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Flux-Coil Generated, Field-Reversed Configuration FRANK WESSEL, THOMAS ROCHE, NATHAN BOLTE, MICHL BINDERBAUER, MARK MOREHOUSE, NORMAN ROSTOKER, MIKHAIL SLEPCHENKOV, Tri Alpha Energy, Inc. — We study two methods of forming a FRC: 1) pre-ionizing a static-gas fill, and 2) using a pre-injected plasma. A 0.6-m dia × 2-m pyrex vessel is configured with an external coil, to provide the bias-B_z field, and a central, flux-coil to form the FRC diamagnetically. Diagnostics include: tomography, spectroscopy, interferometry, magnetic-probe arrays, particle time-of-flight, triple probe. The measured plasma parameters are: $n = 0.1{-}1{\times}10^{14}$ cm^{-3}, $T_i = 10{-}50$ eV, $B_{z0} \leq 20$ mT and indicate that the FRC radial profile is a rigid-rotor,[1] $n(r) = n_0/\cosh^2[(r^2 - r_0^2)/r_0\Delta r]$, $B(r) = -B_0[1 + \sqrt{\beta}\tanh[(r^2 - r_0^2)/r_0\Delta r)]$, where r_0 is the magnetic-null radius, and Δr is the FRC half-width. Data suggest that the sign of E_r and the dominant-current carrying species are opposite to previous reports[2] and derive from different collisionality and magnetization regimes, resulting from the methods of formation. When E_r points toward the magnetic field null, tomography indicates that the (ion) radial-diffusion coefficient is sub-classical and confining for ions.

[1]N. Rostoker and A. Qerushi, Phys. Plasmas, 9(7):3057(2002)
[2]W. S. Harris, E. Trask, T. Roche, et.al., PRL, 70(12):1818(2009)

Frank Wessel
Tri Alpha Energy, Inc.

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