

NSTX-U Weekly Report (June 16, 2017)

NSTX-U Research (J. Menard)

The paper “Overview of NSTX Upgrade initial results and modelling highlights” by J.E. Menard, et al. has been published in the journal Nuclear Fusion (<https://doi.org/10.1088/1741-4326/aa600a>). The abstract reads “The National Spherical Torus Experiment (NSTX) has undergone a major upgrade, and the NSTX Upgrade (NSTX-U) Project was completed in the summer of 2015. NSTX-U first plasma was subsequently achieved, diagnostic and control systems have been commissioned, the H-mode accessed, magnetic error fields identified and mitigated, and the first physics research campaign carried out. During ten run weeks of operation, NSTX-U surpassed NSTX record pulse-durations and toroidal fields (TF), and high-performance ~1 MA H-mode plasmas comparable to the best of NSTX have been sustained near and slightly above the $n = 1$ no-wall stability limit and with H-mode confinement multiplier $H_{98y,2}$ above 1. Transport and turbulence studies in L-mode plasmas have identified the coexistence of at least two ion-gyro-scale turbulent micro-instabilities near the same radial location but propagating in opposite (i.e. ion and electron diamagnetic) directions. These modes have the characteristics of ion-temperature gradient and micro-tearing modes, respectively, and the role of these modes in contributing to thermal transport is under active investigation. The new second more tangential neutral beam injection was observed to significantly modify the stability of two types of Alfvén eigenmodes. Improvements in offline disruption forecasting were made in the areas of identification of rotating MHD modes and other macroscopic instabilities using the disruption event characterization and forecasting code. Lastly, the materials analysis and particle probe was utilized on NSTX-U for the first time and enabled assessments of the correlation between boronized wall conditions and plasma performance. These and other highlights from the first run campaign of NSTX-U are described.”

NSTX-U physicists and engineers participated in the Mini-Course on Diagnostics for Fusion Plasmas at the 27th Symposium on Fusion Engineering (SOFE) in Shanghai, China. The mini-course was organized by R. Kaita and B. Stratton, and targeted engineers and early-career researchers seeking an introduction to fusion plasma diagnostics. There was a particular emphasis on the requirements and practical engineering issues related to diagnostic implementation. The following topics were covered by members of the NSTX-U team: 1) Overview of diagnostics for fusion plasmas (R. Kaita), 2) Thomson scattering for direct and localized measurement of electron properties (A. Diallo), 3) Plasma confinement diagnostics to determine fusion device performance: ion temperature, density and plasma rotation (M. Podesta), 4) X-ray diagnostics for plasma macrostability research (K. Tritz), 5) Engineering issues for diagnostic implementation (R. Ellis), and 6) Fusion product diagnostics (R. Kaita). At SOFE, R. Kaita gave an invited talk entitled "Synergies in Liquid Metal Technology Development for Divertor Applications" that included NSTX results, and D.Cai presented a poster entitled "Lithium Evaporation System Design for the NSTX-Upgrade Fusion Device" on a system under development for coating the upper NSTX-U vacuum vessel with lithium.

NSTX-U Recovery Project (R. Hawryluk)

An Inner PF coil Prototype RFQ has been posted and sent to coil fabricating vendors. Coil conductor cleaning and priming continued at Everson Tesla. A review of the final design for the test stand and instrumentation for the power testing of individual inner PF coils was held this week.

In vessel, the removal of tiles in preparation for the analysis of the passive plates was completed. The vessel floor has been removed and a stand set up in preparation for passive plate and outboard divertor metrology.

The north and south labyrinths for the NSTX Test Cell have been evaluated for shielding enhancements. A design will now be prepared.