

## **NSTX Weekly Report (April 25, 2008)**

### **FY 2008 NSTX plasma operations**

**Planned: 15 weeks**

**Completed: 7.64 weeks, 1146 plasmas (through April 23, 2008)**

S. Kaye was a member of the U.S. delegation participating in the International Program Committee meeting for the 22nd Fusion Energy Conference to be held in Geneva, Switzerland in October 2008. (S. Kaye)

Sije Ding and Yong Guo from ASIPP, China have arrived to NSTX for one year visit. Sije Ding will be working on the TRANSP (transport analysis) Code and Yong Guo will be working on the TSC (tokamak simulation code) which will be then applied to the NSTX data analyses and operating scenario development.

There will be no Monday Physics Meeting this week. (S. Kaye)

### **Run Coordination (M. Bell, R. Raman)**

Six experiments received run time in the week April 17 - 23, 2008 after operation resumed on Monday 4/21 following the maintenance period.

On Monday 4/21, we began with the "Vertical NPA scan" [XP-807, S. Medley] with the goal of obtaining a vertical scan of the NPA sightline at reduced horizontal tangency radius of  $60 \pm 10$  cm in H-mode discharges exhibiting strong MHD-induced energetic ion redistribution. Six suitable discharges were produced. However, despite seemingly robust high-frequency MHD activity, the NPA signals sampled in the range  $R_{tan} = 50 - 80$  cm showed weak or no energetic ion redistribution. We then switched to "Investigation of ion transport with beam modulation" [XP-831, P. Ross]. The NPA detected very good modulation of the energetic neutral flux at different tangency radii for different energies, which, on first analysis, fits with expectations.

On the morning of Tuesday 4/22 we successfully developed discharges for the experiment "Dependence of the H-mode Pedestal Structure on Aspect Ratio" [XP-529, Maingi]. However, the failure of one of the lasers for the MPTS diagnostic prevented obtaining the detailed profile data for this experiment. In the afternoon, the divertor magnetic flux expansion was scanned from about 10 to about 25 for the experiment "Edge Characterization in Highly-Shaped High-Performance Discharges" [XP-816, R. Maqueda]. The scan was accomplished in 1.0 MA, 5.5 kG high-performance H-mode plasmas by scanning the X-point height in two highly-shaped lower single-null configurations utilizing the capabilities of the NSTX plasma control system. Divertor heat flux profiles, impurity and recombination profiles, radiated power, and particle fluxes were measured as a function of the divertor flux expansion / connection length / area expansion. The peak heat flux was reduced from 6-8 MW/m<sup>2</sup> at the lower-end flux expansion, to 1-2 MW/m<sup>2</sup> at the higher end. The data will contribute toward the NSTX Research Milestone R(08-3) on variation and control of SOL heat flux.

In the morning of Wednesday 4/23, we completed the first part of "HHFW Phase Scan and Current Drive in Deuterium L-Mode" [XP-825, P. Ryan]. Scans of array phasing were carried out at 1.1 MW coupled HHFW power for relative phase shifts of  $-30^\circ - -180^\circ$  in  $30^\circ$  increments;

power was also increased to 2.2MW for the  $-90^\circ$  and  $-150^\circ$  cases. The recently refurbished edge reflectometer indicated that better core heating occurred when the edge density was low and the profile less steep. Preliminary analysis of the CHERS data indicates that the HHFW exerts an effective drag on the NBI-driven toroidal rotation velocity. On Wednesday afternoon, we revisited "Divertor detachment with deuterium and impurity gas injection" [XP-814, V. Soukhanovskii]. In high-performance, H-mode plasmas in a highly-shaped LSN configuration at 1.0MA, with 6MW NBI, the optimal divertor deuterium injection rate was found to be between 60 and 100 Torr.l/s. A partially detached divertor with peak heat flux reduced by up to 60 % was obtained without forming an X-point MARFE, and with minimal degradation of core and pedestal plasma parameters.

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

NSTX plasma operations resumed this past week after a maintenance week during which the two lithium evaporator (LITER) probes were each filled with about 40 grams of lithium and re-installed on the NSTX vacuum vessel. During plasma operations this week, the neutral beams were modulated to study fast ion transport, neutral beam power scans were performed to characterize the edge and scrape-off layer of highly elongated plasmas, and beams were then used at full power to study partially detached divertor regimes. The High Harmonic Fast Wave (HHFW) Systems were used at various phasings to study heating and current drive in L-mode plasmas, and the machine's error field coils were used to investigate the stabilization of resistive wall modes. During the evening hours, LITER commissioning continued with the installation/testing of the new shutter controls and manual probe insertions and alignments.

There will be no access to the NSTX test cell during plasma operations this coming week. Access to the test cell will be available from 5PM to 10PM each evening.

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

#### **RF Operations (J. Hosea)**

There will be a final design review of the HHFW antenna upgrade in B-252 on Tuesday, April 29 at 9:30am. Phil Heitzenroeder will chair the review. (Bob Ellis)

#### **Diagnostic Upgrades (B. Stratton)**

George McKee of the University of Wisconsin visited PPPL April 23-24 to participate in design and planning of the beam emission spectroscopy diagnostic, which will be installed on NSTX during the next outage. Good progress was made on defining the concept for the design. A successful conceptual design review was held on April 24. Detailed engineering of the new ports to be installed in the NSTX vacuum vessel and the in-vessel components will start in May.

#### **Diagnostic Operations (R. Kaita)**

- Personnel from the Oak Ridge National Laboratory (ORNL) and PPPL worked on the ORNL edge reflectometer system. One of the two degraded microwave amplifiers was replaced. This should be sufficient to improve the edge profile analysis that is desired for upcoming experiments with lithium-coated plasma-facing components.
- The electronics for the new bolometer array have been received.

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

- Lithium Evaporator (LITER)
  - LITER Bay-F was pumped down after loading, and inserted manually into the vessel to the operating position. This was accomplished without any realignment, indicating that the new probe support was able to reproduce the previous alignment. The shutter control mechanism was installed and is now controllable via the PLC.
  - LITER Bay-K shutter control mechanism was installed and is now controllable via the PLC. Preparations for testing the LITER Bay-K alignment are in progress.
- Liquid Lithium Divertor (LLD)
  - The Final Design Review (FDR) for the LLD Mechanical Design was presented by R. Ellis III (NSTX LLD Chief Engineer) and R. Nygren (SNL project manager for the LLD). The FDR was declared a success pending resolution of CHITS. Following the FDR, a series meetings were held with R. Nygren and the NSTX LLD design team to discuss and move forward on Controls and Interfacing, Schedule, and Procurement plans.