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Mitigating Particle Integration Error in Relativistic Laser-Plasma Simulations ADAM HIGUERA, University of Colorado at Boulder, KATHLEEN WEICHMANN, University of Texas at Austin, BENJAMIN COWAN, JOHN CARY, Tech-X Corporation — In particle-in-cell simulations of laser wakefield accelerators with a_0 greater than unity, errors in particle trajectories produce incorrect beam charges and energies [1], predicting performance not realized in experiments such as the Texas Petawatt Laser [2]. In order to avoid these errors, the simulation time step must resolve a time scale smaller than the laser period by a factor of a_0. If the Yee scheme advances the fields with this time step, the laser wavelength must be over-resolved by a factor of a_0 to avoid dispersion errors. Here is presented and demonstrated with Vorpal [3] simulations, a new electromagnetic algorithm, building on previous work [4, 5, 6], correcting Yee dispersion for arbitrary sub-CFL time steps, reducing simulation times by a_0.

A. V. Arefiev, et al., Physics of Plasmas (1994-present) 22, 013103 (2015).

X. Wang, et al., Nature communications 4, 1988 (2013).

C. Nieter and J. R. Cary, J. Comp. Phys. 196, 448 (2004).

B. M. Cowan, et al., Phys. Rev. Special Topics- Accelerators and Beams 16, 041303 (2013).

B. Finkelstein and R. Kastner, J. of Comp. Phys. 221, 422 (2007).

R. Lehe, A. Lifschitz, C. Thaury, V. Malka, and X. Davoine, Physical Review Special Topics-Accelerators and Beams, 021301 (2013).

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