Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

A detailed examination of the LWFA in the Self-Guided Nonlinear Blowout Regime for 15-100 Joule Lasers[1] ASHER DAVIDSON, ADAM TABLEMAN, PEICHENG YU, WEIMING AN, FRANK TSUNG, WARREN MORI, University of California, Los Angeles, CA 90095, USA, WEI LU, Tsinghua University, Beijing, China, RICARDO FONSECA, GoLP/Instituto de Plasmas e Fuso Nuclear, Instituto Superior Tecnico, Universidade de Lisboa, Lisbon, Portugal — We examine scaling laws for LWFA in the regime nonlinear, self-guided regime [Lu et al. Phys. Rev. Spec. Top. Accel. Beams 10, 061301 (2007)] in detail using the quasi-3D version of the particle-in-cell code OSIRIS. We find that the scaling laws continue to work well when we fix the normalized laser amplitude while reducing plasma density. It is further found that the energy gain for fixed laser energy can be improved by shortening the pulse length until self-guiding almost no longer occurs and that the energy gain can be optimized by using lasers with asymmetric longitudinal profiles. We find that when optimized, a 15 J laser may yield particle energies as high as 5.3 GeV without the need of any external guiding. Detailed studies for optimizing energy gains from 30 J and 100 J lasers will also presented which indicate that energies in excess of 10 GeV can be possible in the near term without the need for external guiding.

[1]This work is supported by the NSF and DOE.

Asher Davidson
University of California, Los Angeles, CA 90095, USA

Date submitted: 13 Jul 2017 Electronic form version 1.4