Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Improved Particle Statistics for Laser-Plasma Self-Injection Simulations[1] BENJAMIN COWAN, Tech-X Corporation, SERGUEI KALMYKOV, KYLE BUNKERS, University of Nebraska, Lincoln, JOHN CARY, Tech-X Corporation, BRAD SHADWICK, DONALD UMSTADTER, University of Nebraska, Lincoln — Simulations of laser-plasma acceleration (LPA) play a key role in understanding the effect of initial conditions on injected beam parameters. Here we present a method for improving the accuracy of simulated particle beams from the LPA self-injection process. We recently demonstrated the ability to compute the collection volume of an injection process – the range of initial locations of injected particles. We find that the collection volume consists of an annular region around the propagation axis. By loading this region with higher particle statistics than in other locations, we can significantly increase the number of macroparticles in the injected beam. We show that this technique captures much finer detail of particle phase space than does uniform loading, and results in lower noise. We demonstrate convergence of key beam parameters in 2D, and present results of full 3D simulations. In addition, we present results of a novel technique in which particles can deform and split if they expand, effectively self-generating statistics. We also discuss a perfect dispersion algorithm and its impact on self-injection results.

[1]Work supported by Contracts DOE DE-SC0006245, DE-FC02-07ER41499, DE-FG02-08ER55000, and DE-FG02-05ER15663; NSF PHY-1104683; DTRA HDTRA1-11-C-0001; and AFOSR FA9550-11-1-0157 and 9550-08-1-0232.

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Date submitted: 13 Jul 2012 Electronic form version 1.4