

## NSTX-U Weekly Report (July 6, 2012)

### **NSTX-U is in the Upgrade Project outage in FY 2012**

Several NSTX-U researchers participated in the 39th EPS Conference on Plasma Physics held July 2-6, 2012 in Stockholm, Sweden. The following posters were given at EPS: “Modeling core impurity reduction via divertor gas injection in NSTX” by E. Meier (LLNL), “Field-line mapping correlation of HHFW-induced divertor heating to power coupled into the SOL in front of the antenna” by R. Perkins (PPPL), “The role of rotation and kinetic damping in high-beta ST plasma stability” by J. Menard (PPPL), “Progress on CHI plasma start-up and MGI experiments on NSTX” by R. Raman (U. Washington), “Study of intrinsic impurities core transport in the National Spherical Torus Experiment” by F. Scotti (Princeton University), “Performance of and future improvements to plasma control in KSTAR” by D. Mueller (PPPL), “Divertor heat flux mitigation with impurity-seeded standard and snowflake divertors in NSTX” by V.A. Soukhanovskii (LLNL), and “Fast-ion energy loss during TAE avalanches in the National Spherical Torus Experiment” by E. Fredrickson (PPPL). D. Ryutov (LLNL) also presented an invited talk entitled “A snowflake divertor: solving a power exhaust problem for tokamaks” which included some NSTX snowflake divertor data. (J. Menard, R. Raman)

Joon-Wook Ahn (ORNL) visited IPP-Garching to conduct collaborative experiment at the ASDEX-Upgrade tokamak, June 18 – 23. The experiment focused on the investigation of the effect of applied 3-D fields on the divertor detachment, with Drs H.W. Muller, A. Kallenbach, M. Wischmeier and a PhD student, Steffen Potzel. Three N<sub>2</sub> gas levels were applied (0.5, 1, and 2e22) during the shot to avoid early disruption and 3-D fields were applied to the later stage of each N<sub>2</sub> puff period, which produced successful data on the power and particle divertor detachment. The following primary observations are noted: (1) Although all three N<sub>2</sub> gas levels increased outer divertor degree of detachment (DoD), which is a ratio of the scaled ion flux to the measured ion flux with Langmuir probe, only the highest gas level led DoD up to ~2. The DoD is an indicator of the divertor particle detachment, with the plasma being attached for DoD ~ 1 and more detached for DoD ~ 2. (2) The 3-D fields application reduced DoD for the first two N<sub>2</sub> levels, which is consistent with the NSTX result. (3) The highest N<sub>2</sub> level moved out the outer divertor heat flux zone. This is consistent with the previous AUG result on the L-mode detachment. Interestingly, the applied 3-D fields brought the outer divertor heat zone back in, closer to the strike point (sign of power re-attachment, similar to the observation in NSTX) although the DoD kept increasing which indicates that the particle detachment was becoming stronger. This data suggests that there is a possibility of a de-coupling of the power and particle detachments. (4) The 3-D fields application during the first two N<sub>2</sub> levels (lower than the 3rd N<sub>2</sub> level) reduced the inner divertor power density but there was no change at the outer divertor. A more detailed data analysis is under way in collaboration with IPP physicists. (J-W Ahn)

The article, "Aspect ratio effects on neoclassical tearing modes from comparison between DIII-D and National Spherical Torus Experiment" by R. J. La Haye (General Atomics) et al., has been published in Phys. Plasmas 19, 062506 (2012). The paper confirms the relative importance of the stabilizing curvature effect, an advantage for low aspect ratio; the relatively greater curvature effect makes for less susceptibility to NTM onset even if the classical tearing stability index is near marginal. (R. La Haye)

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

NSTX Upgrade construction activities continued this week with the ongoing preparations for the cutting of the vessel at bays J-K. This modification will allow for the installation of the vessel extension needed for the new neutral beam port. Trial fit-ups of the required in-vessel support structures at bays J-K are in progress, and containment for the vessel cutting is being prepared. New TF clevis pads are being welded into place on the vessel as they come out of our shops. In the coil fabrication facility, TF inner conductors with cooling tubes freshly soldered in place are being brought over from the machine shop for cleaning and taping. On neutral beams, cycle testing and vacuum leak checking of the two new NB-torus isolation valves is nearing completion, and the lifting lugs on the beam-line lift fixture have been successfully tested.

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