NSTX Weekly Report (May 05, 2006)

FY2006 weeks of research operations
Planned: 11 weeks
Completed: 7.31 weeks

There will be an NSTX Physics Meeting at 1:30 pm in LSB318. At this meeting, we will start discussing possible APS Invited Talks. Since some people are away at the HTPD conference, we will have additional discussions in mid and at the end of this week as well. The agenda of today's meeting is: Summaries of last week's XPs: R. Raman, S. Kaye. H. Kugel. Discussion of Potential APS Invited Talks (S. Kaye)

M. Ono visited Tsukuba University (Gamma-10), University of Tokyo (TST-2, UTST), and National Institute of Fusion Science (LHD), Japan, on April 24 - 26, 2006. He gave presentations on NSTX at University of Tokyo and NIFS.

Run Coordination (R. Raman, S. Sabbagh)

Good progress was made with six experiments and with the use of rtEFIT for plasma shape development.

XP625: EBW emission and oblique O-mode coupling (April 27) – S. Diem: The first half of XP625, Thermal EBW Conversion to O-mode at 8-40 GHz, was completed. An initial mapping of B-X-O mode conversion efficiency was performed for a helium, L-mode, Ip=800 kA discharge. Peaks in emission for fundamental and second harmonic emission were located.

XP 627: Non-Solenoidal Ip rampup with HHFW (April 27) - C. Kessel: The goal is to examine the effectiveness of HHFW to replace inductive current and provide non solenoidal plasma current rampup. The experiments used low plasma currents 250-350 kA, isoflux/rtEFIT control of the outer gap for antenna coupling, HHFW powers ranging from 1.2-1.7 MW, and HHFW heating phasing at 14 m^{-1}. Initially there were difficulties getting the plasma control system to function at low Ip, but these were corrected, and reliable discharges were produced. The HHFW system was choppy at first due to gap control oscillations and non-optimal matching, however, this improved significantly as the matching was tuned. The plasma did enter H-mode in several discharges, however, it did not stay in H-mode, which appears to be correlated to the HHFW power dropping out. The HHFW power required to enter the H-mode is lower than previously observed at these values of the plasma current by about 1.5-2 times, and additional work is required to understand the HHFW power and H-mode sustainment. Phil Ryan (ORNL) was on site to participate in this experiment.

XP614: Comparison of error field correction techniques at high betaN (April 28)– J. Menard: Good progress was made in developing a lower plasma current target as part of the plasma current scan for this experiment. It was determined that the addition of a second NBI source early was needed to trigger reliable early H-mode for the 700kA LSN target. Interestingly, only 4MW of beam power was needed to sustain the discharge with the same flux consumption as the 6MW reference shot from 2005. Once the new target was established, it was observed that early OHxTF EFC can increase the plasma rotation during the first 250ms of the discharge. Dynamic EFC using feedback was also attempted in

this target after t=0.5s. This shot did not last as long as the reference, perhaps due to lower rotation late in the shot. Additional no-DEFC and OHxTF EFC comparison shots are needed to compare the different error field correction techniques.

XP606: Transient CHI startup (May 1) – R. Raman: Transient CHI experiments were run in the configuration used during the previous run. This run utilized a new capacitor based snubber and new noise suppression MOVs (Metal Oxide Varistors) to allow operation above the 1.5kV used in previous experiment. These systems worked very well and limited the injector voltage to about 1.75kV. On NSTX, the applied CHI voltage was increased above 1.5kV for the first time. Using a 15mF capacitor bank the magnitude of the initial peak current was increased up to 180kA and at least 70kA of closed flux current was generated. On a few discharges modest power HHFW (about 1MW) was applied to study antenna loading and coupling of these waves to the CHI target (**J. Hosea**). Tom Jarboe and Brian Nelson (University of Washington) were on site to participate in the CHI experiments.

XP533: CHI into an ohmic discharge (April 28, May2) - D. Mueller: Target development for XP 533, CHI into an ohmic discharge proceeded well. A 600 kA. LSN target plasma heated by a single NB source using PF2L and PF1AL was developed. Using a 40mF capacitor bank, up to 1kV was applied to this and the target discharge that uses PF1B. Up to 30kA increase in the plasma current was observed during the CHI voltage application phase. However, as a result of electrical noise pickup by the flux loops used for plasma position control, the plasma position started to change starting after the voltage application time. Data for the first 15ms after CHI started will be studied and methods to control the discharge will be investigated.

XP526: Dependence of ELM severity and confinement on boundary shape (May 2) – S. Kaye: A suitable target shape at a triangularity of 0.45 and elongation of 2 was developed using rtEFIT isoflux control. This discharge will be the starting point for the ELM severity and confinement studies to be conducted later in the run.

XP612: Perturbed electron transport with heat flux, collisionality and current in NSTX (May 3) – D. Stutman: In the first part of the study that was conducted, the purpose was to study using pellet injection, the dependence of the perturbed electron transport on heat flux in H-mode. To this end the plasma was preheated with various levels of power (from 2 to 6 MW), in order to 'freeze-in' the current profile. At 420 ms the beam power/heat flux was then changed and a small Li or TESPEL pellet injected to create an edge Te perturbation. Interesting results were obtained, with a clear increase in the speed of propagation of the cold pulse with increasing heat flux. The result seems to support critical gradient behavior in the H-mode NSTX electron transport. Results were obtained for different preheating power levels, having different initial Te profiles. Very interestingly, in one discharges a transition to an improved electron confinement regime was triggered by the pellet injection. The pellet caused a substantial and sustained peaking of the Te profile throughout the shot. The confinement time also increased and stayed high for the remainder of the shot. Finally, another important observation is that in the H-modes developed this year the perturbation induced by the pellet was substantially smaller than that observed during previous runs. This suggests an improvement in the electron transport in the peripheral plasma. Since these H-modes are consistently free of Type-I ELMs, the observation also brings further support to our hypothesis that the absence/presence of Type-I ELMs is governed in good measure also by the way in which the electron transport responds to perturbations. Useful data was also obtained by the new optical tangential array developed at JHU and the high-k scattering diagnostic. Also, the pellet injector performed very reliably. Kevin Tritz and Luis Delgado-Aparicio (Johns Hopkins University) participated in this experiment.

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

NSTX plasma operations continued this week, returning to coaxial helicity injection (CHI) experiments with XP-606 "Transient CHI Start-Up", where the bias voltage was increased from 1.5kV to 1.75kV, and XP-533 "CHI into and Ohmic Discharge". Also this week, the Lithium Pellet Injector (LPI) was used in support XP-612 "Perturbed Electron transport", and the new Lithium Evaporator (LITER 1) for XP-601 "Lithium Deposition". In addition, progress was made on shot development for XP-526 "Dependence of ELM Severity and Confinement on Boundary Shape".

NSTX will be off-line for scheduled maintenance this coming week. Plasma operations will resume following the PPPL Safety Forum to be held on Monday, May 15th

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

• LITER-1 was operated in support of XP601 to snout/reservoir temperatures of 700/625 °C to deposit lithium to about 500 Angstroms thickness cm at the Bay H Lower quartz deposition monitor.
• The Supersonic Gas Injector (SGI) was used to reduce the amount of required low field side gas puffing in support of XP601. (V. Soukhanovskii, LLNL)

Plasma Diagnostic Operations (R. Kaita)

• NSTX diagnostics continue to be operating well in general. Recent improvements include upgrades to the electronics for the Langmuir probes in the carbon plasma-facing tiles. Their bias voltage limit has been raised to 50V, and their 120V power supply isolation has been improved.