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Tapering schemes for FCCee

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The electron-positron Future Circular Collider (FCC-ee) is designed to operate at four energies, from 45.6 GeV to 182.5 GeV. At such energy levels, the circulating beam loses a significant fraction of its energy via synchrotron radiation. As a single RF insertion is foreseen in the ring, large closed-orbit shifts featuring a typical sawtooth pattern and optics distortions are induced. This in turn leads to a significant reduction of the dynamic aperture if no mitigation is implemented. Adapting the fields of the magnets to the local beam energy is referred to as tapering. For practical reasons, this field adjustment must be realized for groups of magnets to limit the number of powering circuits. We establish an algorithm to self-consistently compute the tapering strengths of a given scheme, the RF phasing required to compensate the energy loss and the required orbit corrections. Tapering scenarios, from coarse schemes to fine grained options are studied with the Xsuite tracking code in term of closed-orbit excursion, optics distortion and dynamic aperture reduction. The results at the Z-pole (45.6 GeV) and ttbar (182.5 GeV) energies are discussed in detail.

Footnotes

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