

Shaping of femtosecond pulses is a powerful tool to investigate and control reaction dynamics on ultrashort time scales.

The **problems** of typical pulse shapers are:

- **Difficult to align**
- **Energy losses of about 50 %**
- **Usually for use in the visible spectral range**

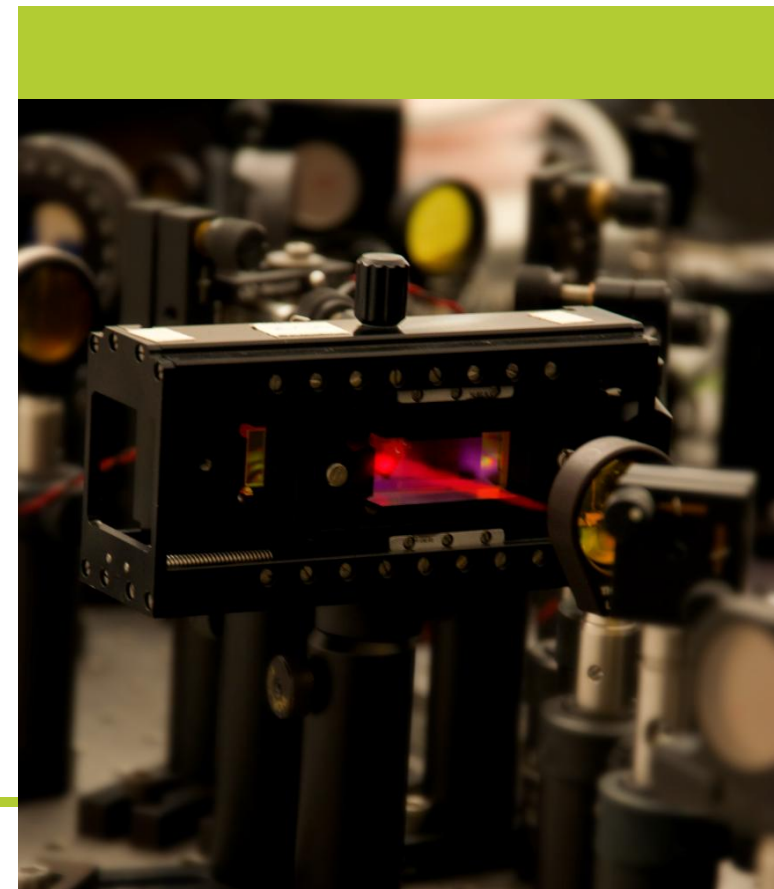
### Patent granted:

Heyne K., Hartmann M., Molkenthin K., inventors; Freie Universität Berlin, assignee. Pulsshaper und Infrarotlaser mit Pulsshaper. Germany patent 102008022724.2 11.06.2008

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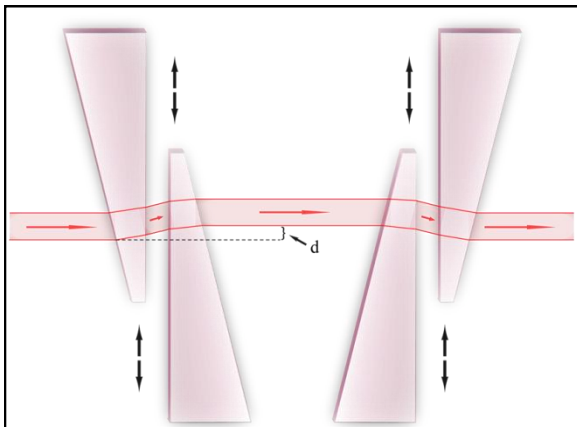
## Alignment-free passive pulse shaper for chirp compensation



## Facts

This alignment-free passive pulse shaper for the mid-infrared region allows changing the linear chirp continuously by use of material properties only.

- Continuous variation of the linear chirp by movement of the wedges (motorized optional)
- No change of the beam direction despite variation of the substrate thickness
- Small parallel displacement of the beam direction ( $\sim 0.5$  mm)
- Can combine PPS with Sapphire and Ge to enable chirping of the pulse up and down continuously
- Adaptable to different wavelength ranges by using different materials



Schematic of the passive pulsshaper

## Key benefits



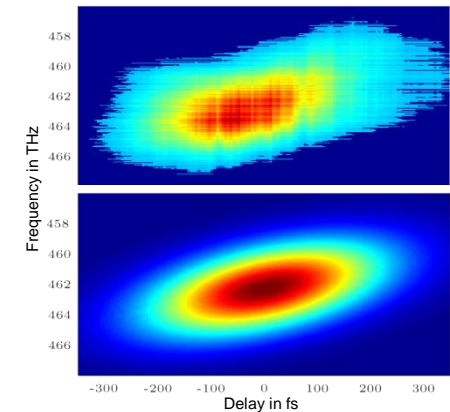
Passive pulse shaper (PPS)

- Alignment-free setup
- Low energy losses (below 15%)
- Perfect for high energy applications e.g. vibrational ladder climbing
- Easy GVD manipulation in the infrared spectral range
- Substrates are available from  $2 \mu\text{m}$  to  $12 \mu\text{m}$ .
- Introduces an additional pulse delay
- Higher chirp contributions (TOD) are small
- **Perfect for fast, simple and economic manipulation of the chirp**

## Results

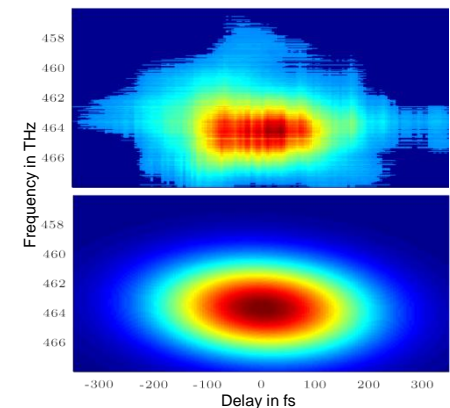
- Linear chirp model describes sufficiently the outcome
- Chirp reduction by introduction of the passive pulse shaper

FROG trace without the PPS in the IR beam



The pulse is positive chirped

FROG trace with the PPS in the IR beam



The pulse is nearly unchirped