



Helmholtz University Young Investigator Group

Coherent THz Radiation from Ultra-Short Bunches in Electron Storage Rings

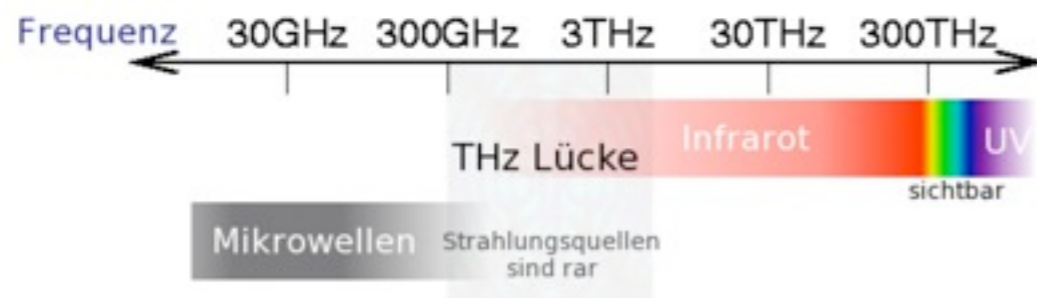
Host Labs

- Forschungszentrum Karlsruhe & University of Karlsruhe
- Accelerators: ANKA, TBONE (Ångstroemquelle **K**arlsruhe)

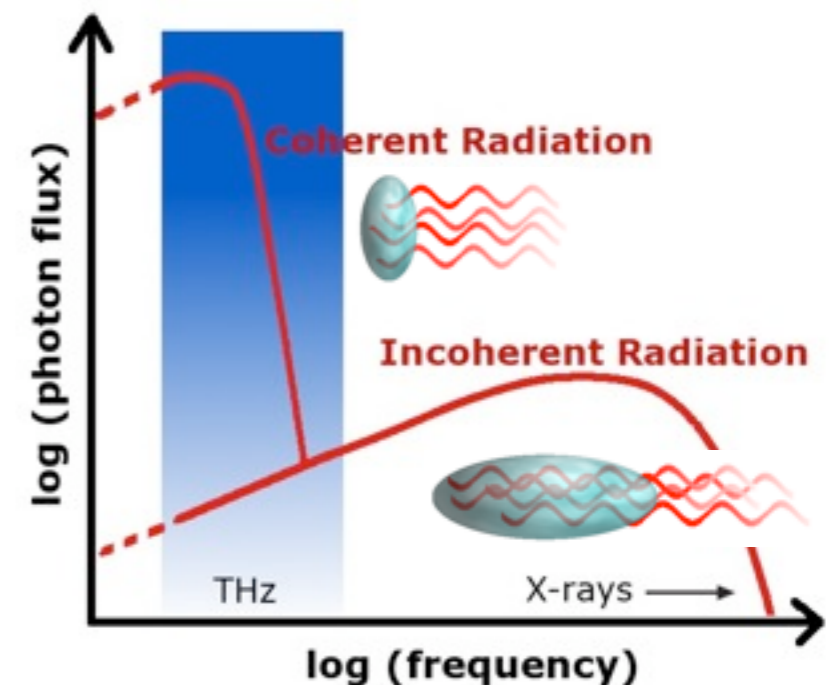


Research Topic: THz Radiation

- THz radiation is a key instrument for many research fields → high demand
- THz radiation is difficult to generate: “THz Gap”



- Generation of THz radiation at the ANKA storage ring:
 - *short bunches emit coherent radiation*
 - *enormous amplification in the THz range*



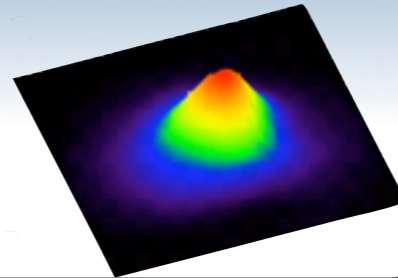


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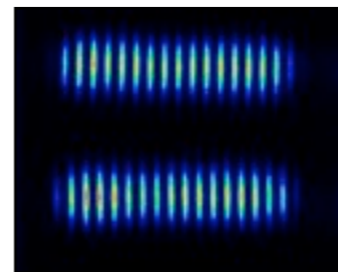
Research Field Accelerator Physics

Characterisation of THz Radiation



Accelerator Optics & Beam Dynamics

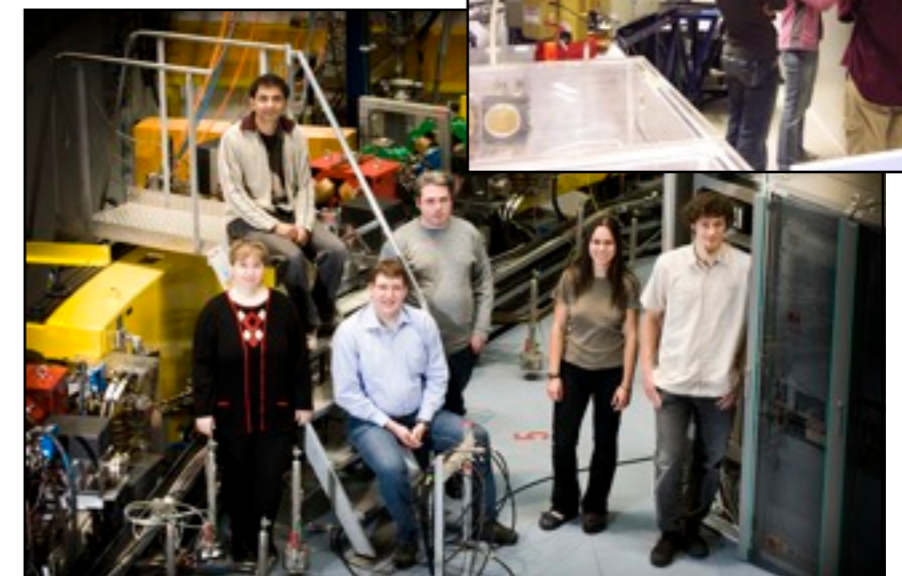
Measurement of Bunch Parameters



Single- and Multi-Bunch Effects

The Group

- Start: May 2007
- Group leader A.-S. Müller
- 8 members (at present)
 - 1 Postdoc, 2 PhD students, 5 diploma students





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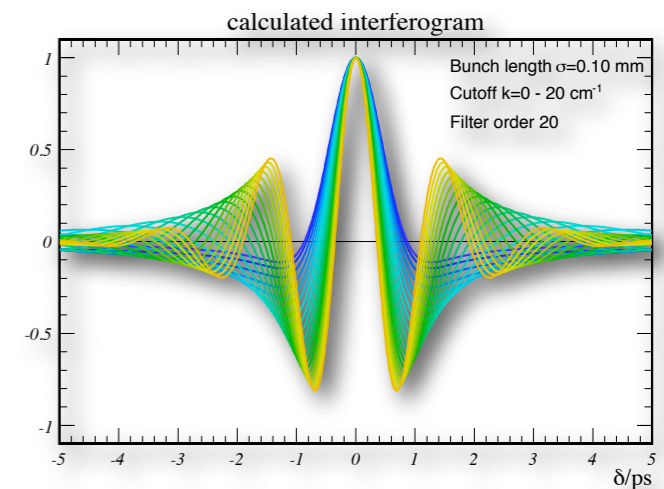
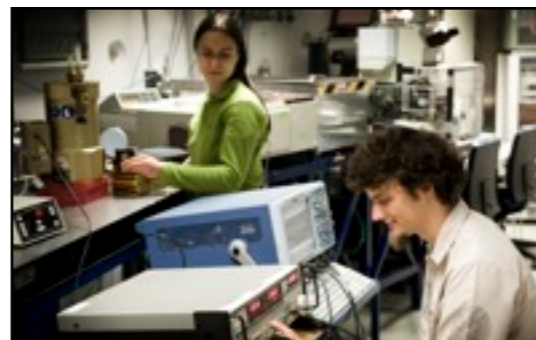
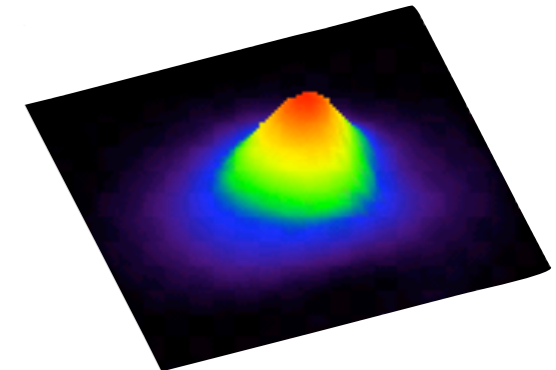
Characterisation of THz Radiation

- Optimization of user operation with THz radiation

- detailed understanding of radiation characteristics as a function of the operating conditions

- Projects

- modelling of THz pulses
 - spatial distribution & THz power
 - THz pulses (shape, ...)
 - polarization of THz edge radiation
 - investigation of bursting/stable threshold





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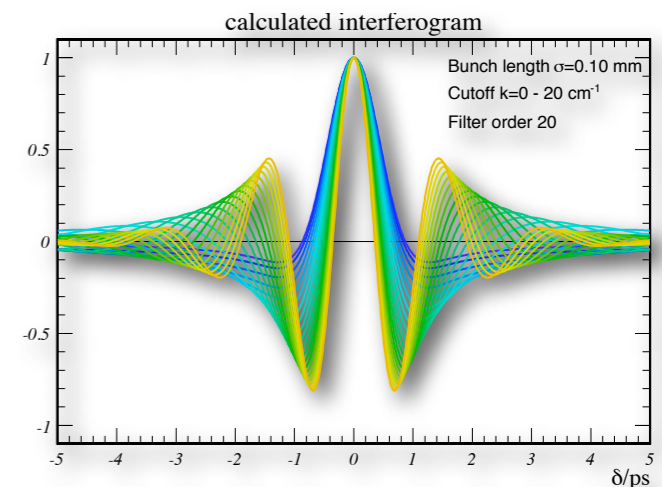
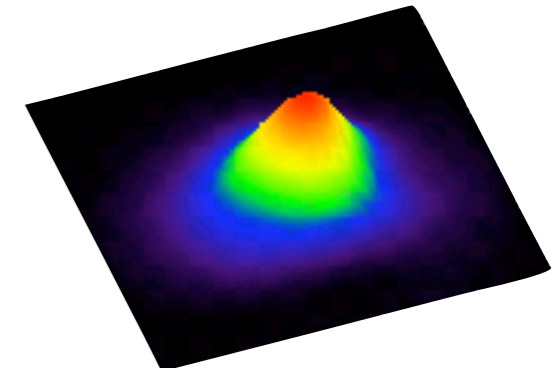
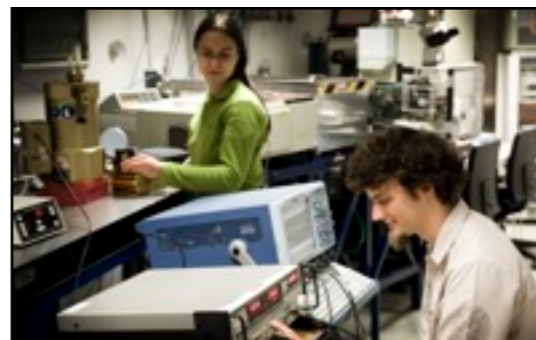
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Talk by Vitali Judin





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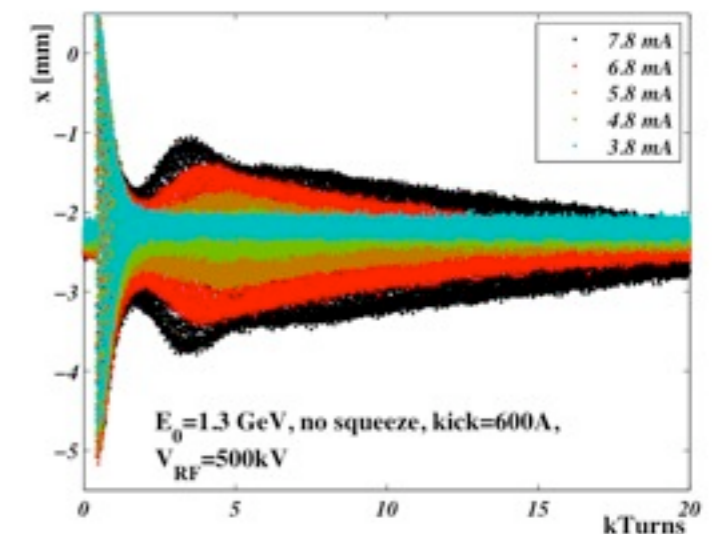
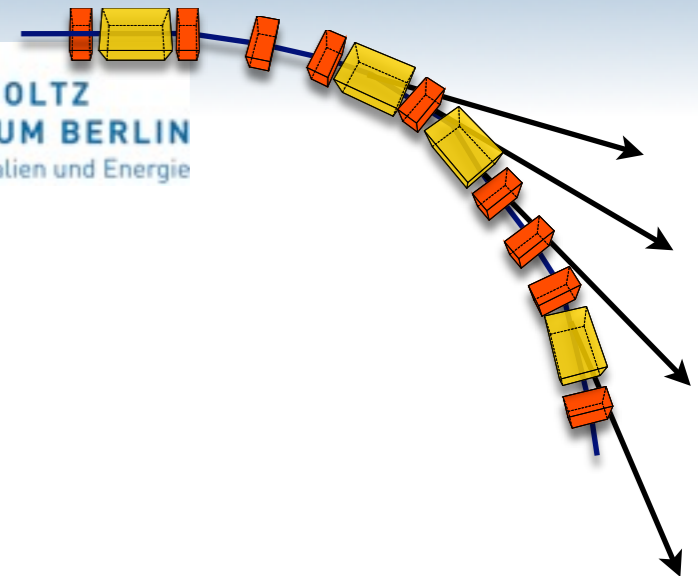
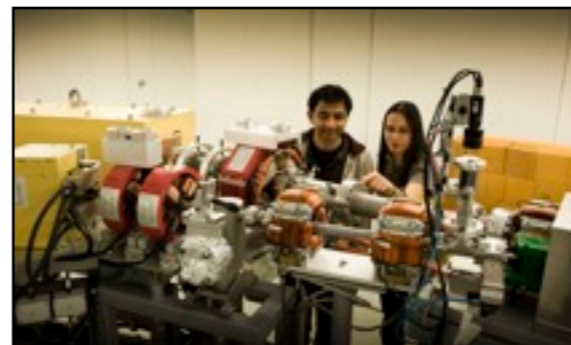
Accelerator Optics & Beam Dynamics

- Optimization of existing and future short bunch optics

- Design, simulation and measurement of particle optics

- Projects

- nonlinearities in short bunch optics
- beam instabilities and short bunch dynamics
- automated control & measurement system for beam optics studies
- halo & tail formation
- bunch compression for TBONE





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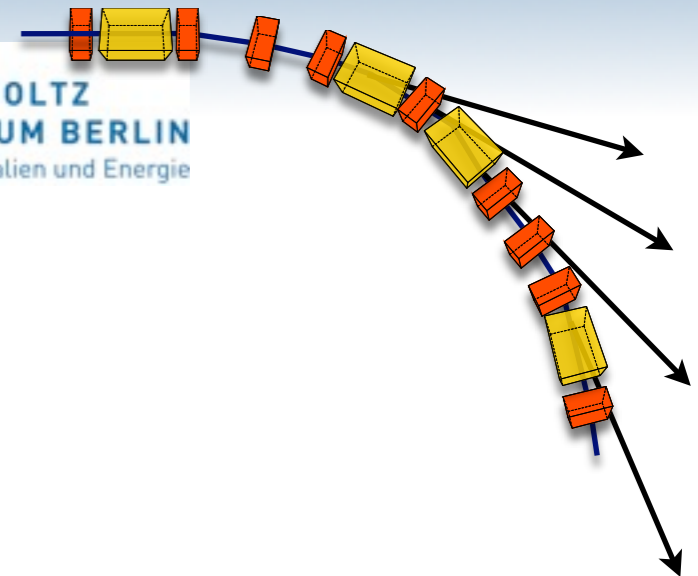
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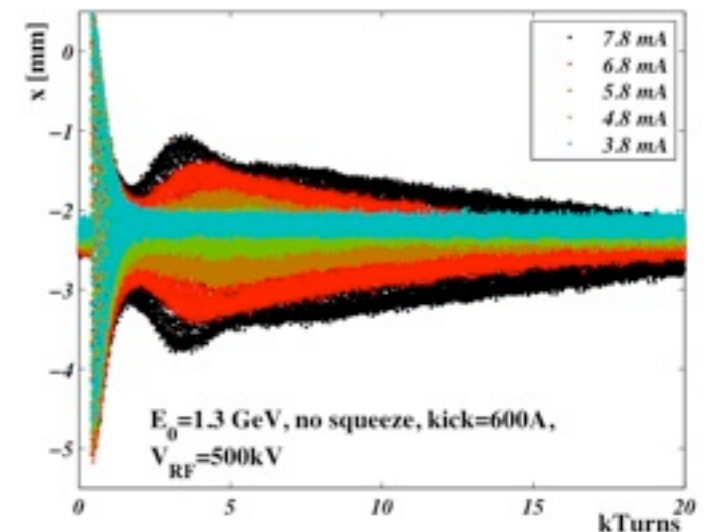
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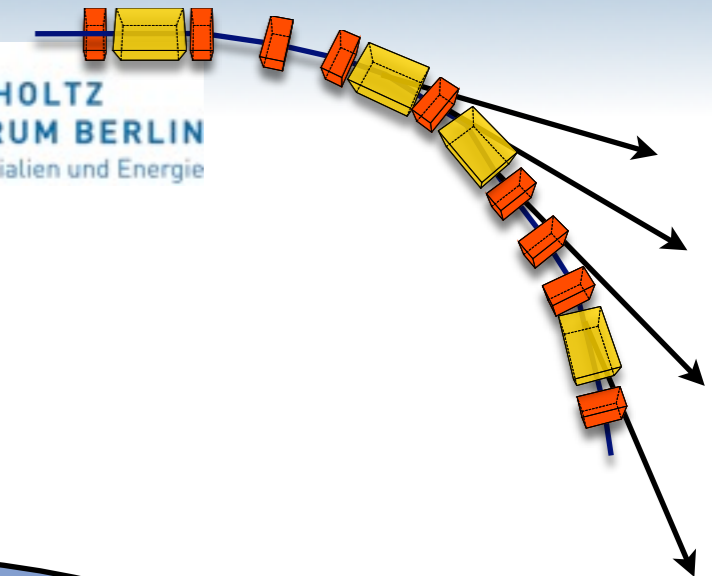
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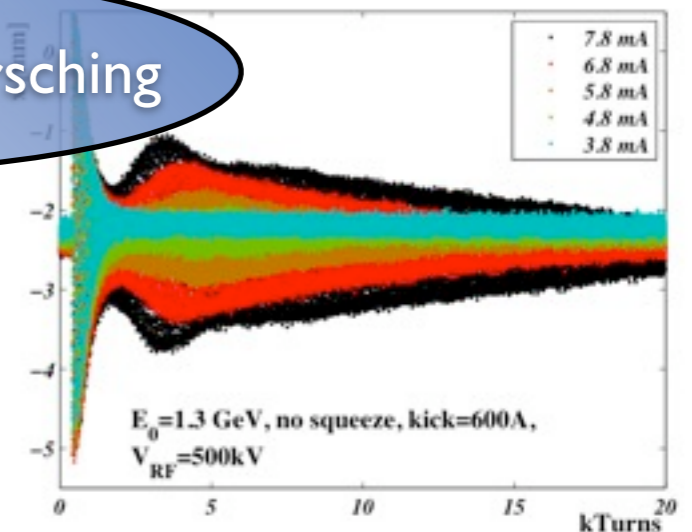
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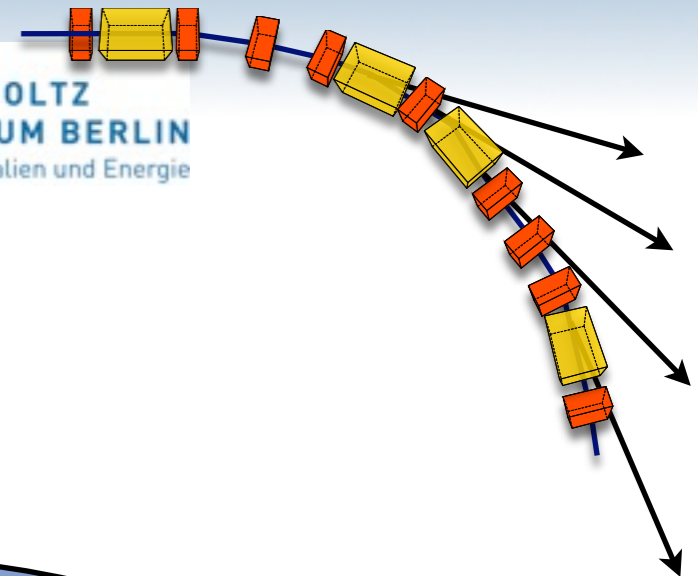
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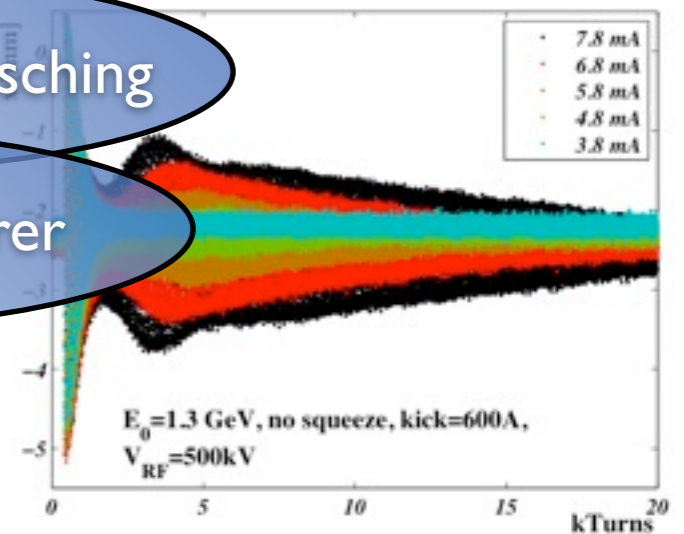
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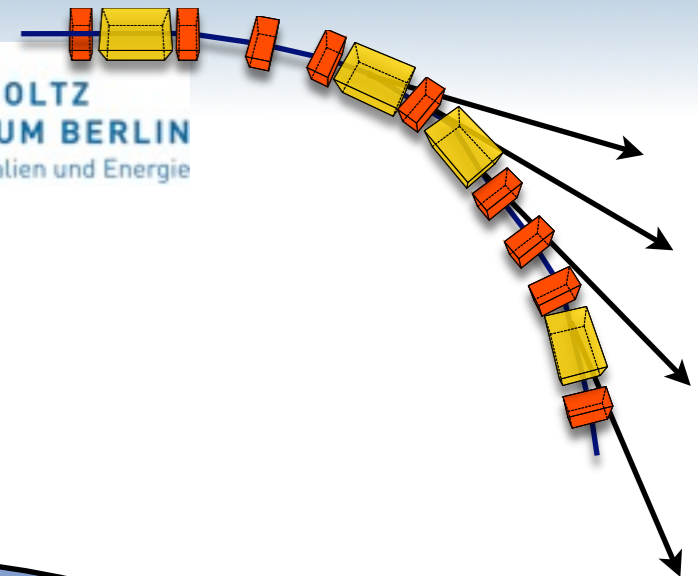
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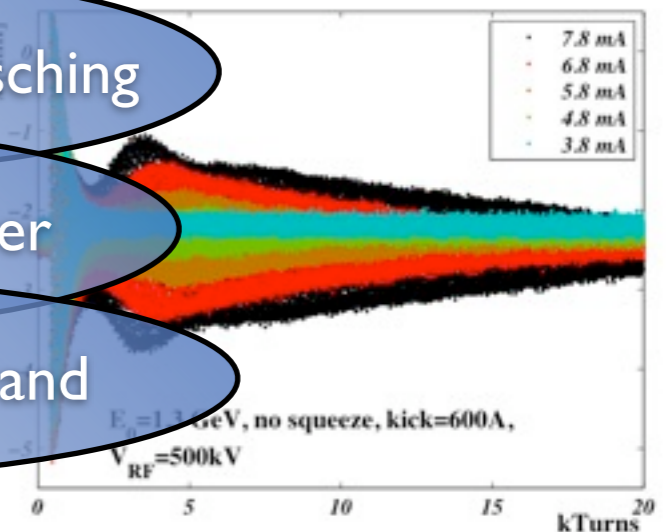


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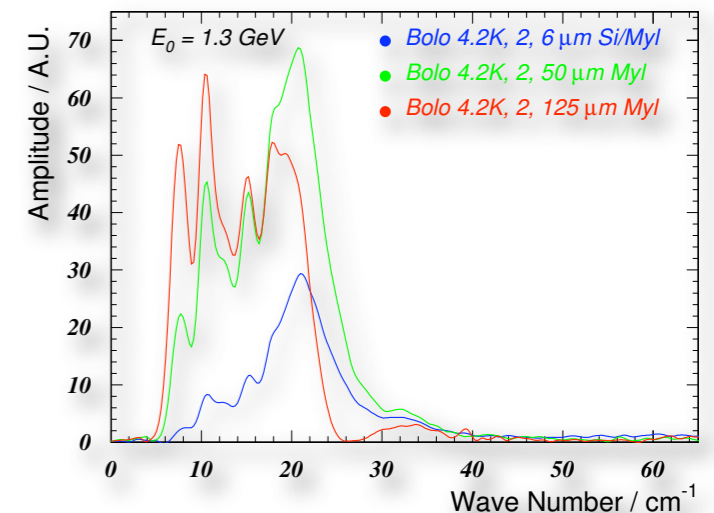
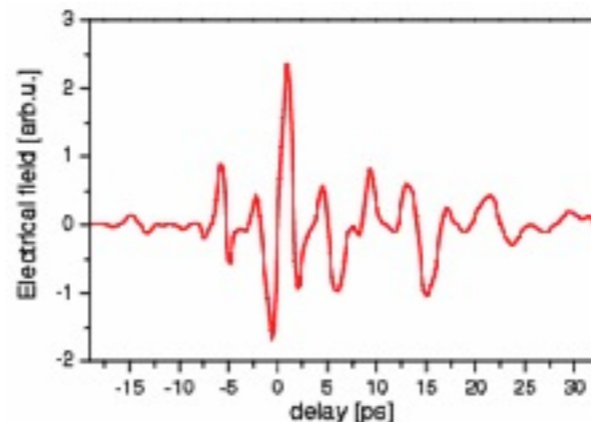
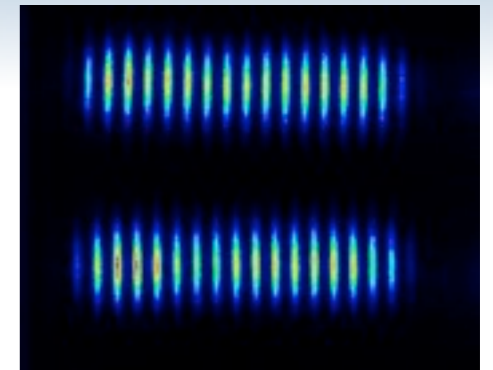


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Measurement of Bunch Parameters

- Understand influence of accelerator parameters on bunch length and shape
 - different detector systems in use or under development
- Projects
 - bunch length and shape from streak camera measurements (visible)
 - bunch length from THz spectrum and EOS techniques (THz)
 - bunch length from autocorrelation (near IR)
 - transverse beam sizes, beam energy, ...





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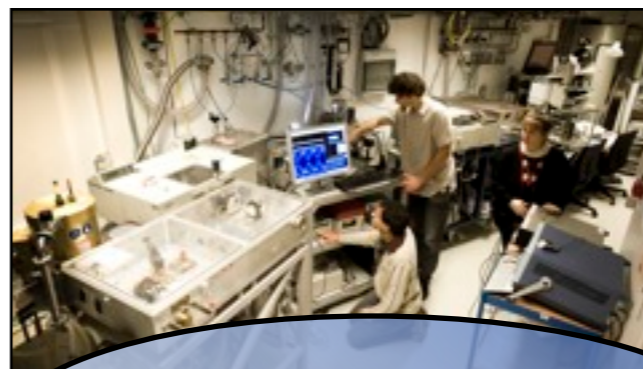
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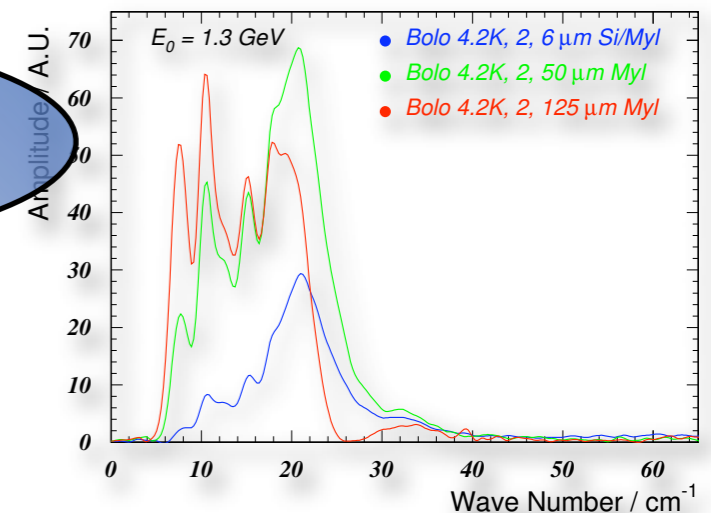
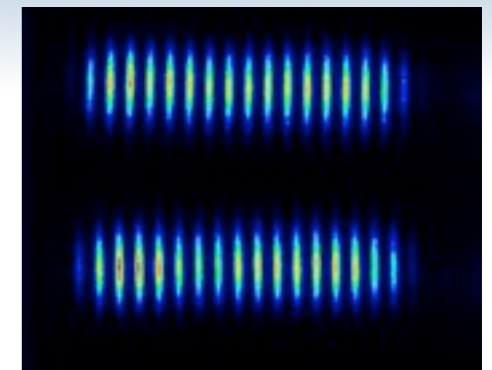
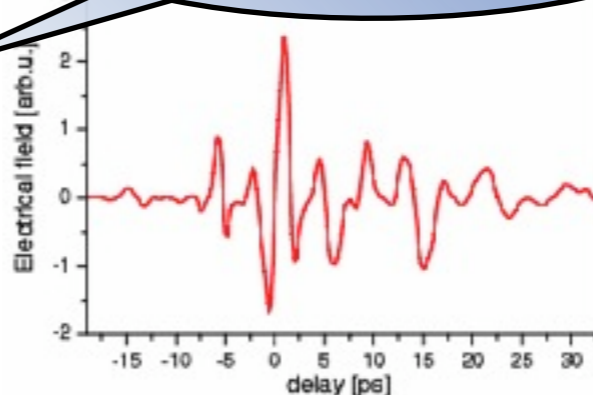
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Talk by Nicole Hiller



A. Plech et al., PAC09



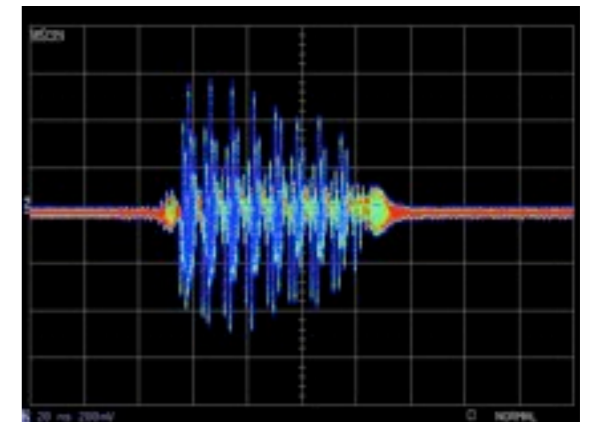
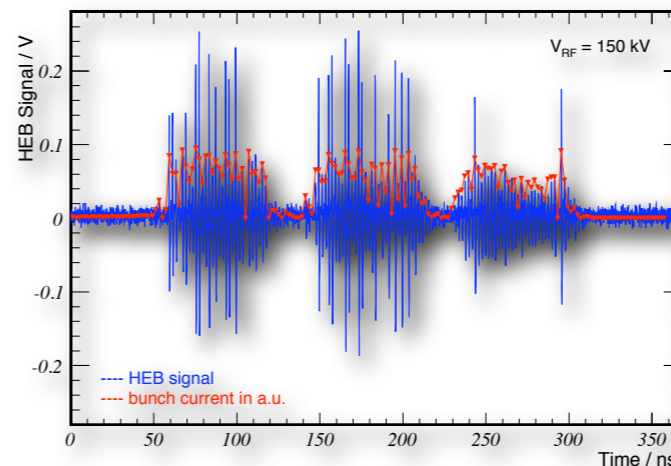
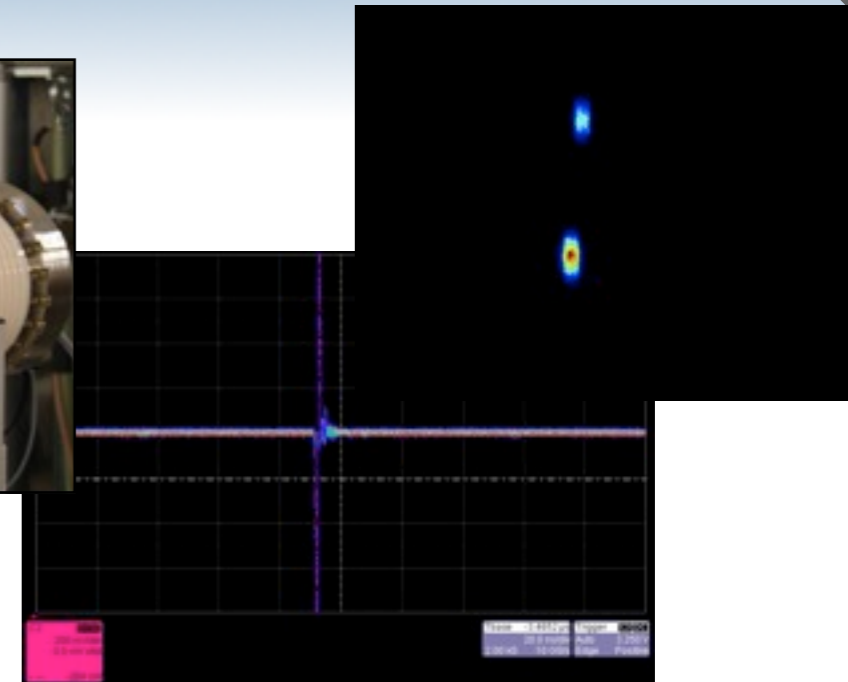
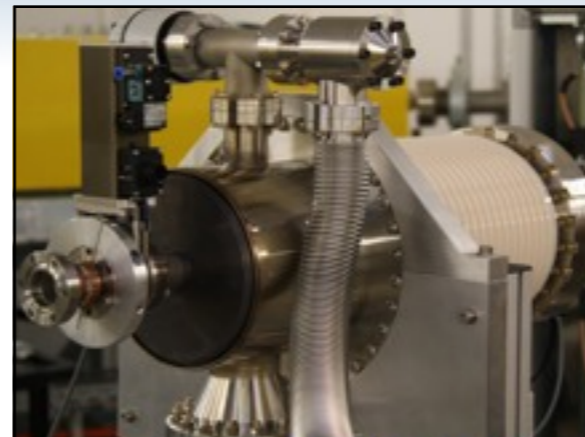
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Single- and Multi-Bunch Effects

- Understand instabilities in the generation of THz radiation
 - Investigation of interactions between bunches and within a bunch

- Projects
 - single bunch operation (new source, new timing system,...)
 - ultra-fast THz detection with a Hot Electron Bolometer (HEB)
 - experimental study of (long range) wake field effects
 - single/multi-bunch and instability thresholds





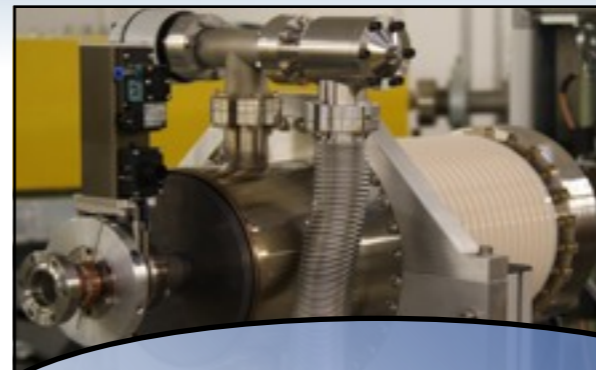
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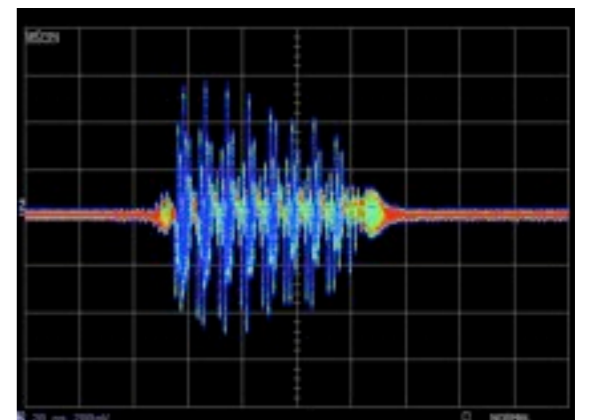
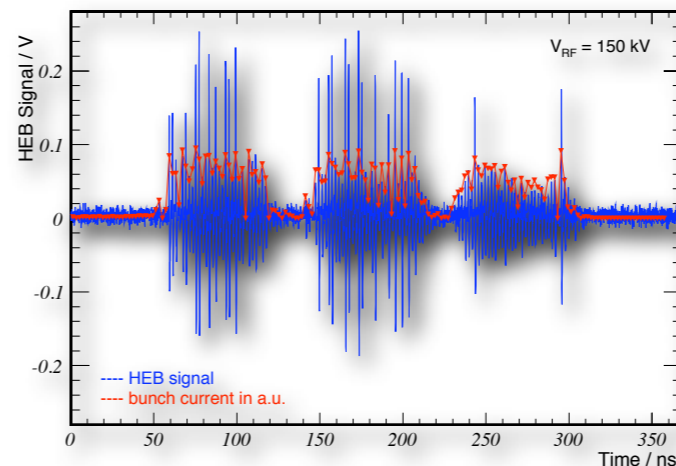
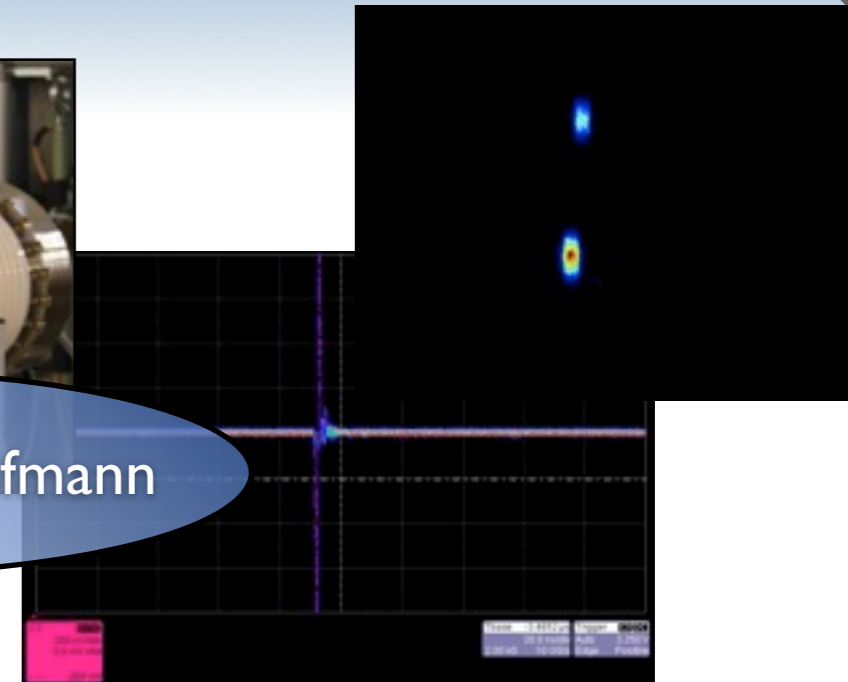
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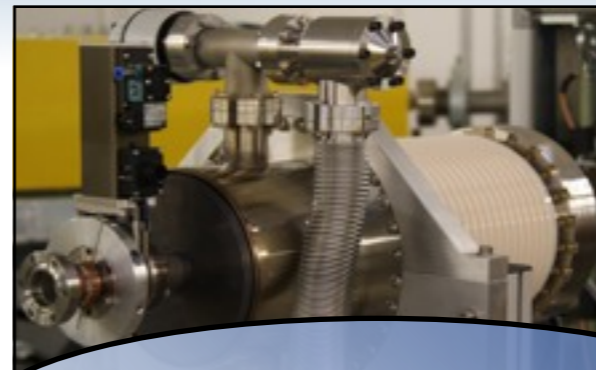
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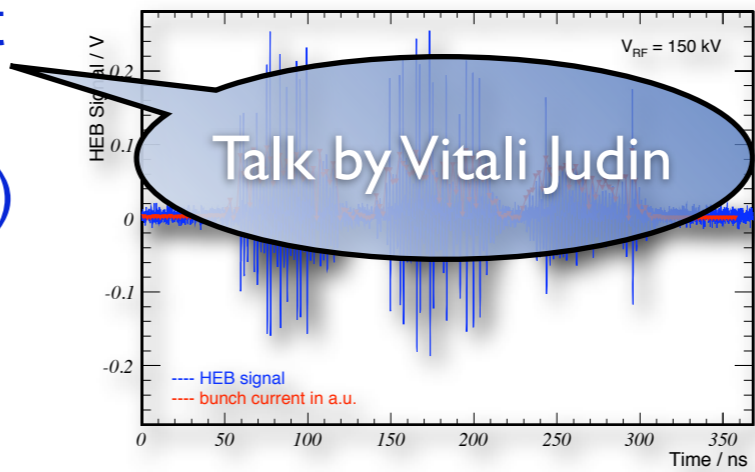
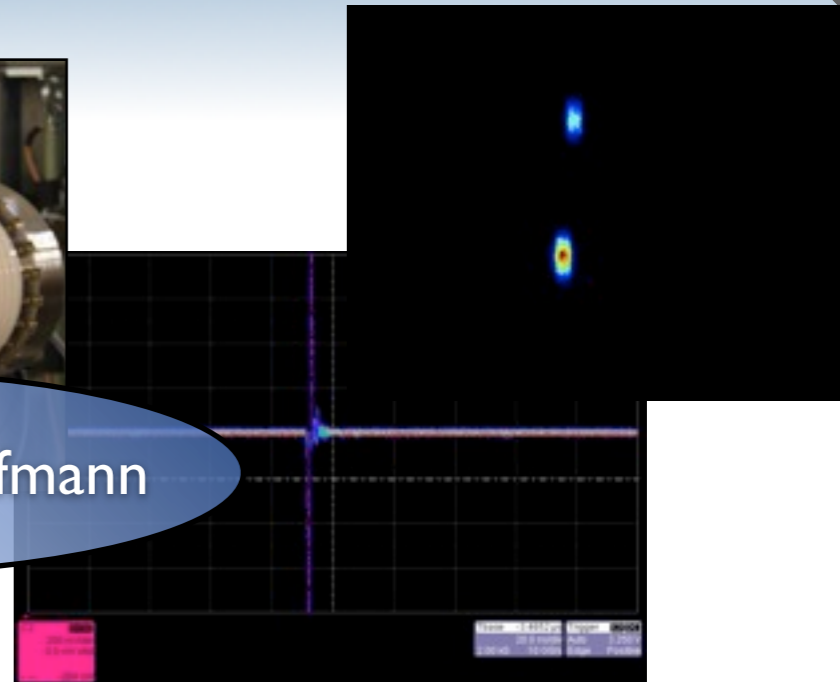
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