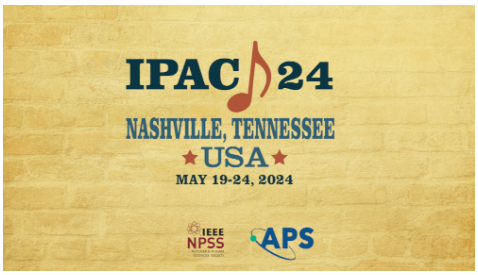

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Linking edge-ML X-ray diagnostics and adaptable photoinjector laser shaping for leveraging the capabilities of LCLS-II

Sunday, 19 May 2024 14:00 (4 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

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