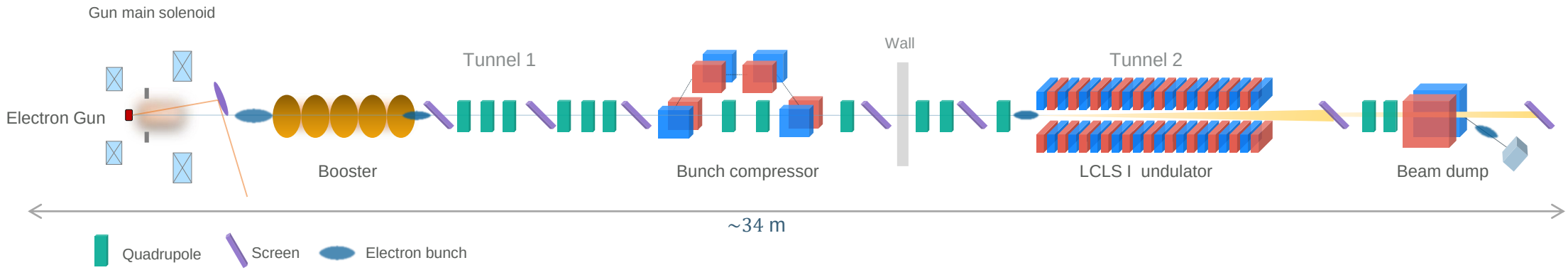
Present Status of the Magnetic Bunch Compressor at PITZ

Ekkachai Kongmon | 11th MT ARD ST3 Meeting 2023 in Dresden-Rossendorf | 5-7 July 2023



The application of the bunch compressor (BC)

Super - radiant FEL (Coherent radiation from ultra-short bunch)

< 500 fs FWHM, bunch charge < 250 pC

SASE FEL

> 5 ps FWHM, I_{peak} ~ 200 – 400 A

Support tuning of FEL seeding

Regarding the parameters for electron beam transportation throughout the bunch compressor (BC)

- → **Dispersion**
- → Space-charge dominated
- → Focusing effect from rectangular dipole magnet

Beam properties that need to be minimized according to requirements.

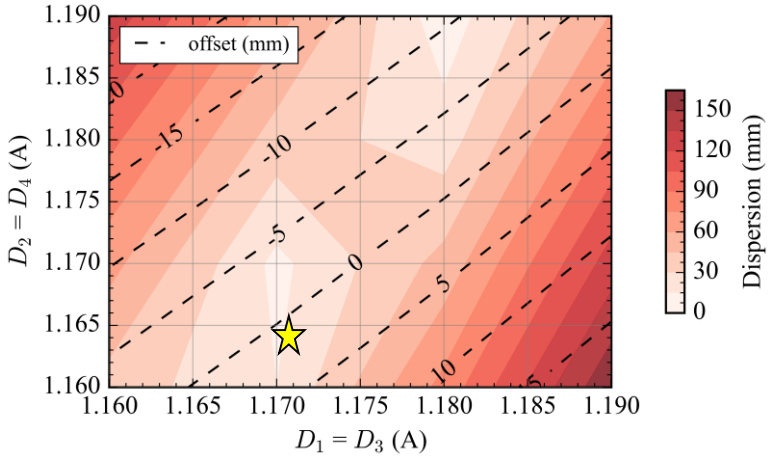
- → **Dispersion and ensure its constantly after BC**
- → **Beam offset after BC**
- → Beam emittance
- → Space charge effect on the electron beam in the BC

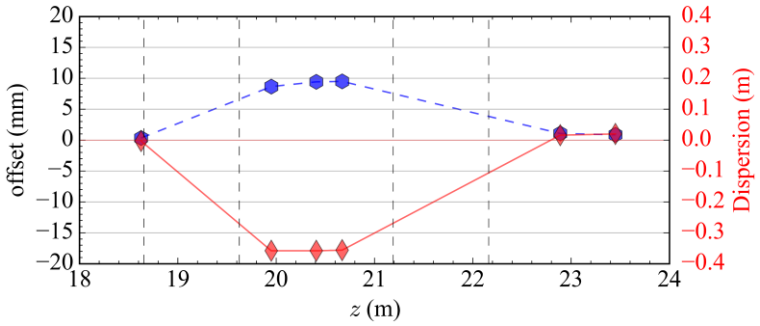
HELMHOLTZ PITZ Photo Injector Test Facility Zeuthen European XFEL DESY.

Highlights

High bending angle (19 degrees), High dispersion, High energy spread up to 0.7% for compression case

Dispersion study using a 3D magnetic field in the simulation.



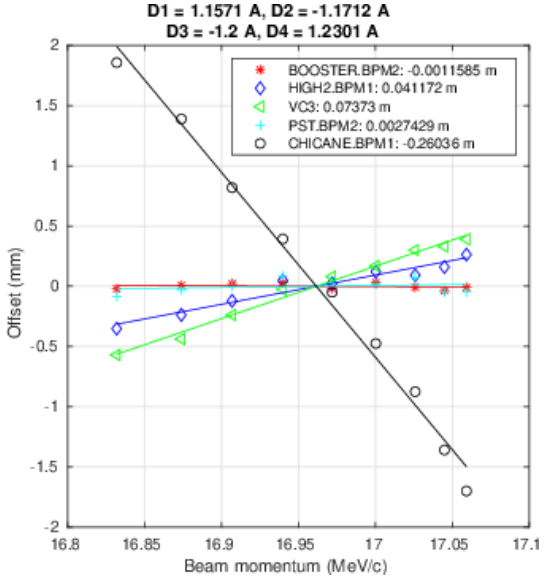


Optimum case from simulation

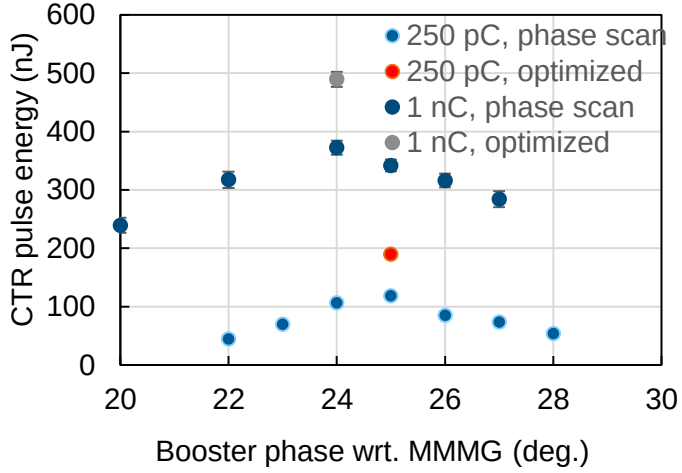
Minimization dispersion after BC in commissioning

$$D(z) = \frac{< x_f(z) > - < x_i(z) >}{\Delta p/p}$$

- Booster phase scan
- Dipole currents scan
- Measured beam centroid offset



CTR results



Electron bunch **full compression** studies

→ Measured Coherent Transition Radiation (CTR) signal to represent full compression of electron beam after passing through bunch compressor.