

NSTX-U Weekly Report (June 9, 2017)

FY 2017 status: NSTX-U is in a maintenance and repair outage.

NSTX-U Recovery Project (R. Hawryluk)

Measurements of impedance vs. frequency of the NSTX-U OH coil in consideration of a design study to provide inductive heating of the machine's center column were completed this week. Test data is now being compared to analytic models.

Recommissioning of the coil winding facility continued with the fabrication of a taped conductor sample and trial bends with the right angle bender. Trial winding to adjust and fine-tune the winding equipment has started. A Final Design Review for the winding of a prototype PF1A coil was successfully held this week.

In vessel, the removal of tiles in preparation for the analysis and possible modifications to the passive plates has started.

The Motor Generator's lower guide bearing has been reinstalled after journal cleaning, the heat exchangers recommissioned, and the thrust bearing tank filled with oil.

A Final Design Review for the winding of a prototype PF1A coil was successfully held this week.

Bill Beck (MIT) was here last week and worked on design effort for the tooling that will be needed for winding a mandrel-less coil.

Charles Neumeyer presented a paper at 27th IEEE Symposium On Fusion Engineering (SOFE) entitled "Extent of Condition Review of the NSTX-U Project".

NSTX-U Research (J. Menard)

Joel Hosea, Eun-Hwa Kim, Nicola Bertelli, Rory Perkins and Gary Taylor attended the 22nd Topical Conference on Radiofrequency Power in Plasmas that was held in Aix en Provence, France, May 30 - June 2, 2017. Joel Hosea presented an invited talk entitled "An Overview of Some of the Main Experimental Results and Challenges in the Development of Slow and Fast Wave Heating from the C-Stellarator to NSTX-U" and Eun-Hwa Kim presented an invited talk entitled "2D Full-wave Simulations of Waves in Space and Tokamak Plasmas". Rory Perkins presented a poster paper entitled "ICRF-Induced Changes in Floating Potential in the EAST Divertor and Implications for Impurity Production", Nicola Bertelli presented a poster paper entitled "Self-Consistent Calculation of the Effects of RF Injection in the ICRF/HHFW Heating Regimes on the Evolution of Fast Ions in Toroidal Plasmas", and Gary Taylor presented a poster paper entitled "Time-Dependent Simulations of Fast-Wave Heated High-Non-Inductive-Fraction H-Mode Plasmas in the National Spherical Torus Experiment Upgrade".

Nicola Bertelli attended the Workshop on ICRH scenarios for ITER that was held in the ITER headquarters (France, June 6-8, 2017) organized by the ITER team. The workshop covered the following topics: (i) ICRF scenarios (including RF wave, Fokker-Planck and possibly transport)

for the ITER non-active and active phases; (ii) Coupling and PWI (including sheath effects), and (iii) Brief review of ITER antenna design. Nicola Bertelli presented a talk entitled "Self-consistent simulations of ITER plasmas using the TORIC-CQL3D coupling".

R. Maingi presented an invited talk at the SOFE 2017 meeting in Shanghai: "Overview of NSTX-U progress." In addition, Maingi presented a 1 hr lecture at the mini-course on plasma-material interactions: "PMI and the divertor", and chaired one of the plenary sessions.

Rory Perkins participated in a three-week campaign at the Large Plasma Device (LAPD) at UCLA focused on ICRF physics and sheaths together with UCLA staff Bart von Compernelle and ORNL staff John Caughman, Cornwall Lau, and Elijah Martin. The LAPD is a long (16.5 m) device that is part of a user-facility dedicated to basic plasma physics. A high-power RF source, recently built by Micheal Martin, has enabled high-power experiments at frequencies up to several times the cyclotron frequency. This experiment focused on RF rectification, near- and far-field sheaths, DC current circuits across the vessel, and antenna-coupling studies. Substantial DC currents were observed both at the antenna and also at limiters several meters away. Wave response to the so-called sheath boundary condition was tested by subjecting the limiter to various electrical terminations. The floating condition of probes was tested at various densities, RF powers, capacitive loads, and probe-emission levels. The effect of rotating the antenna relative to the field line was studied as well as density changes at various levels of RF power.

A paper titled "M3D-C1 simulations of the plasma response to RMPs in NSTX-U single-null and snowflake divertor configurations" has been published in Nuclear Fusion by Gustavo Canal et al. In this paper, linear M3D-C1 single- and two-fluid resistive MHD calculations of the plasma response to $n = 3$ magnetic perturbations in single-null (SN) and snowflake (SF) divertor configurations are compared. Differences between the single- and two-fluid responses were found to be caused by different screening mechanisms intrinsic to each model. No significant differences between the M3D-C1 responses were found in the SN and SF configurations. However, the $n=3$ fields caused the SF configuration to develop additional and longer separatrix lobes than the SN, regardless of the plasma model used. The intersection of the additional SF lobes with the divertor plates are expected to cause more striations in the particle and heat flux target profiles. In addition, the size of the magnetic lobes in both SN and SF configurations are found to be more sensitive to resonant rather than to non-resonant magnetic perturbations. (<https://doi.org/10.1088/1741-4326/aa6e10>).