

## **NSTX Weekly Report (June 27, 2008)**

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

**Planned: 15 run weeks**

**Completed: 14.19 run weeks, 2179 plasmas (through June 25, 2008)**

- An additional NSTX contributed poster not reported last week was presented at the 35th European Physical Society (EPS) Conference on Plasma Physics in Crete, Greece, from June 9 through 13, 2008. Its title was "Global MHD Mode Stabilization Research on NSTX" and its first author was S. Sabbagh of Columbia University. (R. Kaita)
- A meeting to discuss X-divertor and Super-X divertor options for NSTX was held with participation from Prashant Valanju, Mike Kotschenreuther, and Swadesh Mahajan (UT-Austin). Kotschenreuther discussed SOL width scalings and underlying physics implications, while Valanju discussed the basics of the X-divertor and Super-X divertor. Valanju will follow up with Super-X divertor possibilities for NSTX. (R. Maingi, ORNL)
- N. Nishino returned to Hiroshima University last weekend after working on the SWIFT (Shifted Wavelength Interference Filter Technique) flow diagnostic with S. Paul from PPPL. The technique uses the Doppler-shifted visible emission from singly-ionized helium to determine the bulk plasma motion. Two-dimensional images were obtained in helium NSTX plasmas, and data analysis is in progress. (R. Kaita)
- No Physics Meeting this coming Monday. (S. Kaye)

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

On Thursday morning 6/19, we completed the experiment "Momentum transport using  $n=3$  braking" [XP-813, W. Solomon] begun the previous day. Non-resonant magnetic perturbations were applied during both  $B_T$  and  $I_p$  scans, to determine whether the momentum transport was tied more closely to electron or ion thermal transport. By applying perturbative pulses at both early and late times, excellent data were obtained at different density scale lengths to compare with analytical theory of the momentum pinch. In the afternoon we completed "Modulation of core rotation using beam blips" [XP-820, S. Kaye], varying the number of beam sources to change the plasma rotation in the core of the plasma. Both  $I_p$  and  $B_T$  were scanned to determine the parametric dependences of the momentum diffusivity. The change in rotation and its gradient were decoupled for  $R = 1.05 - 1.1$  m, so it will be possible to separate the momentum pinch term from the momentum diffusivity. Finally, for the last 2 hours, we continued "High elongation plasmas" [XP-836, Gates] using lithium evaporation, and combined EF correction and RFA feedback. A plasma was produced with  $\beta_p = 1.8$  at an elongation of  $\sim 2.7$ . The pulse lasted for  $\sim 1$  s and the time average surface voltage was  $\sim 95$  mV over a 0.5 s window.

On Friday 6/20, we first completed the experiment "Magnetic Shear and Transport" [XP-829, H. Yuh], taking high- $k$  data at a new location,  $R = 1.34$  m, outside the surface of  $q_{min}$ , where shear is positive in these centrally reversed shear discharges. The high- $k$  activity remained evident and about the same in both normal and reversed shear conditions. Near the end, a shot was taken replacing NB source A with B and C at 65 keV, resulting in the same power input but

more momentum. The high-k fluctuations seem to have responded moderately to the increase in velocity shear, but no improvement in confinement was observed. In the experiment "High-k turbulent fluctuations in HHFW heated plasmas" [XP-821, E. Mazzucato] performed in the latter half of the day fluctuations were measured in deuterium plasmas at both inboard and outboard positions although at different values of  $T_e$  from those of helium plasmas previously studied.

On Monday 6/23 we performed "ELM Destabilization by RMPs" [XP-809, J. Canik] applying  $n=3$  perturbations in a series of short,  $\sim 10$ ms, pulses to otherwise ELM-free discharges produced by lithium evaporation. In moderately shaped plasmas, ELMs were reproducibly triggered by the applied perturbations, significantly reducing the impurity accumulation and radiated power which occurred without ELMs.

In the experiment "Fast ion transport induced by Alfvén avalanches" [XP-819, E. Fredrickson], performed on Tuesday 6/24, TAE avalanches were made under conditions where FIDA data was obtained, together with reflectometer data and full equilibrium data. Searches for avalanches in deuterium plasmas were unsuccessful, although it was possible to maintain L-mode density profiles in the target conditions. In the late afternoon, the Machine Proposal "Transmission Grating Spectrometer Commissioning" [XMP-58, K. Tritz] was accomplished using low density RF discharges to avoid a high gas load on the detector. The TG spectrometer successfully imaged multicolor soft X-ray profiles and a spatially resolved XUV spectrum.

The experiment "Alfvén cascades and associated transport" [XP-808, N. Crocker] was performed on Wednesday 6/25. Comprehensive fast-ion population and internal mode measurements were obtained during periods of mode activity which will enable study of the associated fast-ion transport. Alfvén cascade modes were measured with varying mass (He and D), density and temperature (using HHFW heating) to test MHD spectroscopy, which use the variation of Alfvén cascade mode frequency to determine  $q_{min}$ , under a variety of equilibrium conditions.

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

NSTX plasma operations continued this past week with extensive use of the two lithium evaporator (LITER) probes in experiments utilizing both HHFW and NBI heating. The machine's error field coils and switching power amplifiers were then used in conjunction with NBI for rotation control and error field correction in another set of experiments. Also this week, the HHFW heating system was used in support of a machine proposal to commission the new Transmission Grating Spectrometer. Over the weekend, both LITER probes were removed, reloaded with lithium and reinstalled.

There will be no access to the NSTX test cell during plasma operations this coming week, and plasma operations will be extended to 7PM on Tuesday and Wednesday. Access to the test cell will be available from the end of the run day to 10PM each evening.

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

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

- Lithium Evaporator (LITER) - The LITER system was used this week to support XP-809 (ELM Destabilization by Resonant Magnetic Perturbations [Canik]), XP-529 (rev. 2) (Dependence of the H-mode Pedestal Structure on Aspect Ratio [Maingi]), XP-802 (RWM Stability [Sabbagh]), and machine operations. Preparations are in progress for LITER reloading on 6/28.

- Liquid Lithium Divertor (LLD) (R. Ellis,III)

-Checking of the drawings for new divertor tiles that interface with the LLD has been completed. Checking of the drawings for manufacturing the plates in a flat configuration is also complete. The statement of work for plate manufacture is being checked by Sandia procurement.

-The toroidal “clocking” of the LLD assembly, based on the location of existing magnetic sensors, has been established. Good progress continues to be made on the diagnostic tile design. The final design review for LLD diagnostics has been set for Wednesday, July 16, at PPPL. Sandia personnel will participate.

- Lithium Powder Dropper - The Li Powder Dropper was fully mechanically and pneumatically installed, and tested, and vacuum qualified by successfully opening the TIV to the vessel briefly. Li dust dropping was tested by observing the dropping of Li dust into the Dropper dump. All CHIT forms have been completed and approved. A meeting was held to discuss the XP shot list in preparation for the final XP review (D. Mansfield)