

Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Production and Optimized Spectroscopic Measurement of High Energy, Narrow Energy-Spread Electron Beams From a Modern Laser Wakefield Accelerator¹ JASON CARDARELLI, YONG MA, EVAN MAHLER, ANATOLY MAKSIMCHUK, JOHN NEES, KARL KRUSHELNICK, ALEXANDER THOMAS, University of Michigan — A continuing goal of laser wakefield acceleration (LWFA) research is to decrease the spread in energy of the electron beams that these accelerators can produce while simultaneously increasing the maximum central-energy of these beams. High energy mono-energetic beams are a requirement for most applications of LWFA including using accelerated beams as light sources, or as probes for fast-evolving fields. These beams present a challenge to accurately measure in the laboratory due to the standard dipole electron spectrometer's decrease in energy resolution as particle energies increase. In this work, it is demonstrated through particle-in-cell simulations of various LWFA injection mechanisms that high energy (in excess of 1 GeV) electron beams with low energy-spread (a few %) are produced using modern laser parameters and feasible experimental setups. These beams are then computationally measured using a simulated magnetic spectrometer. It is shown that a genetic algorithm approach may be applied to the configuration of the spectrometer's magnets and phosphorus screens in order to optimize energy resolutions in the energy range we are interested in. As LWFA beam energies continue to climb, further optimization of spectrometer techniques will be increasingly important.

¹Special thanks and acknowledgement to the NSF (Grant No. 1804463).

Jason Cardarelli
Univ of Michigan - Ann Arbor

Date submitted: 13 Aug 2020

Electronic form version 1.4