NSTX Weekly Report (Apr.10, 2009)

FY 2009 NSTX plasma operations
Planned: Base - 11 run weeks, ARRA - 5 run weeks (pending funding approval)
Completed: Base - 2.46 run weeks, ARRA - 0 run weeks

• S. Kaye chaired the Transport and Confinement ITPA meeting in Naka, Japan, on 31 March – 2 April 2009. The meeting was held jointly (for one day) with the IOS ITPA group. The subject of the joint session was on transport model benchmarking specifically during the current ramp-up and ramp-down phases in order to have a basis to develop ITER scenarios during these phases and assess the control and PF system requirements. Other topics covered included sessions on the Effect of Rotation on Plasma Performance, Momentum Transport and Electron Transport. Future Joint Experiments and Activities were discussed. S. Kaye gave presentations in the Effect of Rotation and Electron Transport sessions. Also in attendance from PPPL were D. Mikkelsen and W. Solomon, giving talks in the Joint and Momentum transport sessions respectively, and C. Kessel and R. Budny, who gave talks in the Joint session. Kessel and Budny also attended IOS-specific sessions, and made presentations in those. (S. Kaye)

• D. Gates, C. Kessel, and R. Budny attended the Integrated Operational Scenarios ITPA meeting in Naka, Japan on 31 March - April 3 2009. For the first day, the meeting was held jointly with the Transport and Confinement group to discuss the impact of transport models on predictions of the flux consumption and internal inductance during ITER current ramp-up and ramp-down. Focus was on the Coppi-Tang model's (the agreed ITER standard model) prediction of the electron temperature in the outer half of the minor radius, which appears to under predict electron temperature in current machines. Discussions were held regarding the impact of the uncertainty associated with variations of the H-mode power threshold during the transient phase on the discharge stability during ramp-up and ramp-down. C. Kessel and R. Budny presented several talks on modeling of ITER scenarios. D. Gates discussed the contribution of NSTX towards joint experimental activities in a separate session. (D. Gates)

There will be an NSTX Physics Meeting on Monday, 4/13 at 2:00 PM in LSB318. Bill Heidbrink of UC Irvine will give a talk entitled "Fast ion transport by microturbulence." (S. Kaye)

<u>Run Coordination (R. Raman , University of Washington, Deputy: E. Fredrickson)</u>

April 2-8: Very Good progress was made during the past week, including initiation of Lithium wall conditioning using the LITER system in NSTX.

On April 2, XP-923 "Thermal transport in the boundary plasma - R. Maingi" was run for a full run day and obtained a substantial dataset. Here we finished the power scan at low current in a low triangularity, low X-point shape, performed a smaller power scan at higher current in a low triangularity, high X-point shape, and performed a current scan in a high triangularity shape.

On April 3 and 6, the first part of X-P911 "Li pumping and retention in NSTX - C. Skinner" was run in support of the FY09 Joule Milestone. The aim is to develop an understanding of particle control and hydrogenic fuel retention in tokamaks. Gas balance measurements showed high (>90%) prompt retention, that decreased due to post-shot outgassing. Experiments were done

with ohmic plasmas with all the pumps closed off, and with neutral beam heated plasmas, where the deuterium pumped by the neutral beam cryopanels was separately tracked. Extensive calibrations were done in support of this measurement. As part of a collaboration with Purdue University ATJ graphite, Si and Pd samples were exposed to the plasmas by a newly installed probe at Bay J. After exposure, thermal desorption spectroscopy was performed on one ATJ sample and all the samples were retrieved and shipped to Purdue University for surface analysis. A similar experiment with lithium conditioned walls is now in preparation.

On April 7 and 8, XP-827, "LITER Characterization and ELM Mitigation - H. Kugel" was started. High-delta, Ip= 1 MA discharges were established, and lithium was evaporated on to the lower divertor, in increasing amounts from 267 mg to 411 mg between 16 discharges. These discharges were used to characterize the effect of these coatings on ELM mitigation and plasma performance. Initial results found that the deposition of relatively thin coatings of lithium increased the plasma current pulse length relative to the before-lithium reference discharges, caused earlier H-mode transitions, significant density reduction in the early part of discharges calling for more fueling, increasing electron temperature, electron stored energy and confinement time, and reduced OV/CIII impurity ratios. At the end of this discharge sequence, the total lithium deposition was 4.6 g, and the discharges were exhibiting reduced ELM events.

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

NSTX continued plasma operations this week, completing the pre- lithium portion of a gas pumping and retention experiment utilizing the Purdue University Sample Probe, and then moving on to the initial lithium evaporation experiments of this year. The two lithium evaporator (LITER) probes performed well, and machine operation with lithium was characterized in high and low triangularity discharges, and with reliable access to H-modes. Also this week, Richard Nygren and Gary Pena of Sandia National Laboratory visited PPPL to continue with the engineering planning of the new Liquid Lithium Divertor. The NSTX Test cell will be in restricted access this coming week during plasma operations. Extended run days (to 7PM) are planned for Tuesday and Thursday this week.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

• Liquid Lithium Divertor (LLD)
- The molybdenum coating vendor has started manufacturing the tooling to hold the LLD plates and prevent distortion.
- Molybdenum coating of samples will be completed 4/13/09 and received at PPPL 4/14/09 for testing.
- Status information on the Control Rack assembly was received.
- Richard Nygren, SNL project manager for the LLD, and Gary Pena, SNL LLD Control Rack engineer visited NSTX to coordinate LLD planning. (M. Viola)

• Lithium Evaporator - LITER 2009

- The two LITER units were used deposit about 21 g of lithium on the lower divertor to support the completion of XP-827 "LITER Characterization and Elm Mitigation".

• Lithium Dropper (D. Mansfield)
- The assembly of dropper unit-2 was completed. Unit-2 was loaded with lithium powder in preparation for calibration and installation. (D. K. Mansfield)

• Edge Sample Probe
- The sample probe was tested, installed, and used to support the pre-lithium phase of gas retention XP-911.
- Samples exposed during XP-911 were sent to Purdue University for analysis. (C. H. Skinner)