



Contribution ID: 2410 Contribution code: SUPM042

Type: Student Poster Presentation

Characterisation of beam dynamics sensitivity to misalignments in the PERLE injector

Sunday 1 June 2025 14:00 (2 hours)

High current linear accelerators require the precise alignment of accelerating cavities to maintain a high beam quality. The PERLE (Powerful Energy Recovery Linac for Experiments) injector cryomodule is composed of four single-cell cavities, each of which can be independently tuned to allow greater control of the beam at this crucial point. Misalignments can lead to perturbations in the beam trajectory and contribute to an increased emittance and energy spread. Here we present a characterisation of the beam dynamics when various misalignments are applied in the injector. Various misalignments are applied, three in the translation axis (x , y , z), and two rotationally, yaw and pitch (θ , ϕ). A study was conducted to determine the tolerances required misalignments to ensure an acceptable beam quality is maintained at. The results indicate that particular combinations of rotational and translational misalignments are especially detrimental to emittance. These findings provide an important guide for the subsequent design of the booster linac and alignment procedure.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

Funding Agency

ASTeC/STFC (Grant number: ST/X000540/1) and IJCLab

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Session Classification: Student Poster

Track Classification: MC2: Photon Sources and Electron Accelerators: MC2.A18 Energy Recovery Linacs (ERLs)