Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Understanding and optimizing the LWFA in the nonlinear self-guided blowout regime ASHER DAVIDSON, PEICHENG YU, XINLU XU, FRANK TSUNG, THAMINE DALICHAOUCH, UCLA, WEI LU, Tsinghua, WEIMING AN, WARREN MORI, UCLA — We report on recent results on LWFA in the nonlinear, self-guided, blowout regime, where the normalized vector potential is larger than 4. In the work of Lu et al. [Phys. Rev. Spec. Top. Accel. Beams 10, 061301 (2007)], matching conditions for the laser spot size were presented as well as scaling laws for the accelerated electron energy in terms of laser and plasma parameters. Recent advances in PIC modeling, including the quasi-3D and boosted frame techniques now make it possible to study these scaling laws for higher laser energies. The quasi-3D algorithm uses a PIC algorithm on an r-z grid and a girdless description in the azimuthal angle. The fields are expanded in azimuthal harmonics that are truncated at a chosen number. We have implemented this algorithm in OSIRIS and here we use it to examine the nonlinear regime for existing and future 15-100 Joule lasers. Excellent agreement with the scaling laws in Lu et al. was found. In addition, we study adjustments to the laser profile characteristics in which the electron beam is optimized for a fixed energy laser.

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Date submitted: 24 Jul 2015 Electronic form version 1.4