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Bayesian Optimization of Laser-Plasma Accelerators

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Laser-plasma accelerators (LPA) are one the verge of becoming drivers for real-world science applications. However, in order to be considered serious alternatives to conventional machines they need to be able to provide competitive quality and versatility of the electron beam parameters as requested by potential applications. As shown by numerous experiments in the past LPAs are in principle capable of doing so. However, specifically finding the configuration of machine parameters to satisfy the demands of an application remains a complex task that involves the optimization of a single or multiple, oftentimes competing, objectives. Bayesian optimization provides a framework that can help to efficiently tune a machine to provide beams individually tailored for each intended application.
Here we show our latest results on optimization of plasma accelerators both in the design phase using simulation and in real time at the LUX experiment and show a perspective of efficiently tuning the experiment to suit various applications.

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