

## NSTX Weekly Report (July 29, 2005)

FY2005 Planned Operations: 17 weeks

Completed: 13.77 weeks producing 1610 plasmas

### **NSTX Department, Project, Program (M. Ono, M. Peng, E. Synakowski)**

- The NSTX Program Advisory Committee (PAC) held a video and teleconference on July 26 to review and render advice on the "NSTX Program Letter on Diagnostic Collaboration Opportunities for FY 2006-2008." The Program Letter is prepared in support of an Office of Science Notice to solicit grant proposals to carry out diagnostic collaboration on NSTX, which was posted on July 27 as Program Notice DE-FG01-05ER05-20 entitled "National Spherical Torus Experiment - Innovative Measurements of Spherical Torus Plasmas" on the Office of Science Grants and Contracts Web Site. The Program Letter, improved according to the PAC advice, is expected to be available during the week of August 1, 2005 on the NSTX Web Site:

[http://nstx.pppl.gov/nstx/NSTX\\_Program\\_Letters/](http://nstx.pppl.gov/nstx/NSTX_Program_Letters/). (M. Peng, ORNL)

- There will be an NSTX Physics Meeting on Monday, 8/1 at 1:30 pm in LSB318. The agenda is: 1) D. Gates – High beta and long pulse DN development (XP502/508) status. 2) DOUBLE-NSTX Code Analysis of Ion Temperature Profiles Measure by NPA Vertical Scanning (S. Kaye)

### **Run Coordination (J. Menard, S. Sabbagh)**

The thirteenth week of operation was completed successfully with seven experimental proposals and one experimental machine proposals.

#### XMP40 - "Argon X-ray crystal spectroscopy"

The Argon puff duration was scanned in ohmic and NBI discharges to further optimize the spectrometer count rate and quality of the Ar spectrum. Good spectra were obtained for several conditions. Residual Argon and/or effects/byproducts of Argon sputtering may have impacted subsequent high-performance H-mode discharges, although there was little residual Ar evident in the SPRED diagnostic.

#### XP502 - "High beta at high delta"

Several reproducible high beta > 35% discharges were obtained immediately following the weekend full boronization. However, these discharges could not be diagnosed with CHERS and MSE due to a loose set screw on the CHERS/MSE diagnostic shutter. Loss of NBI source C interrupted subsequent high beta attempts.

#### XP507 - "Long-pulse discharges in LSN"

Long-pulse ( $t > 1.3\text{s}$ ) LSN discharges were reproduced as target plasmas for XP-509 for elongation scans. Other lower elongation shorter duration discharges were also reproduced. These discharges appear to have a locked island near the plasma edge that typically leads to a locked-mode and/or RWM disruption during the  $I_p$  flat-top external  $n=1$  fields were applied to try to delay the disruption, and the total plasma  $n=1$  non-axisymmetric response was observed to be transiently reduced, however, the plasma routinely disrupted earlier than when no external field was applied. A more complete scan of error field phases and amplitudes will be attempted in future run days.

#### XP508 - "Long-pulse DND plasmas"

Using the balanced DND shape under rt-EFIT control, 1MA flat-top plasmas were produced that lasted just under 1 second in duration in a small ELM operational regime. Interestingly, small boundary changes induced by the PF1B coil unbalanced the DND shape and were observed to change the ELM behavior.

#### XP509 - "Elongation variation in LSN long-pulse plasmas"

An elongation scan was attempted in 750kA long-pulse discharges by modifying the PF3U and PF3L currents. Changes in the discharge shape toward higher elongation appear to have modified the tearing mode activity late in the discharge, and this modified the current profile and typically increased  $I_i$  which lowered  $kappa$  and reduced the range of the elongation scan.

#### XP533 - CHI into Ohmic

LSN ohmic target plasmas were developed that do not require usage of the PF2L coil. This is useful for compatibility with future transient CHI experiments which require reverse polarity of the PF2L coil.

#### XP530 - Edge profile measurements for ELM stability

An experiment to measure the edge plasma  $n_e$ ,  $T_e$ , and  $T_i$  gradients just before and after ELMs with the new edge Thomson channels and existing high resolution CHERs system was successfully executed. Type I ELMs of variable size, Type III ELMs and Type V ELMs were diagnosed with those diagnostics, as well as the the Johns Hopkins USXR system, the UCLA reflectometer, the Nova Photonics fast camera looking into the divertor, a new array of filterscopes which are part of a collaboration with Neil Brooks from DIII-D, and many other diagnostics. These data will be used to assess the edge stability through detailed calculations.

#### XP531 - Transient CHI

For the first time in NSTX CHI was operated above 1kV. At voltages up to 1.35kV used during this run, the modified MOV and capacitor based voltage suppression systems were found to be quite effective, with the voltage spikes being suppressed at 1.5kV as designed. At 1.3kV, and at a capacitor bank energy of 21kJ, discharges with up to 200kA of toroidal

current were generated. Techniques developed during the previous run allowed the discharge initiation to be very reliable and none of the CHI discharges initiated as an absorber arc. The current multiplication factor continued to be very high (over 100), with the observation 40eV electron temperatures. On some of the fast camera images, the visible images indicated a disconnection of the observed light in the vessel from that in the injector. Tom Jarboe and Brian Nelson were at NSTX to participate in these experiments.

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

NSTX operations continued this past week after a boronization of the vacuum vessel on Sunday. Progress was made on developing shots for XP-502 "High beta w/PF1A", and rt-EFIT control successfully achieved 0.7 second plasma duration in XP-508 "Early H-Modes". The newly expanded 30-point MPTS system, as well as the multi-color SXR diagnostic and the reflectometer system, was used to measure plasma edge gradients in XP-530 "ELM characterization". Work continued on XP-507 "Long pulse in LSN", reaching pulse lengths of 1.35 seconds, and good long pulse shots were obtained to assess bootstrap current dependence on elongation in XP-509 "Long Pulse Plasmas at Lower Toroidal Fields". Also, additional progress was made on XMP-40 "Evaluation of the X-ray Crystal Spectrometer". At the end of the week, the machine was configured for CHI operations in support of XP-531 "Transient CHI". In parallel with NSTX operations, good progress was made on commissioning and operation of the new moveable glow discharge cleaning probe.

The NSTX test cell will be open for maintenance this coming week, with plans to continue installations associated with the new high K scattering diagnostic. Machine areas scrubs will begin on Friday, August 5th, and plasma operations will resume on Monday, August 8th. (A. von Halle)

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

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

- The installation of the MGP on the vessel was completed, and its commissioning was initiated. It was successfully cycled in and out of the vessel over its full stroke, and HeGDC's were tested using the MGP anode together with the Bay-G wall anode.
- A Hydrogen Sensor diagnostic was received on loan from the SNL / DIII-D Collaboration (R. Bastasz, SNL). A peer review was held to discuss its installation to characterize low energy deuterium flux to the NSTX wall during FY05 Experimental Operations. (C.H. Skinner)

#### **Diagnostic Upgrades (D. Johnson)**

- The MPTS diagnostic in its upgraded configuration of 30 spatial channels, actively supported an experiment on ELM characterization. Calibration work is needed before the new-channel data be made available." (B. LeBlanc)