XFEL bunch compressors

diagnostic tools = compression monitors

B. Schmidt

Coherent Radiation

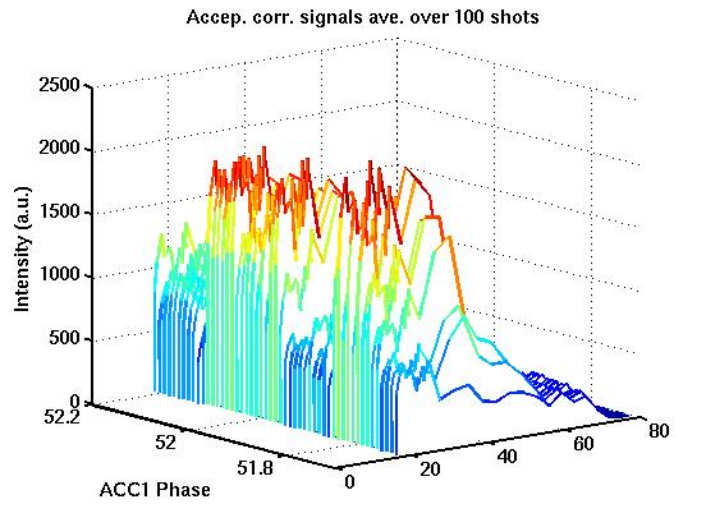
Method:

Measure spectral intensity profile of coherent radiation with 5 µm < λ < 500 µm

Profit :

Longitudinal 'fingerprint' of bunch structure down to micrometer scale

Slow and fast feed-back signals for compressors



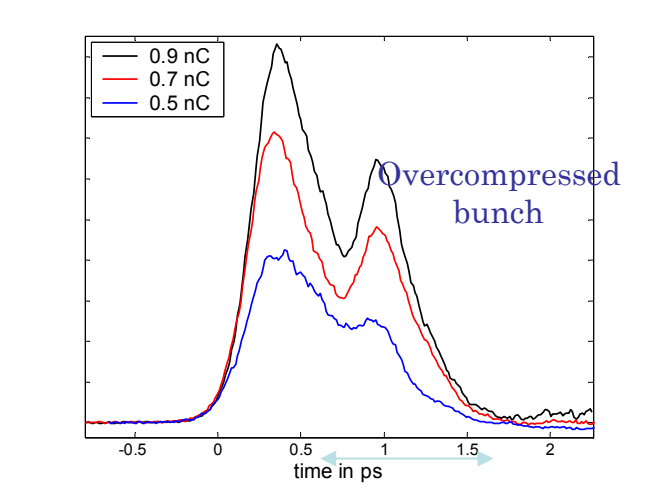
Electro-Optic Methods

Method:

Probe electric field of bunches with laser pulse in electro-optical material

Profit :

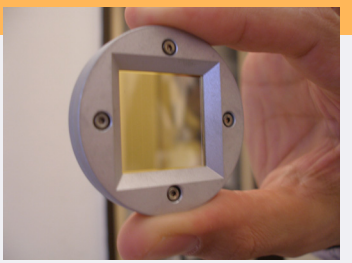
Precise timing of peak density w.r. to optical sync. system , ~ 20 fs rms
Longitudinal profile down to ~ 120 fs rms



Coherent radiation

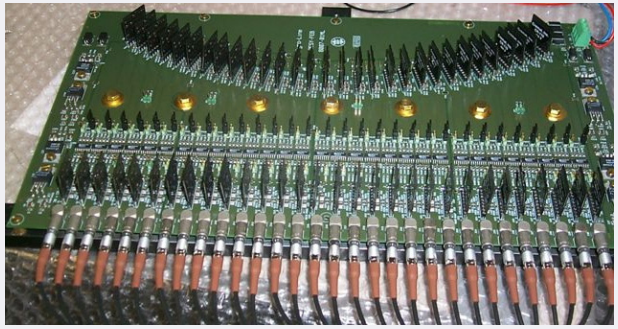
Status :

- spectrally resolving single shot instrument developed
(multi stage grating spectrograph with parallel read out)
-Advanced prototype running at FLASH (THz beam-line)
- Existence of spectroscopic fingerprints shown down to µm scale



To be done :

- develop compact monlithic version
- explore and establish feedback capabilities
- detailed planning of station lay-out



existing detector unit

Zur Anzeige wird der QuickTime™ Dekompressor „TIFF (LZW)" benötigt.

Potential layout for 4-stage spectrograph

Requirements / implications :

- off-axis screens and bunch kickers
  - pilot bunches only, well understood source
- SR ports
  - ALL bunches, source more complex, no experience yet

- diamond windows to accelerator vacuum
- secondary vacuum systems for spectrographs
  - pumping, controls, shutters..
- space : ~ 2 m^2 for spectrograph & beam line to it
- read-out : 20 - 100 ADC channels

Electro-optical monitors

Status :

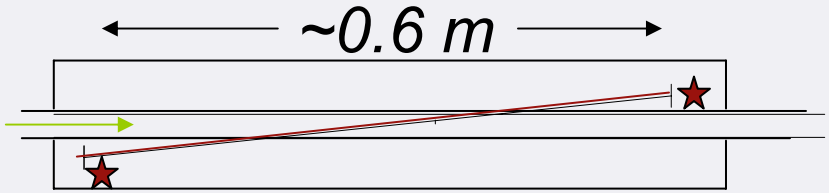
- different methods under study at FLASH
- integrity and validity of data largely explored
- spectral decoding method proven to be sufficiently simple
- dedicated fiber-laser version under construction

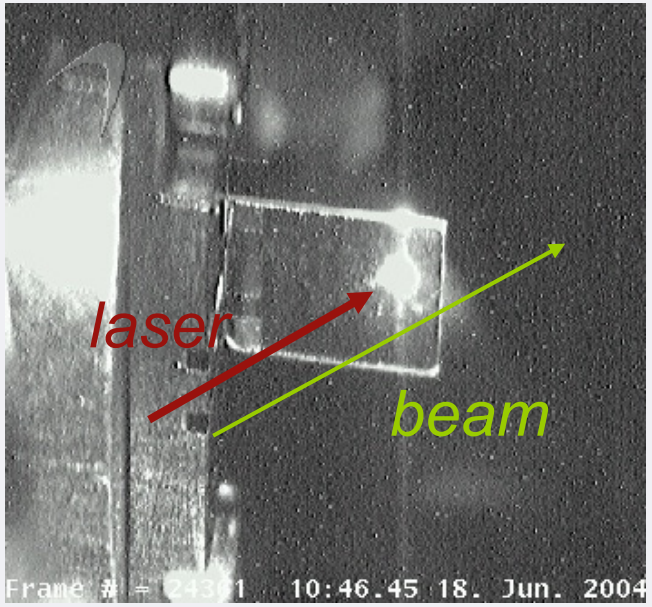
To be done :

- step from ‘experiment’ to ‘on-line tool’
- more robust and reliable laser system (fiber-laser)
- fast (parallel) read-out system (line camera)
- direct (optical) coupling to optical timing system

Requirements / implications :

- EO crystals inside beam pipe (r ~ 2-5 mm), retractable
- optical ports for laser in/out





space underneath beam pipe : ~ 2 m^2 optical table (laser +spectrometer + camera).