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8.42 Measurements of Formation Dynamics in a Multi-Pulse Compact Toroid Injector System

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The C-2W experiment at TAE Technologies aims at sustaining an advanced beam-driven field reversed configuration (FRC) plasma. However, FRC lifetime is limited by particle confinement, among other factors. Injecting a supersonic compact toroid (CT) through the separatrix radius (R_s) is a means of refueling the FRC's core with deuterium. For long-lived plasmas there is a need for multiple, non-disruptive, refueling events with uniform CTs. To develop a consistent and repetitive injection system a dedicated test bed exists to study formation dynamics, as well as translation and merging of CTs. The test bed is outfitted with a diagnostic suite including b-dot probes, a triple probe, an interferometer, rogowskis and a collimated fiber optic array to measure plasma parameters such as electron density (n_e), electron temperature (T_e) and magnetic fields, in addition to macroscopic attributes such as CT velocity, volume and particle count. Neutral gas build-up has been mitigated, in part, by the adoption of a plasma source for pre-ionization which assists the compact toroid injector (CTI) breakdown and increases the ionization fraction. Particulars of pulse to pulse repeatability, which is affected by the accumulation of neutral gas, lingering plasma and pulsed power supply variation.

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