Abstract Submitted
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Simulation of Plasma Jet Dynamics using Hybrid Particle-in-Cell Methods[1] T. HUGHES, T. GENONI, R. CLARK, D. WELCH, Voss Scientific, LLC, M. PHILLIPS, D. WITHERSPOON, HyperV Technologies Corp. — High-energy plasma jets have potential applications in both magnetic and inertial fusion*. Because of the high plasma densities (10^{17}–10^{19} cm^{-3}), and long timescales (several μsec), it is not practical to treat the bulk electrons as kinetic PIC particles. We are applying hybrid methods, including Electron Magnetohydrodynamics (EMHD), where the electrons are treated as an inertialess fluid, and an electron-fluid method, where the electron inertia is retained. The main difficulty in the EMHD method is due to discontinuous field derivatives across the moving plasma-vacuum interface. We solved this by using the vector potential **A** instead of the **E** and **B** fields. We have derived stability conditions for the algorithm: a conventional diffusion-equation constraint, and a constraint on the grid magnetic Reynolds number (ratio of convective to diffusive transport of the magnetic field over one cell). We show results of θ- and z-pinch benchmark calculations in 1D and 2D, and preliminary results applying the algorithm to the HyperV plasma jet experiments.[2]

[1]Work supported by DOE Office of Fusion Energy Science.
[2]F. D. Witherspoon and F. Y. Thio, "Dense Hypervelocity Plasma Jets for Fusion Applications", Bulletin of the American Physical Society, Vol. 50, No. 8, Oct. 2005. (http://www.hyperv.com/projects/pic/)

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