Abstract Submitted
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High-fidelity Simulations of Laser Pulses in long Plasma Channels[1] D. BRUHWILER, P. MESSMER, J. CARY[2], C. NIETER, D. DIMITROV, Tech-X Corp., E. ESAREY, W. LEEMANS, C. GEDDES, LBNL — Capillary discharge plasma channels, with cm lengths and moderate densities, show promise for laser wakefield accelerators operating in a mildly nonlinear regime, with higher energy trapped electrons and fewer laser-plasma instabilities. High-fidelity simulations are required to verify that the laser pulse can sustain a stable plasma wake over such long distances. Absorbing boundary conditions are required to prevent reflections of scattered laser energy back into the domain. The 2nd-order electromagnetic field update used in particle-in-cell (PIC) codes may not propagate a laser pulse over many Rayleigh lengths with sufficient accuracy, so higher-order algorithms must be considered. A PIC model is necessary to see particle trapping and non-laminar flow in the wake, but the particle noise may degrade accuracy over long times, so fluid models are important. The ratio of time and space scales between a laser pulse and a capillary discharge plasma can be $\sim$100, requiring tremendous computational resources for explicit simulations, so the use of ponderomotive guiding center algorithms to average over the smallest time and space scales of the pulse are important. We present initial efforts to address these issues, using the VORPAL code.

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[2]also Univ. of Colorado

David Bruhwiler
Tech-X Corporation

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