

## NSTX-U Weekly Report (July 22, 2016)

### **FY 2016 NSTX plasma operations**

**Operation Targets: Total – 18 run weeks**

**Completed: 10.06 run weeks and 1066 plasma shots**

On July 17-21, 2016 Jon Menard (PPPL) travelled to the United Kingdom to visit the Culham Centre for Fusion Energy (CCFE) to discuss future MAST-U / NSTX-U collaborations, toured Tokamak Energy Ltd and gave a presentation entitled “First results from NSTX-U and some NSTX physics highlights”, heard presentations on the progress and plans for the Centre for Doctoral Training in the Science and Technology of Fusion Energy at the York Plasma Institute, University of York, and participated in the Research Councils UK Fusion Advisory Board (FAB) meeting also hosted by the York Plasma Institute. (J. Menard)

Zixi Liu of ASIPP, China completed a one year visit (PPPL-ASIPP post-doctoral exchange) to analyze NSTX data with the BOUT+++ code. He simulated a pre-lithium ELMy H-mode reference case, as well as a lithiated ELM-free H-mode. A small peeling/ballooning mode was found for the discharge without lithium conditioning. The ballooning drive was larger than the kink/peeling drive for this mode, which appeared only with finite resistivity, suggesting a resistive ballooning mode. There was no sign of ITG. With lithium, no peeling ballooning mode was found, not even a resistive one, due to reduced gradients. The dominant instability was identified as drift Alfvén waves. These results will be submitted to a journal, including a comparison with the use of lithium injection for improved ELM stability in D3D. (R. Maingi, PPPL)

Luis F. Delgado-Aparicio (PPPL) visited ITER and the new WEST tokamak (“Tore Supra upgrade” at CEA), and presented a talk on Multi-energy SXR and HXR cameras for MCF plasmas: “*Alternative method for measuring  $T_e$ ,  $nZ$ ,  $dZ_{eff}$  &  $n_e,fast$* ”. The talks were very well received at both institutions. Scientists at ITER are recently considering several options for broadband x-ray diagnostic systems with the appropriate time, space and energy resolution. The possibilities of measuring the plasma emissivity at various energy ranges opens up an attractive alternative option for providing profile measurements of electron temperature, impurity density, contributions to  $Z_{eff}$  and the fast electron distribution. The new results obtained by the PPPL’s x-ray group aim at developing this soft- and hard x-ray capability for burning plasmas (ITER and beyond). Scientists at WEST are also interested in this multi-energy capability but using Si and CdTe detectors that can be implemented for 2D reconstructions. In addition, WEST scientists recognize that using contours of isotherms  $T_e(R,Z)$  can help constraining plasma flux surfaces during their Ohmic, ICRH and LHCD inductive and non-inductive scenarios. Luis F. Delgado-Aparicio and Jacob Maddox will continue tests in Alcator C-Mod this summer, and Luis F. is expecting installing similar detectors in NSTX-U as part of his DOE Early Career Research Program. (L.F. Delgado-Aparicio)

Masa Ono (PPPL) visited the Center for Plasma-Material Interactions (CPMI), University of Illinois – Champaign campus on July 21-22, 2016 to discuss collaboration research on liquid lithium. He met with CPMI researchers and students including professors Daniel Andruczyk and David Ruzic, and visited facilities including the HYDRA and other CPMI facilities, the IGNIS facility, and Starfire Industries. He gave a seminar entitled “NSTX-U status and plans”. (M. Ono)

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

NSTX-U plasma operations remained on hold this past week during recovery from the PF1aU coil failure. Heating and dry air purges of the center column to address any residual water from the coil leak, and coil system electrical insulation tests (Hi-Pots), were successfully completed. Power testing has resumed with a series of individual field coil test shots utilizing the PF2U, PF3U and OH coils to take magnetic data to compare to past profiles and better establish internal conditions of the damaged PF1aU coil. The PF1aU coil will not be used for the remainder of this year's run campaign, and assessments are being made for the resumption of plasma operations using PF2 in place of PF1aU for similar plasma shape control. Arrangements are being made to have the PF1aU coil analyzed and replaced.

The NSTX-U Test cell will be in restricted access this coming week during power testing and possible plasma operations. Limited access is expected to be available for approved work on second shift.

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

The Liquid Lithium Filler for the LITER (LIFTER) is an apparatus for efficiently filling the Lithium Evaporators (LITERs) prior to their installation on NSTX-U. There is a LIFTER for each of the two LITERs used during lithium operations. Both LIFTERs were successfully filled with lithium under argon in the glove box in L-245, one of the rooms approved for lithium handling. They will be kept in the glove box until needed to fill the LITERs with lithium. (R. Kaita, PPPL)