

Overview of C-2U Field-Reversed Configuration Experiments

Author: Hiroshi Gota

Requested Type: Consider for Invited

Submitted: 2016-01-05 16:03:02

Co-authors: M.W. Binderbauer, T. Tajima, S. Putvinski, M. Tuszewski, D. Barnes, S. Dettrick, E. Garate, S. Korepanov, A. Smirnov, M.C. Thompson, X. Yang, M. Cappello, and the TAE Team

Contact Info:

Tri Alpha Energy, Inc.

P.O. Box 7010

Rancho Santa Margarita, CA 92688

USA

Abstract Text:

The world's largest compact toroid (CT) device, C-2, has recently been upgraded to C-2U at Tri Alpha Energy to achieve sustainment of field-reversed configuration (FRC) plasmas by neutral-beam (NB) injection and edge-biasing control [1, 2]. The C-2 experimental program was successfully completed with dramatic improvements in confinement and stability compared to other FRC devices; C-2's high-performance FRC (HPF) plasma discharges have demonstrated increasing plasma pressure and electron temperature during brief periods of the discharge, which indicates an accumulation of fast ions as well as a core/edge plasma heating by NB injection. The edge-biasing stability control by end-on plasma guns also played an important role in producing HPF plasmas, synergetically with NB injection.

In order to enhance the fast-ion effects and further improve the FRC performance, the C-2U experiment has commenced with the following key system upgrades: increased total NB input power from ~4 MW (20 keV hydrogen) to 10+ MW (15 keV hydrogen) with tilted injection angle; enhanced edge-biasing capability inside end-divertors for boundary and stability control. The C-2U device also features upgraded/new systems such as CT injectors and cryogenic pellet injector for particle inventory control, flux-conserving external coils for plasma length/shape control, and augmented plasma diagnostics for better understanding of FRC physics phenomena. The C-2U experiments have already demonstrated dramatic improvements in FRC performance culminating with sustaining advanced beam-driven FRCs with macroscopically stable and hot plasma state for up to 5+ ms. The C-2U experiment can also produce longer-pulsed plasma discharges, up to 10+ ms. The overall C-2U experimental program and recent accomplishments will be reviewed at the meeting.

[1] M. Tuszewski et al., Phys. Rev. Lett. 108, 255008 (2012).

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

Comments: