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Beam dynamics optimization for high-brightness photo injector with various photocathode laser pulse shapes

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PITZ at DESY Zeuthen focuses on the development and optimization of high-brightness electron sources for the European XFEL. At PITZ, a thorough study of factors influencing emittance growth is carried out. Emittance growth due to space charge can be managed through precise laser pulse shaping techniques. 4D and 6D Integral brightness that incorporates not only the emittance, but electron beam current profile and longitudinal phase space properties from laser pulse shapes are proposed as objectives for the optimization. Multiobjective optimization studies with ASTRA are aimed at not only minimizing emittance but maximizing brightness for various laser temporal profiles and widths. A comparative analysis for Gaussian, flat-top, ellipsoidal and inverted parabolic laser profiles is presented to compare their efficiency not only in terms of emittance but 4D and 6D brightness.

Summary

Primary author: ZEESHAN, Sumaira (Z_PITZ (Betrieb und Forschung))

Co-authors: KRASILNIKOV, Mikhail (Z_PITZ (Betrieb und Forschung)); Mr LI, Xiangkun (Z_PITZ, DESY)

Presenter: ZEESHAN, Sumaira (Z_PITZ (Betrieb und Forschung))

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