

pst-optexp

A PSTricks package to draw optical experimental setups

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1 Introduction

The package `pst-optexp` is a collection of optical components that facilitate easy sketching of optical experimental setups. Mechanisms for proper alignment of different components are provided internally. This way the user does not have to care for proper orientation of the elements. Macros for using user-defined components are also provided.

2 Components

In the sections [2.1–2.12](#) the available components with their parameters are described. Up to now there are two types of components: those which require two reference points and do not alter the direction of the passing light beam (for example lenses and retardation plates) and those which work in reflection and require three reference points (mirrors, grids, beamsplitters etc.).

In section 2.13 general parameters are described that are not proprietary to a specific unit but can be used for several different components. Finally, in section 2.14 the options for the positioning of labels are explained.

The appearance of all components can be changed with the corresponding standard PSTricks parameters such as `fillstyle` or `linestyle`. For some components changing only parts of the layout may be desired (e.g. the extended part of mirrors). For those cases `psstyles` are provided that influence only the corresponding part of the components and can be redefined using `\newpsstyle`.

2.1 Lens

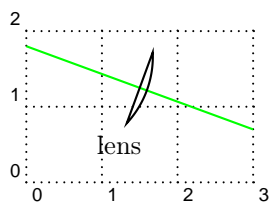
lensheight (dimension): (*default: 1*)

lenswidth (dimension): (*default: 0.3*)

lensradius (dimension): (*default: \empty*)

lenstype (plainconvex | plainconcave | convexplain | concaveplain | biconvex | biconcave):
(*default: biconvex*)

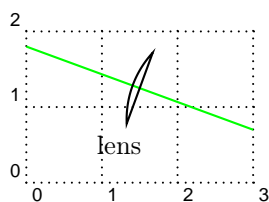
For the convex lenses only two parameters are used. If the parameter `lensradius` is set, its value will be used together with `lensheight` to draw the lens. Otherwise `lenswidth` and `lensheight` are used. For concave lenses all three parameters are required.



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.8){A}
3   \pnode(3,0.7){B}
4   \psline[linecolor=green](A)(B)
5   \lens[lenstype=plainconvex](A)(B){lens}
6 \end{pspicture}

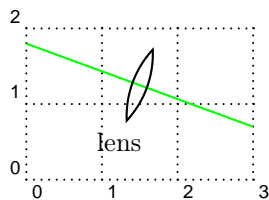
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.8){A}
3   \pnode(3,0.7){B}
4   \psline[linecolor=green](A)(B)
5   \lens[lenstype=convexpain](A)(B){lens}
6 \end{pspicture}

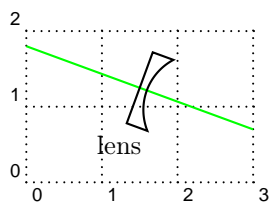
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.8){A}
3   \pnode(3,0.7){B}
4   \psline[linecolor=green](A)(B)
5   \lens(A)(B){lens}
6 \end{pspicture}

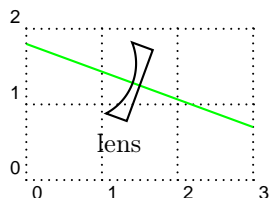
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.8){A}
3   \pnode(3,0.7){B}
4   \psline[linecolor=green](A)(B)
5   \lens[lenstyle=plainconcave](A)(B){lens}
6 \end{pspicture}

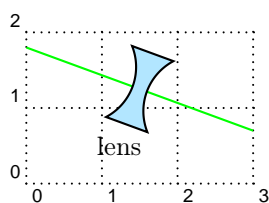
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.8){A}
3   \pnode(3,0.7){B}
4   \psline[linecolor=green](A)(B)
5   \lens[lenstyle=concaveplain](A)(B){lens}
6 \end{pspicture}

```



```

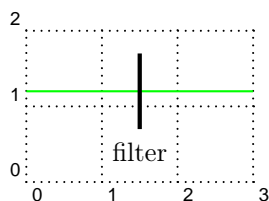
1 \begin{pspicture}(3,2)\psgrid
2   \definecolor{lensColor}{rgb}{0.7, 0.9, 1}
3   \pnode(0,1.8){A}
4   \pnode(3,0.7){B}
5   \psline[linecolor=green](A)(B)
6   \lens[lenstyle=biconcave,
7         fillstyle=solid,
8         fillcolor=lensColor](A)(B){lens}
9 \end{pspicture}

```

2.2 Optical plate

plateheight (dimension): (*default: 1*)

platelinewidth (dimension): (*default: 2\pslinewidth*)



```

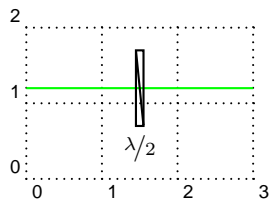
1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.2){A}
3   \pnode(3,1.2){B}
4   \psline[linecolor=green](A)(B)
5   \optplate(A)(B){filter}
6 \end{pspicture}

```

2.3 Retardation plate

plateheight (dimension): (*default: 1*)

platewidth (dimension): (*default: 0.1*)



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.2){A}
3   \pnode(3,1.2){B}
4   \psline[linecolor=green](A)(B)
5   \optretplate(A)(B){$\nicefrac{\lambda}{2}$}
6 \end{pspicture}

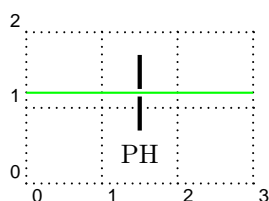
```

2.4 Pinhole

outerheight (dimension): (*default: 1*)

innerheight (dimension): (*default: 0.1*)

phlinewidth (dimension): (*default: 2\pslinewidth*)



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.2){A}
3   \pnode(3,1.2){B}
4   \psline[linecolor=green](A)(B)
5   \pinhole(A)(B){PH}
6 \end{pspicture}

```

2.5 Crystal

crystalwidth (dimension): (*default: 2*)

crystalheight (dimension): (*default: 0.8*)

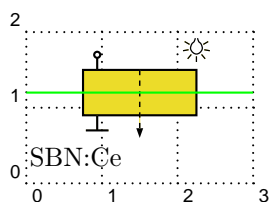
caxislength (dimension): (*default: 0.6*)

caxisinv (boolean): (*default: false*)

voltage (boolean): (*default: false*)

lamp (boolean): (*default: false*)

lampscale (real): (*default: 0.3*)



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,1.2){A}
3   \pnode(3,1.2){B}
4   \crystal[crystalwidth=1.5,
5             crystalheight=0.6,
6             fillstyle=solid,
7             fillcolor=yellow!90!black,
8             labelangle=-45,
9             labeloffset=1.2,
10            voltage,
11            lamp](A)(B){SBN:Ce}
12   \psline[linecolor=green](A)(B)
13 \end{pspicture}

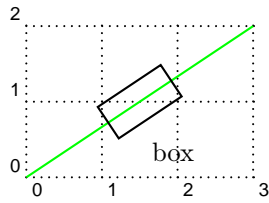
```

2.6 Box

optboxheight (dimension): (*default: 0.5*)

optboxwidth (dimension): (*default: 1*)

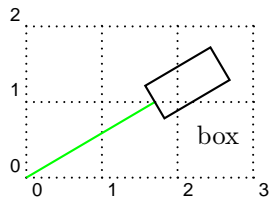
endbox (boolean): (*default: false*)



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,0){A}
3   \pnode(3,2){B}
4   \psline[linecolor=green](A)(B)
5   \optbox(A)(B){box}
6 \end{pspicture}

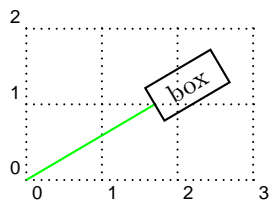
```



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.7,1){B}
4   \psline[linecolor=green](A)(B)
5   \optbox[endbox](A)(B){box}
6 \end{pspicture}

```



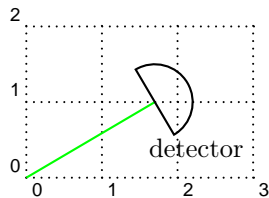
```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.7,1){B}
4   \psline[linecolor=green](A)(B)
5   \optbox[endbox,labelref=relative,labeloffset=0](A)(B){box}
6 \end{pspicture}

```

2.7 Detector

detsize (dimension): (*default: 0.5*)



```

1 \begin{pspicture}(3,2)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.7,1){B}
4   \psline[linecolor=green](A)(B)
5   \detector(A)(B){detector}
6 \end{pspicture}

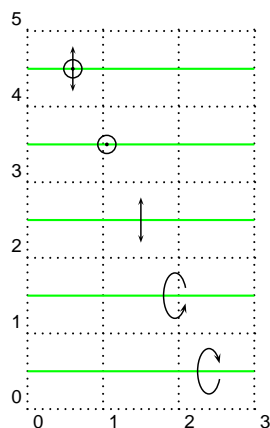
```

2.8 Polarization

poltype (parallel | perp | misc | lcirc | rcirc): (*default: parallel*)

polsize (dimension): (*default: 0.6*)

pollinewidth (dimension): (*default: 0.7\pslinewidth*)



```

1 \begin{pspicture}(3,5)\psgrid
2   \pnode(0,0.5){A1}\pnode(3,0.5){B1}\pnode(0,1.5){A2}
3   \pnode(3,1.5){B2}\pnode(0,2.5){A3}\pnode(3,2.5){B3}
4   \pnode(0,3.5){A4}\pnode(3,3.5){B4}\pnode(0,4.5){A5}
5   \pnode(3,4.5){B5}\psset{linecolor=green}
6   \multido{\i=1+1}{5}{\psline(A\i)(B\i)}
7   \psset{linecolor=black}
8   \polarization[poltype=misc,position=0.2](A5)(B5)
9   \polarization[poltype=perp,position=0.35](A4)(B4)
10  \polarization[poltype=parallel,position=0.5](A3)(B3)
11  \polarization[poltype=rcirc,position=0.65](A2)(B2)
12  \polarization[poltype=lcirc,position=0.8](A1)(B1)
13 \end{pspicture}

```

2.9 Mirror

mirrorwidth (dimension): (*default: 1*)

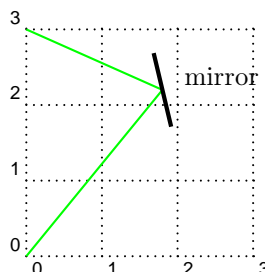
mirrorlinewidth (dimension): (*default: 2\pslinewidth*)

mirrortype (normal | piezo | extended): (*default: normal*)

mirrordepth (dimension): (*default: 0.08*)

variable (boolean): (*default: false*)

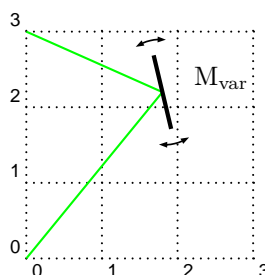
The style of the extended mirror is defined as a psstyle `ExtendedMirror` and can be changed using `\newpsstyle`. The appearance of the piezo mirror likewise can be changed by adapting the psstyle `PiezoMirror`.



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,3){B}
5   \psline[linecolor=green](A)(G)(B)
6   \mirror(A)(G)(B){mirror}
7 \end{pspicture}

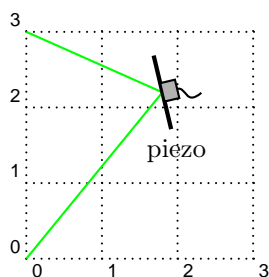
```



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,3){B}
5   \psline[linecolor=green](A)(G)(B)
6   \mirror[variable](A)(G)(B){M$_\mathrm{var}$}
7 \end{pspicture}

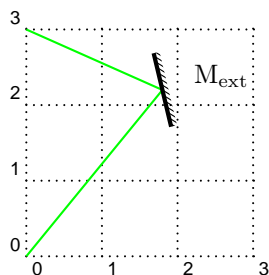
```



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,3){B}
5   \psline[linecolor=green](A)(G)(B)
6   \mirror[mirrortype=piezo,labelangle=-90](A)(G)(B){piezo}
7 \end{pspicture}

```



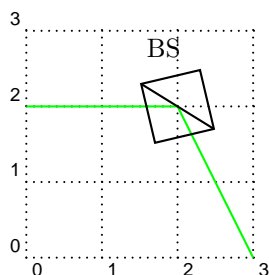
```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,3){B}
5   \psline[linecolor=green](A)(G)(B)
6   \mirror[mirrortype=extended](A)(G)(B){M$_\mathrm{ext}$}
7 \end{pspicture}

```

2.10 Beamsplitter

bssize (dimension): (default: 0.8)



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,2){A}
3   \pnode(2,2){G}
4   \pnode(3,0){B}
5   \psline[linecolor=green](A)(G)(B)
6   \beamsplitter(A)(G)(B){BS}
7 \end{pspicture}

```

2.11 Optical grid

optgridcount (integer): (default: 10)

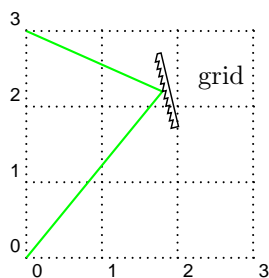
optgridwidth (dimension): (default: 1)

optgridheight (dimension): (default: 0.1)

optgriddepth (dimension): (default: 0.05)

optgridlinewidth (dimension): (default: 0.7\pslinewidth)

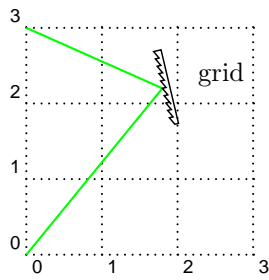
reverse (boolean): (default: false)



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,3){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,0){B}
5   \psline[linecolor=green](A)(G)(B)
6   \optgrid(A)(G)(B){grid}
7 \end{pspicture}

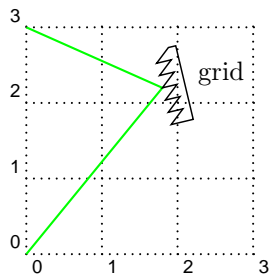
```



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,3){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,0){B}
5   \psline[linecolor=green](A)(G)(B)
6   \optgrid[reverse](A)(G)(B){grid}
7 \end{pspicture}

```

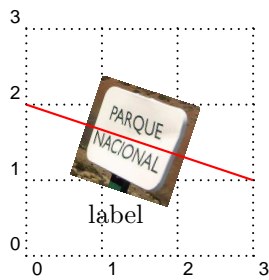


```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,3){A}
3   \pnode(1.8,2.2){G}
4   \pnode(0,0){B}
5   \psline[linecolor=green](A)(G)(B)
6   \optgrid[optgridcount=6,%
7             optgriddepth=0.2,%
8             optgridheight=0.3](A)(G)(B){grid}
9 \end{pspicture}

```

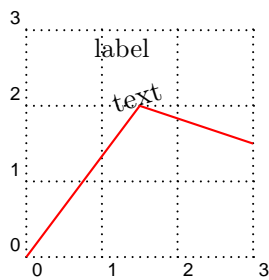
2.12 Custom components



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,2){A}
3   \pnode(3,1){B}
4   \optdipole[labeloffset=1](A)(B){%
5     \rput(0,0){%
6       \includegraphics[scale=0.25]{parque-nacional}
7     }
8   }{label}
9   \psline[linecolor=red](A)(B)
10 \end{pspicture}

```



```

1 \begin{pspicture}(3,3)\psgrid
2   \pnode(0,0){A}
3   \pnode(1.5,2){G}
4   \pnode(3,1.5){B}
5   \opttripole(B)(G)(A){\rput[b](0,0){text}}{label}
6   \psline[linecolor=red](A)(G)(B)
7 \end{pspicture}

```

2.13 General options

angle (real): (default: 0)

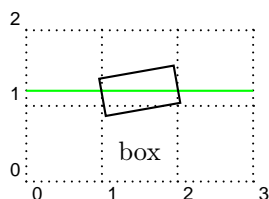
optional (boolean): (default: false)

position (real): (default: \empty)

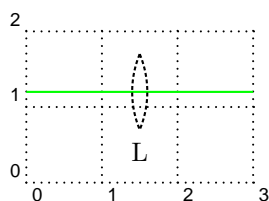
abspos (dimension): (default: \empty)

showoptdots (boolean): (default: false)

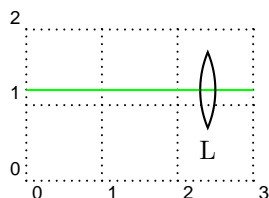
The parameter **angle** is available for the macros `\optbox` and `\crystal` only, as for the most other cases it would make no sense. **optional** can be used with every component and marks it as optional and can be configured by changing the psstyle `OptionalStyle`. **position** is equivalent to the **npos** parameter of `\ncput`, but is used only for the 'dipole'-macros to position the component between the two given points. In addition, there is a parameter **abspos** that allows absolute positioning between the two line points. **showoptdots** shows in black the two points calculated for the positioning of the component, and in red the reference points for the label.



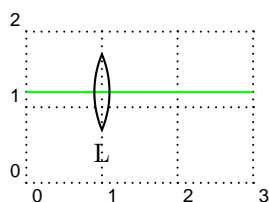
```
\begin{pspicture}(3,2)\psgrid
  \pnode(0,1.2){A}
  \pnode(3,1.2){B}
  \psline[linecolor=green](A)(B)
  \optbox[angle=10](A)(B){box}
\end{pspicture}
```



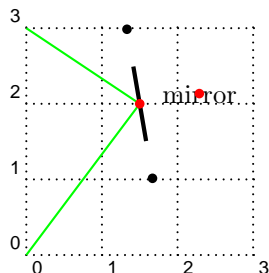
```
\begin{pspicture}(3,2)\psgrid
  \pnode(0,1.2){A}
  \pnode(3,1.2){B}
  \psline[linecolor=green](A)(B)
  \lens[optional](A)(B){L}
\end{pspicture}
```



```
\begin{pspicture}(3,2)\psgrid
  \pnode(0,1.2){A}
  \pnode(3,1.2){B}
  \psline[linecolor=green](A)(B)
  \lens[position=0.8](A)(B){L}
\end{pspicture}
```



```
\begin{pspicture}(3,2)\psgrid
  \pnode(0,1.2){A}
  \pnode(3,1.2){B}
  \psline[linecolor=green](A)(B)
  \lens[abspos=1](A)(B){L}
\end{pspicture}
```



```
\begin{pspicture}(3,3)\psgrid
  \pnode(0,0){A}
  \pnode(1.5,2){G}
  \pnode(0,3){B}
  \psline[linecolor=green](A)(G)(B)
  \mirror[showoptdots](A)(G)(B){mirror}
\end{pspicture}
```

2.14 Labels

labeloffset (dimension): (*default: 1*)

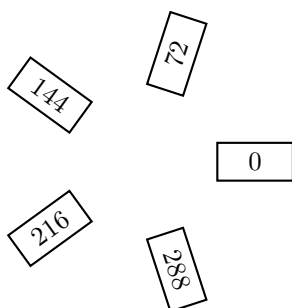
labelangle (real): (*default: 0*)

labelstyle (macro): (*default: \small*)

labelalign (\rput ref string): (*default: c*)

labelref (relative | relgrav | global): (*default: relgrav*)

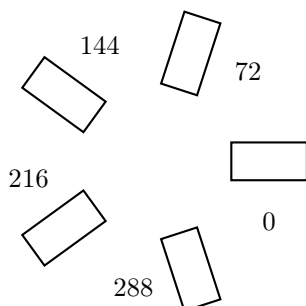
labeloffset specifies the offset from the center of the component, **labelstyle** defines the textstyle that is used to typeset the label and **labelalign** corresponds to the retpoint of **\rput**. The parameter **labelref** sets the reference coordinate system for the **labelangle** and the orientation of the label text. The detailed behaviour is best illustrated looking at the following three examples.



```

1 \begin{pspicture}(-2,-2)(2.5,2)
2   \multido{\i=0+72}{5}{\%
3     \optbox[endbox,
4       labelref=relative,
5       labeloffset=0,
6       optboxwidth=1](0,0)(1;\i){\i}
7   }
8 \end{pspicture}

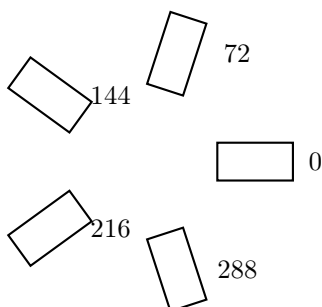
```



```

1 \begin{pspicture}(-2,-2)(2.5,2)
2   \multido{\i=0+72}{5}{\%
3     \optbox[endbox,
4       labelref=relgrav,
5       optboxwidth=1](0,0)(1;\i){\i}
6   }
7 \end{pspicture}

```

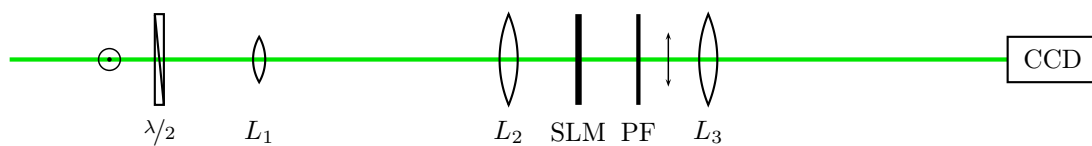


```

1 \begin{pspicture}(-2,-2)(2.5,2)
2   \multido{\i=0+72}{5}{\%
3     \optbox[endbox,
4       labelref=global,
5       optboxwidth=1](0,0)(1;\i){\i}
6   }
7 \end{pspicture}

```

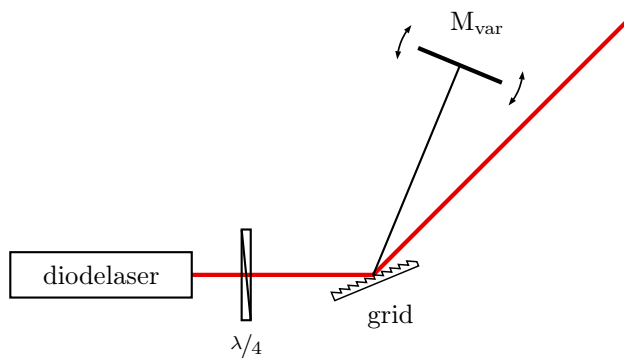
3 Examples



```

1 \begin{pspicture}(0,0.2)(12,1.8)
2 \pnode(0,1.2){Start}\pnode(11,1.2){CCD}
3 \psline[linewidth=2\pslinewidth,linecolor=green!90!black](Start)(CCD)
4 \polarization[poltype=perp,position=0.1](Start)(CCD)
5 \optretplate[position=0.15](Start)(CCD){$\frac{\lambda}{2}$}
6 \lens[lensheight=0.5,
7       lensradius=0.5,
8       position=0.25](Start)(CCD){$L_1$}
9 \lens[position=0.5](Start)(CCD){$L_2$}
10 \optplate[position=0.57, platelinewidth=3\pslinewidth](Start)(CCD){SLM}
11 \optplate[position=0.63](Start)(CCD){PF}
12 \polarization[position=0.66](Start)(CCD)
13 \lens[position=0.7](Start)(CCD){$L_3$}
14 \optbox[endbox,labeloffset=0](Start)(CCD){CCD}
15 \end{pspicture}

```



```

1 \begin{pspicture}(-4,-1)(3,3)
2 \psset{labeloffset=0.5}
3 \pnode(-2,0){LaserOut}
4 \pnode(0,0){Grid}
5 \pnode(4;45){Out}
6 \pnode(2.5;67.5){Mvar}
7 \psline[linewidth=2\pslinewidth,
8         linecolor=red!90!black](LaserOut)(Grid)(Out)\psline(Grid)(Mvar)
9 \optbox[endbox,optboxwidth=2,labeloffset=0](Grid)(LaserOut){diodelaser}
10 \optretplate[position=0.3,labeloffset=0.8](LaserOut)(Grid){$\frac{\lambda}{4}$}
11 \optgrid(LaserOut)(Grid)(Out){grid}
12 \mirror[variable](Grid)(Mvar)(Grid){M$_{\mathrm{var}}$}
13 \end{pspicture}

```



4 Todo

- Add components for fiber optics.

Drawing of extended beams with focusing, and so on, is not planned to be integrated in the near future due to missing ideas for the realization. If somebody is interested in this feature and has some ideas for the implementation, please contact me.

5 Acknowledgements

I thank all the people of the PSTricks mailinglist for the continuous help, especially Herbert Voß.