NSTX Weekly Report (April 14, 2006)

FY2006 weeks of research operations
Planned: 11 weeks
Completed: 4.48 weeks

Run Coordination (R. Raman, S. Sabbagh)

Run Coordination, April 10-14 (R. Raman, S. Sabbagh)

Four Experimental Proposals were run. The Li Evaporator was installed on March 31 and commissioned during the week of April 2. The system operated very reliably during Li evaporation studies. The flow capability of the lower divertor gas injection was doubled and this increased flow capability was used in divertor detachment studies. Error filed correction was applied early in 1MA Lower Single Null Long-pulse discharges to aid operation at low density. A nearly suitable target plasma shape was developed for a future multi-machine (C-MOD, MAST, NSTX) small ELM regime comparison study.

XP605 Divertor detachment - V. Soukhanovskii, April 13: Divertor detachment and heat flux mitigation studies, using divertor deuterium puffing in 4MW NBI H-mode low triangularity (0.4) and elongation (1.8) lower single null plasmas, were completed (XP 605, Part1). Heat fluxes of 5-6 MW/m^2 are measured in this configuration at the outer strike point (OSP). A reduction of the OSP heat flux to 1-1.5 MW/m^2 compatible with H-mode confinement has been demonstrated using a radiative divertor achieved with a private flux region D2 injection. Diagnostic data is being analyzed for signs of OSP detachment. A newly installed additional divertor gas valve provided the required high gas flow rate, up to 160 Torr-l/s. A partial OSP detachment has been demonstrated by a steady-state inner divertor D2 feed, in concordance with the results previously obtained with pulsed D2 injections. While the OSP heat flux is also reduced to 1-1.5 MW/m^2, divertor deuterium puffing in this case eventually leads to an H-L transition or reconnection events. These results are very encouraging news for the CTF divertor heat flux mitigation scenarios and CTF divertor design.

XP601 Effect of Evaporated Lithium PFC Coatings on Density Control – H. Kugel, April 10-13: Initially, 7 helium discharges were performed to remove fuel gas from the plasma facing graphite surfaces. Then a LITER-1 evaporation was performed to a thickness of 36 ng/cm^2 as measured by a Quartz Deposition Monitor (QDM) in the lower divertor 20° from the QDM axis. This was followed by DND, high elongation, H-mode deuterium reference discharges with programmed Ip durations from 0.25 to 1.1 sec. These discharges exhibited Li l luminosity on the lower divertor, but no density change, and little difference from the pre-lithium reference discharge. Next, a second lithium evaporation of 154 ng/cm^2 (QDM) was performed. This was followed by DND high elongation deuterium reference discharges. These discharges exhibited no change as compared to those of the previous thinner lithium deposition. Next, a 1303 ng/cm^2 (QDM) thick lithium evaporation was performed, and followed by the application a series of LSN L-mode deuterium discharges. The density and performance of these discharges was similar to that of the pre-lithium reference discharge, although Li I luminosity from

the lower divertor and Li II luminosity from the plasma edge decreased sequentially to a baseline value over 6 discharges. Next, 3 helium conditioning discharges were performed to recondition the plasma facing graphite surfaces. Then, lithium was evaporated to a thickness of 4000 ng/cm^2, and this was followed by the application of a series of diverted, partially center stack limited, Reverse Shear L-mode deuterium discharges, but without applying HeGDC between discharges. The density and performance of these discharges was similar to that of the pre-lithium reference discharge, although, as previously, the Li I luminosity from the lower divertor and Li II luminosity from the plasma edge decreased sequentially to a baseline value over 6 discharges. It was noteworthy that several discharges in this sequence, without HeGDC between discharges, exhibited ELM-free or relatively ELM-free H-modes. Finally, the DND high elongation deuterium reference discharge was performed again and exhibited the longest Ip pulse length to date for the applied NBI power (5 MW), thus indicating good vacuum conditions. (H.Kugel, R. Maingi [ORNL])

XP602: Long-pulse development in lower-single-null, April 14 – J. Menard: The density was lowered by approximately 20% in the early phase of long-pulse PF1B LSN H-mode discharges. OHxTF error field correction was successfully applied as early as 150ms in these discharges to potentially aid operation at reduced density. In these targets at 750kA and 4.5kG, the duration of high normalized beta was significantly extended by delaying the third beam source, and beta-N at or above 5.5 was sustained for 400ms until the end of the discharge, and beta-N exceeded 6 for short durations. rtEFIT was used to control these long-pulse LSN discharges for the first time.

XP621: C-MOD/NSTX/MAST Small ELM Regime comparison, April 14 – A. Hubbard: The goal is to match to the extent possible, the shape (except R/a) and key dimensionless pedestal parameters of small ELM regimes on C-Mod, MAST and NSTX and to compare access conditions and fluctuation properties of these ELM regimes in each device. During this partial run good progress was made with the required target development by attaining the plasma shape close to that in C-MOD [A. Hubbard (C-MOD), R. Maingi, H. Meyer (MAST)]

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

NSTX plasma operations resumed this past week, successfully completing XP-601 "Lithium evaluation". For this experiment, the new lithium evaporator, LITER 1, was used to deposit various quantities of lithium in the vacuum vessel over several evaporation cycles. In addition, new lower dome gas injection capability was used to complete XP-605 "Divertor Detachment". Progress was also made on XP-602 "Long-pulse development at reduced density using EF correction" and XP-621 "Comparison of Small ELM regimes on C-Mod, MAST, and NSTX". On the off hours, vacuum conditioning of the HHFW system was performed, and the new HHFW voltage limiting control system was tested in preparation for operation into plasma loads.

Plasma operations will continue on Monday this coming week, and the test cell will be locked-up until 5 PM each day. Access to the test cell will be available from 5PM to 9PM each evening. The next NSTX maintenance week is scheduled for May 8-12. (A.

von Halle)

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

• ITER-1 was used to provide lithium evaporations for XP601. It operated normally at liquid lithium temperatures up to 550°C. The helium quenching of the guard vacuum was found to be useful for decreasing the time between deposition and subsequent plasma operations.