

NSTX-U Weekly Report (November 6, 2015)

NSTX-U is in the Upgrade Project outage in FY 2015

The joint 18th International Spherical Torus Workshop (ISTW-2015) and 2015 US-Japan Workshop on ST Plasmas were held in A01 McDonnell Hall at Princeton University, 3-6 November 2015. The workshop was well attended with approximately 100 registered participants. The workshop had approximately 50% international participation with representatives from China, Japan, Korea, Italy, the United Kingdom, the International Atomic Energy Agency (IAEA) in Vienna, Austria, and the United States. The workshop covered topics including compact toroids (field-reverse configurations, spheromaks) and spherical torus/tokamak physics including plasma initiation, energetic particles, core and edge transport, macroscopic stability, and wave heating and current drive. Presentations included 10 overview orals, 28 contributed orals, and 40 posters given in two poster sessions. The program also include guided tours of PPPL experimental facilities including visits to MRX, PFRC-2, LTX, QUASAR, the Hall Thruster, and the NSTX-U control room and test cell. Presentations from the workshop are archived at the following URL: <http://istw-2015.pppl.gov/agenda-presentations> (J. Menard, PPPL).

The paper “Modifications to ideal stability by kinetic effects in NSTX” by J.W. Berkery (Columbia University) et al., Nuclear Fusion **55** (2015) 123007 was recently published. The paper extensively examines the ideal and kinetic resistive wall mode (RWM) stability of NSTX high beta plasmas, including variations in plasma internal inductance, pressure peaking factor, and aspect ratio. The ideal stability of nearly 5,000 equilibria were examined from 350 plasma discharges. Further kinetic RWM marginal stability calculations as computed by the MISK code continue to show the correlation of this limit with the occurrence of disruptions in NSTX. This paper represents the most comprehensive set of such stability calculations for NSTX, and further supports the use of the kinetic RWM stability model to determine proximity to disruptions. (S.A. Sabbagh, Columbia University)

A letter entitled "Distinct turbulence sources and confinement features in the spherical tokamak plasma regime" by W. X. Wang (PPPL) et al., has been published online in Nuclear Fusion **55** (2015) 122001 (<http://stacks.iop.org/0029-5515/55/122001>). The nonlinear gyrokinetic study presented in this paper has discovered two new, important turbulence sources in the ST regime, which are the drift wave Kelvin-Helmholtz (KH) instability and the dissipative trapped electron mode (DTEM). For the first time, the KH mode is identified as a driver of significant transport in realistic fusion experiments. Also for the first time, long wavelength, quasi-coherent dissipative trapped electron modes are found to be excited over a wide range of NSTX parameter regime despite the presence of strong **EXB** shear, providing a robust turbulence source dominant over the traditional collisionless trapped electron modes in ST plasmas. Furthermore, DTEM-driven transport in NSTX parametric regime is shown to increase with electron collision frequency, offering one possible source for the confinement scaling observed in experiments. More interestingly, the existence of a minimum plasma transport regime that future advanced STs may access is predicted. (W. Wang)

M. Ono (PPPL) attended the 25th International Toki Conference in Toki, Japan, November 3 – 6, 2015. He gave an invited plenary presentation entitled “Spherical Tokamaks and Fusion Energy Development Path”, an overview of the world-wide ST research since 2000. (M. Ono)

M. Ono (PPPL) visited National Institute for Fusion Science (Gifu, Japan) on November 2, 2015 to discuss various collaboration topics with the NIFS and LHD scientists. He met with the LHD team members including Drs. Mutoh, Tamura, Kasahara, Seki, and Nagayama to discuss the recent ICRF results. M. Ono then met with Drs. Byron Peterson and his colleagues for collaboration on NSTX-U on a tangential divertor imaging bolometer system. A prototype system is being installed on NSTX-U. He also met with Prof. Hirooka to discuss the liquid lithium and metal R&D activities at NIFS. (M. Ono)

Engineering Operations (A. von Halle, P. Titus)

Vacuum leak checking for small air leaks that developed during the cool-down after the vessel bake continues. The vacuum and mass flow controls for the new deuterated trimethylboron (dTMB) system have been installed, and pre-operational testing of the dTMB system is making good progress. Power testing (into a resistive load) of the Switching Power Amplifier (SPA) systems that will be used to power the Resistive Wall Mode (RWM) coils was completed this past week. The Field Coil Power Conversion (FCPC) fault detector settings are now being finalized in preparation for field coil power testing, and the TF power supply cabling has been configured for 6 parallel power supply operation. Pre-operational testing of the Digital Coil Protection System (DCPS) was successfully completed this past week.

The NSTX-U Test Cell will be in restricted access this coming week during field coil testing.