



Contribution ID: 81 Contribution code: WEP50

Type: Contributed Poster

Controlling Beam Trajectory and Beam Transport in a Tapered Helical Undulator

Wednesday, 24 August 2022 17:10 (20 minutes)

A helical undulator provides a stronger FEL coupling than common planar geometries as the beam's transverse velocity never vanishes. However, a significant challenge lies in tuning and measuring the fields with limited access to the beam axis along the undulator. Confirming the good field region off axis is difficult without space for 3D hall probe scans, and is important for low energy beams used to create THz radiation. We present our tuning procedures developed for the meter-long THESEUS undulators, consisting of two orthogonal permanent magnet Halbach arrays shifted by a quarter period relative to one another. The hall probe and pulsed wire measurements are guided by the general field expansion of helical undulators to correctly tune fields on and near the axis.

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Session Classification: Wednesday posters

Track Classification: Photon beamline instrumentation & undulators