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A New High Performance Field-Reversed Configuration Operating Regime in the C-2 Device

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Large-size hot FRCs are produced in the C-2 device by merging two dynamically-formed, high-beta, Compact Toroids.¹ The good confinement properties of these merged FRCs must be further improved to achieve the C-2 goal of FRC sustainment with neutral beam injection and pellet fuelling. Recently, an AMBAL plasma gun² and 2 T magnetic mirror end plugs were installed on C-2 to attempt electric field control of the plasma sheath outside of the FRC separatrix.³ The combined effects of the gun, mirror plugs, and neutral beams yielded the following important new results. First, the gun produced a radially inward electric field that countered the usual FRC spin-up and mitigated the dangerous $n = 2$ rotational instability without multipole magnetic fields. Better plasma centering was also obtained, presumably from line-tying to the gun electrodes. Second, longer (up to 2.5 ms) FRC lifetimes, with improved FRC flux confinement and rotational stability, were obtained with perpendicular (to B) neutral beam injection. Third, a factor 2 improvement of the FRC particle and global energy confinement times was obtained. These exciting new results will be detailed.

¹M.W. Binderbauer et al., Phys. Rev. Lett. **105**, 045003 (2010).

²T. Akhmetov et al., Trans. Fusion Science and Technology **43**, 58 (2003).

³M. Tuszewski, A. Smirnov et al., Trans. Fusion Science and Technology **59**, 23 (2010).