

## NSTX-U Weekly Report (December 5, 2014)

### **NSTX-U is in the Upgrade Project outage in FY 2014**

Princeton University graduate student Tyler Abrams successfully defended his doctoral thesis entitled “Erosion and Re-Deposition of Lithium and Boron Coatings under High-Flux Plasma Bombardment” on November 24, 2014. His advisors were NSTX-U physicists Michael Jaworski and Robert Kaita. High-Z plasma-facing components (PFCs) are planned for NSTX-U, and Abrams studied lithium and boron coatings on them under ion bombardment on the Magnum-PSI linear plasma device at the Dutch Institute for Fundamental Energy Research. He observed that with deuterium plasmas, lithium eroded at a far lower rate than expected if it was the only constituent of the coating. The data, however, are better matched if the surface is modeled as a mixed material containing both deuterium and lithium. Abrams’ results thus have promising implications for significantly extending the temperature range over which lithium can be used as a PFC in the presence of hydrogenic plasmas. (R. Kaita)

The NSTX-U Team Meeting was held on Dec. 4, 2014. The meeting material is available on the web at [http://nstx.pppl.gov/DragNDrop/NSTX\\_Meetings/Team\\_Meetings/2014/12\\_04\\_2014/](http://nstx.pppl.gov/DragNDrop/NSTX_Meetings/Team_Meetings/2014/12_04_2014/) where the NSTX-U team was updated on the NSTX-U activities including the up-coming NSTX-U Research Forum and the preparation toward plasma operation. The NSTX-U organization chart was also discussed. (M. Ono and J. Menard)

The paper “Active Radiative Liquid Lithium Divertor Concept” by M. Ono (PPPL) et al. was published in Fusion Engineering and Design **89**, 2838 (2014). In this paper, we examine an active version of the previously proposed radial liquid lithium divertor (RLLD) concept, which we term ARLLD, where LL is injected in the upstream region of divertor. We find that the ARLLD has similar effectiveness in reducing the divertor heat flux as the RLLD, again requiring only a few moles/sec of LL to significantly reduce the divertor peak heat flux for a reactor. An advantage of the ARLLD is that one can inject LL proactively even in a feedback mode to insure the divertor peak heat flux remains below an acceptable level, providing the first line of defense against excessive divertor heat loads which could result in damage to divertor PFCs. Moreover, the low confinement property of the divertor (i.e.,  $< 1$  ms for Li particle confinement time) makes the ARLLD response fast enough to mitigate the effects of possible transient events such as large ELMs. (M. Ono)

### **Engineering Operations (A. von Halle, C. Neumeyer)**

NSTX Upgrade activities continued with the ongoing installation of the primary vessel seals in preparation for an initial pumpdown. An initial rough pumpdown of the vessel is now scheduled for December 15th. The last section of Torus Vacuum Pumping System (TVPS) piping has been installed. Bus installation inside the umbrellas continues, and Installation of the new Massive Gas Injector System is in progress.

The Digital Coil Protection System (DCPS) and the Power Supply Real Time Control (PSRTC) development efforts are working towards the start of Field Coil Power Conversion System dummy load testing. DCPS pre-operational testing is nearing completion, and the operation procedure to exercise, set, and verify fault protection algorithms is being developed. PSRTC software testing continued, and procedures for I/O testing, and to simulate and verify the real-

time outputs against recorded shots are being exercised.

Preparations of non-upgrade equipment for plasma operations in the NSTX-U configuration also continued. The exit side flight tube of the Multi-Pulse Thompson Scattering (MPTS) diagnostic has been welded in place. Work packages are being prepared to recommission the system to make the inner to outer Voltage fast measurements needed for CHI operations, and the vacuum vessel Ground Fault Monitoring System. Neutral Beam (NB) Power Supply recommissioning continued with dummy load testing of the Modulator Regulators, and open circuit testing of the TF magnet power supplies has started. NB Helium refrigerator operations continues round the clock to circulate/clean-up process gas. Gas is circulating through both of the beam-line cryo-panels and measured purity is improving.

Access to the NSTX test cell will be available only through previous arrangement with the Upgrade Work Control Center.