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Type: **Poster Presentation**

Beam dynamics optimization in high-brightness Photo Injector with various photocathode laser pulse shapes

Tuesday 3 June 2025 16:00 (2 hours)

At PITZ, a comprehensive study is conducted to analyze the factors influencing emittance growth in the European XFEL (EuXFEL) continuous wave (CW) setup. Emittance growth due to space charge effects can be mitigated using advanced photocathode laser pulse shapes. To optimize beam quality, multiobjective optimization studies using ASTRA are performed, focusing not only on minimizing emittance but also on maximizing beam brightness for various laser temporal profiles and durations. The optimization is initially carried out for the CW injector section planned for EuXFEL. The optimized cases are then further tracked through start-to-end (S2E) simulations to evaluate their behavior in the compression stages of EuXFEL. A comparative analysis of gaussian, flattop, ellipsoidal, and inverted parabolic laser profiles is presented, assessing their efficiency not only in terms of emittance but also in 4D and 6D brightness. Finally, the results of the optimized photoinjector setup and the beam properties after the final bunch compression will be presented.

Footnotes

Paper preparation format

Word

Region represented

Europe

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