



Contribution ID: 1997 Contribution code: WEPG72

Type: **Poster Presentation**

Fast laser focal position correction using deployed models

Wednesday, 22 May 2024 16:00 (2 hours)

Ultrafast high repetition-rate laser systems are essential to modern scientific and industrial applications. Variations in critical figures of merit, such as focal position, can significantly impact efficacy for applications involving laser plasma interactions, such as electron beam acceleration and radiation generation. We present a diagnostic and correction scheme for controlling and determining laser focal position by utilizing fast wavefront sensor measurements from multiple positions to train a focal position predictor. We present the deployment and testing of this scheme at the BELLA Center at Lawrence Berkeley National Laboratory. Online optical adjustments are made to a telescopic lens to provide the desired correction on millisecond timescales. A framework for generating a low-level hardware description of ML-based correction algorithms on FPGA hardware is coupled directly to the beamline using the AMD Xilinx Vitis AI toolchain in conjunction with deployment scripts.

Footnotes

Funding Agency

This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of High Energy Physics, under Award Number DE-SC0021680 and Prime Contract No. DE-AC02-05CH11231.

Paper preparation format

LaTeX

Region represented

North America

Primary author: COOK, Nathan (RadiaSoft LLC)

Co-authors: BERGER, Curtis (Lawrence Berkeley National Laboratory); VAN TILBORG, Jeroen (Lawrence Berkeley National Laboratory); EINSTEIN-CURTIS, Joshua (RadiaSoft LLC); BARBER, Samuel (Lawrence Berkeley National Laboratory); COLEMAN, Stephen (RadiaSoft LLC)

Presenter: COOK, Nathan (RadiaSoft LLC)

Session Classification: Wednesday Poster Session

Track Classification: MC6: Beam Instrumentation, Controls, Feedback, and Operational Aspects:
MC6.T03 Beam Diagnostics and Instrumentation