

## Automated Laser Plasma Accelerators

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This presentation will discuss results on the automation and control of laser wakefield accelerators using Bayesian optimisation. By automating the experimental controls and integrating real-time quantitative analysis of the experimental diagnostics we were able to reduce operation of the accelerator to execution of a line of code. With this system in place, it was then relatively straightforward to perform automated parameter scans and to apply optimisation techniques borrowed from the field of machine learning. We find that Gaussian Process Regression efficiently uses the experimental data to build models of the parameter space and allows for rapid optimisation of any function of the experimental diagnostics. In addition, the models built by this algorithm can also be used to explore the underlying physics to gain valuable insight. We consider that this methodology will be invaluable to the next generation of plasma-based accelerator facilities due to the enhanced performance, stability, and usability it provides.