

## NSTX Weekly Report (July 22, 2005)

FY2005 Planned Operations: 17 weeks

Completed: 12.59 weeks producing 1457 plasmas

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

- Akira Ejiri from the University of Tokyo visited NSTX for two weeks as part of the US-Japan collaboration agreement to participate in reflectometry experiments with UCLA and the NSTX Team. The specific goal of his visit was to investigate correlation reflectometry as a diagnostic for magnetic pitch angle measurements. Some of the results were presented at a seminar, which included the first successful correlation measurements of turbulence along a magnetic field line, as well as the possible existence of long perpendicular correlation lengths at the edge during H-mode.
- There will be an NSTX Physics Meeting on Monday, 7/25 at 1:30 pm in LSB318. We will hear status reports on the following recent experiments:
  - 1) F. Levinton – Reversed Shear L-mode plasmas (MSE measurements and electron transport)
  - 2) J. Menard – Long pulse LSN development, locked mode thresholds with EF/RWM coil
  - 3) S. Kaye – Modeling the fast ion loss and effect on Neutral Beam current drive in long pulse LSN discharges

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

The twelfth week of operation was completed successfully with four experimental proposals and two experimental machine proposals.

#### XMP 30 - Higher power HHFW preionization

Additional straps of the HHFW antenna were utilized to increase the average power from 300kW to 400-800kW for outboard pre-ionization for the non-solenoidal startup experiments planned for August. At the highest HHFW power levels, RF noise appears to corrupt the real-time data acquisition system, and additional filtering and shielding measures are being implemented.

#### XMP 40 - Ti measurements using Ar spectroscopy

Ohmic target discharges were used to assess the Ar puffing requirements to achieve the optimal count-rate for obtaining good Ar impurity spectra. Good spectra were obtained for puff durations of 100-150ms with Argon injected at  $t=-1s$ .

#### XP 503 - Locked modes and error fields

The mode locking threshold was measured for a range of applied error field directions for several plasma parameters including plasma density, current,

toroidal magnetic field, and plasma beta. Clear directional asymmetries in the threshold were measured for plasmas with the  $q=1$  surface absent from the plasma and at sufficiently low density. When  $q(0)=1$  entered the plasma and core MHD instabilities were observed, the EF directional dependence of the locking appeared weaker. The real-time algorithm for pre-programmed error field correction proportional to PF current was also successfully commissioned and will be tested this week.

#### XP 506 - Ohmic H-mode physics

Long ELM-free phases were again achieved in ohmic target plasmas despite the significant time since the last full NSTX boronization. Ion temperature data was obtained before, during, and after the H-mode transition using beam blips and the CHERS. The high-priority elements of this experiment are now complete.

#### XP 512 - NSTX/DIII-D RWM similarity experiment

A lower elongation and lower triangularity LSN target discharge was developed to match the DIII-D target shape of this experiment. A sufficiently long period of high beta significantly above the ideal no-wall limit was also achieved in this configuration.  $n=3$  braking was used to slow the plasma rotation and trigger resistive wall modes allowing the RWM critical rotation to be measured. The plasma current was also scanned from 0.8MA to 1MA to measure the  $q_{95}$  scaling of the RWM critical rotation frequency.

#### XP 527 - HHFW power deposition

Real-time EFIT control of the HHFW target plasma was significantly improved for this experiment by eliminating several improperly compensated B-probes from the control and increasing/optimizing the shape control gains. Plasma-antenna gap scans were then performed and coupling and power deposition measurements made using HHFW power modulation. Significant electron heating was observed for both small and large gaps with core electron temperatures up to 2keV achieved at  $I_p=300kA$ .

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

NSTX operations continued this past week, with progress made on several experiments (XP's) and on increasing machine capabilities (XMP's). Error field correction was used in density, current, and beta scans in support of XP-503 "Error Field Correction and Locked Modes", and a scan of the antenna-plasma gap was performed for XP-527, "HHFW coupling". Additional progress was made on XP-506, "OH H-modes", and a so-called mini-boronization of the vacuum vessel was performed before continuing work on XP-512, "NSTX-DIII-D RWM similarity Experiment". New machine capabilities were explored in XMP-30, "HHFW Breakdown Assistance" where measurable plasma current was produced during a .8MW, 30 millisecond RF pulse, and in XMP-40, "Evaluation of the X-ray Crystal Spectrometer". The new Moveable Glow Discharge Cleaning Probe will be installed at bay K top on Saturday, and will be pumped

and baked to be ready for operations late next week.

Plasma operations will resume on Monday morning after a vacuum vessel boronization on Sunday, and there will be no access to the NSTX test cell during the 1st shift. The run day will be extended to 7PM on Tuesday this week, and the test cell will be in controlled access each evening from the end of run day until 10PM. A machine area scrub will be performed from 10-11PM each evening in preparation for the following day's run. The next NSTX maintenance week is scheduled for the 1st week in August. (A. von Halle)

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

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

- There was a successful Peer Review of the MPG bellows motion characteristics. Installation of the cabling for the MPG from the top of the vessel to the respective landing points was completed. Connection of the cables will be performed after installation of the MPG on the vessel and operational testing begins.
- A brief, 1.3 g, Boronization(-46) was performed.