# NSTX-U Weekly Report (August 19, 2016)

**FY 2016 NSTX plasma operations completed**
**Completed: 10.06 run weeks and 1066 plasma shots**

The paper "Fusion nuclear science facilities and pilot plants based on the spherical tokamak" by J.E. Menard, et al. was published online in the journal Nuclear Fusion on August 16, 2016. The paper describes the possible missions of a Fusion Nuclear Science Facility (FNSF) and Pilot Plant including: providing high neutron wall loading and fluence, demonstrating tritium self-sufficiency, and demonstrating electrical self-sufficiency. ST-FNSF configurations have been developed simultaneously incorporating for the first time: (1) a blanket system capable of tritium breeding ratio TBR approximately 1, (2) a poloidal field coil set supporting high elongation and triangularity for a range of internal inductance and normalized beta values consistent with NSTX/NSTX-U previous/planned operation, (3) a long-legged divertor analogous to the MAST-U divertor which substantially reduces projected peak divertor heat-flux and has all outboard poloidal field coils outside the vacuum chamber and superconducting to reduce power consumption, and (4) a vertical maintenance scheme in which blanket structures and the centerstack can be removed independently. Importantly, it is found the threshold major radius for tritium self-sufficiency is greater than or equal to 1.7m, and a smaller 1m ST device has TBR approximately 0.9 which is below unity but substantially reduces T consumption relative to not breeding. Further, an A=2, major radius = 3m device incorporating high-temperature superconductor toroidal field coil magnets capable of high neutron fluence and both tritium and electrical self-sufficiency is also presented following systematic aspect ratio studies. The paper URL is: http://iopscience.iop.org/article/10.1088/0029-5515/56/10/106023
(J. Menard, PPPL)

As part of the General Atomics' "core" grant collaboration to support NSTX-U, Matt Lanctot gave a talk to the NSTX-U Macroscopic Stability Topical Group titled "Extending 3D Magnetic Diagnostics on NSTX-U". He will be leaving soon to work for DOE and Stefano Munaretto who is a recently started ORAU postdoc working on 3D magnetics on DIII-D will join Ted Strait part-time on this NSTX-U task. Lucas Morton is starting as an ORAU postdoc and will be based at PPPL to work full time on the "core" grant collaboration task of macroscopic plasma stability. (R. La Haye, GA)

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

The upper NSTX-U TF bus links have been removed, and the upper TF joint resistances have been verified to be consistent with pre-run measurements. Lower TF joint integrities will be verified after the removal of the PF-1AU coil. The NSTX-U vacuum vessel has been vented to air, and the dismantling/removals of systems inside the upper machine umbrella continues. Vacuum vessel hi-pots and resistance checks continue daily during the removals to track the integrity of the inner to outer vessel electrical insulation. The PF-1AU coil with the shorted turn will be removed from the machine by mid-September for post-failure analysis. The Coil Shop is being set up to begin the winding of a new PF-1AU coil. Neutral beam (NB) power and cryogenic system maintenance has started. The NB1 beam line is being vented to the stack in preparation for removal of its calorimeter, and pump/purges of NB2 will start this coming week. The schedule to remove the NB duct to provide in-vessel access has been accelerated to start by Sept.15th, and will help to get the in-vessel diagnostic calibrations done by mid October.

Access to the NSTX-U Test cell is expected to be available this coming week.

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

The Far-Infrared Tangential Interferometer and Polarimeter (FIReTIP) is being implemented in collaboration with the University of California at Davis for line-averaged density measurements of NSTX-U plasmas. In the past, vibration compensation was based on a visible laser that followed a path that included all of the reflective elements for the FIReTIP beam. An alternative approach is to use an adaptive filter that continuously tracks the vibrations and corrects for them. To determine if measurements could be taken with the necessary sensitivity, data were obtained with a compact accelerometer at locations around NSTX-U prior to shutting down the pumping system for the vacuum vessel vent. (E. Scott, UCD, R. Ellis, R. Kaita, PPPL)

Lisa Reusch and Daniel Den Hartog from the University of Wisconsin Madison visited PPPL to discuss their ongoing NSTX-U collaboration on integrated data analysis (IDA). They both fulfilled some collaboration requirements by taking the GET test. Computer account for Reusch was provided. Reusch gave a tutorial on Bayesian analysis for (fusion) Science and discussed with R. Bell, K. Tritz, and A. Diallo applications of the IDA to NSTX-U data. D. Den Hartog met with B. LeBlanc and A. Diallo of PPPL to discuss potential upgrades to the pulse burst laser system and also toured the future site of the pulse burst laser system in the Thomson scattering mezzanine. (A. Diallo)