

NSTX-U Weekly Report (September 18, 2015)

NSTX-U is in the Upgrade Project outage in FY 2015

A 'featured article' was published in the September 2015 issue of Nuclear Fusion: "Edge and SOL turbulence and blob variations over a large database in NSTX", by S.J. Zweben (PPPL) et al., *Nucl. Fusion* **55** (2015) 093035. A short description is also at: http://iopscience.iop.org/collections?collection_type=FEATURED_ARTICLES&journal=0029-5515&subject=&online_date=all.

This paper describes the range of variations in edge and SOL turbulence observed using a gas puff imaging (GPI) diagnostic in NSTX discharges. The database consists of 140 shots including Ohmic, L-mode, and H-mode plasmas measured during steady-state conditions (e.g. without ELMs). Turbulence quantities were evaluated using both cross-correlation analysis and blob tracking. Relative fluctuation levels varied from ~ 0.15 – 1.0 , correlation times were ~ 15 – 40 μs , correlation lengths were $L_{\text{pol}} \sim L_{\text{rad}} \sim 5$ – 10 cm, and turbulence velocities were $V_{\text{pol}} \sim 2 \pm 1$ km s $^{-1}$ and $V_{\text{rad}} \sim 0.5 \pm 0.5$ km s $^{-1}$ outwards. These variations were evaluated with respect to both the global and local edge plasma parameters, and compared with simplified theoretical models. (S.J. Zweben)

An article, "Modeling the effect of lithium-induced pedestal profiles on scrape-off-layer turbulence and the heat flux width" by D.A. Russell (Lodestar), et al., has just been published online in *Physics of Plasmas* **22**, 092311 (2015) and may be viewed at <http://dx.doi.org/10.1063/1.4930285>. The effect of lithium wall coatings on scrape-off-layer turbulence in NSTX is modeled with the Lodestar SOLT code. The work focuses on two NSTX discharges occurring pre- and with-Li deposition. The simulation density and temperature profiles are constrained, inside the last closed flux surface only, to match those measured in the two experiments, and the resulting drift-interchange-driven turbulence is explored. The power entering the SOL measured in the experiments is matched in the simulations by adjusting "free" dissipation parameters. At power-matching, (a) the heat flux SOL width is smaller, as observed experimentally, and (b) the simulated density fluctuation amplitudes are reduced with Li. The instabilities and saturation mechanisms that underlie the SOLT model equilibria are also discussed. (D.A. Russell)

On Wed., Sept 16, Rich Hawryluk, Jon Menard and Stan Kaye of PPPL visited FermiLab in Batavia Illinois to discuss with the scientific and technical personnel their experience with setting up their Remote Operations Center (ROC) and how they approach collaborative research. The FermiLab group is part of an international collaboration on the Compact Muon Solenoid experiment on the Large Hadron Collider and is the host institution for the U.S. CMS team. Their experience can help in developing our plans for Remote Control Rooms for future ITER collaborations, as well as helping us optimize our approach to collaborative research on NSTX-U. We heard presentations by a number of FermiLab personnel on the CMS (and earlier CDF) collaborations, their LHC Physics Center (LPC), computing facilities and plans, and how they developed their approach to setting up their ROCs for the CMS and for the four neutrino experiments with which they are involved. We were also given tours of the two ROCs. These presentations and discussions helped us understand both the similarities and differences in our requirements for remote participation. Later in the day, Jon Menard gave a general introductory talk on fusion energy research, with emphasis on work being done at PPPL, to the FermiLab physicists. The talk was attended by approximately 15 scientists, and engendered many questions

and much discussion. The trip was quite useful, and we plan to have follow on discussions in the future with the FermiLab personnel to get their input on our plans, once they are better developed. (S. Kaye)

Jon Menard (PPPL) visited the University of Wisconsin - Madison on September, 14-15 to give a plasma physics seminar entitled "Progress and plans for NSTX Upgrade and prospects for next-step spherical tori", meet with UW scientists, and visit local plasma research facilities. (J. Menard)

Nuclear Fusion recently published a list of their most popular work published since 2011. This list comprises 21 of the most highly cited articles. Among the list were five NSTX related articles:

- “The dependence of H-mode energy confinement and transport on collisionality in NSTX” by S.M. Kaye (PPPL) et al.
- “Overview of the physics and engineering design of NSTX-upgrade” by J.E. Menard (PPPL) et al.
- “The effect of progressively increasing lithium coatings on plasma discharge characteristics, transport, edge profiles and ELM stability in the National Spherical Torus Experiment” by R. Maingi (PPPL) et al.
- “Taming the plasma-material interface with the ‘snowflake’ divertor” in NSTX by V. Soukhanovskii (LLNL) et al.
- “Heuristic drift-based model of the power scrape-off width in low-gas-puff H-mode tokamaks” by R.J. Goldston (PPPL)

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

The components for the granule injector (GI) remote control (National Instruments PXI system) have been delivered acceptance tested. The communications card has been installed in the control computer (1U PC) to be placed in the NSTX-U data acquisition room (DARM) at D-Site. Arrangements are being made for communication between the DARM and the GI electronics rack in the NSTX-U Test Cell after local control system tests are complete. The stand for installing the GI on the Bay J midplane port has also been built. Measurements are being made for cutouts that are needed for the final fitup of the GI on the stand. (R. Lunsford, PPPL)

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

The bake of the NSTX-U vessel continued this past week. Systems were configured to allow local testing of the Switching Power Amplifier (SPA) system used to power the NSTX-U Resistive Wall Mode (RWM) in parallel with the bake. Calibration of MPTS polychromatic electronics continued and is nearing completion. Also this week, planning meetings were held for the design of the Massive Gas Injection (MGI) system controls, and for the installation of a new video camera system for the NSTX-U test cell. Physics Operator training continued.

The NSTX-U Test Cell is expected to be in restricted access this week during the vessel bake.