

NSTX-U Weekly Report (July 8, 2016)

FY 2016 NSTX plasma operations

Operation Targets: Total – 18 run weeks

Completed: 10.06 run weeks and 1066 plasma shots

Steve Sabbagh (Columbia University) delivered the 2016 Landau-Spitzer Award lecture on behalf of fellow awardees Jack Berkery, Yueqiang Liu (CCFE) and Holger Reimerdes (EPFL) at the 43rd EPS Conference on Plasma Physics, held July 4-8 in Leuven, Belgium. The lecture, titled “Establishing a verified understanding of kinetic MHD theory to determine global mode stability in tokamak plasmas” highlighted the research recognized by the award, which covers a time period of approximately one decade. Sabbagh and Reimerdes accepted the award in person during the opening ceremony of the meeting, with explicit recognition given to all awardees. (S. Sabbagh)

S. Kaye (PPPL) authored a chapter on NSTX and NSTX-U in the book "Magnetic Fusion Energy: From Experiments to Power Plants", which was published by Elsevier in late June. The chapter presented highlights of NSTX research since device inception to culmination, focusing on the physics that addressed the critical issues for establishing the basis of ST research. The chapter also covered issues unaddressed or identified by NSTX, as setting the design and goals for NSTX-U. R. Maingi (PPPL) authored a chapter for the same book titled "Plasma Exhaust." (S. Kaye, R. Maingi)

A paper G.J. Kramer (PPPL) et al. on Mitigation of Alfvénic activity by 3D magnetic perturbations on NSTX was published in Plasma Physics and Controlled Fusion (<http://dx.doi.org/10.1088/0741-3335/58/8/085003>). Observations on NSTX indicate that externally applied non-axisymmetric magnetic perturbations (MP) can reduce the amplitude of TAEs and GAE in response to pulsed $n=3$ non-resonant fields. From full-orbit following Monte Carlo simulations with the 1- and 2-fluid resistive MHD plasma response to the magnetic perturbation included, it was found that in response to MP pulses the fast-ion losses increased and the fast-ion drive for the GAEs was reduced. The MP did not affect the fast-ion drive for the TAEs significantly but the Alfvén continuum at the plasma edge was found to be altered due to the toroidal symmetry breaking which leads to coupling of different toroidal harmonics. The TAE gap was reduced at the edge creating enhanced continuum damping of the global TAEs, which is consistent with the observations. The results suggest that optimized non-axisymmetric MP might be exploited to control and mitigate Alfvén instabilities by tailoring the fast-ion distribution function and/or continuum structure. (G.J. Kramer)

Mike Jaworski (PPPL) begins a month-long visit at the University of Illinois collaborating with the research groups of Profs. Jean Paul Allain and David Ruzic. The research is dedicated to developing technologies and procedures for implementing pre-filled liquid metal targets for the NSTX-U, capable of maintaining lithium purity even through the bake-out process. The work will also include diagnostic development to examine the structure of the lithium vapor-cloud previously observed during high-temperature lithium experiments. (M. Jaworski)

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

NSTX-U plasma operations were on hold this past week after discovering what appears to be a

water leak in a winding of the PF1aU coil. The PF1aU coil has been taken out of service for the remainder of this year's run campaign, and experimental proposals have been modified to use PF2 for similar plasma shape control. Arrangements are being made to have the PF1aU coil analyzed and replaced during the upcoming outage. Currently on the machine, forced air drying on the center column and a low temperature (<90C) electrical bake of the center stack to dry residual water is in progress, and will continue until Monday morning. Electrical insulation checks (Hi-Pots) of the field coils have been successfully completed. In parallel with these recovery activities, beam conditioning of all six neutral beam ion sources and vacuum conditioning of the High Harmonic Fast Wave (HHFW) antennas continued. Pre-operational testing of the new Massive Gas Injector (MGI) system was successfully completed, and gas injection testing into NSTX-U vacuum is in progress.

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

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

The limit switches on the linear probe drive for the Materials Analysis and Particle Probe (MAPP) have been attached in their final positions. Under local probe control, it was confirmed that the switch status and remote readings were correct for the sample exposure and surface analysis locations. The final step for enabling MAPP remote position control is to check probe operation using NSTX-U EPICS real time control software.

The vacuum bake of the two Lithium Evaporator (LITER) probes currently mounted on the fill stand has been completed, and the motion controls of the two LITER Probes mounted on the NSTX-U vessel have been successfully synchronized to the shot clock and tested.