Contribution ID: **2492** Contribution code: **MOPL086** Type: **Poster Presentation**

On positron beam dynamics an initial part of a large aperture FCC-ee capture linac

Monday, 8 May 2023 16:30 (2 hours)

The application of HTS coils as a matching device and a large-aperture L-band linac make it possible to transport a substantial part of positrons generated in a positron production target through a capture linac. It raises a question of how to manage their large phase space to provide bunches matched to the damping ring acceptance. This paper presents the beam dynamics studies of the FCC-ee positron linac consisting of an adiabatic matching device (AMD) with theoretical field distribution combined with constant solenoidal field along $\frac{9}{10}\pi$ large aperture L-band accelerating sections. AMD field drop rate, as well as the RF field phase and accelerating section length, were varied to find features of a bunch formation. It was shown that 5D normalized beam brightness is a useful parameter to optimize the initial part of the capture linac. A higher beam brightness can be obtained for the higher AMD field drop rate. Starting from some accelerating section length, two peak structure appears in the normalized brightness dependence on the RF field phase. The peaks correspond to the acceleration of the head or the tail of the initial positron longitudinal distribution. The last one provides a higher positron yield.

Funding Agency

We wishes to acknowledge the support from ANR under Grant No: ANR-21-CE31-0007 and the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 101004730.

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Session Classification: Monday Poster Session

Track Classification: MC1: Colliders and other Particle Physics Accelerators: MC1.A02: Lepton Circular Colliders