Contribution ID: **13** Type: **Oral (16mins + 4 mins)**

Beam Condition Forecasting with Non-destructive Measurements at FACET-II

Thursday, March 7, 2024 9:40 AM (20 minutes)

Beam diagnostic technology is one of the foundations of large particle accelerator facilities. A challenge with operating these systems is the measurement of beam dynamics. Many methods such as beam position monitors have an inherent destructive quality to the beam and produce perturbations after the measurement. The ability to measure the beam conditions with non-destructive edge radiation allows for us to have a more stable understanding and predictability of the beam condition. We are developing a machine learning workflow for the downstream prediction and future forecasting of the beam condition utilizing the non-destructive edge radiation measurements and novel graph neural networks in collaboration with FACET-II at SLAC. Our methods divide the problem into two different aspects. First, we are developing machine learning algorithms with the beam physics integrated within each layer of the network. Second, developing an online surrogate model of edge radiation using SRW will allow for automatic generation of new beam states due to the changing parameters of accelerator facilities over time. We plan to integrate and test our prediction system at the SLAC facility to perform beam condition prediction and verification at FACET-II.

Primary Keyword

failure prediction

Secondary Keyword

surrogate model architecture

Tertiary Keyword

uncertainty quantification

Primary author: KILPATRICK, Matthew (RadiaSoft LLC)

Co-authors: O'SHEA, Brendan (SLAC); MOELLER, Paul (RadiaSoft LLC); WATT, Robbie (SLAC)

Presenter: KILPATRICK, Matthew (RadiaSoft LLC)

Session Classification: Anomaly Detection / Failure Prediction

Track Classification: Anomaly Detection / Failure Prediction