NSTX-U Weekly Report (June 21, 2013)

NSTX-U is in the Upgrade Project outage in FY 2013

The paper "Observation of non-Maxwellian electron distributions in the NSTX divertor" by M.A. Jaworski (PPPL), et al., has been published in the Journal of Nuclear Materials (vol. 438 pp.S384-S387). It describes measurements and analysis of the NSTX divertor indicating kinetic effects are generating energetic tail populations. The Langmuir probe interpretation of the bulk population of electrons is consistent with spectroscopic measurements and modeling of the hydrogen emission. These results are consistent with previous analytical and modeling studies indicating kinetic effects should be expected in steep-gradient regions of the plasma. (M. Jaworski)

The paper "Characterization of fueling in NSTX H-mode plasmas diverted into a liquid lithium divertor" by R. Kaita (PPPL) et al., has been published in the Journal of Nuclear Materials (vol. 438 pp.S488-S492). It discusses observations from deuterium fueling experiments with the NSTX Liquid Lithium Divertor (LLD). In plasmas with the diverted outer strike point on the LLD, high values of applied deuterium gas input relative to the deuterium plasma content were achieved without disrupting the plasma. Under constant deuterium fueling, the deuterium retention by the LLD remained relatively unchanged, as its surface temperature varied from below to above the lithium melting point. The results from both experiments indicated performance improvement over discharges where graphite plasma-facing components were not lithium coated. Their interpretation is complicated, however, by the possibility of lithium compound formation and the deposition of eroded carbon on the LLD surface. (R. Kaita)

The paper "Response of NSTX liquid lithium divertor to high heat loads" by T. Abrams (Ph.D. Thesis Student, Princeton University) et al., has been published in the Journal of Nuclear Materials (vol. 438 pp.S313-S316). It describes the results of an experiment in which samples of the NSTX Liquid Lithium Divertor (LLD) were directly exposed to a neutral beam ex-situ at power densities of 1.5 MW per square meter for up to 3 seconds with and without a lithium coating. The lithium-coated sample developed a lithium hydroxide layer that did not change even when the front face temperature exceeded the pure lithium melting point. These results imply that heating alone may not expose pure liquid lithium to the plasma if the melting point of surface impurities is not exceeded. It suggests that flow and heat may be needed for future plasma-facing components requiring a liquid lithium surface. (T. Abrams)

Purdue University graduate students Sean Gonderman and Felipe Bedoya arrived at PPPL last week with the diagnostics chamber for the Materials Analysis and Particle Probe-Upgrade (MAPP-U). Without breaking vacuum, MAPP-U will enable samples to be exposed to NSTX-U plasmas, and perform analyses with X-ray photoelectron spectroscopy, ion-scattering and direct recoil spectroscopy, and thermal desorption spectroscopy immediately afterwards. This summer, the Purdue students will work with PPPL personnel to test the MAPP-U by exposing samples to LTX plasmas. (R. Kaita, PPPL)

Dr. Hongbin Ding of the Dalian University of Technology in China visited PPPL on Friday, June 21. In its School of Physics and Optical Electronic Technology, Dr. Ding works in the Laboratory of Spectroscopic Diagnosis for Plasma. This is the key laboratory of the Education Ministry of China for the study of material modification by lasers and electron and ion beams.

Dr. Ding gave a seminar entitled "Developing Laser Based Technologies for the Diagnosis of Industry Plasma and Fusion Plasma." He also discussed possibilities for joint work with members of the PPPL staff. What might be of interest to NSTX-U is "Cavity Ring Down Spectroscopy" (CRDS). Because it uses a tunable laser, the same apparatus can be used to obtain density data for a variety of species. "Laser-Induced Breakdown Spectroscopy" (LIBS) was also mentioned. While difficult to implement for "real-time" measurements, it may be possible to perform "offline" analysis of samples exposed to NSTX-U plasmas. (R. Kaita, PPPL)

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

NSTX Upgrade construction activities continued with the removal from its mold and successful electrical testing of the fourth and final TF inner quadrant, and the ongoing preparation of all four quadrants for the full inner TF coil mold, and subsequent winding of the OH Coil. The outer TF14 coil has been installed at bay K, and the bay J-K port extension for the NB2 interface is being temporarily lifted into place to confirm fit and dimensions. The repair of the coolant tube leak and successful hydro testing on TF13 were completed in the south high bay of NSTX. Contractors are on site and making good progress on the installation of new new cooling system piping required for two neutral beam operation.

Preparations for plasma operations in the NSTX-U configuration with the ongoing fabrication and power testing of the new firing generators for the field coil power conversion (FCPC) system rectifiers. Also this week, a peer review was held to discuss proposed modifications to tiles and backing plates at bays C & I as needed to implement a high conductance Divertor Gas Injection system to replace the somewhat restrictive one formally located at bay E.

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