The longtable package*

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Abstract

This package defines the longtable environment, a multi-page version of tabular.

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1 Introduction

longtable

The longtable package defines a new environment, longtable, which has most of the features of the tabular environment, but produces tables which may be broken by TEX's standard page-breaking algorithm. It also shares some features with the table environment. In particular it uses the same counter, `table`, and has a similar `\caption` command. Also, the standard `\listoftables` command lists tables produced by either the table or longtable environments.

The following example uses most of the features of the longtable environment. An edited listing of the input for this example appears in Section 8.

Note: Various parts of the following table will **not** line up correctly until this document has been run through LATEX several times. This is a characteristic feature of this package, as described below.

Table 1: A long table

*	This part appears at the top of the table		*
*		FIRST | SECOND	*
*	longtable columns are specified	in the	*
*	This goes at the	bottom.	*

*This file has version number v4.04, last revised 1996/05/24.

†The new algorithm for aligning 'chunks' of a table used in version 4 of this package was devised coded and documented by David Kastrup, `dak@pool.informatik.rwth-aachen.de`.

Table 1: (continued)

*	This part appears at the top of every other page		*
*	**First**	**Second**	*
*	same way as in the tabular	environment.	*
*	`@{*}r||p{1in}@{*}`	in this case.	*
*	Each row ends with a	`\\` command.	*
*	The `\\` command has an	optional	*
*	argument, just as in	the	*
*	tabular	environment.	*
*	See the effect of `\\[10pt]`	?	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Also `\hline` may be used,	as in tabular.	*
*	That was a `\hline`	.	*
*	That was `\hline\hline`	.	*
	This is a `\multicolumn{2}{||c||}`		
*	If a page break occurs at a `\hline` then	a line is drawn	*
*	at the bottom of one page and at the	top of the next.	*
*	The `[t] [b] [c]` argument of tabular	can not be used.	*
*	The optional argument may be one of	`[l] [r] [c]`	*
*	to specify whether the table should be	adjusted	*
*	to the left, right	or centrally.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	This goes at the	bottom.	*

Table 1: (continued)

*	This part appears at the top of every other page		*
*	**First**	**Second**	*
*Some lines may take up a lot of space, like this:		This last column	*
		is a “p” column so this “row” of the table can take up several lines. Note however that TEX will never break a page within such a row. Page breaks only occur between rows of the table or at `\hline` commands.	
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots[1] of lines	like this.	*
*	Lots of lines	like this[2]	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	These lines will	appear	*
*	in place of the	usual foot	*
*	at the end	of the table	*

2 Chunk Size

`LTchunksize` In order to TEX multi-page tables, it is necessary to break up the table into smaller chunks, so that TEX does not have to keep everything in memory at one time. By default longtable uses 20 rows per chunk, but this can be set by the user, with e.g., `\setcounter{LTchunksize}{10}`.[3] These chunks do not affect page breaking, thus if you are using a TEX with a lot of memory, you can set `LTchunksize` to be several pages of the table. TEX will run faster with a large `LTchunksize`. However, if necessary, longtable can work with `LTchunksize` set to 1, in which case the memory taken up is negligible. Note that if you use the commands for setting the table head or

[1] This is a footnote.

[2] longtable takes special precautions, so that footnotes may also be used in ‘p’ columns.

[3] You can also use the plain TEX syntax `\LTchunksize=10`.

A	tabular	environment
within	a floating	table

Table 2: A floating table

foot (see below), the `LTchunksize` must be at least as large as the number of rows in each of the head or foot sections.

This document specifies `\setcounter{LTchunksize}{10}`. If you look at the previous table, after the *first* run of LaTeX you will see that various parts of the table do not line up. LaTeX will also have printed a warning that the column widths had changed. longtable writes information onto the `.aux` file, so that it can line up the different chunks. Prior to version 4 of this package, this information was not used unless a `\setlongtables` command was issued, however, now the information is always used, using a new algorithm[4] and so `\setlongtables` is no longer needed. It is defined (but does nothing) for the benefit of old documents that use it.

3 Captions and Headings

`\endhead` `\endfirsthead` `\endfoot` `\endlastfoot`

At the start of the table one may specify lines which are to appear at the top of every page (under the headline, but before the other lines of the table). The lines are entered as normal, but the last `\\` command is replaced by a `\endhead` command. If the first page should have a different heading, then this should be entered in the same way, and terminated with the `\endfirsthead` command. The `LTchunksize` should be at least as large as the number of rows in the heading. There are also `\endfoot` and `\endlastfoot` commands which are used in the same way (at the *start* of the table) to specify rows (or an `\hline`) to appear at the bottom of each page. In certain situations, you may want to place lines which logically belong in the table body at the end of the firsthead, or the beginning of the lastfoot. This helps to control which lines appear on the first and last page of the table.

`\caption`

The `\caption{...}` command is essentially equivalent to

```
\multicolumn{n}{c}{\parbox{\LTcapwidth}{...}}
```

where `n` is the number of columns of the table. You may set the width of the caption with a command such as `\setlength{\LTcapwidth}{2in}` in the preamble of your document. The default is 4in. `\caption` also writes the information to produce an entry in the list of tables. As with the `\caption` command in the figure and table environments, an optional argument specifies the text to appear in the list of tables if this is different from the text to appear in the caption. Thus the caption for table 1 was specified as `\caption[An optional table caption (used in the list of tables)]{A long table\label{long}}`.

You may wish the caption on later pages to be different to that on the first page. In this case put the `\caption` command in the first heading, and put a subsidiary caption in a `\caption[]` command in the main heading. If the optional argument to `\caption` is empty, no entry is made in the list of tables. Alternatively, if you do not want the table number to be printed each time, use the `\caption*` command.

The captions are set based on the code for the article class. If you have redefined the standard `\@makecaption` command to produce a different format for the captions, you

[4] Due to David Kastrup.

may need to make similar changes to the longtable version, `\LT@makecaption`. See the code section for more details.

A more convenient method of customising captions is given by the caption(2) package, which provides commands for customising captions, and arranges that the captions in standard environments, and many environments provided by packages (including longtable) are modified in a compatible manner.

You may use the `\label` command so that you can cross reference longtables with `\ref`. Note however, that the `\label` command should not be used in a heading that may appear more than once. Place it either in the firsthead, or in the body of the table. It should not be the *first* command in any entry.

4 Multicolumn entries

The `\multicolumn` command may be used in longtable in exactly the same way as for tabular. So you may want to skip this section, which is rather technical, however coping with `\multicolumn` is one of the main problems for an environment such as longtable. The main effect that a user will see is that certain combinations of `\multicolumn` entries will result in a document needing more runs of LaTeX before the various 'chunks' of a table align.

The examples in this section are set with `LTchunksize` set to the minimum value of one, to demonstrate the effects when `\multicolumn` entries occur in different chunks.

Consider Table 3. In the second chunk, longtable sees the wide multicolumn entry. At this point it thinks that the first two columns are very narrow. All the width of the multicolumn entry is assumed to be in the third column. (This is a 'feature' of TeX's primitive `\halign` command.) longtable then passes the information that there is a wide third column to the later chunks, with the result that the first pass over the table is too wide.

If the 'saved row' from this first pass was re-inserted into the table on the next pass, the table would line up in two passes, but would be much two wide.

`\kill` The solution to this problem used in Versions 1 and 2, was to use a `\kill` line. If a line is `\kill`ed, by using `\kill` rather than `\\` at the end of the line, it is used in calculating column widths, but removed from the final table. Thus entering `\kill`ed copies of the last two rows before the wide multicolumn entry would mean that `\halign` 'saw' the wide entries in the first two columns, and so would not widen the third column by so much to make room for the multicolumn entry.

In Version 3, a new solution was introduced. If the saved row in the `.aux` file was not being used, longtable used a special 'draft' form of `\multicolumn`, this modified the definition, so the spanning entry was never considered to be wider than the columns it spanned. So after the first pass, the `.aux` file stored the widest normal entry for each column, no column was widened due to `\span`ned columns. By default longtable ignored the `.aux` file, and so each run of LaTeX was considered a first pass. Once the `\setlongtables` declaration was given, the saved row in the `.aux` file, and the proper definition of `\multicolumn` were used. If any `\multicolumn` entry caused one of the columns to be widened, this information could not be passed back to earlier chunks, and so the table would not correctly line up until the third pass. This algorithm always converged in three passes as described above, but in examples such as the ones in Tables 3–6, the final widths were not optimal as the width of column 2, which is determined by a `\multicolumn` entry was not known when the final width for column 3 was fixed, due to the fact that *both* `\multicolumn` commands were switched

Table 3: A difficult \multicolumn combination: pass 1

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

Table 4: A difficult \multicolumn combination: pass 2

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

Table 5: A difficult \multicolumn combination: pass 3

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

Table 6: A difficult \multicolumn combination: pass 4

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

from ‘draft’ mode to ‘normal’ mode at the same time.

Version 4 alleviates the problem considerably. The first pass of the table will indeed have the third column much too wide. However, on the next pass longtable will notice the error and reduce the column width accordingly. If this has to propagate to chunks before the `\multicolumn` one, an additional pass will, of course, be needed. It is possible to construct tables where this rippling up of the correct widths taks several passes to ‘converge’ and produce a table with all chunks aligned. However in order to need many passes one needs to construct a table with many overlapping `\multicolumn` entries, all being wider than the natural widths of the columns they span, and all occuring in different chunks. In the typical case the algorithm will converge after three or four passes, and, the benefits of not needing to edit the document before the final run to add `\setlongtables`, and the better choice of final column widths in the case of multiple `\multicolumn` entries will hopefully more than pay for the extra passes that may possibly be needed.

So Table 3 converges after 4 passes, as seen in Table 6.

You can still speed the convergence by introducing judicious `\kill` lines, if you happen to have constellations like the above.

If you object even to LaTeX-ing a file twice, you should make the first line of every longtable a `\kill` line that contains the widest entry to be used in each column. All chunks will then line up on the first pass.

5 Adjustment

The optional argument argument of longtable controls the horizontal alignment of the table. The possible options are `[c]`, `[r]` and `[l]`, for centring, right and left adjustment, respectively. Normally centring is the default, but this document specifies

`\LTleft`
`\LTright`

```
\setlength\LTleft\parindent
\setlength\LTright\fill
```

in the preamble, which means that the tables are set flush left, but indented by the usual paragraph indentation. Any lengths can be specified for these two parameters, but at least one of them should be a rubber length so that it fills up the width of the page, unless rubber lengths are added between the columns using the `\extracolsep` command. For instance

```
\begin{tabular*}{\textwidth}{@{\extracolsep{...}}...}
```

produces a full width table, to get a similar effect with longtable specify

```
\setlength\LTleft{0pt}
\setlength\LTright{0pt}
\begin{longtable}{@{\extracolsep{...}}...}
```

6 Changes

This section highlights the major changes since version 2. A more detailed change log may be produced at the end of the code listing if the `ltxdoc.cfg` file specifies

```
\AtBeginDocument{\RecordChanges}
\AtEndDocument{\PrintChanges}
```

Changes made between versions 2 and 3.

- The mechanism for adding the head and foot of the table has been completely rewritten. With this new mechanism, longtable does not need to issue a `\clearpage` at the start of the table, and so the table may start half way down a page. Also the `\endlastfoot` command which could not safely be implemented under the old scheme, has been added.
- longtable now issues an error if started in the scope of `\twocolumn`, or the multicols environment.
- The separate documentation file `longtable.tex` has been merged with the package file, `longtable.dtx` using Mittelbach's doc package.
- Support for footnotes has been added. Note however that `\footnote` will not work in the 'head' or 'foot' sections of the table. In order to put a footnote in those sections (e.g., inside a caption), use `\footnotemark` at that point, and `\footnotetext` anywhere in the table *body* that will fall on the same page.
- The treatment of `\multicolumn` has changed, making `\kill` lines unnecessary, at the price of sometimes requiring a third pass through LaTeX.
- The `\newpage` command now works inside a longtable.

Changes made between versions 3 and 4.

- A new algorithm is used for aligning chunks. As well as the widest width in each column, longtable remembers which chunk produced this maximum. This allows it to check that the maximum is still achieved in later runs. As longtable can now deal with columns shrinking as the file is edited, the `\setlongtables` system is no longer needed and is disabled.
- An extra benefit of the new algorithm's ability to deal with 'shrinking' columns is that it can give better (narrower) column widths in the case of overlapping `\multicolumn` entries in different chunks than the previous algorithm produced.
- The 'draft' multicolumn system has been removed, along with related commands such as `\LTmulticolumn`.
- The disadvantage of the new algorithm is that it can take more passes. The theoretical maximum is approximately twice the length of a 'chain' of columns with overlapping `\multicolumn` entries, although in practice it usually converges as fast as the old version. (Which always converged in three passes once `\setlongtables` was activated.)

7 Summary

Table 7: A summary of longtable commands

Parameters		
`\LTleft`	Glue to the left of the table.	(`\fill`)
`\LTright`	Glue to the right of the table.	(`\fill`)
`\LTpre`	Glue before the the table.	(`\bigskipamount`)
`\LTpost`	Glue after the the table.	(`\bigskipamount`)
`\LTcapwidth`	The width of a parbox containing the caption.	(4in)
`LTchunksize`	The number of rows per chunk.	(20)
Setlongtables		
`\setlongtables`	Use column widths from the previous run.	
Optional arguments to `\begin{longtable}`		
none	Position as specified by `\LTleft` and `\LTright`.	
`[c]`	Centre the table.	
`[l]`	Place the table flush left.	
`[r]`	Place the table flush right.	
Commands to end table rows		
`\\`	Specifies the end of a row.	
`\tabularnewline`	Alternative to `\\` for use in the scope of `\raggedright` and similar commands that redefine `\\`.	
`\kill`	Row is 'killed', but is used in calculating widths.	
`\endhead`	Specifies rows to appear at the top of every page.	
`\endfirsthead`	Specifies rows to appear at the top the first page.	
`\endfoot`	Specifies rows to appear at the bottom of every page.	
`\endlastfoot`	Specifies rows to appear at the bottom of the last page.	
longtable caption commands		
`\caption{foo}`	Caption 'Table ?: foo', and a 'foo' entry in the list of tables.	
`\caption[bar]{foo}`	Caption 'Table ?: foo', and a 'bar' entry in the list of tables.	
`\caption[]{foo}`	Caption 'Table ?: foo', but no entry in the list of tables.	
`\caption*{foo}`	Caption 'foo', but no entry in the list of tables.	
Other commands available inside longtable		
`\newpage`	Force a page break.	
`\footnote`	Footnotes, but may not be used in the table head & foot.	
`\footnotemark`	Footnotemark, May be used in the table head & foot.	
`\footnotetext`	Footnote text, Use in the table body.	

8 Verbatim highlights from Table 1

```
\begin{longtable}{@{*}r||p{1in}@{*}}
KILLED & LINE!!!! \kill
\caption[An optional table caption ...]{A long table\label{long}}\\
\hline\hline
\multicolumn{2}{@{*}c@{*}}%
     {This part appears at the top of the table}\\
\textsc{First}&\textsc{Second}\\
\hline\hline
\endfirsthead
\caption[]{(continued)}\\
\hline\hline
\multicolumn{2}{@{*}c@{*}}%
      {This part appears at the top of every other page}\\
\textbf{First}&\textbf{Second}\\
\hline\hline
\endhead
\hline
This goes at the&bottom.\\
\hline
\endfoot
\hline
These lines will&appear\\
in place of the & usual foot\\
at the end& of the table\\
\hline
\endlastfoot
\env{longtable}  columns  are specified& in the \\
same way as  in the \env{tabular}& environment.\\
...
\multicolumn{2}{||c||}{This is a ...}\\
...
Some lines may take...&
    \raggedleft This last column is a ‘‘p’’ column...
    \tabularnewline
...
Lots of lines& like this.\\
...
\hline
Lots\footnote{...} of lines& like this.\\
Lots   of   lines& like this\footnote{...}\\
\hline
Lots of lines& like this.\\
...
\end{longtable}
```

9 The Macros

1 ⟨*package⟩

9.1 Initial code

Before declaring the package options, we must define some defaults here.

\LT@err The error generating command

```
2 \def\LT@err{\PackageError{longtable}}
```

\LT@warn The warning generating command

```
3 \def\LT@warn{\PackageWarning{longtable}}
```

\LT@final@warn If any longtables have not aligned, generate a warning at the end of the run at \AtEndDocument.

```
4 \def\LT@final@warn{%
5   \AtEndDocument{%
6     \LT@warn{Table widths have changed. Rerun LaTeX.\@gobbletwo}}%
7   \global\let\LT@final@warn\relax}
```

9.2 Options

The first two options deal with error handling. They are compatible with the options used by the tracefnt package.

errorshow *Only* show errors on the terminal. 'warnings' are just sent to the log file.

```
8 \DeclareOption{errorshow}{%
9   \def\LT@warn{\PackageInfo{longtable}}}
```

pausing Make every warning message into an error so TEX stops. May be useful for debugging.

```
10 \DeclareOption{pausing}{%
11   \def\LT@warn#1{%
12     \LT@err{#1}{This is not really an error}}}
```

set final The next options are just alternative syntax for the \setlongtables declaration.

```
13 \DeclareOption{set}{}
14 \DeclareOption{final}{}
```

```
15 \ProcessOptions
```

9.3 User Setable Parameters

\LTleft \LTright Glue to the left and right of the table, default \fill (ie centred).

```
16 \newskip\LTleft       \LTleft=\fill
17 \newskip\LTright      \LTright=\fill
```

\LTpre \LTpost Glue before and after the longtable. \bigskip by default.

```
18 \newskip\LTpre        \LTpre=\bigskipamount
19 \newskip\LTpost       \LTpost=\bigskipamount
```

\LTchunksize Chunk size (The number of rows taken per \halign). Default 20.

```
20 \newcount\LTchunksize \LTchunksize=20
```

\c@LTchunksize Added in V3.07 to allow the LaTeX syntax `\setcounter{LTchunksize}{10}`.

```
\let\c@LTchunksize\LTchunksize
```

\LTcapwidth Width of the `\parbox` containing the caption. Default 4in.

```
\newdimen\LTcapwidth  \LTcapwidth=4in
```

9.4 Internal Parameters

\LT@head \LT@firsthead \LT@foot \LT@lastfoot Boxes for the table head and foot.

```
\newbox\LT@head
\newbox\LT@firsthead
\newbox\LT@foot
\newbox\LT@lastfoot
```

\LT@cols Counter for number of columns.

```
\newcount\LT@cols
```

\LT@rows Counter for rows up to chunksize.

```
\newcount\LT@rows
```

\c@LT@tables Counter for the tables, added in V3.02. Previous versions just used the LaTeX counter `table`, but this fails if `table` is reset during a document, eg report class resets it every chapter.

This was changed from `\newcount\LT@tables` in V3.04. LaTeX counters are preserved correctly when `\includeonly` is used. In the rest of the file `\LT@tables` has been replaced by `\c@LT@tables` without further comment.

```
\newcounter{LT@tables}
```

\c@LT@chunks We need to count through the chunks of our tables from Version 4 on.

```
\newcounter{LT@chunks}[LT@tables]
```

\c@table \fnum@table \tablename If the `table` counter is not defined (eg in `letter` style), define it. (Added in V3.06.)

```
\ifx\c@table\undefined
  \newcounter{table}
  \def\fnum@table{\tablename~\thetable}
\fi
\ifx\tablename\undefined
  \def\tablename{Table}
\fi
```

\LT@out In a normal style, `longtable` uses the `.aux` file to record the column widths. With `letter.sty`, use a separate `.lta` file. (Added in V3.06.)

Not needed for new letter class.

```
\ifx\startlabels\undefined
  \let\@auxout\@auxout
\else
  {\@input{\jobname.lta}}%
  \newwrite\@auxout
  \immediate\openout\@auxout=\jobname.lta
\fi
```

`\LT@p@ftn` Temporary storage for footnote text in a 'p' column.

```
\newtoks\LT@p@ftn
```

`\LT@end@pen` Special penalty for the end of the table. Done this way to save using up a count register.

```
\mathchardef\LT@end@pen=30000
```

9.5 The longtable environment

`\longtable` Called by `\begin{longtable}`. This implementation does not work in multiple column formats. `\par` added at V3.04.

```
\def\longtable{%
  \par
  \ifx\multicols\@undefined
  \else
     \ifnum\col@number>\@ne
       \@twocolumntrue
     \fi
  \fi
  \if@twocolumn
    \LT@err{longtable not in 1-column mode}\@ehc
  \fi
  \begingroup
```

Check for an optional argument.

```
  \@ifnextchar[\LT@array{\LT@array[x]}}
```

`\LT@array` Start setting the alignment. Based on `\@array` from the LaTeX kernel and the array package.

Since Version 3.02, longtable has used the internal counter `\c@LT@tables`. The LaTeX counter `table` is still incremented so that `\caption` works correctly.

```
\def\LT@array[#1]#2{%
  \refstepcounter{table}\stepcounter{LT@tables}%
```

Set up the glue around the table if an optional argument given.

```
  \if l#1%
    \LTleft\z@ \LTright\fill
  \else\if r#1%
    \LTleft\fill \LTright\z@
  \else\if c#1%
    \LTleft\fill \LTright\fill
  \fi\fi\fi
```

Set up these internal commands for longtable.

```
  \global\let\LT@mcw@rn\relax
  \let\LT@mcol\multicolumn
```

Now redefine `\@tabarray` to restore `\hline` and `\multicolumn` so that arrays and tabulars nested in longtable (or in page headings on longtable pages) work out OK. Saving the original definitions done here so that you can load the array package before or after longtable.

```
  \let\LT@@tabarray\@tabarray
  \let\LT@@hl\hline
  \def\@tabarray{%
    \let\hline\LT@@hl
```

```
    \let\multicolumn\LT@mcol
```

```
67    \LT@@tabarray}%
68  \let\\\LT@tabularcr\let\tabularnewline\\%
69  \def\newpage{\noalign{\break}}%
70  \let\hline\LT@hline \let\kill\LT@kill\let\caption\LT@caption
71  \@tempdima\ht\strutbox
```

Set up internal commands according to Lamport or Mittelbach.

```
72  \ifx\extrarowheight\@undefined
```

Initialise these commands as in tabular from the LaTeX kernel.

```
73    \let\@acol\@tabacol
74    \let\@classz\@tabclassz \let\@classiv\@tabclassiv
75    \def\@startpbox{\vtop\LT@startpbox}\let\LT@LL@FM@cr\@tabularcr
76  \else
```

Initialise these commands as in array. `\d@llar` replaced by `\d@llarbegin` `\d@llarend` in V3.03 to match array V2.0h. We do not need to set `\d@llarbegin` and `\d@llarend` as the array package gives them the correct values at the top level.

```
77    \advance\@tempdima\extrarowheight
78    \col@sep\tabcolsep
79    \let\@startpbox\LT@startpbox\let\LT@LL@FM@cr\@arraycr
80  \fi
```

The rest of this macro is mainly based on array package, but should work for the standard tabular too.

```
81  \setbox\@arstrutbox\hbox{\vrule
82    \@height \arraystretch \@tempdima
83    \@depth \arraystretch \dp \strutbox
84    \@width \z@}%
85  \let\@sharp##\let\protect\relax
```

Interpret the preamble argument.

```
86    \begingroup
87    \@mkpream{#2}%
```

We need to rename `\@preamble` here as F.M.'s scheme uses `\global`, and we may need to nest `\@mkpream`, eg for `\multicolumn` or an array. We do not need to worry about nested longtables though!

```
88    \xdef\LT@bchunk{%
```

```
89       \global\advance\c@LT@chunks\@ne
90       \global\LT@rows\z@\setbox\z@\vbox\bgroup
91       \tabskip\LTleft\halign to\hsize\bgroup
92      \tabskip\z@ \@arstrut \@preamble \tabskip\LTright \cr}%
93  \endgroup
```

Find out how many columns we have (store in `\LT@cols`).

```
94  \expandafter\LT@nofcols\LT@bchunk&\LT@nofcols
```

Get the saved row from `\LT@i`...`\LT@ix` (from the `.aux` file), or make a new blank row.

```
95  \LT@make@row
```

A few more internal commands for longtable.

```
96  \let\@endpbox\LT@endpbox
97  \m@th\let\par\@empty
98  \everycr{}\lineskip\z@\baselineskip\z@
```

Start the first chunk.

```
\LT@bchunk}
```

`\LT@start` This macro starts the process of putting the table on the current page. It is not called until either a `\\` or `\endlongtable` command ends a chunk, as we do not know until that point which of the four possible head or foot sections have been specified.

It begins by redefining itself, so that the table is only started once! Until V3.04, was redefined to `\relax`, now use `\endgraf` to force the page-breaker to wake up.

```
\def\LT@start{%
  \let\LT@start\endgraf
  \endgraf\penalty\z@\vskip\LTpre
```

Start a new page if there is not enough room for the table head, foot, and one extra line.

```
  \dimen@\pagetotal
  \advance\dimen@ \ht\ifvoid\LT@firsthead\LT@head\else\LT@firsthead\fi
  \advance\dimen@ \dp\ifvoid\LT@firsthead\LT@head\else\LT@firsthead\fi
  \advance\dimen@ \ht\LT@foot
```

At this point I used to add `\ht\@arstrutbox` and `\dp\@arstrutbox` as a measure of a row size. However this can fail spectacularly for `p` columns which might be much larger. Previous versions could end up with the table starting with a foot, then a page break then a head *then* a 'first head'! So now measure the first line of the table accurately by `\vsplit`ting it out of the first chunk.

```
  \dimen@ii\vfuzz
  \vfuzz\maxdimen
    \setbox\tw@\copy\z@
    \setbox\tw@\vsplit\tw@ to \ht\@arstrutbox
    \setbox\tw@\vbox{\unvbox\tw@}%
  \vfuzz\dimen@ii
  \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
```

Store height of page minus table foot in `\@colroom`.

```
      \global\@colroom\@colht
```

If the foot is non empty, reduce the `\vsize` and `\@colroom` accordingly.

```
  \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
```

Put the table head on the page, and then switch to the new output routine.

```
  \ifvoid\LT@firsthead\copy\LT@head\else\box\LT@firsthead\fi
  \output{\LT@output}}
```

`\endlongtable` Called by `\end{longtable}`.

```
\def\endlongtable{%
```

Essentially add a final \\. But as we now know the number of actual chunks, we first strip away all entries referring to a maximum entry beyond the table (this can only happen if a table has been shortened, or the table numbering has gone awry). In that case we at least start collecting valid new information with the last chunk of this table, by removing the width constraint.

```
\crcr
\noalign{%
  \let\LT@entry\LT@entry@chop
  \xdef\LT@save@row{\LT@save@row}}%
\LT@echunk
\LT@start
\unvbox\z@
\LT@get@widths
```

Write the dummy row to the .aux file. Since V3.06, use .lta for letter.sty.

```
\if@filesw
  {\let\LT@entry\LT@entry@write\immediate\write\@auxout{%
```

Since Version 3.02, longtable has used the internal counter \c@LT@tables rather than the LaTeX counter table. This information looks entirely different from version 3 information. Still, we don't need to rename the macro name because later code will consider the information to have no columns, and thus will throw the old data away.

```
    \gdef\expandafter\noexpand
      \csname LT@\romannumeral\c@LT@tables\endcsname
        {\LT@save@row}}}%
\fi
```

At this point used to issue a warning if a \multicolumn has been set in draft mode.

```
\LT@mcw@rn
```

If the last chunk has different widths than the first, warn the user. Also trigger a warning to rerun LaTeX at the end of the document.

```
\ifx\LT@save@row\LT@@save@row
\else
  \LT@warn{Column widths have changed\MessageBreak
           in table \thetable}%
  \LT@final@warn
\fi
```

Force one more go with the longtable output routine.

```
\endgraf\penalty -\LT@end@pen
```

Now close the group to return to the standard routine.

```
\endgroup
```

Reset \@mparbottom to allow marginpars close to the end of the table.[5]

```
\global\@mparbottom\z@
\pagegoal\vsize
\endgraf\penalty\z@\addvspace\LTpost
```

Footnotes. As done in the multicol package.

```
\ifvoid\footins\else\insert\footins{}\fi}
```

[5] This can not be the correct. However if it is omitted, there is a problem with marginpars, for example on page 3 of this document. Any Output Routine Gurus out there?

9.6 Counting Columns

Columns are counted by examining `\@preamble`, rather than simply getting `\@mkpream` to increment the counter as it builds the preamble so that this package works with many of the packages which add extra column specifiers to LaTeX's standard ones.

Version 1 counted `\@sharp`'s to calculate the number of columns, this was changed for Version 2 as it does not work with the NFSS. Now count `&`'s. (`lfonts.new` (and now the Standard LaTeX definition) defines `\@tabclassz` so that `\@sharp` is inside a group.)

`\LT@nofcols` Find the next `&`, then look ahead to see what is next.

```
\def\LT@nofcols#1&{%
  \futurelet\@let@token\LT@n@fcols}
```

`\LT@n@fcols` Add one, then stop at an `\LT@nofcols` or look for the next `&`. The `\expandafter` trick was added in Version 3, also the name changed from `\@LT@nofcols` to preserve the `\LT@` naming convention.

```
\def\LT@n@fcols{%
  \advance\LT@cols\@ne
  \ifx\@let@token\LT@nofcols
    \expandafter\@gobble
  \else
    \expandafter\LT@nofcols
  \fi}
```

9.7 The `\\` and `\kill` Commands

`\LT@tabularcr` The internal definition of `\\`.

```
\def\LT@tabularcr{%
```

Increment the counter, and do tabular's `\\` or finish the chunk.
The `\expandafter` trick was added in Version 3.

```
  \global\advance\LT@rows\@ne
  \ifnum\LT@rows=\LTchunksize
    \expandafter\LT@t@bularcr
  \else
    \expandafter\LT@LL@FM@cr
  \fi}
```

`\LT@t@bularcr` This definition also accepts `\\*`, which acts in the same way as `\\`. tabular does this, but longtable probably ought to make `\\*` prevent page breaking. `{\ifnum0=‘}\fi` added in version 3.01, required if the first entry is empty. The above in fact is not good enough, as with array package it can introduce a `{}` group in math mode, which changes the spacing. So use the following variant. Added in v3.14.

```
\def\LT@t@bularcr{%
  \relax\iffalse{\fi\ifnum0=‘}\fi
  \@ifstar\LT@xtabularcr\LT@xtabularcr}
```

`\LT@xtabularcr` This justs looks for an optional argument.

```
\def\LT@xtabularcr{%
  \@ifnextchar[\LT@argtabularcr\LT@ntabularcr}
```

\LT@ntabularcr The version with no optional argument. \ifnum0=‘{\fi} added in version 3.01. Changed in 3.14.

```
\def\LT@ntabularcr{%
  \ifnum0=‘{}\fi
  \LT@echunk
  \LT@start
  \unvbox\z@
  \LT@get@widths
  \LT@bchunk}
```

\LT@argtabularcr The version with an optional argument. \ifnum0=‘{\fi} added in version 3.01. Changed in 3.14.

```
\def\LT@argtabularcr[#1]{%
  \ifnum0=‘{}\fi
  \ifdim #1>\z@
    \unskip\@xargarraycr{#1}%
  \else
    \@yargarraycr{#1}%
  \fi
```

Add the dummy row, and finish the \halign.

```
  \LT@echunk
  \LT@start
  \unvbox\z@
  \LT@get@widths
  \LT@bchunk}
```

\LT@echunk This ends the current chunk, and removes the dummy row.

```
\def\LT@echunk{%
  \crcr\LT@save@row\cr\egroup
  \global\setbox\@ne\lastbox
  \egroup}
```

\LT@entry We here give the ‘basic’ definition of \LT@entry, namely that used in alignment templates. It has a \kern only if the maximum is imposed from a different chunk. The \ifhmode test reveals the first entry, when we don’t want to add an &.

```
\def\LT@entry#1#2{%
  \ifhmode\@firstofone{&}\fi\omit
  \ifnum#1=\c@LT@chunks
  \else
    \kern#2\relax
  \fi}
```

\LT@entry@chop This definition for the argument of \LT@save@row is used to scrap all those maxima which could not be verified because they occur after the end of the table. This can happen only if a table has been shortened (or the sequencing got mixed up) since the previous run. Note that this is premature: the last chunk still is going to be set, and with the chopped limits.

```
\def\LT@entry@chop#1#2{%
  \noexpand\LT@entry
    {\ifnum#1>\c@LT@chunks
       1}{0pt%
     \else
```

```
      #1}{#2%
    \fi}}
```

`\LT@entry@write` To write an entry for the `aux` file, we use a slightly surprising definition which has the sole purpose of avoiding overfull lines (which might break TEX's limits when reading the `aux` file, probably you'd need to have a few hundred columns before this happened but...).

```
\def\LT@entry@write{%
  \@percentchar^^J\@spaces
  \noexpand\LT@entry}
```

`\LT@kill` This ends the current chunk as above, but strips off two rows, the 'dummy row' and the 'killed row' before starting the next chunk. Since V3.04, the old chunk is reboxed at the start of the box containing the next chunk. This allows `\kill` to be used in headers, which must be processed in a single box.

```
\def\LT@kill{%
  \LT@echunk
  \LT@get@widths
  \expandafter\LT@rebox\LT@bchunk}
```

`\LT@rebox` Drop the old chunk (box0) back at the top of the new chunk, removing the killed row. This macro added at V3.04.

```
\def\LT@rebox#1\bgroup{%
  #1\bgroup
  \unvbox\z@
  \unskip
  \setbox\z@\lastbox}
```

9.8 The Dummy Row

The dummy row is kept inside of the macro `\LT@save@row`.

`\LT@blank@row` Create a blank row if we are not using the info in the `.aux` file.

`\LT@build@blank`

```
\def\LT@blank@row{%
  \xdef\LT@save@row{\expandafter\LT@build@blank
    \romannumeral\number\LT@cols 001 }}
```

Whoops! What's that supposed to be? A drop-in replacement for the first task of Appendix D in the TEXbook. The `\romannumeral` produces `\LT@cols` instances of `m` followed by `i`. The below macro then replaces the `m`s by appropriate entries.

```
\def\LT@build@blank#1{%
  \if#1m%
    \noexpand\LT@entry{1}{0pt}%
    \expandafter\LT@build@blank
  \fi}
```

`\LT@make@row` Prior to version 4, by default did not use information in the `.aux` file but now we can define `\LT@make@row` to use the `.aux` file, even on the 'draft' passes.

```
\def\LT@make@row{%
  \global\expandafter\let\expandafter\LT@save@row
    \csname LT@\romannumeral\c@LT@tables\endcsname
  \ifx\LT@save@row\relax
    \LT@blank@row
```

Now a slightly difficult part comes. Before we decide making the template from the `.aux` file info we check that the number of fields has remained the same. If it hasn't, either the table format has changed, or we have the wrong table altogether. In both cases, we decide to better drop all gathered information and start over.

The expansion between `!...!` below will be empty if the number of `\LT@entry` macros including arguments in `\LT@save@row` is equal to `\LT@cols`. If it is not empty, we throw the row away and start from scratch.

```
\else
  {\let\LT@entry\or
   \if!%
       \ifcase\expandafter\expandafter\expandafter\LT@cols
       \expandafter\@gobble\LT@save@row
       \or
       \else
         \relax
       \fi
      !%
   \else
     \aftergroup\LT@blank@row
   \fi}%
\fi}
```

`\setlongtables` Redefine `\LT@make@row` to use information in the `.aux` file, if there is a saved row for this table with the right number of columns.

Since Version 3.02, longtable has used the internal counter `\c@LT@tables` rather than the LaTeX counter table. The warning message was added at V3.04, as was the `\global`, to stop save-stack overflow.

Since Version 4.01 `\setlongtables` does nothing as it is not needed, but is defined as `\relax` for the benefit of old documents.

```
\let\setlongtables\relax
```

`\LT@get@widths` This is the heart of longtable. If it were not for the table head and foot, this macro together with the modified `\\` command would form the basis of quite a simple little package file for long tables. It is closely modelled on the `\endvrulealign` macro of appendix D of the TeXbook.

```
\def\LT@get@widths{%
```

`\global` added at V3.04, to stop save-stack overflow.

Loop through the last row, discarding glue, and saving box widths. At V3.04 changed the scratch box to 2, as the new `\kill` requires that `\box0` be preserved.

```
\setbox\tw@\hbox{%
  \unhbox\@ne
  \let\LT@old@row\LT@save@row
  \global\let\LT@save@row\@empty
  \count@\LT@cols
  \loop
    \unskip
    \setbox\tw@\lastbox
  \ifhbox\tw@
    \LT@def@row
    \advance\count@\m@ne
  \repeat}%
```

Remember the widths if we are in the first chunk.

```
\ifx\LT@@save@row\@undefined
  \let\LT@@save@row\LT@save@row
\fi}
```

`\LT@def@row` Add a column to the dummy row. Name changed from `\defLT@save@row` in Version 3, to preserve the `\LT@` naming convention.

```
\def\LT@def@row{%
```

We start by picking the respective entry from our old row. These redefinitions of `\LT@entry` are local to the group started in `\LT@get@widths`.

```
\let\LT@entry\or
\edef\@tempa{%
  \ifcase\expandafter\count@\LT@old@row
  \else
    {1}{0pt}%
  \fi}%
```

Now we tack the right combination in front of `\LT@save@row`:

```
\let\LT@entry\relax
\xdef\LT@save@row{%
  \LT@entry
  \expandafter\LT@max@sel\@tempa
  \LT@save@row}}
```

`\LT@max@sel` And this is how to select the right combination. Note that we take the old maximum information only if the size does not change in *either* direction. If the size has grown, we of course have a new maximum. If the size has shrunk, the old maximum (which was explicitly not enforced because of being in the current chunk) is invalid, and we start with this chunk as the new size. Note that even in the case of equality we *must* use the `\the\wd\tw@` construct instead of `#2` because `#2` might be read in from the file, and so could have `\catcode` 11 versions of `p` and `t` in it which we want to be replaced by their 'proper' `\catcode` 12 versions.

```
\def\LT@max@sel#1#2{%
 {\ifdim#2=\wd\tw@
    #1%
  \else
    \number\c@LT@chunks
  \fi}%
 {\the\wd\tw@}}
```

9.9 The `\hline` Command

`\LT@hline` `\hline` and `\hline\hline` both produce *two* lines. The only difference being the glue and penalties between them. This is so that a page break at a `\hline` produces a line on both pages.[6] Also this `\hline` is more like a `\cline{1-\LT@cols}`. tabular's `\hline` would draw lines the full width of the page.

```
\def\LT@hline{%
 \noalign{\ifnum0=`}\fi
   \penalty\@M
   \futurelet\@let@token\LT@@hline}
```

[6] longtable has always done this, but perhaps it would be better if hlines were *omitted* at a page break, as the head and foot usually put a hline here anyway.

\LT@@hline This code is based on \cline. Two copies of the line are produced, as described above.

```
\def\LT@@hline{%
  \ifx\@let@token\hline
    \global\let\@gtempa\@gobble
    \gdef\LT@sep{\penalty-\@medpenalty\vskip\doublerulesep}%
  \else
    \global\let\@gtempa\@empty
    \gdef\LT@sep{\penalty-\@lowpenalty\vskip-\arrayrulewidth}%
  \fi
  \ifnum0=‘{\fi}%
  \multispan\LT@cols
     \unskip\leaders\hrule\@height\arrayrulewidth\hfill\cr
  \noalign{\LT@sep}%
  \multispan\LT@cols
     \unskip\leaders\hrule\@height\arrayrulewidth\hfill\cr
  \noalign{\penalty\@M}%
  \@gtempa}
```

9.10 Captions

\LT@caption The caption is \multicolumn{\LT@cols}{c}{⟨*a parbox with the table's caption*⟩}

```
\def\LT@caption{%
  \noalign\bgroup
    \@ifnextchar[{\egroup\LT@c@ption\@firstofone}\LT@capti@n}
```

\LT@c@ption Caption command (with [optional argument]). \protect added in Version 3. \fnum@table added at V3.05.

```
\def\LT@c@ption#1[#2]#3{%
  \LT@makecaption#1\fnum@table{#3}%
  \def\@tempa{#2}%
  \ifx\@tempa\@empty\else
     {\let\\\space
     \addcontentsline{lot}{table}{\protect\numberline{\thetable}{#2}}}%
  \fi}
```

\LT@capti@n Caption command (no [optional argument])

```
\def\LT@capti@n{%
  \@ifstar
    {\egroup\LT@c@ption\@gobble[]}%
    {\egroup\@xdblarg{\LT@c@ption\@firstofone}}}
```

\LT@makecaption Put the caption in a box of width 0pt, so that it never affects the column widths. Inside that is a \parbox of width \LTcapwidth.

```
\def\LT@makecaption#1#2#3{%
  \LT@mcol\LT@cols c{\hbox to\z@{\hss\parbox[t]\LTcapwidth{%
```

Based on article class \@makecaption, #1 is \@gobble in star form, and \@firstofone otherwise.

```
    \sbox\@tempboxa{#1{#2: }#3}%
    \ifdim\wd\@tempboxa>\hsize
      #1{#2: }#3%
    \else
      \hbox to\hsize{\hfil\box\@tempboxa\hfil}%
```

```
    \fi
    \endgraf\vskip\baselineskip}%
  \hss}}}
```

9.11 The Output Routine

The method used here for interfacing a special purpose output routine to the standard LaTeX routine is lifted straight out of F. Mittelbach's multicol package.

`\LT@output` Actually this is not so bad, with FM leading the way.

```
\def\LT@output{%
  \ifnum\outputpenalty <-\@Mi
    \ifnum\outputpenalty > -\LT@end@pen
```

If this was a float or a marginpar we complain.

```
      \LT@err{floats and marginpars not allowed in a longtable}\@ehc
    \else
```

We have reached the end of the table, on the scroll at least,

```
      \setbox\z@\vbox{\unvbox\@cclv}%
      \ifdim \ht\LT@lastfoot>\ht\LT@foot
```

The last foot might not fit, so:[7]

```
        \dimen@\pagegoal
        \advance\dimen@-\ht\LT@lastfoot
        \ifdim\dimen@<\ht\z@
          \setbox\@cclv\vbox{\unvbox\z@\copy\LT@foot\vss}%
          \@makecol
          \@outputpage
          \setbox\z@\vbox{\box\LT@head}%
```

End of `\ifdim\dimen@<\ht\@cclc`.

```
        \fi
```

End of `\ifdim \ht\LT@lastfoot > \ht\LT@foot`.

```
      \fi
```

Reset `\@colroom`.

```
      \global\@colroom\@colht
      \global\vsize\@colht
```

Put the last page of the table on to the main vertical list.

```
      \vbox
        {\unvbox\z@\box\ifvoid\LT@lastfoot\LT@foot\else\LT@lastfoot\fi}%
```

End of `\ifnum\outputpenalty > -\LT@end@pen`.

```
    \fi
```

Else `\outputpenalty > -\@Mi`.

```
  \else
```

If we have not reached the end of the table,

```
    \setbox\@cclv\vbox{\unvbox\@cclv\copy\LT@foot\vss}%
    \@makecol
    \@outputpage
```

[7] An alternative would be to vsplit off a bit of the last chunk, so that the last page did not just have head and foot sections, but it is hard to do this in a consistent manner.

Reset \vsize.

```
\global\vsize\@colroom
```

Put the head at the top of the next page.

```
\copy\LT@head
```

End of \ifnum\outputpenalty <-\@Mi.

```
\fi}
```

9.12 Commands for the the table head and foot

\LT@end@hd@ft

The core of \endhead and friends. Store the current chunk in the box specified by #1. Issue an error if the table has already started. Then start a new chunk.

```
\def\LT@end@hd@ft#1{%
  \LT@echunk
```

Changed from \relax to \endgraf at V3.04, see \LT@start.

```
  \ifx\LT@start\endgraf
    \LT@err
     {Longtable head or foot not at start of table}%
     {Increase LTchunksize}%
  \fi
  \setbox#1\box\z@
  \LT@get@widths
  \LT@bchunk}
```

\endfirsthead
\endhead
\endfoot
\endlastfoot

Call \LT@end@hd@ft with the appropriate box.

```
\def\endfirsthead{\LT@end@hd@ft\LT@firsthead}
\def\endhead{\LT@end@hd@ft\LT@head}
\def\endfoot{\LT@end@hd@ft\LT@foot}
\def\endlastfoot{\LT@end@hd@ft\LT@lastfoot}
```

9.13 The \multicolumn command

Earlier versions needed a special 'draft' form of \multicolumn. This is not needed in version 4, and so these commands have been removed.

\LTmulticolumn

\LT@mcwarn

9.14 Footnotes

The standard \footnote command works in a c column, but we need to modify the definition in a p column to overcome the extra level of boxing. These macros are based on the array package, but should be OK for the standard tabular.

\LT@startpbox

Add extra code to switch the definition of \@footnotetext.

```
\def\LT@startpbox#1{%
  \bgroup
    \let\@footnotetext\LT@p@ftntext
    \hsize#1%
    \@arrayparboxrestore
    \vrule \@height \ht\@arstrutbox \@width \z@}
```

`\LT@endpbox` After the parbox is closed, expand `\LT@p@ftn` which will execute a series of `\footnotetext[`⟨*num*⟩`]{`⟨*note*⟩`}` commands. After being lifted out of the parbox, they can migrate on their own from here.

```
\def\LT@endpbox{%
  \@finalstrut\@arstrutbox
  \egroup
  \the\LT@p@ftn
  \global\LT@p@ftn{}%
  \hfil}
```

`\LT@p@ftntext` Inside the 'p' column, just save up the footnote text in a token register.

```
\def\LT@p@ftntext#1{%
  \edef\@tempa{\the\LT@p@ftn\noexpand\footnotetext[\the\c@footnote]}%
  \global\LT@p@ftn\expandafter{\@tempa{#1}}}%
```

⟨/package⟩