TeXlattice - draw accelerator lattices with LaTeX
using pgf/tikz

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1 Installation

1.1 Copy lattice.sty

You just need to copy the lattice.sty file to a place where your LaTeX installation can recognize it. This can be

- the same folder as your .tex document
- in the LaTeX system or user tree

e.g. to add it to the system tree for texlive under ubuntu:

```
sudo mkdir -p /usr/local/share/texmf/tex/latex/lattice/
sudo cp lattice.sty /usr/local/share/texmf/tex/latex/lattice/
sudo mktexlsr (or sudo texhash)
```

For this path there is also a Makefile prepared, so just enter

```
sudo make install
```

Otherwise read the documentation of your LaTeX distribution.

1.2 Required packages

- tikz, pgf
- siunitx
- ifthen
- xargs

2 What is missing?

- The look of the elements can definitely be improved. Feel free to do it! The only constraint is that it must be drawn as a tikz node.
- More element types can be added easily - please report what you need!

3 lattice environment

To draw a lattice just add

```
\usepackage{lattice}
```

to your preambel and use the lattice environment. the lattice environment has 2 optional arguments:

1. `[tikz options]` give any options for the tikzpicture (e.g. overlay)
2. `[scale]` scale whole picture (default: 1)

4 Within lattice environment

4.1 Elements

- `\drift{length/m}[name (default: none)]`
- `\dipole{name}{length/m}{bending angle/deg}[thickness/m (default 0.4)]`
- `\quadrupole{name}{length/m}[thickness/m (default 0.5)]`
- `\sextupole{name}{length/m}`
- `\kicker{name}{length/m}`
- `\cavity{name}{length/m}`
- `\solenoid{name}{length/m}`
- `\source{name}`
- `\screen{name}`
- `\valve{name}`
- `\marker{name}[length/m (default 0.35)]` a line perpendicular to beamline of given length

4.2 Modify your lattice/elements

- `\rotate{angle/deg}` "bends" the beamline. e.g. to set starting angle
- `\start{coordinate/m}` sets starting point of lattice. use before first element coordinate in form (x,y) or any tikz label, e.g. (mylabel.east) hint: use with `\savecoordinate` to connect lattices! (compile twice!)
- `\drawrule{start coordinate/m}[tick distance/m (default: 1)]` a rule to visualize lattice size. coordinate in form (x,y) or any tikz label, e.g. (mylabel.east)

4.2.1 Labels

- `\turnlabels` moves labels to other side of elements (swap with marker labels)
- `\rotatelabels{angle/deg}[anchor (default: automatic)]` allows rotation of element labels. the anchor sets the center of rotation (north, center, south west, ...). west corresponds to labels first character.
- `\setlabeldistance{distance/m}` distance of text labels to element center (default is 0.35)
- `\resetlabeldistance` reset label distance to previous value (e.g. useful for going back to your "global" but non-default setting)
- `\setlabelfont{fontsize}` text label fontsize (default is `\normalsize`)

4.2.2 Colors

- `\setdriftcolor{color (default black)}` for all following drifts
- `\setmarkercolor{color (default red)}` for all following markers
- `\setelementcolor{type}{color (default depends on type)}` define color for one element-type

4.3 Access lattice coordinates

You can use element coordinates to draw anything you want using pgf/tikz. You can even connect lattices to draw injection/extraction or a complete accelerator facility.

- `\savecoordinate{name}[position (default: east)]` saves coordinate of previous element to access it later.
  - position specifies the exact place of the element (north, center, south west, ...). Here east is always downstream and west upstream.
  - you can use all tikz/pgf commands within lattice environment to draw anything.
  - You can also connect multiple lattices. use tikz overlay option (1. argument of lattice) and `\start`. See example 3.
  - ! DON'T use bare numbers as names (e.g. (1)) These are the internal element identifiers.

5 Remarks

- lengths are set in meter, so you write {1.32} for 1.32m.
- picture scale: for lattice scale=1 an element of 1m length is plotted with 2cm length
- minimum element length 0.01m (drifts can be shorter)
- maximum drift length <2.9m (just add a second drift to get a longer one)
- maximum rule length < 3x29m
- if you refer to a coordinate from another lattice (another tikzpicture) you have to compile twice