Enhanced BEAMER increments: the `beamincr` package

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The `beamincr` package extends and enhances the incremental overlay mechanisms implemented in the BEAMER class. These include labels to refer to and manipulate overlay steps, an extended action syntax, and new increment-aware environments.

1 Background: overlays and increments

The basic BEAMER display unit is the `frame`. A frame may be rendered step-by-step, in which case the individual versions of the frame are called "overlays" or "slides". We will use these terms interchangeably. BEAMER allows you to place material on an arbitrary slide in a frame like this

Example:

```
\begin{frame}
  text on slides 1 and up\\
  \onslide<2->
  text on slides 2 and up\\
  \onslide<3-4>{
  text only on slides 3 and 4\\
  }
  \only<5>{text only on slide 5\\}
  more text on slides 2 and up\\
\end{frame}
```

You can read about the differences between `\onslide` and `\only`, and the many other overlay-sensitive commands, in the BEAMER user guide. Note in particular the difference between the argument form and the declaration forms of `\onslide`. `\only` only works with an argument.

This explicit numbering approach becomes burdensome when you want many overlays. You have to keep track of the numbers explicitly, and if you subsequently add a step early in the sequence you need to re-number the rest. Thus, BEAMER also provides an incremental overlay specification. The following code will produce the same effect as that above.

Example:

```
\begin{frame}
  \resetincr % not standard BEAMER
  text on slides 1+\\
  \onslide<+->
  text on slides 2+\\
  \onslide<+-+(1)>{ % increments counter by 1, despite the two +s
  text only on slides 3-4\\
  }
  \onslide<+>{} % increment counter by another
  \only<+>{text only on slide 5\\}
  more text on slides 2+\\
\end{frame}
```

This form allows easy automation using default overlay specifications. For instance (from the BEAMER user guide)

Example:

```
\begin{itemize}[<+-| alert@+>]
\item Apple
\item Peach
\item Plum
\item Orange
\end{itemize}
```

There are important and sometimes not-entirely-intuitive differences between the incremental and explicit numbering systems. So we will refer to the steps implied in this way as "increments". They will mostly match slide numbers, but not always, as this example shows:

Example:

```
\begin{frame}
  \resetincr % not standard BEAMER
  text on slide 1+\\
  \onslide<3>{text on slide 3}\\
  text on slide 1+\\
  \onslide<+->
  text on slide 2+\\
  \onslide<4->
  text on slide 4+\\ % increment number is still 2!
  \onslide<+->
  text on slide 3+\\
\end{frame}
```

The increments have their own internal logic (specifically, their own internal counter) which is not affected by any explicit slide specifications that may appear between incremental calls. It may make sense to think of the increment number as being associated with *where* in the source file the material appears, rather than (necessarily) on *which slide* it appears.

There are a couple of oddities with the way increments work that often trip up first-time users. There are also some extensions that would be nice, like the ability to refer to a specific increment elsewhere in the frame. These things are certainly possible in stock BEAMER, but take some digging into internals. The tools here make things a bit easier.

As an aside, BEAMER has another incremental overlay system based on the `\pause` command. This uses the same counter as increments (in fact, the counter is called `beamerpauses`), but inteprets it slightly differently. This difference is discussed in Section 9. As a result, the two sets of specifications don't play very well together, at least from the viewpoint of non-experts. More on this below. I strongly suggest avoiding `\pause` entirely when using `beamincr`.

2 Setting increments

`\resetincr[`⟨*incrnum*⟩`]`

This command resets the increment number to 1, or to the value defined by the optional argument if given. It doesn't directly affect the slide on which subsequent text appears, but it does change effect of subsequent `<+>` or `<.>` increments. The command may be useful to synchronise overlays in (say) two columns or between highlighted bullet points and highlighting in a figure.

Example:

```
\begin{frame}
  \resetincr
  \begin{center}
    Two lists \onslide<+->{in sync}
  \end{center}
  \begin{columns}
    \begin{column}{.2\textwidth}
      \begin{itemize}[<+-| alert@+>]
      \item Apple \item Peach \item Plum \item Orange
      \end{itemize}
    \end{column}
    \begin{column}{.2\textwidth}
      \resetincr[2] % restart the increment counter to sync
```

```
      \begin{itemize}[<+-| alert@+>]
      \item green \item yellow \item purple \item orange
      \end{itemize}
    \end{column}
  \end{columns}
\end{frame}
```

Any optional argument must either be a number or be an increment reference enclosed in `//` (these are defined in Section 3). It cannot specify any sort of range, or be `+` or `.`, although `/./` and things like `/.(2)/` are allowed.

It is useful to call `\resetincr` at the start of every increment-based slide (as we have in the examples here). This avoids some potentially confusing behaviour that comes from the way the increment counter is implemented in BEAMER:

Example:

```
\begin{frame}
  text on slides 1-\\
  \onslide<+->
  text still on slides 1-\\
  \onslide<+->
  text on slides 2-
  \resetincr\onslide<.->
  text on slides 1-\\
  \onslide<+->
  text on slides 2-
\end{frame}
```

The first call to `\onslide<+->` doesn't advance the slide, unless it has been preceded by a `\resetincr` (or another `\onslide<+->` or a `\pause`).

`\fromincr<`⟨*incrnum*⟩`>`

This is shorthand for

```
\resetincr[incr]
\onslide<.->
```

It can only be used as a declaration (not with an argument). The restrictions on ⟨*incr*⟩ are the same as above.

3 Labelling and referring to increments

In complicated frames, it may be useful to name certain increments for reference elsewhere. For instance, one might want to change a figure at certain steps while progressing through a list of bullet points. Or one might want to redisplay certain slides in the frame with `\againframe` or `\handoutframe` (described below).

`\incrlabel<`⟨*incrnum*⟩`>{`⟨*label*⟩`}`

`\incrlabel<`⟨*incrnum*⟩`>`⟨`=`⟩`/`⟨*label*⟩`/`

By default, this command attaches the current increment number to the label ⟨*label*⟩. Once defined, the labelled increment can be recovered in (almost) any overlay spec using the constructs discussed below. The ⟨*label*⟩ can contain most characters, but should not start with any of the characters `.!=` or contain any of `()-` .

The `=` in the second form is optional, but if it is present then the `/`⟨*label*⟩`/` may be separated from the `=` by additional material, which will be left in place. The label must appear at the same grouping level as the `\incrlabel=` command and before the end of the current paragraph. This is similar to the behaviour of the `=` action described in Section 4.2.

If the optional ⟨*incr*⟩ is provided, ⟨*label*⟩ is set to its value. The restrictions on ⟨*incr*⟩ are the same as for `\resetincr`: it can be a number or an increment specification. This allows forms like `\incrlabel</.(2)/>x` to set `x` to the current increment + 2. See the discussion of increment specifications below.

If `{`⟨*label*⟩`}` starts with a number in parentheses (e.g. `(2)x`) then this number is added to the current increment, or to the value of ⟨*incr*⟩, to obtain the label value. Thus, the effect of the command above can also be achieved by `\incrlabel{(2)x}`.

`\incrref{`⟨*incrref*⟩`}`

This command returns the increment number defined by increment reference ⟨*incrref*⟩ as described below.

The general form of an increment reference is

⟨*incrref*⟩: ⟨*label*⟩`(`⟨*offset*⟩`)`

The label can be a string assigned by a call to `\incrlabel`, or the special label '`.`' which refers to the current increment (this is subtly different to the incremental overlay specification '`.`'). A further special label '`!`' is introduced in Section 4.1. The ⟨*offset*⟩, if given, is added to the increment indicated by the label. It can be negative.

Increment references can be used as part of almost any overlay specification by enclosing them with slashes, e.g. `</foo(2)/>`.

Example:

```
\begin{frame}[label=twolists]
  \resetincr
  \begin{center}
    Two lists \onslide<+->{in sync}\\
    \onslide<+->{with more material\\}
    \onslide<+->{at the top}
  \end{center}
  \begin{columns}
    \begin{column}{.2\textwidth}
      \incrlabel{startlist}%
      \begin{itemize}[<+-| alert@+>]
      \item Apple \item Peach \incrlabel{halfway} \item Plum \item Orange
      \end{itemize}
    \end{column}
    \begin{column}{.2\textwidth}
      \resetincr[/startlist/]% keep in sync, even if we add extra topmatter
      \begin{itemize}[<+-| alert@+>]
      \item green \item yellow \item purple \item orange
      \end{itemize}
    \end{column}
  \end{columns}
  \vfill
  \onslide<+->
  The final increment is \incrref{.}.
  \incrlabel{end}
\end{frame}
```

Note that of commands discussed here, `\incrref` expects an ⟨*incrref*⟩ specification (i.e. ⟨*label*⟩`(`⟨*offset*⟩`)`), while `\resetincr`, `\fromincr` and `\incrlabel` expect an ⟨*incrnum*⟩ specification that might be an ⟨*incrref*⟩ in `//` (i.e. `/`⟨*label*⟩`(`⟨*offset*⟩`)/`) or just a number. Standard overlay-aware commands should all accept overlay specifications that include increment specs.

One BEAMER command (slightly patched in this package) with which named increments are particularly useful is `\againframe`. So

Example:

```
\againframe<1,/halfway/,/end(-1)/-/end/>{twolists}
```

provides an abbreviated tour of the lists. Increment labels are associated with the label of the enclosing frame, and so the same names can safely be reused across multiple named frames.

There is also a similar new command called `\handoutframe` to render more than one overlay from a frame in `handout` or similar modes that, by default, just show a single slide with all the overlays collapsed. See Section 8.

4 Enhanced overlay action specifications

This section discusses further extensions to the overlay specification syntax, and its interaction with increments and increment labels. Many of these extensions are only valid in a context that supports BEAMER actions. According to the user guide, these are `\action`, `\item`, the `actionenv` environment and block environments like `block` and `theorem`. This package adds the fields of incremental (Section 5) and incremental alignment environments (Section 6) to this list. In the absence of any action specifications, `\action` acts like `\uncover` (or `\onslide` with an argument).

4.1 Setting increments in overlay action specifications

`<resetincr@`⟨*incrnum*⟩`>`

`<!`⟨*incrnum*⟩`-`⟨*incrnum*⟩`>`

It is possible to use the BEAMER syntax for actions in overlays to reset the increment number. This can be done using the explicit `resetincr@`⟨*incrnum*⟩ action or with an implicit `<!`⟨*incrnum*⟩`>` specification.

Example:

```
\action<3-|resetincr@3>{body}
\action<!3->{body}
```

The increment number can be a label, with optional offset:

```
\incrlabel<2>{x}
\resetincr
\action</x/->{body on 2+}
\onslide<.->{this on 1+}
\action<!/x(2)/->{body on 4+}
\onslide<+->{this on 5+}
```

The forms `<!+>` and `<!.>` aren't supported (and wouldn't be useful: `<+>` already advances the increment, while `<!.>` would set it to its current value). However `<!/.(`⟨*offset*⟩`)/>` (note the `/` label notation) can be used to advance the increment counter by multiple (or negative) steps.

The reset takes effect after the overlay specification has been interpreted and before the body is set. So any `+` or `.` references will be relative to the increment in effect *before* the `\action`. However, the special increment label `/!/` can be used to access the most recent reset.

Example:

```
\resetincr
\action<!/.(2)/-|alert@.>{alert too early}
\action<!/.(2)/->{\alert<.>{alert when uncovered}}
\action<!/.(2)/-|alert@/!/>{alert when uncovered}
```

It is possible to issue multiple `!` commands in one overlay spec but only the first of them will take effect.

Actions must be used with argument text (usually enclosed in braces) or as environments. There is no equivalent to the declaration form of `\onslide`. Note, however, that `\fromslide` (Section 2) implements an `\onslide` declaration while also setting the current increment.

4.2 Assigning labels from overlay action specifications

`<···|=(`⟨*offset*⟩`)|···>{.../(`⟨*offset*⟩`)`⟨*label*⟩`/ ...}`

This syntax can be used to assign a label using an action specification. The name of the label to be assigned must be enclosed in `//`s within the *argument* of the `\action` (or `\item` or `\next` or alignment field ...)[1] The label is assigned to the increment number after any `+` or `!` actions have been interpreted, as though it was called with `\incrlabel` in place. Thus in this code

Example:

```
\resetincr[3]
\action<!/.(2)/>{\incrlabel{x}action text}
\resetincr[3]
\action<!/.(2)/|=>{/x/action text}
```

[1] BEAMER actions don't make it possible to pass a text argument to the handler.

```
\resetincr[3]
\action<!/.(3)/>{\incrlabel</.(-1)/>{x}action text}
\resetincr[3]
\action<!/.(3)/|=(-1)>{/x/action text}
\resetincr[3]
\action<!/.(3)/|=>{/(-1)x/action text}
```

the first two action calls set the label `x` to 5. The last three illustrate the use of assignment offsets: if `=` is followed by a number in parentheses, this is treated as an offset to add to the current increment at assignment, in the same way as indicated by the optional `<`⟨*incrnum*⟩`>` argument to `\incrlabel`. The same effect can be achieved by placing the offset before the label name within the enclosing `//`.

If no `/`⟨*label*⟩`/` is found or if ⟨*label*⟩ is empty, the action tries to do nothing quietly. This makes it possible to use an `=` in a default spec, but only assign a label on selected steps. However, this behaviour comes with warnings, and should be used with caution. First, because of the way BEAMER's internals work, it is not currently possible to omit the `//` in an `\item`, although the label can be empty (omission is fine in the fields of an incremental or incremental alignment environment). Second, if there happens to be one more or more `/` characters in the argument to the action, the text between them (or from a single `/` to the end) will be interpreted as a label, unless an explicit `//` pair appears first. You have been warned!

4.3 Extending default overlay or action specifications

`<···|~|···>`

Ordinarily, explicit overlay or action specifications override any defaults that might apply. It may sometimes be convenient to instead extend the default. The `~` spec can be used to add the current default spec fields into an explicit overlay specification. In this form, the `~` may be proceeded by, sat, a mode specification, but must not have any following text with the specification field (i.e. to the next `|` or `>`).

Example:

```
\begin{itemize}[<+-| alert@+|=>]
\item/ap/ Apple \item/pe/ Peach \item/pl/ Plum \item/or/ Orange
\end{itemize}
\begin{itemize}[<alert@/!/>]
\item<!/pe/-|~> yellow \item<!/or/-|~> orange \item<!/ap/-|~>green \item<!/pl/-|~> purple
\end{itemize}
```

Within incremental alignment environments (Section 6), a `~` will incorporate the field-specific default.

This extension is available is any overlay specification.

`<defaultspec@`⟨*range*⟩`>`

Action to set the default specification for overlay references within the action argument. The ⟨*increment range*⟩ may be any valid specificiation for a set of slides (such as `1`, `+-` or `!/foo/-/bar/`), but may not itself contain any actions. The range is evaluated within the context of the `defaultspec@` specification, yielding specific slide numbers. Thus, any labels (including `/./` and `/!/`) or `+` or `.` symbols will be replaced by their current values. For example, in

```
\resetincr[3]
\action<+-|defaultspec@+>{\only<~>{only body} other stuff}
```

the specification to `\only` is set to `<4>`, not to `<+>`, which would evaluate to slide 5 in context. See also the `~` action below.

`<~`⟨*range*⟩`|···>`

This is equivalent to `<`⟨*increment range*⟩`|defaultspec@`⟨*increment range*⟩`|···>`. That is, it executes the calling action on ⟨*increment range*⟩ (using normal overlay evaluation rules) and also set the default specification within the action argument to the evaluated range. This extension only works in an action specification context. As the body of the argument will usually only be visible for the specified range anyway, the specification is most useful to control side effects.

Example:

```
\resetincr
\setcounter{displayed}{0}
\begin{itemize}[<+->]
\item \only<~>{\stepcounter{displayed}} % \only<+-> adds another increment
\item<~+-> \only<~>{\stepcounter{displayed}} % \only<4-> does not
\item<~~> \only<~>{\stepcounter{displayed}} % \only<5-> does not
\end{itemize}
```

The `\only` commands are used to advance the counter on slides where the `\item`s are visible. In both cases the overlay specification to `\only` is a copy of the surrounding default specification. For the first one, this is `<+->`. For the second, it is `<+->` *evaluated* within the `\item` call, giving `<3->`. The final case expands the second `~` to the default `+-`, which becomes the increment specification for the item, and then sets the default within the item to its value, which is `4-`.

4.4 Advanced references: using labels defined later

`\allowundefinedincrlabels[`⟨*flag*⟩`]`

If called alone, or with option ⟨*flag*⟩ > 0, tells LaTeX not to generate an error when encountering an undefined increment label. References to such labels instead evaluate to 0, and any offset in the reference is ignored. If ⟨*flag*⟩=0, the default error-generating behaviour is restored.

If a referenced label is defined later in the same frame, then it will take on that later-defined value on subsequent slides of the frame. Thus, in effect, this option makes it possible to refer to increment labels before they are defined. (Although material intended to be set on slide 1 cannot depend on such advance references.)

If the label is used as part of an open range then it may be necessary to use a special syntax in which the range indicator is placed *within* the `/ /` enclosing the label. If the label is undefined (and so 0), this syntax sets the other limit of the range to 0 as well.

Example:

```
% /foo/ is not defined on first evaluation
\onslide</foo/->{spec expands to <0->, so text appears on all slides}
\onslide</foo-/>{spec expands to <0-0>, so text is suppressed}
\incrlabel<2>{foo} % on later evaluations, both specs will expand to <2->
```

If the range is closed with an explicit numerical or (defined) label upper limit, then there is no current way to suppress early expansion. However forms like `/foo/-/foo(2)/` will evaluate to `0-0` as offsets are ignored for undefined labels.

Many problems with advanced references (including range expansion and the rendering of first-slide material) can be resolved by use of `\framescanonly` and `\againframe` (Section 8).

An `\allowundefinedincrlabels` command also makes it possible to *set* the current increment to an (initially) undefined label value using `\resetincr`, `\fromincr`, or `<!/label/>`, thereby setting the current increment to 0. Text set on that increment will not appear until the label is defined. However, any subsequent `<+>` specs will still advance the increment number, which may not be desired. This behaviour can be avoided by using the form `<!/.(1)/>` instead of `<+>`. The current increment label `/./` is treated in the same way as an undefined one when the increment is 0, and so the offset is ignored.

Example:

```
\resetincr{/foo/} % no list items appear until /foo/ is defined
\begin{itemize}<!/.(1)-/|alert@/!/>
\item foo
\item bar
...
\end{itemize}
```

If an initially undefined label is used to set the increment counter early in the frame, then increment labels that are defined later in the frame may change value once that first label is defined. This can be used for powerful effects, in which overlays in two different sections of the frame each depend on increments from the other. However, if the definition label used in the early reference is itself altered by the change in that early evaluation, then there is a risk of creating an infinite loop.

Example:

```
\begin{itemize}[<alert@/!/>]
\item<!/./-     |~|=(1)>/ping/ Apple  % 1- (!/./ ensures alert occurs on same slide)
\item<!/pong-/  |~> Peach             % 4-
\item<!/.(1)-/  |~|=>/ping2/ Plum     % 5-
\item<!/pong2-/ |~> Orange            % 8-
\end{itemize}

\begin{itemize}[<alert@/!/>]
\item<!/ping-/  |~> green             % 2-
\item<!/.(1)-/  |~|=(1)>/pong/ yellow % 3-
\item<!/ping2-/ |~> purple            % 6-
\item<!/.(1)-/  |~|=(1)>/pong2/orange % 7-
\end{itemize}
```

5 Incremental environments

The `beamincr` package provides a set of new increment-aware environments. These are described in the present section. It also makes it possible to use increment specifications within alignment environments such as `tabular` or $\mathcal{AMS}$-TEX `align`; these are discussed in Section 6.

Each new environment is accessible under two, otherwise equivalent, names. A common base name is either preceded by the word `incremental` or followed by the symbols `<>`. The environments in this section separate material into overlays using the token `\next` or `\next*`. Many will also apply an implicit or explicitly defined command to that material when `\next` is used, but omit the command for `\next*`.

5.1 Standard incremental environments

`\begin{incremental}` `[<`⟨*default specification*⟩`>]`
  `<`⟨*pre-next specification*⟩`>` ⟨*pre-next contents*⟩
`\next<`⟨*next specification*⟩`>`
  ⟨*next contents*⟩
`\next<`⟨*next specification*⟩`>`
  ⟨*next contents*⟩
  ⋮
`\end{incremental}`

This environment can be thought of as an increment-aware `itemize` without the list formatting. This makes it suitable for incremental control of a wider range of types of code, such as Ti*k*Z drawing commands. The keyword `\next` within the environment acts like `\item` in terms of incremental processing: the ⟨*next contents*⟩ are set within an `\action` command. Each `\next` call can be followed by an optional `<`⟨*next specification*⟩`>`, which is applied to the ⟨*next contents*⟩. If the specification is omitted, then the environment ⟨*default specification*⟩ is applied. If no ⟨*default specification*⟩ was given in the environment, then the default is inherited from the frame or container default. This is ordinarily `<*>`.

Unlike in `itemize` environments, code can also appear before the first `\next`. If any does, it is treated just like ⟨*next contents*⟩: it is processed with the action specification given by `<`⟨*pre-next specification*⟩`>` if present, or else the default specification. On the other hand, if nothing but whitespace appears between the opening of the environment—or the optional default overlay spec—and the first `\next`, then no action is applied. This avoids side effects from, e.g., `<+>` specifications in the default. (The same does not apply to later empty ⟨*next contents*⟩: these are always set within action commands, triggering any side effects.)

A counter called `next` is set to 0 in the pre-next field and then advanced at every `\next`.

Example:

```
\resetincr
\begin{incremental}[<+->]
  <.-> this text on slide 1;
\next
  on slide 2;
\next<!/.(2)/->
  on slide 4, but after only \thenext\ next commands.
\end{incremental}
```

```
\begin{<>}[<⟨default specification⟩>]
  ⟨environment contents⟩
\end{<>}
```

This is a synonym for `\begin{incremental} ... \end{incremental}`.

The following environments apply a specified command each overlay's contents.

```
\begin{incrementaldo} {⟨command definition⟩}[<⟨default specification⟩>]
    <⟨pre-next specification⟩> ⟨pre-next contents⟩
  \next<⟨next specification⟩>
    ⟨next contents⟩
  \next<⟨next specification⟩>
    ⟨next contents⟩
      ⋮
\end{incrementaldo}
```

This version treats each ⟨*next contents*⟩ as the argument to a command. The command takes a single argument and is defined by ⟨*command definition*⟩ in the same way as in `\newcommand`. As the command evaluation happens deep within the bowels of BEAMER processing, the single argument generally needs to be accessed as `####1`, *unless* the enclosing frame is declared to be `fragile` (in the frame options), in which case it is just `#1`.

The do command can be avoided for specific fields by using `\next*` in place of `\next`. Contents following `\next*` are set in the same way as in a plain `incremental` environment.

Any non-empty ⟨*pre-next contents*⟩ is always processed without the do command.

```
\begin{do<>}{⟨command definition⟩}[<⟨default specification⟩>]
  ⟨environment contents⟩
\end{do<>}
```

This is a synonym for `\begin{incrementaldo} ... \end{incrementaldo}`.

```
\begin{incrementaldocmd} [⟨num args⟩]{⟨code⟩}[<⟨default specification⟩>]
    <⟨pre-next specification⟩> ⟨pre-next contents⟩
  \next<⟨next specification⟩>
    ⟨next contents⟩
  \next<⟨next specification⟩>
    ⟨next contents⟩
      ⋮
\end{incrementaldocmd}
```

This version inserts ⟨*code*⟩ (comprising arbitrary LaTeX commands) after each `\next` and before ⟨*next contents*⟩. If ⟨*code*⟩ is (or ends with) a command that takes one or more arguments, these will be read from ⟨*next contents*⟩. Braces may be needed within that text to delineate the arguments.

If the optional ⟨*num args*⟩ is non-zero, then this number of arguments is read from the text following `\next` and can be accessed using argument parameters (almost) as in `\newcommand`. As the command evaluation happens deep within the bowels of BEAMER processing, the parameter numbers must be protected with four `####` symbols, *unless* the frame is declared to be `fragile` (in the frame options) in which case a single `#` works.

Execution of the ⟨*code*⟩ can be avoided for specific fields by using `\next*` in place of `\next`. Contents following `\next*` are set in the same way as in a plain `incremental` environment.

Any non-empty ⟨*pre-next contents*⟩ is always processed without ⟨*code*⟩.

Example:

```
\tikz[every node/.style={above,allow upside down,midway,sloped}]{
  \begin{incrementaldocmd}[1]{\draw ({72*\thenext-72}:10ex)--(72*\thenext:10ex) node {#1};}
                           [<+-|alert@+|=>]
    \next/one/   {one}
```

```
    \next/two/   {two}
    \next/three/ {three (\thenext/\theincrement)}
    \next/four/  {four}
    \next/five/  {five}
    \next*/done/ \draw (0:5ex) \foreach \t in {1,...,5}{ -- (\t*72:5ex)};
                 \node [anchor=center] {done!};
  \end{incrementaldocmd}}
```

\begin{docmd<>} [⟨*num args*⟩]{⟨*code*⟩}[<⟨*default specification*⟩>]
⟨*environment contents*⟩
\end{docmd<>}

This is a synonym for `\begin{incrementaldocmd} ... \end{incrementaldocmd}`.

\begin{incrementaldodef} [⟨*parameter spec*⟩]{⟨*code*⟩}[<⟨*default specification*⟩>]
<⟨*pre-next specification*⟩> ⟨*pre-next contents*⟩
\next<⟨*next specification*⟩>
⟨*next contents*⟩
\next<⟨*next specification*⟩>
⟨*next contents*⟩
⋮
\end{incrementaldodef}

This is similar to the `incrementaldocmd` environment, but allows arguments to be specified using the flexible format of `\def`. Parameter numbers must be escaped with four `#`s in both specification and code, unless the frame is declared `fragile`. Code execution can be skipped using `\next*` and is always skipped for any ⟨*pre-next contents*⟩.

\begin{dodef<>} [⟨*parameter spec*⟩]{⟨*code*⟩}[<⟨*default specification*⟩>]
⟨*environment contents*⟩
\end{dodef<>}

This is a synonym for `\begin{incrementaldodef} ... \end{incrementaldodef}`.

\begin{incrementaldolongdef} [⟨*parameter spec*⟩]{⟨*code*⟩}[<⟨*default specification*⟩>]
⟨*environment contents*⟩
\end{incrementaldolongdef}

This form allows paragraph breaks within the arguments, but is otherwise the same as `\begin{incrementaldodef} ...`

\begin{dolongdef<>} [⟨*parameter spec*⟩]{⟨*code*⟩}[<⟨*default specification*⟩>]
⟨*environment contents*⟩
\end{dolongdef<>}

This is a synonym for `\begin{incrementaldolongdef} ... \end{incrementaldolongdef}`.

5.2 Ti*k*Z-based incremental environments

The following environments use Ti*k*Z picture commands to create their effects. They will only be defined if Ti*k*Z is also loaded in the document preamble.

\begin{incrementallayers} [⟨*node options*⟩][<⟨*default specification*⟩>]
<⟨*pre-next specification*⟩> ⟨*pre-next contents*⟩
\next<⟨*next specification*⟩>[⟨*next node options*⟩]
⟨*next contents*⟩
\next<⟨*next specification*⟩>[⟨*next node options*⟩]
⟨*next contents*⟩
⋮

\end{incrementallayers}

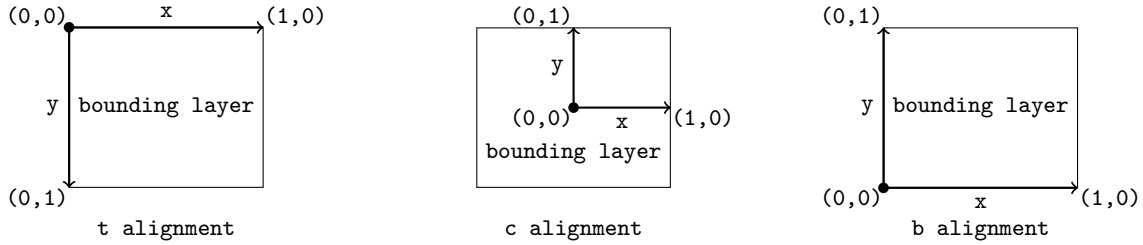
Set ⟨*next contents*⟩ within overlayed Ti*k*Z nodes. This may have the effect of later text appearing to be layered on top of earlier material. If the specifications place material on mutually exclusive increments (e.g. with `<+>`) then this has a similar effect to BEAMER's `overprint` environment. In particular, the region occupied by the environment will correspond to the largest of the nodes. However, this behaviour can be subverted by use of `\only` or similar commands within the ⟨*next contents*⟩, or `only@` actions in ⟨*next specification*⟩s; these should be used with care.

By default, nodes are set with `text width = \columnwidth, inner sep=0pt` so that the text fills the width of the current frame or column or minipage. They are aligned at their top borders. These defaults can be overridden, and arbitrary Ti*k*Z options provided to the nodes, in one of three ways: by setting options in the `incremental layer` Ti*k*Z style, by placing them in the optional ⟨*node options*⟩ argument to the environment, or by placing them in the optional ⟨*next node options*⟩ after a `\next`, (and after any ⟨*next specification*⟩).

Three shorthand node alignment keys are available: `t` aligns the nodes at their top edges (the default); `b` at their bottom edges and `c` at their centres.

The entire environment is set within a single `tikzpicture`. Any ⟨*pre-next contents*⟩ and the contents of any `\next*` are passed directly to Ti*k*Z. The default origin of the coordinate system is the `north`, `center` or `south` anchor points of the layer nodes for `t`, `c` and `b` alignment respectively. The nodes themselves are accessible under the names `(layer` ⟨*n*⟩`)`, where ⟨*n*⟩ is the corresponding value of the `next` counter. The Ti*k*Z option `fit layers` can be given to a node to surround all the layers defined so far in the `incrementallayers` environment (see the Ti*k*Z fit library).

There is also a new environment called `boundinglayerscope` which creates a Ti*k*Z `scope` with the following additions. A node called `(bounding layer)` is created to (tightly) fit the layers defined so far, and the `xy` coordinate system in the scope is redefined according to the alignment of the most recent layer, or a `tcb` alignment option to `boundinglayerscope`. The origin is placed at the `north west`, `center` or `south west` of the bounding node, for `t`, `c`, or `b` alignment respectively. The `x` vector extends horizontally to the east border of the bounding node, while `y` extends vertically to the opposite side (or top for `c` alignment).



\begin{layers<>} [⟨*parameter spec*⟩]{⟨*code*⟩}[<⟨*default specification*⟩>]
⟨*environment contents*⟩
\end{layers<>}

This is a synonym for `\begin{incrementallayers} ... \end{incrementallayers}`.

6 Incremental alignment environments

Standard LaTeX alignment environments including `tabular` and the `align` and `align*` environments from the `amsmath` package are not ordinarily increment-aware. The current package introduces a partial fix for this, although their are remaining fragilities that may need to be worked around. It is possible to make an increment-aware version of any alignment environment using `\CreateIncrementalAlignmentEnvironment` as described below. However, a few such environments are defined automatically when `beamincr` is loaded and these are described first, thus illustrating the behaviour once an increment-aware environment has been created.

6.1 Automatically defined incremental alignment environments

The following two environments are equivalent:

```
\begin{incrementalalign*}[<⟨spec1⟩>&<⟨spec2⟩>& ...]
  ⟨environment contents⟩
\end{incrementalalign*}

\begin{align*<>}[<⟨spec1⟩>&<⟨spec2⟩>& ...]
  ⟨environment contents⟩
\end{align*<>}
```

Each pre-processes the input to `align*`, placing an `\action<>{}` command around each field, defined as the material appearing between successive `&`, `\\` or end environment tokens. By default, the first field on a line is called with `\action<+->{}`, and up to 7 remaining ones with `\action<.->{}`. This has the effect of displaying a full line at a time, unless it has more than 8 fields. The optional argument makes it possible to change this behaviour to `\action<`⟨*spec1*⟩`>`, `\action<`⟨*spec2*⟩`>`, etc. with the sequence of specifications reset to `<`⟨*spec1*⟩`>` at the beginning of every line. If there are fewer specifications in the default than fields on a single line, then the sequence is repeated. The default specification values can be changed by calling `\setincrementalenvspec{align*}{<new defaults>}` or similar.

The default specification for a single field can be overridden by placing a field-specific specification in `<>` at its start. This means that a leading `<` in the field contents itself must be protected, e.g. by preceding it with `{}`.

The use of `\action` means that beamer will interpret both standard `action@`⟨*increment*⟩ actions and implicit ones such as `!`-prefixed increment resets, `=` label assignments or `~`⟨*range*⟩ default specification.

Example:

```
\begin{align*<>}[<+->&<.->] % increment after every two &s
  x\incrlabel{x} &= y  &  1 &{}< 2 \\
  </x/-> x^2 &= y^2    &  <!/x/-> e^{i\pi} &<+->= -1 \\
  \sum_n f(n) &<.-|alert@.> \to \int f(x) dx
\end{align*<>}
```

The pre-processor is not able to distinguish between the `&` alignment characters that apply to the containing environment and any that appear within enclosed environments, such as `array`. Thus, any such environments must be protected. The simplest approach is just to add extra braces to group the enclose environment at a lower level. Alternatively, the environment can be defined within a token register or a protected macro. It is still possible to use increments within the environments: these are processed sequentially with those in the containing `align` environment, respecting increment labels, resets etc.

Example:

```
% using grouping
\newtoks\mymatrix
\begin{align<>}
  \incrlabel{mat}{\begin{pmatrix} 1 & 2 \\ \alt<+->{3}{2} & 4 \\ \end{pmatrix}}\resetincr[/mat/]
  & \text{is \only<+->{not }singular}
\end{align<>}

% using token registers
\newtoks\mymatrix
\mymatrix={\begin{pmatrix} 1 & 2 \\ \alt<+->{3}{2} & 4 \\ \end{pmatrix}}
\begin{align<>}
  \incrlabel{mat}\the\mymatrix \resetincr[/mat/]& \text{is \only<+->{not }singular}
\end{align<>}

% using \protected
\protected\def\mymatrix{\begin{pmatrix} 1 & 2 \\ \alt<+->{3}{2} & 4 \\ \end{pmatrix}}
\begin{align<>}
  \incrlabel{mat}\mymatrix \resetincr[/mat/]& \text{is \only<+->{not }singular}
\end{align<>}
```

It may be wise to put any `\newtoks` declaration outside the frame so as not to consume more of TEX's resources than needed.

`\intertext` lines must be terminated with `\\`. By default they will be grouped within the action call of the last field of the preceding line. This behaviour can be changed by inserting a `\\` between that

field and the `\intertext`. By default, both `\\`s will add extra vertical space (and an equation number in non-starred variants). These can be avoided by using a form like `\nonumber\\[-3ex]` instead.

The `amsmath` `\tag` command is processed in such a way that it cannot easily be made overlay aware. Any `\tag`s will appear on any slides where the overall environment is uncovered, even if no fields have appeared. However, the alternative `\eqtag` can be used. See Section 6.4.

The incremental forms `incrementalgather*` and `gather*<>` are also created when `beamincr` is loaded. Although these contain only one field per line, automatic access to BEAMER and `beamincr` actions as these lines are processed can be useful. By default, they uncover equations a line at a time (using `<+->`).

`\begin{incrementaltabular}`[⟨*pos*⟩]{⟨*cols*⟩}[<⟨*spec1*⟩>&<⟨*spec2*⟩>& ...]
⟨*environment contents*⟩
`\end{incrementaltabular}`

`\begin{tabular<>}`[⟨*pos*⟩]{⟨*cols*⟩}[<⟨*spec1*⟩>&<⟨*spec2*⟩>& ...]
⟨*environment contents*⟩
`\end{tabular<>}`

These provide increment-aware versions of the standard LaTeX `tabular` environment. By default, the entire table is uncovered on the current increment (using `<.->`), but this behaviour can be altered by changing the default specification when called, or by using `\setincrementalenvspec` as described below. It may also be desirable to uncover entries column-by-column. This effect can be achieved using increment labels.

Example:

```
\begin{tabular<>}{cccc}[</col1-/>&</col2-/>&</col3-/>&</col4-/>]
  <=(1)>/col1/\bf fruit & <=(2)>/col2/\bf colour
      & <=(3)>/col3/\bf climate & <=(4)>/col4/\bf family \\[1ex]
  Apple & green & cool & pome \\
  Peach & yellow & warm & drupe \\
  Plum & purple & cool & drupe \\
  Orange & orange & hot & citrus \\
\end{tabular<>}
```

`\begin{incrementaltabular*}`[⟨*pos*⟩]{⟨*width*⟩}{⟨*cols*⟩}[<⟨*spec1*⟩>&<⟨*spec2*⟩>& ...]
⟨*environment contents*⟩
`\end{incrementaltabular*}`

`\begin{tabular*<>}`[⟨*pos*⟩]{⟨*width*⟩}{⟨*cols*⟩}[<⟨*spec1*⟩>&<⟨*spec2*⟩>& ...]
⟨*environment contents*⟩
`\end{tabular*<>}`

These forms add the ⟨*width*⟩ argument of LaTeX's `tabular*` environment.

6.2 Creating new incremental alignment environments

`\CreateIncrementalAlignmentEnvironment`{⟨*name*⟩}[⟨*Nopts*⟩]{⟨*Nreqs*⟩}[<⟨*default spec*⟩>][⟨*base*⟩]

Create an increment-aware version of an alignment environment. Unless a different ⟨*base*⟩ environment is specified in the final argument, the new environment is based on an existing one of the same ⟨*name*⟩. This existing environment should process its contents in fields demarcated by `&` and/or `\\` tokens. The arguments ⟨*Nopts*⟩ and ⟨*Nreqs*⟩ specify the numbers of optional and required arguments the base environment expects. If ⟨*Nopts*⟩ is omitted it is taken to be 0. ⟨*Nreqs*⟩ must be specified, but can be 0. If the ⟨*default specification*⟩ is omitted it is set to `<.->`, thus displaying the environment contents at the prevailing increment number in the frame.

The new environment can be accessed using either of the names `incremental`⟨*name*⟩ or ⟨*name*⟩`<>`.

6.3 Manipulating default behaviour

\useincrementalenv{⟨*name*⟩}

Make all subsequent uses of the ⟨*name*⟩ environment call the incremental version. The incremental version must already have been created.

Example:

```
\useincrementalenv{align*}
\begin{align*}[<+->]
  % this is an incremental environment
\end{align*}
```

The specified ⟨*name*⟩ must match the *name* of the base environment (i.e. the first argument to `\CreateIncrementalAlignmentEnvironment`), whether or not this is the same as its base.

```
\CreateIncrementalAlignmentEnvironment{foo}{0}[<.->][bar]
\begin{foo}
  % error -- environment is accessible as incrementalfoo or foo<>
\end{foo}
\useincrementalenv{foo}
\begin{foo}
  % evokes the incremental version of bar
\end{foo}
```

\usenonincrementalenv{⟨*name*⟩}

Make subsequent uses of the ⟨*name*⟩ environment refer to the non-incremental version. If the name and base specified at creation were the same, this restores the normal behaviour of the ⟨*name*⟩ environment. If a different base environment was specified at creation, this creates a new ⟨*name*⟩ environment that is synonymous with the base.

Example:

```
\CreateIncrementalAlignmentEnvironment{foo}{0}[<.->][bar]
\begin{foo}
  % error -- environment is accessible as incrementalfoo or foo<>
\end{foo}
\usenonincrementalenv{foo}
\begin{foo}
  % evokes the original version of bar
\end{foo}
```

\setincrementalenvspec{⟨*name*⟩}{⟨*default specification*⟩}

Set the default specification for incremental environments of type ⟨*name*⟩.

6.4 Equation numbering

Unfortunately, the `amsmath` `\tag` command, used for equation numbering, is processed in such a way that it cannot easily be made overlay aware. Any `\tag`s will appear on any slides where the overall environment is uncovered, even if no fields have appeared. This is also the case with automatic numbering. Thus if defined using

```
\CreateIncrementalAlignmentEnvironment{gather}{0}[<+->]
```

the `gather<>` environment will also generate all equation numbers whenever the environment as a whole is uncovered, regardless of the status of the relevant fields. In principle, this behaviour could be partially addressed using a technique discussed in the BEAMER manual Howtos, but this requires some hackery.

Instead, beamincr provides an increment-aware version of `\tag` and of automatic equation numbering.

\eqtag<⟨*overlay spec*⟩>{⟨*tag*⟩}

Place ⟨*tag*⟩ on slides that match ⟨*overlay spec*⟩.

`\eqnum<`⟨*overlay spec*⟩`>`

Place the current equation number (as `\theequation`) on slides that match ⟨*overlay spec*⟩, and then increment it.

The second form can be used as an action.

`<eqnum@`⟨*range*⟩`>`

Place the current equation number (as `\theequation`) on slides in ⟨*range*⟩, and then increment it.

Example:

```
\begin{align*}[<+-|eqnum@+->&<.->]
  e^{\pi i} &= -1 \\
  \sqrt[3]{1} &= e^{2\pi i/3}
\end{align*}
```

numbers equation as it is uncovered.

In principle, this method can be used to create automatic numbering forms of the amsmath environments:

```
\CreateIncrementalAlignmentEnvironment{gather}{0}[<+-|eqnum@+->][gather*]
\begin{gather<>}
  % equations will be numbered, with numbers uncovered with the rest of the line
\end{gather<>}
```

Such environments are not created automatically, as the user should be aware of two traps. First, if a default specification is given to `\begin{gather<>}`, the environment will revert to unnumbered unless the appropriate `eqnum` action or commands are provided. Second, a call to `\usenonincrementalenv{gather}` will make `gather` a synonym for `gather*`. At this point, there would be no easy way to restore `gather` to its original behaviour. You have been warned.

7 Directing attention

7.1 Alerts

`\alerts<`⟨*overlay spec*⟩`>{`⟨*argument contents*⟩`}`

Activate any `\alert*` commands in ⟨*argument contents*⟩ on the overlays indicated by ⟨*overlay spec*⟩.

`<alerts@`⟨*range*⟩`>`

This is the action equivalent of `\alerts`.

`\alert*{`⟨*argument*⟩`}`

Executes `\alert{`⟨*argument*⟩`}` if an enclosing `\alerts` command or action is active. Otherwise ⟨*argument*⟩ is displayed unalerted.

7.2 Pointers

`\point<`⟨*overlay spec*⟩`>{`⟨*contents*⟩`}`

In normal text, insert a pointer before ⟨*contents*⟩ on the specified slides. If ⟨*contents*⟩ includes any `\point*` commands, pointers are inserted at the locations of these commands at the same time.

If called within a Ti*k*Z picture, the `\point` command does not insert a pointer itself. Instead, any pointer defined by the `pointer` option to any nodes in ⟨*contents*⟩ is activated. See the description of `pointer` below.

`<point@`⟨*range*⟩`>`

The action form of `\point` can be used in all contexts where an action specification is valid. Its behaviour around normal text or Ti*k*Z code is as above. In `itemize` environments it replaces the default item label with the pointer[2]. In `enumerate` environments it prepends the pointer to the default label. In other list environments, or when the label is set explicitly as an optional argument to `\item`, it has no direct effect. However any `\point*` commands in the item label or text are activated.

[2] Although if the `itemize` is nested within an `enumerate`, it inherits the `enumerate` behaviour.

<pointers@⟨*range*⟩>

This action activates `\point*` commands in the argument contents, but does not insert a pointer.

`\point*[`⟨*options*⟩`]{`⟨*contents*⟩`}`

If the command is not followed by a `[` or `{` character, insert a pointer when an enclosing `\point` command or action is active.

If followed by an argument in `[]` or `{}`, and if Ti*k*Z is loaded, call `\pointtonode` as described below. If Ti*k*Z is *not* loaded a normal pointer is inserted as in the no-argument form, any options are ignored, and the contents is copied to the output.

`pointer=[`⟨*pointer node options*⟩`]`⟨*angle*⟩

This is a Ti*k*Z option that can be passed to a `node` to insert a pointer drawn towards the node whenever an enclosing `\point` command or action is active. If an ⟨*angle*⟩ is specified, the pointer is drawn towards the corresponding point on the node boundary; this can be specified as a numerical angle or a direction like `north`. The default angle is `west` or `180`, so that the pointer points to the node from the left. The pointer itself is drawn within a node: this behaviour is very similar to the regular Ti*k*Z node `label` option, except that the pointer node is automatically sloped so as to point inwards.

The current implementation does not work well with `coordinate`s. The alternative `pointer coordinate` style creates an empty circular node of 0.1pt size, which is broadly equivalent.

If ⟨*pointer node options*⟩ are specified (generally requiring braces around the entire option value to protect Ti*k*Z's option parsing from seeing the `[]`s) these are passed to the pointer node. A few options may be particularly useful:

`pos=`⟨*scale*⟩ adjusts the placement of the pointer as a fraction of the distance from the target node centre to its boundary. The default is 1.0. This option is unlikely to be useful when the target is a `pointer coordinate`.

`pointer sep=`⟨*dimen*⟩ adds ⟨*dimen*⟩ to the distance of the pointer from the target node.

`rotate=`⟨*angle*⟩ rotates the pointer relative to its initial angle.

`\pointtonode[`⟨`pointer` *options*⟩`]{`⟨*contents*⟩`}`

If Ti*k*Z is loaded, this is shorthand for

```
\tikz[baseline]\node[anchor=base,text height=1.5ex,inner sep=0pt,pointer={#1}]{#2};
```

The spacing adjustments ensure that the contents in the node are printed in alignment with the surrounding text, and that pointers to an empty node appear at a similar height to those inserted by `\point` or `\point*`. The availability of ⟨`pointer` *options*⟩ provides flexibility in the pointer placement.

If Ti*k*Z is not loaded, this is the equivalent of `\point*{`⟨*contents*⟩`}`, ignoring any options given.

`\usepointer[`⟨*inactive glyph*⟩`]{`⟨*pointer glyph*⟩`}`

Use ⟨*pointer glyph*⟩ for subsequent pointers in the current group. If the optional argument is absent, then the pointer is replaced by a phantom of the same size when inactive (the size only matters if `\useuncoverpointer` is active). If it is given, then inactive pointers are replaced by ⟨*inactive glyph*⟩ (which may be empty).

Example:

```
\usepointer{\raisebox{0.3ex}{\alert{$\blacktriangleright$}}} % the default
\usepointer{\raisebox{-0.4ex}{\alert{\HandRight}}} % requires \usepackage{bbding}
```

Note that some adjustment of the vertical placement, as in these examples, may be necessary to align the pointer appropriately with the text.

The effect of this command is local to the containing group.

The pointer appearance should really be controlled through BEAMER's template mechanism, but that's a project for another day.

\useoverprintpointer

Print subsequent pointers (and any inactive glyphs) in the current group *over* existing material, without reserving any space for them (internally, they set within a zero-width box). This is the default, and avoids the dilemma of either leaving blank spaces for inactive pointers, or having text rearrange when the pointer appears.

The effect of this command is local to the containing group.

\useuncoverpointer

Set subsequent pointers and any inactive glyph in the current group as normal text, taking up space on the page. If no inactive glyph has been specified, the effect is to leave a blank space when the pointer is inactive, much like the effect of the `\uncover` or `\onslide` commands. If the inactive glyph is set to the empty string, there is no blank space, but surrounding text is rearranged to make room for the pointer when it becomes active.

The effect of this command is local to the containing group.

8 Selectively repeating frames

These functions control the (re)display of frames.

\againframe<⟨*overlay spec*⟩>[<⟨*default spec*⟩>][⟨*options*⟩]{⟨*frame label*⟩}

This is a BEAMER command to repeat a labelled frame, allowing the ⟨*overlay spec*⟩ and other options to be modified. It is modified in `beamincr` so that the ⟨*overlay spec*⟩ respects `beamincr` increment labels, and so that any `\framescanonly` commands in the orginal frame contents are ignored (thus allowing the frame contents to be rendered).

\handoutframe[⟨*modes*⟩]<⟨*overlay spec*⟩>[<⟨*default spec*⟩>][⟨*options*⟩]{⟨*frame label*⟩}

When compiled in one of ⟨*modes*⟩ (defaults to `handout`, but can include more than one, e.g., `[beamer|handout]`), render the specified overlays from the named frame. If ⟨*overlay spec*⟩ is omitted, all the overlays are rendered. No output is produced in modes other than ⟨*modes*⟩.

The code works by switching temporarily to `beamer` mode as that seems to be the only way to produce more than one overlay per frame in `handout`, `trans` and `article` modes, although this means it may behave poorly with any mode-specific material within the frame. The idea is from `https://tex.stackexchange.com/questions/455444/beamer-overlays-and-handout-exclude-frames-from-handout/455459#455459`.

Unfortunately, the natural code

Example:

```
\begin{frame}<handout:0>[label=twolists]
  ...
\end{frame}
\handoutframe<1,/halfway/,/done/>{twolists}
```

fails, because the `<handout:0>` spec stops the increment labels from being defined. If running a recent LaTeX compiler (post 2021) the command `\framescanonly<handout>` described below provides a workaround.

Example:

```
\begin{frame}[label=twolists]
  \framescanonly<handout|trans>%
  ...
\end{frame}
\handoutframe[handout|trans]<1,/halfway/,/done/>{twolists}
```

`\framescanonly<`⟨*modes*⟩`>`

Scan the current frame without producing any output. This is similar to a `<mode:0>` specification to `\begin{frame}`, but as the frame is still scanned it allows side effects such as increment label definitions. The `\framescanonly` command should be placed inside the frame contents. It is only available in recent versions of LaTeX with hook support; a warning is printed in other cases. If used in `beamer` mode the frame will be reprocessed for every overlay. This behaviour can be avoided by also including a `<beamer:1>` or `<beamer:-1>` (but not `<beamer:0>`!) or equivalent specification to `\begin{frame}`. although it may be useful to fully expand advanced increment references when increments are reset (see Section 4.4).

The command has no effect when the frame is recalled with `\againframe` or `\handoutframe`, allowing both commands to render the frame contents. If it is necessary to suppress the output of (say) `\againframe` in certain modes, this can be achieved with the usual `<`⟨*mode*⟩`:0>` specification.

An example use appears above.

`\allowframescanonly[`⟨*flag*⟩`]`

Disable (with ⟨*flag*⟩ = 0) or enable (with ⟨*flag*⟩ > 0 or omitted) the effect of `\framescanonly`.

9 Internals

These sections discuss more background and some implementation details. This is only likely to be of interest to users who wish to extend the approach.

9.1 Pauses, increments and the `beamerpauses` counter

Both `\pause` and incremental overlay specifications access the same underlying counter called `beamerpauses`, but they use them in different ways.

`\pause`

increments `beamerpauses` and then sets subsequent material on the slide given by the incremented `\value{beamerpauses}`.

`\onslide<+->`

increments `beamerpauses` but then sets subsequent (or argument) material on the slide corresponding to the *previous* value of `beamerpauses`.

`\onslide<.->`

leaves `beamerpauses` alone, but sets subsequent (or argument) material on the slide given by `\value{beamerpauses}-1`, unless `\value{beamerpauses}=1` in which case it puts subsequent material on slide 1.

This conflict in interpretation of the `beamerpauses` counter can cause unintuitive effects. The incremental specfication model is far more flexible and powerful, and so the commands of this package can all be interpreted in terms of an *increment number* which ordinarily equals `max(\value{beamerpauses}-1,1)`. In fact, internally they all use the `beamerpauses` counter with this offset. Thus, when commands like `\resetincr` set the increment value, they set `beamerpauses` to the increment + 1. This value then behaves sensibly with `<+>` etc. specifications, but not with `\pause`.

An exception is when the current increment is set to 0, either explicitly or by using an advanced (or otherwise undefined) increment reference. In this case `beamerpauses` is also set to 0, not 1. This is because `beamincr` references use the 0 value to detect the undefined reference, and so suppress offsets and ranges as described in Section 4.4. However, subsequent uses of BEAMER's `<+>` specification will increment `beamerpauses`, potentially placing text on earlier slides than intended. This behaviour can be avoided (at the expense of more typing) by using `<!/.(1)/>` instead.

9.2 Overlay specification parsing routines

The `beamincr` overlay and action specification extensions work by injecting various parsing routines into the core BEAMER parser (called `\beamer@masterdecode`), before calling the original function. These parsers are also available as user commands, and may be helpful for debugging (though see also `\beamincrdebug` below).

`\parseincludedefaultspec{`⟨*overlay spec*⟩`}`

Replace any <~>fields in ⟨*overlay spec*⟩ with the current default specification.

`\parseincrspec{`⟨*overlay spec*⟩`}`

Interpret any text enclosed in /s within ⟨*overlay spec*⟩ as an increment specification, replacing each with the corresponding numerical values (including offset). Also processes any open ranges internal to the label as described in Section 4.4.

`\parseresetspec{`⟨*overlay spec*⟩`}`

`\parselabelspec{`⟨*overlay spec*⟩`}`

9.3 Interface with beamer internals

Many `beamincr` extensions work to pre-process material before passing it to standard BEAMER or other commands. This section details the few cases were it is necessary to interface with BEAMER internals.

As described above, increment control is achieved by reading or setting the `beamerpauses` counter. The user-visible increment number corresponds to `max(\value{beamerpauses}-1,1)`, so as to consistently match the slide numbers on which increment-assigned material appears. Many commands also read and modify BEAMER internal macros used as variables, notably `\beamer`@defaultospec (the current default overlay specification) and `\beamer`@againname (the label of the current frame, used to identify it in calls to `\againframe`). In particular, `\beamer`@againname is incorporated into the internal name associated with `beamincr` labels.

Extensions to the overlay and action specification syntax require modification to the BEAMER parsing routines, to inject the parsing routines described in Section 9.2. This is achieved using the following code.

```
\let\beamer@masterdecode@orig=\beamer@masterdecode
\def\beamer@masterdecode#1{%
  \edef\parsed@spec{\parseincludedefaultspec{#1}}%
  \edef\parsed@spec{\x@\parseincrspec\x@{\parsed@spec}}%
  \edef\parsed@spec{\x@\parseresetspec\x@{\parsed@spec}}%
  \edef\parsed@spec{\x@\parselabelspec\x@{\parsed@spec}}%
  \debug@message{masterdecode: <\unexpanded{#1}> -> <\parsed@spec>^^J}%
  \x@\beamer@masterdecode@orig\x@{\parsed@spec}%
}
```

where `\x@` is an internal abbreviation for `\expandafter`.

The command `\againframe` must be modified separately, both to interpret increment references and to inhibit any `\framescanonly` in the contents. BEAMER uses a cascade of internal commands to read the various possible optional arguments. These are retained, with the change happening at the inner-most command.

```
\let\beamer@@@againframe@orig=\beamer@@@againframe
\def\beamer@@@againframe<#1>[#2][#3]#4{%
  \edef\@scanstate{\@ifallowscanonlystate}%
  \allowframescanonly0%
  \beamer@@@againframe@orig<\parseincrspec{#1}>[#2][#3]{#4}%
  \x@\allowframescanonly\@scanstate%
}
```

The `\handoutframe` command calls this redefined `\againframe` internal after resetting the current mode to `beamer`.

9.4 Debugging

`\beamincrdebug{`⟨*flag*⟩`}`

Turn on (⟨*flag*⟩ > 0) or off (⟨*flag*⟩ = 0) debugging mode. When on, compilation generates messages in the terminal output and log file describing the rewriting actions that `beamincr` performs.

10 Reference

10.1 Increment, overlay and action specifications

⟨*num*⟩	integer	explicit reference to slide number
⟨*label*⟩	text	value assigned by `\incrlabel{`⟨*label*⟩`}` or `<=>`
⟨*incrref*⟩	⟨*label*⟩`(`⟨*offset*⟩`)`	= `value{`⟨*label*⟩`}+`⟨*offset*⟩
|	`.(`⟨*offset*⟩`)`	= ⟨*current increment*⟩`+`⟨*offset*⟩
|	`!(`⟨*offset*⟩`)`	= ⟨*last increment reset*⟩`+`⟨*offset*⟩
⟨*incrnum*⟩	⟨*num*⟩ | `/`⟨*incrref*⟩`/`	increment number for `\resetincr`, `\fromincr`, `\incrlabel`
⟨*incr*⟩	`/`⟨*incrref*⟩`/`	= `value{`⟨*incrref*⟩`}` (including ⟨*offset*⟩)
|	`.(`⟨*offset*⟩`)`	= ⟨*current increment*⟩`+`⟨*offset*⟩
|	`+(`⟨*offset*⟩`)`	= `++`⟨*current increment*⟩`+`⟨*offset*⟩
⟨*slide*⟩	⟨*num*⟩ | ⟨*incr*⟩	
⟨*range*⟩	⟨*slide*⟩ | ⟨*slide*⟩`-`⟨*slide*⟩	(at least one ⟨*slide*⟩ must be present)
|	`/`⟨*incrref*⟩`-/`	= `0-0` if ⟨*incrref*⟩ evaluates to 0 or is undefined and `\allowundefinedincrlabels` is true
⟨*mode*⟩	BEAMER mode	`beamer` | `trans` | `handout` | `presentation` | `article` | `all`
⟨*modes*⟩	⟨*mode*⟩$_1$`|`⟨*mode*⟩$_2$`|...`	

`<`⟨*overlay spec*⟩`>`

`<*>`	active on all slides
`<`⟨*range*⟩$_1$`,`⟨*range*⟩$_2$`,...>`	active for slides within ⟨*range*⟩s
`<~>`	copy default specification
`<`⟨*mode*⟩`:`⟨*overlay spec*⟩`>`	only apply ⟨*overlay spec*⟩ in ⟨*mode*⟩
`<`⟨*overlay spec*⟩$_1$`|`⟨*overlay spec*⟩$_2$`|...>`	apply different ⟨*overlay spec*⟩s in different modes

`<`⟨*action spec*⟩`>`

`<`⟨*overlay spec*⟩`>`	
`<resetincr@`⟨*slide*⟩`>`	set ⟨*current increment*⟩ to ⟨*slide*⟩
`<!`⟨*incrnum*⟩`-`⟨*incrnum*⟩`>`	= `<resetincr@`⟨*incrnum*⟩`|`⟨*incrnum*⟩`-`⟨*incrnum*⟩`>`
`<=(`⟨*offset*⟩`)>.../(`⟨*offset*⟩`)`⟨*label*⟩`/ a`	set ⟨*label*⟩ to increment in effect after ⟨*action spec*⟩ +⟨*offset*⟩s
`<defaultspec@`⟨*range*⟩`>`	set default spec within argument to ⟨*range*⟩ evaluated in ⟨*action spec*⟩
`<~`⟨*range*⟩`>`	= `<`⟨*range*⟩`|defaultspec@`⟨*range*⟩`>`
`<eqnum@`⟨*range*⟩`>`	insert (and advance) `\theequation` tag for slides in ⟨*range*⟩
`<alert@`⟨*range*⟩`>`	`\alert` argument for slides in ⟨*range*⟩
`<alerts@`⟨*range*⟩`>`	activate `\alert*` commands in argument in ⟨*range*⟩
`<point@`⟨*range*⟩`>`	`\point` and activate `\point*` commands in ⟨*range*⟩
`<pointers@`⟨*range*⟩`>`	activate $\texttt{\textbackslash point}^{\widehat{*}}$ commands in argument in ⟨*range*⟩
`<`⟨*mode*⟩`:`⟨*action spec*⟩`>`	only apply ⟨*action spec*⟩ in ⟨*mode*⟩
`<`⟨*action spec*⟩$_1$`|`⟨*action spec*⟩$_2$`|...>`	apply all ⟨*action spec*⟩s subject to any ⟨*mode*⟩ restrictions

10.2 List of commands and environments

Increment labels and references

Incremental environments

Alignment environments

Directing attention

Selectively repeating frames

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Internal parsing commands

`\parseincrspec{`⟨*overlay spec*⟩`}` 19
todo

`\parseresetspec{`⟨*overlay spec*⟩`}` 19
todo

`\parselabelspec{`⟨*overlay spec*⟩`}` 19
todo

Debugging

`\beamincrdebug{`⟨*flag*⟩`}` 20
control generation of debugging information