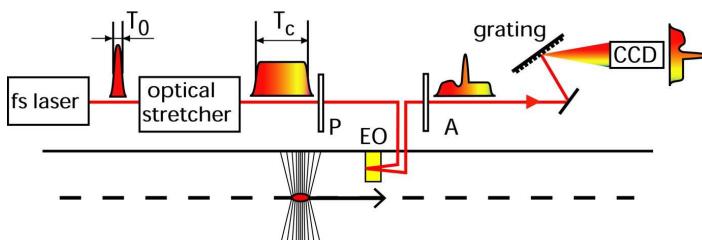


The electro-optical bunch length detection at the European XFEL

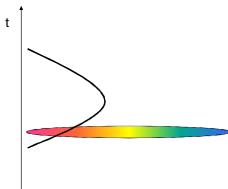


Ch. Gerth, P. Peier, B. Steffen (DESY)

Electro-optical bunch detection

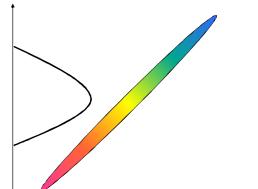


Sampling with laser pulse:



→ Sample electron bunch
with many laser pulses

Chirped laser pulse:

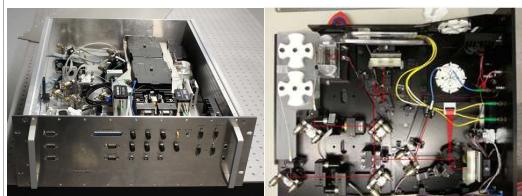


→ Defined relation between
time and frequency

First EOD setup installed in XFEL

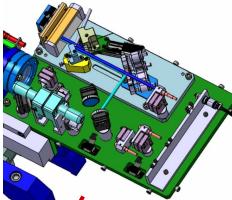
EOD laser

Yb fibre laser specs	
wavelength	1030 nm
bandwidth (osc.)	25nm – 50nm (up to 100nm with ampl.)
chirped laser pulse	5ps (compressible to <10fs)
length	
pulse energy (osc.)	1 nJ – 2 nJ (100 nJ with ampl. at 1 MHz)
repetition rate	54 MHz

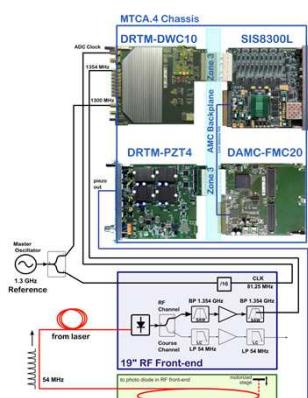


The compact Yb-fiber laser for electro-optical bunch detection at PSI / DESY / KIT

Beamline set-up

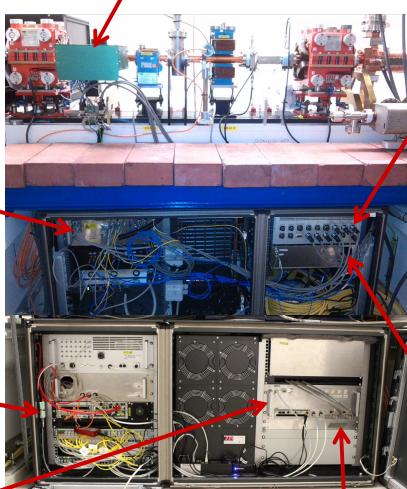


MTCa.4 based synchronization



SD-Module

- Analog part of the synchronization
- Laser diode driver
- Temperature control for laser and RF



Power Supply Module

- all 8 voltages for the SD-Module and the laser pulse picker
- commercial power supply

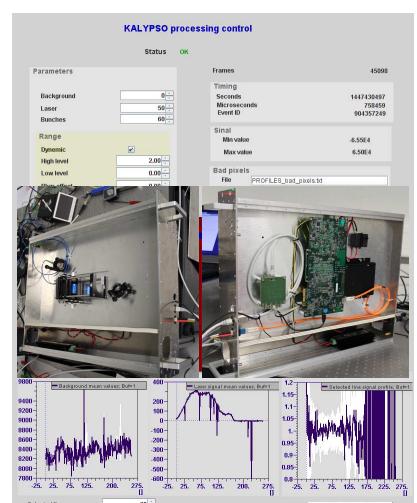
Motor / slow signal control

- Beckhoff SPS for motor control
- Slow analog and digital in and out
- Temperature supervision

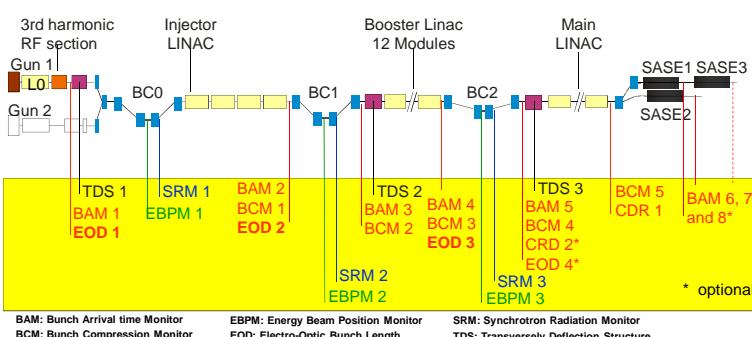


Spectrometer with KALYPSO detector

- 256 pixel linear InGaAs PDA InGaAs (1μm - 2.5μm)
- 1MHz continuous line rate



Longitudinal diagnostics at the E-XFEL



EOD at E-XFEL	injector	injector (alternative config.)	before BC1	after BC1	lower BL limit for EO-SD
position energy	MeV	150	150	600	600
expected bunch length (used for parameter optimization)	rms, ps	8	8	2.5	0.3
crystal thickness	mm	5	5	5	0.5
chirped laser pulse length	FWHM, ps	20	10	6	2
min. measurable bunch length	rms, fs	500	300	250	150
minimum charge	nC	0.25	0.25	0.05	0.10
resolution	rms, fs	400	200	100	50
useful time window (max.)	ps	30	15	9	3



Injector (simulation)

before BC1 (2.5ps gaussian)

after BC1 (simulation)

after BC1 (300fs gaussian)

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