NSTX Weekly Report (June 25, 2004)

FY 2004 weeks of operation planned: - 20 weeks, Completed: - 15.9 weeks

Run Coordination (S. Kaye, J. Menard)

Run Coordination Highlights for the Week of 6/21/04

In the first run week after a two week maintenance period, several previously run XPs (Experimental Proposals) were finished, and several new ones were started. There were XPs to study Ohmic H-mode transitions and duration, a continuation of the vertical control work, a comparison of center stack and shoulder injectors for H-mode access and ELM studies, attempts to increase plasma pulse length through diverting the plasma early and early injection of HHFW, HHFW+NBI synergy, HHFW deposition and edge ion heating studies, and the study of AE "chirping" instabilities.

- Ohmic H-modes were obtained easily after a morning boronization and alternating Helium conditioning shots. Ohmic H-modes were observed over a range of currents, 600 to 900 kA and toroidal fields, 0.3 to 0.45 T. The Edge Rotation Diagnostic indicated the radial electric field at the edge of the plasma becoming more negative approximately 20 msec prior to the L-H transition. The H-phases were short, possibly terminated by a coherent mode. (C. Bush)

- The center stack shoulder injector was successfully used to produce long-pulse good performance H-mode discharges which were either ELM-free or had type I ELMs in balanced and downward biased double-null discharges. Performance appears as good or better than in center stack midplane fueled discharges. The gas injector rate optimal for H-mode access increased as the discharge was biased downward from double-null toward lower single null. (R. Maingi)

- The first half of an experiment to differentiate among ELM types was completed. Data from multiple diagnostics with multiple filters were obtained for type I, type III, and type V ELMs. (R. Maingi)

- An experiment was run to divert very early in the Ip ramp-up of 1.2MA early H-mode PF1B LSN long-pulse discharges. This plasma was designed to be used as a target for early HHFW heating and studies of very early H-mode access. Diverted LSN plasmas with elongation above 2 by t=50ms were created, however vertical control of the plasma was difficult with the very aggressive PF coil current ramp required to divert this early. Slowing the PF ramp slightly and requesting a non-zero current centroid vertical position allowed diverted plasmas to be created by t=55ms with acceptable vertical position control. However, the outer gap could not be reproducibly

controlled to centimeter accuracy during this early phase of the discharge, and significant HHFW power could not be reliably coupled to the plasma. Interestingly, despite the removal of the normal Ip pause and H-mode at 90ms, an H-mode was still obtained reliably at 140ms during the Ip ramp with a single beam source. Future work will focus on optimizing the early diverted target for obtaining very early NBI-induced H-mode. (J. Menard)

- The HHFW+NBI synergy XP was completed in which the High Harmonic Fast Waves were injected into NBI discharges over a range of wave numbers. Good comparison shots with and without the RF were obtained. While it was found that the RF changed the evolution of the total stored energy in the plasma, the final energy achieved was the same with and without the HHFW (up to 3 MW). (B. LeBlanc)

- The HHFW deposition study, using modulated HHFW, was completed in deuterium plasmas. The discharges on this day exhibited sawteeth and continuous 1/1 modes that started later than in discharges in the previous attempt at this XP (not starting until after the second HHFW modulation), allowing for a cleaner assessment of the HHFW deposition and possible edge ion heating. (R.Wilson)

- An experiment to study the effect of modification of the fast-ion distribution function on the nonlinear evolution of fast-ion driven instabilities was performed. The primary fast-ion population was formed by injecting neutral beams with different energies and injection angles; then, 30-ms pulses of HHFW were added to perturb the resonant fast ions. Based on the Berk-Breizman theory of hole and clump formation in phase space, suppression of the rapid frequency sweeping associated with "fishbone" modes was expected but the anticipated suppression did not occur. Surprisingly, modes with steady frequencies were altered by perpendicular acceleration of the beam-ion population. (W. Heidbrink)

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

NSTX plasma operations resumed this past week, beginning with a vacuum vessel boronization in support of an experiment studying H-modes in ohmically heated plasmas (XP-442) and a continuation of an experiment to measure the growth of the vertical instability with the vertical feedback loop frozen (XP-423). Midplane and shoulder gas injectors were compared in the production of H-modes (XP-409) and in ELM studies (XP-450). A divertor configuration for a long pulse with HHFW heating was developed (XP-451), before moving to experiments studying HHFW driven H-modes (XP-413) and HHFW power deposition (XP-441). Both HHFW and NB heating were used in an experiment on applying HHFW to chirping instabilities (XP-449). By the end of this past run week, NSTX had completed 15.9 run weeks this year, producing 1798 plasmas.

At the end of the run day on Friday, an electrical fault occurred at the top of the machine in the outer TF bus area. The arc appears to have started between the water cooling tube of outer TF-1 and the outer bus-link of TF-24. The gap between the water tube and the bus-link is relatively small ~ 1/4" and the water-tube is insulated. The observed damage is localized and easy to repair. The initial coil resistance test shows that the coil insulation for these turns was not damaged. If further testing and analysis does not reveal additional problems, we should be able to resume plasma operation relatively quickly. We are also conducting inspections of the other water fittings on the machine to ensure that the problem does not occur in the future. The extra time will also allow the on-going upgrade work on PF 4 and RWM to be completed this week. (A. von Halle)