

## **NSTX Weekly Report (October 22, 2010)**

**FY 2011 NSTX plasma operations started on October 4, 2010**

**Planned Run Weeks: TBD**

**Run Weeks Completed: 2.72 run weeks and 543 plasma shots**

Several members of the NSTX team attended the ITPA meetings held in Seoul, Korea, October 18 – 21, 2010. Joon-Wook Ahn (ORNL), John Canik(ORNL), and Rajesh Maingi (ORNL) participated in the ITPA Pedestal and Edge Physics group meeting. They also gave presentations entitled "Effect of 3D fields on divertor profiles, and its relation to plasma parameters", "Reduction in pedestal transport with lithium coatings in NSTX", and "Evolution of edge profiles and stability as ELMs (Edge Localized Modes) are gradually suppressed with lithium in NSTX." Stefan Gerhardt and Egemen Kolemen attended the ITPA Integrated Operations Scenarios (IOS) meeting at Seoul University. Stefan presented a summary of NSTX results relevant to the IOS topical scope and NSTX contributions to a database of high performance discharges were discussed. Steve Sabbagh (Columbia U) and Young Seok Park (Columbia U) participated in the ITPA MHD, Disruption & Control meeting. S. Kaye attended and Chaired the 5<sup>th</sup> Mtg of the Transport and Confinement ITPA Topical Group, which was held at the Seoul National University, Seoul, ROK, Oct. 18-20, 2010. Among the topics discussed were: 3D effects on L-H transitions, flows and impurity transport, ITBs, particle transport, current ramp-up modeling and momentum transport. Also, the 2010 summaries and 2011 plans for the Joint Experiments/Joint Activities were discussed. Eric Fredrickson attended the ITPA meeting on energetic particles. He gave a report on long duration runaway discharges on TFTR. (R. Maingi, S. Gerhardt, S. Sabbagh, S Kaye, E. Fredrickson)

A tour of NSTX was organized for the Princeton Chapter of Sigma Xi, the Scientific Research Society, on October 21, 2010 by R. Kaita and A. Zwicker. (R. Kaita)

### **Run Coordination (E. Fredrickson, S. Sabbagh - Columbia University)**

On Thursday 10/14, we ran XP-1040, "Extended reverse shear ITBs and ITBs with H-modes" [H. Yuh]. While the desired plasma equilibria with internal transport barriers (ITBs) were reliably obtained, the reversed-shear phase could be extended only marginally. A variety of techniques was investigated to extend the reversed-shear phase, including current ramp timing, reducing the internal pressure, and changing the plasma current. While these did appear to affect the anomalous current diffusion, they did not eliminate it. We were able to trigger an H-mode using RF heating, but only for very brief periods due to RF trips immediately after the transition. However, it was encouraging that the very short H-modes did not cause rapid current diffusion, as ITBs were observed after the back transition.

XP-1036 "Characterization of the L to H-mode transition in D and He plasmas with HHFW heating" [D. Battaglia] was concluded in the morning on Friday 10/15 by exploring the L-H power threshold in helium plasmas using symmetric phasing of the HHFW antenna. The first part of the XP (run on Wednesday 10/13) had developed a target discharge in deuterium that had an L-H transition with 0.6MW of RF power. On Friday, this discharge was repeated in helium, but no transition was observed with RF power up to 2MW. Time was then spent trying to lower the power threshold, but no transition was observed at the desired time in the helium discharge. After it was verified that the deuterium target discharge still had the same power threshold, the

remaining time was spent replacing the deuterium fueling with helium again, but the RF coupling became unreliable above 1MW. Turbulence measurements were taken throughout so comparisons can be made between discharges with and without the L-H transition.

XP-1041, "Joint NSTX/DIII-D poloidal rotation experiment" [R. Bell] was successfully run on Friday afternoon. Two slightly different plasmas conditions were obtained and documented with poloidal velocity measurements under good impurity conditions with periods free of MHD. The first condition reproduces discharges obtained on DIII-D and NSTX in 2006, and the second conditions matches the conditions on DIII-D in January 2010 during a companion experiment. Additional discharges were also obtained using magnetic braking from  $n=3$  error-field coils to reduce toroidal rotation, which is typically higher on NSTX compared to DIII-D for these plasma conditions.

On Monday 10/18, Tuesday 10/19 and for the latter half of Wednesday 10/20 we conducted XP-1034 "Flux savings from inductive ramp-up of a CHI started discharge" [R. Raman]. The five and seven capacitor start-up discharges developed on September 10 were successfully used to couple to inductive ramp-up after adjusting the conditions to suppress absorber arcs. Early neutral beam injection and optimization of the initial ramp-up phase resulted in ramping to 1MA using less inductive flux than during the September run. Plasma currents over 100kA at 50ms were obtained, which is higher than the previous best result. Many discharges had peak injector current values of about 10kA, which is a very large increase from the typically 4kA that were run during the previous year. This is important for realizing higher start-up currents in NSTX and for extrapolating the concept.

In the morning on Wednesday 10/20, the MSE diagnostic calibration (XMP-33) was performed using NB injection into gas with the toroidal magnetic field and a vertical magnetic field applied. The sequence of shots was completed and the initial examination of the data suggests that the calibration has remained stable through the FY10 run period.

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

NSTX plasma operations for FY11 continued this past week with a set of experiments utilizing High Harmonic Fast Wave (HHFW) and neutral beam heating, and lithium conditioning via evaporation and the Li dropper. The lithium evaporation probe ran dry late in the week, and will be replaced with a freshly-loaded unit over the weekend to be ready to support experiments on Monday. Also this week, the commissioning of a hot air system proposed to be used to heat the four LLD plates continued, and is expected to be ready to use later this month.

Access to the NSTX test cell will be restricted during plasma operations this coming week. Access is expected to be available each evening.

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

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

- Liquid Lithium Divertor (LLD)
  - A Final Design Review of the LLD Alternate Heating System was held and found to be a

success pending resolution of concerns

- Lithium Evaporators (LITER)
  - The LITER-K1 unit supported operations.
  - The LITER-K2 was refilled to a total load of 76.5 g of lithium, and then outgassed in preparation for installation to support the last week of the run.
- Molybdenum Inner Divertor Tiles
  - Work started on fabrication drawings for modifying the existing Row-1 graphite tiles to receive molybdenum top plates.

#### Diagnostic Operations (R. Kaita)

- Diagnostics calibrations for the end of the present run period have begun. Measurements for the motional Stark effect (MSE) system have been completed, and a schedule is being prepared for calibrations to follow the end of plasma operations.