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A novel nonlinear kicker scheme toward a transparent and lossless top-off injection for future diffraction-limited synchrotron light sources

Wednesday 13 August 2025 16:00 (2 hours)

To address the intrinsic dynamic aperture (DA) limitations of fourth-generation diffraction-limited synchrotron light source, we investigate a novel injection scheme utilizing multiple nonlinear kickers (NLKs) with optimized hardware design and phase advances in the storage ring (SR). Positioning the NLKs near the injection point reduces beam perturbation, while their on-axis zero field and gradient enable transparent injection—suppressing orbit and beam-shape oscillations during top-off operations. Particle-tracking simulations were performed using Accelerator Toolbox (AT), alongside the development of automated tools for converting magnetic field maps into AT-compatible kick maps, inserting NLKs at arbitrary lattice locations, conducting tracking, and optimizing NLK configurations. A key challenge is to shift the off-axis magnetic field peak closer to the beam orbit. Our novel NLK design achieves a peak within 5 mm of the axis—a significant improvement over the conventional greater than 7 mm range. Simulations accounting for realistic alignment and magnetic field errors indicate that a relaxed 5 mm DA and injection efficiency > 90% could be feasible for the NSLS-II upgrade lattice.

Please consider my poster for contributed oral presentation

Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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