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Emittance Optimization Studies at PITZ with Laser Pulse Shaping

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The PITZ Facility at DESY Zeuthen focuses on the development & optimization of high-brightness e-beam sources for FELs like the Eu-XFEL. The main scientific program is generation of intense e-beams characterized by small transverse emittance from the photo injector, a critical requirement for modern FELs. At PITZ, a thorough study of factors influencing emittance growth is carried out. Emittance growth due to space charge can be well controlled by precise laser pulse shaping. Astra simulations are utilized for the optimization studies to minimize emittance for various laser temporal & transverse profiles. A benchmarking analysis of Gaussian and flattop laser profiles is presented. The lasing process in XFEL occurs predominantly through highly charged slices with low emittance, assumed to originate from the longitudinal core of the electron bunch in the photo injector. The transverse emittance of these segments is of major importance. Therefore, the optimization of not only the projected emittance but also the slice & core are carried out through Astra. The results of these comprehensive optimization studies will be discussed in terms of further improving the performance of XFEL.

Footnotes

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