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Optics Corrections and Emittance Tuning for FCC-ee

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The FCC-ee project studies the design of a future 100 km e+/e circular collider for precision studies and rare decay observations in the range of 90 to 350 GeV center of mass energy with luminosities in the order of $10^{35} \text{ cm}^{-2} \text{ s}^{-1}$. In order to reach this high luminosity, extreme focusing is required in the interaction regions, with the beta function values range from 0.8 mm to 7736 m (for the Z lattice). This makes FCC-ee particularly susceptible to misalignments and field errors, and therefore presents an appreciable challenge for emittance tuning. We describe a comprehensive correction strategy used for the low emittance tuning. The strategy includes programs that have been developed to optimise the lattice based on Dispersion Free Steering, linear coupling compensation based on Resonant Driving Terms and beta beat correction utilising response matrices. Hundreds of lattices with different random seeds for the misalignment and field errors were introduced in MAD-X and the final corrected lattices are presented.

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