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Hybrid Fluid Model for a Driven, Ion-Current FRC HAFIZ RAHMAN, FRANK WESSEL, NORMAN ROSTOKER, MICHL BINDERBAUER, Tri Alpha Energy, Inc., PAUL NEY, Mount San Jacinto, Menifee — Standard magnetohydrodynamic (MHD) models do not include the effects of an externally applied finite-electric field, finite ion gyro-radius, and ion gyro-period. The 2D radiation hydrodynamic MHD code, MACH2, has been modified in the azimuthal direction to account for two-fluid behavior, while keeping the radial and axial MHD character, in order to simulate the formation of a "driven," field-reversed configuration (FRC). The simulation is run for a period of 150 μs, during which time an azimuthal ion current develops, the FRC forms, and then compresses radially and axially, all while remaining stable. The FRC is characteristic of a Rigid Rotor Equilibrium.[1] Once the FRC forms, an electron current develops, that adds to the total current and sharpens the magnetic-field profile. The simulation results agree with experiments, specifically the r-z shape of the FRC, the magnitude of the total current, magnetic field, plasma density and temperature measurements.

[1]N. Rostoker and A. Qerushi, Phys Plasmas 9(7), p.3057(2002).

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