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Optimization of the ASU CXLS beamline in simulation via Bayesian methods

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Single objective Bayesian optimization is used in the simulation of the compact X-ray light source (CXLS) at Arizona State University, an inverse Compton based X-ray source, to optimize the 6D electron distribution prior to final focusing at the interaction point. For inverse Compton X-ray sources, a small 6D emittance as well as a small pulse (both transversely and longitudinally) are essential for producing bright X-ray pulses. Using IMPACT-T on a 200 pC initial charge with an RF photoinjector operating in blow-out mode, we vary parameters, such as transverse laser diameter on the cathode, RF gun phase, solenoid strength, as well as linac amplitude and phase, to balance minimizing the 6D emittance and spatial profiles. We test objective functions that are combinations of beam parameters, such as energy spread before final focus, pulse duration, and normalized emittance.

Footnotes

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Primary author: MALIN, Lucas (Arizona State University)

Co-authors: GARDECK, Alex (Arizona State University); QIANG, Ji (Lawrence Berkeley National Laboratory); HOLL, Mark (Arizona State University); JASWAL, Rejul (Arizona State University); GRAVES, William (Arizona State University)

Presenter: MALIN, Lucas (Arizona State University)

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