NSTX Weekly Report (September 24, 2010)

FY 2010 NSTX plasma operations completed on September 24, 2010
Planned: Total - 15 run weeks (Base - 14 run weeks, ARRA - 1 run week)
Total completed – 15.43 run weeks and 2941 plasma shots
Completed: Base – 14.42 run weeks and 2770 plasma shots
Completed: ARRA -1.01run week and 171 plasma shots

The NSTX team successfully completed its FY 2010 plasma campaign on September 24, 2010. NSTX met or exceeded all the milestones including the NSTX contributions to the large facility joint research target milestone. NSTX achieved 15.43 run weeks (Target - 15 run weeks) with 2941 plasma shots, the most plasma shots per year achieved with the highest plasma shots per week of 190. The NSTX research team conducted 45 experimental and machine proposals utilizing new capabilities including the Liquid Lithium Divertor target and Beam Emission Spectroscopy diagnsotic.

The paper entitled, "Comparison of poloidal velocity measurements to neoclassical theory on the National Spherical Torus Experiment" by R. E. Bell, R. Andre, S. M. Kaye, R. A. Kolesnikov, B. P. LeBlanc, G. Rewoldt, W. X. Wang, and S. A. Sabbagh was recently published in Physics of Plasmas. The paper shows that measured poloidal velocities in NSTX H-mode plasmas are near or below the values expected from neoclassical calculations. The paper can be found at http://link.aip.org/link/?PHP/17/082507. (R. Bell)

Jon Menard, Stan Kaye, and Michael Bell participated in the PPPL Theory Department 5 year plan review held September 21-22. They presented highlights of theory contributions to experiments - in particular NSTX - in the areas of MHD, transport and lithium plasma-facing components. Jon Menard also served as a member of the Fusion Simulation Program (FSP) PAC for the PAC meeting held September 23-24. (J. Menard)

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

On Thursday, Sept. 16, we completed Stan Kaye's XP936 looking at the affect rotational shear has on confinement. The experiment was completed by midday, and we nearly finished Wayne Solomon's XP1042, now studying the physics of momentum generation and confinement. Probably a couple of more hours of XP1042 are needed, but a good set of data was collected.

On Friday, Sept. 17, we begain with the non-RF part of Steve Sabbagh's XP1062, which continued studies related to rotation. This XP studies damping of rotation through Neoclassical Toroidal Viscosity (NTV). Evidence for faster rotation drop at low rotation was found. Midday Friday we moved on to Steve Sabbagh's XP1031 to study the interaction of ELMs with current ramps and error fields. Target plasmas were developed, but the experiment needs an additional two hours to complete.

On Monday, Sept. 20, we continued Vlad Soukhanovskii's XP1045 to develop and characterize "Snowflake" divertor configurations for divertor peak heat flux reduction. In this part of XP, the standard high triangularity fiducial discharges were used to successfully transition from the standard divertor configuration to the snowflake divertor configuration by adding the PF2L and reversed-polarity PF1b coils. Steady-state snowflake divertor configurations lasting up to 0.6 s

were obtained and documented with divertor IR cameras and spectroscopy. Monday afternoon we made more progress on Rajesh Maingi's XP1043 to study scaling of divertor heat flux utilizing the new, two color IR camera. The XP wasn't entirely finished, leaving a little more to be done on Friday.

On Tuesday, Sept. 21, we returned to the study of ELM physics with three XP's, John Canik's XP1025 to develop ELM pacing using a combination of vertical jogs coupled with error fields. The results were promising, finding that in the presence of an error field, vertical jogs were more effective in triggering ELMs. That was followed by more studies of current ramps on ELM stability through XP1031. The physics of the ELM instability was then investigated with the new BES diagnostic and high- k scattering in John Canik'ss XP1069 by documenting the changes in edge fluctuations as the Lithium rate was raised to suppress the ELMs.

On Wednesday, Sept. 22, we returned to study a new enhanced confinement regime, the Enhanced Pedestal H-mode (EPH mode) in John Canik's XP1064. A prescription for reproducibly producing the EPH mode was developed, and beta feedback was used to mitigate the rapid rise in stored energy following the confinement transition. However, subsequent large ELMs resulted in back-transitions. In future experiments, higher Lithium rates will be explored as a method to suppress the large ELMs. Wednesday afternoon we revisited Egemen Kolemen's XP1058 to study the stability properties of reduced squareness plasmas generated with the use of the PF4 coil. Good data was collected which will require further analysis.

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

NSTX plasma operations for FY10 concluded on Friday evening after a week of experiments utilizing lithium evaporation, the lithium powder dropper, neutral beam heating, and Resistive Wall Mode (RWM) feedback via the Switching Power Amplifier (SPA) driven error field coils. The bay K lithium evaporator probe was replaced with a freshly-filled spare mid-week, and NSTX machine conditions were successfully maintained via the lithium powder dropper system. NSTX will be in a maintenance period this coming week, with plans to complete a portion of the FY11 experimental run during October.

Access to the NSTX test cell will be available this coming maintenance week.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

• Liquid Lithium Divertor (LLD)
- Data analysis indicated LLD pumping as the lithium in the LLD porosity became liquified.
- Fabrication of parts for the gas manifold for air heating of the LLD plates was completed
- Planning for a Peer Review of the LLD plate air heating system was in progress.

• Lithium Evaporators (LITER)
- The installed LITER-K1 unit supported XPs, was emptied, and was removed from the vessel for reloading.

- The LITER-K2 unit was reloaded, outgassed, reinstalled on the vessel, and began supporting operations.

• Molybdenum Inner Divertor Tiles
- A requisition was approved and issued for molybdenum engineering support.
- The water-jet cutting for the prototype molybdenum plate-graphite tile unit was completed. Special tooling was received, and is being used for the final edge machining now in progress.

• Lithium Powder Centrifuge
- The prototype ELM Pacing Lithium Centrifuge was successfully tested at 50 m/s,10,000 rpm. Work started on upgrading the unit for NSTX qualification.

• Lithium R&D
- A double-chamber Argon Glove Box was delivered to the C-128 Lithium Technology R&D laboratory, and installation work started.