

## **NSTX-U Weekly Report (June 12, 2015)**

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

A paper by Masayuki Ono (PPPL) et al., entitled "Progress toward commissioning and plasma operation in NSTX-U" was published online in Nuclear Fusion **55**, 73007 (2015) and is available at <http://stacks.iop.org/0029-5515/55/073007>. The National Spherical Torus Experiment-Upgrade (NSTX-U) is the most powerful spherical torus facility at PPPL, Princeton USA. The major mission of NSTX-U is to develop the physics basis for an ST-based Fusion Nuclear Science Facility (FNSF). The ST-based FNSF has the promise of achieving the high neutron fluence needed for reactor component testing with relatively modest tritium consumption. At the same time, the unique operating regimes of NSTX-U can contribute to several important issues in the physics of burning plasmas to optimize the performance of ITER. NSTX-U further aims to determine the attractiveness of the compact ST for addressing key research needs on the path toward a fusion demonstration power plant (DEMO). The upgrade will nearly double the toroidal magnetic field  $BT$  to 1 T at a major radius of  $R_0 = 0.93$  m, plasma current  $I_p$  to 2 MA and neutral beam injection (NBI) heating power to 14 MW. The anticipated plasma performance enhancement is a quadrupling of the plasma stored energy and near doubling of the plasma confinement time, which would result in a 5–10 fold increase in the fusion performance parameter  $n\tau T$ . A much more tangential 2nd NBI system, with 2–3 times higher current drive efficiency compared to the 1st NBI system, is installed to attain the 100% non-inductive operation needed for a compact FNSF design. With higher fields and heating powers, the NSTX-U plasma collisionality will be reduced by a factor of 3–6 to help explore the favourable trend in transport towards the low collisionality FNSF regime. The NSTX-U first plasma is planned for the summer of 2015, at which time the transition to plasma operations will occur. (M. Ono)

### **Experimental Research Operations (S. Gerhardt, R. Kaita)**

The electronics rack for the Materials Analysis and Particle Probe (MAPP) has been moved to the NSTX-U Test Cell (NTC). Preparations are in progress to establish communications with the MAPP control computer in the D-Site Data Acquisition Room (DARM), using a "remote desktop" in the NSTX-U Control Room. The connectivity will then be checked between the DARM computer and the electronics rack in the NTC. Initial tack welding of the support brackets to the upper umbrella structure was completed for both Bay F and Bay K Lithium Evaporators (LITERs). Bakeout of the bellows will begin after the LITER probe drives are leak-checked. This will enable the insertion of the LITERs into the vacuum vessel to check their alignment relative to the upper divertor penetrations. (R. Kaita, PPPL)

### **Physics Analysis (S. Kaye)**

A new algorithm has been implemented in the tshare version of the code that describes feedback on the anomalous fast ion diffusivity in order to have the calculated neutron rate match the measured one within one TRANSP run. A description of this feature can be found in <https://docs.google.com/document/d/1jCAA0nNWscULvwRc2yXLdAqyh7I6DYONaK8ArzjEnl/edit> or in the TRANSP Wiki <http://theorycodes.pppl.wikispaces.net/TRANSP>

This feature will be made available in a soon to be released pshare version of TRANSP. This will

be announced when it happens.

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

Recovery from an external arc fault at the Ohmic Heating (OH) coil terminals continued this past week. Drawings for upgrades to the new OH cooling tube supports are complete, and electrical insulation tests (Hi-Pots) of prototype supports were successful. Fabrication of the new OH ground clamp has been completed, and fit-ups are in progress. A review of the OH Coax connector was held this week. A pre-operational test procedure to document resistance measurements of TF flex bus assemblies has started. Low power laser alignments of the Multi-Pulse Thompson Scattering (MPTS) diagnostic flight paths continue to make good progress. The probe rack for the Purdue MAPP diagnostic has been installed on NSTX-U.

Access to the NSTX-U Test Cell is expected to be available this coming week. Access must be arranged through Work Permits approved by the D-Site Shift Supervisors.