Design of the Electron Beam Diagnostics of the New THz Beamline at ELBE

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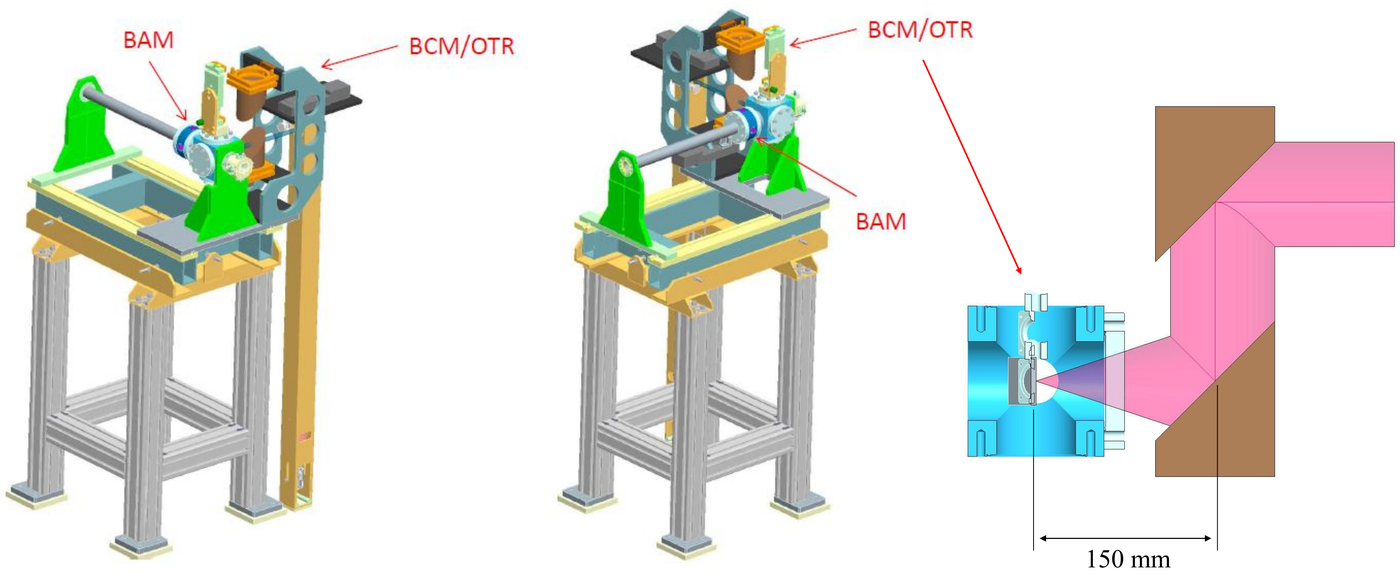
Introduction:

- ✧THz beamline is under construction since Jan. 2012, to be finished Sept. this year
- ✧narrowband electromagnetic undulator ordered
- ✧broadband CDR/CTR source under construction
- ✧BCM/BAM design is fixed and under construction
- ✧EOS measurements ongoing since mid 2011

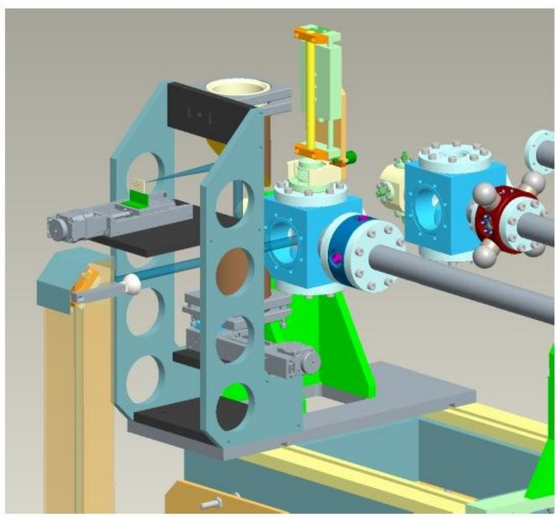
bunch charge	150 pC with thermionic gun 1 nC with SRF gun
electron energy	10 .. 40 MeV 50 MeV with SRF gun
repetition rate	single shot .. 260 MHz
bunch length	200 fs – 2 ps rms
THz properties	100 µm .. 3 mm up to 100 µJ

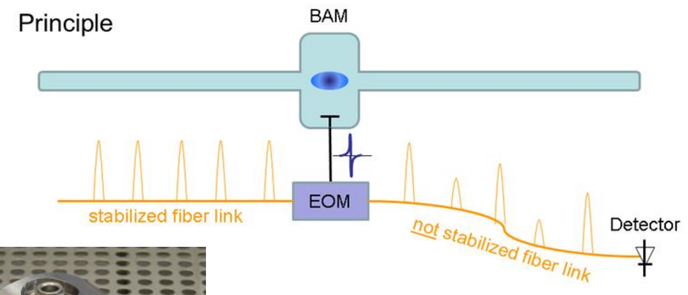
Bunch Compression / Bunch Arrival time Monitor station:

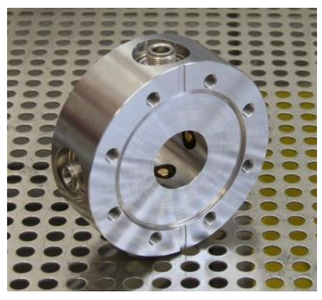


BCM:
- metal plated Si screen generates CTR
- THz via two 100 mm offaxis parabolics to detectors
- 110 – 170 GHz detector Millitec DET-06-RPFW0, 500 mV/mW with horn antenna
- or to Pyro with amplifier [1]
- Pyro/amp combo tested with FEL
- normal OTR viewscreen included in assambly

BAM/BCM pair, current design / M. Gensch, M. Kuntzsch, J. Hauser, 24.01.2012





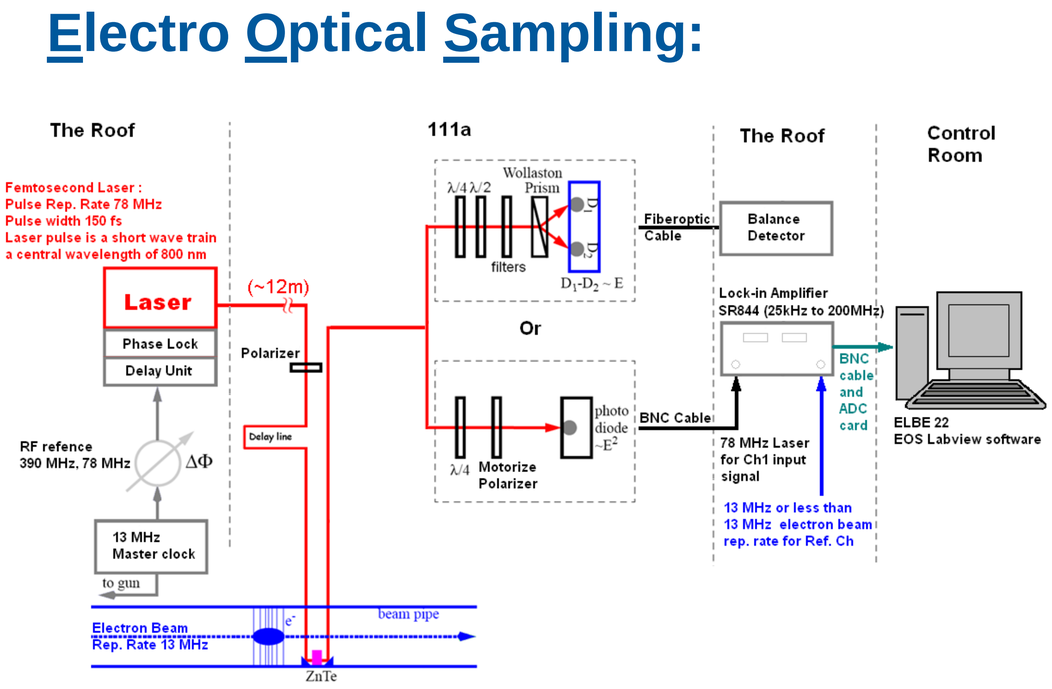


vacuum tested BAM button pickup, Flash design, assembled at DESY

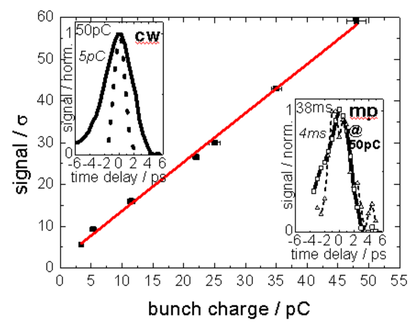
courtesy J. Kruse, DESY

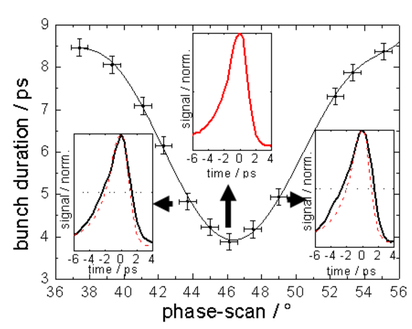
BAM:
- button pickup, TU Darmstadt design [2]
- one coarse and one fine channel
- electronics to be built into cave
- readout with NI PXI
- feedback to LINAC phase controller
- will there be enough SNR at low bunch charge?

Electro Optical Sampling:



principle of the EOS setup at ELBE 2011/12





EOS:
- measurements done in 2011 with 800 nm laser and 0.8 mm ZnTe EO crystal [3]
- usable down to 5 pC
- works in cw and in macropluse mode
- results comparable to those measured with MP interferometer
- conversion to 1050 nm laser (Menlo-Systems) and 1 mm GaP crystal for more signal yield is almost finished

References

[1] C.Behrens et all, Upgrad and Evaluation of the Bunch Compression Monitor at the Free Electron Laser in Hamburg (FLASH), IPAC10, Kyoto

[2] A. Angelovski et all, REALIZATION OF A HIGH BANDWIDTH BUNCH ARRIVAL-TIME MONITOR WITH CONE-SHAPED PICKUP ELECTRODES FOR FLASH AND XFEL, Proceedings of IPAC2011, San Sebastián, Spain

[3] C. Kaya et all, Phase sensitive monitoring of electron bunch form and arrival time in superconducting linear acceleratorsAPPLIED PHYSICS LETTERS 100, 141103 (2012)