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High bunch charge linacs design for the FCC-ee project

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The international e-e FCC study group aims to design an accelerator complex capable of injecting tunable and high charge electron-positron bunches into a collider with center-of-mass energy between 90 and 365 GeV. The injector complex will boost the initial energy of the electron-positron bunches using multiple linacs accelerating only electrons, only positrons, and both species up to the booster injection energy of 20 GeV. The requirements on the charge poses several challenges for the injector chain due to the important role played by the wakefield both in the longitudinal and in the transverse planes. We optimized the bunch length, the RF aperture of the accelerating cavities and the linacs' layout to match the target parameters at the booster injection. In the longitudinal space we studied the impact of the wakefield on the final beam energy spread. In the transverse plane we minimized the emittance growth due to static errors along the different sections using several orbit steering algorithms, and we verified the impact of dynamic errors for the most promising designs. Furthermore, we designed an energy compressor to add flexibility to our design, and to widely scan the beam charge without strongly modifying the final bunch parameters. In this work we present a summary of these studies, which led to the linac design satisfying all the present requests for the injection to the booster. This current design is the basis for the injector complex cost estimation.

Footnotes

- H. Pommerenke and Z. Vostrel presently working not at CERN anymore.

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Region represented

Europe

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