Initial Results of C-2W Field-Reversed Configuration Experiment

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TAE's research has been devoted to producing a high temperature, stable, long-lived field-reversed configuration (FRC) plasma state by neutral-beam injection (NBI) and edge biasing/control. C-2U experiments have demonstrated drastic improvements in particle and energy confinement properties of FRC's, and the plasma performance obtained via ~10 MW NBI has achieved plasma sustainment of up to 5 ms and plasma (diamagnetism) lifetimes of 10+ ms [1,2]. The emerging confinement scaling, whereby electron energy confinement time is proportional to a positive power of the electron temperature, is very attractive for higher energy plasma confinement; accordingly, verification of the observed T_e scaling law will be a key future research objective.

The new experimental device, C-2W (also known as "Norman"), has been constructed with the following key subsystem upgrades from C-2U: (i) higher injected power (up to ~19 MW), optimum and adjustable energies (15–40 keV), and extended pulse duration (up to 30 ms) of the NBI system; (ii) installation of inner divertors with upgraded edge-biasing electrode systems, which allow for high voltage and long-pulse operation; (iii) increased overall stored energy in the FRC formation pulsed-power system; (iv) fast external equilibrium/mirror-coil current ramp-up capability; (v) installation of trim/saddle coils for active feedback control of the FRC plasma; and (vi) enhanced overall diagnostic suite. C-2W experiments have recently commenced, so this paper will review highlights of the C-2W program along with the initial/preliminary experimental results.

[1] M.W. Binderbauer *et al*., AIP Conf. Proc. **1721**, 030003 (2016).

[2] H. Gota *et al*., Nucl. Fusion **57**, 116021 (2017).