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FPIC: A Key Next Step for Stability Studies of Advanced Beam Driven FRCs SEAN DETTRICK, DAN BARNES, FRANCESCO CECCHERINI, LAURA GALEOTTI, VICTOR GUERRERO, DOUG HENDRIX, KEVIN HUBBARD, RICHARD MILROY, ALES NECAS, TriAlpha Energy Inc, TAE TEAM
— The goal of the C-2U experiment [1] is to use neutral beam heating and edge biasing to sustain an advanced beam-driven FRC for many milliseconds, longer than the growth times of known instabilities and the resistive wall time. To guide the experiment further into unexplored parameter regimes, it is desirable to have a stability code suitable for beam-driven FRC plasmas, in which the bulk of ion orbits are not Larmor-like and hence gyrokinetic approximations are inapplicable. Fully kinetic ions are required for stability simulations of beam driven FRCs, as are multiple ion species, end boundary conditions, and a resistive boundary. To meet these challenges a new 3D quasineutral hybrid code, FPIC, is being developed. FPIC has a choice of zero electron mass and finite electron mass Ohm's law solvers. Uniform staggered grids, finite differencing, and cut cell boundaries are used to simplify and optimize the PIC while allowing arbitrary boundary shapes. Finite resistivity of the boundary is implemented by coupling free-space exterior solutions to the cut-cell edges. The code is MPI parallelized and the particle push is GPU accelerated. Code benchmarks will be presented including the stability of the FRC tilt mode.

[1] M.W. Binderbauer et al., Phys. Plasmas 22, 056110 (2015).

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