

NSTX Weekly Report (May 26, 2006)

FY2006 weeks of research operations

Planned: 11 weeks

Completed: 9.25 weeks

Eight NSTX papers were presented at the Plasma Surface Interactions (PSI) meeting in Hefei, China. Ricky Maqueda (Nova Photonics) presented an oral paper entitled "Structure of MARFES and ELMs in NSTX", and seven posters were presented covering a wide range of boundary physics topics including the initial lithium evaporation experimental results (H. Kugel,) divertor heat flux scaling (R. Maingi, ORNL,) divertor heat flux reduction (V. Soukhanovskii, LLNL), wall surface coating (C. skinnert,) dust physics (C. Parker, L. Roquemore), and a neutral transport modeling of Gas Pull Imaging experiment (D. Stotler.) The papers will appear in a special issue of Journal of Nuclear Materials after review. (R. Maingi)

Two NSTX invited papers were presented at the 14th Joint Workshop on Electron Cyclotron Emission and Electron Cyclotron Resonance Heating held in Santorini Island, Greece (May 9-12, 2006). Gary Taylor presented a talk entitled "Electron Bernstein Wave Research on Overdense Plasmas in the National Spherical Torus Experiment." The talk described recent modeling results for electron Bernstein wave current drive on NSTX and compared electron Bernstein wave emission measurements on NSTX to numerical simulation predictions. Abhay Ram (MIT) presented a talk entitled "Propagation and Damping Characteristics of Electron Bernstein Waves Pertinent to Current Drive." The talk described the essential physics of electron Bernstein waves, and their interaction with electrons, that make them suitable for current drive in NSTX, in particular, and in other devices, like stellarators, in general. (G. Taylor, A. Ram)

Martin Peng (ORNL) was invited to participate in a commencement ceremony on the QUEST Project, a new ST experiment under construction at the Kyushu University to replace the TRIAM-1M experiment. He also attended the 4th All Japan ST Steering Committee meeting. (M. Peng)

There will be an NSTX Physics meeting on Tuesday, May 30 at 1:30 pm in LSB18. The agenda is: **XP Summaries:** R. Raman – Transient CHI, S. Diem – EBW emission, S. Kaye – Confinement scaling. **Physics Presentations:** Fredrickson - "Observations related to TAE and BAE(?) in NSTX", and Gorelenkov - "Are there TAEs in NSTX?" (S. Kaye)

There will be an NSTX Team Meeting on Wednesday, May 31, 2006, at 1:30 P.M., in LSB318. In addition to general updates on the NSTX plasma operations and the preparation for the upcoming outage, we will update you on a summary of the recent PPPL Safety Forum breakout sessions. NSTX researchers are requested to attend at least the Safety Forum part of the meeting.

Agenda:

- General Items
- Safety Forum and other safety related matters
- Engineering Operations
- Research Operations
- Run Coordination

- Physics Analysis

Run Coordination (R. Raman, S. Sabbagh)

Very good progress was made during this busy week that contributed to seven experiments, producing new important results.

XP526 ELM severity on confinement (May 18) – S. Kaye: Little progress was made because plasmas in the desired shape could not be maintained stably.

XP615 Active Stabilization of the Resistive Wall Mode at Low Aspect Ratio (May 18) – S. Sabbagh: This half-day run further demonstrated active RWM stabilization in NSTX, focusing on low rotation target plasmas. Pre-programmed $n = 3$ magnetic braking fields produced plasma rotation frequency down to 0.5% of the Alfvén frequency at $q = 2$, which is $\sim 1/7$ of the critical rotation frequency at this location. Core plasma rotation dropped to $1/3$ of the critical rotation frequency at the magnetic axis. The plasma was stabilized above the $n=1$ no-wall beta limit and below the critical plasma rotation profile for more than 90 inverse growth times. Ultra soft X-ray data was taken to further diagnose the RWM and plasma modes observed. A rapidly growing (20 microsec timescale) $n = 2$ plasma mode caused a beta collapse during $n = 1$ RWM feedback stabilization. The resulting $n = 1$ perturbation created in the wake of this mode was damped, not amplified, by the active feedback system, allowing the plasma beta to recover.

XP617 HHFW power balance vs B at constant q (May 19) – J. Hosea: The goal of this run was to complete scans at 5.5 kG and add data at 3 kG with data from Mirnov coil signals to indicate MHD in order to fill out the data set from April 26. The remainder of the data required for 5.5 kG was obtained except for the soft x-ray core stability data. A series of shots were run with and without NB for 4 phase conditions: 14 m^{-1} , 7 m^{-1} , -7 m^{-1} , and -3 m^{-1} . The major initial observations are: The series had good plasma stability conditions. A good comparison of electron heating (TS) and edge ion heating (ERD) vs phase was obtained. It was found that (1) Te(0) increases with increasing k_{\parallel} , (2) Ti(145cm) does not decrease with increasing k_{\parallel} . (3) There is much better core heating at 5.5 kG than at 3 kG for all phases. Scans were also conducted at 3 kG and 3.5 kG to study the field effect on heating with Mirnov signals to look for MHD activity during the scan. Discharge programming at the lower field was more difficult than at 5.5 kG. Initial observations are: Satisfactory MHD data were obtained at both 3 and 3.5 kG. The half kG increase gives a large change in heating and stability. Heating is better at the beginning of the discharge, whereas at 5.5 kG the heating improves throughout the discharge. A large data analysis effort is now required to determine heating efficiency and PDI contribution to the edge power loss as a function of phase and B.

XP529 Dependence of H-mode pedestal structure on aspect ratio (May 19) – R. Maingi: During the several discharges devoted to this XP which was originally run on April 26, the remaining part, which involved producing discharges at low pedestal collisionality was completed. This was accomplished by repeating the discharges after conducting the vessel with a He plasma shot to reduce wall recycling on the subsequent deuterium shot.

XP621 Comparison of small ELM regimes on C-MOD, MAST and NSTX (May 19) – A. Hubbard: During the few discharges devoted to this XP, the required shape development for this XP made progress, in that the target shape common to all three machines was nearly achieved (R. Maingi).

XP606 Transient CHI startup (May 22, 23) – R. Raman: Very good progress was made in the area of solenoid-free plasma startup using Transient CHI. On May 22, 100kA of closed flux current was generated. On May 23, up to 160kA of closed flux current was generated in NSTX. During this run, a capacitor bank scan was conducted at four different capacitor bank sizes (20, 25, 35 and 45mF). The nominal capacitor bank charging voltage was 1800V. The current in the PF1B coil, which to a large extent determines the injector flux was varied from 4400A to 6000A. The highest closed flux currents were obtained at 0.5T. The data indicates that the closed flux current could be further improved in NSTX. Brian Nelson and Tom Jarboe (Univ. of Washington) participated in these experiments.

XMP44 Spatial and k-space alignment of high-k scattering system (May 24) – D. Smith: The purpose of this is to establish the accuracy of the alignment scheme and to measure system sensitivity to misalignment in both real-space and k-space. Two, out of the required five scans were completed.

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

NSTX plasma operations continued this week after a weekend vacuum vessel boronization and the reconfiguration of power systems for CHI operations. XP-606 was performed at machine fields up to .55 Tesla, obtaining closed-flux currents to a new high of 160kA. The machine was then reconfigured for full ohmic operations to support XP-625 "Thermal Electron Bernstein Wave Conversion to O-Mode at 8-40 GHz", XP-532 "B_T and Beta Scaling of Confinement" at machine fields to .55 T, and XMP-44 "Baseline Operation of the High K Scattering System". The LITER probe has been fitted with the LITER-C cartridge and will be installed on NSTX by the coming weekend for bake-out and other preparations needed to continue to use this system in the coming weeks

Plasma operations will continue this coming week. Access to the test cell will be available from the end of the run day to approximately 9PM each evening.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- A Peer Review for the LITER-1C configuration, installation, and operation was held and declared a success pending resolution of 2 CHITS which have since been completed. LITER-1C reassembly is progress. Cartridge-1C has been attached and the power and thermocouple leads have been reconnected.
- Accurate weighing of carbon spheres of sizes 0.25, 0.5, and 0.75 mg for transport measurements was performed at Johns Hopkins University in preparation for LPI loading. (L. Delgado-Aparicio, JHU)
- NSTX TMB Boronization-55 (~5g) was performed.