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Interplay between sextupole settings and single particle instabilities during the FCC-ee commissioning

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The Future Circular Collider of electrons and positrons (FCC-ee) is designed to achieve high luminosity at center-of-mass energies ranging from the Z boson peak to the top quark threshold. During the commissioning phase, specialized optics are essential to accommodate the dynamic needs of machine tuning and beam stabilization. This paper investigates the role of sextupoles in the various FCC-ee commissioning optics, focusing on their influence on nonlinear beam dynamics. Using advanced simulation tools, we analyze how sextupole configurations impact key performance indicators, including the dynamic aperture, emittance evolution and lifetime. Strategies for optimizing sextupole strengths are explored. The findings provide critical insights for the design and optimization of the commissioning optics, ensuring efficient and reliable ramp-up to nominal operation. These results are instrumental in refining the FCC-ee commissioning strategy, supporting its broader objectives for particle physics research.

Footnotes

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