

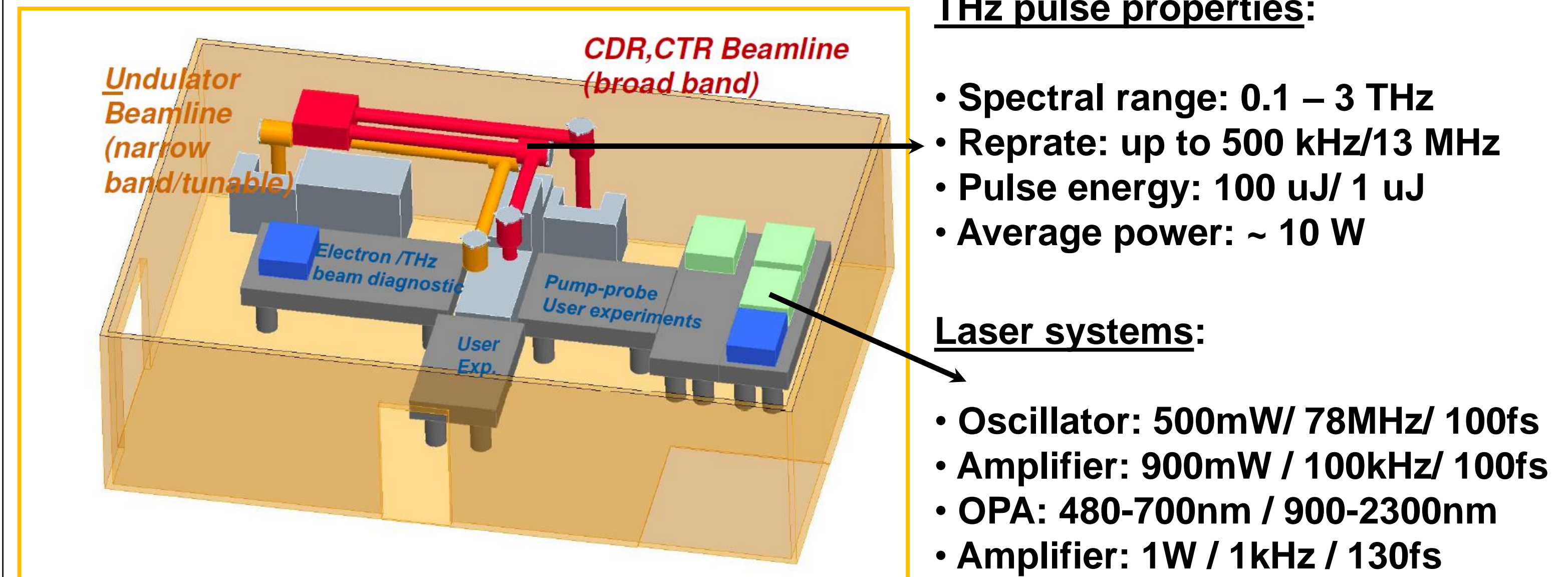
# Towards a novel THz-based monitor for sub picosecond electron bunches working at MHz repetition rates and low bunch charges

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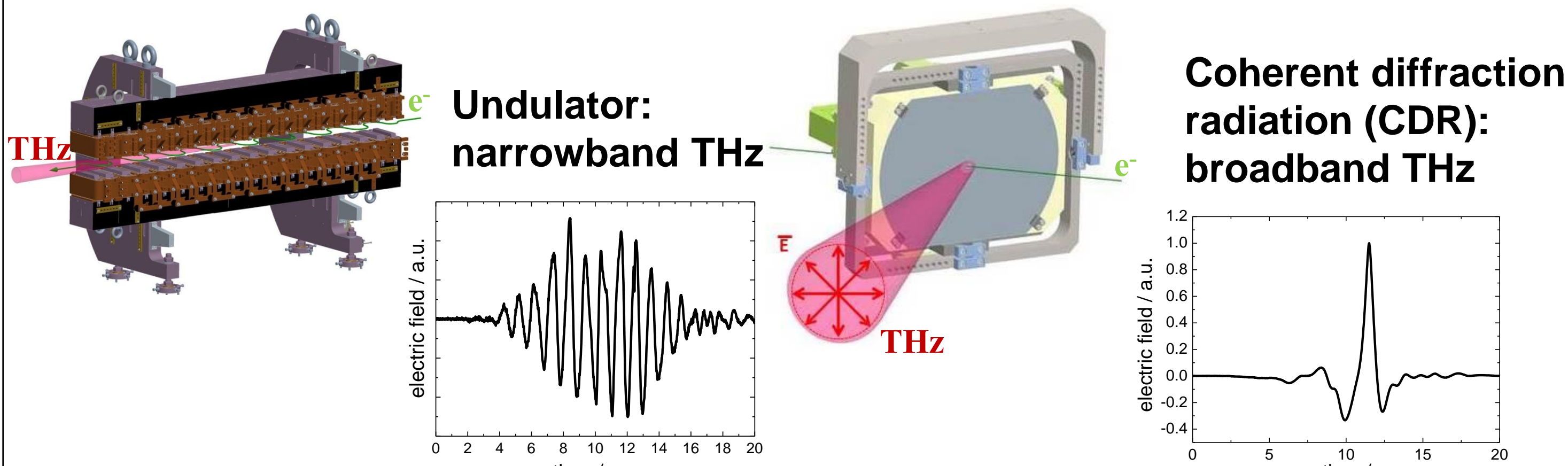
## Abstract:

Femtosecond level diagnostic and control of sub-picosecond electron bunches is an important topic in modern accelerator research. At the same time new quasi-linear electron accelerators are the drivers of many future 4<sup>th</sup> Generation lightsources such as X-ray free electron lasers. A high duty cycle, high stability and online pulse to pulse diagnostic of these new accelerators are crucial ingredients to the success of these large scale facilities. A novel THz based online monitor concept is presented that has the potential to give access to pulse to pulse information on bunch form, arrivaltime and energy at high repetition rate and down to sub pC charges.

## Testfacility – TELBE:

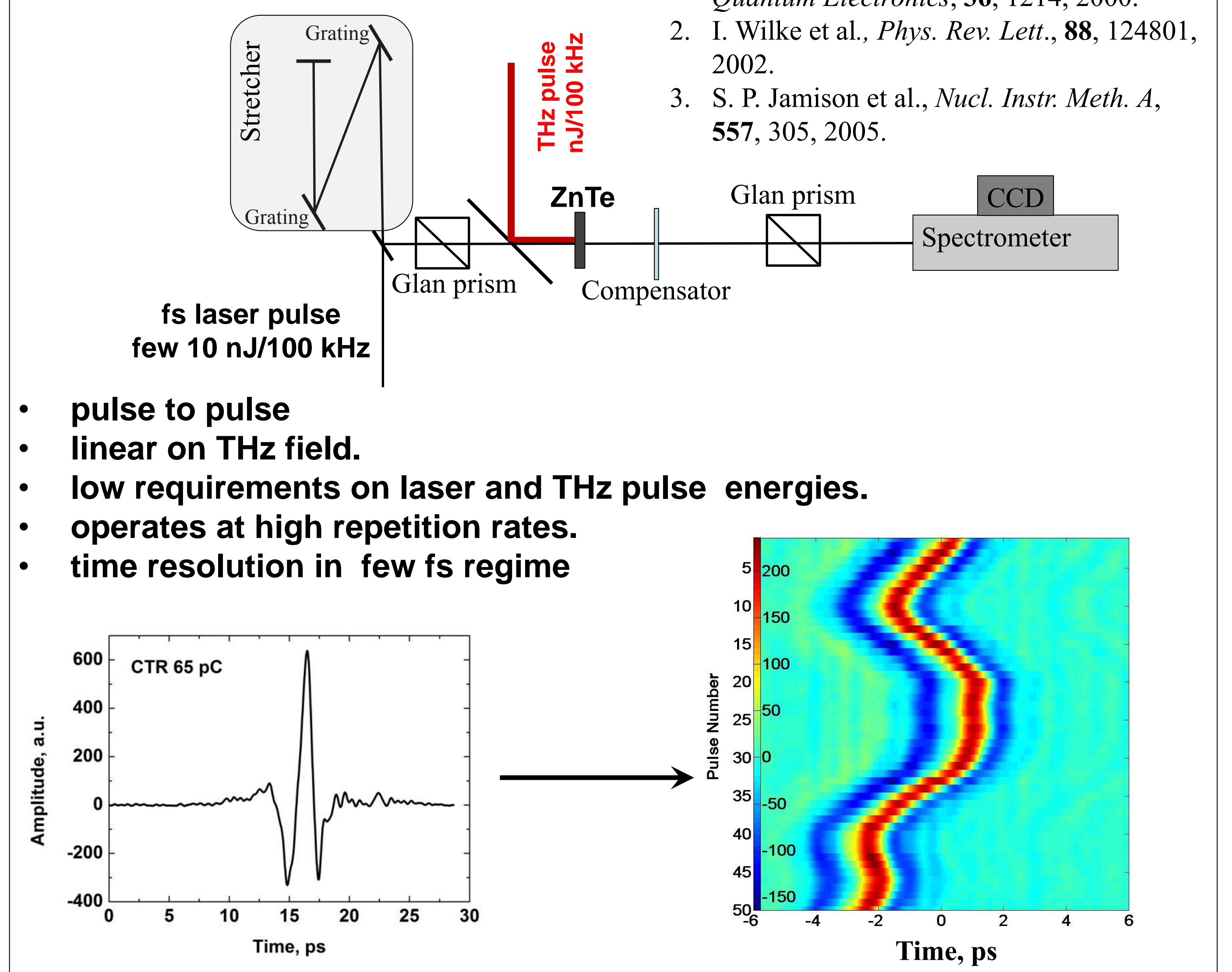


## Super-radiant THz sources



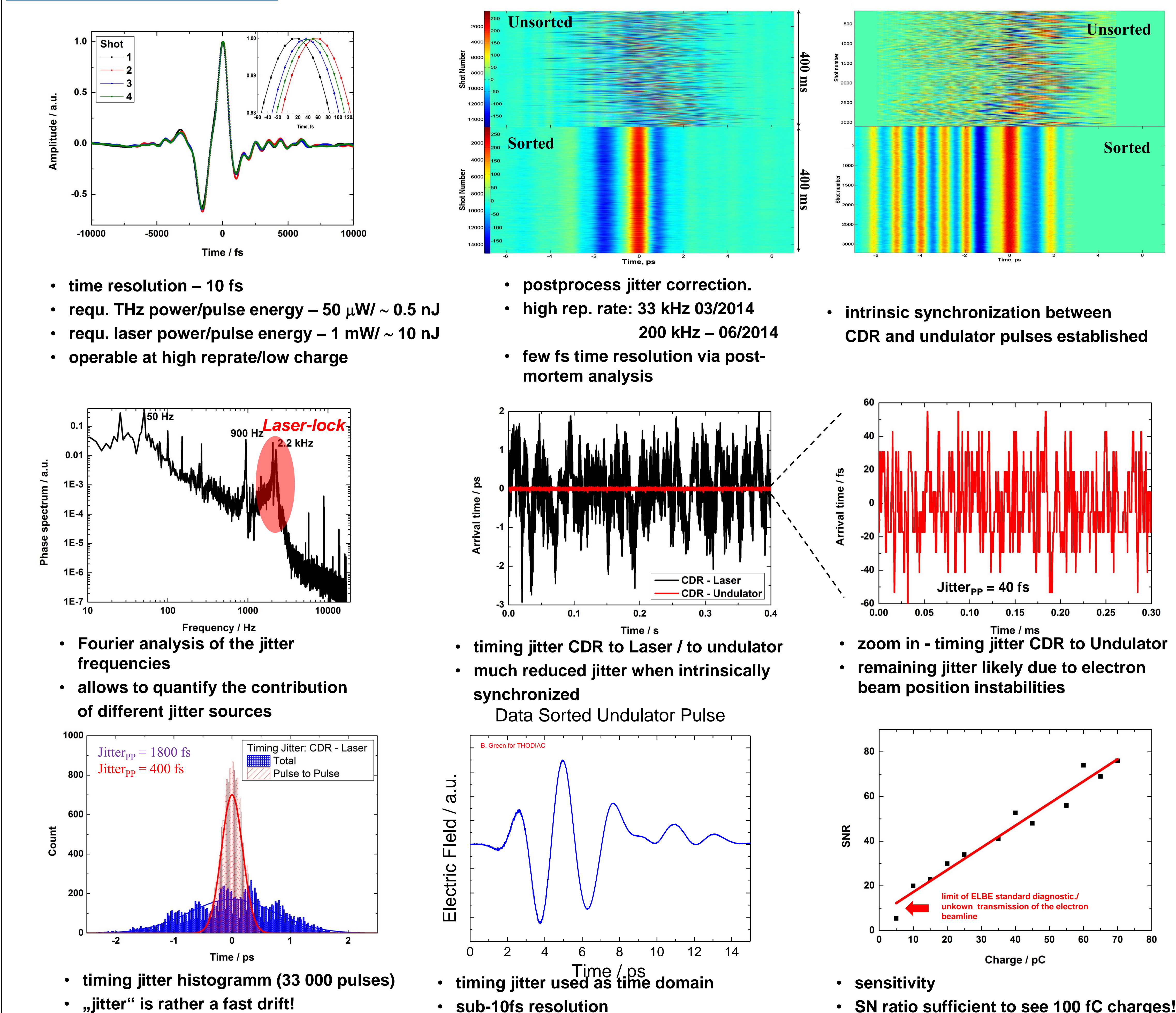
M. Gensch et al., Towards high field THz sources operating at few 100 kHz repetition rates, in preparation

## Spectral decoding setup:



1. Z. Jiang, X. C. Zhang, *IEEE Journal of Quantum Electronics*, **36**, 1214, 2000.
2. I. Wilke et al., *Phys. Rev. Lett.*, **88**, 124801, 2002.
3. S. P. Jamison et al., *Nucl. Instr. Meth. A*, **557**, 305, 2005.

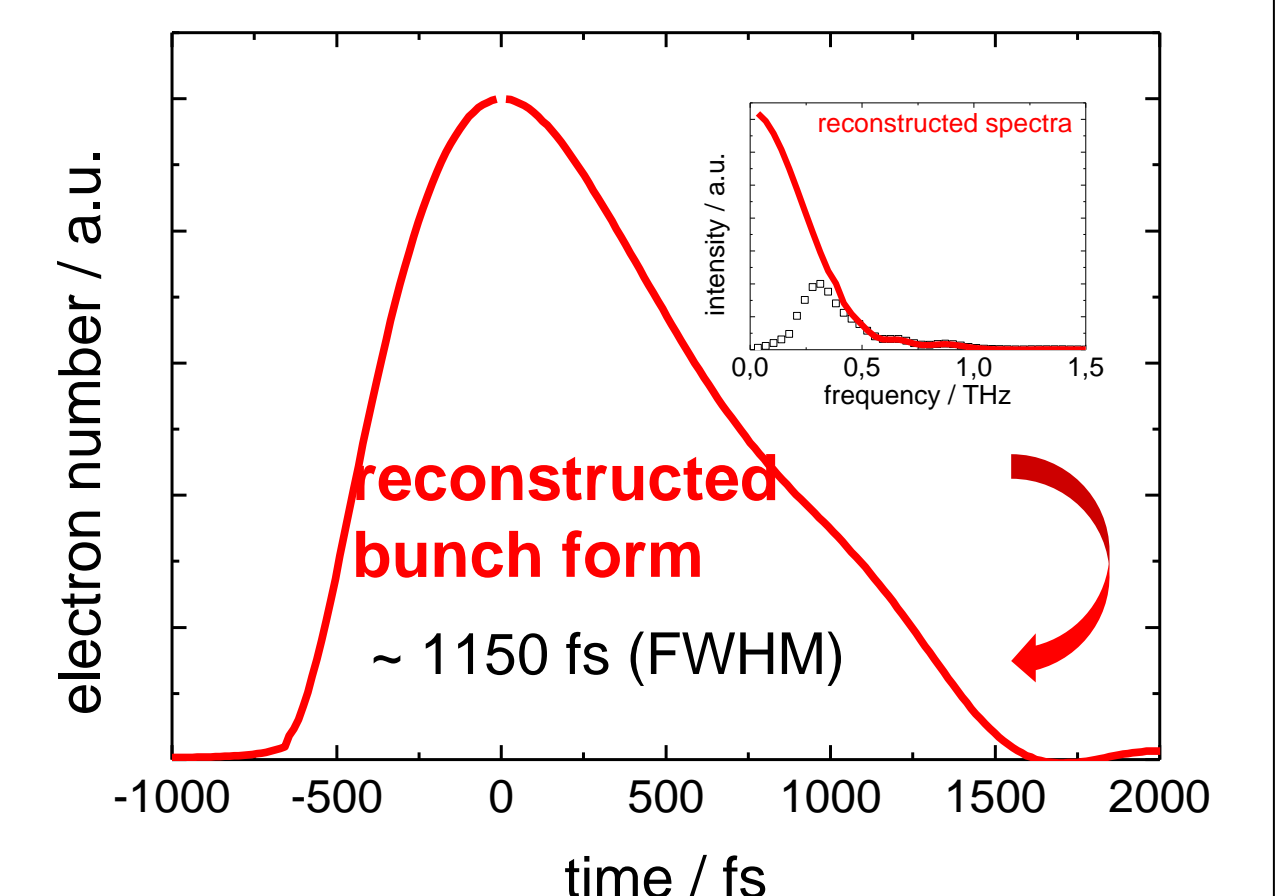
## Experimental results:



## Next steps:

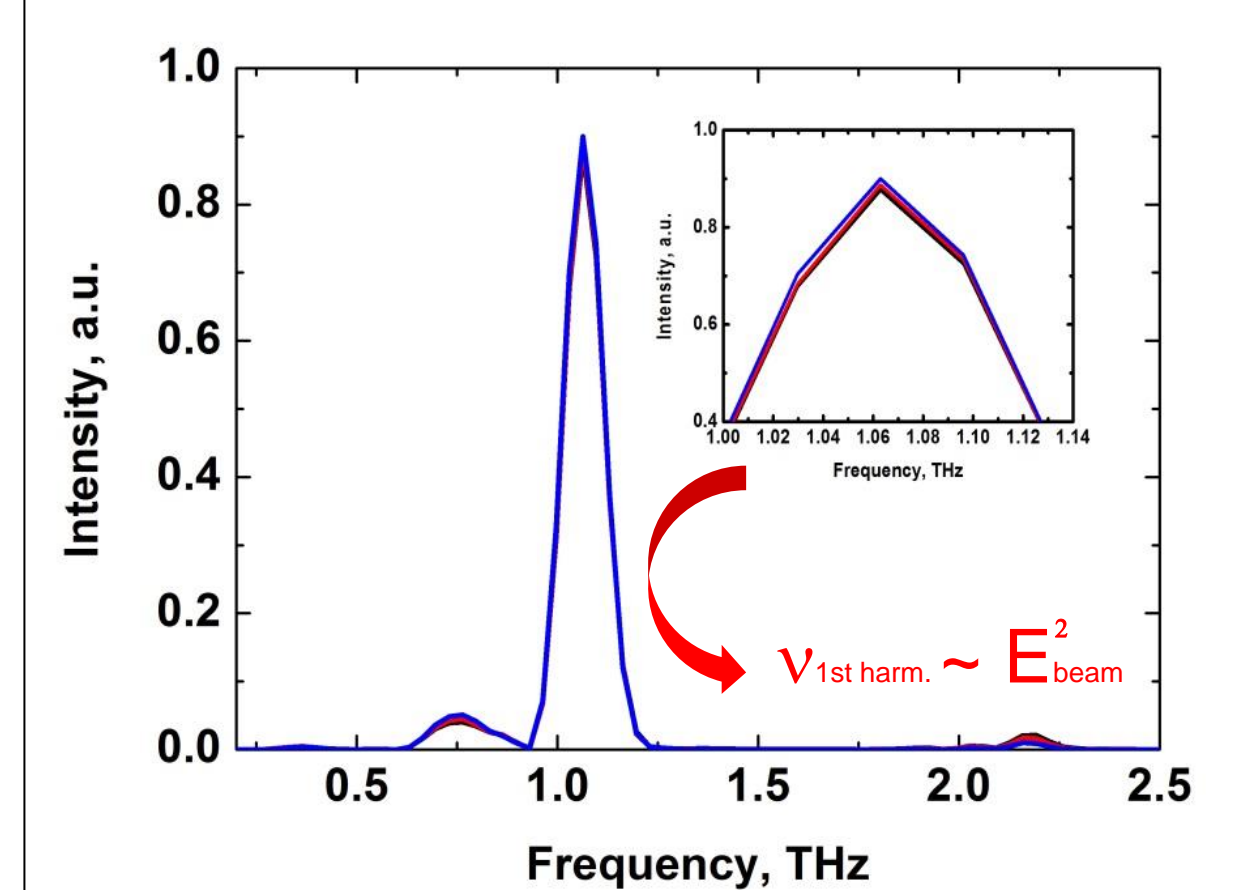
### 1. ONLINE determination of bunch form

idea: THz spectra as (indirect) measure of the bunch form



### 2. ONLINE determination of bunch energy

idea: Undulator frequency as measure for beam energy



### 3. increase repetition rate

idea: method could operate at MHz repetition rates. bottleneck is CCD (readout and dead time)

### replates:

- ELBE (13 MHz),
- X-FEL (4.5 MHz)
- LCLS II (1 MHz)