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Improvements to Quasineutral, Kinetic-Ion Hybrid Particle-in-Cell Modeling DREW HIGGINSON, ANTHONY LINK, MATTHEW MCMAHON, NATHAN MEEZAN, WILL RIEDEL, ANDREA SCHMIDT, SCOTT WILKS, Lawrence Livermore Natl Lab, DALE WELCH, Voss Scientific — In many physical situations, single-fluid magnetohydrodynamic codes do not adequately capture all relevant physics, yet fully-kinetic simulations are computationally prohibitive. For instance, in the acceleration of high-energy, >100 keV, ion beams in dense plasma focus Z-pinch implosions, where instabilities generate strong electric fields leading to ion acceleration and neutron production. Other situations include the interpenetration of fast, >100 km/s, ion streams that may have mean-free-paths much longer than relevant scale lengths. In such situations, a hybrid model with kinetic ions and fluid electrons can capture the relevant ion physics, while still operating at fast computational speeds. In this work, we detail recent improvements and benchmarks implemented in the framework of the particle-in-cell code Chicago [Thoma et al. PoP 24, 062707 (2017)]. The method follows the motion of kinetic ions, and models electrons using a quasi-neutral, magnetized Ohms law. The importance of proper treatment of ion-electron collisions will be discussed. Prepared by LLNL under Contract DE-AC52-07NA27344.

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