

Lattice design optimization of the interaction region for a super tau-charm facility

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The Super Tau-Charm Facility (STCF), a new-generation high luminosity e^+/e^- collider of in the low-energy region of 1-3.5 GeV. To achieve the target luminosity of larger than $5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$, the collision scheme combining a large crossing angle and crab-waist correction is applied. However, the strong nonlinearity within the interaction region (IR), significantly decreases both dynamic and momentum apertures and limiting Touschek lifetime. Consequently, designing as a transparent (achromatic) IR as possible holds critical importance in enhancing the Touschek lifetime. In this paper, the modular linear lattice design for the STCF IR is designed to facilitate nonlinear optimization. The H-invariant is constrained less than 0.02m to help increase the local momentum acceptance. Up to third-order local chromaticity correction is implemented by using Montague function as indicator to broaden the momentum aperture, thereby improving the Touschek lifetime. Fringe field and detector solenoid effects on beam dynamics is designed and optimized.

Footnotes

Funding Agency

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