Contribution ID: **10** Type: **Poster (including Speed Talk)**

Virtual diagnostics for X-ray pulse characterization

Thursday 26 June 2025 10:20 (3 minutes)

Virtual diagnostic tools leveraging readily available input data to offer a non-invasive way to optimize Free-Electron Lasers (FEL) operation and delivery, especially when limitations with conventional diagnostics arise. This work presents a novel approach using an artificial neural network to online predict photon pulse pointing at MHz level for both soft and hard x-rays. The model input is based purely on parasitically available diagnostics of both the electron and the photon beam. The model is validated by diamond sensor measurements in order to measure the model ability to predict intra-train properties. This virtual diagnostic not only streamlines beam alignment and optimization, but is also the funding stone of a MHz-capable beam pointing stabilization. Furthermore, it further improves the online characterization of each photon pulse at MHz level.

Summary

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Session Classification: Beam Diagnostics

Track Classification: Beam diagnostics