

The `zref` package

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Abstract

Package `zref` tries to get rid of the restriction in \LaTeX 's reference system that only two properties are supported. The package implements an extensible referencing system, where properties are handled in a more flexible way. It offers an interface for macro programmers for the access to the system and some applications that uses the new reference scheme.

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*Please report any issues at <https://github.com/ho-tex/oberdiek/issues>

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1 Introduction

Standard L^AT_EX's reference system with `\label`, `\ref`, and `\pageref` supports two properties, the appearance of the counter that is last incremented by `\refstepcounter` and the page with the `\label` command.

Unhappily L^AT_EX does not provide an interface for adding another properties. Packages such as `hyperref`, `nameref`, or `titleref` are forced to use ugly hacks to extend the reference system. These ugly hacks are one of the causes for `hyperref`'s difficulty regarding compatibility with other packages.

1.1 Standard L^AT_EX behaviour

References are created by the `\label` command:

```
\chapter{Second chapter}
\section{First section on page 7} % section 2.1
\label{myref}
```

Now L^AT_EX records the section number 2.1 and the page 7 in the reference. Internally the reference is a list with two entries:

```
\r@myref → {2.1}{7}
```

The length of the list is fixed in the L^AT_EX kernel. An interface for adding new properties is missing.

There are several tries to add new properties:

hyperref uses a list of five properties instead of the standard list with two entries. This causes many compatibility problems with L^AT_EX and other packages.

titleref stores its title data into the first entry in the list. L^AT_EX is happy because it does only see its list with two entries. The situation becomes more difficult, if more properties are added this way. Then the macros form a nested structure inside the first reference argument for the label. Expandable extractions will then become painful.

1.2 Basic idea

Some time ago Morten Høgholm sent me an experimental cross referencing mechanism as “expl3” code. His idea is:

```
\g_xref_mylabel_plist →  
  \xref_dance_key{salsa}\xref_name_key{Morten}...
```

The entries have the following format:

```
\xref_{\langle your key \rangle}_key{\langle some text \rangle}
```

This approach is much more flexible:

- New properties can easily be added, just use a new key.
- The length of the list is not fixed. A reference can use a subset of the keys.
- The order of the entries does not matter.

Unhappily I am not familiar with the experimental code for L^AT_EX3 that will need some time before its first release. Thus I have implemented it as L^AT_EX 2_ε package without disturbing the existing L^AT_EX reference system.

1.3 Interfaces

The package provides a generic *interface for programmers*. Commands of this interface are prefixed by `\zref@`.

Option `user` enables the *user interface*. Here the commands are prefixed by `\z` to avoid name clashes with existing macros.

Then the packages provides some *modules*. They are applications for the reference system and can also be considered as examples how to use the reference system.

The modules can be loaded as packages. The package name is prefixed with `zref-`, for example:

```
\RequirePackage{zref-abspage}
```

This is the preferred way if the package is loaded from within other packages to avoid option clashes.

As alternative package `zref` can be used and the modules are given as options:

```
\usepackage[perpage,user]{zref}
```

2 Interface for programmers

The user interface is described in the next section [3](#).

2.1 Entities

Reference. Internally a reference is a list of key value pairs:

```
\Z@R@myref → \default{2.1}\page{7}
```

The generic format of a entry is:

```
\Z@R@⟨refname⟩ → \⟨propname⟩{⟨value⟩}
```

`⟨refname⟩` is the name that denoted references (the name used in `\label` and `\ref`). `⟨propname⟩` is the name of the property or key. The property key macro is never executed, it is used in parameter text matching only.

Property. Because the name of a property is used in a macro name that must survive the .aux file, the name is restricted to letters and ‘@’.

Property list. Often references are used for special purposes. Thus it saves memory if just the properties are used in this reference that are necessary for its purpose.

Therefore this package uses the concept of *property lists*. A property list is a set of properties. The set of properties that is used by the default \label command is the *main property list*.

2.2 Property list

^{exp} means that the implementation of the marked macro is expandable. ^{exp2} goes a step further and marks the macro expandable in exact two expansion steps.

`\zref@newlist {<listname>}`

Declares a new empty property list.

`\zref@addprop {<listname>} {<propname>}`
`\zref@localaddprop {<listname>} {<propname>}`

Adds the property <propname> to the property list <listname>. The property and list must exist. The addition is global by \zref@addprop and limited to local scope by \zref@localaddprop. Between 2010/04/19 v2.13 and 2010/10/22 v2.19 a comma separated list of properties could be used as argument <propname>. Since 2010/10/22 v2.19 the addition of several properties at once is supported by \zref@addprops.

`\zref@addprops {<listname>} {<propname list>}`
`\zref@localaddprops {<listname>} {<propname list>}`

These macros add a comma separated list of properties <propname list> to list <listname>. \zref@addprops works globally and \zref@localaddprops locally. Since 2010/10/22 v2.19.

`\zref@listexists {<listname>} {<then>}`

Executes <then> if the property list <listname> exists or raise an error otherwise.

`\zref@iflistundefinedexp {<listname>} {<then>} {<else>}`

Executes <then> if the list exists or <else> otherwise.

`\zref@iflistcontainsprop {<listname>} {<propname>} {<then>} {<else>}`

Executes <then> if the property <propname> is part of property list <listname> or otherwise it runs the <else> part.

2.3 Property

`\zref@newprop * {<propname>} [<default>] {<value>}`

This command declares and configures a new property with name *<propname>*.

In case of unknown references or the property does not exist in the reference, the *<default>* is used as value. If it is not specified here, a global default is used, see `\zref@setdefault`.

The correct values of some properties are not known immediately but at page shipout time. Prominent example is the page number. These properties are declared with the star form of the command.

`\zref@setcurrent {<propname>} {<value>}`

This sets the current value of the property *<propname>*. It is a generalization of setting L^AT_EX's `\currentlabel`.

`\zref@getcurrentexp2 {<propname>}`

This returns the current value of the property *<propname>*. The value may not be correct, especially if the property is bound to a page (start form of `\zref@newprop`) and the right value is only known at shipout time (e.g. property ‘page’). In case of errors (e.g. unknown property) the empty string is returned.

Since version 2010/04/22 v2.14 `\zref@getcurrent` supports `\zref@wrapper@unexpanded`.

`\zref@propexists {<propname>} {<then>}`

Calls *<then>* if the property *<propname>* is available or generates an error message otherwise.

`\zref@ifpropundefinedexp {<propname>} {<then>} {<else>}`

Calls *<then>* or *<else>* depending on the existence of property *<propname>*.

2.4 Reference generation

`\zref@label {<refname>}`

This works similar to `\label`. The reference *<refname>* is created and put into the `.aux` file with the properties of the main property list.

`\zref@labelbylist {<refname>} {<listname>}`

Same as `\zref@label` except that the properties are taken from the specified property list *<listname>*.

`\zref@labelbyprops {<refname>} {<propnameA>,<propnameB>,...}`

Same as `\zref@label` except that these properties are used that are given as comma separated list in the second argument.

`\zref@newlabel {<refname>} {...}`

This is the macro that is used in the `.aux` file. It is basically the same as `\newlabel` apart from the format of the data in the second argument.

2.5 Data extraction

`\zref@extractdefaultexp2 {<refname>} {<propname>} {<default>}`

This is the basic command that references the value of a property `<propname>` for the reference `<refname>`. In case of errors such as undefined reference the `<default>` is used instead.

`\zref@extractexp2 {<refname>} {<propname>}`

The command is an abbreviation for `\zref@extractdefault`. As default the default of the property is taken, otherwise the global default.

Example for page references:

```

LATEX: \pageref{foobar}
zref:   \zref@extract{foobar}{page}
```

Both `\zref@extract` and `\zref@extractdefault` are expandable. That means, these macros can directly be used in expandable calculations, see the example file. On the other side, babel's shorthands are not supported, there are no warnings in case of undefined references.

If an user interface doesn't need expandable macros then it can use `\zref@refused` and `\zref@wrapper@babel` for its user macros.

`\zref@refused {<refname>}`

This command is not expandable. It causes the warnings if the reference `<refname>` is not defined. Use the `\zref@extract` commands inside expandable contexts and mark their use outside by `\zref@refused`, see the example file.

`\zref@def@extract {<cmd>} {<refname>} {<propname>}`
`\zref@def@extractdefault {<cmd>} {<refname>} {<propname>} {<default>}`

Both macros extract the property `<propname>` from the reference `<refname>` the same way as macros `\zref@extract` and `\zref@extractdefault`. The result is stored in macro `<cmd>`. Also `\zref@refused` is called to notify L^AT_EX that the reference `<refname>` is used. Added in 2011/10/04 v2.22.

`\zref@ifrefundefinedexp {<refname>} {<then>} {<else>}`

Macro `\zref@ifrefundefined` calls arguments `<then>` or `<else>` dependent on the existence of the reference `<refname>`.

`\zifrefundefined {<refname>} {<then>} {<else>}`

Macro `\zifrefundefined` calls `\ref@refused` before executing `\zref@ifrefundefined`. Babel shorthands are supported in `<refname>`.

<code>\zref@ifrefcontainsprop^{exp} {\langle refname \rangle} {\langle propname \rangle} {\langle then \rangle} {\langle else \rangle}</code>

Test whether a reference provides a property.

2.6 Setup

<code>\zref@default</code>

Holds the global default for unknown values.

<code>\zref@setdefault {\langle value \rangle}</code>

Sets the global default for unknown values. The global default is used, if a property does not specify an own default and the value for a property cannot be extracted. This can happen if the reference is unknown or the reference does not have the property.

<code>\zref@setmainlist {\langle value \rangle}</code>
--

Sets the name of the main property list. The package sets and uses `main`.

2.7 Declared properties

Module	Property	Property list	Default
(base)	default	main	<i><empty></i>
	page	main	<i><empty></i>
abspage	abspage	main	0
counter	counter	main	<i><empty></i>
hyperref	anchor	main	<i><empty></i>
	url		<i><empty></i>
pageattr	pdfpageattr	thepage	...
	pdfpagesattr	LastPage	...
pagelayout ¹	mag	thepage	\number\mag
	paperwidth	thepage	\number\paperwidth
	paperheight	thepage	\number\paperheight
	stockwidth	thepage	\number\stockwidth
	stockheight	thepage	\number\stockheight
	pdfpageheight	thepage	\number\pdfpageheight
	pdfpagewidth	thepage	\number\pdfpagewidth
	pdfhorigin	thepage	\number\pdfhorigin
	pdfvorigin	thepage	\number\pdfvorigin
	hoffset	thepage	\number\hoffset
	voffset	thepage	\number\voffset
	topmargin	thepage	\number\topmargin
	oddsidemargin	thepage	\number\oddsidemargin
	evensidemargin	thepage	\number\evensidemargin
	textwidth	thepage	\number\textwidth
	textheight	thepage	\number\textheight
	headheight	thepage	\number\headheight
	headsep	thepage	\number\headsep
	footskip	thepage	\number\footskip
	marginparwidth	thepage	\number\marginparwidth
	marginparsep	thepage	\number\marginparsep
	columnwidth	thepage	\number\columnwidth
	columnsep	thepage	\number\columnsep
perpage	pagevalue	perpage	0
	page	perpage	<i><empty></i>
	abspage	perpage	0
savepos	posx	savepos	0
	posy	savepos	0
titleref	title	main	<i><empty></i>
xr	anchor		<i><empty></i>
	externaldocument		<i><empty></i>
	thetype		<i><empty></i>
	title		<i><empty></i>
	url		<i><empty></i>

¹Module pagelayout only defines properties if the parameter exists.

2.8 Wrapper for advanced situations

`\zref@wrapper@babel {...} {\langle name \rangle}`

This macro helps to add shorthand support. The second argument is protected, then the code of the first argument is called with the protected name appended. Examples are in the sources.

`\zref@wrapper@immediate {...}`

There are situations where a label must be written instantly to the `.aux` file, for example after the last page. If the `\zlabel` or `\label` command is put inside this wrapper, immediate writing is enabled. See the implementation for module `lastpage` for an example of its use.

`\zref@wrapper@unexpanded {...}`

Assuming someone wants to extract a value for property `bar` and store the result in a macro `\foo` without traces of the expanding macros and without expanding the value. This (theoretical?) problem can be solved by this wrapper:

```
\zref@wrapper@unexpanded{%  
  \edef\foo{%  
    \zref@extract{someref}{bar}%  
  }%  
}
```

The `\edef` forces the expansion of `\zref@extract`, but the extraction of the value is prevented by the wrapper that uses ε -TeX' `\unexpanded` for this purpose. Supported macros are `\zref@extract`, `\zref@extractdefault` and since version 2010/04/22 v2.14 macro `\zref@getcurrent`.

2.9 Counter for unique names

Some modules (`titleref` and `dotfillmin`) need unique names for automatically generated label names.

`\zref@require@unique`

This command creates the unique counter `zref@unique` if the counter does not already exist.

`\thezref@unique`

This command is used to generate unique label names.

3 User interface

3.1 Module user

The user interface for this package and its modules is enabled by `zref's` package option `user` or package `zref-user`. The names of user commands are prefixed by `z` in

order to avoid name clashes with existing macros of the same functionality. Thus the package does not disturb the traditional reference scheme, both can be used together.

The syntax descriptions contain the following markers that are intended as hints for programmers:

<code>babel</code>	Babel shorthands are allowed.
<code>robust</code>	Robust macro.
<code>exp</code>	Expandable version: <ul style="list-style-type: none"> • robust, unless the extracted values are fragile, • no babel shorthand suport.
<code>exp2</code>	Expandable like <code>exp</code> and: <ul style="list-style-type: none"> • expandable in exact two steps.

The basic user interface of the package without modules are commands that mimic the standard L^AT_EX behaviour of `\label`, `\ref`, and `\pageref`:

`\zlabel {⟨refname⟩}^babel`

Similar to `\label`. It generates a label with name `⟨refname⟩` in the new reference scheme.

`\zref [⟨propname⟩] {⟨refname⟩}^babel`

Without optional argument similar to `\ref`, it returns the default reference property. This property is named `default`:

$$\text{\zref}\{x\} \equiv \text{\zref}[\text{default}]\{x\}$$

`\zpageref {⟨refname⟩}^babel`

Convenience macro, similar to `\pageref`.

$$\text{\zpageref}\{x\} \equiv \text{\zref}[\text{page}]\{x\}$$

`\zrefused {⟨refname⟩}^babel`

Some of the user commands in the modules are expandable. The use of such commands do not cause any undefined reference warnings, because inside of expandable contexts this is not possible. However, if there is a place outside of expandable contexts, `\refused` is strongly recommended. The reference `⟨refname⟩` is marked as used, undefined ones will generate warnings.

3.2 Module **abspage**

With the help of package `atbegshi` a new counter `abspage` with absolute page numbers is provided. Also a new property `abspage` is defined and added to the main property list. Thus you can reference the absolute page number:

```
Section \zref{foo} is on page \zpageref{foo}.
This is page \zref[abspage]{foo}
of \zref[abspage]{LastPage}.
```

The example also makes use of module `lastpage`.

3.3 Module lastpage

Provides the functionality of package `lastpage` [3] in the new reference scheme. The label `LastPage` is put at the end of the document. You can refer the last page number with:

```
\zref@extract{LastPage}{page} (+ \zref@refused{LastPage})
```

or

```
\zpageref{LastPage} (module user)
```

Since version 2008/10/01 v2.3 the module defines the list `LastPage`. In addition to the properties of the main list label `LastPage` also stores the properties of this list `LastPage`. The default of this list is empty. The list can be used by the user to add additional properties for label `LastPage`.

3.3.1 Tests for last page

Since version 2010/03/26 v2.8 the macros `\zref@iflastpage` and `\ziflastpage` were added. They test the reference, whether it is a reference of the last page.

`\zref@iflastpageexp {<refname>} {<then>} {<else>}`

Macro `\zref@iflastpage` compares the references `<refname>` with `<LastPage>`. Basis of the comparison is the value of property `abspage`, because the values are different for different pages. This is not ensured by property `page`. Therefore module `abspage` is loaded by module `lastpage`. If both values of property `abspage` are present and match, then `<then>` is executed, otherwise code `<else>` is called. If one or both references are undefined or lack the property `abspage`, then `<else>` is executed.

Macro `\zref@iflastpage` is expandable, therefore `\zref@refused` should be called on `<refname>` and `<LastPage>`.

`\ziflastpage {<refname>} {<then>} {<else>}`

Macro `\ziflastpage` has the same function as `\zref@iflastpage`, but adds support for babel shorthands in `<refname>` and calls `\zref@refused`. However macro `\ziflastpage` is not expandable.

3.3.2 Example

```
1 <*example-lastpage>
2 %<END_EXAMPLE
3 \NeedsTeXFormat{LaTeX2e}
4 \documentclass{report}
5
6 \newcounter{foo}
7 \renewcommand*{\thefoo}{\Alph{foo}}
8
9 \usepackage{zref-lastpage,zref-user}[2018/11/21]
10
11 \makeatletter
12 \zref@newprop{thefoo}{\thefoo}
13 \zref@newprop{valuefoo}{\the\value{foo}}
```

```

14 \zref@newprop{chapter}{\thechapter}
15 \zref@addprops{LastPage}{thefoo,valuefoo,chapter}
16 \makeatother
17
18 \newcommand*{\foo}{%
19   \stepcounter{foo}%
20   [Current foo: \thefoo]%
21 }
22
23 \begin{document}
24   \chapter{First chapter}
25   Last page is \zref{LastPage}.\
26   Last chapter is \zref[chapter]{LastPage}.\
27   Last foo is \zref[thefoo]{LastPage}.\
28   Last value of foo is \zref[valuefoo]{LastPage}.\
29   \foo
30   \chapter{Second chapter}
31   \foo\foo\foo
32   \chapter{Last chapter}
33   \foo
34 \end{document}
35 %END_EXAMPLE
36 /example-lastpage

```

3.4 Module **thepage**

This module **thepage** loads module **abspage**, constructs a reference name using the absolute page number and remembers property **page**. Other properties can be added by adding them to the property list **thepage**.

`\zthepage {<absolute page number>}`

Macro `\zthepage` is basically a `\zpageref`. The reference name is yield by the *<absolute page number>*. If the reference is not defined, then the default for property **page** is used.

`\zref@thepage@nameexp {<absolute page number>}`

Macro `\zref@thepage@name` returns the internal reference name that is constructed using the *<absolute page number>*. The internal reference name should not be used directly, because it might change in future versions.

`\zref@thepageexp {<absolute page number>}`
`\zref@thepage@refused {<absolute page number>}`

Macro `\zref@thepage` returns the page number (`\thepage`) of *<absolute page number>*. Because this macro is expandable, `\zref@thepage@refused` is used outside an expandable context to mark the reference as used.

3.5 Module `nextpage`

`\znexpage`

Macro `\znexpage` prints `\thepage` of the following page. It gets the current absolute page number by using a label. There are three cases for the next page:

1. The next page is not known yet because of undefined references. Then `\zunknownnextpagename` is used instead. The default for this macro is the default of property `page`.
2. This page is the last page. Then `\znonextpagename` is used. Its default is empty.
3. The next page is known, then `\thepage` of the next page is used (the value of property `page` of the next page).

3.5.1 Configuration

The behaviour can be configured by the following macros.

`\zunknownnextpagename`
`\znonextpagename`

If the next page is not known or available, then `\znexpage` uses these name macros as default. `\zunknownnextpagename` is used in case of undefined references. Default is the value of property `page` of the next page (`\thepage`). Module `thepage` is used.

Macro `\znonextpagename` is used, if the next page does not exists. That means that the current page is last page. The default is empty.

`\znexpagesetup {<unknown>} {<no next>} {<next>}`

According to the case (see `\znexpage`) macro `\znexpage` calls an internal macro with an argument. The argument is either `\thepage` of the next page or one of `\zunknownnextpagename` or `\znonextpagename`. These internal macro can be changed by `\znexpagesetup`. It expects the definition texts for these three cases of a macro with one argument. The default is

`\znexpagesetup{#1}{#1}{#1}`

3.5.2 Example

```
37 (*example-nextpage)
38 %<<END_EXAMPLE
39 \documentclass{book}
40
41 \usepackage{zref-nextpage}[2018/11/21]
42 \znexpagesetup
43   {\thepage}% next page is unknown
44   {\thepage\ (#1)}% this page is last page
45   {\thepage\ $\rightarrow$ #1}% next page is known
46 \renewcommand*{\znonextpagename}{last page}
47
48 \usepackage{fancyhdr}
```

```

49 \pagestyle{fancy}
50 \fancyhf{}
51 \fancyhead[LE,R0]{\znextpage}
52 \fancypagestyle{plain}{%
53   \fancyhf{}%
54   \fancyhead[LE,R0]{\znextpage}%
55 }
56
57 \begin{document}
58 \frontmatter
59   \tableofcontents
60 \mainmatter
61   \chapter{Hello World}
62   \clearpage
63   \section{Last section}
64 \end{document}
65 %END_EXAMPLE
66 /example-nextpage\

```

3.6 Module **totpages**

For the total number of pages of a document you need to know the absolute page number of the last page. Both modules **abspage** and **lastpage** are necessary and automatically enabled.

`\ztotpagesexp`

Prints the total number of pages or 0 if this number is not yet known. It expands to an explicit number and can also used even in expandable calculations (`\numexpr`) or counter assignments.

3.7 Module **pagelayout**

The module defines additional properties for each parameter of the page layout that is effective during page shipout. The value of length parameters is given in sp without the unit as plain number.

Some parameters are specific for a class (e.g. **stockwidth** and **stockheight** for class **memoir**) or the T_EX engine like pdfT_EX. If the parameter is not available, then the property will not be defined. The default value of the property is the current setting of the parameter.

The module **thepage** is loaded that generates a label for each page. The properties of module **pagelayout** are added to the property list **thepage** of module **thepage**.

List of properties:

parameter	property	remarks
<code>\mag</code>	mag	
<code>\paperwidth</code>	paperwidth	
<code>\paperheight</code>	paperheight	
<code>\stockwidth</code>	stockwidth	class memoir
<code>\stockheight</code>	stockheight	class memoir
<code>\pdfpagewidth</code>	pdfpagewidth	pdfTeX, LuaTeX
<code>\pdfpageheight</code>	pdfpageheight	pdfTeX, LuaTeX
<code>\pdfhorigin</code>	pdfhorigin	pdfTeX, LuaTeX
<code>\pdfvorigin</code>	pdfvorigin	pdfTeX, LuaTeX
<code>\hoffset</code>	hoffset	
<code>\voffset</code>	voffset	
<code>\topmargin</code>	topmargin	
<code>\oddsidemargin</code>	oddsidemargin	
<code>\evensidemargin</code>	evensidemargin	
<code>\textwidth</code>	textwidth	
<code>\textheight</code>	textheight	
<code>\headheight</code>	headheight	
<code>\headsep</code>	headsep	
<code>\footskip</code>	footskip	
<code>\marginparwidth</code>	marginparwidth	
<code>\marginparsep</code>	marginparsep	
<code>\columnwidth</code>	columnwidth	
<code>\columnsep</code>	columnsep	

`\zlistpagelayout`

At the end of document the page layout parameter for each page are printed into the `.log` file if macro `\zlistpagelayout` is called before `\end{document}` (preamble is a good place).

3.8 Module marks

ToDo.

3.9 Module runs

Module `runs` counts the L^AT_EX runs since last `.aux` file creation and prints the number in the `.log` file.

`\zrunsexp`

Prints the the total number of L^AT_EX runs including the current one. It expands to an explicit number. Before `begin{document}` the value is zero meaning the `.aux` file is not read yet. If a previous `.aux` file exists, the value found there increased by one is the new number. Otherwise `\zruns` is set to one. L^AT_EX runs where the `.aux` files are not rewritten are not counted (see `\nofiles`).

3.10 Module perpage

With `\@addtoreset` or `\numberwithin` a counter can be reset if another counter is incremented. This do not work well if the other counter is the page counter. The page counter is incremented in the output routine that is often called asynchronous

somewhere on the next page. A reference mechanism costs at least two L^AT_EX runs, but ensures correct page counter values.

`\zmakeperpage [reset] {counter}`

At the of a new page counter *counter* starts counting with value *reset* (default is 1). The macro has the same syntax and semantics as `\MakePerPage` of package `perpage` [5]. Also `perpage` of package `footmisc` [1] can easily be simulated by

```
\zmakeperpage{footnote} % \usepackage[perpage]{footmisc}
```

If footnote symbols are used, some people dislike the first symbol †. It can easily be skipped:

```
\zmakeperpage[2]{footnote}
```

`\thezpage`
`counter zpage`

If the formatted counter value of the counter that is reset at a new page contains the page value, then you can use `\thezpage`, the page number of the current page. Or counter `zpage` can be used, if the page number should be formatted differently from the current page number. Example:

```
\newcounter{foobar}
\zmakeperpage{foobar}
\renewcommand*{\thefoobar}{\thezpage-\arabic{foobar}}
%_or
\renewcommand*{\thefoobar}{\roman{zpage}-\arabic{foobar}}
```

`\zunmakeperpage {counter}`

The reset mechanism for this counter is deactivated.

3.11 Module counter

This option just add the property `counter` to the main property list. The property stores the counter name, that was responsible for the reference. This is the property `hyperref`'s `\autoref` feature uses. Thus this property `counter` may be useful for a reimplementaion of the `autoref` feature, see the section 4 with the todo list.

3.12 Module titleref

This option makes section and caption titles available to the reference system similar to packages `titleref` or `nameref`.

`\ztitleref {refname}`^{babel}

Print the section or caption title of reference *refname*, similar to `\nameref` or `\titleref`.

`\ztitlerefsetup {key1=value1, key2=value2, ...}`

This command allows to configure the behaviour of module `titleref`. The following keys are available:

`title=<value>`

Sets the current title.

`stripperiod=true|false`

Follow package `nameref` that removes a last period. Default: `true`.

`expand=true|false`

Package `\titleref` expands the title first. This way garbage and dangerous commands can be removed, e.g. `\label`, `\index...`. See implementation section for more details. Default is `false`.

`cleanup={...}`

Hook to add own cleanup code, if method `expand` is used. See implementation section for more details.

3.13 Module `savepos`

This option supports a feature that pdfTeX provides (and XeTeX). pdfTeX is able to tell the current position on the page. The page position is not instantly known. First the page must be constructed by TeX's asynchronous output routine. Thus the time where the position is known is the page shipout time. Thus a reference system where the information is recorded in the first run and made available for use in the second run comes in handy.

`\zsavepos {<refname>}`

It generates a reference with name `<refname>`. The reference stores the location where `\zsavepos` is executed in properties `posx` and `posy`.

`\zsaveposx {<refname>}`
`\zsaveposy {<refname>}`

Same as `\zsavepos` except that only the x or y component of the position is stored. Since 2011/12/05 v2.23.

`\zposxexp {<refname>}`
`\zposyexp {<refname>}`

Get the position as number. Unit is sp. Horizontal positions by `\zposx` increase from left to right. Vertical positions by `\zposy` from bottom to top.

Do not rely on absolute page numbers. Because of problems with the origin the numbers may differ in DVI or PDF mode of pdfTeX. Therefore work with relative values by comparisons.

Both `\zposx` and `\zposy` are expandable and can be used inside calculations (`\setcounter`, `\addtocounter`, package `calc`, `\numexpr`). However this property prevents from notifying L^AT_EX that the reference is actually used (the notifying is not expandable). Therefore you should mark the reference as used by `\zrefused`.

This module uses pdfTeX's `\pdfsavepos`, `\pdflastxpos`, and `\pdflastypos`. They are available in PDF mode and since version 1.40.0 also in DVI mode.

`\zref@savepos`

Macro `\zref@savepos` performs the first part of `\zsavepos` by calling `\pdfsavepos` (if `.aux` files are writable).

Thus `\zsavepos` is basically `\zref@savepos` followed by `\zref@labelbylist{<refname>}{savepos}`. If `\TeXeTstate` is detected and enabled, `\savepos` also adds `\zref@savepos` at the end to support `\beginR` where the whatits are processed in reverse order. The property list `savepos` contains the properties `posx` and `posy`.

3.14 Module `dotfill`

`\zdotfill`

This package provides the command `\zdotfill` that works similar to `\dotfill`, but can be configured. Especially it suppresses the dots if a minimum number of dots cannot be set.

`\zdotfillsetup {key1=value1, key2=value2, ...}`

This command allows to configure the behaviour of `\zdotfill`. The following keys are available:

`min=<count value>`

If the actual number of dots are smaller than `<count value>`, then the dots are suppressed. Default: 2.

`unit=<dimen value>`

The width of a dot unit is given by `<dimen value>`. Default: 0.44em (same as the unit in `\dotfill`).

`dot=<value>`

The dot itself is given by `<value>`. Default: `.` (dot, same as the dot in `\dotfill`).

3.15 Module `env`

This module defines two properties `envname` and `envline`. They remember the name of the environment and the line number at the start of the environment.

3.16 Module `xr`

This package provides the functionality of package `xr`, see [8]. It also supports the syntax of `xr-hyper`.

`\externaldocument * [<prefix>]babel {<external document>} [<url>]`

See `\externaldocument` for a description of this option. The found labels also get a property `externaldocument` that remembers `<external document>`. The standard reference scheme and the scheme of this package use different name spaces for reference names. If the external document uses both systems. Then one import statement would put the names in one namespace and probably causing problems with multiple references of the same name. Thus the star form only looks for `\newlabel` in the `.aux` files, whereas without star only `\zref@newlabels` are used.

In the star form it tries to detect labels from `hyperref`, `titleref`, and `ntheorem`. If such an extended property from the packages before cannot be found or are empty, they are not included in the imported reference.

Warnings are given if a reference name is already in use and the item is ignored. Unknown properties will automatically be declared.

If the external references contain `anchor` properties, then we need also a url to be able to address the external file. As default the filename is taken with a default extension.

`\zxrsetup {key1=value1, key2=value2, ...}`

The following setup options are available:

ext: It sets the default extension.

tozreflabel: Boolean option. The found references are imported as zref labels. This is enabled by default.

toitxlabel: Boolean option. The found references are imported as L^AT_EX labels. Packages `nameref`, `titleref` and class `memoir` are supported.

urluse: Boolean option. If enabled, then a URL is stored in a macro and the macro is put in property ‘urluse’. The URL is not put in property ‘url’. The purpose is to save T_EX memory.

verbose: Boolean option. List the imported labels in the `.log` file. Default is `false`.

`\zref@xr@ext`

If the `<url>` is not specified in `\zref@externaldocument`, then the url will be constructed with the file name and this macro as extension. `\XR@ext` is used if `hyperref` is loaded, otherwise `pdf`.

4 ToDo

Among other things the following issues are left for future work:

- Other applications: `autoref`, `hyperref`, ...

5 Example

```

67 <*example>
68 \documentclass{book}
69
70 \usepackage[ngerman]{babel}%
71
72 \usepackage[savepos,totpages,titleref,dotfill,counter,user]{zref}
73
```

Chapters are wrapped inside `\ChapterStart` and `\ChapterStop`. The first argument `#1` of `\ChapterStart` is used to form a label id `chap:#1`. At the end of the chapter another label is set by `\zref@wrapper@immediate`, because otherwise at the end of document a deferred write would not be written, because there is no page for shipout.

Also this example shows how chapter titles can be recorded. A new property `chaptitle` is declared and added to the main property list. In `\ChapterStart` the current value of the property is updated.

```

74 \makeatletter
75 \zref@newprop{chaptitle}{}
76 \zref@addprop{main}{chaptitle}
77
78 \newcommand*{\ChapterStart}[2]{%
79   \cleardoublepage
80   \def\current@chapid{#1}%
81   \zref@setcurrent{chaptitle}{#2}%
82   \chapter{#2}%
83   \zlabel{chap:#1}%
84 }
85 \newcommand*{\ChapterStop}{%
86   \cleardoublepage
87   \zref@wrapper@immediate{%
88     \zref@labelbyprops{chapend:\current@chapid}{abspage}%
89   }%
90 }

```

`\ChapterPages` calculates and returns the number of pages of the referenced chapter.

```

91 \newcommand*{\ChapterPages}[1]{%
92   \zrefused{chap:#1}%
93   \zrefused{chapend:#1}%
94   \number\numexpr
95     \zref@extract{chapend:#1}{abspage}%
96     -\zref@extract{chap:#1}{abspage}%
97     +1\relax
98 }
99 \makeatother
100 \begin{document}

```

As exception we use `\makeatletter` here, because this is just an example file that also should show some of programmer's interface.

```

101 \makeatletter
102
103 \frontmatter
104 \zlabel{documentstart}
105
106 \begin{itemize}
107 \item
108   The frontmatter part has
109   \number\numexpr\zref@extract{chap:first}{abspage}-1\relax
110   ~pages.
111 \item
112   Chapter \zref{chap:first} has \ChapterPages{first} page(s).
113 \item
114   Section \zref{hello} is on the
115   \ifcase\numexpr
116     \zref@extractdefault{hello}{page}{0}%
117     -\zref@extractdefault{chap:first}{page}{0}%
118     +1\relax
119     ??\or first\or second\or third\or forth\fi
120   ~page inside its chapter.
121 \item
122   The document has
123   \zref[abspage]{LastPage} pages.

```

```

124 This number is \ifodd\ztotpages odd\else even\fi.
125 \item
126 The last page is labeled with \zpageref{LastPage}.
127 \item
128 The title of chapter \zref{chap:next} %
129 is ``\zref[chaptitle]{chap:next}``.
130 \end{itemize}
131
132 \tableofcontents
133
134 \mainmatter
135 \ChapterStart{first}{First chapter}
136

```

The user level commands should protect babel shorthands where possible. On the other side, expandable extracting macros are useful in calculations, see above the examples with `\numexpr`.

```

137 \section{Test}
138 \zlabel{a"o}
139 Section \zref{a"o} on page
140 \zref@wrapper@babel\zref@extract{a"o}{page}.
141
142 Text.
143 \newpage
144
145 \section{Hello World}
146 \zlabel{hello}
147
148 \ChapterStop
149
150 \ChapterStart{next}{Next chapter with \emph{umlauts}: "a"o"u"s}
151

```

Here an example follows that makes use of pdf \TeX 's “savepos” feature. The position on the page is not known before the page is constructed and shipped out. Therefore the position is stored in references and are available for calculations in the next \LaTeX compile run.

```

152 The width of the first column is
153 \the\dimexpr \zposx{secondcol}sp - \zposx{firstcol}sp\relax,\
154 the height difference of the two baselines is
155 \the\dimexpr \zposy{firstcol}sp - \zposy{secondline}sp\relax:\
156 \begin{tabular}{ll}
157 \zsavapos{firstcol}Hello&\zsavapos{secondcol}World\
158 \zsavapos{secondline}Second line&foobar\
159 \end{tabular}
160

```

With `\zrefused` \LaTeX is notified, if the references are not yet available and \LaTeX can generate the rerun hint.

```

161 \zrefused{firstcol}
162 \zrefused{secondcol}
163 \zrefused{secondline}
164
165 \ChapterStop

```

Test for module `\dotfill`.

```

166 \ChapterStart{dotfill}{Test for dotfill feature}
167 \newcommand*{\dftest}[1]{%
168   #1&
169   [\makebox[#1]{\dotfill}]&

```

```

170 [\makebox[#1]{\zdotfill}]\
171 }
172 \begin{tabular}{rll}
173 & [\verb|\dotfill|] & [\verb|\zdotfill|]\
174 \dftest{0.43em}
175 \dftest{0.44em}
176 \dftest{0.45em}
177 \dftest{0.87em}
178 \dftest{0.88em}
179 \dftest{0.89em}
180 \dftest{1.31em}
181 \dftest{1.32em}
182 \dftest{1.33em}
183 \end{tabular}
184 \ChapterStop
185 \end{document}
186 \example

```

6 Implementation

6.1 Package zref

6.1.1 Identification

```

187 (*package)
188 \NeedsTeXFormat{LaTeX2e}
189 \ProvidesPackage{zref}
190 [2018/11/21 v2.27 A new reference scheme for LaTeX (HO)]%

```

6.1.2 Load basic module

```

191 \RequirePackage{zref-base}[2018/11/21]

```

Abort package loading if zref-base could not be loaded successfully.

```

192 \@ifundefined{ZREF@base@ok}{\endinput}{}

```

6.1.3 Process options

Known modules are loaded and the release date is checked.

```

193 \def\ZREF@temp#1{%
194   \DeclareOption{#1}{%
195     \AtEndOfPackage{%
196       \RequirePackage{zref-#1}[2018/11/21]%
197     }%
198   }%
199 }
200 \ZREF@temp{abspage}
201 \ZREF@temp{counter}
202 \ZREF@temp{dotfill}
203 \ZREF@temp{hyperref}
204 \ZREF@temp{lastpage}
205 \ZREF@temp{marks}
206 \ZREF@temp{nextpage}
207 \ZREF@temp{pageattr}
208 \ZREF@temp{pagelayout}
209 \ZREF@temp{perpage}
210 \ZREF@temp{runs}
211 \ZREF@temp{savepos}
212 \ZREF@temp{thepage}
213 \ZREF@temp{titleref}
214 \ZREF@temp{totpages}

```



```

215 \ZREF@temp{user}
216 \ZREF@temp{xr}
217 \ProcessOptions\relax
218 \end{package}

```

6.2 Module base

6.2.1 Prefixes

This package uses the following prefixes for macro names:

\zref@: Macros of the programmer's interface.

\ZREF@: Internal macros.

\Z@L@listname: The properties of the list *<listname>*.

\Z@D@propname: The default value for property *<propname>*.

\Z@E@propname: Extract function for property *<propname>*.

\Z@X@propname: Information whether a property value for property *<propname>* is expanded immediately or at shipout time.

\Z@C@propname: Current value of the property *<propname>*.

\Z@R@labelname: Data for reference *<labelname>*.

\ZREF@org@: Original versions of patched commands.

\z: For macros in user land, defined if module *user* is set.

The following family names are used for keys defined according to the *keyval* package:

ZREF@TR: Setup for module *titleref*.

6.2.2 Identification

```

219 (*base)
220 \NeedsTeXFormat{LaTeX2e}
221 \ProvidesPackage{zref-base}%
222   [2018/11/21 v2.27 Module base for zref (H0)]%

```

6.2.3 Utilities

```

223 \RequirePackage{ltxcmds}[2010/12/02]
224 \RequirePackage{infwarerr}[2010/04/08]
225 \RequirePackage{kvsetkeys}[2010/03/01]
226 \RequirePackage{kvdefinekeys}[2010/03/01]
227 \RequirePackage{pdftexcmds}[2010/04/01]

```

\ZREF@name Several times the package name is used, thus we store it in **\ZREF@name**.

```

228 \def\ZREF@name{zref}

229 \ltx@ifundefined{protected}{%
230   \RequirePackage{makerobust}[2006/03/18]%

```

\ZREF@Robust

```

231   \def\ZREF@Robust#1#2{%
232     \def\ZREF@temp{\MakeRobustcommand#2}%
233     \afterassignment\ZREF@temp
234     #1#2%
235   }%

```

```

236 }{%-

\ZREF@Robust
237 \def\ZREF@Robust#1{%
238 \protected#1%
239 }%

240 }

\ZREF@IfDefinable
241 \def\ZREF@IfDefinable#1#2#3{%
242 \@ifdefinable{#1}{%
243 \ZREF@Robust{#2}#1#3%
244 }%
245 }

\ZREF@UpdatePdfTeX \ZREF@UpdatePdfTeX is used as help message text in error messages.
246 \def\ZREF@UpdatePdfTeX{Update pdfTeX.}

\ifZREF@found The following switch is used in list processing.
247 \newif\ifZREF@found

\ZREF@patch Macro \ZREF@patch first checks the existence of the command and safes it.
248 \def\ZREF@patch#1{%
249 \ltx@ifundefined{#1}{%
250 \ltx@gobble
251 }{%
252 \expandafter\let\csname ZREF@org@#1\expandafter\endcsname
253 \csname #1\endcsname
254 \ltx@firstofone
255 }%
256 }

```

6.2.4 Check for ε -TeX

The use of ε -TeX should be standard nowadays for L^AT_EX. We test for ε -TeX in order to use its features later.

```

257 \ltx@ifundefined{eTeXversion}{%
258 \PackageError\ZREF@name{%
259 Missing support for eTeX; package is abandoned%
260 }{%
261 Use a TeX compiler that support eTeX and enable eTeX %
262 in the format.%
263 }%
264 \endinput
265 }{}%

266 \RequirePackage{etexcmds}[2007/09/09]
267 \ifetex@unexpanded
268 \else
269 \PackageError\ZREF@name{%
270 Missing e-TeX's \string\unexpanded.\MessageBreak
271 Add \string\RequirePackage\string{etexcmds\string} before %
272 \string\documentclass%
273 }{%
274 Probably you are using some package (e.g. ConTeXt) that %
275 redefines \string\unexpanded%
276 }%
277 \expandafter\endinput
278 \fi

```

6.2.5 Auxiliary file stuff

We are using some commands in the `.aux` files. However sometimes these auxiliary files are interpreted by \LaTeX processes that haven't loaded this package (e.g. package `xr`). Therefore we provide dummy definitions.

```
279 \RequirePackage{auxhook}
280 \AddLineBeginAux{%
281   \string\providecommand\string\zref@newlabel[2]{}%
282 }
```

`\ZREF@RefPrefix`

```
283 \def\ZREF@RefPrefix{Z@R}
```

`\zref@newlabel` For the implementation of `\zref@newlabel` we call the same internal macro `\@newl@bel` that is used in `\newlabel`. Thus we have for free:

- `\Z@R@labelname` is defined.
- \LaTeX 's check for multiple references.
- \LaTeX 's check for changed references.

```
284 \ZREF@Robust\edef\zref@newlabel{%
285   \noexpand\@newl@bel{\ZREF@RefPrefix}%
286 }
```

6.2.6 Property lists

`\zref@newlist` Property lists are stored as list of property names enclosed in curly braces. `\zref@newlist` creates a new list as empty list. Assignments to property lists are global.

```
287 \ZREF@Robust\def\zref@newlist#1{%
288   \zref@iflistundefined{#1}{%
289     \@ifdefinable{Z@L@#1}{%
290       \global\expandafter\let\csname Z@L@#1\endcsname\ltx@empty
291       \PackageInfo\ZREF@name{New property list: #1}%
292     }%
293   }{%
294     \PackageError\ZREF@name{%
295       Property list `#1' already exists%
296     }\@ehc
297   }%
298 }
```

`\zref@iflistundefined` `\zref@iflistundefined` checks the existence of the property list `#1`. If the property list is present, then `#2` is executed and `#3` otherwise.

```
299 \def\zref@iflistundefined#1{%
300   \ltx@ifundefined{Z@L@#1}%
301 }
```

`\zref@listexists` `\zref@listexists` only executes `#2` if the property list `#1` exists and raises an error message otherwise.

```
302 \ZREF@Robust\def\zref@listexists#1{%
303   \zref@iflistundefined{#1}{%
304     \PackageError\ZREF@name{%
305       Property list `#1' does not exist%
306     }\@ehc
307   }%
308 }
```

`\zref@iflistcontainsprop` `\zref@iflistcontainsprop` checks, whether a property #2 is already present in a property list #1.

```

309 \ZREF@Robust\def\zref@iflistcontainsprop#1#2{%
310   \zref@iflistundefined{#1}{%
311     \ltx@secondoftwo
312   }{%
313     \begingroup\expandafter\endgroup
314     \expandafter\in@
315     \csname#2\expandafter\expandafter\expandafter\endcsname
316     \expandafter\expandafter\expandafter{\csname Z@L@#1\endcsname}%
317     \csname ltx@\ifin@ first\else second\fi oftwo\endcsname
318   }%
319 }

```

`\zref@listforloop`

```

320 \def\zref@listforloop#1#2{%
321   \zref@listexists{#1}{%
322     \expandafter\expandafter\expandafter\@tfor
323     \expandafter\expandafter\expandafter\zref@prop
324     \expandafter\expandafter\expandafter:%
325     \expandafter\expandafter\expandafter=%
326     \csname Z@L@#1\endcsname
327   \do{%
328     \begingroup
329     \escapechar=-1 %
330     \edef\x{\endgroup
331       \def\noexpand\zref@prop{%
332         \expandafter\string\zref@prop
333       }%
334     }%
335     \x
336     #2\zref@prop
337   }%
338 }%
339 }

```

`\zref@addprops` `\zref@addprop` adds the properties #2 to the property list #1, if the property is not already in the list. Otherwise a warning is given.

```

340 \ZREF@Robust\def\zref@addprops#1#2{%
341   \zref@listexists{#1}{%
342     \comma@parse{#2}{%
343       \zref@propexists\comma@entry{%
344         \zref@iflistcontainsprop{#1}\comma@entry{%
345           \PackageWarning\ZREF@name{%
346             Property '\comma@entry' is already in list `#1'%
347           }%
348         }{%
349           \begingroup\expandafter\endgroup
350           \expandafter\g@addto@macro
351           \csname Z@L@#1\expandafter\endcsname
352           \expandafter{\csname\comma@entry\endcsname}%
353         }%
354       }%
355     \ltx@gobble
356   }%
357 }%
358 }

```

`\zref@addprop` `\zref@addprop` adds the property #2 to the property list #1, if the property is not already in the list. Otherwise a warning is given.

```

359 \ZREF@Robust\def\zref@addprop#1#2{%
360   \zref@listexists{#1}{%
361     \zref@propexists{#2}{%
362       \zref@iflistcontainsprop{#1}{#2}{%
363         \PackageWarning\ZREF@name{%
364           Property `#2' is already in list `#1'%
365       }%
366     }%
367     \begingroup\expandafter\endgroup
368     \expandafter\g@addto@macro
369     \csname Z@L@#1\expandafter\endcsname
370     \expandafter{\csname#2\endcsname}%
371   }%
372 }%
373 }%
374 }
```

`\zref@localaddprops`

```

375 \ZREF@Robust\def\zref@localaddprops#1#2{%
376   \zref@listexists{#1}{%
377     \comma@parse{#2}{%
378       \zref@propexists\comma@entry{%
379         \zref@iflistcontainsprop{#1}\comma@entry{%
380           \PackageWarning\ZREF@name{%
381             Property `\'comma@entry' is already in list `#1'%
382         }%
383       }%
384       \begingroup\expandafter\endgroup
385       \expandafter\ltx@LocalAppendToMacro
386       \csname Z@L@#1\expandafter\endcsname
387       \expandafter{\csname\comma@entry\endcsname}%
388     }%
389   }%
390   \ltx@gobble
391 }%
392 }%
393 }
```

`\zref@localaddprop`

```

394 \ZREF@Robust\def\zref@localaddprop#1#2{%
395   \zref@listexists{#1}{%
396     \zref@propexists{#2}{%
397       \zref@iflistcontainsprop{#1}{#2}{%
398         \PackageWarning\ZREF@name{%
399           Property `#2' is already in list `#1'%
400       }%
401     }%
402     \begingroup\expandafter\endgroup
403     \expandafter\ltx@LocalAppendToMacro
404     \csname Z@L@#1\expandafter\endcsname
405     \expandafter{\csname#2\endcsname}%
406   }%
407 }%
408 }%
409 }
```

```

410 \ltx@ifundefined{pdf@strcmp}{%

\zref@delprop
411 \ZREF@Robust\def\zref@delprop{%
412 \ZREF@delprop\gdef
413 }%

\zref@localdelprop
414 \ZREF@Robust\def\zref@localdelprop{%
415 \ZREF@delprop\def
416 }%

\ZREF@delprop
417 \def\ZREF@delprop#1#2#3{%
418 \zref@listexists{#2}{%
419 \begingroup
420 \escapechar=-1 %
421 \def\ZREF@param{#3}%
422 \@onelevel@sanitize\ZREF@param
423 \toks@{}%
424 \expandafter\expandafter\expandafter\ZREF@@delprop
425 \csname Z@L@#2\endcsname!%
426 \expandafter\endgroup
427 \expandafter#1\csname Z@L@#2\expandafter\endcsname
428 \expandafter{%
429 \the\toks@
430 }%
431 }%
432 }%

\ZREF@@delprop
433 \def\ZREF@@delprop#1{%
434 \expandafter\ZREF@@delprop\expandafter{\string#1}#1%
435 }%

\ZREF@@@delprop
436 \def\ZREF@@@delprop#1#2{%
437 \ifx#2!%
438 \else
439 \def\ZREF@temp{#1}%
440 \@onelevel@sanitize\ZREF@temp
441 \ifx\ZREF@param\ZREF@temp
442 \else
443 \toks@\expandafter{%
444 \the\expandafter\toks@\csname#1\endcsname
445 }%
446 \fi
447 \expandafter\ZREF@@delprop
448 \fi
449 }%

450 }{%

\zref@delprop
451 \ZREF@Robust\def\zref@delprop{%
452 \ZREF@delprop\xdef
453 }%

```

```

\zref@localdelprop
454 \ZREF@Robust\def\zref@localdelprop{%
455 \ZREF@delprop\edef
456 }%

\ZREF@delprop
457 \def\ZREF@delprop#1#2#3{%
458 \zref@listexists{#2}{%
459 \def\ZREF@param{#3}%
460 \edef\ZREF@SavedEscapechar{\the\escapechar}%
461 \escapechar=-1 %
462 \expandafter#1\csname Z@L@#2%
463 \expandafter\expandafter\expandafter\endcsname{%
464 \expandafter\expandafter\expandafter\ZREF@@delprop
465 \csname Z@L@#2\endcsname!%
466 }%
467 \escapechar=\ZREF@SavedEscapechar\relax
468 }%
469 }%

\ZREF@@delprop Caution: #1 might be an \if or similar token.
470 \def\ZREF@@delprop#1{%
471 \expandafter\ZREF@@delprop\expandafter{\string#1}#1%
472 }%

\ZREF@@@delprop
473 \def\ZREF@@@delprop#1#2{%
474 \ifx#2!%
475 \else
476 \ifnum\pdf@strcmp{#1}{\ZREF@param}=\ltx@zero
477 \else
478 \expandafter\noexpand\csname#1\endcsname
479 \fi
480 \expandafter\ZREF@@delprop
481 \fi
482 }%

483 }

```

6.2.7 Properties

\zref@ifpropundefined **\zref@ifpropundefined** checks the existence of the property #1. If the property is present, then #2 is executed and #3 otherwise.

```

484 \def\zref@ifpropundefined#1{%
485 \ltx@ifundefined{Z@E@#1}%
486 }

```

\zref@propexists Some macros rely on the existence of a property. **\zref@propexists** only executes #2 if the property #1 exists and raises an error message otherwise.

```

487 \ZREF@Robust\def\zref@propexists#1{%
488 \zref@ifpropundefined{#1}{%
489 \PackageError\ZREF@name{%
490 Property `#1' does not exist%
491 }\@ehc
492 }%
493 }

```

`\zref@newprop` A new property is declared by `\zref@newprop`, the property name $\langle propname \rangle$ is given in #1. The property is created and configured. If the star form is given, then the expansion of the property value is delayed to page shipout time, when the reference is written to the `.aux` file.

`\Z@D@propname`: Stores the default value for this property.

`\Z@E@propname`: Extract function.

`\Z@X@propname`: Information whether the expansion of the property value is delayed to shipout time.

`\Z@C@propname`: Current value of the property.

```

494 \ZREF@Robust\def\zref@newprop{%
495   \ifstar{%
496     \let\ZREF@X\noexpand
497     \ZREF@newprop
498   }{%
499     \let\ZREF@X\ltx@empty
500     \ZREF@newprop
501   }%
502 }
```

`\ZREF@newprop`

```

503 \def\ZREF@newprop#1{%
504   \edef\ZREF@P{#1}%
505   \@onelevel@sanitize\ZREF@P
506   \begingroup
507   \ifx\ZREF@P\ZREF@par
508     \@PackageError\ZREF@name{%
509       Invalid property name `ZREF@P'%
510     }{%
511       The property name `par' is not allowed %
512       because of internal reasons.%
513       \MessageBreak
514       \@ehc
515     }%
516   \def\ZREF@@newprop[##1]##2{\endgroup}%
517   \else
518     \zref@ifpropundefined\ZREF@P{%
519       \endgroup
520       \PackageInfo\ZREF@name{%
521         New property: \ZREF@P
522       }%
523     }{%
524       \@PackageError\ZREF@name{%
525         Property `ZREF@P' already exists%
526       }{\@ehc}
527     \def\ZREF@@newprop[##1]##2{\endgroup}%
528   }%
529   \fi
530   \@ifnextchar[\ZREF@@newprop{\ZREF@@newprop[\zref@default]]}%
531 }
```

`\ZREF@par`

```

532 \def\ZREF@par{par}
533 \@onelevel@sanitize\ZREF@par
```


\ZREF@@newprop

```

534 \def\ZREF@@newprop[#1]{%
535   \global\@namedef{Z@D@\ZREF@P}{#1}%
536   \global\expandafter\let\csname Z@X@\ZREF@P\endcsname\ZREF@X
537   \begingroup\expandafter\endgroup
538   \expandafter\ZREF@@@newprop\csname\ZREF@P\endcsname
539   \expandafter\gdef\csname Z@C@\ZREF@P\endcsname{%
540     \zref@setcurrent\ZREF@P
541   }
542 \def\ZREF@@@newprop#1{%
543   \expandafter
544   \gdef\csname Z@E@\ZREF@P\endcsname##1##2##3\ZREF@nil{##2}%
545 }

```

\zref@showprop

```

546 \ZREF@Robust\def\zref@showprop#1{%
547   \zref@ifpropundefined{#1}{%
548     \@PackageInfoNoLine{\ZREF@name}{%
549       Show property `#1': <undefined>%
550     }%
551   }{%
552     \begingroup
553     \toks@\expandafter\expandafter\expandafter{%
554       \csname Z@C@#1\endcsname
555     }%
556     \edef\ZREF@value{\the\toks@}%
557     \ltx@onelevel@sanitize\ZREF@value
558     \toks@\expandafter\expandafter\expandafter{%
559       \csname Z@D@#1\endcsname
560     }%
561     \edef\ZREF@default{\the\toks@}%
562     \ltx@onelevel@sanitize\ZREF@default
563     \@PackageInfoNoLine{\ZREF@name}{%
564       Show property `#1':\MessageBreak
565       \expandafter\ifx\csname Z@X@#1\endcsname\ltx@empty
566         Immediate %
567       \else
568         Delayed %
569       \fi
570       value: [\ZREF@value]\MessageBreak
571       Default: [\ZREF@default]%
572     }%
573   \endgroup
574 }%
575 }

```

\zref@setcurrent \zref@setcurrent sets the current value for a property.

```

576 \ZREF@Robust\def\zref@setcurrent#1#2{%
577   \zref@propexists{#1}{%
578     \expandafter\def\csname Z@C@#1\endcsname{#2}%
579   }%
580 }

```

\ZREF@getcurrent \zref@getcurrent gets the current value for a property.

```

581 \def\ZREF@getcurrent#1{%
582   \romannumeral0%
583   \ltx@ifundefined{Z@C@#1}{%
584     \ltx@space

```

```

585 }{%
586   \expandafter\expandafter\expandafter\ltx@space
587   \csname Z@C@#1\endcsname
588 }%
589 }

```

`\ZREF@u@getcurrent`

```

590 \def\ZREF@wu@getcurrent#1{%
591   \etex@unexpanded\expandafter\expandafter\expandafter{%
592     \ZREF@getcurrent{#1}%
593   }%
594 }

```

`\zref@getcurrent`

```

595 \let\zref@getcurrent\ZREF@getcurrent

```

6.2.8 Reference generation

`\zref@label` Label macro that uses the main property list.

```

596 \ZREF@Robust\def\zref@label#1{%
597   \zref@labelbylist{#1}\ZREF@mainlist
598 }

```

`\zref@labelbylist` Label macro that stores the properties, specified in the property list #2.

```

599 \ZREF@Robust\def\zref@labelbylist#1#2{%
600   \@bsphack
601   \zref@listexists{#2}{%
602     \expandafter\expandafter\expandafter\ZREF@label
603     \expandafter\expandafter\expandafter{%
604       \csname Z@L@#2\endcsname
605     }{#1}%
606   }%
607   \@esphack
608 }

```

`\zref@labelbyprops` The properties are directly specified in a comma separated list.

```

609 \ZREF@Robust\def\zref@labelbyprops#1#2{%
610   \@bsphack
611   \begingroup
612   \toks@{}%
613   \comma@parse{#2}{%
614     \zref@ifpropundefined\comma@entry{%
615       \PackageWarning\ZREF@name{%
616         Property '\comma@entry' is not known%
617       }%
618     }{%
619       \toks@\expandafter{%
620         \the\expandafter\toks@\csname\comma@entry\endcsname
621       }%
622     }%
623     \ltx@gobble
624   }%
625   \expandafter\endgroup
626   \expandafter\ZREF@label\expandafter{\the\toks@}{#1}%
627   \@esphack
628 }

```

\zref@labelbykv

```

629 \ZREF@Robust\def\zref@labelbykv#1#2{%
630   \@bsphack
631   \begingroup
632     \let\Z@L@ZREF@temp\ltx@empty
633     \kvsetkeys{ZREF@LABEL}{#1}%
634     \ifZREF@immediate
635       \expandafter\zref@wrapper@immediate\expandafter{%
636         \expandafter\ZREF@label\expandafter{\Z@L@ZREF@temp}{#2}%
637       }%
638     \else
639       \expandafter\ZREF@label\expandafter{\Z@L@ZREF@temp}{#2}%
640     \fi
641   \endgroup
642   \@esphack
643 }

644 \kv@define@key{ZREF@LABEL}{prop}{%
645   \edef\ZREF@param{#1}%
646   \zref@propexists\ZREF@param{%
647     \zref@iflistcontainsprop{ZREF@temp}\ZREF@param{}{%
648       \begingroup\expandafter\endgroup
649       \expandafter\ltx@LocalAppendToMacro
650       \expandafter\Z@L@ZREF@temp
651       \expandafter{\csname\ZREF@param\endcsname}%
652     }%
653   }%
654 }

655 \kv@define@key{ZREF@LABEL}{list}{%
656   \zref@listforloop{#1}{%
657     \zref@iflistcontainsprop{ZREF@temp}\zref@prop{}{%
658       \begingroup\expandafter\endgroup
659       \expandafter\ltx@LocalAppendToMacro
660       \expandafter\Z@L@ZREF@temp
661       \expandafter{\csname\zref@prop\endcsname}%
662     }%
663     \ltx@gobble
664   }%
665 }

666 \kv@define@key{ZREF@LABEL}{delprop}{%
667   \zref@propexists{#1}{%
668     \zref@localdelprop{ZREF@temp}{#1}%
669   }%
670 }

671 \kv@define@key{ZREF@LABEL}{immediate}[true]{%
672   \edef\ZREF@param{#1}%
673   \ifx\ZREF@param\ZREF@true
674     \ZREF@immediatetrue
675   \else
676     \ifx\ZREF@param\ZREF@false
677       \ZREF@immediatefalse
678     \else
679       \PackageWarning\ZREF@name{%
680         Option `immediate' expects `true' or `false'.\MessageBreak
681         Ignoring invalid value ``\ZREF@param'%
682       }%
683     \fi
684   \fi

```

```

685 }

\ZREF@false

686 \def\ZREF@false{false}

\ZREF@true

687 \def\ZREF@true{true}

688 \kv@define@key{ZREF@LABEL}{values}[]{%
689   \kv@parse{#1}{%
690     \ifx\kv@value\relax
691       \@PackageWarning\ZREF@name{%
692         Missing value for property `kv@key'%
693       }%
694       \expandafter\ltx@gobbletwo
695     \else
696       \expandafter\zref@setcurrent
697     \fi
698   }%
699 }

```

`\ifZREF@immediate` The switch `\ifZREF@immediate` tells us, whether the label should be written immediately or at page shipout time. `\ZREF@label` need to be notified about this, because it must disable the deferred execution of property values, if the label is written immediately.

```
700 \newif\ifZREF@immediate
```

`\zref@wrapper@immediate` The argument of `\zref@wrapper@immediate` is executed inside a group where `\write` is redefined by adding `\immediate` before its execution. Also `\ZREF@label` is notified via the switch `\ifZREF@immediate`.

```

701 \ZREF@Robust{\long\def}\zref@wrapper@immediate#1{%
702   \begingroup
703   \ZREF@immediatetrue
704   \let\ZREF@org@write\write
705   \def\write{\immediate\ZREF@org@write}%
706   #1%
707   \endgroup
708 }

```

`\ZREF@label` `\ZREF@label` writes the data in the `.aux` file. `#1` contains the list of valid properties, `#2` the name of the reference. In case of immediate writing, the deferred execution of property values is disabled. Also `\ZREF@label` is made expandable in this case.

```

709 \def\ZREF@label#1#2{%
710   \if@filesw
711     \begingroup
712     \ifZREF@immediate
713       \let\ZREF@org@thepage\thepage
714     \fi
715     \protected@write\@auxout{%
716       \ifZREF@immediate
717         \let\thepage\ZREF@org@thepage
718       \fi
719       \let\ZREF@temp\ltx@empty
720       \@tfor\ZREF@P:=#1\do{%
721         \begingroup
722         \escapechar=-1 %
723         \edef\x{\endgroup

```

```

724         \def\noexpand\ZREF@P{%
725             \expandafter\string\ZREF@P
726         }%
727     }%
728     \x
729     \expandafter\ifx
730         \csname
731             \ifZREF@immediate
732                 relax%
733             \else
734                 Z@X@\ZREF@P%
735             \fi
736         \endcsname
737         \noexpand
738         \expandafter\let\csname Z@C@\ZREF@P\endcsname\relax
739     \fi
740     \toks@\expandafter{\ZREF@temp}%
741     \edef\ZREF@temp{%
742         \the\toks@
743         \ltx@backslashchar\ZREF@P{%
744             \expandafter\noexpand\csname Z@C@\ZREF@P\endcsname
745         }%
746     }%
747 }%
748 }{%
749     \string\zref@newlabel{#2}{\ZREF@temp}%
750 }%
751 \endgroup
752 \fi
753 }
754 \def\ZREF@addtoks#1{%
755     \toks@\expandafter\expandafter\expandafter{%
756         \expandafter\the\expandafter\toks@#1%
757     }%
758 }

```

6.2.9 Reference querying and extracting

Design goal for the extracting macros is that the extraction process is full expandable. Thus these macros can be used in expandable contexts. But there are problems that cannot be solved by full expandable macros:

- In standard \LaTeX undefined references sets a flag and generate a warning. Both actions are not expandable.
- Babel's support for its shorthand uses commands that use non-expandable assignments. However currently there is hope, that primitives are added to \pdfTeX that allows the detection of contexts. Then the shorthand can detect, if they are executed inside \csname and protect themselves automatically.

$\text{\zref@ifrefundefined}$ If a reference #1 is undefined, then macro $\text{\zref@ifrefundefined}$ calls #2 and #3 otherwise.

```

759 \def\zref@ifrefundefined#1{%
760     \ltx@ifundefined{Z@R@#1}%
761 }

```

`\zifrefundefined` If a reference #1 is undefined, then macro `\zref@ifrefundefined` calls #2 and #3 otherwise. Also the reference is marked used.

```
762 \ZREF@ifDefinable\zifrefundefined\def{%
763   #1{%
764     \zref@wrapper@babel\ZREF@ifrefundefined{#1}%
765   }%
766 }
```

`\ZREF@ifrefundefined`

```
767 \def\ZREF@ifrefundefined#1{%
768   \zref@refused{#1}%
769   \zref@ifrefundefined{#1}%
770 }
```

`\zref@refused` The problem with undefined references is addressed by the macro `\zref@refused`. This can be used outside the expandable context. In case of an undefined reference the flag is set to notify L^AT_EX and a warning is given.

```
771 \ZREF@Robust\def\zref@refused#1{%
772   \zref@wrapper@babel\ZREF@refused{#1}%
773 }
```

`\ZREF@refused`

```
774 \def\ZREF@refused#1{%
775   \zref@ifrefundefined{#1}{%
776     \protect\G@refundefinedtrue
777     \@latex@warning{%
778       Reference `#1' on page \thepage \space undefined%
779     }%
780   }{}%
781 }
```

`\zref@ifrefcontainsprop` `\zref@ifrefcontainsprop` looks, if the reference #1 has the property #2 and calls then #3 and #4 otherwise.

```
782 \def\zref@ifrefcontainsprop#1#2{%
783   \zref@ifrefundefined{#1}{%
784     \ltx@secondoftwo
785   }{%
786     \expandafter\ZREF@ifrefcontainsprop
787     \csname Z@E@#2\expandafter\endcsname
788     \csname#2\expandafter\expandafter\expandafter\endcsname
789     \expandafter\expandafter\expandafter{%
790       \csname Z@R@#1\endcsname
791     }%
792   }%
793 }
794 \def\ZREF@ifrefcontainsprop#1#2#3{%
795   \expandafter\ifx\expandafter\ZREF@novalue
796   #1#3#2\ZREF@novalue\ZREF@nil\ltx@empty
797   \expandafter\ltx@secondoftwo
798   \else
799   \expandafter\ltx@firstoftwo
800   \fi
801 }
802 \def\ZREF@novalue{\ZREF@NOVALUE}
```

`\zref@extract` `\zref@extract` is an abbreviation for the case that the default of the property is used as default value.

```

803 \def\ZREF@extract#1#2{%
804   \romannumeral0%
805   \ltx@ifundefined{Z@D@#2}{%
806     \expandafter\ltx@space\zref@default
807   }{%
808     \expandafter\expandafter\expandafter\ZREF@@extract
809     \expandafter\expandafter\expandafter{%
810       \csname Z@D@#2\endcsname
811     }{#1}{#2}%
812   }%
813 }

\ZREF@@extract

814 \def\ZREF@@extract#1#2#3{%
815   \expandafter\expandafter\expandafter\ltx@space
816   \zref@extractdefault{#2}{#3}{#1}%
817 }

\ZREF@wu@extract

818 \def\ZREF@wu@extract#1#2{%
819   \etex@unexpanded\expandafter\expandafter\expandafter{%
820     \ZREF@extract{#1}{#2}%
821   }%
822 }

\zref@extract

823 \let\zref@extract\ZREF@extract

\ZREF@extractdefault The basic extracting macro is \zref@extractdefault with the reference name in
#1, the property in #2 and the default value in #3 in case for problems.

824 \def\ZREF@extractdefault#1#2#3{%
825   \romannumeral0%
826   \zref@ifrefundefined{#1}\ltx@firstoftwo{%
827     \zref@ifpropundefined{#2}\ltx@firstoftwo\ltx@secondoftwo
828   }{%
829     \ltx@space
830     #3%
831   }{%
832     \expandafter\expandafter\expandafter\ltx@space
833     \csname Z@E@#2\expandafter\expandafter\expandafter\endcsname
834     \csname Z@R@#1\expandafter\endcsname
835     \csname#2\endcsname{#3}\ZREF@nil
836   }%
837 }

\ZREF@wu@extractdefault

838 \def\ZREF@wu@extractdefault#1#2#3{%
839   \etex@unexpanded\expandafter\expandafter\expandafter{%
840     \ZREF@extractdefault{#1}{#2}{#3}%
841   }%
842 }

\zref@extractdefault

843 \let\zref@extractdefault\ZREF@extractdefault

\zref@def@extract

844 \ZREF@Robust\def\zref@def@extract#1{%
845   \zref@wrapper@babel{\ZREF@def@extract{#1}}%
846 }

```

\ZREF@def@extract

```

847 \def\ZREF@def@extract#1#2#3{%
848   \zref@refused{#2}%
849   \expandafter\expandafter\expandafter\def
850   \expandafter\expandafter\expandafter#1%
851   \expandafter\expandafter\expandafter{%
852     \zref@extract{#2}{#3}%
853   }%
854 }

```

\zref@def@extractdefault

```

855 \ZREF@Robust\def\zref@def@extractdefault#1{%
856   \zref@wrapper@babel{\ZREF@def@extractdefault{#1}}%
857 }

```

\ZREF@def@extractdefault

```

858 \def\ZREF@def@extractdefault#1#2#3#4{%
859   \zref@refused{#2}%
860   \expandafter\expandafter\expandafter\def
861   \expandafter\expandafter\expandafter#1%
862   \expandafter\expandafter\expandafter{%
863     \zref@extractdefault{#2}{#3}{#4}%
864   }%
865 }

```

\ZREF@wrapper@unexpanded

```

866 \ZREF@Robust{\long\def}\ZREF@wrapper@unexpanded#1{%
867   \let\zref@wrapper@unexpanded\ltx@firstofone
868   \let\zref@getcurrent\ZREF@wu@getcurrent
869   \let\zref@extractdefault\ZREF@wu@extractdefault
870   \let\zref@extract\ZREF@wu@extract
871   #1%
872   \let\zref@wrapper@unexpanded\ZREF@wrapper@unexpanded
873   \let\zref@getcurrent\ZREF@getcurrent
874   \let\zref@extractdefault\ZREF@extractdefault
875   \let\zref@extract\ZREF@extract
876 }

```

\zref@wrapper@unexpanded

```

877 \ltx@ifUndefined{etex@unexpanded}{%
878   \let\zref@wrapper@unexpanded\ltx@firstofone
879 }{%
880   \let\zref@wrapper@unexpanded\ZREF@wrapper@unexpanded
881 }

```

6.2.10 Compatibility with babel

\zref@wrapper@babel

```

882 \ZREF@Robust{\long\def}\zref@wrapper@babel#1#2{%
883   \ifcsname if@safe@actives\endcsname
884     \expandafter\ltx@firstofone
885   \else
886     \expandafter\ltx@secondoftwo
887   \fi
888   {%
889     \if@safe@actives
890       \expandafter\ltx@secondoftwo

```



```

891 \else
892 \expandafter\ltx@firstoftwo
893 \fi
894 {%
895 \begingroup
896 \csname @safe@activetrue\endcsname
897 \edef\x{#2}%
898 \expandafter\endgroup
899 \expandafter\ZREF@wrapper@babel\expandafter{\x}{#1}%
900 }%
901 }{%
902 #1{#2}%
903 }%
904 }
905 \long\def\ZREF@wrapper@babel#1#2{%
906 #2{#1}%
907 }

```

6.2.11 Unique counter support

`\zref@require@unique` Generate the counter `zref@unique` if the counter does not already exist.

```

908 \ZREF@Robust\def\zref@require@unique{%
909 \ifundefined{c@zref@unique}{%
910 \begingroup
911 \let\@addtoreset\ltx@gobbletwo
912 \newcounter{zref@unique}%
913 \endgroup

```

`\thezref@unique` `\thezref@unique` is used for automatically generated unique labelnames.

```

914 \renewcommand*{\thezref@unique}{%
915 zref@number\c@zref@unique
916 }%
917 }{}%
918 }

```

6.2.12 Utilities

`\ZREF@number`

```

919 \ltx@ifundefined{numexpr}{%
920 \def\ZREF@number#1{\number#1}%
921 }{%
922 \def\ZREF@number#1{\the\numexpr(#1)\relax}%
923 }

```

6.2.13 Setup

`\zref@setdefault` Standard L^AT_EX prints “??” in bold face if a reference is not known. `\zref@default` holds the text that is printed in case of unknown references and is used, if the default was not specified during the definition of the new property by `\ref@newprop`. The global default value can be set by `\zref@setdefault`.

```

924 \ZREF@Robust\def\zref@setdefault#1{%
925 \def\zref@default{#1}%
926 }

```

`\zref@default` Now we initialize `\zref@default` with the same value that L^AT_EX uses for its undefined references.

```

927 \zref@setdefault{%

```

```

928 \nfss@text{\reset@font\bfseries ??}%
929 }

```

Main property list.

`\zref@setmainlist` The name of the default property list is stored in `\ZREF@mainlist` and can be set by `\zref@setmainlist`.

```

930 \ZREF@Robust\def\zref@setmainlist#1{%
931   \def\ZREF@mainlist{#1}%
932 }
933 \zref@setmainlist{main}

```

Now we create the list.

```

934 \zref@newlist\ZREF@mainlist

```

Main properties. The two properties `default` and `page` are created and added to the main property list. They store the data that standard L^AT_EX uses in its references created by `\label`.

default the apperance of the latest counter that is incremented by `\refstepcounter`

page the apperance of the page counter

```

935 \zref@newprop{default}{\@currentlabel}
936 \zref@newprop*{page}{\thepage}
937 \zref@addprops\ZREF@mainlist{default,page}

```

Properties

`\ZREF@NewPropAnchor`

```

938 \def\ZREF@NewPropAnchor{%
939   \zref@newprop{anchor}{%
940     \ltx@ifundefined{@currentHref}{-}{\@currentHref}}%
941   }%
942   \global\let\ZREF@NewPropAnchor\relax
943 }

```

`\zref@titleref@current` Later we will redefine the section and caption macros to catch the current title and remember the value in `\zref@titleref@current`.

`\ZREF@NewPropTitle`

```

944 \def\ZREF@NewPropTitle{%
945   \gdef\zref@titleref@current{}%
946   \zref@newprop{title}{\zref@titleref@current}%
947   \global\let\ZREF@NewPropTitle\relax
948 }

```

`\ZREF@NewPropTheotype`

```

949 \def\ZREF@NewPropTheotype{%
950   \zref@newprop{theotype}{}%
951   \global\let\ZREF@NewPropTheotype\relax
952 }

```

`\ZREF@NewPropPageValue`

```

953 \def\ZREF@NewPropPageValue{%
954   \zref@newprop*{pagevalue}[0]{\number\c@page}%
955   \global\let\ZREF@NewPropPageValue\relax
956 }

```

Mark successful loading

```
957 \let\ZREF@base@ok=Y
958 \base
```

6.3 Module user

```
959 (*user)
960 \NeedsTeXFormat{LaTeX2e}
961 \ProvidesPackage{zref-user}%
962   [2018/11/21 v2.27 Module user for zref (H0)]%
963 \RequirePackage{zref-base}[2018/11/21]
964 \ifx\ZREF@base@ok Y%
965 \else
966   \expandafter\endinput
967 \fi
```

Module `user` enables a small user interface. All macros are prefixed by `\z`.

First we define the pendants to the standard \LaTeX referencing commands `\label`, `\ref`, and `\pageref`.

`\zlabel` Similar to `\label` the macro `\zlabel` writes a reference entry in the `.aux` file. The main property list is used. Also we add the `babel` patch. The `\label` command can also be used inside section titles, but it must not go into the table of contents. Therefore we have to check this situation.

```
968 \newcommand*\zlabel{%
969   \ifx\label\ltx@gobble
970     \expandafter\ltx@gobble
971   \else
972     \expandafter\zref@wrapper@babel\expandafter\zref@label
973   \fi
974 }%
```

`\zkvlabel`

```
975 \newcommand*\zkvlabel}[1]{%
976   \ifx\label\ltx@gobble
977     \expandafter\ltx@gobblethree
978   \fi
979   \zref@wrapper@babel{\zref@labelbykv{#1}}%
980 }%
```

`\zref` Macro `\zref` is the corresponding macro for `\ref`. Also it provides an optional argument in order to select another property.

```
981 \newcommand*\zref}[2][default]{% robust because of optional argument
982   \zref@propexists{#1}{%
983     \zref@wrapper@babel\ZREF@zref{#2}{#1}%
984   }%
985 }%
986 \def\ZREF@zref#1{%
987   \zref@refused{#1}%
988   \zref@extract{#1}%
989 }%
```

`\zpageref` For macro `\zpageref` we just call `\zref` with property `page`.

```
990 \ZREF@IfDefinable\zpageref\def{%
991   {\zref[page]}%
992 }
```

`\zrefused` For the following expandible user macros `\zrefused` should be used to notify L^AT_EX in case of undefined references.

```

993 \ZREF@ifDefinable\zrefused\def{%
994   {\zref@refused}%
995 }

996 \user

```

6.4 Module `abspage`

```

997 \*abspage
998 \NeedsTeXFormat{LaTeX2e}
999 \ProvidesPackage{zref-abspage}%
1000 [2018/11/21 v2.27 Module abspage for zref (HO)]%
1001 \RequirePackage{zref-base}[2018/11/21]
1002 \ifx\ZREF@base@ok Y%
1003 \else
1004   \expandafter\endinput
1005 \fi

```

Module `abspage` adds a new property `abspage` to the main property list for absolute page numbers. These are recorded by the help of package `atbegshi`.

```

1006 \RequirePackage{atbegshi}[2011/10/05]%

```

The counter `abspage` must not go in the clear list of `@ckpt` that is used to set counters in `.aux` files of included T_EX files.

```

1007 \begingroup
1008   \let\@addtoreset\ltx@gobbletwo
1009   \newcounter{abspage}%
1010 \endgroup
1011 \setcounter{abspage}{0}%
1012 \AtBeginShipout{%
1013   \stepcounter{abspage}%
1014 }%
1015 \zref@newprop*{abspage}[0]{\the\c@abspage}%
1016 \zref@addprop\ZREF@mainlist{abspage}%

```

Note that counter `abspage` shows the previous page during page processing. Before shipout the counter is incremented. Thus the property is correctly written with deferred writing. If the counter is written using `\zref@wrapper@immediate`, then the number is too small by one.

```

1017 \abspage

```

6.5 Module `counter`

```

1018 \*counter
1019 \NeedsTeXFormat{LaTeX2e}
1020 \ProvidesPackage{zref-counter}%
1021 [2018/11/21 v2.27 Module counter for zref (HO)]%
1022 \RequirePackage{zref-base}[2018/11/21]
1023 \ifx\ZREF@base@ok Y%
1024 \else
1025   \expandafter\endinput
1026 \fi

```

For features such as `hyperref`'s `\autoref` we need the name of the counter. The property `counter` is defined and added to the main property list.

```

1027 \zref@newprop{counter}{ }
1028 \zref@addprop\ZREF@mainlist{counter}

```

`\refstepcounter` is the central macro where we know which counter is responsible for the reference.

```

1029 \AtBeginDocument{%
1030   \ZREF@patch{refstepcounter}{%
1031     \def\refstepcounter#1{%
1032       \zref@setcurrent{counter}{#1}%
1033       \ZREF@org@refstepcounter{#1}%
1034     }%
1035   }%
1036 }
1037 </counter>

```

6.6 Module `lastpage`

```

1038 (*lastpage)
1039 \NeedsTeXFormat{LaTeX2e}
1040 \ProvidesPackage{zref-lastpage}%
1041   [2018/11/21 v2.27 Module lastpage for zref (HO)]%
1042 \RequirePackage{zref-base}[2018/11/21]
1043 \RequirePackage{zref-abspage}[2018/11/21]
1044 \RequirePackage{atveryend}[2009/12/07]
1045 \ifx\ZREF@base@ok Y%
1046 \else
1047   \expandafter\endinput
1048 \fi

```

The module `lastpage` implements the service of package `lastpage` by setting a reference `LastPage` at the end of the document. If module `abspage` is given, also the absolute page number is available, because the properties of the main property list are used.

```

1049 \zref@newlist{LastPage}
1050 \AfterLastShipout{%
1051   \if@filesw
1052     \begingroup
1053       \advance\c@page\m@ne
1054       \toks@\expandafter\expandafter\expandafter{%
1055         \expandafter\Z@L@main
1056         \Z@L@LastPage
1057       }%
1058       \expandafter\zref@wrapper@immediate\expandafter{%
1059         \expandafter\ZREF@label\expandafter{\the\toks@}{LastPage}%
1060       }%
1061     \endgroup
1062   \fi
1063 }

```

`\zref@iflastpage`

```

1064 \def\zref@iflastpage#1{%
1065   \ifnum\zref@extractdefault{#1}{abspage}{-1}=%
1066     \zref@extractdefault{LastPage}{abspage}{-2} %
1067     \expandafter\ltx@firstoftwo
1068   \else
1069     \expandafter\ltx@secondoftwo
1070   \fi
1071 }

```

`\ziflastpage`

```

1072 \ZREF@ifDefinable\ziflastpage\def{%
1073   {\zref@wrapper@babel\ZREF@iflastpage}%
1074 }

```

ZREF@iflastpage

```
1075 \def\ZREF@iflastpage#1{%
1076   \zref@refused{LastPage}%
1077   \zref@refused{#1}%
1078   \zref@iflastpage{#1}%
1079 }
```

```
1080 \end{lastpage}
```

6.7 Module thepage

```
1081 (*thepage)
1082 \NeedsTeXFormat{LaTeX2e}
1083 \ProvidesPackage{zref-thepage}%
1084   [2018/11/21 v2.27 Module thepage for zref (HO)]%
1085 \RequirePackage{zref-base}[2018/11/21]
1086 \ifx\ZREF@base@ok Y%
1087 \else
1088   \expandafter\endinput
1089 \fi

1090 \RequirePackage{atbegshi}[2011/10/05]
1091 \RequirePackage{zref-abspage}[2018/11/21]

1092 \zref@newlist{thepage}
1093 \zref@addprop{thepage}{page}
1094 \ZREF@NewPropPageValue
```

\zref@thepage@atbegshi@hook

```
1095 \let\zref@thepage@atbegshi@hook\ltx@empty

1096 \zref@addprop{thepage}{pagevalue}
1097 \AtBeginShipout{%
1098   \AtBeginShipoutAddToBox{%
1099     \zref@thepage@atbegshi@hook
1100     \zref@labelbylist{thepage\the\value{abspage}}{thepage}%
1101   }%
1102 }
```

\zref@thepage@name

```
1103 \ltx@ifundefined{numexpr}{%
1104   \def\zref@thepage@name#1{thepage\number#1}%
1105 }{%
1106   \def\zref@thepage@name#1{thepage\the\numexpr#1}%
1107 }
```

\zref@thepage

```
1108 \def\zref@thepage#1{%
1109   \zref@extract{\zref@thepage@name{#1}}{page}%
1110 }%
```

\zref@thepage@refused

```
1111 \ZREF@Robust\def\zref@thepage@refused#1{%
1112   \zref@refused{\zref@thepage@name{#1}}%
1113 }%
```

\zthepage

```
1114 \ZREF@ifdefinable\zthepage\def{%
1115   #1{%
```

```

1116 \zref@thepage@refused{#1}%
1117 \zref@thepage{#1}%
1118 }%
1119 }

1120 </thepage>

```

6.8 Module nextpage

```

1121 (*nextpage)
1122 \NeedsTeXFormat{LaTeX2e}
1123 \ProvidesPackage{zref-nextpage}%
1124 [2018/11/21 v2.27 Module nextpage for zref (HO)]%
1125 \RequirePackage{zref-base}[2018/11/21]
1126 \ifx\ZREF@base@ok Y%
1127 \else
1128 \expandafter\endinput
1129 \fi

1130 \RequirePackage{zref-abspage}[2018/11/21]
1131 \RequirePackage{zref-thepage}[2018/11/21]
1132 \RequirePackage{zref-lastpage}[2018/11/21]
1133 \RequirePackage{uniquecounter}[2009/12/18]

1134 \UniqueCounterNew{znnextpage}
1135
1136 \newcommand*{\znnextpagesetup}{%
1137 \afterassignment\ZREF@np@setup@i
1138 \def\ZREF@np@call@unknown##1%
1139 }
1140 \def\ZREF@np@setup@i{%
1141 \afterassignment\ZREF@np@setup@ii
1142 \def\ZREF@np@call@nonext##1%
1143 }
1144 \def\ZREF@np@setup@ii{%
1145 \def\ZREF@np@call@next##1%
1146 }
1147 \def\ZREF@np@call@unknown#1{#1}
1148 \def\ZREF@np@call@nonext#1{#1}
1149 \def\ZREF@np@call@next#1{#1}
1150 \ZREF@ifDefinable{znnextpage}\def{%
1151 {\UniqueCounterCall{znnextpage}{\ZREF@nextpage}}%
1152 }%
1153 \newcommand*{\znnonextpagename}{}
1154 \newcommand*{\zunknownnextpagename}{\Z@D@page}
1155 \def\ZREF@nextpage#1{%
1156 \begingroup
1157 \def\ZREF@refname@this{zref@np#1}%
1158 \zref@labelbyprops\ZREF@refname@this{abspage}%
1159 \chardef\ZREF@call=0 % unknown
1160 \ZREF@ifrefundefined\ZREF@refname@this{%
1161 }{%
1162 \edef\ZREF@pagenum@this{%
1163 \zref@extractdefault\ZREF@refname@this{abspage}{0}%
1164 }%
1165 \edef\ZREF@refname@next{%
1166 \zref@thepage@name{%
1167 \the\numexpr\ZREF@pagenum@this+1%
1168 }%
1169 }%

```

```

1170 \ifnum\ZREF@pagenum@this>0 %
1171 \ZREF@ifrefundefined{LastPage}{%
1172 \zref@ifrefundefined\ZREF@refname@next{%
1173 }{%
1174 \chardef\ZREF@call=2 % next page
1175 }%
1176 }{%
1177 \edef\ZREF@pagenum@last{%
1178 \zref@extractdefault{LastPage}{abspage}{0}%
1179 }%
1180 \ifnum\ZREF@pagenum@this<\ZREF@pagenum@last\ltx@space
1181 \ZREF@ifrefundefined\ZREF@refname@next{%
1182 }{%
1183 \chardef\ZREF@call=2 % next page
1184 }%
1185 \else
1186 \ifnum\ZREF@pagenum@this=\ZREF@pagenum@this\ltx@space
1187 \chardef\ZREF@call=1 % no next page
1188 \fi
1189 \fi
1190 }%
1191 \fi
1192 }%
1193 \edef\x{%
1194 \endgroup
1195 \ifcase\ZREF@call
1196 \noexpand\ZREF@np@call@unknown{%
1197 \noexpand\zunknownnextpagename
1198 }%
1199 \or
1200 \noexpand\ZREF@np@call@nonext{%
1201 \noexpand\znonextpagename
1202 }%
1203 \else
1204 \noexpand\ZREF@np@call@next{%
1205 \noexpand\zref@extract{\ZREF@refname@next}{page}%
1206 }%
1207 \fi
1208 }%
1209 \x
1210 }
1211 </nextpage>

```

6.9 Module totpages

```

1212 <*totpages>
1213 \NeedsTeXFormat{LaTeX2e}
1214 \ProvidesPackage{zref-totpages}%
1215 [2018/11/21 v2.27 Module totpages for zref (HO)]%
1216 \RequirePackage{zref-base}[2018/11/21]
1217 \ifx\ZREF@base@ok Y%
1218 \else
1219 \expandafter\endinput
1220 \fi

```

The absolute page number of the last page is the total page number.

```

1221 \RequirePackage{zref-abspage}[2018/11/21]
1222 \RequirePackage{zref-lastpage}[2018/11/21]

```


`\ztotpages` Macro `\ztotpages` contains the number of pages. It can be used inside expandable calculations. It expands to zero if the reference is not yet available.

```
1223 \newcommand*{\ztotpages}{%
1224   \zref@extractdefault{LastPage}{abspage}{0}%
1225 }
```

Also we mark the reference `LastPage` as used:

```
1226 \AtBeginDocument{%
1227   \zref@refused{LastPage}%
1228 }
1229 \totpages)
```

6.10 Module pagelayout

```
1230 (*pagelayout)
1231 \NeedsTeXFormat{LaTeX2e}
1232 \ProvidesPackage{zref-pagelayout}%
1233   [2018/11/21 v2.27 Module pagelayout for zref (HO)]%
1234 \RequirePackage{zref-base}[2018/11/21]
1235 \ifx\ZREF@base@ok Y%
1236 \else
1237   \expandafter\endinput
1238 \fi
1239 \RequirePackage{zref-thepage}[2018/11/21]
1240 \RequirePackage{ifluatex}[2010/03/01]
1241 \RequirePackage{atveryend}[2010/03/24]
```

6.10.1 Support for LuaT_EX

```
1242 \ifluatex
1243   \ifnum\luatexversion<39 %
1244   \else
1245     \begingroup
1246       \escapechar=-1 %
1247       \def\ZREF@temp#1{%
1248         \ltx@ifundefined{\string#1}{%
1249           \let#1\ltx@undefined
1250           \directlua{%
1251             if tex.enableprimitives then %
1252               tex.enableprimitives('', {\string#1})%
1253             end%
1254           }%
1255         \ltx@ifundefined{\string#1}{%
1256           }{%
1257             \global#1=#1%
1258             \@PackageInfoNoLine{zref-pagelayout}{%
1259               \string#1 enabled%
1260             }%
1261           }%
1262         }{%
1263           }%
1264         \ZREF@temp\pdfpagewidth
1265         \ZREF@temp\pdfpageheight
1266         \ZREF@temp\pdfhorigin
1267         \ZREF@temp\pdfvorigin
1268       \endgroup
1269     \fi
1270 \fi
```

6.10.2 Define layout properties

```

1271 \def\ZREF@temp#1{%
1272   \begingroup
1273   \escapechar=-1 %
1274   \ltx@ifundefined{\string#1}{\endgroup}{%
1275     \edef\x{%
1276       \endgroup
1277       \noexpand\zref@newprop*{\string#1}%
1278                                     [\noexpand\number\noexpand#1]% hash-ok
1279                                     {\noexpand\number\noexpand#1}%
1280       \noexpand\zref@addprop{thepage}{\string#1}%
1281     }%
1282     \x
1283   }%
1284 }
1285 \ZREF@temp\mag
1286 \ZREF@temp\paperwidth
1287 \ZREF@temp\paperheight
1288 \ZREF@temp\stockwidth % memoir.cls, crop.sty
1289 \ZREF@temp\stockheight % memoir.cls, crop.sty
1290 \ZREF@temp\mediawidth % VTeX
1291 \ZREF@temp\mediaheight % VTeX
1292 \ZREF@temp\pdfpagewidth
1293 \ZREF@temp\pdfpageheight
1294 \ZREF@temp\pdfhorigin
1295 \ZREF@temp\pdfvorigin
1296 \ZREF@temp\hoffset
1297 \ZREF@temp\voffset
1298 \ZREF@temp\topmargin
1299 \ZREF@temp\oddsidemargin
1300 \ZREF@temp\evensidemargin
1301 \ZREF@temp\textwidth
1302 \ZREF@temp\textheight
1303 \ZREF@temp\headheight
1304 \ZREF@temp\headsep
1305 \ZREF@temp\footskip
1306 \ZREF@temp\marginparwidth
1307 \ZREF@temp\marginparsep
1308 \ZREF@temp\columnwidth
1309 \ZREF@temp\columnsep
1310 \ZREF@temp\trimedge % memoir.cls
1311 \ZREF@temp\spinemargin % memoir.cls
1312 \ZREF@temp\foremargin % memoir.cls
1313 \ZREF@temp\trintop % memoir.cls
1314 \ZREF@temp\uppermargin % memoir.cls
1315 \ZREF@temp\headmargin % memoir.cls
1316 \zref@newprop*{outputboxwd}[Opt]{\AtBeginShipoutBoxWidth}
1317 \zref@newprop*{outputboxht}[Opt]{\AtBeginShipoutBoxHeight}
1318 \zref@newprop*{outputboxdp}[Opt]{\AtBeginShipoutBoxDepth}
1319 \zref@addprops{thepage}{outputboxwd,outputboxht,outputboxdp}

\ifZREF@pl@list
1320 \ltx@newif\ifZREF@pl@list

\zref@listpagelayout
1321 \ZREF@IfDefinable\zlistpagelayout\def{%

```

```

1322 {\global\ZREF@pl@listtrue}%
1323 }

\ZREF@pl@AfterLastShipout
1324 \def\ZREF@pl@AfterLastShipout{%
1325   \ifZREF@pl@list
1326     \edef\ZREF@page@max{\the\value{abspage}}%
1327     \ltx@ifundefined{ZREF@org@testdef}{%
1328       \let\ZREF@org@testdef\@testdef
1329       \def\@testdef##1##2##3{%
1330         \ZREF@org@testdef{##1}{##2}{##3}%
1331         \def\ZREF@temp{##1}%
1332         \ifx\ZREF@temp\ZREF@RefPrefix
1333           \expandafter\gdef\csname##1@##2\endcsname{##3}%
1334         \fi
1335       }%
1336     }{}%
1337     \AtVeryEndDocument{\ZREF@pl@AtVeryEnd}%
1338   \fi
1339 }

\ZREF@pl@AtVeryEnd
1340 \def\ZREF@pl@AtVeryEnd{%
1341   \begingroup
1342   \toks@{Page layout parameters:\MessageBreak}%
1343   \count@=1 %
1344   \ZREF@pl@ListPage
1345   \edef\x{\endgroup
1346     \noexpand\@PackageInfoNoLine{zref-pagelayout}{\the\toks@}%
1347   }%
1348   \x
1349 }

\ZREF@pl@ListPage
1350 \def\ZREF@pl@ListPage{%
1351   \edef\x{%
1352     \toks@={%
1353       \the\toks@
1354       Page \the\count@:\noexpand\MessageBreak
1355       \zref@ifrefundefined{thepage\the\count@}{}{%
1356         \ltx@space\ltx@space mag = %
1357         \zref@extract{thepage\the\count@}{mag}%
1358         \noexpand\MessageBreak
1359         \ZREF@pl@ListEntry{paperwidth}%
1360         \ZREF@pl@ListEntry{paperheight}%
1361         \ZREF@pl@ListEntry{stockwidth}%
1362         \ZREF@pl@ListEntry{stockheight}%
1363         \ZREF@pl@ListEntry{mediawidth}%
1364         \ZREF@pl@ListEntry{mediaheight}%
1365         \ZREF@pl@ListEntry{pdfpagewidth}%
1366         \ZREF@pl@ListEntry{pdfpageheight}%
1367         \ZREF@pl@ListEntry{pdfhorigin}%
1368         \ZREF@pl@ListEntry{pdfvorigin}%
1369         \ZREF@pl@ListEntry{hoffset}%
1370         \ZREF@pl@ListEntry{voffset}%
1371         \ZREF@pl@ListEntry{topmargin}%
1372         \ZREF@pl@ListEntry{oddsidemargin}%
1373         \ZREF@pl@ListEntry{evensidemargin}%

```

```

1374 \ZREF@pl@ListEntry{textwidth}%
1375 \ZREF@pl@ListEntry{textheight}%
1376 \ZREF@pl@ListEntry{headheight}%
1377 \ZREF@pl@ListEntry{headsep}%
1378 \ZREF@pl@ListEntry{footskip}%
1379 \ZREF@pl@ListEntry{marginparwidth}%
1380 \ZREF@pl@ListEntry{marginparsep}%
1381 \ZREF@pl@ListEntry{columnwidth}%
1382 \ZREF@pl@ListEntry{columnsep}%
1383 \ZREF@pl@ListEntry{trimedge}%
1384 \ZREF@pl@ListEntry{spinemargin}%
1385 \ZREF@pl@ListEntry{foremargin}%
1386 \ZREF@pl@ListEntry{trimtop}%
1387 \ZREF@pl@ListEntry{uppermargin}%
1388 \ZREF@pl@ListEntry{headmargin}%
1389 }%
1390 }%
1391 }\x
1392 \ifnum\ZREF@page@max>\count@
1393 \advance\count@ by\ltx@one
1394 \else
1395 \expandafter\ltx@gobble
1396 \fi
1397 \ZREF@pl@ListPage
1398 }

```

\ZREF@pl@ListEntry

```

1399 \def\ZREF@pl@ListEntry#1{%
1400 \zref@ifpropundefined{#1}{%
1401 }{%
1402 \zref@ifrefcontainsprop{thepage\the\count@}{#1}{%
1403 \ltx@space\ltx@space#1 = %
1404 \zref@extract{thepage\the\count@}{#1}sp = %
1405 \the\dimexpr\zref@extract{thepage\the\count@}{#1}sp\relax
1406 \noexpand\MessageBreak
1407 }{%}
1408 }%
1409 }

1410 \AfterLastShipout{%
1411 \ZREF@pl@AfterLastShipout
1412 }

1413 </pagelayout>

```

6.11 Module pageattr

```

1414 (*pageattr)
1415 \NeedsTeXFormat{LaTeX2e}
1416 \ProvidesPackage{zref-pageattr}%
1417 [2018/11/21 v2.27 Module pageattr for zref (HO)]%
1418 \RequirePackage{zref-base}[2018/11/21]
1419 \ifx\ZREF@base@ok Y%
1420 \else
1421 \expandafter\endinput
1422 \fi

1423 \RequirePackage{ifluatex}[2010/03/01]
1424 \ifluatex

```

```

1425 \ifnum\luatexversion<39 %
1426 \else
1427   \begingroup
1428     \escapechar=-1 %
1429     \def\ZREF@temp#1{%
1430       \ltx@ifundefined{\string#1}{%
1431         \let#1\ltx@undefined
1432         \directlua{%
1433           if tex.enableprimitives then %
1434             tex.enableprimitives('', {\string#1})%
1435           end%
1436         }%
1437       \ltx@ifundefined{\string#1}{%
1438       }{%
1439         \global#1=#1%
1440         \@PackageInfoNoLine{zref-pageattr}{%
1441           \string#1 enabled%
1442         }%
1443       }%
1444     }{%}%
1445   }%
1446   \ZREF@temp\pdfpageattr
1447   \ZREF@temp\pdfpagesattr
1448 \endgroup
1449 \fi
1450 \fi

1451 \let\ZREF@temp=N%
1452 \ltx@ifundefined{pdfpageattr}{%
1453   \@PackageInfoNoLine{zref-pageattr}{%
1454     \string\pdfpageattr\space is not available%
1455   }%
1456   \def\zref@pdfpageattr#1{%
1457     \def\zref@pdfpageattr@used#1{%
1458     }{%
1459       \RequirePackage{zref-thepage}[2018/11/21]%
1460       \zref@newprop*{pdfpageattr}[]{\zref@hex{\the\pdfpageattr}}%
1461       \zref@addprop{thepage}{pdfpageattr}%
1462       \let\ZREF@temp=Y%
1463     }%
1464   \ltx@ifundefined{pdfpagesattr}{%
1465     \@PackageInfoNoLine{zref-pageattr}{%
1466       \string\pdfpagesattr\space is not available%
1467     }%
1468     \def\zref@pdfpagesattr{%
1469     \def\zref@pdfpagesattr@used{%
1470     }{%
1471       \RequirePackage{zref-lastpage}[2018/11/21]%
1472       \zref@newprop*{pdfpagesattr}[]{\zref@hex{\the\pdfpagesattr}}%
1473       \zref@addprop{LastPage}{pdfpagesattr}%
1474       \let\ZREF@temp=Y%
1475     }%
1476   \ifx\ZREF@temp N%
1477     \expandafter\endinput
1478   \fi

1479 \RequirePackage{zref-abspage}[2018/11/21]
1480 \RequirePackage{atveryend}[2010/03/24]
1481 \RequirePackage{pdftexcmds}[2010/04/01]

```

```

1482 \let\ZREF@temp=Y%
1483 \ltx@ifundefined{pdf@escapehex}{\let\ZREF@temp=N}{%}
1484 \ltx@ifundefined{pdf@unescapehex}{\let\ZREF@temp=N}{%}
1485 \ifx\ZREF@temp N%
1486   \let\zref@hex\ltx@firstofone
1487   \let\zref@unhex\ltx@firstofone
1488 \else
1489   \let\zref@hex\pdf@escapehex
1490   \let\zref@unhex\pdf@unescapehex
1491 \fi

\ifZREF@pa@list

1492 \ltx@newif\ifZREF@pa@list

\zref@listpageattr

1493 \ZREF@ifdefinable\zlistpageattr\def{%
1494   {\ZREF@pa@listtrue}%
1495 }

\ZREF@pa@AfterLastShipout

1496 \def\ZREF@pa@AfterLastShipout{%
1497   \ifZREF@pa@list
1498     \edef\ZREF@page@max{\the\value{abspage}}%
1499     \ltx@ifundefined{ZREF@org@testdef}{%
1500       \let\ZREF@org@testdef\@testdef
1501       \def\@testdef##1##2##3{%
1502         \ZREF@org@testdef{##1}{##2}{##3}%
1503         \def\ZREF@temp{##1}%
1504         \ifx\ZREF@temp\ZREF@RefPrefix
1505           \expandafter\xdef\csname##1@##2\endcsname{##3}%
1506         \fi
1507       }%
1508     }%
1509     \AtVeryEndDocument{\ZREF@pa@AtVeryEnd}%
1510   \fi
1511 }

\ZREF@pa@AtVeryEnd

1512 \ltx@ifundefined{pdfpageattr}{%
1513   \def\ZREF@pa@AtVeryEnd{%
1514 }{%
1515   \def\ZREF@pa@AtVeryEnd{%
1516     \begingroup
1517     \toks@{\List of \ltx@backslashchar pdfpageattr:\MessageBreak}%
1518     \count@=1 %
1519     \ZREF@pa@ListPage
1520     \edef\x{\endgroup
1521       \noexpand\@PackageInfoNoLine{zref-pageattr}{%
1522         \the\toks@
1523       }%
1524     }%
1525     \x
1526   }%

\zref@pageattr

1527 \def\zref@pageattr#1{%
1528   \zref@unhex{%
1529     \zref@extract{thepage\ZREF@number{#1}}{pdfpageattr}%

```

```

1530 }%
1531 }

\zref@pageattr@used
1532 \ZREF@Robust\def\zref@pageattr@used#1{%
1533   \zref@refused{thepage\ZREF@number{#1}}%
1534 }

\ZREF@pa@ListPage
1535 \def\ZREF@pa@ListPage{%
1536   \edef\x{%
1537     \toks@={%
1538       \the\toks@
1539       Page \the\count@:%
1540       \noexpand\MessageBreak
1541       \zref@ifrefundefined{thepage\the\count@}{}{%
1542         <<\zref@pdfpageattr\count@>>%
1543         \noexpand\MessageBreak
1544       }%
1545     }%
1546   }\x
1547   \ifnum\ZREF@page@max>\count@
1548     \advance\count@ by\ltx@one
1549   \else
1550     \expandafter\ltx@gobble
1551   \fi
1552   \ZREF@pa@ListPage
1553 }%
1554 }

1555 \ltx@ifundefined{pdfpagesattr}{%
1556 }{%

\zref@pdfpagesattr
1557 \def\zref@pdfpagesattr{%
1558   \zref@unhex{%
1559     \zref@extract{LastPage}{pdfpagesattr}%
1560   }%
1561 }%

\zref@pdfpagesattr@used
1562 \ZREF@Robust\def\zref@pdfpagesattr@used{%
1563   \zref@refused{LastPage}%
1564 }%

1565 \ltx@LocalAppendToMacro\ZREF@pa@AtVeryEnd{%
1566   \@PackageInfoNoLine{zref-pageattr}{%
1567     \ltx@backslashchar pdfpagesattr:\MessageBreak
1568     <<\zref@pdfpagesattr>>%
1569     \MessageBreak
1570   }%
1571 }%
1572 }
1573 \AfterLastShipout{%
1574   \ZREF@pa@AfterLastShipout
1575 }
1576 </pageattr>

```

6.12 Module marks

```

1577 \*marks\
1578 \NeedsTeXFormat{LaTeX2e}
1579 \ProvidesPackage{zref-marks}%
1580 [2018/11/21 v2.27 Module marks for zref (H0)]%
1581 \RequirePackage{zref-base}[2018/11/21]
1582 \ifx\ZREF@base@ok Y%
1583 \else
1584 \expandafter\endinput
1585 \fi

1586 \newcommand*{\zref@marks@register}[3][{}]{%
1587 \edef\ZREF@TempName{#1}%
1588 \edef\ZREF@TempNum{\ZREF@number{#2}}%
1589 \ifnum\ZREF@TempNum<\ltx@zero %
1590 \PackageError\ZREF@name{%
1591 \string\zref@marks@register\ltx@space is called with invalid%
1592 \MessageBreak
1593 marks register number (\ZREF@TempNum)%
1594 }{%
1595 Use `0' or the command, defined by \string\newmarks.\MessageBreak
1596 \@ehc
1597 }%
1598 \else
1599 \ifx\ZREF@TempName\ltx@empty
1600 \edef\ZREF@TempName{mark\romannumeral\ZREF@TempNum}%
1601 \else
1602 \edef\ZREF@TempName{marks\ZREF@TempName}%
1603 \fi
1604 \ZREF@MARKS@DefineProp{top}%
1605 \ZREF@MARKS@DefineProp{first}%
1606 \ZREF@MARKS@DefineProp{bot}%
1607 \kv@parse{#3}{%
1608 \ifx\kv@value\relax
1609 \def\kv@value{top,first,bot}%
1610 \fi
1611 \edef\ZREF@temp{\expandafter\ltx@car\kv@key X\@nil}%
1612 \ifx\ZREF@temp\ZREF@STAR
1613 \edef\kv@key{\expandafter\ltx@cdr\kv@key\@nil}%
1614 \zref@newlist\kv@key
1615 \fi
1616 \expandafter\comma@parse\expandafter{\kv@value}{%
1617 \ifcase0\ifx\comma@entry\ZREF@NAME@top 1\else
1618 \ifx\comma@entry\ZREF@NAME@first 1\else
1619 \ifx\comma@entry\ZREF@NAME@bot 1\fi\fi\fi\ltx@space
1620 \PackageWarning{zref-marks}{%
1621 Use `top', `first' or `bot' for the list values%
1622 \MessageBreak
1623 in the third argument of \string\zref@marks@register.%
1624 \MessageBreak
1625 Ignoring unkown value `\'comma@entry'%
1626 }%
1627 \else
1628 \zref@addprop{\kv@key}{\comma@entry\ZREF@TempName}%
1629 \fi
1630 \ltx@gobble
1631 }%
1632 \ltx@gobbletwo

```



```

1633 }%
1634 \fi
1635 }
1636 \def\ZREF@STAR{*}
1637 \def\ZREF@NAME@top{top}
1638 \def\ZREF@NAME@first{first}
1639 \def\ZREF@NAME@bot{bot}
1640 \def\ZREF@MARKS@DefineProp#1{%
1641   \zref@ifpropundefined{#1\ZREF@TempName}{%
1642     \ifnum\ZREF@TempNum=\ltx@zero
1643       \begingroup
1644         \edef\x{\endgroup
1645           \noexpand\zref@newprop*{#1\ZREF@TempName}[]{%
1646             \expandafter\noexpand\csname#1mark\endcsname
1647           }%
1648         }%
1649         \x
1650       \else
1651         \begingroup
1652         \edef\x{\endgroup
1653           \noexpand\zref@newprop*{#1\ZREF@TempName}[]{%
1654             \expandafter\noexpand\csname#1marks\endcsname
1655             \ZREF@TempNum
1656           }%
1657         }%
1658         \x
1659       \fi
1660     }{%
1661       \PackageWarning{zref-marks}{%
1662         \string\zref@marks@register\ltx@space does not generate the%
1663         \MessageBreak
1664         new property `#1\ZREF@TempName', because\MessageBreak
1665         it is already defined%
1666       }%
1667     }%
1668 }
1669 \</marks>

```

6.13 Module runs

This module does not use the label-reference-system. The reference changes with each \LaTeX run and would force a rerun warning always.

```

1670 (*runs)
1671 \NeedsTeXFormat{LaTeX2e}
1672 \ProvidesPackage{zref-runs}%
1673   [2018/11/21 v2.27 Module runs for zref (H0)]%

```

\backslash zruns

```

1674 \providecommand*{\zruns}{0}%
1675 \AtBeginDocument{%
1676   \edef\zruns{\number\numexpr\zruns+1}%
1677   \begingroup
1678     \def\on@line{}%
1679     \PackageInfo{zref-runs}{LaTeX runs: \zruns}%
1680     \if@filesw
1681       \immediate\write\@mainaux{%
1682         \string\gdef\string\zruns{\zruns}%
1683       }%

```

```

1684 \fi
1685 \endgroup
1686 }

1687 </runs>

```

6.14 Module perpage

```

1688 (*perpage)
1689 \NeedsTeXFormat{LaTeX2e}
1690 \ProvidesPackage{zref-perpage}%
1691 [2018/11/21 v2.27 Module perpage for zref (H0)]%
1692 \RequirePackage{zref-base}[2018/11/21]
1693 \ifx\ZREF@base@ok Y%
1694 \else
1695 \expandafter\endinput
1696 \fi

```

This module resets a counter at page boundaries. Because of the asynchronous output routine page counter properties cannot be asked directly, references are necessary.

For detecting changed pages module `abspage` is loaded.

```

1697 \RequirePackage{zref-abspage}[2018/11/21]

```

We group the properties for the needed references in the property list `perpage`. The property `pagevalue` records the correct value of the page counter.

```

1698 \ZREF@NewPropPageValue
1699 \zref@newlist{perpage}
1700 \zref@addprops{perpage}{abspage,page,pagevalue}

```

The page value, known by the reference mechanism, will be stored in counter `zpage`.

```

1701 \newcounter{zpage}

```

Counter `zref@unique` helps in generating unique reference names.

```

1702 \zref@require@unique

```

In order to be able to reset the counter, we hook here into `\stepcounter`. In fact two nested hooks are used to allow other packages to use the first hook at the beginning of `\stepcounter`.

```

1703 \let\ZREF@org@stepcounter\stepcounter
1704 \def\stepcounter#1{%
1705   \ifcsname @stepcounterhook@#1\endcsname
1706     \csname @stepcounterhook@#1\endcsname
1707   \fi
1708   \ZREF@org@stepcounter{#1}%
1709 }

```

`\@stpelt` must be adapted due to the change in latex 2015-01, see <https://github.com/hotex/oberdiek/issues/26>

```

1710 \let\ZREF@org@@stpelt\@stpelt
1711 \def\@stpelt#1{%
1712   \ifcsname ZREF@perpage@#1\endcsname
1713     \begingroup
1714       \let\stepcounter\ZREF@org@stepcounter
1715       \ZREF@org@@stpelt{#1}%
1716     \endgroup
1717     \expandafter\ltx@gobbletwo
1718   \fi
1719   \ZREF@org@@stpelt{#1}%
1720 }

```

`\zmakeperpage` Makro `\zmakeperpage` resets a counter at each page break. It uses the same syntax and semantics as `\MakePerPage` from package `perpage` [5]. The initial start value can be given by the optional argument. Default is one that means after the first `\stepcounter` on a new page the counter starts with one.

```
1721 \ZREF@ifDefinable\zmakeperpage\def{%
1722   {%
1723     \@ifnextchar[\ZREF@makeperpage@opt{\ZREF@@makeperpage[\ltx@zero]}%
1724   }%
1725 }
```

We hook before the counter is incremented in `\stepcounter`, package `perpage` afterwards. Thus a little calculation is necessary.

```
1726 \def\ZREF@makeperpage@opt[#1]{%
1727   \begingroup
1728   \edef\x{\endgroup
1729     \noexpand\ZREF@@makeperpage[\number\numexpr#1-1\relax]%
1730   }%
1731   \x
1732 }

1733 \def\ZREF@@makeperpage[#1]#2{%
1734   \@ifundefined{stepcounterhook@#2}{%
1735     \expandafter\gdef\csname stepcounterhook@#2\endcsname{%
1736     }%
1737     \expandafter\gdef\csname ZREF@perpage@#2\endcsname{%
1738       \ZREF@perpage@step{#2}{#1}%
1739     }%
1740     \expandafter\g@addto@macro\csname stepcounterhook@#2\endcsname{%
1741       \ifcsname ZREF@perpage@#2\endcsname
1742         \csname ZREF@perpage@#2\endcsname
1743       \fi
1744     }%
1745 }
```

`\ZREF@@perpage@step` The heart of this module follows.

```
1746 \def\ZREF@@perpage@step#1#2{%
```

First the reference is generated.

```
1747   \global\advance\c@zref@unique\ltx@one
1748   \begingroup
1749   \expandafter
1750   \zref@labelbylist\expandafter{\thezref@unique}{perpage}%
```

The `\expandafter` commands are necessary, because `\ZREF@temp` is also used inside of `\zref@labelbylist`.

The evaluation of the reference follows. If the reference is not yet known, we use the page counter as approximation.

```
1751   \zref@ifrefundefined\thezref@unique{%
1752     \global\c@zpage=\c@page
1753     \global\let\thezpage\thepage
1754     \expandafter\xdef\csname ZREF@abspage@#1\endcsname{%
1755       \number\c@abspage
1756     }%
1757   }{%
```

The reference is used to set `\thezpage` and counter `zpage`.

```
1758     \global\c@zpage=\zref@extract\thezref@unique{pagevalue}\relax
1759     \xdef\thezpage{\noexpand\zref@extract{\thezref@unique}{page}}%
1760     \expandafter\xdef\csname ZREF@abspage@#1\endcsname{%
```

```

1761      \zref@extractdefault\thezref@unique
1762      {abspage}{\number\c@abspage}%
1763    }%
1764  }%

```

Page changes are detected by a changed absolute page number.

```

1765    \expandafter\ifx\csname ZREF@abspage@#1\expandafter\endcsname
1766      \csname ZREF@currentabspage@#1\endcsname
1767    \else
1768      \global\csname c@#1\endcsname=#2\relax
1769      \global\expandafter\let
1770        \csname ZREF@currentabspage@#1\expandafter\endcsname
1771        \csname ZREF@abspage@#1\endcsname
1772    \fi
1773  \endgroup
1774 }

```

`\zunmakeperpage` Macro `\zunmakeperpage` cancels the effect of `\zmakeperpage`.

```

1775 \ZREF@ifDefinable\zunmakeperpage\def{%
1776   #1{%
1777     \global\expandafter
1778     \let\csname ZREF@perpage@#1\endcsname\@undefined
1779   }%
1780 }

```

1781 `/perpage`

6.15 Module `titleref`

```

1782 (*titleref)
1783 \NeedsTeXFormat{LaTeX2e}
1784 \ProvidesPackage{zref-titleref}%
1785   [2018/11/21 v2.27 Module titleref for zref (HO)]%
1786 \RequirePackage{zref-base}[2018/11/21]
1787 \ifx\ZREF@base@ok Y%
1788 \else
1789   \expandafter\endinput
1790 \fi
1791 \RequirePackage{getttitlestring}[2009/12/08]

```

6.15.1 Implementation

```
1792 \RequirePackage{keyval}
```

This module makes section and caption titles available for the reference system. It uses some of the ideas of package `nameref` and `titleref`.

Now we can add the property `title` is added to the main property list.

```

1793 \ZREF@NewPropTitle
1794 \zref@addprop\ZREF@mainlist{title}%

```

The title strings go into the `.aux` file, thus they need some kind of protection. Package `titleref` uses a protected expansion method. The advantage is that this can be used to cleanup the string and to remove `\label`, `\index` and other macros unwanted for referencing. But there is the risk that fragile stuff can break.

Therefore package `nameref` does not expand the string. Thus the entries can safely be written to the `.aux` file. But potentially dangerous macros such as `\label` remain in the string and can cause problems when using the string in references. The switch `\ifzref@titleref@expand` distinguishes between the both methods. Package `nameref`'s behaviour is achieved by setting the switch to false, otherwise `titleref`'s expansion is used. Default is false.

```
\ifzref@titleref@expand
```

```

1795 \newif\ifzref@titleref@expand

\ZREF@titleref@hook The hook \ZREF@titleref@hook allows to extend the cleanup for the expansion
method. Thus unnecessary macros can be removed or dangerous commands re-
moved. The hook is executed before the expansion of \zref@titleref@current.
1796 \let\ZREF@titleref@hook\ltx@empty

\zref@titleref@cleanup The hook should not be used directly, instead we provide the macro
\zref@titleref@cleanup to add stuff to the hook and prevents that a previous
non-empty content is not discarded accidentally.
1797 \ZREF@Robust\def\zref@titleref@cleanup#1{%
1798   \begingroup
1799   \toks@\expandafter{%
1800     \ZREF@titleref@hook
1801     #1%
1802   }%
1803   \expandafter\endgroup
1804   \expandafter\def\expandafter\ZREF@titleref@hook\expandafter{%
1805     \the\toks@
1806   }%
1807 }%

\ifzref@titleref@stripperperiod Sometimes a title contains a period at the end. Package nameref removes this.
This behaviour is controlled by the switch \ifzref@titleref@stripperperiod and
works regardless of the setting of option expand. Period stripping is the default.
1808 \newif\ifzref@titleref@stripperperiod
1809 \zref@titleref@stripperperiodtrue

\zref@titleref@setcurrent Macro \zref@titleref@setcurrent sets a new current title stored in
\zref@titleref@current. Some cleanup and expansion is performed that can
be controlled by the previous switches.
1810 \ZREF@Robust\def\zref@titleref@setcurrent#1{%
1811   \ifzref@titleref@expand
1812     \GetTitleStringExpand{#1}%
1813   \else
1814     \GetTitleStringNonExpand{#1}%
1815   \fi
1816   \edef\zref@titleref@current{%
1817     \detokenize\expandafter{\GetTitleStringResult}%
1818   }%
1819   \ifzref@titleref@stripperperiod
1820     \edef\zref@titleref@current{%
1821       \expandafter\ZREF@stripperperiod\zref@titleref@current
1822       \ltx@empty.\ltx@empty\@nil
1823     }%
1824   \fi
1825 }%
1826 \GetTitleStringDisableCommands{%
1827   \ZREF@titleref@hook
1828 }

\ZREF@stripperperiod If \ZREF@stripperperiod is called, the argument consists of space tokens and tokens
with catcode 12 (other), because of  $\epsilon$ -TeX's \detokenize.
1829 \def\ZREF@stripperperiod#1.\ltx@empty#2\@nil{#1}%

```

6.15.2 User interface

`\ztitlerefsetup` The behaviour of module `titleref` is controlled by switches and a hook. They can be set by `\ztitlerefsetup` with a key value interface, provided by package `keyval`. Also the current title can be given explicitly by the key `title`.

```
1830 \define@key{ZREF@TR}{expand}[true]{%
1831   \csname zref@titleref@expand#1\endcsname
1832 }%
1833 \define@key{ZREF@TR}{stripperperiod}[true]{%
1834   \csname zref@titleref@stripperperiod#1\endcsname
1835 }%
1836 \define@key{ZREF@TR}{cleanup}{%
1837   \zref@titleref@cleanup{#1}%
1838 }%
1839 \define@key{ZREF@TR}{title}{%
1840   \def\zref@titleref@current{#1}%
1841 }%
1842 \ZREF@ifDefinable\ztitlerefsetup\def{%
1843   {\kvsetkeys{ZREF@TR}}}%
1844 }%
```

`\ztitleref` The user command `\ztitleref` references the title. For safety `\label` is disabled to prevent multiply defined references.

```
1845 \ZREF@ifDefinable\ztitleref\def{%
1846   {\zref@wrapper@babel\ZREF@titleref}%
1847 }%
1848 \def\ZREF@titleref#1{%
1849   \begingroup
1850     \zref@refused{#1}%
1851     \let\label\ltx@gobble
1852     \zref@extract{#1}{title}%
1853   \endgroup
1854 }%
```

6.15.3 Patches for section and caption commands

The section and caption macros are patched to extract the title data.

Captions of figures and tables.

```
1855 \AtBeginDocument{%
1856   \ZREF@patch{@caption}{%
1857     \long\def@caption#1[#2]{%
1858       \zref@titleref@setcurrent{#2}%
1859       \ZREF@org@@caption{#1}[{#2}]%
1860     }%
1861   }%
```

Section commands without star. The title version for the table of contents is used because it is usually shorter and more robust.

```
1862   \ZREF@patch{@part}{%
1863     \def@part[#1]{%
1864       \zref@titleref@setcurrent{#1}%
1865       \ZREF@org@@part[{#1}]%
1866     }%
1867   }%
1868   \ZREF@patch{@chapter}{%
1869     \def@chapter[#1]{%
1870       \zref@titleref@setcurrent{#1}%
1871       \ZREF@org@@chapter[{#1}]%
1872     }%
1873   }%
```

```

1872 }%
1873 }%
1874 \ZREF@patch{@sect}{%
1875   \def\@sect#1#2#3#4#5#6[#7]{%
1876     \zref@titleref@setcurrent{#7}%
1877     \ZREF@org@sect{#1}{#2}{#3}{#4}{#5}{#6}[{#7}]%
1878   }%
1879 }%

```

The star versions of the section commands.

```

1880 \ZREF@patch{@spart}{%
1881   \def\@spart#1{%
1882     \zref@titleref@setcurrent{#1}%
1883     \ZREF@org@@spart{#1}%
1884   }%
1885 }%
1886 \ZREF@patch{@schapter}{%
1887   \def\@schapter#1{%
1888     \zref@titleref@setcurrent{#1}%
1889     \ZREF@org@@schapter{#1}%
1890   }%
1891 }%
1892 \ZREF@patch{@ssect}{%
1893   \def\@ssect#1#2#3#4#5{%
1894     \zref@titleref@setcurrent{#5}%
1895     \ZREF@org@ssect{#1}{#2}{#3}{#4}{#5}%
1896   }%
1897 }%

```

6.15.4 Environment description

```

1898 \ZREF@patch{descriptionlabel}{%
1899   \def\descriptionlabel#1{%
1900     \zref@titleref@setcurrent{#1}%
1901     \ZREF@org@descriptionlabel{#1}%
1902   }%
1903 }%

```

6.15.5 Class memoir

```

1904 \@ifclassloaded{memoir}{%
1905   \ltx@ifundefined{ifheadnameref}{}{%
1906     \def\@chapter[#1]#2{%
1907       \ltx@ifundefined{ch@pt@c}{%
1908         \zref@titleref@setcurrent{#1}%
1909       }{%
1910         \ifx\ch@pt@c\ltx@empty
1911           \zref@titleref@setcurrent{#2}%
1912         \else
1913           \def\NR@temp{#1}%
1914           \ifx\NR@temp\ltx@empty
1915             \expandafter\zref@titleref@setcurrent
1916             \expandafter{\ch@pt@c}%
1917           \else
1918             \ifheadnameref
1919               \zref@titleref@setcurrent{#1}%
1920             \else
1921               \expandafter\zref@titleref@setcurrent
1922               \expandafter{\ch@pt@c}%
1923             \fi

```

```

1924         \fi
1925     \fi
1926 }%
1927 \ZREF@org@@chapter[{#1}]{#2}%
1928 }%
1929 \ZREF@patch{M@sect}{%
1930     \def\M@sect#1#2#3#4#5#6[#7][#8]{%
1931         \ifheadnameref
1932             \zref@titleref@setcurrent{#8}%
1933         \else
1934             \zref@titleref@setcurrent{#7}%
1935         \fi
1936         \ZREF@org@M@sect{#1}{#2}{#3}{#4}{#5}{#6}[{#7}][{#8}]%
1937     }%
1938 }%
1939 }%
1940 }{}%

```

6.15.6 Class beamer

```

1941 \@ifclassloaded{beamer}{%
1942     \ZREF@patch{beamer@section}{%
1943         \long\def\beamer@section[#1]{%
1944             \zref@titleref@setcurrent{#1}%
1945             \ZREF@org@beamer@section[{#1}]%
1946         }%
1947     }%
1948     \ZREF@patch{beamer@subsection}{%
1949         \long\def\beamer@subsection[#1]{%
1950             \zref@titleref@setcurrent{#1}%
1951             \ZREF@org@beamer@subsection[{#1}]%
1952         }%
1953     }%
1954     \ZREF@patch{beamer@subsubsection}{%
1955         \long\def\beamer@subsubsection[#1]{%
1956             \zref@titleref@setcurrent{#1}%
1957             \ZREF@org@beamer@subsubsection[{#1}]%
1958         }%
1959     }%
1960 }{}%

```

6.15.7 Package titlesec

```

1961 \@ifpackageloaded{titlesec}{%
1962     \ZREF@patch{ttl@sect@i}{%
1963         \def\ttl@sect@i#1#2[#3]#4{%
1964             \zref@titleref@setcurrent{#4}%
1965             \ZREF@org@ttl@sect@i{#1}{#2}[{#3}]{#4}%
1966         }%
1967     }%
1968     \ZREF@patch{ttl@straight@i}{%
1969         \def\ttl@straight@i#1[#2]#3{%
1970             \def\ZREF@temp{#2}%
1971             \ifx\ZREF@temp\ltx@empty
1972                 \zref@titleref@setcurrent{#3}%
1973             \else
1974                 \zref@titleref@setcurrent{#2}%
1975             \fi
1976             \ZREF@org@ttl@straight@i{#1}[{#2}]{#3}%
1977         }%

```



```

1978 }%
1979 }{}%

```

6.15.8 Package longtable

Package longtable: some support for its `\caption`. However `\label` inside the caption is not supported.

```

1980 \@ifpackageloaded{longtable}{%
1981   \ZREF@patch{LT@c@ption}{%
1982     \def\LT@c@ption#1[#2]#3{%
1983       \ZREF@org@LT@c@ption{#1}[{#2}]{#3}%
1984       \zref@titleref@setcurrent{#2}%
1985     }%
1986   }%
1987 }{}%

```

6.15.9 Package listings

Package listings: support for its caption.

```

1988 \@ifpackageloaded{listings}{%
1989   \ZREF@patch{lst@MakeCaption}{%
1990     \def\lst@MakeCaption{%
1991       \ifx\lst@label\ltx@empty
1992       \else
1993         \expandafter\zref@titleref@setcurrent\expandafter{%
1994           \lst@@caption
1995         }%
1996       \fi
1997       \ZREF@org@lst@MakeCaption
1998     }%
1999   }%
2000 }{}%

```

6.15.10 Theorems

```

2001 \ZREF@patch{@opargbegintheorem}{%
2002   \def\@opargbegintheorem#1#2#3{%
2003     \zref@titleref@setcurrent{#3}%
2004     \ZREF@org@@opargbegintheorem{#1}{#2}{#3}%
2005   }%
2006 }%
2007 \@ifpackageloaded{amsthm}{%
2008   \begingroup
2009     \edef\x{macro:\string#1\string#2[\string#3]}%
2010     \@onelevel@sanitize\x
2011     \def\y#1->#2\@nil{#1}%
2012     \edef\z{\expandafter\y\meaning\@begintheorem->\@nil}%
2013     \@onelevel@sanitize\z
2014     \expandafter\endgroup
2015     \ifx\x\z
2016       \ZREF@patch{@begintheorem}{%
2017         \def\@begintheorem#1#2[#3]{%
2018           \zref@titleref@setcurrent{#3}%
2019           \ZREF@org@@begintheorem{#1}{#2}[{#3}]%
2020         }%
2021       }%
2022     \fi
2023 }{}%

```

```

2024 }
2025 
```

6.16 Module xr

```

2026 (*xr)
2027 \NeedsTeXFormat{LaTeX2e}
2028 \ProvidesPackage{zref-xr}%
2029   [2018/11/21 v2.27 Module xr for zref (HO)]%
2030 \RequirePackage{zref-base}[2018/11/21]
2031 \ifx\ZREF@base@ok Y%
2032 \else
2033   \expandafter\endinput
2034 \fi

2035 \RequirePackage{keyval}
2036 \RequirePackage{kvoptions}[2010/02/22]

```

We declare property `url`, because this is added, if a reference is imported and has not already set this field. Or if `hyperref` is used, then this property can be asked.

```

2037 \zref@newprop{url}{}%
2038 \zref@newprop{urluse}{}%
2039 \zref@newprop{externaldocument}{}%

```

Most code, especially the handling of the `.aux` files are taken from David Carlisle's `xr` package. Therefore I drop the documentation for these macros here.

`\zref@xr@ext` If the URL is not specied, then assume processed file with a guessed extension. Use the setting of `hyperref` if available.

```

2040 \providecommand*{\zref@xr@ext}{%
2041   \ltx@ifundefined{XR@ext}{pdf}{\XR@ext}%
2042 }%

```

`\ifZREF@xr@zreflabel` The use of the star form of `\zexternaldocument` is remembered in the switch `\ifZREF@xr@zreflabel`.

```

2043 \newif\ifZREF@xr@zreflabel

2044 \SetupKeyvalOptions{%
2045   family=ZREF@XR,%
2046   prefix=ZREF@xr@%
2047 }
2048 \DeclareBoolOption[true]{tozreflabel}
2049 \DeclareBoolOption[false]{toltxlabel}
2050 \DeclareBoolOption{verbose}
2051 \define@key{ZREF@XR}{ext}{%
2052   \def\zref@xr@{#1}%
2053 }
2054 \DeclareBoolOption[false]{urluse}

```

`\zxrsetup`

```

2055 \newcommand*{\zxrsetup}{%
2056   \kvsetkeys{ZREF@XR}%
2057 }%

```

`\ZREF@xr@URL`

```

2058 \newcount\ZREF@xr@URL
2059 \ZREF@xr@URL=\ltx@zero

```

\ZREF@xr@AddURL

```

2060 \def\ZREF@xr@AddURL#1{%
2061   \begingroup
2062     \def\ZREF@temp{#1}%
2063     \count@=\ltx@one
2064     \ZREF@xr@@AddUrl
2065   \endgroup
2066 }

```

\ZREF@xr@@AddUrl

```

2067 \def\ZREF@xr@@AddUrl{%
2068   \ifnum\count@>\ZREF@xr@URL
2069     \global\advance\ZREF@xr@URL by\ltx@one
2070     \xdef\ZREF@xr@theURL{\romannumeral\ZREF@xr@URL}%
2071     \global\expandafter\let
2072       \csname Z@U@\ZREF@xr@theURL\endcsname\ZREF@temp
2073     \@PackageInfo{zref-xr}{%
2074       \ltx@backslashchar Z@U@\ZREF@xr@theURL:\MessageBreak
2075       \ZREF@temp\MessageBreak
2076     }%
2077   \else
2078     \expandafter
2079     \ifx\csname Z@U@\romannumeral\count@\endcsname\ZREF@temp
2080       \xdef\ZREF@xr@theURL{\romannumeral\count@}%
2081     \else
2082       \expandafter\expandafter\expandafter\ZREF@xr@@AddUrl
2083     \fi
2084   \fi
2085 }

```

\zexternaldocument In its star form it looks for \newlabel, otherwise for \zref@newlabel. Later we will read .aux files that expects @ to have catcode 11 (letter).

```

2086 \ZREF@ifDefinable\zexternaldocument\def{%
2087   {%
2088     \ZREF@NewPropAnchor
2089     \ZREF@NewPropTitle
2090     \begingroup
2091       \csname @safe@actives@true\endcsname
2092       \makeatletter
2093       \@ifstar{%
2094         \ZREF@xr@zreflabelfalse
2095         \@testopt\ZREF@xr@externaldocument{}%
2096       }{%
2097         \ZREF@xr@zreflabeltrue
2098         \@testopt\ZREF@xr@externaldocument{}%
2099       }%
2100     }%
2101   }%

```

If the \include featurer was used, there can be several .aux files. These files are read one after another, especially they are not recursively read in order to save read registers. Thus it can happen that the read order of the newlabel commands differs from L^AT_EX's order using \input.

\ZREF@xr@externaldocument It reads the remaining arguments. \newcommand comes in handy for the optional argument.

```

2102 \def\ZREF@xr@externaldocument[#1]#2{%

```

```

2103 \def\ZREF@xr@prefix{#1}%
2104 \let\ZREF@xr@filelist\ltx@empty
2105 \edef\ZREF@xr@externalfile{#2}%
2106 \edef\ZREF@xr@file{\ZREF@xr@externalfile.aux}%
2107 \filename@parse{#2}%
2108 \@testopt\ZREF@xr@graburl{#2.\zref@xr@ext}%
2109 }%
2110 \def\ZREF@xr@graburl[#1]{%
2111 \edef\ZREF@xr@url{#1}%
2112 \ifZREF@xr@urluse
2113 \expandafter\ZREF@xr@AddURL\expandafter{\ZREF@xr@url}%
2114 \expandafter\def\expandafter\ZREF@xr@url
2115 \expandafter{\csname Z@U@\ZREF@xr@theURL\endcsname}%
2116 \fi
2117 \ZREF@xr@checkfile
2118 \endgroup
2119 }%

```

\ZREF@xr@processfile We follow xr here, \IfFileExists offers a nicer test, but we have to open the file anyway.

```

2120 \def\ZREF@xr@checkfile{%
2121 \openin\@inputcheck\ZREF@xr@file\relax
2122 \ifeof\@inputcheck
2123 \PackageWarning{zref-xr}{%
2124 File '\ZREF@xr@file' not found or empty,\MessageBreak
2125 labels not imported%
2126 }%
2127 \else
2128 \PackageInfo{zref-xr}{%
2129 Label \ifZREF@xr@zreflabel (zref) \fi
2130 import from '\ZREF@xr@file'%
2131 }%
2132 \def\ZREF@xr@found{0}%
2133 \def\ZREF@xr@ignored@empty{0}%
2134 \def\ZREF@xr@ignored@zref{0}%
2135 \def\ZREF@xr@ignored@ltx{0}%
2136 \ZREF@xr@processfile
2137 \closein\@inputcheck
2138 \begingroup
2139 \let\on@line\ltx@empty
2140 \PackageInfo{zref-xr}{%
2141 Statistics for '\ZREF@xr@file':\MessageBreak
2142 \ZREF@xr@found\space
2143 \ifZREF@xr@zreflabel zref\else LaTeX\fi\space
2144 label(s) found%
2145 \ifnum\ZREF@xr@ignored@empty>0 %
2146 ,\MessageBreak
2147 \ZREF@xr@ignored@empty\space empty label(s) ignored%
2148 \fi
2149 \ifnum\ZREF@xr@ignored@zref>0 %
2150 ,\MessageBreak
2151 \ZREF@xr@ignored@zref\space
2152 duplicated zref label(s) ignored%
2153 \fi
2154 \ifnum\ZREF@xr@ignored@ltx>0 %
2155 ,\MessageBreak
2156 \ZREF@xr@ignored@ltx\space
2157 duplicated latex label(s) ignored%

```

```

2158     \fi
2159   }%
2160   \endgroup
2161 \fi
2162 \ifx\ZREF@xr@filelist\ltx@empty
2163 \else
2164   \edef\ZREF@xr@file{%
2165     \expandafter\ltx@car\ZREF@xr@filelist\@nil
2166   }%
2167   \edef\ZREF@xr@filelist{%
2168     \expandafter\ltx@cdr\ZREF@xr@filelist\ltx@empty\@nil
2169   }%
2170   \expandafter\ZREF@xr@checkfile
2171 \fi
2172 }%

```

\ZREF@xr@processfile

```

2173 \def\ZREF@xr@processfile{%
2174   \read\@inputcheck to\ZREF@xr@line
2175   \expandafter\ZREF@xr@processline\ZREF@xr@line..\ZREF@nil
2176   \ifeof\@inputcheck
2177   \else
2178     \expandafter\ZREF@xr@processfile
2179   \fi
2180 }%

```

\ZREF@xr@processline The most work must be done for analyzing the arguments of \newlabel.

```

2181 \long\def\ZREF@xr@processline#1#2#3\ZREF@nil{%
2182   \def\x{#1}%
2183   \toks@{#2}%
2184   \ifZREF@xr@zreflabel
2185     \ifx\x\ZREF@xr@zref@newlabel
2186       \expandafter
2187       \ZREF@xr@process@zreflabel\ZREF@xr@line...\ZREF@nil
2188     \fi
2189   \else
2190     \ifx\x\ZREF@xr@newlabel
2191       \expandafter
2192       \ZREF@xr@process@label\ZREF@xr@line...[]\ZREF@nil
2193     \fi
2194   \fi
2195   \ifx\x\ZREF@xr@input
2196     \edef\ZREF@xr@filelist{%
2197       \etex@unexpanded\expandafter{\ZREF@xr@filelist}%
2198       {\filename@area\the\toks@}%
2199     }%
2200   \fi
2201 }%
2202 \def\ZREF@xr@process@zreflabel\zref@newlabel#1#2#3\ZREF@nil{%
2203   \edef\ZREF@xr@refname{Z@R@\ZREF@xr@prefix#1}%
2204   \edef\ZREF@xr@found{\the\numexpr\ZREF@xr@found+1\relax}%
2205   \def\x{#2}%
2206   \edef\ZREF@xr@tempname{$temp$}%
2207   \edef\ZREF@xr@temprefname{Z@R@\ZREF@xr@tempname}%
2208   \let\ZREF@xr@list\x
2209   \ifx\ZREF@xr@list\ltx@empty
2210     \PackageWarningNoLine{zref-xr}{%
2211       Label `#1' without properties ignored\MessageBreak

```

```

2212 in file `\\ZREF@xr@file'%
2213 }%
2214 \\edef\\ZREF@xr@ignored@empty{%
2215   \\the\\numexpr\\ZREF@xr@ignored@empty+1\\relax
2216 }%
2217 \\else
2218   \\expandafter\\ZREF@xr@checklist\\x\\ZREF@nil
2219   \\expandafter\\let\\csname\\ZREF@xr@temprefname\\endcsname\\x
2220   \\expandafter\\ltx@LocalAppendToMacro
2221   \\csname\\ZREF@xr@temprefname\\expandafter\\endcsname
2222   \\expandafter{%
2223     \\expandafter\\externaldocument\\expandafter{%
2224       \\ZREF@xr@externalfile
2225     }%
2226   }%
2227   \\ZREF@xr@urlcheck\\ZREF@xr@tempname
2228   \\ifZREF@xr@tozreflabel
2229     \\ifundefined{\\ZREF@xr@refname}{%
2230       \\ifZREF@xr@verbose
2231         \\PackageInfo{zref-xr}{%
2232           Import to zref label `\\ZREF@xr@tempname#1'%
2233         }%
2234       \\fi
2235       \\global\\expandafter
2236       \\let\\csname\\ZREF@xr@refname\\expandafter\\endcsname
2237       \\csname\\ZREF@xr@temprefname\\endcsname
2238     }{%
2239       \\ZREF@xr@zref@ignorewarning{\\ZREF@xr@prefix#1}%
2240     }%
2241     \\fi
2242     \\ifZREF@xr@toltxlabel
2243       \\ZREF@xr@tolabel{\\ZREF@xr@tempname}{\\ZREF@xr@prefix#1}%
2244     \\fi
2245     \\fi
2246 }%
2247 \\def\\ZREF@xr@process@label\\newlabel#1#2#3[#4]#5\\ZREF@nil{%
2248   \\def\\ZREF@xr@refname{Z@R@\\ZREF@xr@prefix#1}%
2249   \\edef\\ZREF@xr@found{\\the\\numexpr\\ZREF@xr@found+1\\relax}%
2250   \\def\\x{#2}%
2251   \\edef\\ZREF@xr@tempname{\\temp$}%
2252   \\edef\\ZREF@xr@temprefname{Z@R@\\ZREF@xr@tempname}%
2253   \\expandafter\\ZREF@xr@scanparams
2254     \\csname\\ZREF@xr@temprefname\\expandafter\\endcsname
2255     \\x{}{}{}{}\\ZREF@nil
2256   \\ifx\\#4\\%
2257   \\else
2258     % ntheorem knows an optional argument at the end of \\newlabel
2259     \\ZREF@NewPropTheotype
2260     \\expandafter\\ltx@LocalAppendToMacro
2261       \\csname\\ZREF@xr@temprefname\\endcsname{\\thetype{#4}}%
2262   \\fi
2263   \\expandafter\\ltx@LocalAppendToMacro
2264   \\csname\\ZREF@xr@temprefname\\expandafter\\endcsname\\expandafter{%
2265     \\expandafter\\externaldocument\\expandafter{%
2266       \\ZREF@xr@externalfile
2267     }%
2268   }%
2269   \\ZREF@xr@urlcheck\\ZREF@xr@tempname

```

```

2270 \ifZREF@xr@tozreflabel
2271   \@ifundefined{\ZREF@xr@refname}{%
2272     \ifZREF@xr@verbose
2273       \PackageInfo{zref-xr}{%
2274         Import to zref label `~\ZREF@xr@prefix#1'%
2275       }%
2276     \fi
2277     \global\expandafter
2278     \let\csname\ZREF@xr@refname\expandafter\endcsname
2279     \csname\ZREF@xr@temprefname\endcsname
2280   }{%
2281     \ZREF@xr@zref@ignorewarning{\ZREF@xr@prefix#1}%
2282   }%
2283 \fi
2284 \ifZREF@xr@toltxlabel
2285   \ZREF@xr@tolabel{\ZREF@xr@tempname}{\ZREF@xr@prefix#1}%
2286 \fi
2287 }
2288 \def\ZREF@xr@zref@newlabel{\zref@newlabel}%
2289 \def\ZREF@xr@newlabel{\newlabel}%
2290 \def\ZREF@xr@@input{\@input}%
2291 \def\ZREF@xr@relax{\relax}%

```

\ZREF@xr@tolabel

```

2292 \def\ZREF@xr@tolabel#1#2{%
2293   \ifZREF@xr@verbose
2294     \PackageInfo{zref-xr}{%
2295       Import to LaTeX label `#2'%
2296     }%
2297   \fi
2298   \zref@wrapper@unexpanded{%
2299     \expandafter\xdef\csname r@#2\endcsname{%
2300       {%
2301         \ltx@ifundefined{M@TitleReference}{%
2302           \ltx@ifundefined{TR@TitleReference}{%
2303             \zref@extractdefault{#1}{default}{}}%
2304           {%
2305             \noexpand\TR@TitleReference
2306             {\zref@extractdefault{#1}{default}{}}%
2307             {\zref@extractdefault{#1}{title}{}}%
2308           }%
2309         }{%
2310           \noexpand\M@TitleReference
2311           {\zref@extractdefault{#1}{default}{}}%
2312           {\zref@extractdefault{#1}{title}{}}%
2313         }%
2314       }%
2315       {\zref@extractdefault{#1}{page}{}}%
2316       \ltx@ifpackageloaded{nameref}{%
2317         {\zref@extractdefault{#1}{title}{}}%
2318         {\zref@extractdefault{#1}{anchor}{}}%
2319         \zref@ifrefcontainsprop{#1}{urluse}{%
2320           {\zref@extractdefault{#1}{urluse}{}}%
2321         }{%
2322           {\zref@extractdefault{#1}{url}{}}%
2323         }%
2324       }{}%
2325     }%

```

```

2326 }%
2327 }

```

\ZREF@xr@zref@ignorewarning

```

2328 \def\ZREF@xr@zref@ignorewarning#1{%
2329   \PackageWarningNoLine{zref-xr}{%
2330     Zref label `#1' is already in use\MessageBreak
2331     in file ``\ZREF@xr@file'%
2332   }%
2333   \edef\ZREF@xr@ignored@zref{%
2334     \the\numexpr\ZREF@xr@ignored@zref+1%
2335   }%
2336 }%

```

\ZREF@xr@ltx@ignorewarning

```

2337 \def\ZREF@xr@ltx@ignorewarning#1{%
2338   \PackageWarningNoLine{zref-xr}{%
2339     LaTeX label `#1' is already in use\MessageBreak
2340     in file ``\ZREF@xr@file'%
2341   }%
2342   \edef\ZREF@xr@ignored@ltx{%
2343     \the\numexpr\ZREF@xr@ignored@ltx+1%
2344   }%
2345 }%

```

\ZREF@xr@checklist

```

2346 \def\ZREF@xr@checklist#1#2#3\ZREF@nil{%
2347   \ifx\@undefined#1\relax
2348     \expandafter\ZREF@xr@checkkey\string#1\@nil
2349   \fi
2350   \ifx\#3\%
2351   \else
2352     \ltx@ReturnAfterFi{%
2353       \ZREF@xr@checklist#3\ZREF@nil
2354     }%
2355   \fi
2356 }%
2357 \def\ZREF@xr@checkkey#1#2\@nil{%
2358   \zref@ifpropundefined{#2}{%
2359     \zref@newprop{#2}{}%
2360   }{}%
2361 }%

```

\ZREF@xr@scanparams

```

2362 \def\ZREF@xr@scanparams#1#2#3#4#5#6#7\ZREF@nil{%
2363   \let#1\ltx@empty
2364   \ZREF@foundfalse
2365   \ZREF@xr@scantitleref#1#2\TR@TitleReference{}{}\ZREF@nil
2366   \ifZREF@found
2367   \else
2368     \ltx@LocalAppendToMacro#1{\default{#2}}%
2369   \fi
2370   % page
2371   \ltx@LocalAppendToMacro#1{\page{#3}}%
2372   % nameref title
2373   \ifZREF@found
2374   \else
2375     \ifx\#4\%

```



```

2376 \else
2377 \def\ZREF@xr@temp{#4}%
2378 \ifx\ZREF@xr@temp\ZREF@xr@relax
2379 \else
2380 \ltx@LocalAppendToMacro#1{\title{#4}}%
2381 \fi
2382 \fi
2383 \fi
2384 % anchor
2385 \ifx\#5\%
2386 \else
2387 \ltx@LocalAppendToMacro#1{\anchor{#5}}%
2388 \fi
2389 \ifx\#6\%
2390 \else
2391 \ifZREF@xr@urluse
2392 \ZREF@xr@AddURL{#6}%
2393 \expandafter\ltx@LocalAppendToMacro\expandafter#1%
2394 \expandafter{%
2395 \expandafter\urluse\expandafter{%
2396 \csname Z@U@\ZREF@xr@theURL\endcsname
2397 }%
2398 }%
2399 \else
2400 \ltx@LocalAppendToMacro#1{\url{#6}}%
2401 \fi
2402 \fi
2403 }%

```

\ZREF@xr@scantitleref

```

2404 \def\ZREF@xr@scantitleref#1#2\TR@TitleReference#3#4#5\ZREF@nil{%
2405 \ifx\#5\%
2406 \else
2407 \ltx@LocalAppendToMacro#1{%
2408 \default{#3}%
2409 \title{#4}%
2410 }%
2411 \ZREF@foundtrue
2412 \fi
2413 }%

```

\ZREF@xr@urlcheck

```

2414 \def\ZREF@xr@urlcheck#1{%
2415 \zref@ifrefcontainsprop{#1}{anchor}{%
2416 \zref@ifrefcontainsprop{#1}{url}{%
2417 }{%
2418 \expandafter
2419 \ltx@LocalAppendToMacro\csname Z@R@#1\expandafter\endcsname
2420 \expandafter{%
2421 \csname url\ifZREF@xr@urluse use\fi
2422 \expandafter\endcsname\expandafter{\ZREF@xr@url}%
2423 }%
2424 }%
2425 }{%
2426 }%
2427 }%
2428 \</xr>

```

6.17 Module `hyperref`

```
UNFINISHED :-(
2429 \*hyperref
2430 \NeedsTeXFormat{LaTeX2e}
2431 \ProvidesPackage{zref-hyperref}%
2432   [2018/11/21 v2.27 Module hyperref for zref (H0)]%
2433 \RequirePackage{zref-base}[2018/11/21]
2434 \ifx\ZREF@base@ok Y%
2435 \else
2436   \expandafter\endinput
2437 \fi

2438 \ZREF@NewPropAnchor
2439 \zref@addprop\ZREF@mainlist{anchor}%
2440 \end{hyperref}
```

6.18 Module `savepos`

Module `savepos` provides an interface for pdfTeX's `\pdfsavepos`, see the manual for pdfTeX.

6.18.1 Identification

```
2441 \*savepos
2442 \NeedsTeXFormat{LaTeX2e}
2443 \ProvidesPackage{zref-savepos}%
2444   [2018/11/21 v2.27 Module savepos for zref (H0)]%
2445 \RequirePackage{zref-base}[2018/11/21]
2446 \ifx\ZREF@base@ok Y%
2447 \else
2448   \expandafter\endinput
2449 \fi

LuaTeX compatibility
2450 \ifx\pdfsavepos\undefined
2451   \let\pdfsavepos      \savepos
2452   \let\pdflastxpos     \lastxpos
2453   \let\pdflastypos     \lastypos
2454 \fi
```

6.18.2 Availability

First we check, whether the feature is available.

```
2455 \ltx@ifundefined{pdfsavepos}{%
2456   \PackageError\ZREF@name{%
2457     \string\pdfsavepos\space is not supported.\MessageBreak
2458     It is provided by pdfTeX (1.40) or XeTeX%
2459   }\ZREF@UpdatePdfTeX
2460 \endinput
2461 }{}%
```

In PDF mode we are done. However support for DVI mode was added later in version 1.40.0. In earlier versions `\pdfsavepos` is defined, but its execution raises an error. Note that XeTeX also provides `\pdfsavepos`.

```
2462 \RequirePackage{ifpdf}
2463 \ifpdf
2464 \else
2465   \ltx@ifundefined{pdftexversion}{%
```

```

2466 }{%
2467   \ifnum\pdfTeXversion<140 %
2468     \PackageError\ZREF@name{%
2469       \string\pdfsavepos\space is not supported in DVI mode%
2470       \MessageBreak
2471       of this pdfTeX version%
2472     }\ZREF@UpdatePdfTeX
2473     \expandafter\expandafter\expandafter\endinput
2474   \fi
2475 }%
2476 \fi

```

6.18.3 Setup

```

2477 \zref@newlist{savepos}
2478 \zref@newprop*{posx}[0]{\the\pdflastxpos}
2479 \zref@newprop*{posy}[0]{\the\pdflastypos}
2480 \zref@addprops{savepos}{posx,posy}

```

6.18.4 User macros

\zref@savepos

```

2481 \def\zref@savepos{%
2482   \if@files
2483     \pdfsavepos
2484   \fi
2485 }

```

\ZREF@zsavepos

```

2486 \def\ZREF@zsavepos#1#2#3{%
2487   \@bsphack
2488   \if@files
2489     \zref@savepos
2490     #1{#3}{#2}%
2491     \ltx@ifundefined{TeXeTstate}{%
2492       }{%
2493         \ifnum\TeXeTstate=\ltx@zero
2494         \else
2495           \zref@savepos
2496         \fi
2497       }%
2498     \fi
2499     \@esphack
2500 }

```

\zsavepos The current location is stored in a reference with the given name.

```

2501 \ZREF@ifDefinable\zsavepos\def{%
2502   {%
2503     \ZREF@zsavepos\zref@labelbylist{savepos}%
2504   }%
2505 }

```

\zsaveposx

```

2506 \ZREF@ifDefinable\zsaveposx\def{%
2507   {%
2508     \ZREF@zsavepos\zref@labelbyprops{posx}%
2509   }%
2510 }

```

`\zsavaposy`

```
2511 \ZREF@ifDefinable\zsavaposy\def{%
2512   {%
2513     \ZREF@zsavapos\zref@labelbyprops{posy}%
2514   }%
2515 }
```

`\zposx` The horizontal and vertical position are available by `\zposx` and `\zposy`. Do not rely on absolute positions. They differ in DVI and PDF mode of pdfTeX. Use differences instead. The unit of the position numbers is sp.

`\zposy`

```
2516 \newcommand*{\zposx}[1]{%
2517   \zref@extract{#1}{posx}%
2518 }%
2519 \newcommand*{\zposy}[1]{%
2520   \zref@extract{#1}{posy}%
2521 }%
```

Typically horizontal and vertical positions are used inside calculations. Therefore the extracting macros should be expandable and babel's patch is not applicable.

Also it is in the responsibility of the user to marked used positions by `\zrefused` in order to notify L^AT_EX about undefined references.

`\ZREF@savepos@ok`

```
2522 \let\ZREF@savepos@ok=Y
2523 \</savepos>
```

6.19 Module abspos

6.19.1 Identification

```
2524 (*abspos)
2525 \NeedsTeXFormat{LaTeX2e}
2526 \ProvidesPackage{zref-abspos}%
2527   [2018/11/21 v2.27 Module abspos for zref (H0)]%
2528 \RequirePackage{zref-base}[2018/11/21]
2529 \ifx\ZREF@base@ok Y%
2530 \else
2531   \expandafter\endinput
2532 \fi
2533 \RequirePackage{zref-savepos}[2018/11/21]
2534 \ifx\ZREF@savepos@ok Y%
2535 \else
2536   \expandafter\endinput
2537 \fi
2538 \RequirePackage{zref-pagelayout}[2018/11/21]
2539 \zref@addprop{savepos}{abspage}
2540 \RequirePackage{ifpdf}[2010/09/13]
```

`\zref@absposx`

```
2541 \newcommand*{\zref@absposx}[3]{%
2542   \number
2543     \expandafter\zref@absposnumx\expandafter{%
2544       \number\zref@extractdefault{#1}{abspage}{0}%
2545     }{#2}{#3}%
2546   \ltx@space
2547 }
```

\zref@absposy

```
2548 \newcommand*{\zref@absposy}[3]{%
2549   \number
2550   \expandafter\zref@absposnumy\expandafter{%
2551     \number\zref@extractdefault{#1}{abspage}{0}%
2552   }{#2}{#3}%
2553   \ltx@space
2554 }
```

\zref@absposnumx

```
2555 \newcommand*{\zref@absposnumx}[3]{%
2556   \number
2557   % \ifnum#1>\ltx@zero
2558   %   \zref@ifrefundefined{thepage#1}{%
2559   %     0%
2560   %   }{%
2561     \numexpr\ZREF@absposnum{thepage#1}{#2}{x}{#3}\relax
2562   }%
2563   % \else
2564   %   0%
2565   % \fi
2566 }
```

\zref@absposnumy

```
2567 \newcommand*{\zref@absposnumy}[3]{%
2568   \number
2569   % \ifnum#1>\ltx@zero
2570   %   \zref@ifrefundefined{thepage#1}{%
2571   %     0%
2572   %   }{%
2573     \numexpr\ZREF@absposnum{thepage#1}{#2}{y}{#3}\relax
2574   }%
2575   % \else
2576   %   0%
2577   % \fi
2578 }
```

\ZREF@absposnum

```
2579 \def\ZREF@absposnum#1#2#3#4{%
2580   \ltx@ifundefined{ZREF@abspos@#2@#3@#4}{%
2581     0%
2582   }{%
2583     \csname ZREF@abspos@#2@#3@#4\endcsname{#1}%
2584   }%
2585 }
```

\zref@def@absposx

```
2586 \ZREF@Robust\def\zref@def@absposx#1{%
2587   \zref@wrapper@babel{\ZREF@def@abspos{#1}\zref@absposx}%
2588 }
```

\zref@def@absposy

```
2589 \ZREF@Robust\def\zref@def@absposy#1{%
2590   \zref@wrapper@babel{\ZREF@def@abspos{#1}\zref@absposy}%
2591 }
```

\zref@def@absposnumx

```

2592 \ZREF@Robust\def\zref@def@absposnumx#1{%
2593   \zref@wrapper@babel{\ZREF@def@abspos{#1}\zref@absposnumx}%
2594 }

\zref@def@absposnumy
2595 \ZREF@Robust\def\zref@def@absposnumy#1{%
2596   \zref@wrapper@babel{\ZREF@def@abspos{#1}\zref@absposnumy}%
2597 }

\ZREF@def@abspos
2598 \def\ZREF@def@absposnumy#1#2#3#4#5{%
2599   \edef#1{#2{#3}{#4}{#5}}%
2600 }

\zref@absposused
2601 \ZREF@Robust\def\zref@absposused{%
2602   \zref@wrapper@babel\ZREF@abspos@used
2603 }

\ZREF@abspos@used
2604 \def\ZREF@abspos@used#1{%
2605   \zref@refused{#1}%
2606   \zref@ifrefundefined{#1}{%
2607     }{%
2608     \begingroup
2609       \edef\ZREF@temp{%
2610         \zref@extractdefault{#1}{abspage}{0}%
2611       }%
2612       \ifnum\ZREF@temp>\ltx@zero
2613         \zref@refused{thepage\ZREF@temp}%
2614       \else
2615         \@PackageError{zref-abspos}{%
2616           \string\zref@pos@label@used\ltx@space
2617           needs property `abspage'\MessageBreak
2618           in label `#1'%
2619         }\@ehc
2620       \fi
2621     \endgroup
2622   }%
2623 }

\zref@absposnumused
2624 \newcommand*{\zref@absposnumused}[1]{%
2625   \ifnum#1>\ltx@zero
2626     \zref@refused{thepage\number#1}%
2627   \else
2628     \@PackageError{zref-abspos}{%
2629       Invalid absolute page number (#1)\MessageBreak
2630       for \string\zref@pos@num@used.\MessageBreak
2631       A positive integer is expected%
2632     }\@ehc
2633   \fi
2634 }

\zref@ifabsposundefined
2635 \def\zref@ifabsposundefined#1{%
2636   \zref@ifrefundefined{#1}\ltx@firsttwo%

```

```

2637 \expandafter\zref@ifabsposnumundefined\expandafter{%
2638 \number\zref@extractdefault{#1}{abspage}{0}%
2639 }%
2640 }%
2641 }

```

\zref@ifabsposnumundefined

```

2642 \def\zref@ifabsposnumundefined#1{%
2643 \ifnum\ZREF@number{#1}>\ltx@zero
2644 \zref@ifrefundefined{thepage#1}%
2645 \ltx@firstoftwo\ltx@secondoftwo
2646 \else
2647 \expandafter\ltx@firstoftwo
2648 \fi
2649 }

```

6.19.2 Media

\ZREF@abspos@media@width

```

2650 \edef\ZREF@abspos@media@width{%
2651 \ltx@ifundefined{pdfpagewidth}{%
2652 \ltx@ifundefined{mediawidth}{%
2653 \ltx@ifundefined{stockwidth}{%
2654 paperwidth%
2655 }{%
2656 stockwidth%
2657 }%
2658 }{%
2659 mediawidth%
2660 }%
2661 }{%
2662 pdfpagewidth%
2663 }%
2664 }

```

\ZREF@abspos@media@height

```

2665 \edef\ZREF@abspos@media@height{%
2666 \ltx@ifundefined{pdfpageheight}{%
2667 \ltx@ifundefined{mediaheight}{%
2668 \ltx@ifundefined{stockheight}{%
2669 paperheight%
2670 }{%
2671 stockheight%
2672 }%
2673 }{%
2674 mediaheight%
2675 }%
2676 }{%
2677 \noexpand\ifcase\pdfpageheight
2678 \ltx@ifundefined{stockheight}{%
2679 paperheight%
2680 }{%
2681 stockheight%
2682 }%
2683 \noexpand\else
2684 pdfpageheight%
2685 \noexpand\fi
2686 }%

```

2687 }

\ZREF@abspos@media@x@left

2688 \def\ZREF@abspos@media@x@left#1{%
2689 0%
2690 }

\ZREF@abspos@media@x@right

2691 \def\ZREF@abspos@media@x@right#1{%
2692 \zref@extract{#1}\ZREF@abspos@media@width
2693 }

\ZREF@abspos@media@x@center

2694 \def\ZREF@abspos@media@x@center#1{%
2695 \ZREF@abspos@media@x@left{#1}%
2696 +\zref@extract{#1}\ZREF@abspos@media@width/2%
2697 }

\ZREF@abspos@media@y@top

2698 \def\ZREF@abspos@media@y@top#1{%
2699 \zref@extract{#1}\ZREF@abspos@media@height
2700 }

\ZREF@abspos@media@y@bottom

2701 \def\ZREF@abspos@media@y@bottom#1{%
2702 0%
2703 }

\ZREF@abspos@media@y@center

2704 \def\ZREF@abspos@media@y@center#1{%
2705 \zref@extract{#1}\ZREF@abspos@media@height/2%
2706 }

6.19.3 Paper

\ZREF@abspos@paper@x@left

2707 \def\ZREF@abspos@paper@x@left#1{%
2708 0%
2709 }

\ZREF@abspos@paper@x@right

2710 \def\ZREF@abspos@paper@x@right#1{%
2711 \zref@extract{#1}{paperwidth}%
2712 }

\ZREF@abspos@paper@x@center

2713 \def\ZREF@abspos@paper@x@center#1{%
2714 \zref@extract{#1}{paperwidth}/2%
2715 }

\ZREF@abspos@paper@y@top

2716 \let\ZREF@abspos@paper@y@top\ZREF@abspos@media@y@top

\ZREF@abspos@paper@y@bottom

2717 \def\ZREF@abspos@paper@y@bottom#1{%
2718 \ZREF@abspos@paper@y@top{#1}%
2719 -\zref@extract{#1}{paperheight}%
2720 }

\ZREF@abspos@paper@y@center

```
2721 \def\ZREF@abspos@paper@y@center#1{%
2722   \ZREF@abspos@paper@y@top{#1}%
2723   -\zref@extract{#1}{paperheight}/2%
2724 }
```

6.19.4 Origin

\ZREF@abspos@origin@x

```
2725 \let\ZREF@temp\ltx@two
2726 \ltx@ifundefined{pdfhorigin}{-}{%
2727   \ifpdf
2728     \let\ZREF@temp\ltx@zero
2729   \fi
2730 }
2731 \ifx\ZREF@temp\ltx@two
2732   \ifnum\mag=1000 %
2733     \let\ZREF@temp\ltx@one
2734   \fi
2735 \fi
2736 \ifcase\ZREF@temp
2737   \def\ZREF@abspos@origin@x#1{%
2738     \zref@extract{#1}{pdfhorigin}%
2739   }%
2740 \or
2741   \def\ZREF@abspos@origin@x#1{%
2742     4736286%
2743   }%
2744 \or
2745   \def\ZREF@abspos@origin@x#1{%
2746     \numexpr\mag/1000*\dimexpr 1truein\relax\relax
2747   }%
2748 \fi
```

\ZREF@abspos@origin@y

```
2749 \let\ZREF@temp\ltx@two
2750 \ltx@ifundefined{pdfvorigin}{-}{%
2751   \ifpdf
2752     \let\ZREF@temp\ltx@zero
2753   \fi
2754 }
2755 \ifx\ZREF@temp\ltx@two
2756   \ifnum\mag=1000 %
2757     \let\ZREF@temp\ltx@one
2758   \fi
2759 \fi
2760 \ifcase\ZREF@temp
2761   \def\ZREF@abspos@origin@y#1{%
2762     \zref@extract{#1}{pdfvorigin}%
2763   }%
2764 \or
2765   \def\ZREF@abspos@origin@y#1{%
2766     4736286%
2767   }%
2768 \or
2769   \def\ZREF@abspos@origin@y#1{%
2770     \numexpr\mag/1000*\dimexpr 1truein\relax\relax
2771   }%
```

2772 \fi

6.19.5 Header

\ZREF@abspos@head@x@left

```
2773 \def\ZREF@abspos@head@x@left#1{%
2774   \ZREF@abspos@paper@x@left{#1}%
2775   +\ZREF@abspos@origin@x{#1}%
2776   +\zref@extract{#1}{hoffset}%
2777   +\ifodd\zref@extractdefault{#1}{pagevalue}{\number\c@page} %
2778     \zref@extract{#1}{oddsidemargin}%
2779   \else
2780     \zref@extract{#1}{evensidemargin}%
2781   \fi
2782 }
```

\ZREF@abspos@head@x@right

```
2783 \def\ZREF@abspos@head@x@right#1{%
2784   \ZREF@abspos@head@x@left{#1}%
2785   +\zref@extract{#1}{textwidth}%
2786 }
```

\ZREF@abspos@head@x@center

```
2787 \def\ZREF@abspos@head@x@center#1{%
2788   \ZREF@abspos@head@x@left{#1}%
2789   +\zref@extract{#1}{textwidth}/2%
2790 }
```

\ZREF@abspos@head@y@top

```
2791 \def\ZREF@abspos@head@y@top#1{%
2792   \ZREF@abspos@paper@y@top{#1}%
2793   -\ZREF@abspos@origin@y{#1}%
2794   -\zref@extract{#1}{voffset}%
2795   -\zref@extract{#1}{topmargin}%
2796 }
```

\ZREF@abspos@head@y@bottom

```
2797 \def\ZREF@abspos@head@y@bottom#1{%
2798   \ZREF@abspos@head@y@top{#1}%
2799   -\zref@extract{#1}{headheight}%
2800 }
```

\ZREF@abspos@head@y@center

```
2801 \def\ZREF@abspos@head@y@center#1{%
2802   \ZREF@abspos@head@y@top{#1}%
2803   -\zref@extract{#1}{headheight}/2%
2804 }
```

6.19.6 Body

\ZREF@abspos@body@x@left

```
2805 \let\ZREF@abspos@body@x@left\ZREF@abspos@head@x@left
```

\ZREF@abspos@body@x@right

```
2806 \let\ZREF@abspos@body@x@right\ZREF@abspos@head@x@right
```

\ZREF@abspos@body@x@center

```
2807 \let\ZREF@abspos@body@x@center\ZREF@abspos@head@x@center
```

\ZREF@abspos@body@y@top

```
2808 \def\ZREF@abspos@body@y@top#1{%
2809   \ZREF@abspos@head@y@bottom{#1}%
2810   -\zref@extract{#1}{headsep}%
2811 }
```

\ZREF@abspos@body@y@bottom

```
2812 \def\ZREF@abspos@body@y@bottom#1{%
2813   \ZREF@abspos@body@y@top{#1}%
2814   -\zref@extract{#1}{textheight}%
2815 }
```

\ZREF@abspos@body@y@center

```
2816 \def\ZREF@abspos@body@y@center#1{%
2817   \ZREF@abspos@body@y@top{#1}%
2818   -\zref@extract{#1}{textheight}/2%
2819 }
```

6.19.7 Footer

\ZREF@abspos@foot@x@left

```
2820 \let\ZREF@abspos@foot@x@left\ZREF@abspos@head@x@left
```

\ZREF@abspos@foot@x@right

```
2821 \let\ZREF@abspos@foot@x@right\ZREF@abspos@head@x@right
```

\ZREF@abspos@foot@x@center

```
2822 \let\ZREF@abspos@foot@x@center\ZREF@abspos@head@x@center
```

\ZREF@abspos@foot@y@bottom

```
2823 \def\ZREF@abspos@foot@y@bottom#1{%
2824   \ZREF@abspos@body@y@bottom{#1}%
2825   -\zref@extract{#1}{footskip}%
2826 }
```

6.19.8 Marginal notes

\ZREF@abspos@marginpar@x@left

```
2827 \def\ZREF@abspos@marginpar@x@left#1{%
2828   \ifodd\zref@extractdefault{#1}{pagevalue}{\number\c@page} %
2829   \ZREF@abspos@body@x@right{#1}%
2830   +\zref@extract{#1}{marginparsep}%
2831   \else
2832   \ZREF@abspos@body@x@left{#1}%
2833   -\zref@extract{#1}{marginparsep}%
2834   -\zref@extract{#1}{marginparwidth}%
2835   \fi
2836 }
```

\ZREF@abspos@marginpar@x@right

```
2837 \def\ZREF@abspos@marginpar@x@right#1{%
2838   \ZREF@abspos@marginpar@x@left{#1}%
2839   +\zref@extract{#1}{marginparwidth}%
2840 }
```

`\ZREF@abspos@marginpar@x@center`

```
2841 \def\ZREF@abspos@marginpar@x@center#1{%
2842   \ZREF@abspos@marginpar@x@left{#1}%
2843   +\zref@extract{#1}{marginparwidth}/2%
2844 }
```

`\ZREF@abspos@marginpar@y@top`

```
2845 \let\ZREF@abspos@marginpar@y@top\ZREF@abspos@body@y@top
```

`\ZREF@abspos@marginpar@y@bottom`

```
2846 \let\ZREF@abspos@marginpar@y@bottom\ZREF@abspos@body@y@bottom
```

`\ZREF@abspos@marginpar@y@center`

```
2847 \let\ZREF@abspos@marginpar@y@center\ZREF@abspos@body@y@center
```

6.19.9 Stock paper

`\ZREF@abspos@stock@x@left`

```
2848 \let\ZREF@abspos@stock@x@left\ZREF@abspos@paper@x@left
```

`\ZREF@abspos@stock@x@right`

```
2849 \let\ZREF@abspos@stock@x@right\ZREF@abspos@paper@x@right
```

`\ZREF@abspos@stock@x@center`

```
2850 \let\ZREF@abspos@stock@x@center\ZREF@abspos@paper@x@center
```

`\ZREF@abspos@stock@y@top`

```
2851 \let\ZREF@abspos@stock@y@top\ZREF@abspos@paper@y@top
```

`\ZREF@abspos@stock@y@bottom`

```
2852 \let\ZREF@abspos@stock@y@bottom\ZREF@abspos@paper@y@bottom
```

`\ZREF@abspos@stock@y@center`

```
2853 \let\ZREF@abspos@stock@y@center\ZREF@abspos@paper@y@center
```

```
2854 /abspos)
```

6.20 Module dotfill

```
2855 (*dotfill)
2856 \NeedsTeXFormat{LaTeX2e}
2857 \ProvidesPackage{zref-dotfill}%
2858   [2018/11/21 v2.27 Module dotfill for zref (HO)]%
2859 \RequirePackage{zref-base}[2018/11/21]
2860 \ifx\ZREF@base@ok Y%
2861 \else
2862   \expandafter\endinput
2863 \fi
```

For measuring the width of `\zdotfill` we use the features provided by module `savepos`.

```
2864 \RequirePackage{zref-savepos}[2018/11/21]
```

For automatically generated label names we use the unique counter of module `base`.

```
2865 \zref@require@unique
```

Configuration is done by the key value interface of package `keyval`.

```

2866 \RequirePackage{keyval}
The definitions of the keys follow.
2867 \define@key{ZREF@DF}{unit}{%
2868   \def\ZREF@df@unit{#1}%
2869 }
2870 \define@key{ZREF@DF}{min}{%
2871   \def\ZREF@df@min{#1}%
2872 }
2873 \define@key{ZREF@DF}{dot}{%
2874   \def\ZREF@df@dot{#1}%
2875 }
Defaults are set, see user interface.
2876 \providecommand\ZREF@df@min{2}
2877 \providecommand\ZREF@df@unit{.44em}
2878 \providecommand\ZREF@df@dot{.}
\zdotfillsetup Configuration of \zdotfill is done by \zdotfillsetup.
2879 \newcommand*{\zdotfillsetup}{\kvsetkeys{ZREF@DF}}

\zdotfill \zdotfill sets labels at the left and the right to get the horizontal position.
\zsavepos is not used, because we do not need the vertical position.
2880 \ZREF@IfDefinable\zdotfill\def{%
2881   {%
2882     \leavevmode
2883     \global\advance\c@zref@unique\ltx@one
2884     \begingroup
2885       \def\ZREF@temp{zref@\number\c@zref@unique}%
2886       \pdfsavepos
2887       \zref@labelbyprops{\thezref@unique L}{posx}%
2888       \setlength{\dimen@}{\ZREF@df@unit}%
2889       \zref@ifrefundefined{\thezref@unique R}{%
2890         \ZREF@dotfill
2891       }{%
2892         \ifnum\numexpr\zposx{\thezref@unique R}%
2893           -\zposx{\thezref@unique L}\relax
2894         <\dimexpr\ZREF@df@min\dimen@\relax
2895         \hfill
2896       }else
2897         \ZREF@dotfill
2898       \fi
2899     }%
2900     \pdfsavepos
2901     \zref@labelbyprops{\thezref@unique R}{posx}%
2902   \endgroup
2903   \kern\z@
2904 }%
2905 }

\ZREF@dotfill Help macro that actually sets the dots.
2906 \def\ZREF@dotfill{%
2907   \cleaders\hb@xt@\dimen@{\hss\ZREF@df@dot\hss}\hfill
2908 }

2909 </dotfill>

```

6.21 Module env

```

2910 (*env)

```

```

2911 \NeedsTeXFormat{LaTeX2e}
2912 \ProvidesPackage{zref-env}%
2913 [2018/11/21 v2.27 Module env for zref (HO)]%
2914 \RequirePackage{zref-base}[2018/11/21]
2915 \ifx\ZREF@base@ok Y%
2916 \else
2917 \expandafter\endinput
2918 \fi

2919 \zref@newprop{envname}[]{\@currentenv}
2920 \zref@newprop{envline}[]{\zref@env@line}

\zref@env@line Macro \zref@env@line extracts the line number from \@currentline.
2921 \def\zref@env@line{%
2922 \ifx\@currentline\ltx@empty
2923 \else
2924 \expandafter
2925 \ZREF@ENV@line\@currentline\ltx@empty line \ltx@empty\@nil
2926 \fi
2927 }

\ZREF@ENV@line
2928 \def\ZREF@ENV@line#1line #2\ltx@empty#3\@nil{#2}%
2929 </env>

```

7 Test

7.1 \zref@localaddprop

```

2930 <*test1>
2931 \NeedsTeXFormat{LaTeX2e}
2932 \nofiles
2933 \documentclass{article}
2934 \usepackage{zref-base}[2018/11/21]
2935 \usepackage{qstest}
2936 \IncludeTests{*}
2937 \LogTests{log}{*}{*}
2938
2939 \makeatletter
2940 \def\ExpectList#1#2{%
2941 \expandafter\expandafter\expandafter\Expect
2942 \expandafter\expandafter\expandafter{\csname Z@L@#1\endcsname}{#2}%
2943 }
2944 \begin{qstest}\localaddprop\localaddprop
2945 \ExpectList{main}{\default\page}%
2946 \Expect{undefined}*\meaning\foobar}%
2947 \zref@newprop{foobar}{F00}%
2948 \Expect{undefined}*\meaning\foobar}%
2949 \zref@newlist{alist}%
2950 \ExpectList{alist}{}%
2951 \begingroup
2952 \zref@localaddprop{main}{foobar}%
2953 \Expect{undefined}*\meaning\foobar}%
2954 \ExpectList{main}{\default\page\foobar}%
2955 \zref@localaddprop{alist}{page}%
2956 \ExpectList{alist}{\page}%
2957 \endgroup

```

```

2958 \ExpectList{main}{\default\page}%
2959 \ExpectList{alist}{}%
2960 \zref@addprop{alist}{foobar}%
2961 \ExpectList{alist}{\foobar}%
2962 \Expect{undefined}*{\meaning\foobar}%
2963 \end{qstest}
2964 \@@end
2965 \test1

```

7.2 Module base

```

2966 (*test-base)
2967 \NeedsTeXFormat{LaTeX2e}
2968 \documentclass{article}
2969 \usepackage{zref-base,zref-titleref}[2018/11/21]
2970 \usepackage{qstest}
2971 \IncludeTests{*}
2972 \LogTests{log}{*}{*}
2973
2974 \makeatletter
2975 \newcommand*{\DefExpand}[2]{%
2976   \expandafter\expandafter\expandafter\def
2977   \expandafter\expandafter\expandafter#1%
2978   \expandafter\expandafter\expandafter{#2}%
2979   \@onelevel@sanitize#1%
2980 }
2981 \newcommand*{\Test}[3]{%
2982   \Expect{#2}*{#1}%
2983   \zref@wrapper@unexpanded{%
2984     \Expect*{#3}*{#1}%
2985   }%
2986   \DefExpand\x{#1}%
2987   \Expect*{#3}*{\x}%
2988 }
2989 \makeatother
2990
2991 \begin{document}
2992 \section{\textit{Hello} \textbf{World}}
2993 \label{sec:hello}
2994 \makeatletter
2995 \zref@newprop{foo}[\@empty D\@empty efault]{\@empty V\@empty alue}
2996 \begin{qstest}{getcurrent}{getcurrent}
2997   \Test{\zref@getcurrent{foo}}%
2998     {Value}{\noexpand\@empty V\noexpand\@empty alue}%
2999   \Test{\zref@getcurrent{xy}}{}{}%
3000 \end{qstest}
3001 \begin{qstest}{extract}{extract}
3002   \def\textbf#1{<#1>}%
3003   \def\textit#1{[#1]}% hash-ok
3004   \Test{\zref@extractdefault{xy}{page}{\@empty D\@empty efault}}%
3005     {Default}{\noexpand\@empty D\noexpand\@empty efault}%
3006   \Test{\zref@extractdefault{sec:hello}{foo}{\@empty A\@empty B}}%
3007     {AB}{\noexpand\@empty A\noexpand\@empty B}%
3008   \Test{\zref@extract{sec:hello}{foo}}%
3009     {Default}{\noexpand\@empty D\noexpand\@empty efault}%
3010   \zref@ifrefundefined{sec:hello}{%
3011   }{%
3012     \Test{\zref@extract{sec:hello}{default}}{1}{1}%
3013     \Test{\zref@extract{sec:hello}{title}}%

```

```

3014      {[Hello] <World>}}%
3015      {\noexpand\textit{Hello} \noexpand\textbf{World}}}%
3016  }%
3017 \end{qstest}
3018 \end{document}
3019 /test-base>

```

7.3 Module runs

```

3020 (*test-runs)
3021 \NeedsTeXFormat{LaTeX2e}
3022 \documentclass{article}
3023 \usepackage{zref-runs}[2018/11/21]
3024 \usepackage{qstest}
3025 \IncludeTests{*}
3026 \LogTests{log}{*}{*}
3027
3028 \begin{qstest}{zruns-preamble}{zruns-preamble}
3029   \Expect{0}{*}{\zruns}%
3030 \end{qstest}
3031
3032 \AtBeginDocument{%
3033   \begin{qstest}{zruns-atbegindocument}{zruns-atbegindocument}%
3034     \Expect*{\number\ExpectRuns}{*}{\zruns}%
3035   \end{qstest}%
3036 }
3037
3038 \begin{document}
3039 \begin{qstest}{zruns-document}{zruns-document}
3040   \Expect*{\number\ExpectRuns}{*}{\zruns}%
3041 \end{qstest}
3042 \end{document}
3043 /test-runs>

```

7.4 Module titleref

```

3044 (*test-titleref-memoir)
3045 \NeedsTeXFormat{LaTeX2e}
3046 \documentclass{memoir}
3047 \usepackage{zref-titleref}[2018/11/21]
3048 \usepackage{qstest}
3049 \IncludeTests{*}
3050 \LogTests{log}{*}{*}
3051 \begin{document}
3052 \makeatletter
3053 \def\List{}
3054 \def\Label#1{%
3055   \zref@label{#1}%
3056   \g@addto@macro\List{%
3057     \par
3058     #1: [\ztitleref{#1}]}%
3059   }%
3060   \mbox{}%
3061   \zref@refused{#1}%
3062   \zref@ifrefundefined{#1}{%
3063     }{%
3064       \begingroup
3065         \edef\x{\zref@extract{#1}{title}}%
3066         \Expect{OK/}{*}{\expandafter\ltx@carthree\x{}{}{}\@nil}%
3067       \endgroup

```



```

3068 }%
3069 }
3070 \def\Test#1{%
3071   \csname#1\endcsname*{OK/#1}%
3072   \Label{#1*}%
3073   \csname#1\endcsname{OK/#1}%
3074   \Label{#1}%
3075   \csname#1\endcsname[OK/#1-toc]%
3076           {WRONG-in-titleref/#1-toc-2}%
3077   \Label{#1-toc}%
3078   \expandafter\ifx\csname#1\endcsname\part
3079   \else
3080     \headnamereffalse
3081     \csname#1\endcsname[OK/#1-th-toc]%
3082             [WRONG-in-titleref/#1-th-toc-2]%
3083             {WRONG-in-titleref/#1-th-toc-3}%
3084     \Label{#1-th-toc}%
3085     \headnamereftrue
3086     \csname#1\endcsname[WRONG-in-titleref/#1-th-head-1]%
3087             [OK/#1-th-head]%
3088             {WRONG-in-titleref/#1-th-head-3}%
3089     \Label{#1-th-head}%
3090   \fi
3091 }
3092 \begin{qstest}{section}{section}
3093   \@for\x:=part,chapter,section,subsection,subsubsection\do{%
3094     \expandafter\Test\expandafter{\x}%
3095   }%
3096 \end{qstest}
3097 \newpage
3098 \List
3099 \end{document}
3100 </test-titleref-memoir>

```

8 Installation

8.1 Download

Package. This package is available on CTAN²:

[CTAN:macros/latex/contrib/oberdiek/zref.dtx](#) The source file.

[CTAN:macros/latex/contrib/oberdiek/zref.pdf](#) Documentation.

Bundle. All the packages of the bundle ‘oberdiek’ are also available in a TDS compliant ZIP archive. There the packages are already unpacked and the documentation files are generated. The files and directories obey the TDS standard.

[CTAN:install/macros/latex/contrib/oberdiek.tds.zip](#)

TDS refers to the standard “A Directory Structure for \TeX Files” ([CTAN:tds/tds.pdf](#)). Directories with `texmf` in their name are usually organized this way.

8.2 Bundle installation

Unpacking. Unpack the `oberdiek.tds.zip` in the TDS tree (also known as `texmf` tree) of your choice. Example (linux):

```
unzip oberdiek.tds.zip -d ~/texmf
```

²[CTAN:pkg/zref](#)

Script installation. Check the directory `TDS:scripts/oberdiek/` for scripts that need further installation steps. Package `attachfile2` comes with the Perl script `pdfatfi.pl` that should be installed in such a way that it can be called as `pdfatfi`. Example (linux):

```
chmod +x scripts/oberdiek/pdfatfi.pl
cp scripts/oberdiek/pdfatfi.pl /usr/local/bin/
```

8.3 Package installation

Unpacking. The `.dtx` file is a self-extracting docstrip archive. The files are extracted by running the `.dtx` through plain \TeX :

```
tex zref.dtx
```

TDS. Now the different files must be moved into the different directories in your installation TDS tree (also known as `texmf` tree):

<code>zref.sty</code>	→ <code>tex/latex/oberdiek/zref.sty</code>
<code>zref-base.sty</code>	→ <code>tex/latex/oberdiek/zref-base.sty</code>
<code>zref-abspage.sty</code>	→ <code>tex/latex/oberdiek/zref-abspage.sty</code>
<code>zref-abspos.sty</code>	→ <code>tex/latex/oberdiek/zref-abspos.sty</code>
<code>zref-counter.sty</code>	→ <code>tex/latex/oberdiek/zref-counter.sty</code>
<code>zref-dotfill.sty</code>	→ <code>tex/latex/oberdiek/zref-dotfill.sty</code>
<code>zref-env.sty</code>	→ <code>tex/latex/oberdiek/zref-env.sty</code>
<code>zref-hyperref.sty</code>	→ <code>tex/latex/oberdiek/zref-hyperref.sty</code>
<code>zref-lastpage.sty</code>	→ <code>tex/latex/oberdiek/zref-lastpage.sty</code>
<code>zref-marks.sty</code>	→ <code>tex/latex/oberdiek/zref-marks.sty</code>
<code>zref-nextpage.sty</code>	→ <code>tex/latex/oberdiek/zref-nextpage.sty</code>
<code>zref-pageattr.sty</code>	→ <code>tex/latex/oberdiek/zref-pageattr.sty</code>
<code>zref-pagelayout.sty</code>	→ <code>tex/latex/oberdiek/zref-pagelayout.sty</code>
<code>zref-perpage.sty</code>	→ <code>tex/latex/oberdiek/zref-perpage.sty</code>
<code>zref-runs.sty</code>	→ <code>tex/latex/oberdiek/zref-runs.sty</code>
<code>zref-savepos.sty</code>	→ <code>tex/latex/oberdiek/zref-savepos.sty</code>
<code>zref-thepage.sty</code>	→ <code>tex/latex/oberdiek/zref-thepage.sty</code>
<code>zref-titleref.sty</code>	→ <code>tex/latex/oberdiek/zref-titleref.sty</code>
<code>zref-totpages.sty</code>	→ <code>tex/latex/oberdiek/zref-totpages.sty</code>
<code>zref-user.sty</code>	→ <code>tex/latex/oberdiek/zref-user.sty</code>
<code>zref-xr.sty</code>	→ <code>tex/latex/oberdiek/zref-xr.sty</code>
<code>zref.pdf</code>	→ <code>doc/latex/oberdiek/zref.pdf</code>
<code>zref-example.tex</code>	→ <code>doc/latex/oberdiek/zref-example.tex</code>
<code>zref-example-lastpage.tex</code>	→ <code>doc/latex/oberdiek/zref-example-lastpage.tex</code>
<code>zref-example-nextpage.tex</code>	→ <code>doc/latex/oberdiek/zref-example-nextpage.tex</code>
<code>test/zref-test1.tex</code>	→ <code>doc/latex/oberdiek/test/zref-test1.tex</code>
<code>test/zref-test-base.tex</code>	→ <code>doc/latex/oberdiek/test/zref-test-base.tex</code>
<code>test/zref-test-runs.tex</code>	→ <code>doc/latex/oberdiek/test/zref-test-runs.tex</code>
<code>test/zref-test-titleref-memoir.tex</code>	→ <code>doc/latex/oberdiek/test/zref-test-titleref-memoir.tex</code>
<code>zref.dtx</code>	→ <code>source/latex/oberdiek/zref.dtx</code>

If you have a `docstrip.cfg` that configures and enables docstrip's TDS installing feature, then some files can already be in the right place, see the documentation of docstrip.

8.4 Refresh file name databases

If your \TeX distribution (te \TeX , mi \TeX , ...) relies on file name databases, you must refresh these. For example, te \TeX users run `texhash` or `mktextlsr`.

8.5 Some details for the interested

Unpacking with \LaTeX . The `.dtx` chooses its action depending on the format:

plain \TeX : Run docstrip and extract the files.

\LaTeX : Generate the documentation.

If you insist on using \LaTeX for `docstrip` (really, `docstrip` does not need \LaTeX), then inform the autodetect routine about your intention:

```
latex \let\install=y\input{zref.dtx}
```

Do not forget to quote the argument according to the demands of your shell.

Generating the documentation. You can use both the `.dtx` or the `.drv` to generate the documentation. The process can be configured by the configuration file `ltxdoc.cfg`. For instance, put this line into this file, if you want to have A4 as paper format:

```
\PassOptionsToClass{a4paper}{article}
```

An example follows how to generate the documentation with `pdf \LaTeX` :

```
pdflatex zref.dtx
makeindex -s gind.ist zref.idx
pdflatex zref.dtx
makeindex -s gind.ist zref.idx
pdflatex zref.dtx
```

9 References

- [1] Package `footmisc`, Robin Fairbairns, 2004/01/23 v5.3a. [CTAN:pkg/footmisc](#)
- [2] Package `hyperref`, Sebastian Rahtz, Heiko Oberdiek, 2006/08/16 v6.75c. [CTAN:pkg/hyperref](#)
- [3] Package `lastpage`, Jeff Goldberg, 1994/06/25 v0.1b. [CTAN:pkg/lastpage](#)
- [4] Package `nameref`, Sebastian Rahtz, Heiko Oberdiek, 2006/02/12 v2.24. [CTAN:pkg/nameref](#)
- [5] Package `perpage`, David Kastrup, 2002/12/20 v1.0. [CTAN:pkg/perpage](#)
- [6] Package `titleref`, Donald Arsenau, 2001/04/05 v3.1. [CTAN:pkg/titleref](#)
- [7] Package `totpages`, Wilhelm Müller, 1999/07/14 v1.00. [CTAN:pkg/totpages](#)
- [8] Package `xr`, David Carlisle, 1994/05/28 v5.02. [CTAN:pkg/xr](#)
- [9] Package `xr-hyper`, David Carlisle, 2000/03/22 v6.00beta4. [CTAN:pkg/xr-hyper](#)

10 History

[2006/02/20 v1.0]

- First version.

[2006/05/03 v1.1]

- Module `perpage` added.
- Module redesign as packages.

[2006/05/25 v1.2]

- Module `dotfillmin` added.
- Module `base`: macros `\zref@require@unique` and `\thezref@unique` added (used by modules `titleref` and `dotfillmin`).

[2006/09/08 v1.3]

- Typo fixes and English cleanup by Per Starback.

[2007/01/23 v1.4]

- Typo in macro name fixed in documentation.

[2007/02/18 v1.5]

- `\zref@getcurrent` added (suggestion of Igor Akkerman).
- Module `savepos` also supports \LaTeX .

[2007/04/06 v1.6]

- Fix in modules `abspage` and `base`: Now counter `abspage` and `zref@unique` are not remembered by `\include`.
- Beamer support for module `titleref`.

[2007/04/17 v1.7]

- Package `atbegshi` replaces `everyshi`.

[2007/04/22 v1.8]

- `\zref@wrapper@babel` and `\zref@refused` are now expandable if `babel` is not used or `\if@safe@actives` is already set to true. (Feature request of Josselin Noirel)

[2007/05/02 v1.9]

- Module `titleref`: Some support for `\caption` of package `longtable`, but only if `\label` is given after `\caption`.

[2007/05/06 v2.0]

- Uses package `etexcmds` for accessing \LaTeX 's `\unexpanded`.

[2007/05/28 v2.1]

- Module `titleref` supports caption of package `listings`.
- Fixes in module `titleref` for support of packages `titlesec` and `longtable`.

[2008/09/21 v2.2]

- Module base: `\zref@iflistcontainsprop` is documented, but a broken `\zref@listcontainsprop` implemented. Name and implementation fixed (thanks Ohad Kammar).

[2008/10/01 v2.3]

- `\zref@localaddprop` added (feature request of Ohad Kammar).
- Module lastpage: list ‘LastPage’ added. Label ‘LastPage’ will use the properties of this list (default is empty) along with the properties of the main list.

[2009/08/07 v2.4]

- Module runs added.

[2009/12/06 v2.5]

- Module lastpage: Uses package `atveryend`.
- Module titleref: Further commands are disabled during string expansion, imported from package `nameref`.

[2009/12/07 v2.6]

- Version date added for package `atveryend`.

[2009/12/08 v2.7]

- Module titleref: Use of package `getttitlestring`.

[2010/03/26 v2.8]

- `\zifrefundefined` added.
- Module lastpage: Macros `\zref@iflastpage` and `\ziflastpage` added.
- Module thepage added.
- Module nextpage added.

[2010/03/29 v2.9]

- Module marks added (without documentation).
- `\zref@addprop` now adds expanded property to list.
- Useless `\ZREF@ErrorNoLine` removed.

[2010/04/08 v2.10]

- Module xr remembers the external document name in property ‘externaldocument’.

[2010/04/15 v2.11]

- Module `titleref`: Better support of class `memoir`.
- Module `titleref`: Support of theorems.

[2010/04/17 v2.12]

- Module `base`: `\zref@newprop` ensures global empty default.
- Module `xr`: Setup options `tozreflabel` and `toltxlabel` added.

[2010/04/19 v2.13]

- `\zref@setcurrent` throws an error if the property does not exist (Florent Chervet).
- `\zref@getcurrent` the documentation is fixed (Florent Chervet). Also it returns the empty string in case of errors.
- `\zref@addprop` and `\zref@localaddprop` now take a list of property names (feature request of Florent Chervet).
- Example for `\zref@wrapper@unexpanded` corrected (Florent Chervet).

[2010/04/22 v2.14]

- Bug fix for `\zref@getcurrent` second argument wasn't eaten in case of unknown property.
- `\zref@getcurrent` supports `\zref@wrapper@unexpanded`.
- `\zref@wrapper@unexpanded` added for `\ZREF@xr@tolabel`.
- `\zref@extract`, `\zref@extractdefault`, `\zref@getcurrent` are expandable in exact two steps except inside `\zref@wrapper@unexpanded`.

[2010/04/23 v2.15]

- `\zexternaldocument` fixed for property 'url' when importing `\new@label` (bug found by Victor Ivrii).
- Two expansion steps also in `\zref@wrapper@unexpanded`.
- Nested calls of `\zref@wrapper@unexpanded` possible.

[2010/04/28 v2.16]

- More consequent use of package 'ltxcmds' and 'hologo'.
- Module `pagelayout` added.
- Module `pageattr` added.
- Robustness introduced for non-expandable interface macros.
- Internal change of the data format of property lists (suggestion of Florent Chervet).
- Module `titleref`: Support of environment `description`.

[2010/05/01 v2.17]

- `\zref@newprop` throws an error if the property already exists.
- Module `xr`: Bug fix for the case of several `.aux` files (bug found by Victor Ivrii).
- Module `xr`: Property `'urluse'` and option `urluse` added.

[2010/05/13 v2.18]

- Module `env` added.
- Module `savepos`: `\zref@savepos` added.

[2010/10/22 v2.19]

- `\zref@addprop` and `\zref@localaddprop` are limited to one property only (incompatibility to versions v2.13 to v2.18).
- `\zref@addprops` and `\zref@localaddprops` added.
- `\zref@delprop` and `\zref@localdelprop` added.
- `\zref@labelbykv` and `\zkvlabel` (module `user`) with keys `prop`, `list`, `delprop`, `immediate`, `values` added.

[2011/02/12 v2.20]

- Fix for warning in `zref-xr`.

[2011/03/18 v2.21]

- Fix in module `pagelayout` for `\zlistpagelayout`.
- Fix for `\zref@localaddprop` (probably since v2.19).

[2011/10/05 v2.22]

- Documentation fixed for `\zref@(local)addprop(s)`.
- Module `base`: `\zref@def@extract`, `\zref@def@extractdefault` added.
- Fix in module `pagelayout`: Because of missing `\noexpand` commands the values of the `pagelayout` properties on all pages were the values at package loading.
- Module `base`: `\zref@showprop` added.

[2011/12/05 v2.23]

- Module `savepos`: `\zsaveposx` and `\zsaveposy` added.

[2012/04/04 v2.24]

- Module `titleref`, package `titlesec`: some support for class `'straight'` (`\ttl@straight@i`) added.

[2016/05/16 v2.25]

- Documentation updates.

[2016/05/21 v2.26]

- update zref-savepos for new luatex

[2018/11/21 v2.27]

- adapted zref-perpage, see issue
<https://github.com/ho-tex/oberdiek/issues/26>

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