

Abstract Submitted
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Beam-plasma instabilities and their impact on D-D reactivity

ALES NECAS, R. MAGEE, T. TAJIMA, Tri Alpha Energy, B. NICKS, University of California, Irvine, M. SEGGEBRUCH, University of Florida, E. GARATE, I. ALLFREY, T. VALENTINE, Tri Alpha Energy, ENTIRE TAE TEAM — The goal of the C-2U program [1] is to achieve 5+ms steady state FRC sustainment via beam injection. In support, we simulate possible beam driven instabilities that are non-destructive, but transfer energy from fast ions to the plasma, causing phase space bunching. Such a mechanism may explain an experimentally observed anomalous neutron signal (10-100× greater than the predicted thermonuclear component and peaking between 1-2 ms, correlated with a 1 ms beam slowing down time), as other explanations have been eliminated (D in the beams, fast-thermal ion head-on collisions, and miscalculation of Ti). We propose that the hydrogen beam generates an energetic ion population that then drives collective modes in the plasma, giving rise to an instability and increased fusion rate. A two-body correlation function is employed to determine DD reactivity enhancements. The instability changes character from electrostatic (ES; phase velocity is 70% of the beam velocity) in the low beta edge to fully electromagnetic (EM; at magnetosonic speeds) in the core, with an associated reduction in growth rates. A 1D ES analytical dispersion relation will be compared with a 1D3V PIC code [2] (full EM study only performed with PIC code). Results from simulations are consistent with the observed neutron yield.

[1] M. Binderbauer et al., Phys. Plasmas 22, 056110 (2015)

[2] J.W.S. Cook et al., Plasma Phys. Control. Fusion 53, 074019 (2011)

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