

NSTX Weekly Report (May 2, 2008)

FY 2008 NSTX plasma operations

Planned: 15 weeks

Completed: 8.75 weeks, 1307 plasmas (through April 30, 2008)

R. Maingi (ORNL) presented "ELM control experiments with midplane coils in NSTX" at the ITPA Pedestal and Edge Physics Group meeting in San Diego, CA. (R. Maingi)

There will be an NSTX Physics Meeting on Monday, 5/5 at 1:30 PM in LSB318. We will have XP and analysis updates by: Steve Sabbagh, Phil Ryan, Joon-Wook Ahn, Rajesh Maingi. The talks will be found in <http://nstx.pppl.gov/DragNDrop/NSTX Meetings/Monday Physics Meetings/2008/5-5-08/> (S. Kaye)

Run Coordination (M. Bell, R. Raman)

Nine experiments received run time in the week April 24 - 30.

On Thursday 4/24, we began an experiment on "RWM stabilization physics" [XP-830, J. Berkery] in which $n=3$ magnetic error field correction, $n=3$ magnetic braking, and $n=1$ feedback were used to create various rotation profiles to test the effectiveness of kinetic dissipation in stabilizing the resistive wall mode. Interestingly, the RWM was destabilized at higher rotation in a few shots, while shots with lower rotation were stable, which is incompatible with simple theories of a "critical" rotation, but is allowed by more complex kinetic stabilization theories. Analysis of MHD spectroscopy data and numerical calculations of theoretical kinetic stability is underway.

The new fast-ion D-alpha (FIDA) and other diagnostics were employed in the experiment on Friday 4/25 "Spatial profile of beam ions accelerated by HHFW" [XP-832, W. Heidbrink (UCD)] to measure the acceleration of energetic ions from the neutral beams by high-harmonic fast-wave (HHFW) heating in deuterium L-mode plasmas. The neutron rate and in the electron temperature were much larger with the HHFW heating and neutral-particle analyzers (NPA) detected ions accelerated to twice the NB injection energy. Preliminary analysis of FIDA data suggests a very broad heating profile, as expected for multiple resonance layers at low-aspect ratio. Instabilities in the CAE and GAE range of frequencies were strongly driven during the HHFW heating, possibly due to enhancement of the velocity-space anisotropy that drives the modes. Late in the day, we performed shot development for the experiment "X-point limiter" [XP-826, M. Bell] and did obtain configurations with the dominant magnetic X-point very close to the lower outer divertor target.

On Monday 4/28, we continued "Divertor heat flux width and midplane SOL widths" [XP-815, J. Ahn (UCSD)] to complete the plasma current scan in low NBI power H-mode plasmas. With 1.4MW NBI, we successfully obtained the desired H-mode in 800kA and 1MA plasmas. The fast probe data and the divertor heat flux profile were obtained close to the separatrix for these two plasma conditions. On Monday afternoon, we continued the experiment "Divertor detachment with deuterium and impurity gas injection" [XP-814, V. Soukhanovskii]. In high-performance,

H-mode plasmas in a highly-shaped LSN configuration at 1.2 MA, with 6MW NBI, a partially detached divertor was established using divertor deuterium injection which reduced the peak divertor heat flux from 8-12 to 1.5-3 MW/m². The optimal divertor deuterium injection rate was found at which no core performance degradation was observed.

The experiment "Investigation of ion transport with beam modulation" [XP-831, P. Ross] continued on the morning of Tuesday 4/29 using PW modulation of 2 NBI sources during MHD-free periods to observe the effects on the thermal population. The electrons behaved as expected, but the ion temperature dropped rapidly when the beams turned off. The NPA and FIDA diagnostics gathered data which will be analyzed to obtain the slowing-down spectrum of fast ions. In the afternoon we switched to the experiment "Magnetic Shear and Transport" [XP-829, H. Yuh (Nova Phototonics)]. Although the desired reversed-shear q-profile with an internal electron transport barrier was apparently produced, the HHFW power did not produce the same response in the central electron temperature as previously, possibly because of a change in edge conditions. High-k fluctuations were observed for weakly reversed shear cases at a new radius of 124cm that did not appear for more reversed shear cases.

After reconnecting the EFC coils to the even-parity configuration the previous evening, the experiment "Intrinsic n=2 error fields and RWM critical rotation" [XP-805, S. Gerhardt] was continued on Wednesday 4/30. Two 6-shot scans of the applied n=2 phase were conducted: one scan with the current in the RWM coils at 500A, and one at 1000A. Four reference shots with no applied n=2 fields were also taken. Initial analysis shows that no applied field phase resulted in an increase in plasma rotation or pulse length, indicating that n=2 error-fields, if present, are in some sense "small". Many resistive wall modes (RWMs) were generated with n=2 applied fields, and these shots are being incorporated into the RWM critical rotation database. For the last three hours of operation we continued the experiment "NTV with n=2 error fields" [XP-804, S. Sabbagh (Columbia)] to investigate the beta dependence of the non-resonant braking effect. Saturation of the plasma rotation profile was successfully produced at reduced normalized beta of 3.5 %m.T/MA with clear outward momentum transport across the rational surface, before the appearance of a strong n = 1 rotating mode and subsequent resonant braking. The saturated rotation profile is distinct from profiles produced at higher normalized beta.

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

NSTX plasma operations continued this past week with experiments investigating ion transport with beam modulation, divertor heat flux width and SOL width. Further experiments were run examining divertor detachment with deuterium and impurity injection, magnetic shear transport and error field suppression in long-pulse discharges. The SPA/EFC coil connections were configured for even parity for the error field and plasma rotation experiments and then returned to the odd parity configuration the following evening after the run. A boronization (1/2 bottle) of the vacuum vessel was completed on Monday evening. Additionally, the Bay K LITER probe alignment was confirmed, limit switches were installed, and the motor, shutter controls and interlocks were successfully tested.

There will be no access to the NSTX test cell during plasma operations this coming week. Access to the test cell will be available from 5PM to 10PM each evening.

Research Operations (M. Bell)

RF Operations (J. Hosea)

14 people attended the Final Design Review of in-vacuum changes to NSTX's HHFW antenna on 4/28. These changes are being made to increase the maximum power by a factor of ~2 and voltage standoff by a factor of ~1.4. Bob Ellis presented a very comprehensive review of the changes; the details were well discussed throughout the presentation. Three chits were submitted - two suggested modest detailed design changes for consideration and one recommended that disruption loads on the ceramic be evaluated. The review committee concurred with all 3, and judged the review to be successful, pending close-out of these chits and NEPA form submittal and approval. The manufacturing plans and schedules presented were felt to be reasonable, but will require that procurement activities begin as soon as possible. (P. Heitzenroeder)

Diagnostic Operations (R. Kaita)

- A peer review was held to discuss the instrumentation and control details for the remote mirror control system being assembled for the high-k turbulence diagnostic.
- A second grazing incidence spectrometer (XEUS-II) from LLNL was installed on NSTX to monitor light and heavy impurities. First data was obtained this week though some fine tuning is still required. The wavelength range of the new system is from 50Å to 200Å for a combined wavelength range from both spectrometers of 8-200 Å. (L. Roquemore)

Boundary Physics Operations (H. Kugel)

Lithium Evaporator (LITER)

- The LITER probe motion drives were operated successfully in local NTC mode to test shutter and limit switch controls. (P. Sichta, M. Cropper)
- Preparations are in progress to complete the EPICS controls testing (P. Sichta) and to begin the preliminary test procedure (H. Schneider).
- The Final Review for OP-XP-827, "LITER Characterization and ELM Mitigation" (H. Kugel) and was declared a success pending resolution of the CHITS.

Liquid Lithium Divertor (LLD)

- The mounting of the LITER-1c oven (NSTX 2006) for evaporator service in support of LLD conditioning tests in L245 started. (T.Provost)
- Tile and LLD edge design team resolved remaining edge tile issues. (R. Ellis)

- A teleconference was held 4/29/08 between the respective NSTX and SNL design teams to resolve control system and interfacing issues, and to discuss status of near term procurement plans.

-A teleconference was held 5/02/08 between the members of the NSTX and SNL design teams, and S. O'Dell of Plasma Processes, Inc. to obtain technical and schedule information for plasma spray coatings of thin, porous, molybdenum on stainless steel.