

NSTX Weekly Report (March 28, 2008)

FY 2008 NSTX plasma operations

Planned: 15 weeks

Completed: 4.81 weeks (through March 26, 2008)

The NSTX Project has received the New Jersey State Commissioner of Labor and Workforce Development Continued Excellence Award for working 7 consecutive years without an away from work lost time injury/illness case. The award will be presented at an upcoming Governor's Occupational Safety and Health Awards Program Area dinner. (J. Levine)

Naoki Tamura, from the National Institute for Fusion Science (NIFS) Toki, Japan, visited NSTX March 3- 21 as part of the US-Japan collaboration. During his visit, he analyzed the experimental data on the past TESPEL injection experiments on NSTX and held discussions with NSTX scientists. He visited Johns Hopkins University in Baltimore, MD on March 20 and held discussions with D. Stutman and L.F. Delgado-Aparicio about future collaborations between JHU and NIFS. (H. Kugel)

Masayoshi Nagata (Professor, University of Hyogo) visited NSTX to study spectroscopic and plasma rotation physics in transient CHI experiments. It is of interest to know if transient CHI discharges exhibit some of the observed $E \times B$ rotation and $n=1$ oscillations previously observed in longer pulse CHI discharges in NSTX. The work is ongoing and will be continued remotely using data collected from the 2008 CHI run. (R. Raman, University of Washington)

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

Run Coordination (M. Bell, R. Raman)

Three experiments were conducted in the week March 20 - 26, 2008.

On Monday 3/24, we performed XP-818 "ELM mitigation with midplane control coils" [S. Sabbagh] using a new connection of the EFC coils that allowed the generation of $n = 2, 3$, and $2 + 3$ field perturbations. All of these field configurations were tested, primarily with DC, some with AC fields. While some shots showed a clear change in ELM behavior, similar to the clear and reproducible changes previously made using $n = 2$ configurations, the $2 + 3$ configuration did not clearly affect the ELMs at current levels near the maximum allowable. Target plasmas had $q_{95} \sim 7$, which varied slightly during the application of the non-axisymmetric field.

The experiment XP-822 "Field scaling of central electron transport change with heating power in beam H-mode" [D. Stutman] was run on March 25. Beam power scans were executed at 0.45 and 0.55 T toroidal field, while keeping the I_p/B_T ratio constant. The results indicate that in the central plasma (approximately $r/a < 0.5$) there is little increase in the T_e gradient with increasing power at both fields. Nevertheless, at higher field the gradient at the periphery is increased, leading also to an about 10% increase in the central T_e and an improved global confinement. The role of decreased edge MHD in this effect has to be determined. In addition, an improvement in particle transport with increased power at high field is estimated, possibly associated with increased rotation.

On Wednesday 3/26, we conducted XP-814 "Divertor heat flux reduction and detachment in highly-shaped high performance plasmas" [V. Soukhanovskii]. A high-performance, H-mode reference discharges with small ELMs was established at 1.0 MA, 0.45 T, 6 MW NBI in a highly-shaped configuration optimized for diagnostic coverage. A partially detached divertor (PDD) condition was then produced by divertor deuterium injection at increasing rates. Increased power and momentum losses in the PDD region were evidenced by a significant (up to 50-70 %) reduction in the peak heat flux to the divertor, increases in divertor radiated power and volume recombination rates, and a decrease in the particle flux to the divertor plate. The good core plasma confinement characteristics were maintained in the PDD discharges. Investigation of the PDD phase in higher current 1.2 MA, 4.5 kG, 6 MW discharges was started.

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

NSTX plasma operations resumed this past week after a scheduled maintenance week to install the new lithium evaporator (LITER) probe at bay K. The machine's mid-plane error field coils were reconfigured to support an on-going experiment on ELM mitigation, and the neutral beam systems were used extensively in support of experiments on field scaling of electron transport, the study of a partially detached divertor regime, and plasma edge characterization. Also this week, a repair of the HHFW source #1 transformer/rectifier output bushing was completed, and vacuum conditioning of the HHFW antennas was performed one evening.

NSTX Test Cell access will be restricted during plasma operations this coming week. Test Cell access is expected to be available from 5PM to 10PM each evening.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- The first phase of off-line LLD tests were completed. Lithium from the LITER-Bay F unit was evaporated on a candidate LLD substrate sample consisting of flame sprayed porous molybdenum on stainless steel. The sample temperature was varied between 200-400°C. Data useful for future LLD operations were obtained. The principal results demonstrated a) good wetting of the molybdenum, b) once the activated lithium surface was passivated by nitrogen, elevating the substrate temperature to 400°C alone did not cleanup the surface, and c) operating at 400°C for a sufficient time can cause the evaporation of all remaining activated lithium. Preparations started for the next phase of LLD tests that will use a LITER-2006 unit as an evaporation source.

- Preparations continued for the installation of LITER Bay F. Measurements were performed and documentation prepared for the installation of the motion drive limit switches. A trial fit up of the probe support unit is in progress. (T. Provost)

- Off-line tests of a lithium powder shaker to disperse a wax-covered (CH₂) lithium powder demonstrated that a) under high vacuum conditions there was no apparent hydrocarbon evaporation observable with a Residual Gas Analyzer, and b) under NSTX-like deuterium

pressures, the lithium powder appeared to be inert with no observable reactions with the deuterium gas. (D. Mansfield)

Diagnostic Operations (R. Kaita)

- A calibration of the high-k microwave scattering system was performed. The receiver power response for five channels was obtained at different attenuation levels.