



Contribution ID: 1889 Contribution code: MOPG64

Type: **Poster Presentation**

Linking edge-ML X-ray diagnostics and adaptable photoinjector laser shaping for leveraging the capabilities of LCLS-II

Monday, 20 May 2024 16:00 (2 hours)

SLAC's LCLS-II is rapidly advancing towards MHz repetition rate attosecond X-ray pulses, opening new opportunities to leverage the abundance of data in combination with advances in machine learning (ML) to better align the x-ray source with specific experimental goals. We approach the challenge from both ends of the facility. Starting at the X-ray output, we showcase our low latency, high throughput ML algorithms implemented at-the-edge for X-ray detection and reconstruction in the Multi-Resolution 'Cookiebox' (MRCO) angle resolved electron spectrometer with its 16 electron time-of-flight detectors. MRCO performs spectro-temporal characterization of X-ray profiles with a resolution that allows single shot identification of well-seeded shots versus SASE background at MHz rate. MRCO enables fast feedback, so we also tackle the problem as a control issue, focusing on programmable photoinjector laser shaping to adjust the initial electron bunch. Towards this end of using advances in ML to explore the parameter space for optimizing X-ray production, we present our progress towards a digital twin linking the photoinjector laser all the way through MRCO in the endstation diagnostics.

Footnotes

Funding Agency

DOE under Contract No. DE-AC02-76SF00515 (LCLS), DE-SC0022559, DE-SC002246, and FWP 100498; NSF under Contract No. 2231334; and DOD AFOSR under FA9550-23-1-0409 and under an ONR NDSEG Fellowship.

Paper preparation format

Word

Region represented

North America

Primary author: HIRSCHMAN, Jack (Stanford University)

Co-authors: LEMONS, Randy (SLAC National Accelerator Laboratory); ZHANG, Hao (University of California, Los Angeles); SHACKELFORD, Amanda (SLAC National Accelerator Laboratory); WANG, Minyang (University of California, Los Angeles); LI, Siqi (Stanford University); BRITTON, Mat (SLAC National Accelerator Laboratory)

Laboratory); EDELEN, Auralee (SLAC National Accelerator Laboratory); MARINELLI, Agostino (SLAC National Accelerator Laboratory); OBAID, Razib (SLAC National Accelerator Laboratory); CARBAJO, Sergio (University of California, Los Angeles); COFFEE, Ryan (SLAC National Accelerator Laboratory)

Presenter: HIRSCHMAN, Jack (Stanford University)

Session Classification: Monday Poster Session

Track Classification: MC2: Photon Sources and Electron Accelerators: MC2.A06 Free Electron Lasers