

## NSTX Weekly Report (June 26, 2009)

### **FY 2009 NSTX plasma operations**

**Planned: Base - 11 run weeks, ARRA - 5 run weeks (pending funding approval)**

**Completed: Base -10.48 run weeks with 1,611 plasma shots, ARRA - 0 run weeks**

David Gates chaired a panel review of the ITER Plasma Control Systems Requirements Document (SRD-47) in Cadarache, France on Monday June 22, 2009. The review panel consisted of 30 members with expertise in both plasma physics and various technical disciplines. The purpose of the meeting was to review comments on the draft system requirements document prepared by Dr. Joseph Snipes, Senior Scientific Officer - Integrated Scenarios, Fusion Science and Technology Department, ITER Organization, and to develop a list of action items and required changes. A report summarizing the outcome of the meeting will be written and submitted to the ITER Organization. (D. Gates)

Jon Menard attended the MAST Program Advisory Committee (PAC) meeting held June 22-23, 2009 at Culham, U.K. (J. Menard)

The paper "Spectral effects on fast wave core heating and current drive" by C. K. Phillips et al, has been published in [Nucl. Fusion 49 \(2009\) 075015](http://stacks.iop.org/0029-5515/49/075015), and is available on line at <http://stacks.iop.org/0029-5515/49/075015>. The paper provides a review of NSTX studies that demonstrate that the core heating efficiency by HHFW is improved over a range of antenna phasings if the location at which the fast waves begin to propagate is moved away from the antenna and nearby structures by increasing the magnetic field and extensive conditioning to reduce the edge density. Since the ITER project is considering enhancing the scrape-off density to improve coupling with a large antenna-plasma gap, the NSTX results indicate that careful balancing of the edge density projected in ITER should be considered to limit the edge power losses from direct fast wave interactions with the antenna and plasma facing materials while at the same time insuring adequate coupling of power across the evanescent layer in front of the antenna. Under conditions of improved core heating, the MSE diagnostic was used to measure the noninductive current driven by the HHFWs. Good agreement was found between the MSE measurements and numerical simulations obtained with the AORSA, GENRAY and TORIC modeling codes. The published work was presented at the 22<sup>nd</sup> IAEA Fusion Energy Conference in Geneva, Switzerland in October 2008. (C. K Phillips)

The paper "Impurity transport studies in NSTX neutral beam heated H-mode plasmas" by L. Delgado-Aparicio et al. was accepted for publication in Nuclear Fusion. The first experimental assessment of low-Z impurity transport in a neutral beam heated, high-confinement H-mode plasma sustained in a low-field, low-aspect ratio spherical tokamak, was performed at the National Spherical Torus Experiment (NSTX). The injected impurities penetrate to the core on a hundred millisecond time scale, indicating a low core particle diffusivity ( $<1$  m<sup>2</sup>/s) in good agreement with the values predicted by neoclassical transport theory. In addition, a q-profile magnetic field scan showed reduced impurity penetration at high fields. These results suggest that anomalous ion particle transport associated with turbulent long-wavelength electrostatic instabilities must be largely suppressed in the NSTX core. (S. Kaye)

Information from 99 entries from 26 NSTX discharges was submitted to the ITPA (International Tokamak Physics Activity) Momentum Transport Database. This is a new database that is being

put together to study momentum diffusivities and pinches from all devices that have performed experiments in this area (NSTX, DIII-D, JET, JT-60U). The information consists of global and local information, and contains parameters that are necessary for input into gyrokinetic codes in order to determine whether the experimentally inferred values of momentum diffusivity and pinch are consistent with those expected from low-k turbulence theory. (S. Kaye)

### **Run Coordination (R. Raman , University of Washington, Deputy: E. Fredrickson)**

NSTX is in a scheduled maintenance period.

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

NSTX maintenance continued this past week. The neutral beam calorimeter has been re-installed after bellows replacements, and the beam-line is under vacuum and cooling down in preparation for ion source conditioning next week. The installation of new wave-guides for the HHFW system has been completed, and pre-operational testing is in progress. Both LITER probes have been re-filled with lithium, re-installed on NSTX, and have had their alignments checked. A lithium powder dropper (shaker) has been installed at Bay I, and a second will be installed at Bay C by early next week. Inspections and re-shimming of Error Field Correction coil mounting brackets is in progress, and power testing will be performed next week to both verify performance and further evaluate the electrical noise generated by the SPA/EFC coil system and seen on machine diagnostics. Also this week, remote controls for the Bay J sample probe were successfully tested, the X-Ray Spectrometer was re-installed, and UCSD collaborators were on site to complete work on the Fast Reciprocating Probe. The NSTX Test cell will be in restricted access this coming week during neutral beam and HHFW antenna conditioning and RWM error field coil power testing. Test Cell access will be available after 5PM each evening.

### **Research Operations (M. Bell)**

#### **Boundary Physics Operations (H. Kugel)**

- Liquid Lithium Divertor (LLD)
  - A teleconference was held with SNL, PPPL, and the coating vendor to discuss LLD progress and planning.
  - The molybdenum coating of the plates is scheduled to start 6/30. (M. Viola)
  
- Lithium Evaporator (LITER 2009)
  - Both LITER units were reloaded with lithium, test procedures were completed and the alignments checked. Both units are now at their parked positions in the vessel awaiting final pre-operation outgassing. (J. Winston)
  
- Lithium Powder Dropper
  - The testing of the remote controls for the installed Dropper\_Bay-I were completed and the unit is operational.
  - Dropper\_Bay-C was calibrated, loaded with lithium, and is awaiting installation on 6/29. (D.K. Mansfield)

- Divertor Region Sample Probe
  - The remote control testing of the sample probe was completed and the probe is now operable. (Cropper)
- UCSD Fast Probe
  - Maintenance and upgrades of the fast probe were completed. (J. Boedo, L. Chousal, R. Hernandez, UCSD)

#### Diagnostic Operations (R. Kaita)

- A single-channel X-ray spectrometer was installed on NSTX during the past maintenance week. It will be used to study plasma instabilities and also monitor impurities during NSTX operations.