Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Fluid simulations of GeV scale laser plasma accelerator experiments[1] D.L. BRUHWILER, J.R. CARY, Tech-X, C.B. SCHROEDER, E. ESAREY, LBNL, B.M. COWAN, E. CORMIER-MICHEL, Tech-X, C.G.R. GEDDES, W.P. LEEMANS, LBNL — The cold, relativistic fluid algorithm of the parallel VORPAL framework [1] is used to simulate GeV scale laser plasma accelerator stages in the quasilinear regime. Simulations conducted in a Lorentz-boosted frame are compared with results using appropriately scaled physical parameters [2]. Both approaches offer speed-up which can exceed 1000x for meter-scale interaction lengths; however, boosted frame simulations can correctly treat betatron oscillations of the laser pulse and the accelerated bunch, which is important for accurate treatment of the beam emittance. The parallel 1D, 2D and 3D fluid algorithm in VORPAL has been shown to agree with PIC for laser-plasma simulations in the quasilinear regime, it is free of particle noise, and it can be used together with a PIC representation of the accelerated bunch. We will address the difficult question of preserving ultra-low beam emittance. Also, progress on implementation of a warm, relativistic fluid model [3] will be presented.

[1] Nieter and Cary, JCP (2004).
[2] Cormier-Michel et al., AAC (2008).
[3] Schroeder and Esarey, PRE (2010).

[1]Work supported by DOE Office of Science, Office of High Energy Physics.

David Bruhwiler
Tech-X Corporation

Date submitted: 26 Jul 2010 Electronic form version 1.4