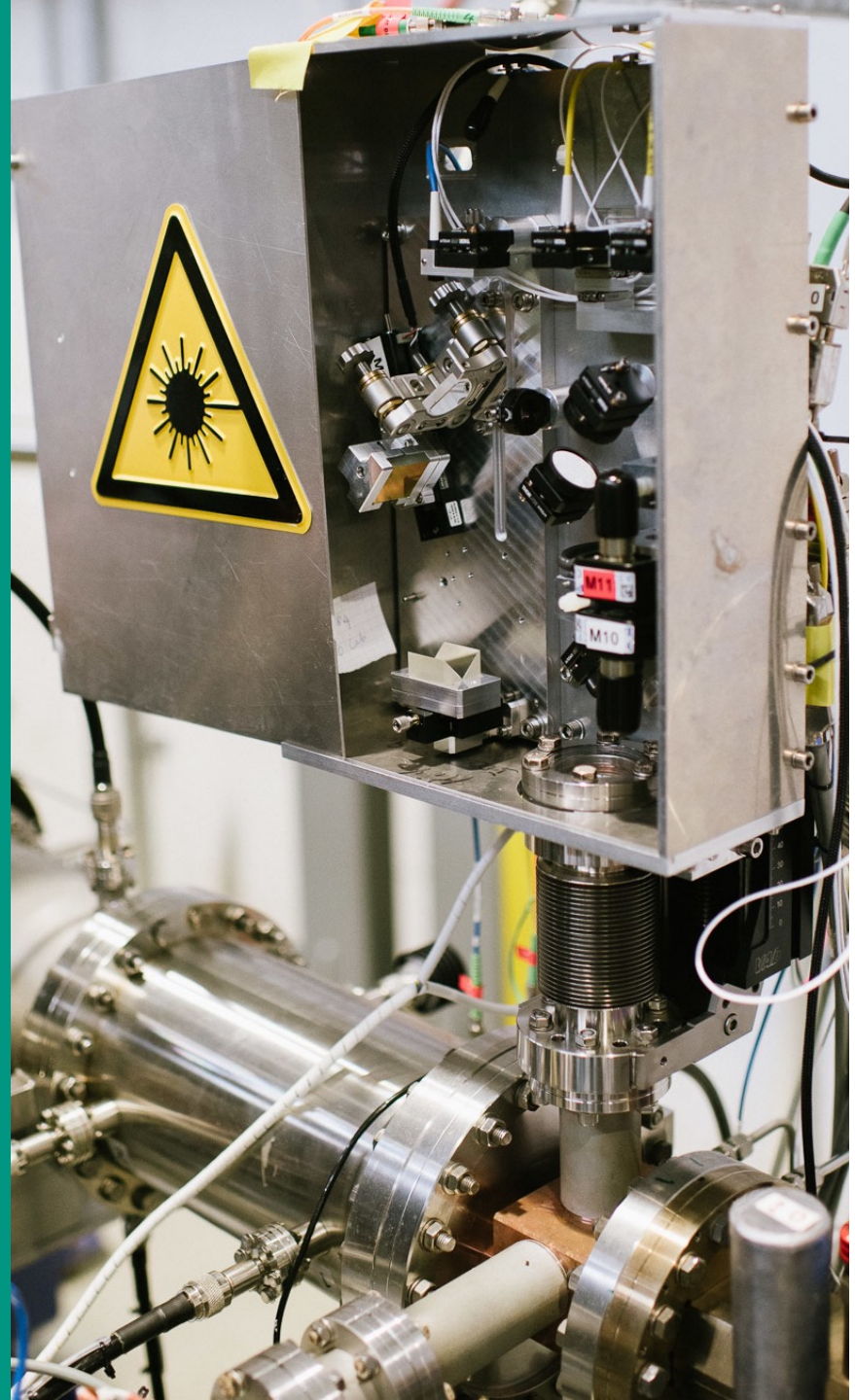
First prototype measurements with an electro-optical bunch profile monitor for FCC-ee



13th MT ARD ST3 Meeting, Zeuthen, 2025

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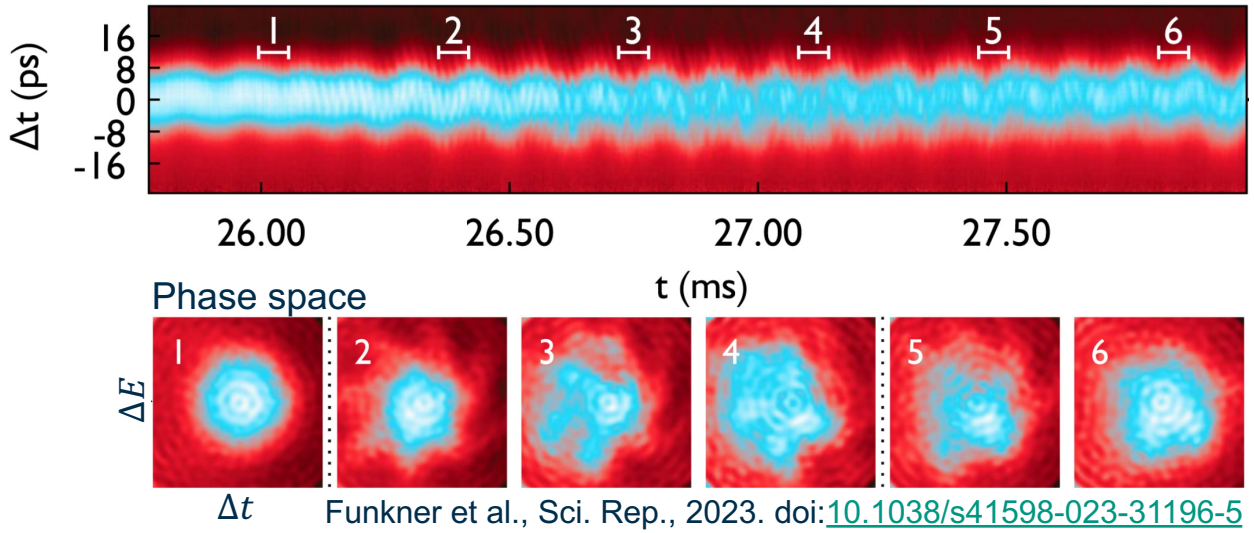
KIT, Karlsruhe, Germany

Institute for Beam Physics and Technology

First prototype measurements with an electro-optical bunch profile monitor for FCC-ee

EO system at KARA:

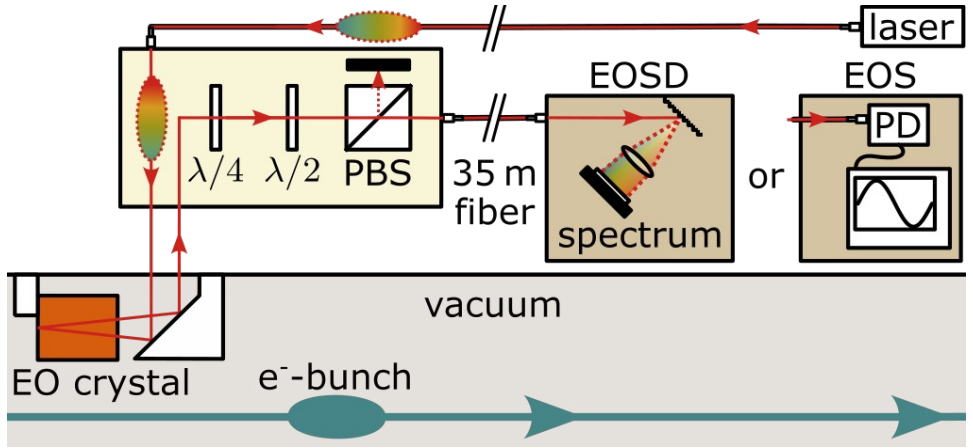
- Single-shot bunch profile measurements
- Turn-by-turn measurements at 2.7 MHz
- Designed for short bunches in the picosecond region
- Allows reconstruction of phase-space dynamics using tomography



Funkner et al., Sci. Rep., 2023. doi:10.1038/s41598-023-31196-5

Principle of Electro-optical spectral decoding (EOSD)

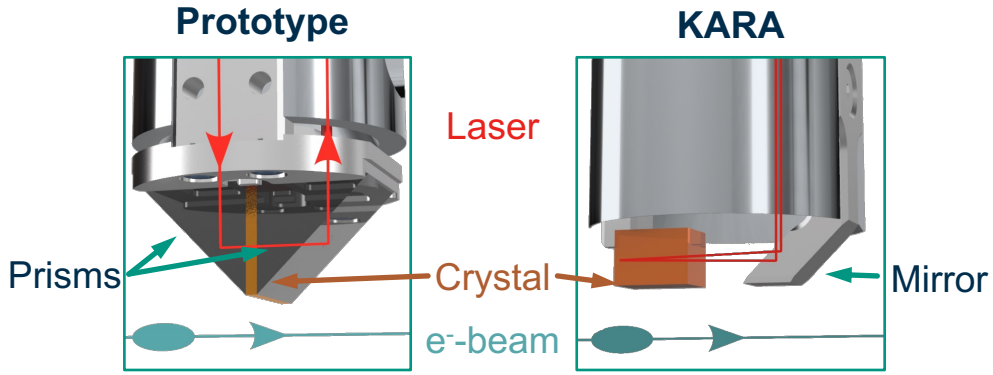
1. Pockels effect to encode bunch profile in polarization of the laser
2. Polarizer to transform into intensity modulation
3. Spectrum of the chirped laser pulse contains longitudinal bunch profile



First prototype measurements with an electro-optical bunch profile monitor for FCC-ee

Novel crystal holder design

- Suitable for long and short e⁻-bunches
- Prisms instead of mirrors and reflective coatings
- Compact single-pass design → low impedance



Proof-of-principle experiment at CLEAR
(CERN Linear Electron Accelerator for Research)

- Prototype built on basis of the KARA EO monitor
- Successful EO sampling of two consecutive bunches