Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Optimizing Laser-Plasma Interactions for Ion Acceleration using Particle-in-Cell Simulations and Evolutionary Algorithms[1] JOSEPH SMITH, CHRIS ORBAN, Ohio State University, JOHN MORRISON, KEVIN GEORGE, Innovative Scientific Solutions, Inc., GREGORY NGIRMANG, National Research Council, ENAM CHOWDHURY, Ohio State University, W. MEL ROQUEMORE, Air Force Research Laboratory — The development of ultra-intense laser-based sources of high energy ions is an important goal for the field with a variety of potential applications. One of the barriers to achieving this is the need to maximize the laser to ion energy conversion efficiency. We use evolutionary algorithms to optimize laser to ion conversion efficiency by exploring variations of the target density profile and by performing thousands of one-dimensional particle-in-cell (PIC) simulations. We then use the optimal target from these one-dimensional PIC simulations in a series of two and three-dimensional PIC simulations comparing the optimal target to more conventional targets. Ions seem to accelerate from the optimal target with a TNSA-like mechanism but with increased laser coupling to electrons due to the target geometry. These results underscore the potential for this statistics-driven approach to optimizing laser-plasma simulations and experiments.

[1]We acknowledge support from the Air Force Office of Scientific Research and from the DOD High Performance Computing Modernization Program

Joseph Smith
Ohio State University

Date submitted: 03 Jul 2019 Electronic form version 1.4