

## NSTX Weekly Report (June 3, 2005)

FY2005 Planned Operations: 17 weeks  
Completed: 5.87 weeks producing 588 plasmas

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

The sixth week of operations was completed successfully with two experimental machine proposals and three experimental proposals conducted.

#### XMP-037 - Assessment of RWM/EFC coil capabilities

The goal of this XMP is to perform an assessment of the magnitude and structure of applied field inside the vacuum vessel as a function of the toroidal mode number and rotation/oscillation frequency of applied field. DC, standing and rotating fields for both  $n = 1$  &  $3$  were produced with the RWM/EFC coil set operating with up to 1 kA of current. These fields were measured inside the vacuum vessel using the internal Br and Bp sensor arrays for a variety of applied frequencies, and the measured fields are being compared to expectations.

#### XMP-039 - CHI Pre-ionization

A new pre-ionization method for initiation of CHI discharges at vessel gas pressures comparable to that used for normal inductive operation was successfully tested. After injecting 2 TorrL of D2 in the region below the lower divertor plates, 10kW of ECH power (also injected below the divertor plates) was used to ionize the gas. Toroidal field and gas pressure scans were conducted to determine optimum conditions for pre-ionization. As required, the pre-ionized plasma successfully coupled to and initiated a high current capacitor bank discharge. This represents a factor of ten reduction in gas pressure compared to that used in FY04.

#### XP-503 - Error fields and Locked Modes

Ohmic, low-density target plasmas with  $I_p=800\text{kA}$  and  $B_t=4.5\text{kG}$  with reproducible density and q-profile evolution were developed for this experiment. The new RWM/EF coils powered by new SPAs were used during plasma operations for the first time on NSTX. Preliminary application of  $n=1$  error fields in the same direction as tested last year show no strong field asymmetry in the current flat-top – consistent with last year's results. Different applied field directions and lower density targets will be tested in future run days.

#### XP-528 - High poloidal beta with current ramp-down

The goals of this experiment include: generating high poloidal beta plasmas with high rotation, maximizing beta-N, and examining bootstrap and reconnection physics at high beta-P. An  $I_p$  ramp from 1.0-0.5MA was successfully developed in high-delta DND plasmas, and high poloidal beta equilibria near 2 was generated with high rotation. MSE data was taken, and MSE reconstructions

indicate that a record NSTX beta-N value was reached with  $\beta_N > 7.2$  in shot 116055. Very high beta-P values = 2.1 were also achieved, and the plasmas were approaching the equilibrium limit as evident from poloidal field measurements at the plasma inboard side. Reconnection events leading to rapid drops in  $W_{tot}$  during the  $I_p$  ramps were also sometimes observed.

XP-520 "Divertor regimes and outer target detachment in NBI-heated plasmas" The goal of this experiment was to investigate means to reduce heat flux on outer divertor target and determine conditions for outer target detachment. Dr Charlie Lasnier (LLNL @ DIII-D) came to PPPL to participate in the experiment. Two means to reduce heat flux at the outer divertor target by attempting plasma detachment from target have been investigated. D2 was injected in 3 and 4 MW NBI-heated L-mode plasmas in increased quantities until a limit of gas intake by plasma was reached. While some reduction of peak heat flux and slight broadening of the heat flux profile was observed on the outer target, along with slight increase in radiated power, no clear signatures of the outer target detachment have been observed. The inner target remained detached as in most NBI-heated L- and H-mode plasmas. Second, Neon was injected in 3 MW NBI-heated L-mode plasmas and 4 MW H-mode plasmas in increased quantities to establish an additional power exhaust channel through edge radiation. While an up to 4-fold reduction of outer target heat flux was measured, no clear signatures of the outer target detachment have yet to be observed.

### **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). In preparation for CHI experiments, gas injected into the new lower dome was successfully ionized by the new ECH lower dome injector, and the CHI capacitor bank produced a measurable toroidal plasma current (XMP-39). The noise immunity of the SPA system needed for RWM Experiments has been greatly improved, and current control of the error field coils, while measuring magnetic field responses, has been demonstrated (XMP-37). The EF/RWM coils were then used in support of "Error-field and locked-mode physics studies using RWM/EF coils" (XP-503). Progress was also made this week on XP-528 "High beta poloidal with current rampdown", and on XP-520 "Divertor regimes and outer target detachment in NBI heated plasmas". Work continued on the commissioning of the new High-k Scattering diagnostic over the weekend.

Plasma operations will resume on Monday morning and there will be no access to the NSTX test cell during the 1st shift. 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. (A. von Halle)

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

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

- This week, the Omega IR Camera returned from vendor maintenance. First, it was installed on CDX-U and used to help characterize liquid lithium experiments. After this work, it was removed from CDX-U and reinstalled on NSTX. It is currently acquiring data during NSTX plasma operations. (R. Maingi, ORNL)
- The Joint CDX-U/NSTX Lithium Evaporator Team reviewed results presented by D. Mansfield on a successful non-lithium full power test of a prototype Lithium Resistive Evaporator (LRE) in preparation for operational testing with lithium.
- Fiber optic and electronic equipment on loan from DIII-D (N. Brooks, GA) for the joint NSTX / GA / ORNL / LLNL collaboration was received.
- Charlie Lasnier (LLNL) visited NSTX for two days to participate in the divertor detachment experiment lead by LLNL and to discuss divertor data analysis with NSTX researchers. (V. A. Soukhanovskii, LLNL)

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

- A survey X-ray spectrometer was installed at the end of the Bay L pump duct as part of a collaboration with the Lawrence Livermore National Laboratory.
- A new fast camera was installed as part of a collaboration with the Los Alamos National Laboratory. The instrument is coupled with a fiber optic bundle to a viewing window on the Bay K port cover.
- The installation of the new multipoint Thomson scattering system (MPTS) channels has been completed. All the avalanche photodiode detectors appear to be functioning, but calibration is required before the data from the new channels can be used.
- Additional shielding was installed on the solid state neutral particle analyzer (SSNPA) to reduce detector noise.
- A water pump was replaced on the SPRED vacuum ultraviolet survey spectrometer.