

NSTX Weekly Report (Apr. 29, 2005)

FY2005 Planned Operations: 17 weeks

Completed: 1.35* weeks producing 133 plasmas

(*Includes 0.18 week run during the week of April 11)

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

- There will be a Physics meeting on Monday, 5/2 at 1:30 pm in LSB318. Speakers will be David Gates and Sid Medley.

- The FY 05 NSTX Run Log is available on the web.
http://nstx.pppl.gov/Menu_folder/operations.html

Run Coordination (J. Menard)

- XMP-038, "Evaluate Hot Boronization Applied During Bakeout" was completed. The purpose of this XMP was to test the reproducibility of previous results indicating that boronization on hot surfaces yields a significant improvement in initial operating conditions relative to boronization on cold surfaces, and to characterize the state of the wall conditions for subsequent planned experiments requiring low deuterium recycling and impurity influxes. 3 Ohmic fiducial discharges immediately exhibited the once elusive Ohmic H-Modes. The D-alpha waveforms exhibited relative intensities comparable to those of the 2004 Hot Boronization, all of which were a factor of 4 lower than those following Cold Boronizations. 10 NBI fiducial discharges were examined, and all exhibited H-Mode transitions in spite of these being the first FY05 discharges using high-power NBI heating.

- XMP-36 "Supersonic gas injector commissioning for FY05 operations" has been completed. The supersonic gas injector (SGI) flow rate has been measured, and gas injections into the far scrape-off layer plasmas were performed. The diagnostic package mounted on the SGI probe head - The Langmuir probe, thermocouples and magnetic pickup coils (Bz, Bt, Br, Mirnov) - has been fully commissioned.

- XP 508 "DND long-pulse development using new PF1A coils High kappa, high delta double null plasmas with $\kappa \sim 2.4$ and $\delta \sim 0.7$ were produced for the first time using the new PF1A coils. The internal inductance was higher (minimum value ~ 0.75) than in similar reference discharges, and the achievable δ/κ is expected to increase further at lower internal inductance. Optimization of time evolution of the discharge shape and position was also begun. H-mode accessibility, while not definitively assessed with a power scan, was acceptable. The energy confinement time was ~ 30 -40ms, also somewhat lower than the best values for similar shots ~ 40 -50ms. This is likely the result of tearing mode activity associated with initial high-power operation.

- XP 516 - "Plasma fueling with supersonic gas jet". A scan of the distance between the SGI and the plasma separatrix has been accomplished in ohmic L-mode plasmas. Not surprisingly, edge and core density rise was directly correlated with the proximity of the SGI to the plasma separatrix. Steady-state SGI fueling of NBI-heated H-mode plasmas has been demonstrated. H-mode access was possible only when the SGI head was located in the shadow of the RF limiter. Particle balance, recycling and SGI fueling efficiency analyses are in progress. Valuable operational information of the supersonic gas jet interaction with L- and H-mode scrape-off layer plasmas was available during the experiment from the fish-eye plasma TV, operated by ORNL (C. Bush), and fast framing cameras as a result of collaboration with Nova Photonics (R. Maqueda and K. Williams - Florida A&M University) and the CDX-U team (R. Kaita, T. Gray).

- XMP 33 - Gas filled torus calibration for the MSE diagnostic. The MSE gas filled torus calibration began with beam into plasma to complete filter tuning for eight sightlines. After this was completed, beam into gas was done to calibrate the eight MSE sightlines. The TF and PF coils systems were used to produce known pitch angles in NSTX that are used to calibrate the diagnostic. Two visitors from the C-Mod project, Steve Scott (PPPL) and Howard Yuh (MIT) were on hand to participate in the calibration and compare results between deuterium and helium as the target gas. The analysis will be ongoing, however the MSE diagnostic will now be available to support NSTX experiments.

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

NSTX Operations resumed this past week after the completion of the previous week's vessel bake-out and hot boronization. Tuesday and Thursday were the extended run days. An experiment to evaluate the effects of the hot boronization was performed (XMP-38), confirming that this procedure improved machine conditions to the extent that H-mode transitions occurred readily in ohmically heated plasmas. The new PF1A coil, as well as neutral beam injection, was used in the commissioning of rEFIT, and in an experiment on long-pulse double-null plasmas (XP-508), during which 1MA discharges were produced. The Supersonic Gas Injector (SGI) was commissioned (XMP-36), and used in a plasma fueling experiment (XP-516). A calibration of the Motional Stark Effect (MSE) diagnostic was performed using neutral beams into a gas filled torus, and a neon glow calibration of the CHERS diagnostic was performed one evening at the end of the run day. Power testing of the new Switching Power Amplifier using the real-time control system continued in parallel with machine operations, and the conditioning of the refurbished ion source in the "B" position continued with good progress.

Plasma operations will continue on Monday morning and there will be no access to the NSTX test cell on the 1st shift, with plans to extend the run day to 7PM on

Tuesday and Thursday. 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)

Physics Operations (D. Mueller)

The first full week of plasma operations went very well at 4.5 kG. The first full day scheduled plasma operations, Monday, was used to make adjustments to control gains, and assess the Hot boronization. We achieved Ohmic H-modes as well as H-Modes during NBI. Investigations aimed at increasing the pulse duration in the double null configuration went well, the largest plasma volume on NSTX was achieved (14 m^3), the plasma performed very well for so early in the run as the development of a discharge for XP508 proceeded. Discharges fueled by the Supersonic Gas Injector (SSGI) were made on Wednesday; the ohmic part of XP516 was completed and the NBI part was begun. A mix of NBI heated discharges and NBI into gas-filled torus shots to commission and calibrate the MSE diagnostic were completed on Thursday and Friday. The SSGI injected into the plasmas to continue XP516 in a piggyback. Performance of the plasmas continued to improve as the machine conditions; the 800 kA discharge with 2 NB sources lasted nearly 700 ms and those with a single source out to 600 ms. The discharge duration was limited by the slowing (and locking) of MHD. These discharges will provide good tests to investigate the control of MHD and locked modes with the RWM system.

Boundary Physics Operations (H. Kugel)

- XMP-036, "Supersonic Gas Injector Commissioning for FY05 Operations" was completed. (V. Soukhanovskii, LLNL)
- XMP-038, "Evaluate Hot Boronization Applied During Bakeout" was completed. (H. Kugel)
- XP-516, "Plasma Re-fueling with Supersonic Gas Injection" was initiated. (V. Soukhanovskii, LLNL)
- The UCSD Fast Probe upgrades and testing were completed, and the Probe was used to support experiments this week. (J.Boedo, L.Chousal, R.Hernandez, UCSD)
- The NSTX web page "Supersonic Gas Jet for Fueling and Diagnostics Applications", became operational at nstx.pppl.gov - Operations - Diagnostics & Support Systems (shortcut is <http://nstx.pppl.gov/sgi>). (V. Soukhanovskii, LLNL)

- The bellows motion drive for the Moveable GDC (MGDC) system received recently from the vendor passed its acceptance leak test. (T.Provost)

- A neon glow discharge was performed for calibration of CHERS. (W.Blanchard)

Diagnostic Upgrades (D. Johnson)

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Diagnostic Operations (R. Kaita)

- The calibration of the CHERS ion temperature diagnostic with a neon glow discharge was completed.

- First data for the present NSTX operational period were obtained with fast visible cameras on Bays B and L. Detailed images of the supersonic gas injector were obtained during its operation in Ohmic and neutral beam heated plasmas.

- A compensation calibration of the plasma current Rogowski coils was performed.

- Calibration of the motional Stark effect (MSE) current profile diagnostic was accomplished. The NSTX magnetic fields were varied in a sequence of gas-filled torus shots to check the magnetic field “pitch-angles” measured by the MSE diagnostic.

Physics Analysis (S. Kaye)

Rajesh Maingi and Chuck Kessel gave overviews of possible invited APS talks, Maingi on the small ELM regime in NSTX and the effect of low aspect ratio, and Kessel on modeling steady-state scenarios and how to achieve them experimentally. Bill Heidbrink of UC Irvine gave a talk on implementation of a D-alpha fast ion diagnostic on DIII-D. The diagnostic takes advantage of the Doppler shift of the D-alpha emission gyrating beam particles to determine the injected fast ion population. Bill indicated that this technique is appropriate for use on NSTX, and plans for this are being discussed.