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Hybrid Algorithms for Modeling Plasma Jet Transport and Merging[1] NICHELLE BRUNER, CARSTEN THOMA, ROBERT CLARK, DALE WELCH, Voss Scientific, LLC — New algorithms have been developed which enable more stable and accurate modeling of high energy density (HED) plasmas. These algorithms have been incorporated in a hybrid particle framework within the fully electromagnetic, implicit particle-in-cell (PIC) code LSP. The hybrid framework combines a treatment of thermal plasma species governed by fluid equations of motion with more energetic, non-Maxwellian particle species treated fully kinetically. The hybrid PIC approach enables modeling of the dynamics of HED plasmas which are inaccessible in a magnetohydrodynamic code, such as kinetic instabilities, turbulence, finite mean-free-path effects, charge separation, complex ion orbits, and strong Hall physics. The new algorithms include a stabilizing remap technique for kinetic particles, a charge-conserving fluid algorithm, and a treatment for multiple-ionization states, and an equation-of-state (EOS) formalism. The improved model is used to simulate HED plasma jet transport and merging under conditions expected for the upcoming Plasma Liner Experiment (PLX) at Los Alamos National Laboratory. For this configuration, the kinetic treatment is required to accurately model dynamics during jet interpenetration.

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