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Automation and Control of Laser-Plasma Accelerators using Bayesian Optimisation ROB SHALLOO, DESY, ET AL., Multiple — A new generation of particle accelerator facilities based on laser-plasma sources are being established globally. Controlling the highly nonlinear physics of laser-plasma accelerators is challenging, as small changes to the input parameters can create a fundamental shift in behaviour. Here, we demonstrate the application of machine learning techniques to automate the control and optimisation of the electron and X-ray beams generated by a plasma accelerator. The algorithm, based on Bayesian optimisation, simultaneously varied up to 6 parameters controlling the spectral and spatial phase of the laser as well as the plasma density and length. This enables efficient optimisation and tailoring of electron and X-ray source properties for different potential applications. It is also shown that interrogation of the models generated by the machine learning algorithm can be used to provide physical insight into the systems under study.

Rob Shalloo
DESY

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