

The zref package

Heiko Oberdiek
<oberdiek@uni-freiburg.de>

2007/05/28 v2.1

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.

Contents

1	Introduction	3
1.1	Standard \LaTeX behaviour	3
1.2	Basic idea	3
1.3	Interfaces	4
2	Interface for programmers	4
2.1	Entities	4
2.2	Property list	4
2.3	Property	5
2.4	Reference generation	5
2.5	Data extraction	6
2.6	Setup	7
2.7	Declared properties	7
2.8	Wrapper for advanced situations	7
2.9	Counter for unique names	8
3	User interface	8
3.1	Module <code>user</code>	8
3.2	Module <code>abspage</code>	9
3.3	Module <code>lastpage</code>	9
3.4	Module <code>totpages</code>	9
3.5	Module <code>perpage</code>	9
3.6	Module <code>counter</code>	10
3.7	Module <code>titleref</code>	10
3.8	Module <code>savepos</code>	11
3.9	Module <code>dotfill</code>	11
3.10	Module <code>xr</code>	12
4	ToDo	12
5	Example	12

6	Implementation	15
6.1	Package <code>zref</code>	15
6.1.1	Identification	15
6.1.2	Load basic module	15
6.1.3	Process options	15
6.2	Module <code>base</code>	15
6.2.1	Prefixes	15
6.2.2	Identification	16
6.2.3	Utilities	16
6.2.4	Check for ε - <code>T_EX</code>	16
6.2.5	Auxiliary file stuff	17
6.2.6	Property lists	17
6.2.7	Properties	19
6.2.8	Reference generation	20
6.2.9	Reference querying and extracting	21
6.2.10	Compatibility with <code>babel</code>	23
6.2.11	Unique counter support	23
6.2.12	Setup	24
6.3	Module <code>user</code>	24
6.4	Module <code>abspage</code>	25
6.5	Module <code>counter</code>	26
6.6	Module <code>lastpage</code>	26
6.7	Module <code>totpages</code>	26
6.8	Module <code>perpage</code>	27
6.9	Module <code>titleref</code>	29
6.9.1	Implementation	29
6.9.2	User interface	30
6.9.3	Patches for section and caption commands	31
6.10	Module <code>xr</code>	33
6.11	Module <code>hyperref</code>	37
6.12	Module <code>savepos</code>	37
6.12.1	Identification	37
6.12.2	Availability	38
6.12.3	Setup	38
6.12.4	User macros	38
6.13	Module <code>dotfill</code>	39
7	Installation	40
7.1	Download	40
7.2	Bundle installation	40
7.3	Package installation	40
7.4	Refresh file name databases	41
7.5	Some details for the interested	41
8	References	42
9	History	42
	[2006/02/20 v1.0]	42
	[2006/05/03 v1.1]	42
	[2006/05/25 v1.2]	42
	[2006/09/08 v1.3]	42
	[2007/01/23 v1.4]	42
	[2007/02/18 v1.5]	42
	[2007/04/06 v1.6]	43
	[2007/04/17 v1.7]	43
	[2007/04/22 v1.8]	43
	[2007/05/02 v1.9]	43
	[2007/05/06 v2.0]	43

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_⟨your key⟩_key{⟨some text⟩}
```

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.

`\zref@newlist {⟨listname⟩}`

Declares a new empty property list.

`\zref@addprop {⟨listname⟩} {⟨propname⟩}`

Adds the property ⟨*propname*⟩ to the property list ⟨*listname*⟩. The property and list must exist.

`\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@getcurrent {<propname>} {<value>}`

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’).

`\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@extractdefaultexp {<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@extractexp {<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@ifrefundefinedexp {<refname>} {<then>} {<else>}`

A possibility to check whether a reference exists.

`\zref@ifrefcontainspropexp {<refname>} {<propname>} {<then>} {<else>}`

Test whether a reference provides a property.

2.6 Setup

`\zref@default`

Holds the global default for unknown values.

`\zref@setdefault {<value>}`

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.

`\zref@setmainlist {<value>}`

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

2.7 Declared properties

Modul	Property	Property list	Default
	<code>default</code>	<code>main</code>	<code><empty></code>
	<code>page</code>	<code>main</code>	<code><empty></code>
<code>abspage, totpages</code>	<code>abspage</code>	<code>main</code>	<code>0</code>
<code>perpage</code>	<code>pagevalue</code>	<code>perpage</code>	<code>0</code>
	<code>page</code>	<code>perpage</code>	<code><empty></code>
	<code>abspage</code>	<code>perpage</code>	<code>0</code>
<code>counter</code>	<code>counter</code>	<code>main</code>	<code><empty></code>
<code>titleref</code>	<code>title</code>	<code>main</code>	<code><empty></code>
<code>savepos</code>	<code>posx</code>	<code>savepos</code>	<code>0</code>
	<code>posy</code>	<code>savepos</code>	<code>0</code>
<code>hyperref</code>	<code>anchor</code>	<code>main</code>	<code><empty></code>
	<code>url</code>		<code><empty></code>
<code>xr</code>	<code>url</code>		<code><empty></code>

2.8 Wrapper for advanced situations

`\zref@wrapper@babel {...} {<name>}`

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 `\label` command is put inside this wrapper, immediate writing is enabled. See the implementation for option `lastpage`.

`\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:

```

\edef\foo{%
  \zref@wrapper@unexpanded{%
    \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.

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.

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`.

`\zpageref{x} ≡ \zref[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, `\zrefused` 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 option `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:

`\zpageref{LastPage}`

3.4 Module **totpages**

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

`\ztotpages`^{exp}

Prints the total number of pages or 0 if this number is not yet known. This command can also be used in calculations or counter assignments.

3.5 Module **perpage**

With `\@addtoreset` or `\numberwithin` a counter can be reset if another counter is incremented. This does 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.

3.6 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 reimplementation of the `autoref` feature, see the section 4 with the todo list.

3.7 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 modul `titleref`. The following keys are available:

`title=⟨value⟩`

Sets the current title.

`stripperperiod=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.

3.8 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 $\langle refname \rangle$ to the location where the command is executed.

`\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.

3.9 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 $\langle count\ value \rangle$, then the dots are suppressed. Default: 2.

`unit=⟨dimen value⟩`

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

`dot=⟨value⟩`

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

3.10 Module `xr`

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

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

See `\xexternaldocument` for a description of this option. 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, ...}`

Currently the key `ext` is defined, this sets the url default extension.

`\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:

- The user land macros are not checked for robustness yet. They can be fragile. If this happens, use `\protect` until a later version of this package. The `\protect` will not disturb, if the protected macro become robust in the future.
- Other applications: `autoref`, `hyperref`, ...

5 Example

```
1 <*example>
2 \documentclass{book}
3
4 \usepackage[ngerman]{babel}%
5
6 \usepackage[savepos,totpages,titleref,dotfill,counter,user]{zref}
7
```

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.

```

8 \makeatletter
9 \zref@newprop{chaptitle}{}
10 \zref@addprop{main}{chaptitle}
11
12 \newcommand*{\ChapterStart}[2]{%
13   \cleardoublepage
14   \def\current@chapid{#1}%
15   \zref@setcurrent{chaptitle}{#2}%
16   \chapter{#2}%
17   \zlabel{chap:#1}%
18 }
19 \newcommand*{\ChapterStop}{%
20   \cleardoublepage
21   \zref@wrapper@immediate{%
22     \zref@labelbyprops{chapend:\current@chapid}{abspage}%
23   }%
24 }
```

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

```

25 \newcommand*{\ChapterPages}[1]{%
26   \zrefused{chap:#1}%
27   \zrefused{chapend:#1}%
28   \number\numexpr
29     \zref@extract{chapend:#1}{abspage}%
30     -\zref@extract{chap:#1}{abspage}%
31     +1\relax
32 }
33 \makeatother
34 \begin{document}
```

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

```

35 \makeatletter
36
37 \frontmatter
38 \zlabel{documentstart}
39
40 \begin{itemize}
41 \item
42   The frontmatter part has
43   \number\numexpr\zref@extract{chap:first}{abspage}-1\relax~pages.
44 \item
45   Chapter \zref{chap:first} has \ChapterPages{first} page(s).
46 \item
47   Section \zref{hello} is on the
48   \ifcase\numexpr
49     \zref@extractdefault{hello}{page}{0}%
50     -\zref@extractdefault{chap:first}{page}{0}%
51     +1\relax
52     ??\or first\or second\or third\or forth\fi
53   ~page inside its chapter.
54 \item
55   The document has
56   \zref[abspage]{LastPage} pages.
57   This number is \ifodd\ztotpages odd\else even\fi.
58 \item
59   The last page is labeled with \pageref{LastPage}.
```

```

60 \item
61   The title of chapter \zref{chap:next} is ‘‘\zref[chaptitle]{chap:next}’’.
62 \end{itemize}
63
64 \tableofcontents
65
66 \mainmatter
67 \ChapterStart{first}{First chapter}
68

```

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`.

```

69 \section{Test}
70 \zlabel{a"o}
71 Section \zref{a"o} on page
72 \zref@wrapper@babel\zref@extract{a"o}{page}.
73
74 Text.
75 \newpage
76
77 \section{Hello World}
78 \zlabel{hello}
79
80 \ChapterStop
81
82 \ChapterStart{next}{Next chapter with \emph{umlauts}: "a"o"u"s}
83

```

Here an example follows that makes use of pdfTeX’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 L^AT_EX compile run.

```

84 The width of the first column is
85   \the\dimexpr \zposx{secondcol}sp - \zposx{firstcol}sp\relax,\,
86 the height difference of the two baselines is
87   \the\dimexpr \zposy{firstcol}sp - \zposy{secondline}sp\relax:\,
88 \begin{tabular}{ll}
89   \zsavapos{firstcol}Hello&\zsavapos{secondcol}World\\
90   \zsavapos{secondline}Second line&foobar\\
91 \end{tabular}
92

```

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

```

93 \zrefused{firstcol}
94 \zrefused{secondcol}
95 \zrefused{secondline}
96
97 \ChapterStop

```

Test for module `\dotfill`.

```

98 \ChapterStart{dotfill}{Test for dotfill feature}
99 \newcommand*{\dfptest}[1]{%
100   #1&
101   [\makebox[{#1}]{\dotfill}]&
102   [\makebox[{#1}]{\zdotfill}]\,\\
103 }
104 \begin{tabular}{rll}
105 & [\verb|\dotfill|] & [\verb|\zdotfill|]\,\\
106 \dfptest{0.43em}
107 \dfptest{0.44em}
108 \dfptest{0.45em}
109 \dfptest{0.87em}
110 \dfptest{0.88em}

```

```

111 \dfptest{0.89em}
112 \dfptest{1.31em}
113 \dfptest{1.32em}
114 \dfptest{1.33em}
115 \end{tabular}
116 \ChapterStop
117 \end{document}
118 \example

```

6 Implementation

6.1 Package zref

6.1.1 Identification

```

119 <*package>
120 \NeedsTeXFormat{LaTeX2e}
121 \ProvidesPackage{zref}
122 [2007/05/28 v2.1 New reference scheme for LaTeX2e (H0)]%

```

6.1.2 Load basic module

```

123 \RequirePackage{zref-base}[2007/05/28]

```

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

```

124 \@ifundefined{ZREF@baseok}{\endinput}{}

```

6.1.3 Process options

Known modules are loaded and the release date is checked.

```

125 \def\ZREF@temp#1{%
126   \DeclareOption{#1}{%
127     \AtEndOfPackage{%
128       \RequirePackage{zref-#1}[2007/05/28]%
129     }%
130   }%
131 }
132 \ZREF@temp{abspage}
133 \ZREF@temp{counter}
134 \ZREF@temp{dotfill}
135 \ZREF@temp{hyperref}
136 \ZREF@temp{lastpage}
137 \ZREF@temp{perpage}
138 \ZREF@temp{savepos}
139 \ZREF@temp{titleref}
140 \ZREF@temp{totpages}
141 \ZREF@temp{user}
142 \ZREF@temp{xr}
143 \ProcessOptions\relax
144 </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 $\langle propname \rangle$ is expanded immediately or at shipout time.

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

`\Z@R@labelname`: Data for reference $\langle labelname \rangle$.

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

`\z`: For macros in user land, defined if option `user` is set.

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

`ZREF@TR`: Setup for `titleref`.

6.2.2 Identification

```

145 <*base>
146 \NeedsTeXFormat{LaTeX2e}
147 \ProvidesPackage{zref-base}%
148 [2007/05/28 v2.1 Module base for zref (HO)]%
```

6.2.3 Utilities

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

```

149 \def\ZREF@name{zref}
```

`\ZREF@ErrorNoLine` An error message for this package without line information is generated by `\ZREF@ErrorNoLine`

```

150 \def\ZREF@ErrorNoLine#1#2{%
151   \begingroup
152     \let\on@line\@empty
153     \PackageError\ZREF@name{#1}{#2}%
154   \endgroup
155 }
```

`\ZREF@UpdatePdfTeX` `\ZREF@UpdatePdfTeX` is used as help message text in error messages.

```

156 \def\ZREF@UpdatePdfTeX{Update pdfTeX.}
```

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

```

157 \newif\ifZREF@found
```

`\ZREF@patch` Macro `\ZREF@patch` first checks the existence of the command and safes it.

```

158 \def\ZREF@patch#1{%
159   \begingroup\expandafter\expandafter\expandafter\endgroup
160   \expandafter\ifx\csname #1\endcsname\relax
161     \expandafter\@gobble
162   \else
163     \expandafter\let\csname ZREF@org@#1\expandafter\endcsname
164     \csname #1\endcsname
165     \expandafter\@firstofone
166   \fi
167 }
```

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.

```

168 \begingroup
169 \@ifundefined{eTeXversion}{%
170   \ZREF@ErrorNoLine{%
171     Missing support for eTeX; package is abandoned%
```



```

172 }{%
173     Use a TeX compiler that support eTeX and enable eTeX %
174     in the format.%
175 }%
176 \endgroup
177 \endinput
178 }{}%
179 \endgroup

180 \RequirePackage{etexcmds}
181 \ifetex@unexpanded
182 \else
183   \ZREF@ErrorNoLine{%
184     Missing e-TeX's \string\unexpanded.\MessageBreak
185     Add \string\RequirePackage\string{etexcmds\string} before %
186     \string\documentclass%
187   }{%
188     Probably you are using some package (e.g. ConTeXt) that %
189     redefines \string\unexpanded%
190   }%
191   \expandafter\endinput
192 \fi

```

6.2.5 Auxiliary file stuff

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

```

193 \RequirePackage{auxhook}
194 \AddLineBeginAux{%
195   \string\providecommand\string\zref@newlabel[2]{}%
196 }

```

`\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.
- L^AT_EX's check for multiple references.
- L^AT_EX's check for changed references.

```

197 \def\zref@newlabel{%
198   \@newl@bel{Z@R}%
199 }

```

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.

```

200 \def\zref@newlist#1{%
201   \zref@iflistundefined{#1}{%
202     \ifdefinable{Z@L@#1}{%
203       \global\expandafter\let\csname Z@L@#1\endcsname\@empty
204       \PackageInfo{zref}{New property list: #1}%
205     }%
206   }{%
207     \PackageError{ZREF@name}{%
208       Property list '#1' already exists%
209     }\@ehc
210   }%
211 }

```

`\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.

```

212 \def\zref@iflistundefined#1{%
213   \expandafter\ifx\csname Z@L@#1\endcsname\relax
214     \expandafter\@firstoftwo
215   \else
216     \expandafter\@secondoftwo
217   \fi
218 }

```

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

```

219 \def\zref@listexists#1{%
220   \zref@iflistundefined{#1}{%
221     \PackageError\ZREF@name{%
222       Property list ‘#1’ does not exist%
223     }\@ehc
224   }%
225 }

```

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

```

226 \def\zref@listcontainsprop#1{%
227   \expandafter\ZREF@listcontainsprop\csname Z@L@#1\endcsname
228 }
229 \def\ZREF@listcontainsprop#1#2{%
230   \begingroup
231     \ZREF@foundfalse
232     \edef\y{#2}%
233     \@tfor\x:=#1\do{%
234       \edef\x{\x}%
235       \ifx\x\y
236         \ZREF@foundtrue
237       \fi
238     }%
239   \expandafter\endgroup
240   \ifZREF@found
241     \expandafter\@firstoftwo
242   \else
243     \expandafter\@secondoftwo
244   \fi
245 }

```

`\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.

```

246 \def\zref@addprop#1#2{%
247   \zref@listexists{#1}{%
248     \zref@propexists{#2}{%
249       \zref@listcontainsprop{#1}{#2}{%
250         \PackageWarning\ZREF@name{%
251           Property ‘#2’ is already in list ‘#1’%
252         }%
253       }{%
254         \expandafter\g@addto@macro\csname Z@L@#1\endcsname{{#2}}%
255       }%
256     }%
257   }%
258 }

```

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.

```
259 \def\zref@ifpropundefined#1{%
260   \expandafter\ifx\csname Z@E@#1\endcsname\relax
261     \expandafter\@firstoftwo
262   \else
263     \expandafter\@secondoftwo
264   \fi
265 }
```

`\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.

```
266 \def\zref@propexists#1{%
267   \zref@ifpropundefined{#1}{%
268     \PackageError\ZREF@name{%
269       Property ‘#1’ does not exist%
270     }\@ehc
271   }%
272 }
```

`\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.

```
273 \def\zref@newprop{%
274   \ifstar{%
275     \let\ZREF@X\noexpand
276     \ZREF@newprop
277   }{%
278     \let\ZREF@X\empty
279     \ZREF@newprop
280   }%
281 }
282 \def\ZREF@newprop#1{%
283   \PackageInfo{zref}{New property: #1}%
284   \def\ZREF@P{#1}%
285   \ifnextchar[\ZREF@@newprop{\ZREF@@newprop[\zref@default]}%
286 }
287 \def\ZREF@@newprop[#1]{%
288   \global\@namedef{Z@D@\ZREF@P}{#1}%
289   \global\expandafter\let\csname Z@X@\ZREF@P\endcsname\ZREF@X
290   \expandafter\ZREF@@@newprop\csname\ZREF@P\endcsname
291   \zref@setcurrent\ZREF@P
292 }
293 \def\ZREF@@@newprop#1{%
294   \expandafter\gdef\csname Z@E@\ZREF@P\endcsname##1#1##2##3\ZREF@nil{##2}%
295 }
```

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

```
296 \def\zref@setcurrent#1{%
297   \expandafter\def\csname Z@C@#1\endcsname
298 }
```

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

```

299 \def\zref@getcurrent#1{%
300   \csname Z@C@#1\endcsname
301 }
```

6.2.8 Reference generation

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

```

302 \def\zref@label#1{%
303   \zref@labelbylist{#1}\ZREF@mainlist
304 }
```

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

```

305 \def\zref@labelbylist#1#2{%
306   \@bsphack
307   \zref@listexists{#2}{%
308     \expandafter\expandafter\expandafter\ZREF@label
309     \expandafter\expandafter\expandafter{%
310       \csname Z@L@#2\endcsname
311     }{#1}%
312   }%
313   \@esphack
314 }
```

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

```

315 \def\zref@labelbyprops#1#2{%
316   \@bsphack
317   \begingroup
318   \edef\l{#2}%
319   \toks@{}%
320   \@for\x:=#2\do{%
321     \zref@ifpropundefined{\x}{%
322       \PackageWarning\ZREF@name{%
323         Property ‘\x’ is not known%
324       }%
325     }{%
326       \toks@\expandafter\expandafter\expandafter{%
327         \expandafter\the\expandafter\toks@\expandafter{\x}%
328       }%
329     }%
330   }%
331   \expandafter\endgroup
332   \expandafter\ZREF@label\expandafter{\the\toks@}{#1}%
333   \@esphack
334 }
```

`\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.

```

335 \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`.

```

336 \long\def\zref@wrapper@immediate#1{%
337   \begingroup
338   \ZREF@immediatetrue
339   \let\ZREF@org@write\write
340   \def\write{\immediate\ZREF@org@write}%
341   #1%
```

```

342 \endgroup
343 }

\ZREF@label \ZREF@label writes the data in the .aux file. #1 contains the list of valid prop-
erties, #2 the name of the reference. In case of immediate writing, the deferred
execution of property values is disabled. Also 21is made expandable in this case.
344 \def\ZREF@label#1#2{%
345 \if@filesw
346 \begingroup
347 \ifZREF@immediate
348 \let\ZREF@org@thepage\thepage
349 \fi
350 \protected@write\@auxout{%
351 \ifZREF@immediate
352 \let\thepage\ZREF@org@thepage
353 \fi
354 \let\ZREF@temp\@empty
355 \@tfor\ZREF@P:=#1\do{%
356 \expandafter\ifx
357 \csname\ifZREF@immediate relax\else Z@X@\ZREF@P\fi\endcsname
358 \noexpand
359 \expandafter\let\csname Z@C@\ZREF@P\endcsname\relax
360 \fi
361 \toks@\expandafter{\ZREF@temp}%
362 \edef\ZREF@temp{%
363 \the\toks@
364 \expandafter\string\csname\ZREF@P\endcsname{%
365 \expandafter\noexpand\csname Z@C@\ZREF@P\endcsname
366 }%
367 }%
368 }%
369 }-%
370 \string\zref@newlabel{#2}{\ZREF@temp}%
371 }%
372 \endgroup
373 \fi
374 }
375 \def\ZREF@addtoks#1{%
376 \toks@\expandafter\expandafter\expandafter{%
377 \expandafter\the\expandafter\toks@#1%
378 }%
379 }

```

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 L^AT_EX 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 pdfT_EX that allows the detection of contexts. Then the shorthand can detect, if they are executed inside \csname and protect themselves automatically.

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

```

380 \def\zref@ifrefundefined#1{%
381 \expandafter\ifx\csname Z@R@#1\endcsname\relax

```

```

382     \expandafter\@firstoftwo
383   \else
384     \expandafter\@secondoftwo
385   \fi
386 }

```

`\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.

```

387 \def\zref@refused#1{%
388   \zref@wrapper@babel\ZREF@refused{#1}%
389 }

```

`\ZREF@refused`

```

390 \def\ZREF@refused#1{%
391   \zref@ifrefundefined{#1}{%
392     \protect\G@refundefinedtrue
393     \@latex@warning{%
394       Reference ‘#1’ on page \thepage \space undefined%
395     }%
396   }{}%
397 }

```

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

```

398 \def\zref@extract#1#2{%
399   \expandafter\expandafter\expandafter\ZREF@extract
400   \expandafter\expandafter\expandafter{%
401     \csname Z@D@#2\endcsname
402   }{#1}{#2}%
403 }
404 \def\ZREF@extract#1#2#3{%
405   \zref@extractdefault{#2}{#3}{#1}%
406 }

```

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

```

407 \def\zref@ifrefcontainsprop#1#2{%
408   \zref@ifrefundefined{#1}{%
409     \@secondoftwo
410   }{%
411     \expandafter\ZREF@ifrefcontainsprop
412     \csname Z@E@#2\expandafter\endcsname
413     \csname#2\expandafter\expandafter\expandafter\endcsname
414     \expandafter\expandafter\expandafter{%
415       \csname Z@R@#1\endcsname
416     }%
417   }%
418 }
419 \def\ZREF@ifrefcontainsprop#1#2#3{%
420   \expandafter\ifx\expandafter\ZREF@novalue
421   #1#3#2\ZREF@novalue\ZREF@nil\@empty
422     \expandafter\@secondoftwo
423   \else
424     \expandafter\@firstoftwo
425   \fi
426 }
427 \def\ZREF@novalue{\ZREF@NOVALUE}

```

`\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.

```

428 \def\zref@extractdefault#1#2#3{%
429   \zref@ifrefundefined{#1}{%
430     \ZREF@unexpanded{#3}%
431   }{%
432     \expandafter\expandafter\expandafter\ZREF@unexpanded
433     \expandafter\expandafter\expandafter{%
434       \csname Z@E@#2\expandafter\expandafter\expandafter\endcsname
435       \csname Z@R@#1\expandafter\endcsname
436       \csname#2\endcsname{#3}\ZREF@nil
437     }%
438   }%
439 }

```

`\zref@wrapper@unexpanded`

```

440 \long\def\zref@wrapper@unexpanded#1{%
441   \let\ZREF@unexpanded\etex@unexpanded
442   #1%
443   \let\ZREF@unexpanded\@firstofone
444 }
445 \let\ZREF@unexpanded\@firstofone

```

6.2.10 Compatibility with babel

`\zref@wrapper@babel`

```

446 \long\def\zref@wrapper@babel#1#2{%
447   \ifcsname if@safe@actives\endcsname
448     \expandafter\@firstofone
449   \else
450     \expandafter\@secondoftwo
451   \fi
452   {%
453     \if@safe@actives
454       \expandafter\@secondoftwo
455     \else
456       \expandafter\@firstoftwo
457     \fi
458     {%
459       \begingroup
460         \csname @safe@activestrue\endcsname
461         \edef\x{#2}%
462         \expandafter\endgroup
463         \expandafter\ZREF@wrapper@babel\expandafter{\x}{#1}%
464       }%
465     }{%
466       #1{#2}%
467     }%
468 }
469 \long\def\ZREF@wrapper@babel#1#2{%
470   #2{#1}%
471 }

```

6.2.11 Unique counter support

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

```

472 \def\zref@require@unique{%
473   \@ifundefined{c@zref@unique}{%
474     \begingroup
475       \let\@addtoreset\@gobbletwo
476       \newcounter{zref@unique}%
477     \endgroup

```

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

```

478 \renewcommand*{\thezref@unique}{%
479   zref@number\c@zref@unique
480 }%
481 }{}%
482 }

```

6.2.12 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`.

```

483 \def\zref@setdefault#1{%
484   \def\zref@default{#1}%
485 }

```

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

```

486 \zref@setdefault{%
487   \nfss@text{\reset@font\bfseries ??}%
488 }

```

Main property list.

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

```

489 \def\zref@setmainlist#1{%
490   \def\ZREF@mainlist{#1}%
491 }
492 \zref@setmainlist{main}

```

Now we create the list.

```

493 \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

```

494 \zref@newprop{default}{\@currentlabel}
495 \zref@newprop*{page}{\thepage}
496 \zref@addprop\ZREF@mainlist{default}
497 \zref@addprop\ZREF@mainlist{page}

```

Mark successful loading

```

498 \let\ZREF@baseok\@empty
499 \</base>

```

6.3 Module user

```

500 <*user>
501 \NeedsTeXFormat{LaTeX2e}
502 \ProvidesPackage{zref-user}%
503 [2007/05/28 v2.1 Module user for zref (HO)]%
504 \RequirePackage{zref-base}[2007/05/28]
505 \@ifundefined{ZREF@baseok}{\endinput}{}

```


Option `zuser` 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.

```
506 \newcommand*\zlabel{%
507   \ifx\label\@gobble
508     \expandafter\@gobble
509   \else
510     \expandafter\zref@wrapper@babel\expandafter\zref@label
511   \fi
512 }%
```

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

```
513 \newcommand*\zref}[2][default]{%
514   \zref@propexists{#1}%
515   \zref@wrapper@babel\ZREF@zref{#2}{#1}%
516 }%
517 }%
518 \def\ZREF@zref#1{%
519   \zref@refused{#1}%
520   \zref@extract{#1}%
521 }%
```

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

```
522 \newcommand*\zpageref{%
523   \zref[page]%
524 }%
```

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

```
525 \newcommand*\zrefused{\zref@refused}%
526 </user>
```

6.4 Module `abspage`

```
527 <*abspage>
528 \NeedsTeXFormat{LaTeX2e}
529 \ProvidesPackage{zref-abspage}%
530 [2007/05/28 v2.1 Module abspage for zref (HO)]%
531 \RequirePackage{zref-base}[2007/05/28]
532 \ifundefined{ZREF@baseok}{\endinput}{}
```

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`.

```
533 \RequirePackage{atbegshi}%
```

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

```
534 \begingroup
535   \let\@addtoreset\@gobbletwo
536   \newcounter{abspage}%
537 \endgroup
538 \setcounter{abspage}{0}%
539 \AtBeginShipout{%
540   \stepcounter{abspage}%
541 }%
542 \zref@newprop*{abspage}[0]{\the\c@abspage}%
```

```
543 \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.

```
544 \end{abspage}
```

6.5 Module counter

```
545 \newcounter{counter}
546 \NeedsTeXFormat{LaTeX2e}
547 \ProvidesPackage{zref-counter}%
548 [2007/05/28 v2.1 Module counter for zref (H0)]%
549 \RequirePackage{zref-base}[2007/05/28]
550 \ifundefined{ZREF@baseok}{\endinput}{}
```

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.

```
551 \zref@newprop{counter}{}
552 \zref@addprop\ZREF@mainlist{counter}
```

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

```
553 \AtBeginDocument{%
554   \ZREF@patch{refstepcounter}{%
555     \def\refstepcounter#1{%
556       \zref@setcurrent{counter}{#1}%
557       \ZREF@org@refstepcounter{#1}%
558     }%
559   }%
560 }
561 \end{counter}
```

6.6 Module lastpage

```
562 \newlastpage
563 \NeedsTeXFormat{LaTeX2e}
564 \ProvidesPackage{zref-lastpage}%
565 [2007/05/28 v2.1 Module lastpage for zref (H0)]%
566 \RequirePackage{zref-base}[2007/05/28]
567 \ifundefined{ZREF@baseok}{\endinput}{}
```

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

```
568 \AtBeginDocument{%
569   \AtEndDocument{%
570     \if@filesw
571       \clearpage
572       \begin{group}
573         \advance\c@page\m@ne
574         \zref@wrapper@immediate{\zref@label{LastPage}}%
575       \end{group}
576     \fi
577   }%
578 }
579 \end{lastpage}
```

6.7 Module totpages

```
580 \newtotpages
581 \NeedsTeXFormat{LaTeX2e}
582 \ProvidesPackage{zref-totpages}%
583 [2007/05/28 v2.1 Module totpages for zref (H0)]%
```

```

584 \RequirePackage{zref-base}[2007/05/28]
585 \@ifundefined{ZREF@baseok}{\endinput}{}

```

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

```

586 \RequirePackage{zref-abspage}[2007/05/28]
587 \RequirePackage{zref-lastpage}[2007/05/28]

```

\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.

```

588 \newcommand*{\ztotpages}{%
589   \zref@extractdefault{LastPage}{abspage}{0}%
590 }

```

Also we mark the reference `LastPage` as used:

```

591 \AtBeginDocument{%
592   \zref@refused{LastPage}%
593 }
594 </totpages>

```

6.8 Module `perpage`

```

595 <*perpage>
596 \NeedsTeXFormat{LaTeX2e}
597 \ProvidesPackage{zref-perpage}%
598   [2007/05/28 v2.1 Module perpage for zref (H0)]%
599 \RequirePackage{zref-base}[2007/05/28]
600 \@ifundefined{ZREF@baseok}{\endinput}{}

```

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.

```

601 \RequirePackage{zref-abspage}[2007/05/28]

```

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

```

602 \zref@newprop*{pagevalue}[0]{\number\c@page}
603 \zref@newlist{perpage}
604 \zref@addprop{perpage}{abspage}
605 \zref@addprop{perpage}{page}
606 \zref@addprop{perpage}{pagevalue}

```

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

```

607 \newcounter{zpage}

```

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

```

608 \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`.

```

609 \let\ZREF@org@stepcounter\stepcounter
610 \def\stepcounter#1{%
611   \ifcsname @stepcounterhook@#1\endcsname
612     \csname @stepcounterhook@#1\endcsname
613   \fi
614   \ZREF@org@stepcounter{#1}%
615 }

```

\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.

```

616 \newcommand*{\zmakeperpage}{%

```

```

617 \@ifnextchar[\ZREF@makeperpage@opt{\ZREF@makeperpage[\z@]}%
618 }

```

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

```

619 \def\ZREF@makeperpage@opt[#1]{%
620   \begingroup
621   \edef\x{\endgroup
622     \noexpand\ZREF@makeperpage[\number\numexpr#1-1\relax]%
623   }%
624   \x
625 }

626 \def\ZREF@makeperpage[#1]#2{%
627   \ifundefined{@stepcounterhook@#2}{%
628     \expandafter\gdef\csname @stepcounterhook@#2\endcsname{%
629   }-%
630   \expandafter\gdef\csname ZREF@perpage@#2\endcsname{%
631     \ZREF@perpage@step{#2}{#1}%
632   }%
633   \expandafter\g@addto@macro\csname @stepcounterhook@#2\endcsname{%
634     \ifcsname ZREF@perpage@#2\endcsname
635       \csname ZREF@perpage@#2\endcsname
636     \fi
637   }%
638 }

```

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

```

639 \def\ZREF@perpage@step#1#2{%

```

First the reference is generated.

```

640 \global\advance\c@zref@unique\@ne
641 \begingroup
642 \expandafter\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.

```

643 \zref@ifrefundefined\thezref@unique{%
644   \global\c@zpage=\c@page
645   \global\let\thezpage\thepage
646   \expandafter\xdef\csname ZREF@abspage@#1\endcsname{\number\c@abspage}%
647 }%

```

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

```

648 \global\c@zpage=\zref@extract\thezref@unique{pagevalue}\relax
649 \xdef\thezpage{\noexpand\zref@extract{\thezref@unique}{page}}%
650 \expandafter\xdef\csname ZREF@abspage@#1\endcsname{%
651   \zref@extractdefault\thezref@unique{abspage}{\number\c@abspage}%
652 }%
653 }%

```

Page changes are detected by a changed absolute page number.

```

654 \expandafter\ifx\csname ZREF@abspage@#1\endcsname
655   \csname ZREF@currentabspage@#1\endcsname
656 \else
657   \global\csname c@#1\endcsname=#2\relax
658   \global\expandafter\let
659     \csname ZREF@currentabspage@#1\endcsname
660     \csname ZREF@abspage@#1\endcsname
661   \fi
662 \endgroup
663 }

```

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

```
664 \newcommand*{\zunmakeperpage}[1]{%
665   \global\expandafter\let\csname ZREF@perpage@#1\endcsname\@undefined
666 }

667 \perpage
```

6.9 Module `titleref`

```
668 \*titleref
669 \NeedsTeXFormat{LaTeX2e}
670 \ProvidesPackage{zref-titleref}%
671   [2007/05/28 v2.1 Module titleref for zref (HO)]%
672 \RequirePackage{zref-base}[2007/05/28]
673 \@ifundefined{ZREF@baseok}{\endinput}{}%
```

6.9.1 Implementation

```
674 \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`.

`\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`.

```
675 \let\zref@titleref@current\@empty
```

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

```
676 \zref@newprop{title}{\zref@titleref@current}%
677 \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.

`\ifzref@titleref@expand` 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.

```
678 \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 removed. The hook is executed before the expansion of `\zref@titleref@current`.

```
679 \let\ZREF@titleref@hook\@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.

```
680 \def\zref@titleref@cleanup#1{%
681   \begingroup
682   \toks@\expandafter{%
683     \ZREF@titleref@hook
684     #1%
685   }%
686   \expandafter\endgroup
687   \expandafter\def\expandafter\ZREF@titleref@hook\expandafter{%
688     \the\toks@
689   }%
690 }
```

`\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.

```

691 \newif\ifzref@titleref@stripperperiod
692 \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.

```

693 \def\zref@titleref@setcurrent#1{%
694   \def\zref@titleref@current{#1}%
695   \ifzref@titleref@expand
696     \begingroup
697       \let\label\@gobble
698       \let\index\@gobble
699       \let\glossary\@gobble
700       \let\markboth\@gobbletwo
701       \let\@mkboth\@gobbletwo
702       \let\markright\@gobble
703       \let\protect\@unexpandable@protect
704       \ZREF@titleref@hook
705       \edef\x{\endgroup
706         \noexpand\def\noexpand\zref@titleref@current{%
707           \zref@titleref@current
708         }%
709       }%
710       \x
711     \fi
712     \edef\zref@titleref@current{%
713       \detokenize\expandafter{\zref@titleref@current}%
714     }%
715     \ifzref@titleref@stripperperiod
716       \edef\zref@titleref@current{%
717         \expandafter\ZREF@stripperperiod\zref@titleref@current
718         \@empty.\@empty\@nil
719       }%
720     \fi
721   }%

```

`\ZREF@stripperperiod` If `\ZREF@stripperperiod` is called, the argument consists of space tokens and tokens with catcode 12 (other), because of ε -TEX's `\detokenize`.

```

722 \def\ZREF@stripperperiod#1.\@empty#2\@nil{#1}%

```

6.9.2 User interface

`\ztitlerefsetup` The behaviour of option `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`.

```

723 \define@key{ZREF@TR}{expand}[true]{%
724   \csname zref@titleref@expand#1\endcsname
725 }%
726 \define@key{ZREF@TR}{stripperperiod}[true]{%
727   \csname zref@titleref@stripperperiod#1\endcsname
728 }%
729 \define@key{ZREF@TR}{cleanup}{%
730   \zref@titleref@cleanup{#1}%
731 }%
732 \define@key{ZREF@TR}{title}{%
733   \def\zref@titleref@current{#1}%
734 }%
735 \newcommand*{\ztitlerefsetup}{%

```

```

736 \setkeys{ZREF@TR}%
737 }%

```

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

```

738 \newcommand*{\ztitleref}{%
739 \zref@wrapper@babel\ZREF@titleref
740 }%
741 \def\ZREF@titleref#1{%
742 \begingroup
743 \zref@refused{#1}%
744 \let\label\gobble
745 \zref@extract{#1}{title}%
746 \endgroup
747 }%

```

6.9.3 Patches for section and caption commands

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

Captions of figures and tables.

```

748 \AtBeginDocument{%
749 \ZREF@patch{@caption}{%
750 \long\def\@caption#1[#2]{%
751 \zref@titleref@setcurrent{#2}%
752 \ZREF@org@@caption{#1}[{#2}]%
753 }%
754 }%

```

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

```

755 \ZREF@patch{@part}{%
756 \def\@part#1{%
757 \zref@titleref@setcurrent{#1}%
758 \ZREF@org@@part[{#1}]%
759 }%
760 }%
761 \ZREF@patch{@chapter}{%
762 \def\@chapter#1{%
763 \zref@titleref@setcurrent{#1}%
764 \ZREF@org@@chapter[{#1}]%
765 }%
766 }%
767 \ZREF@patch{@sect}{%
768 \def\@sect#1#2#3#4#5#6[#7]{%
769 \zref@titleref@setcurrent{#7}%
770 \ZREF@org@@sect{#1}{#2}{#3}{#4}{#5}{#6}[{#7}]%
771 }%
772 }%

```

The star versions of the section commands.

```

773 \ZREF@patch{@spart}{%
774 \def\@spart#1{%
775 \zref@titleref@setcurrent{#1}%
776 \ZREF@org@@spart{#1}%
777 }%
778 }%
779 \ZREF@patch{@schapter}{%
780 \def\@schapter#1{%
781 \zref@titleref@setcurrent{#1}%
782 \ZREF@org@@schapter{#1}%
783 }%
784 }%
785 \ZREF@patch{@ssect}{%

```

```

786     \def\ssect#1#2#3#4#5{%
787         \zref@titleref@setcurrent{#5}%
788         \ZREF@org@ssect{#1}{#2}{#3}{#4}{#5}%
789     }%
790 }%

Class beamer.
791 \@ifclassloaded{beamer}{%
792     \ZREF@patch{beamer@section}{%
793         \long\def\beamer@section[#1]{%
794             \zref@titleref@setcurrent{#1}%
795             \ZREF@org@beamer@section[{#1}]%
796         }%
797     }%
798     \ZREF@patch{beamer@subsection}{%
799         \long\def\beamer@subsection[#1]{%
800             \zref@titleref@setcurrent{#1}%
801             \ZREF@org@beamer@subsection[{#1}]%
802         }%
803     }%
804     \ZREF@patch{beamer@subsubsection}{%
805         \long\def\beamer@subsubsection[#1]{%
806             \zref@titleref@setcurrent{#1}%
807             \ZREF@org@beamer@subsubsection[{#1}]%
808         }%
809     }%
810 }{}%

Package titlesec.
811 \@ifpackageloaded{titlesec}{%
812     \ZREF@patch{ttl@sect@i}{%
813         \def\ttl@sect@i#1#2[#3]#4{%
814             \zref@titleref@setcurrent{#4}%
815             \ZREF@org@ttl@sect@i{#1}{#2}[{#3}]{#4}%
816         }%
817     }%
818 }{}%

```

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

```

819 \@ifpackageloaded{longtable}{%
820     \ZREF@patch{LT@c@ption}{%
821         \def\LT@c@ption#1[#2]#3{%
822             \ZREF@org@LT@c@ption{#1}[{#2}]{#3}%
823             \zref@titleref@setcurrent{#2}%
824         }%
825     }%
826 }{}%

Package listings: support for its caption.
827 \@ifpackageloaded{listings}{%
828     \ZREF@patch{lst@MakeCaption}{%
829         \def\lst@MakeCaption{%
830             \ifx\lst@label\@empty
831             \else
832                 \expandafter\zref@titleref@setcurrent\expandafter{%
833                     \lst@caption
834                 }%
835             \fi
836             \ZREF@org@lst@MakeCaption
837         }%
838     }%
839 }{}%
840 }

```


841 \langle /titleref \rangle

6.10 Module `xr`

```
842  $\langle$ *xr $\rangle$ 
843 \NeedsTeXFormat{LaTeX2e}
844 \ProvidesPackage{zref-xr}%
845 [2007/05/28 v2.1 Module xr for zref (H0)]%
846 \RequirePackage{zref-base}[2007/05/28]
847 \ifundefined{ZREF@baseok}{\endinput}{}
848 \RequirePackage{keyval}
```

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.

```
849 \zref@newprop{url}{}%
```

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.

```
850 \providecommand*{\zref@xr@ext}{}%
851 \ifundefined{XR@ext}{pdf}{\XR@ext}%
852 }%
```

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

```
853 \newif\ifZREF@xr@zreflabel
```

`\xexternaldocument` 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).

```
854 \newcommand*{\xexternaldocument}{%
855   \begingroup
856     \csname @safe@actives@true\endcsname
857     \makeatletter
858     \ifstar{%
859       \ZREF@xr@zreflabelfalse
860       \@testopt\ZREF@xr@externaldocument{}%
861     }{%
862       \ZREF@xr@zreflabeltrue
863       \@testopt\ZREF@xr@externaldocument{}%
864     }%
865   }%
```

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.

```
866 \def\ZREF@xr@externaldocument[#1]#2{%
867   \def\ZREF@xr@prefix{#1}%
868   \let\ZREF@xr@filelist\@empty
869   \edef\ZREF@xr@file{#2.aux}%
870   \filename@parse{#2}%
871   \@testopt\ZREF@xr@graburl{#2.\zref@xr@ext}%
872 }%
873 \def\ZREF@xr@graburl[#1]{%
874   \edef\ZREF@xr@url{#1}%
875   \ZREF@xr@checkfile
876   \endgroup
877 }%
```

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

```

878 \def\ZREF@xr@checkfile{%
879   \openin\@inputcheck\ZREF@xr@file\relax
880   \ifeof\@inputcheck
881     \PackageWarning{zref/xr}{%
882       File '\ZREF@xr@file' not found or empty,\MessageBreak
883       labels not imported%
884     }%
885   \else
886     \PackageInfo{zref/xr}{%
887       Label \ifZREF@xr@zreflabel (zref) \fi import from '\ZREF@xr@file'%
888     }%
889     \def\ZREF@xr@found{O}%
890     \def\ZREF@xr@ignored{O}%
891     \ZREF@xr@processfile
892     \closein\@inputcheck
893     \begingroup
894       \let\on@line\@empty
895       \PackageInfo{zref/xr}{%
896         Statistics for '\ZREF@xr@file': %
897         \ZREF@xr@found\space found, %
898         \ZREF@xr@ignored\space ignored%
899       }%
900     \endgroup
901   \fi
902   \ifx\ZREF@xr@filelist\@empty
903   \else
904     \edef\ZREF@xr@file{\expandafter\@car\ZREF@xr@filelist\@nil}%
905     \edef\ZREF@xr@filelist{\expandafter\@cdr\ZREF@xr@filelist\@nil}%
906     \expandafter\ZREF@xr@checkfile
907   \fi
908 }%

```

\ZREF@xr@processfile

```

909 \def\ZREF@xr@processfile{%
910   \read\@inputcheck to\ZREF@xr@line
911   \expandafter\ZREF@xr@processline\ZREF@xr@line..\ZREF@nil
912   \ifeof\@inputcheck
913   \else
914     \expandafter\ZREF@xr@procesfile
915   \fi
916 }%

```

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

```

917 \long\def\ZREF@xr@processline#1#2#3\ZREF@nil{%
918   \def\x{#1}%
919   \toks@{#2}%
920   \ifZREF@xr@zreflabel
921     \ifx\x\ZREF@xr@zref@newlabel
922       \expandafter\ZREF@xr@process@zreflabel\ZREF@xr@line...\ZREF@nil
923     \fi
924   \else
925     \ifx\x\ZREF@xr@newlabel
926       \expandafter\ZREF@xr@process@label\ZREF@xr@line...[]\ZREF@nil
927     \fi
928   \fi
929   \ifx\x\ZREF@xr@@input
930     \edef\ZREF@xr@filelist{%
931       \etex@unexpanded\expandafter{\ZREF@xr@filelist}%
932       {\filename@area\the\toks@}%
933     }%

```

```

934 \fi
935 \ifeof\@inputcheck
936 \else
937 \expandafter\ZREF@xr@processfile
938 \fi
939 }%
940 \def\ZREF@xr@process@zreflabel\zref@newlabel#1#2#3\ZREF@nil{%
941 \def\ZREF@xr@refname{Z@R@\ZREF@xr@prefix#1}%
942 \edef\ZREF@xr@found{\the\numexpr\ZREF@xr@found+1\relax}%
943 \def\x{#2}%
944 \@ifundefined{\ZREF@xr@refname}{%
945 \let\ZREF@xr@list\x
946 \ifx\ZREF@xr@list\@empty
947 \PackageWarningNoLine{zref/xr}{%
948 Label ‘#1’ without properties ignored\MessageBreak
949 in file ‘\ZREF@xr@file’%
950 }%
951 \edef\ZREF@xr@ignored{\the\numexpr\ZREF@xr@ignored+1\relax}%
952 \else
953 \expandafter\ZREF@xr@checklist\x\ZREF@nil
954 \expandafter\global\expandafter\let
955 \csname \ZREF@xr@refname\endcsname\x
956 \fi
957 \ZREF@xr@urlcheck{\ZREF@xr@prefix#1}%
958 }{%
959 \ZREF@xr@ignorewarning{\ZREF@xr@prefix#1}%
960 }%
961 }%
962 \def\ZREF@xr@process@label\newlabel#1#2#3[#4]#5\ZREF@nil{%
963 \def\ZREF@xr@refname{Z@R@\ZREF@xr@prefix#1}%
964 \edef\ZREF@xr@found{\the\numexpr\ZREF@xr@found+1\relax}%
965 \def\x{#2}%
966 \@ifundefined{\ZREF@xr@refname}{%
967 \expandafter\ZREF@xr@scanparams
968 \csname\ZREF@xr@refname\expandafter\endcsname
969 \x{}{}{}{}{}\ZREF@nil
970 \ifx\#4\%
971 \else
972 % ntheorem knows an optional argument at the end of \newlabel
973 \zref@ifpropundefined{theotype}{%
974 \zref@newprop{theotype}{}%
975 }{}%
976 \expandafter\g@addto@macro
977 \csname\ZREF@xr@refname\endcsname{\theotype{#4}}%
978 \fi
979 \ZREF@xr@urlcheck{\ZREF@xr@prefix#1}%
980 }{%
981 \ZREF@xr@ignorewarning{\ZREF@xr@prefix#1}%
982 }%
983 }
984 \def\ZREF@xr@zref@newlabel{\zref@newlabel}%
985 \def\ZREF@xr@newlabel{\newlabel}%
986 \def\ZREF@xr@@input{\@input}%

```

\ZREF@xr@ignorewarning

```

987 \def\ZREF@xr@ignorewarning#1{%
988 \PackageWarningNoLine{zref/xr}{%
989 Label ‘#1’ is already in use\MessageBreak
990 in file ‘\ZREF@xr@file’%
991 }%
992 \edef\ZREF@xr@ignored{\the\numexpr\ZREF@xr@ignored+1\relax}%
993 }%

```

\ZREF@xr@checklist

```
994 \def\ZREF@xr@checklist#1#2#3\ZREF@nil{%
995   \ifx\@undefined#1\relax
996     \expandafter\ZREF@xr@checkkey\string#1\@nil
997   \fi
998   \ifx\#3\%
999   \else
1000     \@ReturnAfterFi{%
1001       \ZREF@xr@checklist#3\ZREF@nil
1002     }%
1003   \fi
1004 }%
1005 \long\def\@ReturnAfterFi#1\fi{\fi#1}%
1006 \def\ZREF@xr@checkkey#1#2\@nil{%
1007   \zref@ifpropundefined{#2}{%
1008     \zref@newprop{#2}{}%
1009   }{%
1010   }%
1011 }
```

\ZREF@xr@scanparams

```
1011 \def\ZREF@xr@scanparams#1#2#3#4#5#6#7\ZREF@nil{%
1012   \global\let#1\@empty
1013   \ZREF@foundfalse
1014   \ZREF@xr@scantitleref#1#2\TR@TitleReference{}{}\ZREF@nil
1015   \ifZREF@found
1016   \else
1017     \g@addto@macro#1{\default{#2}}%
1018   \fi
1019   % page
1020   \g@addto@macro#1{\page{#3}}%
1021   % nameref title
1022   \ifZREF@found
1023   \else
1024     \ifx\#4\%
1025     \else
1026       \zref@ifpropundefined{title}{%
1027         \zref@newprop{title}{}%
1028       }{%
1029         \g@addto@macro#1{\title{#4}}%
1030       }%
1031     \fi
1032     % anchor
1033     \ifx\#5\%
1034     \else
1035       \zref@ifpropundefined{anchor}{%
1036         \zref@newprop{anchor}{}%
1037       }{%
1038         \g@addto@macro#1{\anchor{#5}}%
1039       }%
1040     \fi
1041     \ifx\#6\%
1042     \else
1043       \zref@ifpropundefined{url}{%
1044         \zref@newprop{url}{}%
1045       }{%
1046         \g@addto@macro#1{\url{#6}}%
1047       }%
1048     \fi
1049   }
```

\ZREF@xr@scantitleref

```
1048 \def\ZREF@xr@scantitleref#1#2\TR@TitleReference#3#4#5\ZREF@nil{%
1049   \ifx\#5\%
1050   \else
```

```

1051 \g@addto@macro#1{%
1052 \default{#3}%
1053 \title{#4}%
1054 }%
1055 \ZREF@foundtrue
1056 \fi
1057 }%

```

`\ZREF@xr@urlcheck`

```

1058 \def\ZREF@xr@urlcheck#1{%
1059 \zref@ifrefcontainsprop{#1}{anchor}{%
1060 \zref@ifrefcontainsprop{#1}{url}{%
1061 }{%
1062 \expandafter\g@addto@macro\csname Z@R@#1\expandafter\endcsname
1063 \expandafter{%
1064 \expandafter\url\expandafter{\ZREF@xr@url}%
1065 }%
1066 }%
1067 }{%
1068 }%
1069 }%

```

`\zxrsetup` Just one key for setting the default extension is currently used.

```

1070 \define@key{ZREF@XR}{ext}{%
1071 \def\zref@xr@ext{#1}%
1072 }%
1073 \newcommand*{\zxrsetup}{%
1074 \setkeys{ZREF@XR}%
1075 }%
1076 </xr>

```

6.11 Module `hyperref`

UNFINISHED :-(

```

1077 <*hyperref>
1078 \NeedsTeXFormat{LaTeX2e}
1079 \ProvidesPackage{zref-hyperref}%
1080 [2007/05/28 v2.1 Module hyperref for zref (HO)]%
1081 \RequirePackage{zref-base}[2007/05/28]
1082 \@ifundefined{ZREF@baseok}{\endinput}{}
1083 \zref@newprop{anchor}[]{%
1084 \@ifundefined{@currentHref}{\@currentHref}%
1085 }%
1086 \zref@addprop\ZREF@mainlist{anchor}%
1087 </hyperref>

```

6.12 Module `savepos`

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

6.12.1 Identification

```

1088 <*savepos>
1089 \NeedsTeXFormat{LaTeX2e}
1090 \ProvidesPackage{zref-savepos}%
1091 [2007/05/28 v2.1 Module savepos for zref (HO)]%
1092 \RequirePackage{zref-base}[2007/05/28]
1093 \@ifundefined{ZREF@baseok}{\endinput}{}

```

6.12.2 Availability

First we check, whether the feature is available.

```
1094 \begingroup
1095   \@ifundefined{pdfsavepos}{%
1096     \ZREF@ErrorNoLine{%
1097       \string\pdfsavepos\space is not supported.\MessageBreak
1098       It is provided by pdfTeX (1.40) or XeTeX%
1099     }\ZREF@UpdatePdfTeX
1100   }\endgroup
1101   \endinput
1102 }{}%
1103 \endgroup
```

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`.

```
1104 \RequirePackage{ifpdf}
1105 \ifpdf
1106 \else
1107   \begingroup\expandafter\expandafter\expandafter\endgroup
1108   \expandafter\ifx\csname pdftexversion\endcsname\relax
1109   \else
1110     \ifnum\pdftexversion<140 %
1111       \ZREF@ErrorNoLine{%
1112         \string\pdfsavepos\space is not supported in DVI mode\MessageBreak
1113         of this pdfTeX version%
1114       }\ZREF@UpdatePdfTeX
1115     \expandafter\expandafter\expandafter\endinput
1116   \fi
1117 \fi
1118 \fi
```

6.12.3 Setup

```
1119 \zref@newlist{savepos}
1120 \zref@newprop*{posx}[0]{\the\pdflastxpos}
1121 \zref@newprop*{posy}[0]{\the\pdflastypos}
1122 \zref@addprop{savepos}{posx}
1123 \zref@addprop{savepos}{posy}
```

6.12.4 User macros

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

```
1124 \def\zsavpos#1{%
1125   \@bsphack
1126   \if@filesw
1127     \pdfsavepos
1128     \zref@labelbylist{#1}{savepos}%
1129   \fi
1130   \@esphack
1131 }
```

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

```
1132 \newcommand*{\zposx}[1]{%
1133   \zref@extract{#1}{posx}%
1134 }%
1135 \newcommand*{\zposy}[1]{%
1136   \zref@extract{#1}{posy}%
1137 }%
```

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 mark used positions by `\zrefused` in order to notify L^AT_EX about undefined references.

1138 `</savepos>`

6.13 Module `dotfill`

```
1139 <*dotfill>
1140 \NeedsTeXFormat{LaTeX2e}
1141 \ProvidesPackage{zref-dotfill}%
1142 [2007/05/28 v2.1 Module dotfill for zref (HO)]%
1143 \RequirePackage{zref-base}[2007/05/28]
1144 \@ifundefined{ZREF@baseok}{\endinput}{}

```

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

```
1145 \RequirePackage{zref-savepos}[2007/05/28]
```

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

```
1146 \zref@require@unique
```

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

```
1147 \RequirePackage{keyval}
```

The definitions of the keys follow.

```
1148 \define@key{ZREF@DF}{unit}{%
1149   \def\ZREF@df@unit{#1}%
1150 }
1151 \define@key{ZREF@DF}{min}{%
1152   \def\ZREF@df@min{#1}%
1153 }
1154 \define@key{ZREF@DF}{dot}{%
1155   \def\ZREF@df@dot{#1}%
1156 }

```

Defaults are set, see user interface.

```
1157 \providecommand\ZREF@df@min{2}
1158 \providecommand\ZREF@df@unit{.44em}
1159 \providecommand\ZREF@df@dot{.}

```

`\zdotfillsetup` Configuration of `\zdotfill` is done by `\zdotfillsetup`.

```
1160 \newcommand*{\zdotfillsetup}{\setkeys{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.

```
1161 \newcommand*{\zdotfill}{%
1162   \leavevmode
1163   \global\advance\c@zref@unique\@ne
1164   \begingroup
1165     \def\ZREF@temp{zref@\number\c@zref@unique}%
1166     \pdfsavepos
1167     \zref@labelbyprops{\thezref@unique L}{posx}%
1168     \setlength{\dimen@}{\ZREF@df@unit}%
1169     \zref@ifrefundefined{\thezref@unique R}{%
1170       \ZREF@dotfill
1171     }{%
1172       \ifnum\numexpr\zposx{\thezref@unique R}-\zposx{\thezref@unique L}\relax
1173         <\dimexpr\ZREF@df@min\dimen@\relax
1174         \hfill
1175       \else
1176         \ZREF@dotfill
1177       \fi

```

```

1178 }%
1179 \pdfsavepos
1180 \zref@labelbyprops{\thezref@unique R}{posx}%
1181 \endgroup
1182 \kern\z@
1183 }

```

`\ZREF@dotfill` Help macro that actually sets the dots.

```

1184 \def\ZREF@dotfill{%
1185 \cleaders\hb@xt@\dimen@{\hss\ZREF@df@dot\hss}\hfill
1186 }

1187 </dotfill>

```

7 Installation

7.1 Download

Package. This package is available on CTAN¹:

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

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

7.2 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
```

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/
```

7.3 Package installation

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

```
tex zref.dtx
```

¹<http://ftp.ctan.org/tex-archive/>

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

```

zref.sty           → tex/latex/oberdiek/zref.sty
zref-base.sty      → tex/latex/oberdiek/zref-base.sty
zref-abspage.sty   → tex/latex/oberdiek/zref-abspage.sty
zref-counter.sty   → tex/latex/oberdiek/zref-counter.sty
zref-dotfill.sty   → tex/latex/oberdiek/zref-dotfill.sty
zref-hyperref.sty  → tex/latex/oberdiek/zref-hyperref.sty
zref-lastpage.sty  → tex/latex/oberdiek/zref-lastpage.sty
zref-perpage.sty   → tex/latex/oberdiek/zref-perpage.sty
zref-savepos.sty   → tex/latex/oberdiek/zref-savepos.sty
zref-titleref.sty  → tex/latex/oberdiek/zref-titleref.sty
zref-totpages.sty  → tex/latex/oberdiek/zref-totpages.sty
zref-user.sty      → tex/latex/oberdiek/zref-user.sty
zref-xr.sty        → tex/latex/oberdiek/zref-xr.sty
zref.pdf           → doc/latex/oberdiek/zref.pdf
zref-example.tex   → doc/latex/oberdiek/zref-example.tex
zref.dtx           → source/latex/oberdiek/zref.dtx

```

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`.

7.4 Refresh file name databases

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

7.5 Some details for the interested

Attached source. The PDF documentation on CTAN also includes the `.dtx` source file. It can be extracted by AcrobatReader 6 or higher. Another option is `pdftk`, e.g. unpack the file into the current directory:

```
pdftk zref.pdf unpack_files output .
```

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

```

8 References

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

9 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).
- Modul `savepos` also supports XeTeX.

[2007/04/06 v1.6]

- Fix in modul `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 ε -T_EX'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`.

10 Index

Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in roman refer to the code lines where the entry is used.

Symbols	
<code>\@ReturnAfterFi</code>	1000, 1005
<code>\@addtoreset</code>	475, 535
<code>\@auxout</code>	350
<code>\@bsphack</code>	306, 316, 1125
<code>\@caption</code>	750
<code>\@car</code>	904
<code>\@cdr</code>	905
<code>\@chapter</code>	762
<code>\@currentHref</code>	1084
<code>\@currentlabel</code>	494
<code>\@ehc</code>	209, 223, 270
<code>\@empty</code>	152, 203, 278, 354, 421, 498, 675, 679, 718, 722, 830, 868, 894, 902, 946, 1012
<code>\@esphack</code>	313, 333, 1130
<code>\@firstofone</code>	165, 443, 445, 448
<code>\@firstoftwo</code>	214, 241, 261, 382, 424, 456
<code>\@for</code>	320
<code>\@gobble</code>	161, 507, 508, 697, 698, 699, 702, 744
<code>\@gobbletwo</code>	475, 535, 700, 701
<code>\@ifclassloaded</code>	791
<code>\@ifdefinable</code>	202
<code>\@ifnextchar</code>	285, 617
<code>\@ifpackageloaded</code>	811, 819, 827
<code>\@ifstar</code>	274, 858
<code>\@ifundefined</code>	124, 169, 473, 505, 532, 550, 567, 585, 600, 627, 673, 847, 851, 944, 966, 1082, 1084, 1093, 1095, 1144
<code>\@input</code>	986
<code>\@inputcheck</code>	879, 880, 892, 910, 912, 935
<code>\@latex@warning</code>	393
<code>\@mkboth</code>	701
<code>\@namedef</code>	288
<code>\@one</code>	640, 1163
<code>\@newl@bel</code>	198
<code>\@nil</code>	718, 722, 904, 905, 996, 1006
<code>\@part</code>	756
<code>\@schapter</code>	780
<code>\@secondoftwo</code>	216, 243, 263, 384, 409, 422, 450, 454
<code>\@sect</code>	768

\@spart	774	\end	62, 91, 115, 117
\@ssect	786	\endcsname	160, 163,
\@testopt	860, 863, 871		164, 203, 213, 227, 254, 260,
\@tfor	233, 355		289, 290, 294, 297, 300, 310,
\@undefined	665, 995		357, 359, 364, 365, 381, 401,
\@unexpandable@protect	703		412, 413, 415, 434, 435, 436,
\\	85, 87, 89, 90, 102, 105,		447, 460, 611, 612, 628, 630,
	970, 998, 1024, 1033, 1040, 1049		633, 634, 635, 646, 650, 654,
			655, 657, 659, 660, 665, 724,
			727, 856, 955, 968, 977, 1062, 1108
A			
\AddLineBeginAux	194	\endinput	124, 177, 191, 505,
\advance	573, 640, 1163		532, 550, 567, 585, 600, 673,
\anchor	1038		847, 1082, 1093, 1101, 1115, 1144
\AtBeginDocument ..	553, 568, 591, 748	\etex@unexpanded	441, 931
\AtBeginShipout	539	F	
\AtEndDocument	569	\filename@area	932
\AtEndOfPackage	127	\filename@parse	870
		\frontmatter	37
B			
\beamer@section	793	G	
\beamer@subsection	799	\g@addto@macro	254, 633, 976, 1017,
\beamer@subsubsection	805		1020, 1029, 1038, 1045, 1051, 1062
\begin	34, 40, 88, 104	\G@refundefinedtrue	392
\bfseries	487	\gdef	294, 628, 630
		\glossary	699
C			
\c@abspage	542, 646, 651	H	
\c@page	573, 602, 644	\hb@xt@	1185
\c@zpage	644, 648	\hfill	1174, 1185
\c@zref@unique ..	479, 640, 1163, 1165	\hss	1185
\chapter	16	I	
\ChapterPages	25, 45	\if@filesw	345, 570, 1126
\ChapterStart	12, 67, 82, 98	\if@safe@actives	453
\ChapterStop	19, 80, 97, 116	\ifcase	48
\cleaders	1185	\ifcsname	447, 611, 634
\cleardoublepage	13, 20	\ifeof	880, 912, 935
\clearpage	571	\ifetex@unexpanded	181
\closein	892	\ifnum	1110, 1172
\csname ...	160, 163, 164, 203, 213,	\ifodd	57
	227, 254, 260, 289, 290, 294,	\ifpdf	1105
	297, 300, 310, 357, 359, 364,	\ifx	160, 213, 235, 260, 356,
	365, 381, 401, 412, 413, 415,		381, 420, 507, 654, 830, 902,
	434, 435, 436, 460, 612, 628,		921, 925, 929, 946, 970, 995,
	630, 633, 635, 646, 650, 654,		998, 1024, 1033, 1040, 1049, 1108
	655, 657, 659, 660, 665, 724,	\ifZREF@found ...	157, 240, 1015, 1022
	727, 856, 955, 968, 977, 1062, 1108	\ifZREF@immediate ..	335, 347, 351, 357
\current@chapid	14, 22	\ifzref@titleref@expand ...	678, 695
		\ifzref@titleref@stripperperiod	691, 715
D			
\DeclareOption	126	\ifZREF@xr@zreflabel ..	853, 887, 920
\default	1017, 1052	\immediate	340
\define@key	723, 726,	\index	698
	729, 732, 1070, 1148, 1151, 1154	\item	41, 44, 46, 54, 58, 60
\detokenize	713	K	
\dftest	99, 106, 107,	\kern	1182
	108, 109, 110, 111, 112, 113, 114	L	
\dimen@	1168, 1173, 1185	\l	318
\dimexpr	85, 87, 1173	\label	507, 697, 744
\do	233, 320, 355	\leavevmode	1162
\documentclass	2, 186	\lst@@caption	833
\dotfill	101, 105	\lst@label	830
		\lst@MakeCaption	829
E			
\emph	82		

<code>\LT@c@ption</code>	821	<code>\reset@font</code>	487
M		S	
<code>\m@ne</code>	573	<code>\section</code>	69, 77
<code>\mainmatter</code>	66	<code>\setcounter</code>	538
<code>\makeatletter</code>	8, 35, 857	<code>\setkeys</code>	736, 1074, 1160
<code>\makeatother</code>	33	<code>\setlength</code>	1168
<code>\makebox</code>	101, 102	<code>\space</code>	394, 897, 898, 1097, 1112
<code>\markboth</code>	700	<code>\stepcounter</code>	540, 609, 610
<code>\markright</code>	702	T	
<code>\MessageBreak</code>		<code>\tableofcontents</code>	64
... 184, 882, 948, 989, 1097, 1112		<code>\the</code>	85,
N		87, 327, 332, 363, 377, 542, 688,	
<code>\NeedsTeXFormat</code>		932, 942, 951, 964, 992, 1120, 1121	
. 120, 146, 501, 528, 546, 563,		<code>\thetype</code>	977
581, 596, 669, 843, 1078, 1089, 1140		<code>\thepage</code>	348, 352, 394, 495, 645
<code>\newcommand</code>		<code>\thezpage</code>	10, 645, 649
. 12, 19, 25, 99, 506, 513, 522,		<code>\thezref@unique</code> 8, <u>478</u> , 642, 643, 648,	
525, 588, 616, 664, 735, 738,		649, 651, 1167, 1169, 1172, 1180	
854, 1073, 1132, 1135, 1160, 1161		<code>\title</code>	1029, 1053
<code>\newcounter</code>	476, 536, 607	<code>\toks@</code> 319, 326, 327, 332, 361,	
<code>\newif</code>	157, 335, 678, 691, 853	363, 376, 377, 682, 688, 919, 932	
<code>\newlabel</code>	962, 972, 985	<code>\TR@TitleReference</code>	1014, 1048
<code>\newpage</code>	75	<code>\ttl@sect@i</code>	813
<code>\nfss@text</code>	487	U	
<code>\number</code>	28,	<code>\unexpanded</code>	184, 189
43, 479, 602, 622, 646, 651, 1165		<code>\url</code>	1045, 1064
<code>\numexpr</code>	28,	<code>\usepackage</code>	4, 6
43, 48, 622, 942, 951, 964, 992, 1172		V	
O		<code>\verb</code>	105
<code>\on@line</code>	152, 894	W	
<code>\openin</code>	879	<code>\write</code>	339, 340
P		X	
<code>\PackageError</code>	153, 207, 221, 268	<code>\x</code>	233, 234, 235, 320,
<code>\PackageInfo</code>	204, 283, 886, 895	321, 323, 327, 461, 463, 621,	
<code>\PackageWarning</code>	250, 322, 881	624, 705, 710, 918, 921, 925,	
<code>\PackageWarningNoLine</code>	947, 988	929, 943, 945, 953, 955, 965, 969	
<code>\page</code>	1020	<code>\XR@ext</code>	851
<code>\pdflastxpos</code>	1120	Y	
<code>\pdflastypos</code>	1121	<code>\y</code>	232, 235
<code>\pdfsavepos</code> 1097, 1112, 1127, 1166, 1179		Z	
<code>\pdfTeXversion</code>	1110	<code>\z@</code>	617, 1182
<code>\ProcessOptions</code>	143	<code>\zdotfill</code>	11, 102, 105, <u>1161</u>
<code>\protect</code>	392, 703	<code>\zdotfillsetup</code>	11, <u>1160</u>
<code>\protected@write</code>	350	<code>\zexternaldocument</code>	12, <u>854</u>
<code>\providecommand</code>		<code>\zlabel</code>	8, 17, 38, 70, 78, <u>506</u>
..... 195, 850, 1157, 1158, 1159		<code>\zmakeperpage</code>	9, <u>616</u>
<code>\ProvidesPackage</code>		<code>\zpageref</code>	9, 59, <u>522</u>
. 121, 147, 502, 529, 547, 564,		<code>\zposx</code>	11, 85, <u>1132</u> , 1172
582, 597, 670, 844, 1079, 1090, 1141		<code>\zposy</code>	11, 87, <u>1132</u>
R		<code>\zref</code> 8, 45, 47, 56, 61, 71, <u>513</u> , 523	
<code>\read</code>	910	<code>\ZREF@@newprop</code>	290, 293
<code>\refstepcounter</code>	555	<code>\ZREF@@makeperpage</code> 617, 622, 626	
<code>\renewcommand</code>	478	<code>\ZREF@newprop</code>	285, 287
<code>\RequirePackage</code>	123,	<code>\ZREF@perpage@step</code>	631, <u>639</u>
128, 180, 185, 193, 504, 531,			
533, 549, 566, 584, 586, 587,			
599, 601, 672, 674, 846, 848,			
1081, 1092, 1104, 1143, 1145, 1147			

<code>\zref@addprop</code>	<code>\ZREF@org@beamer@subsection</code>	801
4, 10, 246, 496, 497, 543, 552,	<code>\ZREF@org@beamer@subsubsection</code> .	807
604, 605, 606, 677, 1086, 1122, 1123	<code>\ZREF@org@lst@MakeCaption</code>	836
<code>\ZREF@addtoks</code>	<code>\ZREF@org@LT@ccOption</code>	822
<code>\ZREF@baseok</code>	<code>\ZREF@org@refstepcounter</code>	557
<code>\zref@default</code>	<code>\ZREF@org@stepcounter</code>	609, 614
7, 285, 484, 486	<code>\ZREF@org@thepage</code>	348, 352
<code>\ZREF@df@dot</code>	<code>\ZREF@org@ttl@sect@i</code>	815
1155, 1159, 1185	<code>\ZREF@org@write</code>	339, 340
<code>\ZREF@df@min</code>	<code>\ZREF@P</code>	284, 288, 289, 290,
1152, 1157, 1173	291, 294, 355, 357, 359, 364, 365	
<code>\ZREF@df@unit</code>	<code>\ZREF@patch</code>	158, 554,
1149, 1158, 1168	749, 755, 761, 767, 773, 779,	
<code>\ZREF@dotfill</code>	785, 792, 798, 804, 812, 820, 828	
1170, 1176, 1184	<code>\zref@propexists</code>	5, 248, 266, 514
<code>\ZREF@ErrorNoLine</code>	<code>\ZREF@refused</code>	388, 390
150, 170, 183, 1096, 1111	<code>\zref@refused</code> 6, 387, 519, 525, 592, 743	
<code>\ZREF@extract</code>	<code>\zref@require@unique</code> 8, 472, 608, 1146	
399, 404	<code>\zref@setcurrent</code> . 5, 15, 291, 296, 556	
<code>\zref@extract</code> ... 6, 29, 30, 43, 72,	<code>\zref@setdefault</code>	7, 483, 486
398, 520, 648, 649, 745, 1133, 1136	<code>\zref@setmainlist</code>	7, 489
<code>\zref@extractdefault</code>	<code>\ZREF@stripperperiod</code>	717, 722
6, 49, 50, 405, 428, 589, 651	<code>\ZREF@temp</code> 125, 132, 133, 134,	
<code>\ZREF@foundfalse</code>	135, 136, 137, 138, 139, 140,	
231, 1013	141, 142, 354, 361, 362, 370, 1165	
<code>\ZREF@foundtrue</code>	<code>\ZREF@titleref</code>	739, 741
236, 1055	<code>\zref@titleref@cleanup</code>	680, 730
<code>\zref@getcurrent</code>	<code>\zref@titleref@current</code>	
5, 299	675, 676, 694,	
<code>\zref@iflistcontainsprop</code>	706, 707, 712, 713, 716, 717, 733	
5	<code>\ZREF@titleref@hook</code> 679, 683, 687, 704	
<code>\zref@iflistundefined</code> 5, 201, 212, 220	<code>\zref@titleref@setcurrent</code> ..	693,
<code>\zref@ifpropundefined</code> 5, 259, 267,	751, 757, 763, 769, 775, 781,	
321, 973, 1007, 1026, 1035, 1042	787, 794, 800, 806, 814, 823, 832	
<code>\ZREF@ifrefcontainsprop</code> ... 411, 419	<code>\zref@titleref@stripperperiodtrue</code> .	692
<code>\zref@ifrefcontainsprop</code>	<code>\ZREF@unexpanded</code> 430, 432, 441, 443, 445	
6, 407, 1059, 1060	<code>\ZREF@UpdatePdfTeX</code> ... 156, 1099, 1114	
<code>\zref@ifrefundefined</code>	<code>\ZREF@wrapper@babel</code>	463, 469
6, 380, 391, 408, 429, 643, 1169	<code>\zref@wrapper@babel</code>	
<code>\ZREF@immediatetrue</code>	7, 72, 388, 446, 510, 515, 739	
338	<code>\zref@wrapper@immediate</code> 7, 21, 336, 574	
<code>\ZREF@label</code>	<code>\zref@wrapper@unexpanded</code>	7, 440
308, 332, 344	<code>\ZREF@X</code>	275, 278, 289
<code>\zref@label</code>	<code>\ZREF@xr@input</code>	929, 986
5, 302, 510, 574	<code>\ZREF@xr@checkfile</code>	875, 878, 906
<code>\zref@labelbylist</code> 6, 303, 305, 642, 1128	<code>\ZREF@xr@checkkey</code>	996, 1006
<code>\zref@labelbyprops</code>	<code>\ZREF@xr@checklist</code>	953, 994
6, 22, 315, 1167, 1180	<code>\zref@xr@ext</code>	12, 850, 871, 1071
<code>\ZREF@listcontainsprop</code>	<code>\ZREF@xr@externaldocument</code>	
227, 229	860, 863, 866	
<code>\zref@listcontainsprop</code>	<code>\ZREF@xr@file</code>	869,
226, 249	879, 882, 887, 896, 904, 949, 990	
<code>\zref@listexists</code> 5, 219, 247, 307	<code>\ZREF@xr@filelist</code>	
<code>\ZREF@mainlist</code>	868, 902, 904, 905, 930, 931	
303, 490,	<code>\ZREF@xr@found</code>	889, 897, 942, 964
493, 496, 497, 543, 552, 677, 1086	<code>\ZREF@xr@graburl</code>	871, 873
<code>\ZREF@makeperpage@opt</code>	<code>\ZREF@xr@ignored</code> ..	890, 898, 951, 992
617, 619	<code>\ZREF@xr@ignorewarning</code> 959, 981, 987	
<code>\ZREF@name</code>	<code>\ZREF@xr@line</code>	910, 911, 922, 926
149, 153, 207, 221, 250, 268, 322	<code>\ZREF@xr@list</code>	945, 946
<code>\zref@newlabel</code> 6, 195, 197, 370, 940, 984	<code>\ZREF@xr@newlabel</code>	925, 985
<code>\zref@newlist</code> .. 4, 200, 493, 603, 1119		
<code>\ZREF@newprop</code>		
276, 279, 282		
<code>\zref@newprop</code> 5, 9, 273, 494, 495, 542,		
551, 602, 676, 849, 974, 1008,		
1027, 1036, 1043, 1083, 1120, 1121		
<code>\ZREF@nil</code> 294, 421, 436, 911,		
917, 922, 926, 940, 953, 962,		
969, 994, 1001, 1011, 1014, 1048		
<code>\ZREF@NOVALUE</code>		
427		
<code>\ZREF@novalue</code>		
420, 421, 427		
<code>\ZREF@org@@caption</code>		
752		
<code>\ZREF@org@@chapter</code>		
764		
<code>\ZREF@org@@part</code>		
758		
<code>\ZREF@org@@schapter</code>		
782		
<code>\ZREF@org@@sect</code>		
770		
<code>\ZREF@org@@spart</code>		
776		
<code>\ZREF@org@@ssect</code>		
788		
<code>\ZREF@org@beamer@section</code>		
795		

\ZREF@xr@prefix	\ZREF@xr@urlcheck	957, 979, <u>1058</u>
. 867, 941, 957, 959, 963, 979, 981	\ZREF@xr@zref@newlabel	921, 984
\ZREF@xr@procesfile	\ZREF@xr@zreflabelfalse	859
914	\ZREF@xr@zreflabeltrue	862
\ZREF@xr@process@label	\ZREF@zref	515, 518
926, 962	\zrefused ...	9, 26, 27, 93, 94, 95, <u>525</u>
\ZREF@xr@process@zreflabel .	\zsavepos	11, 89, 90, <u>1124</u>
922, 940	\ztitleref	10, <u>738</u>
\ZREF@xr@processfile ..	\ztitlerefsetup	10, <u>723</u>
<u>878</u> , 909, 937	\ztotpages	9, 57, <u>588</u>
\ZREF@xr@processline	\zunmakeperpage	10, <u>664</u>
911, <u>917</u>	\zxrsetup	12, <u>1070</u>
\ZREF@xr@refname		
. 941, 944, 955, 963, 966, 968, 977		
\ZREF@xr@scanparams		
967, <u>1011</u>		
\ZREF@xr@scantitleref ...		
1014, <u>1048</u>		
\ZREF@xr@url		
874, <u>1064</u>		