

NSTX Weekly Report (June 15, 2007)

FY 2007 NSTX plasma operations started on Feb. 19, 2007.

Planned: 12 weeks

Completed: 11.47 weeks with 1,679 plasma discharges (through June 14, 2007)

Abhay Ram (MIT) gave a talk titled "Relativistic Effects in Electron Cyclotron Resonance Heating and Current Drive" at the 4th IAEA Technical Meeting on ECRH Physics and Technology for ITER (held in Vienna). The purpose of this talk was to show the similarities between the ECRH physics of electron Bernstein waves in NSTX and that of the ordinary electromagnetic waves in ITER. Theoretical and experimental studies of EBW on NSTX will provide useful physical insights into wave propagation and the interaction of EBWs with electrons. This, in turn, will provide a detailed understanding of the O mode propagation and its interaction with electrons for current drive in ITER. The presented work is being done in collaboration with Joan Decker at Cadarache. (A. Ram)

There will be an NSTX Physics Meeting on Monday, 6/18 at 1:30 pm in LSB318. We will have summaries of last week's XPs and a brief overview of initial FIDA results by M. Podesta. (S. Kaye)

Run Coordination (D. Gates, M. Bell)

On the morning of Thursday June 7th XP-729 entitled " $n = 3$ magnetic braking with optimal $n = 1$ error field correction" was run by A. Garofalo - a Columbia University researcher on long term assignment to DIII-D at General Atomics. The mode feedback algorithm was used in an iterative way to determine the "optimal error field correction". After this $n=3$ magnetic braking was applied and the results will be compared to similar experiments performed without the error field correction.

In the afternoon of the 7th, XP-705 entitled "Multi-mode beam fast ion loss power scan" was completed. Using "fast-ion MHD quiescent discharges" developed in the previous run of this experiment, a beam power and voltage scan was performed and the onset of Alfvén cascades was observed. Interesting results were also obtained by varying the concentration of Helium and Deuterium in the discharge. This XP was in support of the NSTX Joule milestone on understanding of fast-ion MHD.

On the morning of Friday June 8th XP-704 entitled "Measurement of ideal plasma response by asymmetric external magnetic perturbations" was performed. Non-axisymmetric magnetic perturbations were applied using the NSTX RWM feedback coil system and the response of the plasma to these perturbations was observed using several diagnostics. These results will be compared to predictions of the ideal MHD response. This XP was run in support of the Princeton University Ph. D. candidate J. Park.

In the afternoon of Friday the 8th XP-737 entitled "Investigation of Ion Transport with Beam Modulation" was run. An NPA scan was performed on low-frequency-MHD free H-mode discharges that had beam modulation. This XP was run in support of Princeton University Ph. D. candidate P. Ross.

On Monday June 11th XP-745 entitled "Relationship of ELM Severity and Electron Transport" was run. Data was obtained using the recently upgraded high- k scattering system during discharges with different

types of ELMs. This data will contribute to the APS invited talk to be given by K. Tritz of Johns Hopkins University in Orlando this year.

On the morning of Tuesday June 12th XP-714 entitled “Dependence of high-k fluctuations on B_T ” was run. This experiment documented the high-k turbulent spectrum during H-mode discharges at varying toroidal magnetic field using the higher band width now available on this system. Interesting spectral features were observed that were not apparent during the previous run of this XP performed with the lower bandwidth high-k data system. This experiment was run in support of the NSTX milestone on studying the variation of local high-k turbulence with plasma conditions.

In the afternoon of the 12th XP-735 entitled “High-k measurements in RF-heated discharges” was run. Data was taken in discharges with very high central electron temperatures using the high-k scattering system. This experiment was also run in support of the NSTX milestone on studying the variation of local high-k turbulence with plasma conditions. During this XP, a record central electron temperature of $T_e = 4.7\text{keV}$ was observed.

On the morning of Wednesday June 13th XP-734 entitled “ T_e gradient and magnetic shear effects on core transport” was run. Reverse shear plasmas were created using both NBI alone and NBI+RF heating to create strongly peaked electron profiles with steep gradients at the magnetic shear reversal surface. High-k data was obtained in these conditions, in support of the NSTX milestone on studying the variation of local high-k turbulence with plasma conditions.

In the afternoon of the 13th XP-717 entitled “HHFW Current Drive at High B Field” was run. Data was taken stepping the NBI blips through plasmas heated with HHFW in current drive phasing to measure the current profile in these plasmas.

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

NSTX Operations continued this past week with extensive use of the high-k scattering diagnostic to measure fluctuations in experiments at various machine fields, and at varied NBI and HHFW power inputs at fields to 5.5kG and in reverse shear plasmas. HHFW heating was also used in an experiment to measure current drive for RF into ohmic discharges using the MSE diagnostic with the addition of NBI. The LITER lithium evaporator was reloaded with about 50 grams of lithium and re-installed on NSTX. About 12 grams of lithium was then evaporated in support of an experiment to peak the non-inductive current drive fraction by increasing the thermal confinement and beta. Also this week, additional halo current Rogowski coils were instrumented, and pre-operational testing of the gas controls portion of the new plasma control system continued in the off-shifts.

The NSTX test cell will be in restricted access during plasma operations this coming week, with plans to extend the run day to from 5PM to 7PM on Tuesday, Thursday and Friday. Access to the test cell will be available from the end of the run day to 10PM each evening.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- LITER-1d after reloading with 51.7 g of lithium was baked internally to 150°C using its oven heaters,

and externally to 120°C using heating tapes on the probe bellows. The torus interface valve was closed for this bakeout. After the baking and cool-down, the torus interface valve was opened during a maintenance period, and LITER-1d was inserted into the vessel to its operating position. LITER-1d was then briefly heated to about 600°C. The resulting rise in vessel base pressure due to residual outgassing was found to be minimal. LITER-1d was then used to support XP-724 at typical deposition rates of about 18 mg/min for a total deposition during the XP of 11.7g.

Diagnostic Operations (R. Kaita)

- Recent improvements to the high-k microwave turbulence diagnostic include a new video amplifier to increase the frequency bandpass and new high-speed digitizers.
- Adjustments to the detection hardware for the Johns Hopkins University transmission grating spectrometer have been successfully made, and spectra are now being obtained.
- W. Heidbrink of the University of California at Irvine (UCI) led a discussion of outage activities for the FIDA fast ion diagnostic on Thursday, June 14, 2007. Tasks were identified for UCI and PPPL personnel.