Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Hybrid fluid-PIC simulations of injected electron beams in laser wakefield accelerators[1] DAVID BRUHWILER, JOHN CARY[2], BEN COWAN, Tech-X Corporation, CAMERON GEDDES, ESTELLE CORMIER-MICHEL, ERIC ESAREY, Lawrence Berkeley National Laboratory — Laser wakefield accelerators (LWFA) have accelerated $\sim nC$ electron bunches to $\sim GeV$ energies over cm scale distances, via self-trapping of plasma electrons. Self-trapping cannot be tolerated in staged LWFA modules for high-energy physics applications. The % level energy spread of self-trapped electron bunches is an order of magnitude too large for light source applications. Both of these difficulties could be resolved via external injection of a low-emittance electron bunch into a quasilinear LWFA, for which the dimensionless laser amplitude is in the range $0.5 < a_0 < 2$. It is challenging for an electromagnetic PIC simulation to model such systems without artificial emittance growth in the beam. An improved cold, relativistic fluid model is used in the parallel VORPAL framework to simulate the electron plasma with no particle noise, while PIC is used for the beam. The importance of high-order particle shapes, current smoothing and other techniques is also discussed.

[1]Work supported by the US DOE Office of Science, Office of High Energy Physics
[2]also University of Colorado

David Bruhwiler
Tech-X Corporation

Date submitted: 20 Jul 2008 Electronic form version 1.4