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Optimization of high repetition-rate laser wakefield accelerators using machine-learning techniques[1] JON MURPHY, YONG MA, MILOS BURGER, JOHN NEES, ALEC THOMAS, KARL KRUSHELNICK, University of Michigan — Many potential applications of laser accelerator sources require operation at high repetition rate. Here, 20 milliJoule pulses are generated at kilohertz repetition rate for pulse self-compression and laser wakefield acceleration experiments. A genetic algorithm is implemented using a Dazzler acousto-optic programmable dispersive filter with the laser pulse characteristics from FROG measurements or wakefield electron beam signal optimized onto several different masks used as feedback. This procedure allows a heuristic search for the optimal laser pulse phase characteristics up to 4th order to produce a desired arbitrary wakefield electron beam or a well self-compressed pulse. Additionally, in progress is the implementation of a spiral phase plate in order to produce a $Laguerre - Gaussian_{01}$ laser pulse with optical angular momentum. Were investigating the use of this exotic beam for laser wakefield acceleration experiments.

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