

The `ltxmarks.dtx` code*

Frank Mittelbach, L^AT_EX Project[†]

July 5, 2022

Abstract

Marks are used to communicate information about the content of a page to the output routine. For example, in order to construct running headers, the output routine needs information about which section names are present on a page, and this information is passed to it through the mark system. However, marks may also be used for other purposes. This module provides a generalized mechanism for marks of independent classes.

Contents

1	Introduction	2
2	Design-level and code-level interfaces	2
	2.1 Debugging mark code	5
3	Application examples	5
4	Legacy L^AT_EX 2_ε interface	5
	4.1 Legacy design-level and document-level interfaces	6
	4.2 Legacy interface extensions	6
5	Notes on the mechanism	7
6	Internal output routine functions	8
7	The Implementation	9
	7.1 Allocating new mark classes	9
	7.2 Updating mark structures	10
	7.3 Placing and retrieving marks	14
	7.4 Comparing mark values	16
	7.5 Messages	16
	7.6 Debugging the mark structures	17
	7.7 Designer-level interfaces	18

*This file has version v1.0d dated 2022/06/01, © L^AT_EX Project.

[†]E-mail: latex-team@latex-project.org

8	L^AT_εX 2_ε integration	19
8.1	Core L ^A T _ε X 2 _ε integration	19
8.2	Other L ^A T _ε X 2 _ε output routines	21

1 Introduction

The T_εX engines offer a low-level mark mechanism to communicate information about the content of the current page to the asynchronous operating output routine. It works by placing `\mark` commands into the source document. When the material for the current page is assembled in box 255, T_εX scans for such marks and sets the commands `\topmark`, `\firstmark` and `\botmark`. The `\firstmark` receives the content of the first `\mark` seen in box 255 and `\botmark` the content of the last mark seen. The `\topmark` holds the content of the last mark seen on the previous page or more exactly the value of `\botmark` from the previous page. If there are no marks on the current page then all three are made equal to the `\botmark` from the previous page.

This mechanism works well for simple formats (such as plain T_εX) whose output routines are only called to generate pages. It fails, however, in L^AT_εX (and other more complex formats), because here the output routine is sometimes called without producing a page, e.g., when encountering a float and placing it into one of the float regions. In that case the output routine is called, determines where to place the float, alters the goal for assembling text material (if the float was added to the top or bottom region) and then it resumes collecting textual material.

As a result the `\botmark` gets updated and so `\topmark` no longer reflects the situation at the top of the next page when that page is finally boxed.

Another problem for L^AT_εX was that it wanted to use several “independent” marks and in the early implementations of T_εX there was only a single `\mark` command available. For that reason L^AT_εX implemented its own mark mechanism where the marks always contained two parts with their own interfaces: `\markboth` and `\markright` to set marks and `\leftmark` and `\rightmark` to retrieve them.

However, this extended mechanism (while supporting scenarios such as chapter/section marks) was far from general. The mark situation at the top of a page (i.e., `\topmark`) remained unusable and the two marks offered were not really independent of each other because `\markboth` (as the name indicates) was always setting both.

The new mechanism overcomes both issues:

- It provides arbitrarily many, fully independent named marks, that can be allocated and, from that point onwards, used.
- It offers access for each such marks to retrieve its top, first, and bottom values separately.
- Furthermore, the mechanism is augmented to give access to marks in different “regions” which may not be just full pages.

2 Design-level and code-level interfaces

The interfaces are mainly meant for package developers, but they are usable (with appropriate care) also in the document preamble, for example, when setting up special running headers with `fancyhdr`, etc. They are therefore available both as CamelCase commands

as well as commands for use in the L3 programming layer. Both are described together below.

<code>\NewMarkClass</code>	<code>\NewMarkClass {<class>}</code>
<code>\mark_new_class:n</code>	<code>\mark_new_class:n {<class>}</code>

Declares a new *<class>* of marks to be tracked by L^AT_EX. Each *<class>* must be declared before it is used.

Mark classes can only be declared before `\begin{document}`.

<code>\InsertMark</code>	<code>\InsertMark {<class>} {<text>}</code>
<code>\mark_insert:nn</code>	<code>\mark_insert:nn {<class>} {<text>}</code>

Adds a mark to the current galley for the *<class>*, containing the *<text>*.

It has no effect in places in which you can't place floats, e.g., a mark inside a box or inside a footnote never shows up anywhere.

If used in vertical mode it obeys L^AT_EX's internal `\@nobreak` switch, i.e., it does not introduce a breakpoint if used after a heading. If used in horizontal mode it doesn't handle spacing (like, for example, `\index` or `\label` does, so it should be attached to material that is typeset.

<code>insertmark</code>	<code>\AddToHook {insertmark} {<code>}</code>
-------------------------	---

When marks are inserted, the mark content may need some special treatment, e.g., by default `\label`, `\index`, and `\glossary` do not expand at this time (but only later if and when the mark content is actually used. In order to allow packages to augment or alter this setup there is a public hook `insertmark` that is executed at this point. It runs in a group so local modification to commands are only applied to the *<text>* argument of `\InsertMark` or `\mark_insert:nn`.

<code>\TopMark</code>	<code>* \TopMark [(region)] {<class>}</code>
<code>\FirstMark</code>	<code>* \FirstMark [(region)] {<class>}</code>
<code>\LastMark</code>	<code>* \LastMark [(region)] {<class>}</code>
<code>\mark_use_top:nn</code>	<code>* \mark_use_top:nn {<region>} {<class>}</code>
<code>\mark_use_first:nn</code>	<code>* \mark_use_first:nn {<region>} {<class>}</code>
<code>\mark_use_last:nn</code>	<code>* \mark_use_last:nn {<region>} {<class>}</code>

These functions expand to the appropriate mark *<text>* for the given *<class>* in the specified *<region>*. The default *<region>* in the design-level commands is `page`. Note that with the L3 layer commands there are no optional arguments, i.e., both arguments have to be provided.

T_EXhackers note: The result is returned within the `\unexpanded` primitive (`\exp_not:n`), which means that the *<text>* does not expand further when appearing in an `x`-type or `e`-type argument expansion.

The “first” and “last” marks are those seen first and last in the current region/page, respectively. The “top” mark is the last mark of the *<class>* seen in an earlier region, i.e., the *<text>* what would be “current” at the very top of the region.

Important!

The commands are only meaningful inside the output routine, in other places their result is (while not random) unpredictable due to the way L^AT_EX cuts text material into pages.

Currently, *<region>* is one of `page`, `previous-page`, `column`, and `previous-column`. If a page has just been finished then the region `page` refers to the current page and

`previous-page`, as the name indicates, to the page that has been finished previously. This means you are able to access mark information for the current page as well as for the page before if you are inside the output routine, without the need to explicitly save that information beforehand.

In single column documents the `column` is the same as the `page` region, but in two-column documents, `column` refers to the current column that just got finished and `previous-column` to the one previously finished. Code for running headers are (in standard L^AT_EX) only evaluated when both columns are assembled, which is another way of saying that in that case `previous-column` refers to the left column and `column` to the right column. However, to make this a bit nicer to access, there are also alias regions named `first-column` and `last-column`¹ to access these regions.²

Note that you can only look backwards at already processed regions, e.g., in a `twoside` document finishing a recto (odd, right-hand) page you can access the data from the facing verso (left-hand) page, but if you are finishing a left-hand page you can't integrate data from the upcoming right-hand page. If such a scenario needs to be realized then it is necessary to save the left-hand page temporarily instead of finalizing it, process material for the right-hand page and once both are ready, attach running headers and footers and shipout out both in one go.³

<code>\IfMarksEqualTF</code>	*	<code>\IfMarksEqualTF</code>	<code>[\langle region \rangle]</code>	<code>\{ \langle class \rangle \}</code>	<code>\{ \langle pos_1 \rangle \}</code>	<code>\{ \langle pos_2 \rangle \}</code>	<code>\{ \langle true \rangle \}</code>	<code>\{ \langle false \rangle \}</code>		
<code>\mark_if_eq:nnnnTF</code>	*	<code>\mark_if_eq:nnnnTF</code>	<code>\{ \langle region \rangle \}</code>	<code>\{ \langle class \rangle \}</code>	<code>\{ \langle pos_1 \rangle \}</code>	<code>\{ \langle pos_2 \rangle \}</code>	<code>\{ \langle true \rangle \}</code>	<code>\{ \langle false \rangle \}</code>		
<code>\mark_if_eq:nnnnnnTF</code>	*	<code>\mark_if_eq:nnnnnnTF</code>	<code>\{ \langle region_1 \rangle \}</code>	<code>\{ \langle class_1 \rangle \}</code>	<code>\{ \langle pos_1 \rangle \}</code>	<code>\{ \langle region_2 \rangle \}</code>	<code>\{ \langle class_2 \rangle \}</code>	<code>\{ \langle pos_2 \rangle \}</code>	<code>\{ \langle true \rangle \}</code>	<code>\{ \langle false \rangle \}</code>

These conditionals allow you to compare the content of two marks and act based on the result. The commands work in an expansion context, if necessary.

It is quite common when programming with marks to need to interrogate conditions such as whether marks have appeared on a previous page, or if there are multiple marks present on the current page, and so on. The tests above allow for the construction of a variety of typical test scenarios, with three examples presented below.

The first two conditionals cover only the common scenarios. Both marks are picked up from the same `\langle region \rangle` (by default `page`) and they have to be of the same `\langle class \rangle`.⁴ The `\langle pos_i \rangle` argument can be either `top`, `first`, or `last`.

If you wish to compare marks across different regions or across different classes, you have to do it using the generic test only available in the L₃ programming layer or do it manually, i.e., get the marks and then compare the values yourself.⁵

However, the basic version is enough for the following typical use cases:

Test for at most one mark of class `myclass` on current page: If the first and last mark in a region are the same then either there was no mark at all, or there was at most one. To test this on the current page:

```
\NewMarkClass{myclass}
\IfMarksEqualTF{myclass}{first}{last}
{ <zero or one mark> }{ <two or more marks> }
```

¹This is called “last” not “second” in anticipation of extending the mechanism to multiple columns, where first and last would still make sense.

²At the moment there aren't any `previous-...-column` regions to access the columns from the previous page. If necessary, the mechanism could be easily augmented to cover them too, though.

³As of now that scenario is not yet officially supported.

⁴If an undeclared mark class is used the tests return `true` (not an error).

⁵If two undeclared mark classes are compared the result is always `true`; if a declared and an undeclared mark class is used it is always `false`.

Test for no mark of class `myclass` in the previous page: If the top mark is the same as the first mark, there is no mark in the region at all. If we wanted to do this test for the previous page:

```
\IfMarksEqualTF[previous-page]{myclass}{top}{first}
{ <no marks> }{ <at least one mark> }
```

Comparing top and last would give you the same result.

Test for zero, one, or more than one: Combining the two tests from above you can test for zero, one or more than one mark.

```
\IfMarksEqualTF{myclass}{top}{first}
{ <no marks> }
{\IfMarksEqualTF{myclass}{first}{last}
{ <exactly one mark> }{ <more than one mark> }}
```

If you need one of such tests more often (or if you want a separate command for it for readability), then consider defining:

```
\providecommand\IfNoMarkTF[2][page]{\IfMarksEqualTF[#1]{#2}{first}{last}}
```

2.1 Debugging mark code

<pre>\DebugMarksOn \DebugMarksOff \mark_debug_on: \mark_debug_off:</pre>	<pre>\DebugMarksOn ... \DebugMarksOff</pre> <p>Commands to turn the debugging of mark code on or off. The debugging output is rather coarse and not really intended for normal use at this point in time.</p>
--	---

3 Application examples

If you want to figure out if a break was taken at a specific point, e.g., whether a heading appears at the top of the page, you can do something like this:

```
\newcounter{breakcounter}
\NewMarkClass{break}
\newcommand\markedbreak[1]{\stepcounter{breakcounter}%
\InsertMark{break}{\arabic{breakcounter}}%
\penalty #1\relax
\InsertMark{break}{-\arabic{breakcounter}}}
```

To test if the break was taken you can test if `\TopMark{break}` is positive (taken) or negative (not taken) or zero (there was never any marked break so far). The absolute value can be used to keep track of which break it was (with some further coding).

to be extended with additional application examples

4 Legacy L^AT_EX 2_ε interface

Here we describe the interfaces that L^AT_EX 2_ε offered since the early nineties and some minor extensions.

4.1 Legacy design-level and document-level interfaces

```
\markboth \markboth  {(left)} {(right)}  
\markright \markright  {(right)}
```

L^AT_EX 2_ε uses two marks which aren't fully independent. A “left” mark generated by the first argument of `\markboth` and a “right” mark generated by the second argument of `\markboth` or by the only argument of `\markright`. The command `\markboth` and `\markright` are in turn called from heading commands such as `\chaptermark` or `\sectionmark` and their behavior is controlled by the document class.

For example, in the `article` class with `twoside` in force the `\sectionmark` will issue `\markboth` with an empty second argument and `\subsectionmark` will issue `\markright`. As a result the left mark will contain chapter titles and the right mark subsection titles.

Note, however, that in one-sided documents the standard behavior is that only `\markright` is used, i.e., there will only be right-marks but no left marks!

```
\leftmark * \leftmark  
\rightmark * \rightmark
```

These functions return the appropriate mark value from the current page and work as before, that is `\leftmark` will get the last (!) left mark from the page and `\rightmark` the first (!) right mark.

In other words they work reasonably well if you want to show the section title that is current when you are about to turn the page and also show the first subsection title on the current page (or the last from the previous page if there wasn't one). Other combinations can't be shown using this interface.

The commands are fully expandable, because this is how they have been always defined in L^AT_EX. However, this is of course only true if the content of the mark they return is itself expandable and does not contain any fragile material. Given that this can't be guaranteed for arbitrary content, a programmer using them in this way should use `\protected@edef` and *not* `\edef` to avoid bad surprises as far as this is possible, or use the new interfaces (`\TopMark`, `\FirstMark`, and `\LastMark`) which return the *text* in `\exp_not:n` to prevent uncontrolled expansion.

4.2 Legacy interface extensions

The new implementation adds three mark classes: `2e-left`, `2e-right` and `2e-right-nonempty` and patches `\markboth` and `\markright` slightly so that they also update these new mark classes, so that the new classes work with existing document classes.

As a result you can use `\LastMark{2e-left}` and `\FirstMark{2e-right}` instead of `\leftmark` and `\rightmark`. But more importantly, you can use any of the other retrieval commands to get a different status value from those marks, e.g., `\LastMark{2e-right}` would return the last subsection on the page (instead of the first as returned by `\rightmark`).

The difference between `2e-right` and `2e-right-nonempty` is that the latter will only be updated if the material for the mark is not empty. Thus `\markboth{title}{}` as issued by, say, `\sectionmark`, sets a `2e-left` mark with `title` and a `2e-right` mark with the empty string but does not add a `2e-right-nonempty` mark.

Thus, if you have a section at the start of a page and you would ask for `\FirstMark{2e-right}` you would get an empty string even if there are subsections on that page. But `2e-right-nonempty` would then give you the first or last subsection

on that page. Of course, nothing is simple. If there are no subsections it would tell you the last subsection from an earlier page. We therefore need comparison tools, e.g., if top and first are identical you know that the value is bogus, i.e., a suitable implementation would be

```
\IfMarksEqualTF{2e-right-nonempty}{top}{first}
  { <appropriate action if there was no real mark> }
  {\FirstMark{2e-right-nonempty}}
```

5 Notes on the mechanism

In contrast to vanilla \TeX , $\varepsilon\text{-}\TeX$ extends the mark system to allow multiple independent marks. However, it does not solve the `\topmark` problem which means that \LaTeX still needs to manage marks almost independently of \TeX . The reason for this is that the more complex output routine used by \LaTeX to handle floats (and related structures) means that `\topmark(s)` remain unreliable. Each time the output routine is fired up, \TeX moves `\botmark` to `\topmark`, and while $\varepsilon\text{-}\TeX$ extends this to multiple registers the fundamental concept remains the same. That means that the state of marks needs to be tracked by \LaTeX itself. An early implementation of this package used \TeX 's `\botmark` only to ensure the correct interaction with the output routine (this was before the $\varepsilon\text{-}\TeX$ mechanism was even available). However, other than in a prototype implementation for $\LaTeX3$, this package was never made public.

The new implementation now uses $\varepsilon\text{-}\TeX$'s marks as they have some advantages, because with them we can leave the mark text within the galley and only extract the marks during the output routine when we are finally shipping out a page or storing away a column for use in the next page. That means we do not have to maintain a global data structure that we have to keep in sync with informational marks in the galley but can rely on everything being in one place and thus manipulations (e.g. reordering of material) will take the marks with them without a need for updating a fragile linkage.

To allow for completely independent marks we use the following procedure:

- For every type of marks we allocate a mark class so that in the output routine \TeX can calculate for each class the current top, first, and bottom mark independently. For this we use `\newmarks`, i.e., one marks register per class.
- As already mentioned firing up an output routine without shipping out a page means that \TeX 's top marks get wrong so it is impossible to rely on \TeX 's approach directly. What we do instead is to keep track of the real marks (for the last page or more generally last region) in some global variables.
- These variables are updated in the output routine at defined places, i.e., when we do real output processing but not if we use special output routines to do internal housekeeping.
- The trick we use to get correctly updated variables is the following: the material that contains new marks (for example the page to be shipped out) is stored in a box. We then use \TeX primitive box splitting functions by splitting off the largest amount possible (which should be the whole box if nothing goes really wrong). While that seems a rather pointless thing to do, it has one important side effect: \TeX sets up first and bottom marks for each mark class from the material it has split off. This way we get the first and last marks (if there have been any) from the material in the box.

- The top marks are simply the last marks from the previous page or region. And if there hasn't been a first or bottom mark in the box then the new top mark also becomes new first and last mark for that class.
- That mark data is then stored in global token lists for use during the output routine and legacy commands such as `\leftmark` or new commands such as `\TopMark` simply access the data stored in these token lists.

That's about it in a nutshell. Of course, there are some details to be taken care of—those are discussed in the implementation sections.

6 Internal output routine functions

The functions in this section are tied to the output routine and used in the interface to $\text{\LaTeX} 2_{\epsilon}$ and perhaps at some later time within a new output routine for \LaTeX . They are not meant for general use and are therefore made internal. Internal means that `@@` automatically gets replaced in the code (and in the documentation) so we have to give it a suitable value.

`1 <@@=mark>`

`_mark_update_singlecol_structures: _mark_update_singlecol_structures:`

$\text{\LaTeX} 2_{\epsilon}$ integration function in case we are doing single column layouts. It assumes that the page content is already stored in `\@outputbox` and processes the marks inside that box. It is called as part of `\@opcol`.

`_mark_update_dblcol_structures: _mark_update_singlecol_structures:`

$\text{\LaTeX} 2_{\epsilon}$ integration function mark used when we are doing double column documents. It assumes that the page content is already stored in `\@outputbox` and processes the marks inside that box. It then does different post-processing depending on the start of the switch `\if@firstcolumn`. If we are in the second column it also has to update page marks, otherwise it only updates column marks. It too is called as part of `\@opcol`.

`_mark_update_structure:nn _mark_update_structure:nn <{region}> <{material with marks}>`

Helper function that inspects the marks inside the second argument and assigns new mark values based on that to the `<region>` given in the first argument. For this it first copies the mark structure from `<region>` to `previous-<region>` and then takes all last mark values currently in the region and makes them the new top mark values. Finally it assigns new first and last values for all mark classes based on what was found in the second argument.

As a consequence, the allowed values for `<region>` are `page` and `column` because only they have `previous-...` counterparts.

Another important part to keep in mind is that marks are only recognized if they appear on top-level, e.g., if we want to process material stored in boxes we need to put it unboxed (using `\unvcopy` etc.) into the second argument.

```
\__mark_update_structure_alias:nn \__mark_update_structure_alias:nn {<alias>} {<source>}
```

Helper function that copies all mark values in the *<source>* region to *<alias>*, i.e., make the structures identical. Used to update the `previous-...` structures inside `__mark_update_structure:nn` and `first-column` and `last-column` structures inside `__mark_update_singlecol_structures:` or `__mark_update_dbcol_structures:`.

```
\__mark_update_structure_to_err:n \__mark_update_structure_to_err:n {<region>}
```

Helper function that sets all mark values in the *<region>* to an error message. This is currently used for `last-column` at times where using marks from it would be questionable/wrong, i.e., when we have just processed the first column in a two-column document.

7 The Implementation

```
2 <*2ekernel | latexrelease>
3 \ExplSyntaxOn
4 <latexrelease> \NewModuleRelease{2022/06/01}{!tmarks}
5 <latexrelease> {Marks-handling}
```

7.1 Allocating new mark classes

```
\g__mark_classes_seq
```

A list holding all the mark classes that have been declared.

```
6 \seq_new:N \g__mark_classes_seq
```

```
\mark_new_class:n
```

A mark class is created by initializing a number of data structures. First, we get a register number to refer to the mark class. The new mark class is then added to the `\g__mark_classes_seq` sequence to be able to easily loop over all classes. Finally a number of top-level global token lists are declared that hold various versions of the mark for access.

```
\__mark_new_class:nn
```

```
7 \cs_new_protected:Npn \mark_new_class:n #1
8 {
9   \seq_if_in:NnTF \g__mark_classes_seq {#1}
10     {
11       \msg_error:nnn { mark } { class-already-defined }
12         {#1}
13     }
14     { \__mark_new_class:nn {#1} }
15 }
```

This is only available in the preamble.

```
16 \@onlypreamble \mark_new_class:n
```

The internal command carries out the necessary allocations.

```
17 \cs_new_protected:Npn \__mark_new_class:nn #1
18 {
19   <*trace>
20   \__mark_debug:n { \iow_term:x { Marks:-new-mark:~#1~\msg_line_context: } }
21   </trace>
```

Use the L^AT_EX 2_ε interface for now as the L3 programming layer doesn't have one for marks yet.

```
22 \exp_args:Nc \newmarks {c__mark_class_ #1 _mark}
```

Remember the new class in the sequence.

```
23 \seq_gput_right:Nn \g__mark_classes_seq {#1}
```

We need three token lists for each region, one for top, first, and last.

```
24 \tl_new:c { g__mark_page_top_ #1 _tl }
```

```
25 \tl_new:c { g__mark_page_first_ #1 _tl }
```

```
26 \tl_new:c { g__mark_page_last_ #1 _tl }
```

For the page region we also keep track of the previous-page.

```
27 \tl_new:c { g__mark_previous-page_top_ #1 _tl }
```

```
28 \tl_new:c { g__mark_previous-page_first_ #1 _tl }
```

```
29 \tl_new:c { g__mark_previous-page_last_ #1 _tl }
```

Same game for column and previous-column

```
30 \tl_new:c { g__mark_column_top_ #1 _tl }
```

```
31 \tl_new:c { g__mark_column_first_ #1 _tl }
```

```
32 \tl_new:c { g__mark_column_last_ #1 _tl }
```

```
33 \tl_new:c { g__mark_previous-column_top_ #1 _tl }
```

```
34 \tl_new:c { g__mark_previous-column_first_ #1 _tl }
```

```
35 \tl_new:c { g__mark_previous-column_last_ #1 _tl }
```

But for columns we also allocate token lists for the alias regions `first-column` and `last-column`.

```
36 \tl_new:c { g__mark_first-column_top_ #1 _tl }
```

```
37 \tl_new:c { g__mark_first-column_first_ #1 _tl }
```

```
38 \tl_new:c { g__mark_first-column_last_ #1 _tl }
```

```
39 \tl_new:c { g__mark_last-column_top_ #1 _tl }
```

```
40 \tl_new:c { g__mark_last-column_first_ #1 _tl }
```

```
41 \tl_new:c { g__mark_last-column_last_ #1 _tl }
```

```
42 }
```

(End definition for `\mark_new_class:n` and `_mark_new_class:nn`. This function is documented on page 3.)

7.2 Updating mark structures

`\l__mark_box` For some operations we need a temporary private box and two private global token lists.

```
\g__mark_tmp_tl 43 \box_new:N \l__mark_box
```

```
\g__mark_new_top_tl 44 \tl_new:N \g__mark_tmp_tl
```

```
45 \tl_new:N \g__mark_new_top_tl
```

(End definition for `\l__mark_box`, `\g__mark_tmp_tl`, and `\g__mark_new_top_tl`.)

`_mark_update_structure:nn` This function updates the mark structures. The first argument is the region to update and second argument receives the material that holds the marks. Out of this material we extract the first and last marks for all classes (if there are any) to do the assignments.

```
46 \cs_new_protected:Npn \_mark_update_structure:nn #1#2
```

```
47 {
```

First thing we do is copying the current structure to `previous-...`; this leaves the current structure untouched so we can update it class by class (which is necessary).

```
48 \_mark_update_structure_alias:nn { previous-#1 } {#1}
```

Getting the first and last marks out of the material in #2 is done by putting the material in a box and then doing a split operation to the maximum size possible (which hopefully means all of the content).⁶ Because this is an action only for the sake of getting at the mark values we don't want any underfull box warnings so we turn those (locally) off.

```

49   \group_begin:
50     \dim_set_eq:NN \tex_splitmaxdepth:D \c_max_dim
51     \int_set_eq:NN \tex_vbadness:D      \c_max_int
52     \dim_set_eq:NN \tex_vfuzz:D        \c_max_dim

```

There is a further complication: if the region contains infinite shrinking glue then a `\vsplit` operation will balk with a low-level error. Now pages or columns, which are our main concern here, can't have such infinite shrinkage if they are cut straight from the galley, however the use of `\enlargethispage` actually does add some at the very bottom (and also wraps the whole page into a box by itself, so if we leave it this way then a) we get this error and b) we don't see any marks because they are hidden one level down).

Another possible issue are packages or user code that place stray `\vboxes` directly into the main galley (an example is `marginnote` that attaches its marginals in this way). If such boxes end up as the last item on the page we should not unpack them.

We therefore do an `\unskip` to get rid of that glue if present and also check if we have then a `\vbox` as the last item and if so unpack that too, but only under certain conditions, see below. All this is temporary, just for getting the marks out, so it doesn't affect the final page production.

In fact, we go one step further and set the box to a large negative height possible and afterwards take a look at the reported badness: if it is zero we know that there has still been infinite shrinkage in the box so that we can't do a `\vsplit`. If that is the case we generate an error message and bypass extracting the marks. We use only half of `\c_max_dim` because otherwise T_EX will report an overfull vbox despite our setting of `\tex_vfuzz:D`. This test will not find existing infinite shrinkage in all cases, e.g., if there are several glues that cancel each other, but it is the best we can do.

```

53     \vbox_set_to_ht:Nnn \l__mark_box { -.5\c_max_dim }
54     {
55       #2
56       \tex_unskip:D
57       \box_set_to_last:N \l__mark_box

```

After having removed the last box from the current list (if there was one) we check if the list is now empty. If not, the the last box is definitely not the one from `\enlargethispage` and so we can and should leave it alone. Otherwise we check if this last box is a `\vbox`.

```

58     \int_compare:nNnT \tex_lastnodetype:D < 0
59     {
60       \box_if_vertical:NT \l__mark_box
61       {

```

If it is we do a further test and reset the `\l__mark_box` to check if it contains infinitely shrinkable glue.

```

62         \vbox_set_to_ht:Nnn \l__mark_box { -.5\c_max_dim }
63         {
64           \vbox_unpack:N \l__mark_box
65           \tex_kern:D \c_zero_dim % ensure that box
66                                 % is not empty
67         }

```

⁶We could verify this, maybe we should.

If not, then we unpack it, if yes we still ignore it for the process of mark extraction. We do not generate an error though, because in all likelihood this is an ordinary box like a marginal that does contain something like `\vss`.

```

68             \int_compare:nNnT \tex_badness:D > 0
69             { \vbox_unpack:N \l__mark_box }
70             }
71         }

```

If it wasn't a vbox, it was either an hbox or there was no box. Given that we are only interested in the marks we don't need put it back in that case. However, we have to make sure that the outer box under construction is not totally empty (which it might have been from the start, or now), because `TEX` does not report a badness for empty boxes and that means our test would incorrectly conclude that we have infinite shrinking glue. A simple `\kern` is enough to avoid this (the same was already done above).

```

72         \tex_kern:D \c_zero_dim
73     }
74     \int_compare:nNnTF \tex_badness:D > 0

```

If the box had no infinite shrinkage (or rather if our test didn't show any) we vsplit it. Note that it doesn't matter that we set it to this strange size first. If there was infinite shrinkage after all, we end up with a low-level `TEX` error, but if there is, it is a coding error and needs correcting.

```

75     {
76         \vbox_set_split_to_ht:NNn \l__mark_box \l__mark_box \c_max_dim

```

After this action we can get first and last marks of the various classes through `\tex_splitfirstmarks:D` and `\tex_splitbotmarks:D`. So now we loop over all classes stored in `\g__mark_classes_seq`.

```

77         \seq_map_inline:Nn \g__mark_classes_seq
78         {

```

First action: get the last mark from the previous region, i.e., `previous-#1`. But because it is also still inside `#1`, at the moment we use that to construct the name because this is a tiny bit faster. Given that we need this value in various assignments we store it away which avoids unnecessary further csname generations.

```

79             \tl_gset_eq:Nc \g__mark_new_top_tl { g__mark_#1_last_##1_tl }

```

This will first of all become the new top mark for the current class.

```

80             \tl_gset_eq:cN { g__mark_#1_top_##1_tl } \g__mark_new_top_tl

```

Next action is to get ourselves the new last mark from the material supplied.

```

81             \tl_gset:No \g__mark_tmp_tl
82             { \tex_splitbotmarks:D \use:c { c__mark_class_##1_mark } }

```

If this mark doesn't exist then obviously first mark does neither, so both become the last mark from the previous region. We have to be a little careful here: something like `\mark_insert:nn{foo}{}` adds an "empty" mark that should not be confused with no mark at all. But no mark in our material will result in `\g__mark_tmp_tl` being fully empty. This is why we have to make sure that "empty" from `\mark_insert:nn` only appears to be empty but fails the next test (see below how this is done).

```

83             \tl_if_empty:NTF \g__mark_tmp_tl
84             {
85                 \tl_gset_eq:cN { g__mark_#1_last_ ##1_tl }
86                 \g__mark_new_top_tl
87                 \tl_gset_eq:cN { g__mark_#1_first_##1_tl }

```

```

88         \g__mark_new_top_tl
89     }

```

If it wasn't empty, i.e., if it had a real value then we use this value for our new last mark instead.

```

90     {
91         \tl_gset_eq:cN { g__mark_#1_last_##1_tl } \g__mark_tmp_tl

```

Because we had a last mark we also have a first mark (which might be the same, but might be not), so we pick that up and assign it to the appropriate token list. This explains why we first checked for the last mark because that makes the processing faster in case there is none.

```

92         \tl_gset:co { g__mark_#1_first_##1_tl }
93         {
94             \tex_splitfirstmarks:D
95             \use:c { c__mark_class_##1_mark }
96         }
97     }
98 }
99 }

```

If the badness was zero (we actually tested for > 0 but it can't get negative) then we had infinite shrinkage, so we report that and set all marks to the value the last mark had before.

```

100     {
101         \msg_error:nnn { mark } { infinite-shrinkage } {#1}
102         \seq_map_inline:Nn \g__mark_classes_seq
103         {
104             \tl_gset_eq:cc { g__mark_#1_top_ ##1_tl }
105                 { g__mark_#1_last_ ##1_tl }
106             \tl_gset_eq:cc { g__mark_#1_first_##1_tl }
107                 { g__mark_#1_last_ ##1_tl }
108         }
109     }

```

Once all mark classes have been processed the data structures are updated and we can close the group which undoes our local changes and retains only the global ones.

```

110     \group_end:
111 }

```

(End definition for __mark_update_structure:nn.)

`__mark_update_structure_alias:mn`

This function copies the structure for one region to another (name), e.g., from `page` to `previous-page` above, or later from `column` to `first-column`, etc.

```

112 \cs_new_protected:Npn \__mark_update_structure_alias:mn #1#2 {

```

This requires a simple loop through all mark classes copying the token list from one name to the next.

```

113     \seq_map_inline:Nn \g__mark_classes_seq
114     {
115         \tl_gset_eq:cc { g__mark_ #1 _top_ ##1 _tl }
116                 { g__mark_ #2 _top_ ##1 _tl }
117         \tl_gset_eq:cc { g__mark_ #1 _first_ ##1 _tl }
118                 { g__mark_ #2 _first_ ##1 _tl }
119         \tl_gset_eq:cc { g__mark_ #1 _last_ ##1 _tl }

```

```

120             { g__mark_ #2 _last_  ##1 _tl }
121         }
122 }

```

(End definition for `_mark_update_structure_alias:nn`.)

`_mark_update_structure_to_err:n`
`_mark_error:n`

A slight variation is to install a fixed error message as the value.

```

123 \cs_new_protected:Npn \_mark_update_structure_to_err:n #1 {
124   \seq_map_inline:Nn \g__mark_classes_seq
125     {
126     \tl_gset:cn { g__mark_ #1 _top_  ##1 _tl } { \_mark_error:n {#1} }
127     \tl_gset:cn { g__mark_ #1 _first_ ##1 _tl } { \_mark_error:n {#1} }
128     \tl_gset:cn { g__mark_ #1 _last_  ##1 _tl } { \_mark_error:n {#1} }
129     }
130 }

```

Given that this is used in only one place, we could hardwire the argument which would be a bit more compact, but who knows, perhaps we end up with another reason to use this error command elsewhere, so for now we keep the argument.

```

131 \cs_new_protected:Npn \_mark_error:n #1 {
132   \msg_error:nnn { mark } { invalid-use } {#1}
133 }

```

(End definition for `_mark_update_structure_to_err:n` and `_mark_error:n`.)

7.3 Placing and retrieving marks

`\mark_insert:nn`

This function puts a mark for some $\langle class \rangle$ at the current point.

```

134 \cs_new_protected:Npn \mark_insert:nn #1#2
135 {
136   \seq_if_in:NnTF \g__mark_classes_seq {#1}
137     {

```

We need to pass the evaluated argument into the mark but protected commands should not expand including those protected using the `\protect` approach of L^AT_EX 2_ε. We also disable `\label` and the like.⁷

At this point the code eventually should get a public (and a kernel) hook instead of a set of hardwired settings.

```

138     \group_begin:

```

Within the group we alter some comments, e.g. `\label` or `\index`, to do the right at this point. This is done in the kernel hook `\@kernel@before@insertmark` which is followed by the public hook `insertmark` that can be used by packages to augment or alter that setup as necessary.

```

139     \@kernel@before@insertmark
140     \hook_use:n { insertmark }
141     \unrestored@protected@xdef \g__mark_tmp_tl {#2}
142     <{*trace}
143     \_mark_debug:n{ \iow_term:x { Marks:~ set~#1~<~<~
144     '\tl_to_str:V \g__mark_tmp_tl' ~ \msg_line_context: } }
145     <{/trace}
146     \tex_marks:D \use:c { c__mark_class_ #1 _mark }
147     {

```

⁷Straight copy from `latex.ltx` but is this even correct? At least a label in a running header makes little sense if it get set several times! Maybe that needs looking at in the 2e kernel.

Here is the trick to avoid truly empty marks: if the result from the above processing is empty we add something which eventually becomes empty, but not immediately; otherwise we just put `\g__mark_tmp_tl` in.

```

148         \tl_if_empty:NTF \g__mark_tmp_tl
149         { \exp_not:n { \prg_do_nothing: } }
150         { \exp_not:o { \g__mark_tmp_tl } }
151     }
152     \group_end:

```

A mark introduces a possible break point and in certain situations that should not happen in vertical mode in L^AT_EX. This needs some cleanup

```

153     \if@nbreak\ifvmode\nobreak\fi\fi
154 }

```

If the mark class was not known, raise an error.

```

155     {
156     \msg_error:nxx { mark } { unknown-class }
157     { \tl_to_str:n {#1} }
158     }
159 }

```

(End definition for `\mark_insert:nn`. This function is documented on page 3.)

`\@kernel@before@insertmark` By default `\label`, `\index`, and `\glossary` do nothing when the mark is inserted.

```

insertmark 160 \cs_new:Npn \@kernel@before@insertmark {
161         \cs_set_eq:NN \label \scan_stop:
162         \cs_set_eq:NN \index \scan_stop:
163         \cs_set_eq:NN \glossary \scan_stop:
164 }

```

The public hook to augment the setup.

```

165 \hook_new:n {insertmark}

```

(End definition for `\@kernel@before@insertmark` and `insertmark`.)

`\mark_use_top:nn` To retrieve the first, last or top region mark, we grab the appropriate value stored in the
`\mark_use_first:nn` corresponding token list variable and pass its contents back. These functions should be
`\mark_use_last:nn` used only in output routines after `__mark_update_structure:nn` has acted, otherwise their value will be wrong.

If used with an unknown class or region they generate an error (fairly low-level because we are in an expandable context).

```

166 \cs_new:Npn \mark_use_first:nn #1#2 { \exp_not:v { g__mark_#1_first_#2_tl } }
167 \cs_new:Npn \mark_use_last:nn #1#2 { \exp_not:v { g__mark_#1_last_#2_tl } }
168 \cs_new:Npn \mark_use_top:nn #1#2 { \exp_not:v { g__mark_#1_top_#2_tl } }

```

(End definition for `\mark_use_top:nn`, `\mark_use_first:nn`, and `\mark_use_last:nn`. These functions are documented on page 3.)

7.4 Comparing mark values

`\mark_if_eq:n \underline{nnn} TF` Test if in a given region (#1) for a given class (#2) the marks in position #3 and #4 (top, first, or last) are identical

`\mark_if_eq:n \underline{nnnn} TF`

```
169 \prg_new_conditional:Npnn \mark_if_eq:n $\underline{nnn}$  #1#2#3#4 { T , F , TF }
170 {
171   \tl_if_eq:ccTF { g__mark_ #1 _#3_ #2 _tl }
172                 { g__mark_ #1 _#4_ #2 _tl }
173                 \prg_return_true:
174                 \prg_return_false:
175 }
```

The fully general test (with two triplets of the form $\langle region \rangle$, $\langle class \rangle$, and $\langle position \rangle$) is this:

```
176 \prg_new_conditional:Npnn \mark_if_eq:n $\underline{nnnn}$  #1#2#3#4#5#6 { T , F , TF }
177 {
178   \tl_if_eq:ccTF { g__mark_ #1 _#3_ #2 _tl }
179                 { g__mark_ #4 _#6_ #5 _tl }
180                 \prg_return_true:
181                 \prg_return_false:
182 }
```

(End definition for `\mark_if_eq:n \underline{nnnn} TF` and `\mark_if_eq:n \underline{nnnnn} TF`. These functions are documented on page 4.)

7.5 Messages

Mark errors are LaTeX kernel errors:

```
183 \prop_gput:Nnn \g_msg_module_type_prop { mark } { LaTeX }
184 \msg_new:n $\underline{nnn}$  { mark } { class-already-defined }
185   { Mark~class~'#1'~already~defined }
186   {
187     \c__msg_coding_error_text_tl
188     LaTeX~was~asked~to~define~a~new~mark~class~called~'#1':~
189     this~mark~class~already~exists.
190     \c__msg_return_text_tl
191   }
192 \msg_new:n $\underline{nnnn}$  { mark } { unknown-class }
193   { Unknown~mark~class~'#1'. }
194   {
195     \c__msg_coding_error_text_tl
196     LaTeX~was~asked~to~manipulate~a~mark~of~class~'#1',~
197     but~this~class~of~marks~does~not~exist.
198   }
199
200 \msg_new:n $\underline{nnnn}$  { mark } { invalid-use }
201   { Mark~region~'#1'~not~usable }
202   {
203     \c__msg_coding_error_text_tl
204     The~region~'#1'~can~only~be~used~after~
205     all~columns~have~been~assembled.
206     \c__msg_return_text_tl
207   }
```

```

208 \msg_new:nnnn { mark } { infinite-shrinkage }
209   { Infinite-shrinkage-found-in-'#1'. }
210   {
211     \c__msg_coding_error_text_tl
212     The~mark~region~'#1'~contains~some~infinite~negative~glue~
213     allowing~it~to~shrink~to~an~arbitrary~size.~
214     This~makes~it~impossible~to~split~the~region~apart~to~
215     get~at~its~marks.~They~are~lost.
216   }

```

7.6 Debugging the mark structures

Code and commands in this section are not final, it needs more experimentation to see what kind of tracing information is going to be useful in practice. For now the tracing is mainly meant to be used for code testing and not so much for application testing.

It is quite likely that the commands and the behavior of the tracing might change in the future once we gained some experience with it.

`\g__mark_debug_bool` Holds the current debugging state.

```
217 \bool_new:N \g__mark_debug_bool
```

(End definition for \g__mark_debug_bool.)

`\mark_debug_on:` Turns debugging on and off by redefining `__mark_debug:n`.

`\mark_debug_off:`

```
218 \cs_new_eq:NN \__mark_debug:n \use_none:n
```

`__mark_debug:n`

```
219 \cs_new_protected:Npn \mark_debug_on:
```

`__mark_debug_gset:`

```

220   {
221     \bool_gset_true:N \g__mark_debug_bool
222     \__mark_debug_gset:
223   }
224 \cs_new_protected:Npn \mark_debug_off:
225   {
226     \bool_gset_false:N \g__mark_debug_bool
227     \__mark_debug_gset:
228   }
229 \cs_new_protected:Npn \__mark_debug_gset:
230   {
231     \cs_gset_protected:Npx \__mark_debug:n ##1
232     { \bool_if:NT \g__mark_debug_bool {##1} }
233   }

```

(End definition for \mark_debug_on: and others. These functions are documented on page 5.)

`\DebugMarksOn` CamelCase commands for debugging.

`\DebugMarksOff`

```
234 \cs_new_eq:NN \DebugMarksOn \mark_debug_on:
235 \cs_new_eq:NN \DebugMarksOff \mark_debug_off:
```

(End definition for \DebugMarksOn and \DebugMarksOff. These functions are documented on page 5.)

`__mark_class_status:nn` Shows the mark values across all regions for one mark class (#2). The first argument gives some *<info>* to help identifying where the command was called.

```

236 (*trace)
237 \cs_new_protected:Npn \__mark_class_status:nn #1#2
238   {

```

```

239 \typeout{ Marks:~#2~ #1:}
240 \typeout{\@spaces page~ (current):
241 | \exp_not:v { g__mark_page_top_ #2 _t1 }
242 | \exp_not:v { g__mark_page_first_ #2 _t1 }
243 | \exp_not:v { g__mark_page_last_ #2 _t1 } |}
244 \typeout{\@spaces page~ (previous):
245 | \exp_not:v { g__mark_previous-page_top_ #2 _t1 }
246 | \exp_not:v { g__mark_previous-page_first_ #2 _t1 }
247 | \exp_not:v { g__mark_previous-page_last_ #2 _t1 } |}
248 \typeout{\@spaces column~ (previous):
249 | \exp_not:v { g__mark_previous-column_top_ #2 _t1 }
250 | \exp_not:v { g__mark_previous-column_first_ #2 _t1 }
251 | \exp_not:v { g__mark_previous-column_last_ #2 _t1 } |}
252 \typeout{\@spaces column~ (current):
253 | \exp_not:v { g__mark_column_top_ #2 _t1 }
254 | \exp_not:v { g__mark_column_first_ #2 _t1 }
255 | \exp_not:v { g__mark_column_last_ #2 _t1 } |}
256 \typeout{\@spaces column~ (first):
257 | \exp_not:v { g__mark_first-column_top_ #2 _t1 }
258 | \exp_not:v { g__mark_first-column_first_ #2 _t1 }
259 | \exp_not:v { g__mark_first-column_last_ #2 _t1 } |}
260 \typeout{\@spaces column~ (second):
261 | \exp_not:v { g__mark_last-column_top_ #2 _t1 }
262 | \exp_not:v { g__mark_last-column_first_ #2 _t1 }
263 | \exp_not:v { g__mark_last-column_last_ #2 _t1 } |}
264 }

```

(End definition for _mark_class_status:nn.)

_mark_status:n Show all mark class values across all regions.

```

265 \cs_new_protected:Npn \_mark_status:n #1
266 {
267 \seq_map_inline:Nn \g__mark_classes_seq
268 { \_mark_class_status:nn {#1} {##1} }
269 }
270 \</trace>

```

(End definition for _mark_status:n.)

7.7 Designer-level interfaces

\NewMarkClass These two are identical to the L3 programming layer commands.

```

\InsertMark
271 \cs_new_eq:NN \NewMarkClass \mark_new_class:n
272 \@onlypreamble \NewMarkClass
273 \cs_new_eq:NN \InsertMark \mark_insert:nn

```

(End definition for \NewMarkClass and \InsertMark. These functions are documented on page 3.)

\TopMark The following commands take an optional argument that defaults to page. There is no
\FirstMark checking that the region is actually valid. If not there is simply an empty return.
\LastMark

```

274 \NewExpandableDocumentCommand \FirstMark { 0{page} m }
275 { \mark_use_first:nn {#1}{#2} }
276 \NewExpandableDocumentCommand \LastMark { 0{page} m }
277 { \mark_use_last:nn {#1}{#2} }

```

```

278 \NewExpandableDocumentCommand \TopMark { 0{page} m }
279     { \mark_use_top:nn {#1}{#2} }

```

(End definition for `\TopMark`, `\FirstMark`, and `\LastMark`. These functions are documented on page 3.)

\IfMarksEqualTF We only provide a CamelCase command for the case with one region (optional) and one class. One could think of also providing a version for the general case with several optional arguments, but use cases for this are most likely rare, so not done yet.

```

280 \NewExpandableDocumentCommand \IfMarksEqualTF {0{page}mmm} {
281     \mark_if_eq:nnnnTF {#1}{#2}{#3}{#4}
282 }

```

(End definition for `\IfMarksEqualTF`. This function is documented on page 4.)

8 L^AT_EX 2_ε integration

8.1 Core L^AT_EX 2_ε integration

`_mark_update_singlecol_structures`: This command updates the mark structures if we are producing a single column document.

```

283 \cs_new_protected:Npn \_mark_update_singlecol_structures: {

```

First we update the `page` region (which also updates the `previous-page`).

The `\@outputbox` is normally in `\vbox` in L^AT_EX but we can't take that for granted (an `amsmath` test document changed it to an `\hbox` just to trip me up) so we are a little careful with `unpack` now.

```

284     \box_if_vertical:NTF \@outputbox
285     {
286         \_mark_update_structure:nn {page}
287         { \vbox_unpack:N \@outputbox }
288     }
289     {
290         \_mark_update_structure:nn {page}
291         { \hbox_unpack:N \@outputbox }
292     }

```

The we provide the necessary updates for the aliases.

```

293     \_mark_update_structure_alias:nn {previous-column}{previous-page}
294     \_mark_update_structure_alias:nn {column}{page}
295     \_mark_update_structure_alias:nn {first-column}{page}
296     \_mark_update_structure_alias:nn {last-column}{page}
297     <{*trace}
298     % move this into status itself?
299     \_mark_debug:n
300     {
301         \_mark_status:n
302         { in~ OR~ (
303             \legacy_if:nTF {@twoside}
304             { twoside-
305                 \int_if_odd:nTF \c@page
306                 { odd }{ even }
307             }
308             { onside }
309         )

```

```

310         }
311     }
312 </trace>
313 }

```

(End definition for `_mark_update_singlecol_structures:`.)

`_mark_update_dblcol_structures:` This commands handles the updates if we are doing two-column pages.

```

314 \cs_new_protected:Npn \_mark_update_dblcol_structures: {

```

First we update the column and previous-column regions using the material assembled in `\@outputbox`.

```

315   \box_if_vertical:NTF \@outputbox
316   {
317     \_mark_update_structure:nn {column}
318     { \vbox_unpack:N \@outputbox }
319   }
320   {
321     \_mark_update_structure:nn {column}
322     { \hbox_unpack:N \@outputbox }
323   }

```

How we have to update the alias regions depends on whether or not `\@opcol` was called to process the first column or to produce the completed page

```

324   \legacy_if:nTF {@firstcolumn}
325   {

```

If we are processing the first column then `column` is our `first-column` and there is no `last-column` yet, so we make those an error.

```

326     \_mark_update_structure_alias:nn {first-column}{column}
327     \_mark_update_structure_to_err:n {last-column}
328   }
329   {

```

If we produce the completed page then the `first-column` is the same as the new `previous-column`. However, the structure should already be correct if you think about it (because it was set to `column` last time which is now the `previous-column`), thus there is no need to make an update.

```

330 %   \_mark_update_structure_alias:nn {first-column}{previous-column}

```

However, we now have a proper `last-column` so we assign that.

```

331     \_mark_update_structure_alias:nn {last-column}{column}

```

What now remains doing is to update the `page` and `previous-page` regions. For this we have to copy the settings in `page` into `previous-page` and then update `page` such that the top and first marks are taken from the `first-column` region and the last marks are taken from the `last-column` region. All this has to be done for all mark classes so we loop over our sequence.

Note that one loop is needed if we arrange the copy statements in a suitable way.

```

332   \seq_map_inline:Nn \g__mark_classes_seq
333   {
334     \tl_gset_eq:cc { g__mark_previous-page_top_   ##1 _tl }
335                   { g__mark_page_top_           ##1 _tl }
336     \tl_gset_eq:cc { g__mark_previous-page_first_ ##1 _tl }
337                   { g__mark_page_first_         ##1 _tl }
338     \tl_gset_eq:cc { g__mark_previous-page_last_  ##1 _tl }
339                   { g__mark_page_last_          ##1 _tl }

```

The page updates need to come after the corresponding updates for `previous-page` otherwise we lose the necessary value.

```

340     \tl_gset_eq:cc { g__mark_page_top_          ##1 _tl }
341                   { g__mark_first-column_top_  ##1 _tl }
342     \tl_gset_eq:cc { g__mark_page_first_       ##1 _tl }
343                   { g__mark_first-column_first_ ##1 _tl }
344     \tl_gset_eq:cc { g__mark_page_last_        ##1 _tl }
345                   { g__mark_last-column_last_  ##1 _tl }
346   }
347 }
348 < *trace >
349   \__mark_debug:n
350   {
351     \__mark_status:n
352     { in~ OR~ (
353       \legacy_if:nTF {@twoside}
354         { twoside-
355           \int_if_odd:nTF \c@page
356             { odd }{ even }
357         }
358       { onside }
359       \space
360       \legacy_if:nTF {@firstcolumn}
361         { first~ }{ second~ }
362         column )
363     }
364   }
365 < /trace >
366 }

```

(End definition for `__mark_update_dblcol_structures:.`)

```

367 < @ @ = >

```

```

\@expl@@mark@update@singlecol@structures@@
\@expl@@mark@update@dblcol@structures@@

```

```

368 \cs_new_eq:NN \@expl@@mark@update@singlecol@structures@@
369   \__mark_update_singlecol_structures:
370 \cs_new_eq:NN \@expl@@mark@update@dblcol@structures@@
371   \__mark_update_dblcol_structures:

```

(End definition for `\@expl@@mark@update@singlecol@structures@@` and `\@expl@@mark@update@dblcol@structures@@`.)

8.2 Other L^AT_EX 2_ε output routines

This section will cover `multicol` and other packages altering or providing their own output routine. Not done yet.

```

372 < latexrelease > \IncludeInRelease{0000/00/00}{lmarks}%
373 < latexrelease >           {Undo-Marks-handling}
374 < latexrelease >

```

We keep the interface commands around even if we roll back in case they are used in packages that don't roll back. Not likely to do a lot of good, but then there is not much we can do, but this at least then doesn't give errors.

```

375 < latexrelease > \DeclareRobustCommand \NewMarkClass [1]{}

```

```

376 <latexrelease>\DeclareRobustCommand \InsertMark[2]{ }
377 <latexrelease>\RenewExpandableDocumentCommand \FirstMark { O{ } m } { }
378 <latexrelease>\RenewExpandableDocumentCommand \LastMark { O{ } m } { }
379 <latexrelease>\RenewExpandableDocumentCommand \TopMark { O{ } m } { }
380 <latexrelease>\RenewExpandableDocumentCommand \IfMarksEqualTF { O{ } mmm }{ }
381 <latexrelease>

```

Same here, this avoided extra roll back code in the OR.

```

382 <latexrelease>\let \@expl@@mark@update@singlecol@structures@@ \relax
383 <latexrelease>\let \@expl@@mark@update@dblcol@structures@@ \relax
384 <latexrelease>
385 <latexrelease>
386 <latexrelease>\EndModuleRelease

387 \ExplSyntaxOff
388 </2ekernel | latexrelease>

Reset module prefix:
389 <@@= >

```