Contribution ID: **229** Type: **not specified**

Phase space reconstruction of downramp-injection LPA electron beam for modeling FEL operation

Tuesday, 23 July 2024 16:48 (24 minutes)

Free electron lasers (FEL) are powerful scientific tools for a wide variety of applications which require bright, coherent X-ray light. FELs require electron beams with high requirements on brightness, as well as alignment and matching into the undulators. At the Hundred Terawatt Undulator (HTU) system at the BELLA Center, we are aiming to demonstrate a compact Laser-Plasma Accelerator (LPA)-driven FEL using 100-500 MeV electron beams from a gas jet target. Knowledge of the electron beam phase space prior to the undulator is key for achieving good FEL operation, and creative beam diagnostics can greatly improve our understanding of the electron beams generated in the compact LPA.

We present progress at adapting a machine-learning approach to reconstructing the transverse electron beam phase space using images of the electron beam in a quadrupole magnet scan. While this algorithm has previously been used with great success for electron beams produced in conventional accelerators, here we perform reconstructions using beams injected from an LPA with considerably more shot-to-shot jitter. Additionally, by including a dipole magnetic spectrometer we can improve this 4D transverse reconstruction to a 5D reconstruction using the electron beam's energy spectrum.

This work was supported by the U.S. Department of Energy (DOE) Office of Science, the Office of Basic Energy Sciences, and the Office of High Energy Physics, under Contract No. DE-AC02-05CH11231, and through a CRADA with Tau Systems.

Working group

WG5 : Beam sources, monitoring and control

Primary author: DOSS, Christopher (Lawrence Berkeley National Laboratory)

Co-authors: BARBER, Sam (LBNL); JENSEN, Kyle (Lawrence Berkeley National Lab); KOHRELL, Finn (Lawrence Berkeley National Lab); GONZALEZ-AGUILERA, Juan Pablo (University of Chicago); ROUSSEL, Ryan (SLAC National Laboratory); GONSALVES, Anthony J. (Lawrence Berkeley National Laboratory); OSTERHOFF, Jens (LBNL); SCHROEDER, Carl (Lawrence Berkeley National Laboratory); ESAREY, Eric (LBNL); VAN TILBORG, Jeroen (LBNL)

Presenter: DOSS, Christopher (Lawrence Berkeley National Laboratory)

Session Classification: WG5