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Beam-beam simulation with lattice and related researches of STCF

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To achieve the design luminosity of 1×10^{35} cm^{-2}s^{-1}, the Super Tau-Charm Facility (STCF) adopts an extremely low β_y^* and a crab waist (CW) collision design. The extremely small vertical beam size at the interaction point and low vertical emittance required to achieve a beam-beam parameter of around 0.1 make the CW colliders highly susceptible to beam instabilities arising from beam-beam interactions. Some of these instabilities need to be carefully assessed and optimized through strong-strong beam-beam simulations. The nonlinearity from lattice will further increase the need to circumvent these instabilities.In this paper, we investigate the luminosity stability of the STCF design parameters using strong-strong simulations with lattice. We also explore the influence of the CW scheme and various beam parameters on luminosity. These findings offer valuable insight to guide lattice design and optimize global parameters for STCF.

Footnotes

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