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Hybrid Kinetic-Fluid Electromagnetic Simulations of Imploding High Energy Density Plasmas for IFE[1] DALE WELCH, DAVE ROSE, CARSTEN THOMA, THOMAS GENONI, NICHELLE BRUNER, ROBERT CLARK, Voss Scientific, WILLIAM STYGAR, RAMON LEEPER, Sandia National Laboratories — A new simulation technique is being developed to study high current and moderate density-radius product (ρR) z-pinch plasmas relevant to Inertial Fusion Energy (IFE). Fully kinetic, collisional, and electromagnetic simulations of the time evolution of up to 40-MA current (deuterium and DT) z-pinches, but with relatively low ρR, have yielded new insights into the mechanisms of neutron production.[2] At fusion relevant conditions (ρR > 0.01 gm/cm^2), however, this technique requires a prohibitively large number of cells and particles. A new hybrid implicit technique has been developed that accurately describes high-density and magnetized imploding plasmas. The technique adapts a recently published algorithm,[3] that enables accurate descriptions of highly magnetized particle orbits, to high density plasmas and also makes use of an improved kinetic particle remap technique. We will discuss the new technique, stable range of operation, and application to an IFE relevant z-pinch design at 60 MA.

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[2]D. R. Welch, *et al.,* Phys. Rev. Lett. **103**, 255002 (2009).
[3]T. C. Genoni, *et al.*, Open Plasma Phys. J. **3**, 36 (2010).

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