NSTX Weekly Report (August 6, 2010)

FY 2010 NSTX plasma operations
Planned: Total - 15 run weeks (Base - 14 run weeks, ARRA - 1 run week)
Total completed – 7.87 run weeks and 1463 plasma shots
Completed: Base – 6.86 run weeks and 1292 plasma shots
Completed: ARRA -1.01run week and 171 plasma shots

R. Maingi gave a seminar at MIT on 8/2/10: "Triggered Enhancement Confinement and Pedestal Expansion in NSTX: The Enhanced Pedestal H-mode".

Jon Menard, R. Maingi (ORNL), and R. Kaita attended the FNST/PFC/MASCO Meetings, August 2-6, 2010 at the University of California, Los Angeles. J. Menard presented the talk "Overview of Pilot Plant Studies and contributions to FNST" and co-chaired a session "FNSF Testing Strategy Discussions for PFCs" with N. Morley and R. Maingi. Menard also presented a perspective on FNSF parameters and features that are required for divertor and PMI testing and also discussed PFC/PMI testing strategy in FNSF.R. R. Maingi presented two talks at the PFC meeting at UCLA: "What R & D is required for the FNSF divertor - a personal perspective", and "Recent NSTX experimental results related to lithium." R. Kaita gave a presentation on NSTX PFC upgrade plans and co-chaired a session specifically devoted to ITER and NSTX PFC issues.

Run Coordination (E. Fredrickson, S. Sabbagh - Columbia University)

Friday, July 30 we completed XP1041A (Kugel) to document the indications of Liquid Lithium Divertor (LLD) pumping seen during XP1041 “Joint NSTX-DIII-D poloidal rotation experiment”. Stable plasmas were made with the strike point on LLD using strike point control. Two- color infrared (IR) measurements indicated Lithium temperatures well above melting temperature, and post shot cool-down showed a pause at the melting temperature of 180º. As before, from shot-to-shot an increase in plenum pressure was needed to maintain plasma density (although the density was not held constant, but was dropping). August 2 began with XP1067 (Zweben), “the search for zonal flows & blobs.” The scans of plasma current and toroidal field in ohmic and beam heated plasmas from B = 3.5 to 5.5 kG was completed. Excellent Gas Puff Imaging (GPI) data was obtained by Ricky Maqueda for the 10-15 good shots. Beam Emission Spectroscopy (BES) data on edge turbulence was also obtained for comparison. A first look at the GPI data showed a possible complex spectrum for zonal flows in these cases (compared with a simpler spectrum in earlier runs), with a relatively high correlation between zonal flow and blob creation (as seen in earlier runs). Monday afternoon we began XP1058 (Kolemen) to study the impact of squareness on high kappa plasmas. We made progress in developing the target plasma. Tuesday morning, August 3, the plasma squareness was scanned by increasing the PF4 current to as high as 7kA. Additional run time would be used to increase the PF4 coil current to 15kA and also to reverse the current in PF4 to extend the range of the squareness scan. Following XP1058, we ran the first half of XP1045 (Soukhanovskii), to characterize Snowflake divertor configurations. In the first part of the experiment, scans of inner and outer divertor strike points and lower squareness were completed to develop understanding of the control factors for the “snowflake” configuration. Two divertor coils PF1A and PF2L controlled by NSTX plasma control system were used. The “snowflake” divertor configuration was obtained in a number of discharges for periods lasting

up to 150-200 ms. In the second part, a new proposal to obtain the "snowflake" divertor configuration using three divertor coils was studied. For this test, a new operational capability of divertor coil PF1B in reversed polarity had been developed. According to plasma equilibria modeling with ISOLVER code, the PF1B coil in reversed polarity would create a region of reversed flux in the divertor between the two divertor coils PF1A and PF2L thus facilitating the creation and steady-state control of the secondary null point. Stable "snowflake" divertor configurations were obtained for hundreds of milliseconds in the experiment, confirming the predictions and paving the way to future studies of the steady-state "snowflake" divertor. The remaining time Tuesday was spent finishing part of XP1023 (Sabbagh), the determination of RWM feedback parameters for low li plasmas. The target plasma was restored, then small variations of feedback settings were run for Bp feedback, Bp + Br feedback, and the compensations of OHxTF and AC were tuned for both. The feedback phase for this target plasma is significantly different that was found previously for higher li plasmas. The target plasmas were remarkably stable at very high betaN / li ratios between ~ 12 and 12.5 (among our highest) with n = 1 RWM feedback control and n = 3 pre-programmed error field correction. On Wednesday, August 4, the Bay F and Bay K LITERs were replaced in preparation for the 50% LLD fill experiment. Even without LITERs, we were able to complete a large part XP1021 (McLean), to characterize the halo-currents during the vertical displacement events (VDEs).

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

NSTX plasma operations continued on extended shifts this past week with experiments utilizing lithium evaporation, combined PF4/PF5 operation, neutral beam heating, and Resistive Wall Mode (RWM) feedback utilizing the machine's Br sensors and Switching Power Amplifier (SPA) driven error field coils. On Thursday, an extended period of lithium evaporation began using freshly filled LITER probes. This will continue around the clock through the weekend, again swapping the LITER probes out on Saturday with freshly filled units, to provide the needed lithium inventory for a Liquid Lithium Divertor (LLD) experiment scheduled for August 9th.

Access to the NSTX test cell will be restricted during plasma operations this coming week. Access is expected to be available each evening.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

• Liquid Lithium Dvertor (LLD)
- Loading of the LLD at 220°C for a 50% lithium fill level was started.
• Lithium Evaporators (LITER)
- LITER-F1 was installed on the vessel, aligned, and used to support the LLD 50% fill.
- LITER-K2 was installed on the vessel, aligned, and used to support the LLD 50% fill.
- During the separate warmups of LITER-F1 and LITER-K2 to their operating temperatures, Residual Gas Analyzer (RGA) spectra were obtained to characterize each unit.
- During the temperature rise of the LITER-K2 unit to its operating temperature, the deposition rate was held constant for 5 minutes at selected deposition rates to provide steps in the Quartz Deposition Monitors (QDM) signals to aid deposition rate analysis.

- LITER-F1 and K2 completed a deposition of 179g on to the lower divertor region.
- LITER-F2 was reloaded with 90g of lithium, and LITER-K1 was reloaded with 78g of lithium.
- The reloaded LITER F2 and K1 units were outgassed on their respective Fill Stands to 600°C using the new Fill Stand Outgassing system.

• Lithium Powder Droppers

- Lithium Powders Droppers were installed on Bays I and Bay C, and their pump-down is in progress.

• Divertor Sample probe

- The Divertor sample probe was installed. The exposure of ATJ, Si, and LLD-Mo samples during the LLD fill process is in progress.