

NSTX Weekly Report (September 30, 2011)

FY 2011 NSTX plasma operations started on October 4, 2010

FY 2011 NSTX Outage started on October 25, 2010

Planned Run Weeks: 14 run weeks

Run Weeks Completed: 4.21 run weeks and 839 plasma shots

Members of the NSTX research team attended the 16th International Workshop on Spherical Torus (ISTW2011) on September 27-30, 2011 at National Institute for Fusion Science, Toki, Japan. The following invited / oral presentations were made at the workshop: "Overview of NSTX Research Operations and Facility Upgrade Activities" by M. Ono (PPPL), "NSTX Research Progress towards NSTX Upgrade and Next-Step STs" by J. Menard (PPPL), "Demonstration of Tokamak Inductive Flux Saving by Transient Coaxial Helicity Injection on NSTX" by R. Raman (University of Washington), "Global Alfvén Eigenmodes Induced Electron Thermal Transport in NSTX" by K. Tritz (Johns Hopkins University), "Energy confinement enhancement and pedestal growth triggered by an ELM in NSTX" by R. Maingi (ORNL), and "Advanced Scenario and Control Development on NSTX" by D. Gates (PPPL). Additionally the following poster presentations were made: "Disruption Mitigation Studies in NSTX" by R. Raman (University of Washington), "Multi-Energy Soft X-ray Array Diagnostic for Electron Temperature and Impurity Measurements on NSTX" by K. Tritz (Johns Hopkins University), "Plasma-Material Interface Development for Future Spherical Tokamak based Devices in NSTX" by V. Soukhanovskii (LLNL), "Recent progress in transport and turbulence research at NSTX" by Y. Ren (PPPL), and "Control Science and Technology on the National Spherical Torus Experiment" by D. Gates (PPPL).

The paper "Experimental demonstration of tokamak inductive flux saving by transient coaxial helicity injection on national spherical torus experiment" by R. Raman (University of Washington) et al., has been published on-line in Physics of Plasmas [Phys. Plasmas **18**, 092504 (2011)]. The paper describes results in which a 300 kA CHI started discharge after coupling to induction ramps up to 1 MA using 40% less inductive flux than standard inductive discharges in NSTX. In addition it has low internal inductance and low density similar to the type of discharge needed for Advanced Scenario operations in the NSTX-U. These new results from NSTX also show very favorable CHI scaling to NSTX-U. (R. Raman)

A paper "Predicting High Harmonic Ion Cyclotron Heating Efficiency in Tokamak Plasmas" by D. L. Green (ORNL) et al., was published in Phys. Rev. Lett. **107**, 145001 (2011). The paper investigates observations of improved radio frequency (rf) heating efficiency in ITER relevant high-confinement (H-) mode plasmas on the National Spherical Tokamak Experiment (NSTX) by whole-device linear simulation. The steady-state rf electric field is calculated for various antenna spectra and the results examined for characteristics that correlate with observations of improved or reduced rf heating efficiency. The paper reports that launching toroidal wave numbers that give fast-wave propagation in the scrape-off plasma excites large amplitude (~kV m⁻¹) coaxial standing modes between the confined plasma density pedestal and conducting vessel wall. Qualitative comparison with measurements of the stored plasma energy suggests that these modes are a probable cause of degraded heating efficiency. (G. Taylor, PPPL)

Engineering Operations (A. von Halle, C. Neumeier)

Preparations for the NSTX Upgrade continued this week with the completion of electrical insulation testing (HiPots) to document the insulation quality of the outer TF windings and the PF2, 3, 4 & 5 coils. Vacuum vessel thermal insulation and diagnostic equipment is now being removed in preparation for photogrammetry measurements of vessel, TF and PF structure and supports. Evaporation of lithium from the two new LITER probes has been completed, and the probes are being mothballed and safely stored for future use. Preparations are also underway in the D-Site Basement and DARMs for NSTX storage during the upgrade work.

Access to the NSTX test cell is expected to be available throughout most of this coming week.