CDCS
CENTER FOR DATA AND COMPUTING
IN NATURAL SCIENCES

OPENING SYMPOSIUM 2022

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

DESY.

TUHH

Contribution ID: **82** Type: **Poster**

Machine learning-based surrogate model construction for optics matching at the European XFEL

Beam optics matching is a daily routine in the operation of an X-ray free-electron laser facility. Usually, linear optics is employed to conduct the beam matching in the control room. However, the collective effects like space charge dominate the electron bunch in the low-energy region which decreases the accuracy of the existing tool. Therefore, we proposed a scheme to construct a surrogate model with nonlinear optics and collective effects to speed up the optics matching in the European XFEL injector section. Furthermore, this model also facilitates further research on beam dynamics for the space-charge dominated beam.

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Session Classification: Poster session with buffet

Track Classification: CDL4 (Control of Accelerators)