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Study of DESY2 as an injector option for PETRA IV storage ring

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PETRA IV is the storage ring light source currently under design at DESY in Germany. The baseline injector is a 6-GeV synchrotron DESY IV, an upgrade to the existing injector DESY II. Even if the project matures DESY IV's engineering design, we studied the intensity limit of DESY II, whose aim was to increase the single bunch charge to more than 10 nC suitable for the on-axis swap-out injection with PETRA IV in mind. We identify the microwave instability-induced energy spread and the transient beam loading as a limiting mechanism of single bunch intensity in a 12.5 Hz cycle synchrotron. This paper reports the numerical simulation, its analysis, and its follow-up experiments of high charge acceleration at DESY II and its subsequent injection into PETRA III. The injection efficiency of DESY II's beam into future PETRA IV is also computed assuming the imperfect lattice with 5% beta-beating. To overcome the intensity limit set by the pre-accelerator PIA, we investigated the possibility of multi-cycle accumulation at the low-energy. In this regard, we measured the lifetime and emittance over cycles and the chromaticities of the lattice. These are also reported in the paper.

Footnotes

Paper preparation format

LaTeX

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Europe

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