtdp\adl@@colhtdp
        \let\adl@vlineL\adl@@vlineL \let\adl@vlineR\adl@@vlineR}
```

\adl@@colhtdp

For the measurement of the height and depth of a row, \adl@@colhtdp compares \adl@height and \adl@depth to the height and depth of \adl@box which contains the main part of the column to be built, and \global-ly updates the registers if they are less.

```
\def\adl@@colhtdp{%
        \ifdim\adl@height<\ht\adl@box \global\adl@height\ht\adl@box \fi
        \ifdim\adl@depth<\dp\adl@box \global\adl@depth\dp\adl@box\fi}
```

\adl@@vlineL
\adl@@vlineR
\adl@@ivline
\adl@setcolor
\adl@nocolor
\adl@dashcolor
\adl@gapcolor

The macro \adl@@vlineL⟨Γ_d⟩⟨Γ_g⟩⟨c⟩{⟨d⟩/⟨g⟩} adds the element $e = \langle c, d, g\rangle$ = \@elt{⟨c⟩}{⟨d⟩}{⟨g⟩}{⟨γ_d⟩}{⟨γ_g⟩} to the tail of the list \adl@colsL to construct C_i^L, where γ_d and γ_g are the color specifications given by \color macros in Γ_d and Γ_g. The macro \add@@vlineR performs similar operation but the element is added to the head of \adl@colsR for C_i^R because it is processed right-to-left manner. The argument ⟨d⟩ and ⟨g⟩ are extracted by the macro \adl@ivline which converts given dimensional values of them to integers. It also sets ⟨d⟩ and ⟨g⟩ to 0 (i.e. solid-line) if one of given values are not positive, in order to make it sure that one dash segment has positive length. Then it invokes \adl@setcolor to define \adl@dashcolor and \adl@gapcolor with the color specification of Γ_d and Γ_g. Since \adl@setcolor locally expands \color macro in Γ_d and Γ_g to define \currnet@color that becomes the body of \adl@dashcolor (γ_d) and \adl@gapcolor (γ_g) with expansion, different \color specifications of a color, such as \color{red} and \color[rgb]{1,0,0}, will produce a unified result such as {rgb 1 0 0}. If Γ_d or Γ_g is \relax which is the body of \adl@nocolor, γ_d or γ_g is also \relax to indicate dashes are colored (or not colored) as done in outer world and gaps are transparent.

```
\def\adl@@vlineL#1#2#3#4{\adl@ivline#4\@nil{#1}{#2}%
        \xdef\adl@colsL{\adl@colsL
                \@elt{#3}{\number\@tempcnta}{\number\@tempcntb}%
                        {\adl@dashcolor}{\adl@gapcolor}}}
\def\adl@@vlineR#1#2#3#4{\adl@ivline#4\@nil{#1}{#2}%
        \xdef\adl@colsR{%
                \@elt{#3}{\number\@tempcnta}{\number\@tempcntb}%
                        {\adl@dashcolor}{\adl@gapcolor}%
                \adl@colsR}}
\def\adl@ivline#1/#2\@nil#3#4{%
        \@tempdima#1\relax \@tempcnta\@tempdima
        \@tempdima#2\relax \@tempcntb\@tempdima
        \ifnum\@tempcnta>\z@ \else \@tempcnta\z@ \@tempcntb\z@ \fi
        \ifnum\@tempcntb>\z@ \else \@tempcnta\z@ \@tempcntb\z@ \fi
        \adl@setcolor\adl@dashcolor{#3}\adl@setcolor\adl@gapcolor{#4}}
\def\adl@setcolor#1#2{\def\@tempa{#2}\ifx\@tempa\adl@nocolor \def#1{\relax}%
        \else{#2\xdef#1{\current@color}}\fi}
\def\adl@nocolor{\relax}
```

\adl@colhtdp
\adl@vlineL
\adl@vlineR

After \adl@@colhtdp, \adl@@vlineL and \adl@@vlineR are defined, we call \adl@preaminit to \let their single @ counterparts be equal to them. Therefore, in the case with array, \adl@colhtdp etc. are temporarily \relax when \@preamble is being generated

in the group of \@mkpream, and regain their own definitions outside the group where the completed \@preamble is referred to.

```
\adl@preaminit
```

\adl@inactivevl If \ADLinactivate is in effect, \adl@vlineL/R and \adl@@vlineL/R are \let-equal to \adl@inactivevl. This macro simply puts a \vrule by \vline with \color (or \relax) in its first argument and with/without negative \hskip of a half of \arrayrulewidth wide depending on \ifadl@zwvrule, discarding other arguments.

```
\def\adl@inactivevl#1#2#3#4{\ifadl@zwvrule \hskip-.5\arrayrulewidth \fi
        {#1\vline}\ifadl@zwvrule \hskip-.5\arrayrulewidth \fi}
```

\@@startpbox
\@@endpbox
\@startpbox
\@endpbox
\adl@startmbox
\adl@endmbox

The macros to make \parbox for 'p', \@@startpbox and \@@endpbox, are modified for height/depth measurement. The code for \@@endpbox is based on that of LaTeX 2_ε to fix the bug of \strut-ing in LaTeX-2.09, but \@finalstrut is manually expanded because it is not available in LaTeX-2.09.

In array, these two macros are not used but \@startpbox and \@endpbox are. Until v2.4h, the former may be untouched and the latter can be \let-equal to \@@endpbox. However in v2.4i, \color@begingroup and \color@endgroup are added to them to make the compatibility issue a little bit complicated. That is, our version of \@endpbox would have to have \color@endgroup if and only if array is v2.4i or later because \@startpbox has \color@begingroup in these versions, if we relied on the original \@startpbox. To avoid version dependent coding, we copy the new definitiopn of \@starpbox to ensure it has \color@begingroup and let our own \@endpbox with height/depth measurement have \color@endgroup irrespective of the version of array. Note that the assigning the box having 'p' or 'b' to \adl@box for the measurement is done in our own \@classz shown in §4.5.

As for m-type columns, we need a special care because its body \vcenter cannot be assigned directly to \adl@box by \setbox[15]. Thus we enclose a $\vcenter{...}$ construct in a \hbox and assign it to \adl@box. The construct is opened and closed by the macros \adl@startmbox and \adl@endmbox with \adl@org@startpbox and \adl@org@endpbox, being unmodified \@startpbox and \@endpbox of array to avoid the version dependent color-grouping problem, and then the latter measures the height and depth of the \hbox by \adl@colhtdp. Note that the mechanism with \vcenter was replaced with a vertical shift of a box for 'm' in v2.4f of array, but we stick the old mechanism to avoid version dependent coding.

```
\def\@@startpbox#1{\setbox\adl@box\vtop\bgroup \hsize#1\@arrayparboxrestore}
\def\@@endpbox{\unskip \ifhmode \nobreak
        \vrule\@width\z@\@height\z@\@depth\dp\@arstrutbox \fi
        \par \egroup \adl@colhtdp \box\adl@box \hfil}
\def\@startpbox#1{\bgroup
        \color@begingroup
        \setlength\hsize{#1}\@arrayparboxrestore
```

[15] The author had forgotten this fact until Morten Høgholm pointed out it. Thanks Morten.

```
        \everypar{%
                \vrule \@height \ht\@arstrutbox \@width \z@
                \everypar{}}%
}
\def\@endpbox{\@finalstrut\@arstrutbox \color@endgroup \egroup
        \adl@colhtdp \box\adl@box \hfil}
\def\adl@startmbox{\bgroup $\vcenter\adl@org@startpbox}
\def\adl@endmbox{\adl@org@endpbox $\egroup \adl@colhtdp \box\adl@box \hfil}

%%^L
```

4.7 Multi-columns

\multicolumn
\adl@preamble
\adl@mcaddamp
\adl@activatepbox

The macro \multicolumn is modified for the following.

- The macros to construct the parts of \@preamble for vertical lines, \adl@arrayrule, \adl@arraydashrule and \adl@argarraydashrule, have to perform operations slightly different from those for main preamble. Thus they are \def-ined to multi-column version \adl@mcarrayrule, etc. These \def-initions are enclosed in a group so that they are not affected to array or tabular which may occur in the third argument of \multicolumn. In order to make \@preamble work well outside of the group containing \@makepream, \adl@preamble is \global-ly \let-equal to \@preamble just after \@makepream in the group and then reverse \let-assignment is performed just after the group is closed. These global assignment is unnecessary with array because \@preamlbe is constructed \global-ly, but safe.

  Since this grouping nullifies the effect of \adl@preaminit called in \@mkpream, we call \adl@preaminit again after the group closing.

- In array, \@addamp to make \@preamble for \multicolumn has a different definition from that for main one. Thus it is \let-equal to \adl@mcaddamp whose definition is switched by \ifadl@usingarypkg.

- If array is in use, \@preamble has to be \xdef-ed once again by \@addpreamble with an \@empty argument after \@mkpreamble to expand the contents of \toks registers. This is performed whether or not with array because it is safe.

- As done in \@array, \set@typeset@protect is replaced with direct \let.

- If without array, \@startpbox and \@endpbox should be \let-equal to their @@ counterparts, while should not with array. Thus we define \adl@activatepbox to do or not to do so depending on \ifadl@usingarypkg.

- The counter \adl@currentcolumn is \global-ly incremented by the first argument of \multicolumn (number of columns to be \span-ned).

Note that \adl@columns is modified by \@mkpream, but it is not referred to by \adl@mcarrayrule etc., and its value is restored before referred to by \hdashline, etc.

```
%% Multi-Columns

\def\multicolumn#1#2#3{\multispan{#1}\begingroup \begingroup
        \def\adl@arrayrule{\adl@mcarrayrule{#1}}%
        \def\adl@arraydashrule{\adl@mcarraydashrule{#1}}%
        \def\adl@argarraydashrule{\adl@mcargarraydashrule{#1}}%
        \let\@addamp\adl@mcaddamp
        \@mkpream{#2}\@addtopreamble\@empty
        \global\let\adl@preamble\@preamble \endgroup
        \let\@preamble\adl@preamble
        \def\@sharp{#3}\let\protect\relax
        \adl@activatepbox
        \adl@preaminit
        \@arstrut \@preamble\hbox{}\endgroup
        \global\advance\adl@currentcolumn#1\ignorespaces}
\ifadl@usingarypkg
        \def\adl@mcaddamp{\if@firstamp\@firstampfalse \else\@preamerror5\fi}
        \let\adl@activatepbox\relax
\else
        \let\adl@mcaddamp\@addamp
        \def\adl@activatepbox{\let\@startpbox\@@startpbox
                \let\@endpbox\@@endpbox}
\fi
```

\adl@mcarrayrule
\adl@mcarraydashrule
\adl@mcargarraydashrule

The preamble parts for vertical lines are constructed by the macros `\adl@mcarrayrule`, `\adl@mcarraydashrule` and `\adl@mcargarraydashrule` to which the first argument $\langle n \rangle$ of `\multicolumn` is passed to know the number of columns to be `\span`-ned. They are similar to their relatives for main preamble, `\adl@arrayrule`, etc., but the arguments $\langle c^L \rangle$ and $\langle c^R \rangle$ passed to `\adl@xarraydashrule` are;

$$c^L = c, \qquad c^R = c + n - 1$$

where $c =$ `\adl@currentcolumn`. This makes leading vertical lines drawn at the left edge of the leftmost `\span`-ned column and trailing ones at the right edge of the rightmost column.

```
\def\adl@mcarrayrule#1{\@tempcnta#1\advance\@tempcnta\adl@currentcolumn
        \advance\@tempcnta\m@ne
        \adl@xarraydashrule
                {\adl@currentcolumn}{\@tempcnta}{{\z@/\z@}}}
\def\adl@mcarraydashrule#1{\@tempcnta#1\advance\@tempcnta\adl@currentcolumn
        \advance\@tempcnta\m@ne
        \adl@xarraydashrule
                {\adl@currentcolumn}{\@tempcnta}%
                {{\dashlinedash/\dashlinegap}}}
\def\adl@mcargarraydashrule#1{\@tempcnta#1\advance\@tempcnta\adl@currentcolumn
        \advance\@tempcnta\m@ne
        \adl@xarraydashrule
                {\adl@currentcolumn}{\@tempcnta}{}%
```

```
        \@chclass\adl@class@iiiorvii \let\@classv\adl@classvfordash}

%%^L
```

4.8 End of Rows

`\@xarraycr` `\@xtabularcr` `\@xargarraycr` `\@yargarraycr`

At the end of the i^{th} row, we have to calculate h_i which is the height plus depth of the row, and add elements $\langle C_i^L, h_i\rangle$ and $\langle C_i^R, h_i\rangle$ to R^L and R^R. To do this, `\cr`-s in the macros `\@xarraycr`, `\@xtabularcr`, `\@xargarraycr` are replaced with our own `\adl@cr`. The macro `\@yargarraycr`$\langle$*dimen*$\rangle$ is also modified but its `\cr` is replaced with `\adl@argcr`$\langle$*dimen*$\rangle$ to add (negative) `\dimen` to h_i. Note that `\@xargarraycr`$\langle$*dimen*$\rangle$ uses ordinary `\adl@cr` because the extra vertical space of $\langle$*dimen*$\rangle$ is inserted to the last column.

Note that the implementation of `\@xarraycr` is slightly different between LaTeX and array, we have to have two versions and choose one.

```

%% End of row

\ifadl@usingarypkg
\def\@xarraycr{\@ifnextchar[{\@argarraycr}{\ifnum0=`{}\fi\adl@cr}}
\else
\def\@xarraycr{\@ifnextchar[{\@argarraycr}{\ifnum0=`{\fi}${}\adl@cr}}
\fi
\def\@xtabularcr{\@ifnextchar[{\@argtabularcr}{\ifnum0=`{\fi}\adl@cr}}
\def\@xargarraycr#1{\@tempdima#1\advance\@tempdima\dp\@arstrutbox
        \vrule\@height\z@\@depth\@tempdima\@width\z@
        \adl@cr}
\def\@yargarraycr#1{\adl@argcr{#1}\noalign{\vskip #1}}

```

`\adl@cr` `\adl@argcr`

The macro `\adl@cr` and `\adl@argcr` perform `\cr` and then invoke the common macro `\adl@@cr`$\langle x\rangle$. The argument $\langle x\rangle$ is the extra (negative) vertical space for `\adl@argcr`, while it is 0 for `\adl@cr`.

`\adl@@cr`

The macro `\adl@@cr`$\langle x\rangle$ at first calculate h_i as follows. The registers `\adl@height` $= \eta$ and `\adl@depth` $= \delta$ have the maximum height and depth of the columns in the row. However, they could be smaller than the height and/or depth of `\@arstrutbox`, η_s and δ_s. If so, the height and/or depth of the row are η_s and δ_s. Therefore, h_i is caluclated by;

$$h_i = \max(\eta, \eta_s) + \max(\delta, \delta_s).$$

Additionally, if the extra space $\langle x\rangle$ is negative, a vertical space of x is inserted below the row[16]. Thus the integer value of $h_i + x$ is `\global`-ly added to `\adl@totalheight`, and the elements $\langle C_i^L$=`\adl@colsL`$, h_i\rangle$ and $\langle C_i^R$=`\adl@colsR`$, h_i\rangle$ are added to the tail of R^L = `\adl@rowsL` and R^C = `\adl@rowsR`. If x is not 0 (negative), *discard*(x) or *connect*(x)

[16] Before v1.54, negative $\langle x\rangle$ shrinks the height of the row by $|x|$. Although the former result may be more appropriate if the row has vertical lines than the current because lines extrude to the next row now, new feature is considered compatible with original `array/tabular`.

is also added after $\langle C_i^{L/R}, h_i \rangle$ according to the current environment (`longtable` or not). In the real implementation, R^L and R^C has the following format of $\langle rows \rangle$.

$$
\begin{aligned}
\langle rows \rangle &::= [\langle row \rangle \texttt{;}]^* \\
\langle row \rangle &::= \texttt{(}\langle cols \rangle \texttt{/} \langle h_i \rangle \texttt{)} \\
\langle cols \rangle &::= [\texttt{\textbackslash elt\{}\langle c \rangle \texttt{\}\{}\langle d \rangle \texttt{\}\{}\langle g \rangle \texttt{\}}]^* \mid && \ldots\ C^L \text{ or } C^R \\
&\quad \texttt{\textbackslash adl@connect} \mid && \ldots \text{ for } \mathit{connect}(h_i) \\
&\quad \texttt{\textbackslash adl@discard} \mid && \ldots \text{ for } \mathit{discard}(h_i) \\
&\quad \texttt{\textbackslash relax} && \ldots \text{ for } \mathit{disconnect}(h_i)
\end{aligned}
$$

Since `\adl@discard` is `\def`-ined as `\adl@connect` by `\adl@arrayinit`, added `\adl@discard` transforms itself into `\adl@connect` if current envrionment is not `longtable`. Otherwise, as we make `\adl@discard` `\let`-equal to `\relax` when a `longtable` environment starts, it keeps its own form.

Then, `\adl@finaldepth` is set to `\adl@depth` if x is zero, or to zero otherwise (negative), in order to make the depth of `array`/`tabular` equal to that of the last row. Finally, `\adl@colsL`, `\adl@colsR`, `\adl@currentcolumn`, `\adl@height` and `\adl@depth` are reinitialized to process the next row.

```
\def\adl@cr{\cr\noalign{\adl@@cr\z@}}
\def\adl@argcr#1{\cr\noalign{\adl@@cr{#1}}}
\def\adl@@cr#1{
        \ifdim\adl@height<\ht\@arstrutbox \adl@height\ht\@arstrutbox\fi
        \ifdim\adl@depth<\dp\@arstrutbox \adl@depth\dp\@arstrutbox\fi
        \advance\adl@height\adl@depth
        \global\advance\adl@totalheight\adl@height
        \@tempdima#1\relax \global\advance\adl@totalheight\@tempdima
        \xdef\adl@rowsL{\adl@rowsL
                (\adl@colsL/\number\adl@height);%
                \ifdim#1=\z@\else (\adl@discard/\number\@tempdima);\fi}%
        \xdef\adl@rowsR{\adl@rowsR
                (\adl@colsR/\number\adl@height);%
                \ifdim#1=\z@\else (\adl@discard/\number\@tempdima);\fi}%
        \gdef\adl@colsL{}\gdef\adl@colsR{}
        \global\adl@currentcolumn\@ne
        \ifdim#1=\z@ \global\adl@finaldepth\adl@depth
        \else        \global\adl@finaldepth\z@\fi
        \global\adl@height\z@ \global\adl@depth\z@}

%%^L
```

4.9 Horizontal Lines

`\hline` `\cline`

The macro `\hline` is modified to insert `\vskip-\arrayrulewidth` before drawing if `\ADLnullwidehline` is in effect, or to add the element $\mathit{connect}(w)$ = `(\adl@connect/\number\arrayrulewidth)` to the end of R^L and R^R by `\adl@hline` otherwise. The other modifications are to set `\adl@finaldepth` to zero for the case that the last vertical item

is \hline, and to check if it is followed by not only \hline but also \hdashline by \adl@xhline.

The macro \cline is also modified to set \adl@finaldepth to zero. As for the feature of \ADLnullwidehline, it inserts \vskip-\arrayrulewidth to shift the line up befor drawing, and \vskip\arrayrulewidth after drawing to cancel the negative skip inserted by \adl@org@cline.

```
%% Horizontal Lines

\def\hline{\noalign{\ifnum0=`}\fi
        \ifadl@zwhrule \vskip-\arrayrulewidth
        \else \adl@hline\adl@connect\arrayrulewidth \fi
        \hrule\@height\arrayrulewidth
        \global\adl@finaldepth\z@
        \futurelet\@tempa\adl@xhline}
\def\cline#1{\noalign{\global\adl@finaldepth\z@
                \ifadl@zwhrule \vskip-\arrayrulewidth\fi}
        \adl@org@cline{#1}%
        \noalign{\ifadl@zwhrule \vskip\arrayrulewidth\fi}}

```

\hdashline
\adl@hdashline
\adl@ihdashline

The macro \hdashline calls \adl@hdashline to open the \noalign construct by the well-known trick {\ifnum0=`}\fi and then to invoke \adl@ihdashline checking the existence of its optional argument [⟨*dash*⟩/⟨*gap*⟩]. Before the invocation, it inserts \vskip-\arrayrulewidth if \ADLnullwidehline is in effect, or adds *connect*(w) to the end of R^L and R^R. Then \adl@ihdashline closes the \noalign by \ifnum0=`{\fi} to start the pseudo row for the horizontal dash-line. Before the dash-line is drawn by \adl@hcline which is also used for \cdashline, all the columns are \span-ned by giving \adl@columns to \multispan. Finally, the \noalign is opened again and \adl@xhline is invoked to check whether \h(dash)line is followed.

\adl@inactivehdl

If \ADLinactivate is in effect, \adl@ihdashline is \let-equal to \adl@inactivehdl. This macro simply puts a \hrule discarding its arguments after inserting \vskip-\arrayrulewidth if \ADLnullwidehline is in effect.

```
\def\hdashline{\adl@hdashline\adl@ihdashline}
\def\adl@hdashline#1{\noalign{\ifnum0=`}\fi
        \ifadl@zwhrule \vskip-\arrayrulewidth
        \else \adl@hline\adl@connect\arrayrulewidth \fi
        \@ifnextchar[%]
                    {#1}%
                    {#1[\dashlinedash/\dashlinegap]}}
\def\adl@ihdashline[#1/#2]{\ifnum0=`{\fi}%
        \multispan{\adl@columns}\unskip \adl@hcline\z@[#1/#2]%
        \noalign{\ifnum0=`}\fi
        \futurelet\@tempa\adl@xhline}
\def\adl@inactivehdl[#1/#2]{\ifadl@zwhrule \vskip-\arrayrulewidth \fi
        \hrule\@height\arrayrulewidth
```

```
        \futurelet\@tempa\adl@xhline}

```

`\adl@xhline` The macro `\adl@xhline` is the counterpart of the original `\@xhline`. This is introduced to check the mixed sequence of `\hline` and `\hdashline`, and to add the element *disconnect*(s) = `(\relax/\doublerulesep)` to the end of R^L and R^R by `\adl@hline` if a pair of `\h(dash)line` is found.

```
\def\adl@xhline{\ifx\@tempa\hline \adl@ixhline\fi
        \ifx\@tempa\hdashline \adl@ixhline\fi
        \ifnum0=‘{\fi}}
\def\adl@ixhline{\vskip\doublerulesep \adl@hline\relax\doublerulesep}

```

`\adl@hline` The macro `\adl@hline`⟨*cs*⟩⟨*dimen*⟩ `\global`-ly adds the integer value of ⟨*dimen*⟩ to `\adl@totalheight` and adds the element `(`⟨*cs*⟩`/\number`⟨*dimen*⟩`)` to the tail of R^L and R^R. The arguments ⟨*cs*⟩⟨*dimen*⟩ are `\adl@connect\arrayrulewidth` for *connect*(w) or `\relax\doublerulesep` for *disconnect*(s).

```
\def\adl@hline#1#2{\@tempcnta#2
        \global\advance\adl@totalheight\@tempcnta
        \xdef\adl@rowsL{\adl@rowsL
                (#1/\number\@tempcnta);}%
        \xdef\adl@rowsR{\adl@rowsR
                (#1/\number\@tempcnta);}}

```

`\cdashline` `\adl@cdline` `\adl@cdlinea` `\adl@cdlineb` The macro `\cdashline` at first opens `\noalign` and then invokes `\adl@cdline` checking the existence of its optional argument `[`⟨*dash*⟩`/`⟨*gap*⟩`]`. The macro `\adl@cdline` first inserts `\vskip-\arrayrulewidth` if `\ADLnullwidehline` is in effect. Then it performs column `\span`-ing by the code based on that of `\@cline` in LaTeX-2.09 because LaTeX 2ε's version will not work with LaTeX-2.09. The main job is done by `\adl@hcline` after the target columns are `\span`-ned by `\adl@cdlinea` or `\adl@cdlineb`.

`\adl@inactivecdl` If `\ADLinactivate` is in effect, `\adl@cdline` is `\let`-equal to `\adl@inactivecdl`. This macro simply calls our own `\cline`, after closing the `\noalign` opened by `\cdashline`.

```
\def\cdashline#1{\noalign{\ifnum0=‘}\fi
        \@ifnextchar[%]
                     {\adl@cdline[#1]}%
                     {\adl@cdline[#1][\dashlinedash/\dashlinegap]}}
\def\adl@cdline[#1-#2]{\ifadl@zwhrule \vskip-\arrayrulewidth \fi
        \global\adl@cla#1\relax
        \global\advance\adl@cla\m@ne
        \ifnum\adl@cla>\z@ \global\let\@gtempa\adl@cdlinea
        \else              \global\let\@gtempa\adl@cdlineb\fi
        \global\adl@clb#2\relax
        \global\advance\adl@clb-\adl@cla \ifnum0=‘{\fi}
        \@gtempa{-\arrayrulewidth}}
\def\adl@cdlinea{\multispan\adl@cla &\multispan\adl@clb \unskip \adl@hcline}
```

```
\def\adl@cdlineb{\multispan\adl@clb \unskip \adl@hcline}

\def\adl@inactivecdl[#1-#2][#3]{\ifnum0=‘{\fi}\cline{#1-#2}}

```

`\adl@hcline` The macro `\adl@hcline`⟨*w*⟩`[`⟨*d*⟩`/`⟨*g*⟩`]` draws a horizontal dash-line of dash size d and gap size g for `\hdashline` and `\cdashline` in the `\span`-ned columns by `\adl@draw`. As we will discuss in §4.12, the macro requires d and g are passed through `\@tempdima` and `\@tempdimb`, and control sequences ⟨*rule*⟩, ⟨*skip*⟩ and ⟨*box*⟩ are passed through its arguments to make it usable for both horizontal and vertical lines. Then the vertical space of w, $-$`\arrayrulewidth` for `\cdashline`, is inserted if it is not 0 (for `\hdashline`) and `\ADLnullwidehline` is not in effect.

```
\def\adl@hcline#1[#2/#3]{\@tempdima#2\relax \@tempdimb#3\relax
        \adl@draw\adl@vrule\hskip\hbox \cr
        \noalign{\global\adl@finaldepth\z@ \ifdim#1=\z@\else
                \ifadl@zwhrule\else \vskip#1\fi\fi}}

```

`\firsthdashline` `\lasthdashline` If array is in use, we wish to have dashed counterparts of `\first/lasthline` named `\first/lasthdashline`, which simply call `\adl@hdashline` with an argument to call `\adl@first/lasthdashline` after closing `\noalign` opened by `\adl@hdashline`.

`\adl@defflhdl` `\adl@idefflhdl` `\adl@firsthdashline` `\adl@lasthdashline` The macros `\adl@first/lasthdashline`, however, are defined in a tricky manner to replace `\hline` in `\first/lasthline` with;

`\adl@hdashline\adl@ihdashline[`⟨*dash*⟩`/`⟨*gap*⟩`]`

in order to avoid copy-and-replace. To do that, we define `\adl@defflhdl` and `\adl@idefflhdl` in which the body of `\first/lasthline` is expanded by `\exapndafter` and the parts preceding and following `\hline` are extracted. Then the preceding part ⟨*p*⟩, the calling sequence of `\adl@hdashline`, and the following part ⟨*f*⟩ are connected to be the body of `\adl@first/lasthdashline`. Thus we define `\adl@firsthdashline` as follows.

```
\def\adl@firsthdashline[#1/#2]{%
    ⟨p⟩
    \adl@hdashline\adl@ihdashline[#1/#2]
    ⟨f⟩}
```

```
\ifadl@usingarypkg
\def\firsthdashline{\adl@hdashline{\ifnum0=‘{\fi}\adl@firsthdashline}}
\def\lasthdashline{\adl@hdashline{\ifnum0=‘{\fi}\adl@lasthdashline}}

\def\adl@defflhdl#1{\def\@tempa{#1}
        \expandafter\adl@idefflhdl}
\def\adl@idefflhdl#1\hline#2\@nil{%
        \@namedef\@tempa[##1/##2]{#1\adl@hdashline\adl@ihdashline[##1/##2]#2}}
\adl@defflhdl{adl@firsthdashline}\firsthline\@nil
\adl@defflhdl{adl@lasthdashline}\lasthline\@nil
\fi

%%^L
```

4.10 End of Environment

\endarray
\endtabular
\endtabular*

The macros to close the array/tabular environment, \endarray and \endtabular(*), are modified so that they invoke \adl@endarray to draw vertical lines just before closing \halign, and \adl@arrayrestore to restore registers and data structures \global-ly modified in the environment. Note that array and related packages such as delarray define a macro \@arrayright as the closing hook and thus we invoke it if it is defined.

```
%% End of Environment

\def\endarray{\adl@endarray \egroup \adl@arrayrestore \egroup
        \csname @arrayright\endcsname}
\def\endtabular{\endarray $\egroup}
\expandafter\let\csname endtabular*\endcsname\endtabular

```

\adl@endarray
\adl@rows
\adl@addvl
\adl@vlrowL
\adl@vlrowR
\adl@vlrow

The macro \adl@endarray at first closes the last row by \crcr. If this \crcr has real effect, we have to invoke \adl@@cr to perfrom our own end-of-row operations. We assume that the \crcr is effective if either \adl@height or \adl@depth has a non-zero value[17].

Then the rows to draw vertical lines $L_1, \ldots, L_n$;

$$\sigma_1 L_1 \sigma_2 L_2 \ldots L_{n-1} \sigma_n L_n \sigma_{n+1}$$

are created in \adl@vlrowL and \adl@vlrowR by \adl@makevlrL and \adl@makevlrR. In the real implementation, $L_k = \langle \gamma_k, \pi_k, \delta_k, \xi_k, \tau_k, \beta_k \rangle$ is represented as;

\adl@vl{β_k}{$\tau_k - \beta_k$}{δ_k}{ξ_k}.

Thus \adl@vl is made \let-equal to \relax when the rows are constructed and to \adl@@vl when the rows are put.

Since \adl@makevlrL and \adl@makevlrR shares common macros, they conceptually have the following interface.

\adl@vlrow = \adl@makevlrL/R(\adl@rows : $\langle R^L$ *or* $R^R \rangle$,
\adl@currentcolumn : $\langle$*start column*$\rangle$,
\adl@addvl : $\langle$*macro to add an element*$\rangle$)

Thus they are invoked as;

\adl@vlrowL = \adl@makevrL(\adl@rowsL, 1, \adl@addvlL)
\adl@vlrowR = \adl@makevrR(\adl@rowsR, \adl@columns, \adl@addvlR)

Finally, after constructed rows for vertical lines are put by \adl@drawvl, a vertical skip of −\adl@finaldepth is inserted to move back to the last baseline, and then an invisible \vrule of \adl@finaldepth deep is put to make array/tabular has the depth of the last real row or zero if it ends with a horizontal line.

[17] The author confesses that this rule is not strict and the introduction of a switch could improve the strictness.

```
\def\adl@endarray{\crcr \noalign{
        \ifdim\adl@height=\z@
        \ifdim\adl@depth=\z@  \else \adl@@cr\z@ \fi
                             \else \adl@@cr\z@ \fi
        \let\adl@vl\relax
        \def\adl@vlrow{}\adl@currentcolumn\@ne
                \let\adl@rows\adl@rowsL
                \let\adl@addvl\adl@addvlL
                \adl@makevlrL \global\let\adl@vlrowL\adl@vlrow
        \def\adl@vlrow{}\adl@currentcolumn\adl@columns
                \let\adl@rows\adl@rowsR
                \let\adl@addvl\adl@addvlR
                \adl@makevlrR \global\let\adl@vlrowR\adl@vlrow
        \global\let\adl@vl\adl@@vl}%
        \adl@drawvl
        \noalign{\vskip-\adl@finaldepth}%
        \omit\vrule\@width\z@\@height\z@\@depth\adl@finaldepth\cr}

```

`\adl@arrayrestore` The macro `\adl@arrayrestore` restores the values of registers and data structures, `\adl@height`, `\adl@depth`, `\adl@currentcolumn`, `\adl@totalheight`, `\adl@rowsL`, `\adl@rowsR`, `\adl@colsL` and `\adl@colsR`, saved by `\adl@arrayinit`.

```
\def\adl@arrayrestore{%
        \global\adl@height\adl@heightsave
        \global\adl@depth\adl@depthsave
        \global\adl@currentcolumn\adl@currentcolumnsave
        \global\adl@totalheight\adl@totalheightsave
        \global\let\adl@rowsL\adl@rowsLsave
        \global\let\adl@rowsR\adl@rowsRsave
        \global\let\adl@colsL\adl@colsLsave
        \global\let\adl@colsR\adl@colsRsave}

%%^L
```

4.11 Drawing Vertical Lines

Figure 2 shows the conceptual code of `\adl@makevlrL`. The correspondance of variables in the code and control sequences in the real implementation is as follows.

R^L : `\adl@rowsL` R : `\adl@rows` R' : `\@tempb` Λ : `\adl@vlrowL`
Γ : `\adl@columns` γ : `\adl@currentcolumn`
τ : `\@tempcnta` β : `\@tempcntb` η : `\adl@lastconn`
δ : `\adl@dash`/`\adl@dashcolor` ξ : `\adl@gap`/`\adl@gapcolor`
H : `\adl@totalheight`
conn : `\ifadl@connected` *double* : `\ifadl@doublerule`

`\adl@makevlrL` `\adl@makevlrR` The macro `\adl@makevlrL` corresponds to the line (2) and (31)–(36). Its right-edge counterpart `\adl@makevlrR` has the same correspondance but the lines (1)–(2) are;

```
(1)  Λ ← ⟨⟩; R ← R^L; γ ← 1;
(2)  while γ ≤ Γ do begin
(3)      τ ← H; β ← H; η ← 0; δ ← ⟨−1, ⊥⟩; ξ ← ⟨−1, ⊥⟩;
(4)      conn ← false; double ← false;; R′ ← ⟨⟩
(5)      while R ≠ ⟨⟩ do begin
(6)          ⟨r, R⟩ ← R;
(7)          ⟨C, h⟩ ← r;
(8)          if C = ⟨⟩ then begin   add(τ, β, δ, ξ); η ← 0;   end;
(9)          elseif C = ⟨connect⟩ then   η ← h;
(10)         else begin
(11)             ⟨e, C′⟩ = C; ⟨c, d, g⟩ = e;
(12)             if c = γ then begin
(13)                 if d = δ ∧ g = ξ then begin
(14)                     if ¬conn then begin
(15)                         τ ← β + η; conn ← true;
(16)                     end;
(17)                 end;
(18)                 else begin
(19)                     add(τ, β, δ, ξ);
(20)                     δ ← d; ξ ← g; τ ← β + η; conn ← true;
(21)                 end;
(22)                 if C′ = ⟨⟨γ, ?, ?⟩,?⟩ then   double ← true;
(23)                 C ← C′;
(24)             end;
(25)             else   add(τ, β, δ, ξ);
(26)             η ← 0;
(27)         end;
(28)         β ← β − h; R′ ← ⟨R′, ⟨C, h⟩⟩
(29)     end;
(30)     add(τ, β, δ, ξ); R ← R′;
(31)     if double then   Λ ← ⟨Λ, \hskip\doublerulesep⟩;
(32)     else begin
(33)         γ ← γ + 1;
(34)         if γ > Γ then   Λ ← ⟨Λ, \hfil⟩;
(35)         else            Λ ← ⟨Λ, \hfil&\omit⟩;
(36)     end;
(37) end;
(38)
(39) procedure add(τ, β, δ, ξ) begin
(40)     if conn then begin
(41)         Λ ← ⟨Λ, ⟨β, τ − β, δ, ξ⟩⟩; conn ← false;
(42)     end;
(43) end;
```

Figure 2: Conceptual Code of `\adl@makevlrL`

(1) $\Lambda \leftarrow \langle\rangle$; $R \leftarrow R^R$; $\gamma \leftarrow \Gamma$;
(2) **while** $\gamma > 0$ **do begin**

and (31)–(36) are;

(31) **if** *double* **then** $\Lambda \leftarrow \langle$`\hskip\doublerulesep`$, \Lambda\rangle$;
(32) **else begin**
(33) $\gamma \leftarrow \gamma - 1$;
(34) **if** $\gamma = 0$ **then** $\Lambda \leftarrow \langle$`\hss`$, \Lambda\rangle$;
(35) **else** $\Lambda \leftarrow \langle$`&\omit\hss`$, \Lambda\rangle$;
(36) **end**;

```
%% Drawing Vertical Lines

\def\adl@makevlrL{\adl@makevlr
        \ifadl@doublerule
                \edef\adl@vlrow{\adl@vlrow \hskip\doublerulesep}%
                \let\next\adl@makevlrL
        \else
                \advance\adl@currentcolumn\@ne
                \ifnum\adl@currentcolumn>\adl@columns \let\next\relax
                        \edef\adl@vlrow{\adl@vlrow \hss}%
                \else \let\next\adl@makevlrL
                        \edef\adl@vlrow{\adl@vlrow \hss &\omit}%
        \fi\fi\next}
\def\adl@makevlrR{\adl@makevlr
        \ifadl@doublerule
                \edef\adl@vlrow{\hskip\doublerulesep \adl@vlrow}%
                \let\next\adl@makevlrR
        \else
                \advance\adl@currentcolumn\m@ne
                \ifnum\adl@currentcolumn=\z@ \let\next\relax
                        \edef\adl@vlrow{\hss \adl@vlrow}%
                \else \let\next\adl@makevlrR
                        \edef\adl@vlrow{&\omit \hss \adl@vlrow}%
        \fi\fi\next}

```

`\adl@makevlr` The macro `\adl@makevlr` corresponds to the lines (3)–(4) and (30).

```
\def\adl@makevlr{\@tempcnta\adl@totalheight \@tempcntb\adl@totalheight
        \let\adl@lastconn\z@ \adl@dash\m@ne \adl@gap\m@ne
        \let\adl@dashcolor\relax \let\adl@gapcolor\relax
        \adl@connectedfalse \adl@doublerulefalse \def\@tempb{}%
        \expandafter\adl@imakevlr\adl@rows\@nil;%
        \adl@addvl
        \edef\adl@rows{\@tempb}}

```

\adl@imakevlr
\adl@iimakevlr
\adl@endmakevlr

The macro `\adl@imakevlr`⟨r⟩`;` corresponds to the lines (5)–(6), and the macro `\adl@iimakevlr(`⟨C⟩`/`⟨h⟩`)` to (7) and (28).

```
\def\adl@imakevlr#1;{\def\@tempa{#1}\ifx\@tempa\@nnil \let\next\relax
        \else \adl@iimakevlr#1\let\next\adl@imakevlr \fi \next}
\def\adl@iimakevlr(#1/#2){\let\@elt\adl@iiimakevlr
        \def\adl@connect{\adl@@connect#2}%
        \let\adl@endmakevlr\adl@endmakevlrcut
        #1\adl@endmakevlr
        \let\@elt\relax \let\adl@connect\relax
        \advance\@tempcntb-#2\edef\@tempb{\@tempb(\@tempc/#2);}}

```

\adl@iiimakevlr
\adl@ivmakevlr
\adl@vmakevlr
\adl@endmakevlrcut
\adl@endmakevlrconn
\adl@@connect

The correspondance of the lines (8)–(30) is a little bit complicated. As shown above, `\adl@iimakevlr` expands C attaching the sentinel `\adl@endmakevlr`.

1. If $C \neq \langle\rangle$ and $C \neq \langle connect\rangle$, C has at least one `\@elt`⟨c⟩⟨d⟩⟨g⟩ which is made `\let`-equal to `\adl@iiimakevlr` by `\adl@iimakevlr`. Thus the lines (10)–(21) and (25)–(26) are performed by `\adl@iiimakevlr`.

   Then;

   (a) if $c = \gamma$, `\@elt` becomes `\let`-equal to `\adl@ivmakevlr` which corresponds to (22) in the case of $C' \neq \langle\rangle$. Then `\adl@vmakevlr` is invoked for (23) and to eat the sentinel `\adl@endmakevlr`. If $C' = \langle\rangle$, `\adl@endmakevlrconn` is invoked, because the sentinel `\adl@endmakevlr` is made `\let`-equal to it by `\adl@iiimakevlr`, for (23) (i.e. $C \leftarrow \langle\rangle$).

   (b) if $c \neq \gamma$, `\adl@vmakevlr` is invoked to perform implicit $C \leftarrow C$ operation and to eat the sentinel.

2. If $C = \langle connect\rangle$, i.e. it has only one element `\adl@connect`, the macro `\adl@@connect` is invoked with h because it is `\define`-dl to be `\adl@@connect`⟨h⟩. The macro performs (9) and implict $C \leftarrow C$ ($= \langle connect\rangle$) eating the sentinel.

3. If $C = \langle\rangle$, `\adl@endmakevlrcut` that is `\let`-equal to the sentinel `\adl@endmakevlr` is invoked to perform (8) and implicit $C \leftarrow C$ ($= \langle\rangle$).

```
\def\adl@iiimakevlr#1#2#3#4#5{\let\@elt\adl@ivmakevlr \let\next\relax
        \ifnum#1=\adl@currentcolumn\relax
                \let\adl@endmakevlr\adl@endmakevlrconn
                \@tempswafalse
                \ifnum#2=\adl@dash\relax
                \ifnum#3=\adl@gap\relax
                \def\@tempa{#4}\ifx\@tempa\adl@dashcolor
                \def\@tempa{#5}\ifx\@tempa\adl@gapcolor
                        \@tempswatrue
                \fi\fi\fi\fi
                \if@tempswa
                        \ifadl@connected\else
                                \@tempcnta\@tempcntb
```

```
                                \advance\@tempcnta\adl@lastconn\relax
                                \adl@connectedtrue
                        \fi
                \else
                        \adl@addvl
                        \adl@dash#2\relax \adl@gap#3\relax
                        \def\adl@dashcolor{#4}\def\adl@gapcolor{#5}%
                        \@tempcnta\@tempcntb
                        \advance\@tempcnta\adl@lastconn\relax
                        \adl@connectedtrue
                \fi
        \else
                \adl@addvl
                \def\next{\adl@vmakevlr\@elt{#1}{#2}{#3}{#4}{#5}}%
        \fi
        \let\adl@lastconn\z@ \next}
\def\adl@ivmakevlr#1{%
        \ifnum#1=\adl@currentcolumn \adl@doubleruletrue \fi
        \adl@vmakevlr\@elt{#1}}
\def\adl@vmakevlr#1\adl@endmakevlr{\def\@tempc{#1}}
\def\adl@endmakevlrcut{\adl@addvl \let\adl@lastconn\z@ \def\@tempc{}}
\def\adl@endmakevlrconn{\def\@tempc{}}
\def\adl@@connect#1\adl@endmakevlr{\def\adl@lastconn{#1}%
        \def\@tempc{\adl@connect}}
```

`\adl@addvlL` `\adl@addvlR`

The macro `\adl@addvlL` corresonds to the lines (38)–(42), i.e. the procedure *add*. The macro `\adl@addvlR` performs simlar operations, but its conceptual code is the following.

(38) **procedure** $add(\tau, \beta, \delta, \xi)$ **begin**
(39) **if** *conn* **then begin**
(40) $\Lambda \leftarrow \langle\langle \beta, \tau - \beta, \delta, \xi\rangle, \Lambda\rangle$; $conn \leftarrow$ **false**;
(41) **end**;
(42) **end**;

```
\def\adl@addvlL{\ifadl@connected
        \advance\@tempcnta-\@tempcntb
        \edef\adl@vlrow{\adl@vlrow
                \adl@vl{\number\@tempcntb}{\number\@tempcnta}%
                       {\number\adl@dash}{\number\adl@gap}%
                       {\adl@dashcolor}{\adl@gapcolor}}%
        \adl@connectedfalse \fi}
\def\adl@addvlR{\ifadl@connected
        \advance\@tempcnta-\@tempcntb
        \edef\adl@vlrow{\adl@vl{\number\@tempcntb}{\number\@tempcnta}%
                               {\number\adl@dash}{\number\adl@gap}%
                               {\adl@dashcolor}{\adl@gapcolor}\adl@vlrow}%
        \adl@connectedfalse \fi}
```

\adl@drawvl
\adl@@vl
\adl@vl@leftskip
\adl@vl@rightskip

After the the macros \adl@vlrowL and \adl@vlrowR are constructed, they are expanded to draw vertical lines by \adl@drawvl. Prior to the expansion, the macro \adl@drawvl globally defines \adl@vl@leftskip and \adl@vl@rightskip, which are the amount of negative spaces inserted to the left/right of a vertical line, as follows.

$$\texttt{\textbackslash adl@vl@leftskip} = \begin{cases} \texttt{\textbackslash arrayrulewidth}/2 & \text{if } \texttt{\textbackslash ifadl@zwrule} \\ 0 & \text{else if leftside} \\ \texttt{\textbackslash arrayrulewidth} & \text{otherwise} \end{cases}$$

$$\texttt{\textbackslash adl@vl@rightskip} = \begin{cases} \texttt{\textbackslash arrayrulewidth}/2 & \text{if } \texttt{\textbackslash ifadl@zwrule} \\ 0 & \text{else if rightside} \\ \texttt{\textbackslash arrayrulewidth} & \text{otherwise} \end{cases}$$

That is, if \ADLnulwide is in effect, a vertical line is surrounded by horizontal spaces of $-$\arrayrulewidth/2 to adjust the center of the line to the left or right edge of its column. Otherwise, a horizontal space $-$\arrayrulewidth is inserted after (before) the line is drawn to adjust its left (right) edge to the left (right) edge of the column[18].

Then the macros \adl@vlrowL and \adl@vlrowR are expanded. These macros will have \adl@vl, which is made \let-equal to \adl@@vl prior to the expansion, to draw a vertical line. The macro \adl@@vl$\langle\beta\rangle\langle\lambda\rangle\langle\delta_l\rangle\langle\gamma_l\rangle\langle\delta_c\rangle\langle\gamma_c\rangle$ (x_l and x_c are length and color) draws a sloid line if $\gamma_l = 0$ or a dash-line otherwise in a \vbox of $\lambda = \tau - \beta$ high and \raise-s it by β. The method to draw a dash line in the \vbox is analogous to that for horizontal line shown in §4.9, except that a line is surrounded by horizontal spaces of \adl@vl@leftskip and \adl@vl@rightskip. Coloring gaps is done by drawing a vertical rule setting γ_c by \set@color prior to dash line drawing if γ_c is not \relax. To color dashes or solid line, \set@color with δ_c is done if it is not \relax before line drawing.

```
\def\adl@drawvl{%
        \omit \relax \ifadl@zwvrule
                        \gdef\adl@vl@leftskip{.5\arrayrulewidth}%
                        \global\let\adl@vl@rightskip\adl@vl@leftskip
                \else   \global\let\adl@vl@leftskip\z@
                        \global\let\adl@vl@rightskip\arrayrulewidth
                \fi \adl@vlrowL \cr
        \omit \relax \ifadl@zwvrule
                        \gdef\adl@vl@leftskip{.5\arrayrulewidth}%
                        \global\let\adl@vl@rightskip\adl@vl@leftskip
                \else   \global\let\adl@vl@leftskip\arrayrulewidth
                        \global\let\adl@vl@rightskip\z@
                \fi \adl@vlrowR \cr}

\def\adl@@vl#1#2#3#4#5#6{\vbox to\z@{\vss\hbox{%
        \hskip-\adl@vl@leftskip
        \ifnum#3=\z@\else \def\@tempa{#6}\ifx\@tempa\adl@nocolor\else
                \raise#1sp\hbox{\let\current@color\@tempa \set@color
                        \vrule height#2sp width\arrayrulewidth}%
                \hskip-\arrayrulewidth \fi \fi
```

[18] Before v1.54, the horizontal spaces was not inserted if \ADLsomewide and thus disconnected lines were not aligned vertically.

```
592         \raise#1sp\vbox to#2sp{
593                 \def\@tempa{#5}\ifx\@tempa\adl@nocolor\else
594                         \let\current@color\@tempa \set@color \fi
595                 \ifnum#3=\z@
596                         \hrule height#2sp depth\z@ width\arrayrulewidth
597                 \else   \@tempdima#3sp \@tempdimb#4sp
598                         \adl@draw\adl@hrule\vskip\vbox
599                 \fi}%
600         \hskip-\adl@vl@rightskip}}
601
602 %%^L
```

4.12 Drawing Dash-lines

`\adl@vrule` `\adl@hrule`

As explained later, horizontal and vertical lines are drawn by a common macro `\adl@draw` to which the length of a dash segment, d, is passed through `\@tempdima`. The macro also has an argument that is either `\adl@vrule` to draw a dash for *horizontal* lines or `\adl@hrule` for *vertical*. These two macros commonly have one argument $\langle f \rangle$ to draw a dash of $f \times d$ long and of `\arrayrulewidth` wide.

```
603
604 %% Draw Dash Lines (\adl@vrule/\adl@hrule, \hskip/\vskip, \hbox/\vbox)
605
606 \def\adl@vrule#1{\vrule\@width#1\@tempdima\@height\arrayrulewidth\relax}
607 \def\adl@hrule#1{\hrule\@height#1\@tempdima\@width\arrayrulewidth\relax}
```

`\adl@drawi` `\adl@drawii` `\adl@drawiii` `\adl@draw`

The macro `\adl@draw` is to draw a horizontal or vertical line. It is `\let`-equal to one of `\adl@drawi`, `\adl@drawii` and `\adl@drawiii` according to the drawing mode specified by `\ADLdrawingmode`. These three macros have common interface, `\@tempdima` and `\@tempdimb` for the length of dash and gap, d and g, and three arguments $\langle rule \rangle$, $\langle skip \rangle$ and $\langle box \rangle$ with which `\adl@draw` is called in the following manner.

`\adl@draw\adl@vrule\hskip\hbox` ... horizontal

`\adl@draw\adl@hrule\vskip\vbox` ... vertical

The drawing methods in three modes have been explained in §4.2. More specifically, `\adl@drawi` for mode 1, to which `\adl@draw` is `\let`-equal by default, conceptually performs the following operations.

$\langle rule \rangle${1/2} $\langle skip \rangle(g/2)$
`\xlearders`$\langle box \rangle${$\langle skip \rangle(g/2)$ $\langle rule \rangle${1} $\langle skip \rangle(g/2)$}
$\langle skip \rangle$(0 `plus 1fil minus 1fil`)
$\langle skip \rangle(g/2)$ $\langle rule \rangle${1/2}

The conceptual operations of `\adl@drawii` for mode 2 are as follows.

$\langle rule \rangle${1/2} $\langle skip \rangle(g/2)$
$\langle box \rangle${$\langle skip \rangle(g/2)$ $\langle rule \rangle${1} $\langle skip \rangle(g/2)$} $\langle skip \rangle(-d-g)$
`\xlearders`$\langle box \rangle${$\langle skip \rangle(g/2)$ $\langle rule \rangle${1} $\langle skip \rangle(g/2)$}

⟨*skip*⟩(0 plus 1fil minus 1fil)
⟨*skip*⟩(−*d* − *g*) ⟨*box*⟩{⟨*skip*⟩(*g*/2) ⟨*rule*⟩{1} ⟨*skip*⟩(*g*/2)}
⟨*skip*⟩(*g*/2) ⟨*rule*⟩{1/2}

The macro `\adl@drawiii` for mode 3 is quite similar to `\adl@drawi` except that `\xleaders` is replaced by `\cleaders`. This replacement is done by temporarily `\let`-ing `\xleaders` be equal to `\cleaders`.

```
\def\adl@drawi#1#2#3{%
        #1{.5}#2.5\@tempdimb
        \xleaders#3{#2.5\@tempdimb #1{1}#2.5\@tempdimb}%
                #2\z@ plus1fil minus1fil\relax
        #2.5\@tempdimb #1{.5}}
\def\adl@drawii#1#2#3{%
        \setbox\adl@box#3{#2.5\@tempdimb #1{1}#2.5\@tempdimb}%
        #1{.5}#2.5\@tempdimb
        \copy\adl@box #2-\@tempdima #2-\@tempdimb
        \xleaders\copy\adl@box#2\z@ plus1fil minus1fil\relax
        #2-\@tempdima #2-\@tempdimb \copy\adl@box
        #2.5\@tempdimb #1{.5}}
\def\adl@drawiii#1#2#3{{\let\xleaders\cleaders \adl@drawi#1#2#3}}
\let\adl@draw\adl@drawi

```

`\ADLdrawingmode` The macro `\ADLdrawingmode{`⟨*m*⟩`}` defines the drawing mode by `\let`-ing `\adl@draw` be equal to `\adl@drawi` if $m = 1$, and so on. If ⟨*m*⟩ is neither 1, 2 nor 3, it is assumed as 1.

```
\def\ADLdrawingmode#1{\ifcase #1%
        \let\adl@draw\adl@drawi \or
        \let\adl@draw\adl@drawi \or
        \let\adl@draw\adl@drawii \or
        \let\adl@draw\adl@drawiii \else
        \let\adl@draw\adl@drawi \fi}

%%^L
```

4.13 Shorthand Activation

`\adl@Array` `\adl@Tabular` `\adl@Tabularstar` `\adl@Longtable` The macros`\adl@Array`, `\adl@Tabular`, `\adl@Tabular*` and `\adl@Longtable` start environments `array`, `tabular`, `tabular*` and `longtable` respectively, turning `\ifadl@inactive` false to activate dash-line functions. We will `\let` macros `\Array` etc. be equal to them for shorthand activation.

```

%% Shorthand Activation

\def\adl@Array{\adl@inactivefalse \array}
\def\adl@Tabular{\adl@inactivefalse \tabular}
\def\adl@Tabularstar{\adl@inactivefalse \@nameuse{tabular*}}
```

```
\def\adl@Longtable{\adl@inactivefalse \longtable}
```

\@notdefinable
\adl@notdefinable

Before making \Array etc. \let-equal to \adl@Array etc., we have to check if these macros having too natural names have already used. This check is done by \@ifdefinable that will call \@notdefinable for the complaint if undefinable. Since we want to complain with our own warning message, \@notdefinable is temporarily \def-ined so that it simply \def-ines a macro \adl@notdefinable as empty. Therefore, \adl@notdefinebale will have some definition if one of \Array, \Tabular, \Tabular* and \Longtable (if longtable is loaded) cannot be defined, while it will stay undefined otherwise.

```
\begingroup
\def\@notdefinable{\gdef\adl@notdefinable{}}
\@ifdefinable\Array\relax
\@ifdefinable\Tabular\relax
\expandafter\@ifdefinable\csname Tabular*\endcsname\relax
\ifx\longtable\undefined\else \@ifdefinable\Longtable\relax \fi
\endgroup
```

\Array
\Tabular
\Tabular*
\Longtable
\endArray
\endTabular
\endTabular*
\endLongtable

If \adl@notdefinable is \undefined indicating that all \Array etc. are definable, we \let them be equal to \adl@Array etc. We also \let ending macros \endArray etc. be equal to \endarray etc. Note that \Longtable and \endLongtable are defined only when longtable is loaded, and \endLongtable is \def-ined as (not being \let-equal to) \endlongtable because its definition of our own is not given yet.

Otherwise, we complain with a warning message put by \PackageWarning if it is defined (i.e. LaTeX 2_ε) or \@warning otherwise (i.e. LaTeX-2.09).

```
\ifx\adl@notdefinable\undefined
        \let\Array\adl@Array
        \let\Tabular\adl@Tabular
        \expandafter\let\csname Tabular*\endcsname\adl@Tabularstar
        \let\endArray\endarray
        \let\endTabular\endtabular
        \expandafter\let\csname endTabular*\endcsname\endtabular
        \ifx\longtable\undefined\else
                \let\Longtable\adl@Longtable
                \def\endLongtable{\endlongtable}
        \fi
\else
\begingroup
\ifx\longtable\undefined
\def\@tempa{Array and Tabular are not defined because one of them\MessageBreak
        has been defined}
\else
\def\@tempa{Array/Tabular/Longtable are not defined because \MessageBreak
        one of them has been defined}
\fi
\ifx\PackageWarning\undefined
```

```
        \def\MessageBreak{^^J}
        \@warning\@tempa
\else
        \let\on@line\empty
        \PackageWarning{arydshln}\@tempa
\fi
\endgroup
\fi
```

\ADLnoshorthanded

If a user wishes to define an environment named `Array` or `Tabular(*)` (or `Longtable` if longtable is in use) by him/herself or by loading other packages *after* arydshln is loaded, `\newenvironment` for `Array` etc. will fail because they have already been undefinable. The macro `\ADLnoshorthanded` makes them definable again by `\let`-ing them and their ending counterparts be equal to `\relax`.

```
\def\ADLnoshorthanded{%
        \let\Array\relax
        \let\Tabular\relax
        \expandafter\let\csname Tabular*\endcsname\relax
        \let\endArray\relax
        \let\endTabular\relax
        \expandafter\let\csname endTabular*\endcsname\relax
        \ifx\longtable\undefined\else
                \let\Longtable\relax
                \let\endLongtable\relax \fi}
```

\adl@act@arrayclassz
\adl@act@tabclassz
\adl@act@classz
\adl@act@@startpbox
\adl@act@@endpbox
\adl@act@startpbox
\adl@act@endpbox
\adl@act@cr
\adl@act@argcr
\adl@act@cline
\adl@act@endarray
\adl@act@hline
\adl@act@ihdashline
\adl@act@cdline
\adl@act@@vlineL
\adl@act@@vlineR

Finally here we define *active* version of `\@arrayclassz` named `\adl@act@arrayclassz` etc. for `\adl@activate` (see §4.4). The definitions are simply done by `\let`-ing `\adl@act@arrayclassz` equal to `\@arrayclassz` etc[19].

```
\let\adl@act@arrayclassz\@arrayclassz
\let\adl@act@tabclassz\@tabclassz
\ifadl@usingarypkg \let\adl@act@classz\@classz \fi
\let\adl@act@@startpbox\@@startpbox
\let\adl@act@@endpbox\@@endpbox
\let\adl@act@startpbox\@startpbox
\let\adl@act@endpbox\@endpbox
\let\adl@act@cr\adl@cr
\let\adl@act@argcr\adl@argcr
\let\adl@act@endarray\adl@endarray
\let\adl@act@hline\adl@hline
\let\adl@act@ihdashline\adl@ihdashline
\let\adl@act@cdline\adl@cdline
\let\adl@act@@vlineL\adl@@vlineL
\let\adl@act@@vlineR\adl@@vlineR
```

[19] Alternatively, we may define `\adl@act@arrayclassz` in place of `\@arrayclassz` but the author chose this way to minimize the possiblity of *enbug*.

```
%%^L
```

4.14 Compatibility with colortab

`\adl@CC@` `\CC@`

The package colortab has a macro;

`\LCC`⟨*colorspec*⟩`\\`⟨*rows*⟩`\ECC`

to color ⟨*rows*⟩ referring ⟨*colorspec*⟩. The macro `\CC@`, the heart of the coloring function, first makes a box with ⟨*rows*⟩ using `\@preamble` to measure the height of ⟨*rows*⟩, then makes a row putting a heavy rule of the height in each column with a color command for the column specified by ⟨*colorspec*⟩, and finally puts ⟨*rows*⟩ overlaying them on the colored rule. Therefore ⟨*rows*⟩ is processed twice by `\CC@` to update `\global` registers/structures incorrectly.

Thus we modify `\CC@`, if the package colortab is provided, to save `\global` stuff by `\adl@arraysave` before the height measurement and restore them by `\adl@arrayrestore` after that.

```
%% Compatibility with colortab

\def\adl@CC@#1#2#3{%
  \ifcolortab
    \noalign{%
      \adl@arraysave
      \setbox\CT@box=\vbox{#1#3\crcr\egroup}%
      \adl@arrayrestore
      \CT@dim=\ht\CT@box
      \global\advance\CT@dim by \dp\CT@box
      \def\CT@next{}%
      \futurelet\next\CT@columncolor#2&\@nil}%
    \CT@next\cr
    \noalign{\vskip-\CT@dim}%
  \fi
  #3}
\ifx\ColortabLoaded\undefined\else
\let\CC@\adl@CC@
\fi

%%^L
```

4.15 Compatibility with longtable

Making arydshln compatible with longtable is a hard job because a `longtable` consists of multiple *chunks* and each chunk is a distinct `\halign`. We could draw vertical lines in each chunks as we do with ordinary `array`/`table`. However this straightforward solution should *break* dash-lines at invisible borders of chunks and produce awful results.

Therefore, this implementation draws dash-lines in `\output` routine in which we have all the rows to be put in a page. The hard part is to know which rows are being put in `\output`. This problem is solved by extracting the leading part of R^L (`\adl@rowsL`) and R^R (`\adl@rowsR`) by the height/depth of the table fraction to be put and removing the part from $R^{L/R}$.

4.15.1 Initialization

First of all, the following switch and `\dimen` register are declared.

`\ifadl@LTfirstpage`
- `\ifadl@LTfirstpage` is tested in `\output` routine to examine if the page being put has the first fraction of a `longtable`.

`\adl@LTpagetotal`
- `\adl@LTpagetotal` is set to `\pagetotal` just before the first portion of a `longtable` is added to the main vertical list. Since the `\box255` has items preceding the `\longtable` and its first fraction, we can obtain the height of the first fraction by subtracting `\adl@LTpagetotal` from the height plus depth of `\box255`.

```
727
728 %% Compatibility with longtable: initialization
729
730 \newif\ifadl@LTfirstpage
731 \newdimen\adl@LTpagetotal
732
```

Next, we skip everything if longtable is not in use, or we have undefined-error when we refer to the definitions in it. Note that since `\newif` cannot be in the `\ifx`/`\fi` construct, the declarations above are excluded.

```
733 \ifx\longtable\undefined\else
734
```

`\adl@LT@array` `\LT@array` `\adl@discard`
Then we redefine the macro `\LT@array`, which is the heart of `\longtable`, saving its original definition in `\adl@LT@array`. The modified `\LT@array` first calls `\adl@arrayinit` to initialize the global data structures, and sets `\ifadl@LTfirstpage` to true. Then `\adl@dashline`, `\adl@idashline` and `\adl@discard` are made `\let`-equal to the longtable versions `\adl@LTdashline` and `\adl@LTidashline`, and `\relax` (to inhibit expansion) respectively. Then the macro calls `\adl@LTinactivate` if `\adl@inactive` is true, and finally calls its original version `\adl@LT@array`. Note that since `longtable` cannot be nested;

- `\adl@arraysave` in `\adl@arrayinit` is unnecessary but safe, and thus its invocation timing is not so sensitive; and
- activator is not required.

Also note that the assignment `\adl@ncol` to `\adl@columns` in `\adl@arrayinit` is void and thus we will do it afterward.

`\adl@LTinactivate`
The macro `\adl@LTinactivate` first calls `\adl@inactivate` to do basic inactivation and then `\let`-s the following control sequences be equal to their counterparts in longtable.

\endlongtable \LT@make@row \LT@echunk \LT@end@hd@ft \LT@kill \LT@output

It also make \adl@idashline \let-equal to its inactive version because we need the macro to find mixed \hline and \hdasnline sequence.

```
\let\adl@LT@array\LT@array
\def\LT@array{\adl@arrayinit \adl@LTfirstpagetrue
        \let\adl@discard\relax \let\adl@hdashline\adl@LThdashline
        \let\adl@ihdashline\adl@LTihdashline
        \ifadl@inactive \adl@LTinactivate \fi
        \adl@LT@array}
\def\adl@LTinactivate{\adl@inactivate
        \let\endlongtable\adl@org@endlongtable
        \let\LT@make@row\adl@org@LT@make@row
        \let\LT@echunk\adl@org@LT@echunk
        \let\LT@end@hd@ft\adl@org@LT@end@hd@ft
        \let\LT@kill\adl@org@LT@kill
        \let\LT@output\adl@org@LT@output
        \let\adl@ihdashline\adl@LTinactivehdl}

```

\adl@org@LT@make@row
\LT@make@row

The macro \LT@make@row is redefined for additional initialization which must be done after the original \LT@array performs its own initialization. First, \LT@make@row itself is reset to its original version \adl@org@LT@make@row to initialize stuff only once, since \LT@make@row is called repeatedly at each chunk. Next \adl@ncol is assigned to \adl@columns to give its value calculated in \@mkpream. Then macros to begin/end p-boxes are made \let-equal to our own version because the original \LT@array has done it with its own version. Note that \@@startpbox and \@statpbox are \let-equal to our own \adl@LTstartpbox if array is not in use because with array opening a p-box is not done by \@startpbox but is embedded in \@preamble. Also note that \@@endpbox and \@endpbox are commonly \let-equal to \adl@LTendpbox because \LT@startpbox does not have \color@begingroup even with array. Yet another remark is that we need \adl@LTendmbox to close m-boxes through our own closing macro \adl@endmbox, whose definition is kept in \adl@@endmbox, for longtable-specific operations for footnotes. Finally, the original version \adl@org@LT@make@row is called.

```
\let\adl@org@LT@make@row\LT@make@row
\def\LT@make@row{\let\LT@make@row\adl@org@LT@make@row
        \adl@columns\adl@ncol
        \ifadl@usingarypkg\else
                \let\@@startpbox\adl@LTstartpbox
                \let\@startpbox\adl@LTstartpbox \fi
        \let\@@endpbox\adl@LTendpbox
        \let\@endpbox\adl@LTendpbox
        \let\adl@@endmbox\adl@endmbox
        \let\adl@endmbox\adl@LTendmbox
        \adl@org@LT@make@row}

%%^L
```

Table 2: Active and Inactive longtable Operations

command	active	inactive
p b (open)		
with array	\adl@act@classz →\LT@startpbox	\adl@org@classz →\LT@startpbox
without array	\adl@LTstartpbox	\LT@startpbox
m (open)	\adl@act@classz →\adl@startmbox →\LT@startpbox	\adl@org@classz →\LT@startpbox
p b (close)	\adl@LTendpbox	\LT@endpbox
m (close)	\adl@LTendmbox	\LT@endpbox
\hline	→\adl@act@hline	→\@gobbletwo
\hdashline	→\adl@LTihdashline →\adl@act@hline	→\adl@LTinactivehdl →\@gobbletwo
\endlongtable	modified version	\adl@org@endlongtable
\LT@make@row		\adl@org@LT@make@row
\LT@echunk		\adl@org@LT@echunk
\LT@end@hd@ft		\adl@org@LT@end@hd@ft
\LT@kill		\adl@org@LT@kill
\LT@output		\adl@org@LT@output

The summary of the activation and inactivation specific to longtable is shown in Table 2.

4.15.2 Ending Chunks

\adl@org@endlongtable
\endlongtable
\adl@org@LT@echunk
\LT@echunk
\adl@LTlastrow

When a chunk is closed with \crcr, we have to add the information of the last row to $R^{L/R}$ = \adl@rowsL/R if the row is not finished by an explicit \\. This is done by \adl@LTlastrow as we did at the first job of \adl@endarray. Two chunk closing macros, \endlongtable and \LT@echunk, are modified to call \adl@LTlastrow before its original job done by \adl@org@endlongtable and \adl@org@LT@echunk respectively. Note that \adl@LTlastrow only has \crcr and \noalign and thus another \crcr in original \endlongtable and \LT@echunk is no-operation as desired. Also note that \adl@LTlastrow is called twice from \endlongtable, once from \LT@echunk in the original version, but it is safe because the first call makes \adl@height and \adl@depth zero and thus the second become no-operation.

```
763
764 %% Compatibility with longtable: end chunk
765
766 \let\adl@org@endlongtable\endlongtable
767 \def\endlongtable{\adl@LTlastrow \adl@org@endlongtable}
768
769 \let\adl@org@LT@echunk\LT@echunk
770 \def\LT@echunk{\adl@LTlastrow \adl@org@LT@echunk}
```

```
771
772 \def\adl@LTlastrow{\crcr \noalign{
773         \ifdim\adl@height=\z@
774         \ifdim\adl@depth=\z@  \else \adl@@cr\z@ \fi
775                               \else \adl@@cr\z@ \fi}}
776
```

\adl@org@LT@end@hd@ft
\LT@end@hd@ft
\adl@LThfsave
\adl@LTth
\\adl@LTth\LT@firsthead
\\adl@LTth\LT@head
\\adl@LTth\LT@lastfoot
\\adl@LTth\LT@foot
\\adl@rowsL\LT@firsthead
\\adl@rowsL\LT@head
\\adl@rowsL\LT@lastfoot
\\adl@rowsL\LT@foot
\\adl@rowsR\LT@firsthead
\\adl@rowsR\LT@head
\\adl@rowsR\LT@lastfoot
\\adl@rowsR\LT@foot

Another chunk ending macro is `\LT@end@hd@ft`⟨*box*⟩ to close a header/footer called by `\endfirsthead`, `\endhead`, `\endlastfoot` and `\endfoot` with an argument ⟨*box*⟩ being `\LT@firsthead`, `\LT@head`, `\LT@lastfoot` and `\LT@foot` respectively. In order to maintain the information of rows $R^{L/R}$ = `\adl@rowsL/R` of headers/footers separately from the main one, the modified `\LT@end@hd@ft` saves them together with `\adl@totalheight` to weirdly named macros;

`\\adl@LTth`⟨*box*⟩
`\\adl@rowsL`⟨*box*⟩
`\\adl@rowsR`⟨*box*⟩

after closing the last row by `\adl@LTlastrow`. The `\string` representation of the macros looks like;

`\\adl@LTth\LT@firsthead`

and so on. The saving operation is done by the macro `\adl@LThfsave`⟨*box*⟩⟨*info*⟩ and is equivalent to;

`\global\let\`⟨*info*⟩⟨*box*⟩=⟨*info*⟩

After the saving, three global variables are reinitialized. Calling `\adl@LTlastrow` twice, once from the original version through `\LT@echunk` is safe as described above.

```
777 \let\adl@org@LT@end@hd@ft\LT@end@hd@ft
778 \def\LT@end@hd@ft#1{\adl@LTlastrow
779         \noalign{\edef\adl@LTth{\number\adl@totalheight}%
780                 \adl@LThfsave#1\adl@LTth \global\adl@totalheight\z@
781                 \adl@LThfsave#1\adl@rowsL\gdef\adl@rowsL{}%
782                 \adl@LThfsave#1\adl@rowsR\gdef\adl@rowsR{}}
783         \adl@org@LT@end@hd@ft#1}
784 \def\adl@LThfsave#1#2{\expandafter\global\expandafter\let
785         \csname\string#2\string#1\endcsname#2}
786
```

\adl@org@LT@kill
\LT@kill
\adl@LTkill
\adl@LTkillend

The additional job for yet another chunk closer `\LT@kill` to kill a template row is a little bit harder. Since the row information might have been added by an explicit `\\` preceding `\kill`, we have to remove it from the tail of `\adl@rowsL/R`, and subtract its h_i from `\adl@totalheight` because `\kill`-ed row may be in header/footer definition. To do that, modified `\LT@kill` first ensures the information addition by `\adl@LTlastrow`, then traverses `\adl@rowsL/R` adding its non-last elements to `\@tempb` by the loop of `\adl@LTkill`, and assigns `\@tempb` to `\adl@rowsL/R` globally by `\adl@LTkillend` when `\adl@LTkill` finds the tail. The macro `\adl@LTkillend` also sets the h_i of the last element to `\@tempcnta`, which is subtracted from `\adl@totalheight` globally. Finally, the original version `\adl@org@LT@kill` is called.

```
\let\adl@org@LT@kill\LT@kill
\def\LT@kill{\adl@LTlastrow \noalign{
            \def\@tempb{}\expandafter\adl@LTkill\adl@rowsL\@nil\adl@rowsL
            \def\@tempb{}\expandafter\adl@LTkill\adl@rowsR\@nil\adl@rowsR
            \global\advance\adl@totalheight-\@tempcnta}%
        \adl@org@LT@kill}
\def\adl@LTkill#1;#2{\def\@tempa{#2}%
        \ifx\@tempa\@nnil\def\next{\adl@LTkillend#1}%
        \else\edef\@tempb{\@tempb#1;}\def\next{\adl@LTkill#2}\fi
        \next}
\def\adl@LTkillend(#1/#2)#3{\global\let#3\@tempb \@tempcnta#2\relax}

%%^L
```

4.15.3 Horizontal Lines and p-Boxes

\LT@hline
\adl@LThdashline
\adl@LTihdashline
\adl@LTinactivehdl
\adl@LThdlrow

The macro \LT@hline, longtable version of \hline, is redefined to add pseudo row information to $R^{L/R}$ and to check mixed sequence of \hline and \hdashline[20]. We also define the macro \adl@LTihdashline[⟨*dash*⟩/⟨*gap*⟩] and its inactive counterpart \adl@LTinactivehdl as the longtable version of \adl@ihdashline and \adl@inactivehdl. These two macros, the main part of \hdashline, are redefined to make it possible that \hdashline can be broken into two part by TEX's page breaker.

These three macros call a common routine \adl@LThdline after defining \adl@LThdlrow which makes a row of horizontal (dash) line drawn by \multispan and \leaders\hrule or \adl@hcline[⟨*dash*⟩/⟨*gap*⟩].

Note that we define \adl@LThdashline to make \adl@hdashline \let-equal to it in longtable environments because its version without longtable performs a part of the job done by \adl@LThdline as shown soon.

```

%% Compatibility with longtable: horizontal lines and p-boxes

\def\LT@hline{\noalign{\ifnum0=`}\fi
        \gdef\adl@LThdlrow{\multispan{\LT@cols}\unskip
                \leaders\hrule\@height\arrayrulewidth\hfill\cr}%
        \adl@LThdline}
\def\adl@LThdashline#1{\noalign{\ifnum0=`}\fi
        \@ifnextchar[%]
                     {#1}%
                     {#1[\dashlinedash/\dashlinegap]}}
\def\adl@LTihdashline[#1/#2]{%
        \gdef\adl@LThdlrow{\multispan{\LT@cols}\unskip
                \adl@hcline\z@[#1/#2]}%
        \adl@LThdline}
\def\adl@LTinactivehdl[#1/#2]{%
        \gdef\adl@LThdlrow{\multispan{\LT@cols}\unskip
```

[20] In the original longtable, a sequence of three \hline-s are not recognized. This buggy feature is fixed in this implementation.

```
                \leaders\hrule\@height\arrayrulewidth\hfill\cr}%
        \adl@LThdline}
```

`\adl@LThdline` `\adl@LTxhline` `\adl@LTixhline`

The macro `\adl@LThdline` called by above three macros first inserts a vertical penalty 10000 to inhibit page break between the horizontal line and preceding row. Then it inserts `\vskip-\arrayrulewidth` with another break inhibitor if `\ADLnullwidehline` is in effect, or adds the pseudo row information *connect*(`\arrayrulewidth`) to $R^{L/R}$ by `\adl@hline`[21]. Next, it draw a horizontal (dash) line by `\adl@LThdlrow` and checks if the following control sequence is `\hline` or `\hdashline` by `\futurelet` and `\adl@LTxhline`. If `\hline` or `\hdashline` is the next token, `\adl@LTixhline` is called to insert a vertical penalty of $-$`\@medpenalty` and a vertical space of `\doublerulesep`. The macro `\adl@LTixhline` also adds *disconnect*(`\doublerulesep`) to $R^{L/R}$ and makes `\adl@LThdlrow` void. Otherwise, `\adl@LThdline` inserts a vertical penalty of $-$`\@lowpanalty` and a vertical space of $-$`\arrayrulewidth` and draws the horizontal (dash) line again by `\adl@LThdlrow`. Thus a page can be broken between two overlaid horizontal (dash) lines[22]. Two pseudo row information, *discard*($-$`\arrayrulewidth`) for the negative vertical space which may be discarded and *connect*(`\arrayrulewidth`) for the second horizontal line, are also added to $R^{L/R}$.

```
\def\adl@LThdline{\penalty\@M
        \ifadl@zwhrule \vskip-\arrayrulewidth \penalty\@M
        \else          \adl@hline\adl@connect\arrayrulewidth \fi
        \ifnum0=‘{\fi}%
        \adl@LThdlrow
        \noalign{\ifnum0=‘}\fi
        \futurelet\@tempa\adl@LTxhline}
\def\adl@LTxhline{\ifx\@tempa\hline \adl@LTixhline
        \else\ifx\@tempa\hdashline \adl@LTixhline
        \else \penalty-\@lowpenalty \vskip-\arrayrulewidth
                \adl@hline\adl@discard{-\arrayrulewidth}%
                \adl@hline\adl@connect\arrayrulewidth
        \fi\fi \ifnum0=‘{\fi}%
        \adl@LThdlrow \noalign{\penalty\@M}}
\def\adl@LTixhline{\penalty-\@medpenalty \vskip\doublerulesep
        \adl@hline\relax\doublerulesep \global\let\adl@LThdlrow\@empty}
```

`\adl@LTstartpbox` `\adl@LTendpbox` `\adl@LTendmbox`

Macros for opening/closing p-boxes are fairly simple. The macro `\adl@LTstartpbox{`$\langle w \rangle$`}` is `\let`-assigned to `\@@startpbox` by `\LT@make@row` to open a p-box of w wide by our own `\adl@act@@startpbox` and performs a footnote related operation introduced by longtable, when array is not in use. Note that if array is in use, a p-box is opened by codes embedded in `\@preamble` and its initialization is done by `\@startpbox` = `\LT@startpbox`, unnecessitating our own version of opening macros.

[21] Or do noting if inactive and thus it is `\let`-equal to `\@gobbletwo`.

[22] If the page is broken, the horizontal line at the beginning of the succeeding page has a width even if `\ADLnullwidehline` is in effect.

On the other hand, the closing macro \adl@LTendpbox for p (or d)-boxes is \let-equal to \@endpbox and \@@endpbox for the cases with/without array, and performs the footnote operations after doing our own ones by \adl@act@@endpbox. Note that \LT@startpbox does not have \color@begingroup so far and thus this macro without \color@endgroup is common for the cases with and without array.

Similarly, \adl@LTendmbox for m-boxes is \let-equal to \adl@endmbox and performs our own operations by \adl@@endmbox in which the originnal definition of \adl@enmbox is kept.

```
\def\adl@LTstartpbox#1{%
        \adl@act@@startpbox{#1}\let\@footnotetext\LT@p@ftntext}
\def\adl@LTendpbox{\adl@act@@endpbox \the\LT@p@ftn \global\LT@p@ftn{}}
\def\adl@LTendmbox{\adl@@endmbox \the\LT@p@ftn \global\LT@p@ftn{}}

%%^L
```

4.15.4 First Chunk

\LT@start The macro \LT@start which puts (first) head and controls the page break of the first page is modified for the following.

- After it inserts a vertical skip \LTpre, \endgraf is performed so that the skip contributes to \pagetotal[23].
- When the \box2 is \vsplit to get first item of the first chunk, \vbadness is saved into \@tempcnta, set to 10000 to avoid unnecessary underfull message[24], and restored from \@tempcnta.
- The \dimen register \adl@LTpagetotal is set to \pagetotal to know the total height of the items preceding longtable. Since the assignment is performed after the inserted \endgraf and the intentional page break, it should have real total height.
- The box \LT@firsthead is put by \copy rather than \box because it is referred to in the \output routine.

This macro does not have inactive counterpart because the modification shown above is desirable (first two) or not-harmful[25] (last two) to the original version.

```

%% Compatibility with longtable: first chunk

\def\LT@start{%
        \let\LT@start\endgraf
        \endgraf \penalty\z@ \vskip\LTpre \endgraf
        \dimen@\pagetotal
        \advance\dimen@ \ht\ifvoid\LT@firsthead\LT@head\else\LT@firsthead\fi
```

[23] This modification is necessary for the original longtable, or it underestimates the room of the first page and leaves head and foot only.

[24] This is also necessary for the original version.

[25] Logically, at least.

```
        \advance\dimen@ \dp\ifvoid\LT@firsthead\LT@head\else\LT@firsthead\fi
        \advance\dimen@ \ht\LT@foot
        \dimen@ii\vfuzz \@tempcnta\vbadness
        \vfuzz\maxdimen \vbadness\@M
        \setbox\tw@\copy\z@
        \setbox\tw@\vsplit\tw@ to \ht\@arstrutbox
        \setbox\tw@\vbox{\unvbox\tw@}%
        \vfuzz\dimen@ii \vbadness\@tempcnta
        \advance\dimen@\ht
                \ifdim\ht\@arstrutbox>\ht\tw@\@arstrutbox\else\tw@\fi
        \advance\dimen@\dp
                \ifdim\dp\@arstrutbox>\dp\tw@\@arstrutbox\else\tw@\fi
        \advance\dimen@ -\pagegoal
        \ifdim \dimen@>\z@\vfil\break \fi
        \global\adl@LTpagetotal\pagetotal
        \global\@colroom\@colht
        \ifvoid\LT@foot\else
                \advance\vsize-\ht\LT@foot
                \global\advance\@colroom-\ht\LT@foot
                \dimen@\pagegoal\advance\dimen@-\ht\LT@foot\pagegoal\dimen@
                \maxdepth\z@
        \fi
        \copy\ifvoid\LT@firsthead \LT@head \else \LT@firsthead \fi
        \output{\LT@output}}

%%^L
```

4.15.5 Output Routine

`\adl@org@LT@output` `\LT@output`

The output routine is the heart of the longtable compatible implementation. The macro `\LT@output` which is set to `\output` by `\LT@start` is modified from its original (and thus inactive) version `\adl@org@LT@output` as follows.

- Three fractions of the original version to compile the final output image of the table portion into `\box255` or the main vertical list are modified to set the image into `\box255` unconditionally and to call `\adl@LTdraw`⟨*foot*⟩⟨*tail*⟩ which is the real heart of the compatible implementation. The argument ⟨*foot*⟩ is `\LT@foot` or `\LT@lastfoot` according to the portion of the `longtable` to be output. The argument ⟨*tail*⟩ is `\vss` if the last item is it which is not included in `\box255` yet, or `\@empty` otherwise. Since `\adl@LTdraw` builds final output image drawing vertical (dash) lines in `\box255`, it is put to the main vertical list if the `longtable` portion is the last one.
- Since the boxes `\LT@head`, `\LT@foot` and `\LT@lastfoot` are referred to in `\adl@LTdraw`, they are put by `\copy` rather than `\box`.

```

%% Compatibility with longtable: output routine

\let\adl@org@LT@output\LT@output
\def\LT@output{%
```

```
        \ifnum\outputpenalty <-\@Mi
            \ifnum\outputpenalty > -\LT@end@pen
                \LT@err{floats and marginpars not allowed in a longtable}\@ehc
            \else
                \setbox\z@\vbox{\unvbox\@cclv}%
                \ifdim \ht\LT@lastfoot>\ht\LT@foot
                    \dimen@\pagegoal
                    \advance\dimen@-\ht\LT@lastfoot
                    \ifdim\dimen@<\ht\z@
                        \setbox\@cclv\vbox{\unvbox\z@\copy\LT@foot}%
                        \adl@LTdraw\LT@foot\vss
                        \@makecol
                        \@outputpage
                        \setbox\z@\vbox{\copy\LT@head}%
                    \fi
                \fi
                \global\@colroom\@colht
                \global\vsize\@colht
                \setbox\@cclv\vbox{\unvbox\z@
                    \copy\ifvoid\LT@lastfoot\LT@foot\else\LT@lastfoot\fi}%
                \adl@LTdraw\LT@lastfoot\@empty \box\@cclv
            \fi
        \else
            \setbox\@cclv\vbox{\unvbox\@cclv\copy\LT@foot}%
            \adl@LTdraw\LT@foot\vss
            \@makecol
            \@outputpage
            \global\vsize\@colroom
            \copy\LT@head
        \fi}
```

`\adl@LTdraw` `\adl@LTinit` `\adl@LTheadL` `\adl@LTheadR` `\adl@LTfootL` `\adl@LTfootR`

The macro `\adl@LTdraw`⟨*foot*⟩⟨*tail*⟩ draws vertical (dash) lines onto the image in `\box255`. First it measures the total height H (`\adl@totalheight`) of `longtable` rows in `\box255` and the total height H_b (`\@tempdima`) of its *body* which consists of the rows without the header and footer, as follows where H_{255}, H_h and H_t are the height plus depth of `\box255` and the effective header and footer of the page respectively.

$$T = \begin{cases} \texttt{\textbackslash adl@LTpagetotal} & \text{if } \texttt{\textbackslash ifadl@LTfirstpage} \\ 0 & \text{otherwise} \end{cases}$$

$$t = \begin{cases} \texttt{\textbackslash topskip} \text{ glue} & \text{if } \texttt{longtable} \text{ is the first item of the page} \\ & (\neg(\texttt{\textbackslash ifadl@firstpage} \wedge T{>}0)) \\ 0 & \text{otherwise} \end{cases}$$

$$H = H_{255} - t - T$$

$$H_b = H - H_h - H_t$$

The hard part is to measure t because it is not `\topskip` but that minus the first box of `\box255`. Thus we do not measure t but remove it from the box by the following tricky way. First we copy `\box255` items into `\box0` adding a `\hrule` of 1 sp high as its first item.

Then \box0 is \vsplit to 1 sp setting \splittopskip to 0. Since the \topskip glue is the first item of \box255 and the \vsplit discards it at the breakpoint, \box0 must have all the items in \box255 lead by 0 (\splittopskip) glue rather than \topskip glue. Thus the height of \box0 is $H_{255} - t$.

Subtraction of H_h and H_t is done by the macro \adl@LTinit{⟨*hf*⟩}⟨*box*⟩, where ⟨*hf*⟩ is head or foot and ⟨*box*⟩ is one of \LT@firsthead, \LT@head and ⟨*foot*⟩ (\LT@lastfoot or \LT@foot). This macro also copies the contents of weirdly named structure such as \\adl@rowsL\LT@head into \adl@LTheadL and so on[26] if ⟨*box*⟩ is not void. Otherwise, \adl@LTheadL etc. is kept to their initial value, \@empty.

Next, we make rows for vertical lines by \adl@makevlrL/R after extracting the leading part of $R^{L/R}$ corresponding to the *body* by the macro \adl@LTsplit⟨$R^{L/R}$⟩⟨$R_h^{L/R}$⟩⟨$R_f^{L/R}$⟩, where $R_h^{L/R}$ and $R_f^{L/R}$ are \adl@LTheadL and so on. Since the macro defines \adl@rows given to \adl@makevlL/R to the sequence of $R_h^{L/R}$, the extracted part of $R^{L/R}$ and $R_f^{L/R}$, the rows for vertical lines for all the rows including header and footer are build in \adl@vlrowL and \adl@vlrowR as in the ordinary case without longtable.

Then the rows are put into \box0 by calling \LT@bchunk with \adl@drawvl (line drawing) and \LT@save@row (column widths adjustment), saving/restoring counters \LT@rows and \c@LT@chunks which \LT@bchunk globally updates. Since we refer to potentially immature \LT@save@row here, some weird looking vertical lines could be drawn but the result after convergence should be correct. Finally, the contents of \box255 followed by the vertical lines in \box0 are put back into \box255 keeping its original depth and adding ⟨*tail*⟩ (\vss or nothing) to its end.

```
\def\adl@LTdraw#1#2{%
        \@tempswatrue
        \ifadl@LTfirstpage\ifdim\adl@LTpagetotal>\z@\@tempswafalse \fi\fi
        \if@tempswa
                \setbox\z@\vbox{\hrule height1sp\unvcopy\@cclv}
                \splittopskip\z@
                \setbox\@ne\vsplit\z@ to1sp\relax
                \@tempdima\ht\z@
        \else   \@tempdima\ht\@cclv \fi
        \advance\@tempdima\dp\@cclv
        \adl@totalheight\@tempdima
        \let\adl@LTheadL\@empty \let\adl@LTheadR\@empty
        \let\adl@LTfootL\@empty \let\adl@LTfootR\@empty
        \ifadl@LTfirstpage
                \global\adl@LTfirstpagefalse
                \advance\@tempdima-\adl@LTpagetotal
                \adl@totalheight\@tempdima
                \ifvoid\LT@firsthead
                        \adl@LTinit{head}\LT@head
                \else   \adl@LTinit{head}\LT@firsthead
                \fi
        \else   \adl@LTinit{head}\LT@head \fi
        \ifvoid#1%
```

[26] Copying by \edef can be replaced by \let with many \expandafter but it is not comprehensible.

```
                \adl@LTinit{foot}\LT@foot
        \else   \adl@LTinit{foot}#1\fi
        \let\adl@vl\relax \def\adl@discard{\adl@connect}%
        \def\adl@vlrow{}\adl@currentcolumn\@ne
                \adl@LTsplit\adl@rowsL\adl@LTheadL\adl@LTfootL
                \let\adl@addvl\adl@addvlL
                \adl@makevlrL \let\adl@vlrowL\adl@vlrow
        \def\adl@vlrow{}\adl@currentcolumn\adl@columns
                \adl@LTsplit\adl@rowsR\adl@LTheadR\adl@LTfootR
                \let\adl@addvl\adl@addvlR
                \adl@makevlrR \let\adl@vlrowR\adl@vlrow
        \let\adl@vl\adl@@vl
        \@tempcnta\LT@rows
        \LT@bchunk \adl@drawvl
        \LT@save@row\cr \egroup \setbox\@ne\lastbox \unskip \egroup
        \global\advance\c@LT@chunks\m@ne
        \global\LT@rows\@tempcnta
        \@tempdima\dp\@cclv
        \setbox\@cclv\vbox{\unvbox\@cclv \box\z@ \vskip-\@tempdima
                \hrule\@width\z@\@height\z@\@depth\@tempdima#2}}
\def\adl@LTinit#1#2{\ifvoid#2\else
        \advance\@tempdima-\csname\string\adl@LTth\string#2\endcsname sp%
        \expandafter\edef\csname adl@LT#1L\endcsname{%
                \csname\string\adl@rowsL\string#2\endcsname}%
        \expandafter\edef\csname adl@LT#1R\endcsname{%
                \csname\string\adl@rowsR\string#2\endcsname}\fi}

```

\adl@LTsplit
\adl@LTxsplit
\adl@LTrowrelax
\adl@LTrowdiscard
\adl@LTysplit
\adl@LTisplit
\adl@LTiisplit
\adl@LTsplitend

The macro `\adl@LTsplit`$\langle R^{L/R}\rangle\langle R_h^{L/R}\rangle\langle R_f^{L/R}\rangle$ moves leading elements in $R^{L/R}$ into R' (`\adl@rows`) until total heights of the elements summed in h (`\@tempdimb`) reaches to H_b (`\@tempdima`)[27] by a straightforward loop with the macros `\adl@LTisplit` to fetch the i-th element and `\adl@LTiisplit` to get h_i. Before moving, however, we have to remove discardable item(s)[28] from the top of $R^{L/R}$. Since an element for a discardable item is *disconnect* (`\relax`) or *discard* (`\adl@discard`), we check the first part of the element by `\ifx`-comparison with `\adl@LTrowrelax` and `\adl@LTrowdiscard` whose bodies are `\relax` and `\adl@discard` if the `longtable` portion does not have a header ($R_h^{L/R}$ is `\@empty`). Otherwise, the discardable item was not discarded because the first item of the page is not it but the header.

Note that since moving from $R^{L/R}$ to R' is done by `\edef` and `\adl@discard` is `\def`-ined as `\adl@connect` in `\adl@LTdraw`, non-discarded *discard* transforms into *connect* in R'. Also note that since the remaining part of $R^{L/R}$ is `\def`-ined as the body of `\@tempb` which is globally `\let`-assigned to $R^{L/R}$ again, `\adl@discard` survives in the new $R^{L/R}$.

```
\def\adl@LTsplit#1#2#3{\def\adl@rows{}\@tempdimb\z@
        \expandafter\adl@LTxsplit#1\@nil;%
        \edef\adl@rows{#2\adl@rows#3}%
```

[27] Although h must become H_b exactly in usual case, we stop the loop when $h \geq H_b$ to avoid accidental overrun in unusual cases.

[28] Must be only one but the implementation allows two or more.

```
        \global\let#1\@tempb}
\def\adl@LTxsplit#1;{\def\@tempa{#1}%
        \ifx\@tempa\@nnil \def\@tempb{}\let\next\relax
        \else\ifx\adl@LTheadL\@empty \def\next{\adl@LTysplit#1}%
        \else \def\next{\adl@LTisplit#1;}\fi \fi
        \next}
\def\adl@LTrowrelax{\relax}
\def\adl@LTrowdiscard{\adl@discard}
\def\adl@LTysplit(#1/#2){\def\@tempa{#1}%
        \ifx\@tempa\adl@LTrowrelax \let\next\adl@LTxsplit
        \else\ifx\@tempa\adl@LTrowdiscard \let\next\adl@LTxsplit
        \else \def\next{\adl@LTisplit(#1/#2);}\fi \fi
        \next}
\def\adl@LTisplit#1;{\def\@tempa{#1}%
        \ifx\@tempa\@nnil \def\@tempb{}\let\next\relax
        \else\ifdim\@tempdimb<\@tempdima
                \adl@LTiisplit#1\let\next\adl@LTisplit
        \else   \def\next{\adl@LTsplitend#1;}\fi \fi
        \next}
\def\adl@LTiisplit(#1/#2){\edef\adl@rows{\adl@rows(#1/#2);}%
        \advance\@tempdimb#2sp}
\def\adl@LTsplitend#1;\@nil;{\def\@tempb{#1;}}
\fi

%%^L
```

4.16 Compatibility with colortbl

The implementation to make arydshln compatible with colortbl consists of the following three (almost independent) issues.

Cell coloring is the easiest part because it does not affect dash line drawing. Another reason of the easiness is that colortbl packs each cell in a box to measure its height for painting in the modified version of `\@classz`. Thus we do not need to code `\@classz` for both of colortbl and arydshln, but may sneak our own height/depth measurement into `\@classz` of colortbl. Almost everything we have to pay attention to is the compatibility of the initialization and finalization of colortbl and arydshln.

Horizontal line coloring is relatively easy because it is almost enough to insert coloring macro `\CT@arc@` before the line drawing. A little bit complicated part is the gap coloring which is done by drawing a solid line of gap color before dash line is drawn.

Vertical line coloring is the hardest part but almost everything is done in previous sections to attach dash/gap color to each vertical line segment e_j^i in the list C_i^L and C_i^R of the i-th row information r_i. What we do here is to fix the bugs of `\arrayrulecolor` and `\doublerulesepcolor` in colortbl implementation and to add `\dashgapcolor`. If you put `\arrayrulecolor` in `>{...}` construct to specify the color of the vertical lines following the construct as the manual of colortbl says, you will have an error message "Misplaced `\noalign`" because the macro is expanded with `\noalign` in a

column body. Even if you somehow remove \noalign to avoid the error, you will have a mysterious line coloring as follows:

- If you have \arrayrulecolor before the \array/\tabular starts, \arrayrulecolor in the preamble has no effect to vertical lines but decides the color of horizontal lines except for those at the top of the environment. Additional \arrayrulecolor at the beginning of a row has no effect to vertical lines (as expected) but decides horizontal lines following it (also as expected). The effect of \doublerulesepcolor is same as \arrayrulecolor.
- Otherwise, i.e. without \arrayrulecolor outside the environment, \arrayrulecolor in the preamble decides the color of vertical and horizontal lines except for verticals preceding columns in the first row and horizontals at the top of the environment. Additional \arrayrulecolor at the beginning of a row decides all the vertical and horizontal lines following it. On the other hand, \doublerulesepcolor acts as if \doublerulesepcolor{white} is done outside the environment.

The reason of the mysterious behavior is as follows. An \arrayrulecolor, which globally \def-ines a macro \CT@arc@ with a body containing \color, in the preamble is not expanded nor evaluated in the preamble construction phase but done when the first (and succeeding) row is build. On the other hand, \CT@arc@ attached to vertical line drawing is expanded in the preamble construction phase. Thus if \CT@arc@ has been defined before the environment starts, vertical lines are colored following the outside definition. Otherwise, since \CT@arc@ is \let-equal to \relax, it remains unchanged in the preamble construction phase and expanded when each row is build referring to its definition that \arrayrulecolor modifies in the row building phase. Since the macro \CT@drsc@ defined by \doublerulesepcolor is examined if it is \relax or not in the preamble construction phase, \doublerulesepcolor in the preamble has no effect regardless the existence of the outside definition.

Thus we have to expand and evaluate \arrayrulecolor and \doublerulecolor in the preamble construction phase to define \CT@arc@ and \CT@drsc@. We also have to initialize \CT@arc@ as an expandable but non-operative token (e.g. a macro with a body of \relax as we do) to make it is expanded in the preamble construction phase rather than the row building.

4.16.1 Initialization, Cell Coloring and Finalization

\CT@arc@
\adl@dashgapcolor

First of all, we initialize the macro \CT@arc@, which will be \def-ined as \color to specify the color of solid lines and dash segments by \arrayrulecolor, with a body of \relax because it will be referred to by the vertical line drawing process even if colortbl is not in use. We also initialize the macro \adl@dashgapcolor for the color of gaps of dash lines similarly. Note that these macros are not \let-equal to \relax but have bodies of \relax so that they are replaced with \relax in the preamble construction phase rather than surviving with their own name.

```
991
992 %% Compatibility with colortbl
```

```
993
994 \def\CT@arc@{\relax}
995 \def\adl@dashgapcolor{\relax}
```

Next we examine if colortbl is in use by `\@ifpackageloaded`, and skip everything if not, or we have some errors especially when array is not in use.

```
996 \@ifpackageloaded{colortbl}\@tempswatrue\@tempswafalse
997 \if@tempswa
```

`\adl@org@inactivate` `\adl@org@activate` `\adl@inactivate` `\adl@activate` `\CT@setup` `\@endpbox`

Then we redefine `\adl@inactivate` and `\adl@activate` referring their original version `\adl@org@inactivate` and `\adl@org@activate` so that they make `\CT@setup` `\let`-equal to its original version `\adl@CT@setup` if `\ADLinactivate` is in effect, or to our own version `\adl@act@CT@setup` which will be defined soon. New `\adl@activate` also *inactivates* `\@startpbox` and `\@endpbox` because our own ones for column height/depth measuremnt is inappropriate with colortbl as explained soon.

```
998 \let\adl@org@inactivate\adl@inactivate
999 \let\adl@org@activate\adl@activate
1000 \def\adl@inactivate{\adl@org@inactivate \let\CT@setup\adl@CT@setup}
1001 \def\adl@activate{\adl@org@activate \let\CT@setup\adl@act@CT@setup
1002         \let\@startpbox\adl@org@startpbox \let\@endpbox\adl@org@endpbox}
1003
```

`\adl@CT@setup` `\CT@setup` `\adl@act@CT@setup`

Cell coloring is done by `\@classz` preamble of colortbl in which a column is packed in `\box0`. On the other hand, our own `\@classz` one with array packs the column in `\adl@box` so that we measure its height and depth. Thus we have choices; to insert height/depth measurement into colrotbl's version; or to insert coloring into our own version. Since the code of height/depth measurement is much simpler than the coloring, we choose the first way. Thus the macro `\adl@act@CT@setup`, which is `\let`-equal to `\CT@setup` and is invoked from `\@classz` preamble after the column is packed into `\box0`, measures the height and depth of `\box0` and sets `\adl@height` and/or `\adl@depth` to them if they break the records as `\adl@@colhtdp` does with `\adl@box`, after it invokes its original version `\adl@CT@setup`. Note that we compare `\adl@height` with the height of `\box0` plus `\minrowclearance` because it is the real height. Also note that we could insert the measurement code into the modified version of colortbls's `\@classz` placing it just before the `\box0` is put where `\ht0` plus `\minrowclearance` is caluculated, but did not because the author wished to make it clear that `\@classz` is modified only for the bug fix of `\arrayrulecolor` and `\doublerulesepcolor` (and to introduce `\dashgapcolor`).

```
1004 \let\adl@CT@setup\CT@setup
1005 \def\CT@setup{\adl@CT@setup
1006         \@tempdima\ht\z@ \advance\@tempdima\minrowclearance
1007         \ifdim\adl@height<\@tempdima \global\adl@height\@tempdima \fi
1008         \ifdim\adl@depth<\dp\z@ \global\adl@depth\dp\z@\fi}
1009 \let\adl@act@CT@setup\CT@setup
1010
```

`\adl@activatepbox`

Another job for cell coloring is to make `\CT@`x`@color` ($x \in \{$`cell`, `column`, `do`$\}$) `\let`-equal to `\relax` before the body of `\multicolumn` is put so that the `\columncolor` in the environment preamble does not affect the `\span`-ned column. Note that resetting `\CT@cell@`

color will be unnecessary (but safe) because it is always reset after its invocation. Also note that resetting \CT@row@color in colortbl's \multicolumn is a buggy feature because it should be effective, and thus we remove it. Although we have our own \multicolumn for dash lines, we keep it unchanged. Instead we redefine \adl@activatepbox, which is usually \relax with array, to do the color resetting to minimize recoding.

```
\def\adl@activatepbox{\let\CT@cell@color\relax
        \let\CT@column@color\relax
        \let\CT@do@color\relax}
```

\adl@CT@start
\CT@start
\adl@dashgapcolor@save
\adl@CT@end
\CT@end
\endarray
\endArray

Yet another job is the save/restore of color information at the beginning and end of the environment. Since this is done by \CT@start and \CT@end, we modify them to save/restore \adl@dashgapcolor to/from \adl@dashgapcolor@save referring their original version \adl@CT@start and \adl@CT@end. We also modify our own \endarray and its shorthand active version \endArray so that \CT@end is invoked at the end of environment together with \@arrayright if it is defined. Note that we may not modify \endtabular because it refers \endarray. Also note that \CT@start is invoked from \@tabarray which we keep unchanged.

```
\let\adl@CT@start\CT@start
\def\CT@start{\adl@CT@start \let\adl@dashgapcolor@save\adl@dashgapcolor}
\let\adl@CT@end\CT@end
\def\CT@end{\adl@CT@end \global\let\adl@dashgapcolor\adl@dashgapcolor@save}
\def\endarray{\adl@endarray \egroup \adl@arrayrestore \CT@end \egroup
        \csname @arrayright\endcsname}
\ifx\adl@notdefinable\undefined \let\endArray\endarray \fi
```

4.16.2 Horizontal Line Coloring

\hline
\adl@inactivehdl
\adl@ixhline

To color \hline and inactivated \hdashline, we modify our own \hline and \adl@inactivehdl inserting the line coloring macro \CT@arc@ before drawing by \hrule and pushing the coloring/drawing into a group. We also modify \adl@ixhline to draw a colored horizontal rule of \doublerulesep wide with the color defined in \CT@drsc@ if it is not \relax, rather than to insert a vertical skip. Note that the \cline coloring is done by colortbl's \cline renamed as \adl@org@cline and invoked from our own one.

```
\def\hline{\noalign{\ifnum0=`}\fi
        \ifadl@zwhrule \vskip-\arrayrulewidth
        \else \adl@hline\adl@connect\arrayrulewidth \fi
        {\CT@arc@ \hrule\@height\arrayrulewidth}%
        \global\adl@finaldepth\z@
        \futurelet\@tempa\adl@xhline}
\def\adl@inactivehdl[#1/#2]{\ifadl@zwhrule \vskip-\arrayrulewidth \fi
        {\CT@arc@ \hrule\@height\arrayrulewidth}%
        \futurelet\@tempa\adl@xhline}
\def\adl@ixhline{{\ifx\CT@drsc@\relax \vskip \else
        \CT@drsc@\hrule\@height \fi \doublerulesep}%
        \adl@hline\relax\doublerulesep}
```

\adl@ihdashline
\adl@act@ihdashline
\adl@cdline
\adl@act@cdline

To draw a horizontal dash line with colored dashes and also colored gaps, we drastically modified `\adl@ihdashline` for `\hdashline` and `\adl@cdline` for `\cdashline`. First, they invoke `\adl@hclinesetup` that makes the prefix of a `\multispan`-ned row from the first to last columns for `\hdashline` or given columns for `\cdashline`. Then the line is drawn by the modified version of `\adl@hcline`. We have to declare these macros are active ones again.

```
\def\adl@ihdashline[#1/#2]{\adl@hclinesetup\@ne\adl@columns
        \adl@hcline\z@[#1/#2]%
        \noalign{\ifnum0=`}\fi
        \futurelet\@tempa\adl@xhline}
\let\adl@act@ihdashline\adl@ihdashline
\def\adl@cdline[#1-#2]{\ifadl@zwhrule \vskip-\arrayrulewidth \fi
        \adl@hclinesetup{#1}{#2}%
        \adl@hcline{-\arrayrulewidth}}
\let\adl@act@cdline\adl@cdline
```

\adl@hclinesetup
\adl@cdlinea
\adl@cdlineb

The macro `\adl@hclinesetup`$\langle f\rangle\langle t\rangle$ makes the prefix of a `\multispan`-ned row from the column f to t and `\global`-ly defines it as `\@gtempa`. This is done by a code very similar to original `\adl@cdline` (and thus LaTeX-2.09's `\cline`) but the invocation of `\adl@hcline` is removed from `\adl@cdliena` and `\adl@cdlineb`, one of which is `\@gtempa`.

```
\def\adl@hclinesetup#1#2{\global\adl@cla#1\relax
        \global\advance\adl@cla\m@ne
        \ifnum\adl@cla>\z@ \global\let\@gtempa\adl@cdlinea
        \else              \global\let\@gtempa\adl@cdlineb\fi
        \global\adl@clb#2\relax
        \global\advance\adl@clb-\adl@cla \ifnum0=`{\fi}}
\def\adl@cdlinea{\multispan\adl@cla &\multispan\adl@clb \unskip}
\def\adl@cdlineb{\multispan\adl@clb \unskip}
```

\adl@hcline
\adl@paintdashgap

The modified version of `\adl@hcline`$\langle w\rangle$`[`$\langle d\rangle$`/`$\langle g\rangle$`]` draws a colored horizontal dash line of dash size d and gap size g and insert vertical skip of w. First it `\span`-s columns by `\@gtempa` and checks if the body of `\adl@dashgapcolor` is something other than `\relax`. If so, i.e. it has `\color`, `\adl@paintdashgap` is invoked to draw a horizontal rule of `\color` by `\leaders` as the background of the dash line, to insert `\nobreak` (for longtable) and a negative space for canceling the width of the rule, and to `\span` the columns again. Then `\adl@hcline` draws the colored dash line, over the background if the gaps are colored, by inserting `\CT@arc@` before the invocation of `\adl@draw`.

```
\def\adl@hcline#1[#2/#3]{\@gtempa
        \ifx\adl@dashgapcolor\adl@nocolor \else \adl@paintdashgap \fi
        {\@tempdima#2\relax \@tempdimb#3\relax
                \CT@arc@ \adl@draw\adl@vrule\hskip\hbox}\cr
        \noalign{\global\adl@finaldepth\z@ \ifdim#1=\z@\else
                \ifadl@zwhrule\else \vskip#1\fi\fi}}
\def\adl@paintdashgap{{\adl@dashgapcolor
        \leaders\hrule\@height\arrayrulewidth\hfill}\cr
        \noalign{\penalty\@M \vskip-\arrayrulewidth}\@gtempa}
```

4.16.3 Vertical Line Coloring

\arrayrulecolor
\CT@arc@
\doublerulesepcolor
\CT@drsc@
\dashgapcolor
\adl@dashgapcolor
\adl@defcolor
\adl@idefcolor
\adl@noalign
\nodashgapcolor

A bug of colortbl's \arrayrulecolor and \doublerulesepcolor is that they are defined like;

```
\ifdim\baselineskip=\z@ \noalign \fi{\gdef\CT@arc@{\color...}}
```

This aims to do \noalign{\gdef...} in array/tabular and do {\gdef...} outside but has two problems: First, if they are in >{...} construct, they are expanded with \noalign inappropriately when the argument of > is expanded. Second, they may appear at a place where \baselineskip is 0 but is outside of array/tabular and will cause the misplaced \noalign error. To solve the second problem, we introduced \adl@noalign which is set to \noalign in the environment by our own \@array, and \relax outside. We also introduced \adl@defcolor⟨*cs*⟩⟨*opt*⟩ for the common job to define ⟨*cs*⟩ as \color with ⟨*opt*⟩, in \noalign if necessary, by \adl@idefcolor. Thus \arrayrulecolor and \doublerulesepcolor are modified to define \CT@arc@ and \CT@drsc@ using \adl@defcolor, and our own \dashgapcolor is defined similarly to define \adl@dashgapcolor. Another macro \nodashgapcolor to nullify \dashgapcolor is also defined with \adl@noalign to reset \adl@dashgapcolor to \relax.

```
\def\arrayrulecolor{\adl@defcolor\CT@arc@}
\def\doublerulesepcolor{\adl@defcolor\CT@drsc@}
\def\dashgapcolor{\adl@defcolor\adl@dashgapcolor}
\def\adl@defcolor#1#2#{\adl@idefcolor{#1}{#2}}
\def\adl@idefcolor#1#2#3{\adl@noalign{\gdef#1{\color#2{#3}}}}
\let\adl@noalign\relax
\def\nodashgapcolor{\adl@noalign{\gdef\adl@dashgapcolor{\relax}}}
```

\@classz
\adl@act@classz
\adl@org@classz

The tougher bug of colortbl is the expansion timing of \arrayrulecolor and \dobulerulesepcolor in a >-argument. We have to modify \@classz to extract them from \toks\@tempcnta as its original version does for \columncolor. Thus we inserted the invocation of \adl@extract@arc for \arrayrulecolor, \adl@extract@drsc for \doublerulesepcolor, and \adl@extract@dgc for \dashgapcolor just after the invocation of \CT@extract. Note that the other part of \@classz is not modified logically, but done for author's preference of indentation. Also note that both \adl@act@classz and \adl@org@classz are \let-equal to the modified \@classz because we have to be bug free even if \ADLinactive is in effect.

```
\def\@classz{\@classx
        \@tempcnta\count@ \prepnext@tok
        \expandafter\CT@extract\the\toks\@tempcnta\columncolor!\@nil
        \expandafter\adl@extract@arc\the\toks\@tempcnta\arrayrulecolor!\@nil
        \expandafter\adl@extract@drsc
                \the\toks\@tempcnta\doublerulesepcolor!\@nil
        \expandafter\adl@extract@dgc\the\toks\@tempcnta\dashgapcolor!\@nil
        \@addtopreamble{%
                \setbox\z@\hbox\bgroup\bgroup
                \ifcase \@chnum
```

```
                        \hskip\stretch{.5}\kern\z@
                        \d@llarbegin
                        \insert@column
                        \d@llarend\hskip\stretch{.5}%
                \or \d@llarbegin \insert@column \d@llarend \hfill
                \or \hfill \kern\z@ \d@llarbegin \insert@column \d@llarend
                \or  $\vcenter
                        \@startpbox{\@nextchar}\insert@column \@endpbox $%
                \or  \vtop \@startpbox{\@nextchar}\insert@column \@endpbox
                \or  \vbox \@startpbox{\@nextchar}\insert@column \@endpbox
                \fi
                \egroup\egroup
                \begingroup
                        \CT@setup
                        \CT@column@color
                        \CT@row@color
                        \CT@cell@color
                        \CT@do@color
                \endgroup
                \@tempdima\ht\z@
                \advance\@tempdima\minrowclearance
                \vrule\@height\@tempdima\@width\z@
                \unhbox\z@}%
        \prepnext@tok}
\let\adl@act@classz\@classz
\let\adl@org@classz\@classz
```

\adl@def@extract
\adl@extract@arc
\adl@extract@arc@b
\CT@arc@
\adl@extract@drsc
\adl@extract@drsc@b
\CT@drsc@
\adl@extract@dgc
\adl@extract@dgc@b
\adl@dashgapcolor

The definitions of `\adl@extract@`x ($x \in \{$`arc`, `drsc`, `dgc`$\}$) are quite similar to each other. For example `\adl@extract@arc` is defined as follows.

```
\def\adl@extract@arc#1\arrayrulecolor#2#3\@nil{%
        \if!#2\toks\@tempcnta{#1}\let\@tempa\relax%
        \else\if[#2%]
                \def\@tempa{\adl@extract@arc@b{#1}#3\@nil}%
        \else   \def\CT@arc@{\color{#2}}%
                \def\@tempa{\adl@extract@arc#1#3\@nil}%
        \fi\fi \@tempa}
\def\adl@extract@arc@b#1#2]#3{%
        \def\CT@arc@{\color[#2]{#3}}%
        \adl@extract@arc#1}
```

This code extracts *all the* occurrences of `\arrayrulecolor[`$\langle m\rangle$`]{`$\langle c\rangle$`}` from the token register and `\def`-ines `\CT@arc@` as `\color[`$\langle m\rangle$`]{`$\langle c\rangle$`}`. Note that `\CT@extract` does a similar job for `\columncolor` but it mistakingly ignores the possibility that the token register has two or more `\columncolor`[29]. Anyway, if we copy the code above and replace '`@arc`' with '`@drsc`', `\arrayrulecolor` with `\doublerulesepcolor`, and `\CT@arc@` with `\CT@drsc@`, we will have `\adl@extract@drsc`(`@b`) for `\doublerulesepcolor`. The code for `\adl@extract@`

[29] Fixing this bug is not our business.

dgc(@b) will be also obtained similarly. However, having three relatives for a almost common job is too awful. Thus we introduce;

\adl@def@extract⟨*key*⟩⟨*umac*⟩⟨*cmac*⟩

to define the macros \adl@extract@*key* and \adl@extract@*key*@b for the user interface macro ⟨*umac*⟩ in which a color macro ⟨*cmac*⟩ is defined with \color. For example, we will obtain \adl@extract@arc(@b) shown above by;

```
\adl@def@extract{arc}\arrayrulecolor\CT@arc@
```

Note that \color is made \relax in the preamble construction phase by colortbl's \@mkpream and regain its proper meaning after the phase.

```
\def\adl@def@extract#1#2#3{%
        \expandafter\def\csname adl@extract@#1\endcsname##1#2##2##3\@nil{%
                \if!##2\toks\@tempcnta{##1}\let\@tempa\relax
                \else\if[##2%]
                        \def\@tempa{\@nameuse{adl@extract@#1@b}{##1}##3\@nil}%
                \else   \def#3{\color{##2}}%
                        \def\@tempa{\@nameuse{adl@extract@#1}##1##3\@nil}%
                \fi\fi \@tempa}
        \expandafter\def\csname adl@extract@#1@b\endcsname##1##2]##3{%
                \def#3{\color[##2]{##3}}%
                \@nameuse{adl@extract@#1}##1}}
\adl@def@extract{arc}\arrayrulecolor\CT@arc@
\adl@def@extract{drsc}\doublerulesepcolor\CT@drsc@
\adl@def@extract{dgc}\dashgapcolor\adl@dashgapcolor

```

4.16.4 Compatibility with longtable

\LT@hline
\adl@LTihdashline
\adl@LTinactivehdl
\adl@LTixhline

Yet another compatiblity issue is to cope with both longtable and colortbl. We redefine \LT@hline and \LT@inactivehdl in order to put \CT@arc@ before line drawing and to push them in a group. Modified \adl@LTidashline first invokes \adl@hclinesetup and open \noalign because it is closed by \adl@hclinesetup. The contents of \adl@LThdlrow for \adl@LTidashline is simply \adl@hcline because it does \multispan now. The macro \adl@LTixhline is modified to paint the \doublerulesep gap by \leaders\hrule with color of \CT@drsc@ if it is not \relax.

```
\ifx\longtable\undefined\else
\def\LT@hline{\noalign{\ifnum0=`}\fi
        \gdef\adl@LThdlrow{\multispan{\LT@cols}\unskip{\CT@arc@
                \leaders\hrule\@height\arrayrulewidth\hfill}\cr}%
        \adl@LThdline}
\def\adl@LTihdashline[#1/#2]{\adl@hclinesetup\@ne\adl@columns
        \noalign{\ifnum0=`}\fi
        \gdef\adl@LThdlrow{\adl@hcline\z@[#1/#2]}%
        \adl@LThdline}
\def\adl@LTinactivehdl[#1/#2]{%
```

```
        \gdef\adl@LThdlrow{\multispan{\LT@cols}\unskip{\CT@arc@
                \leaders\hrule\@height\arrayrulewidth\hfill}\cr}%
        \adl@LThdline}
\def\adl@LTixhline{%
        \ifx\CT@drsc@\relax \gdef\adl@LThdlrow{\noalign{
                \penalty-\@medpenalty \vskip\doublerulesep}}
        \else \gdef\adl@LThdlrow{\noalign{\penalty\@M}%
                \multispan{\LT@cols}\unskip{\CT@drsc@
                \leaders\hrule\@height\doublerulesep\hfill}\cr}\fi
        \ifnum0=‘{\fi}\adl@LThdlrow \noalign{\ifnum0=‘}\fi
        \adl@hline\relax\doublerulesep \global\let\adl@LThdlrow\@empty}
\fi
\fi
```

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The base implementation of `array` and `tabular` environments, part of which the author gives new definitions referring original ones, are written by Leslie Lamport as a part of LATEX-2.09 and LATEX 2$_\varepsilon$ (1997/12/01) to which Johannes Braams and other authors also contributed. The author also refers array package (v2.4j) written by Frank Mittelbach and David Carlisle; colortab package (v0.9) written by Timothy van Zandt; and longtable (v4.10) and colortbl (v0.1j) packages written by David Carlisle; to make the style compatible with those packages.

Index

Italicized number refers to the page where the specification and usage of corresponding entry are described, while underlined is for the implementation of the entry. To find a control sequence, remove prefixes `\@`, `\adl@` and `\ifadl@` from its name if it has one of them.

D

E

M

N

O

P

R

S

T

U

V

W

X

Y

Z

Change History