

## NSTX Weekly Report (Jan. 29, 2009)

### **FY 2010 NSTX plasma operations**

**Planned: Total - 15 run weeks (Base - 14 run weeks, ARRA - 1 run week)**

**Completed: 0 run week and 0 plasma shot**

- The paper entitled “Resistive Wall Mode (RWM) Instability at Intermediate Plasma Rotation” by J.W. Berkery (Columbia University), S.A. Sabbagh (Columbia University), R. Betti (University of Rochester), et al. has been published in Physical Review Letters (Vol 104, 035003 (2010)). The paper can be found at this link: <http://prl.aps.org/pdf/PRL/v104/i3/e035003>. This paper documents how the Hu/Betti theory of kinetic modification to ideal MHD stability (as implemented in the Modification to Ideal Stability by Kinetic effects or MISK code) can reproduce the observed RWM destabilization at relative high plasma rotation in NSTX. The results also show that a low level of plasma rotation is generally not a sufficient condition to assure RWM stabilization (an important consideration for ITER), and that an increased level of plasma rotation beyond some “critical rotation” is generally not a sufficient condition for RWM stability (an important consideration for NBI-driven fusion systems, such as an ST-CTF). Instead, the proximity of the plasma rotation profile to energy dissipative resonances is a key factor for RWM passive stabilization. (S. Sabbagh)

- The paper "Progress in the development of Edge Localized Mode (ELM) pace-making with non-axisymmetric magnetic perturbations in NSTX" by J.M. Canik (ORNL), A.C. Sontag (ORNL), R. Maingi (ORNL), et. al., was accepted for publication in Nucl. Fusion. This paper builds on the recent PRL and recent Nucl. Fusion paper with results from the 2009 campaign: 1) near 100% efficiency of ELM triggering with high amplitude, short duration  $n=3$  field pulses, 2) dependence of density and radiated power control on triggering frequency, and 3) achievement of flat line density via ELM triggering and gas fueling optimization. (R. Maingi)

- The article, “Characteristics of energy transport in Li-conditioned and non-Li-conditioned plasmas in the National Spherical Torus Experiment (NSTX)” by S. Ding (ASIPP, China) et al. was published in PPCF **52** (2010) 015001. The article reports on transport trends and dependences for discharges with and without Li conditioning. It is found that the transport coefficients for both thermal ions and electrons in all discharges, regardless of conditioning, have a strong dependence on local  $n_{\text{grad}T}$ , which in turn is strongly dependent on the local current density profile. The thermal transport loss, especially in the electron channel, is found to depend strongly on the amount of Li deposited, decreasing by up to 50% of its no-lithium value. (S. Kaye)

- M. Ono visited the Kyoto University to discuss the electron cyclotron / electron Bernstein wave (ECH/EBW) plasma start-up experiments with the LATE group on January 21, 2010. He gave a seminar on the recent results from NSTX for the Kyoto University group. He then visited the Tsukuba University's GAMMA-10 group on January 22 where he also discussed the on-going 28 GHz 1 MW ECH/EBW gyrotron development. He gave a seminar on the recent results from NSTX for the Tsukuba University group.

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

The NSTX start-up activities continued this past week with the ongoing alignments of the MPTS lasers, and the integrated system testing of the new Liquid Lithium Divertor (LLD) system. Upon completion of the MPTS Laser alignments, the NSTX vacuum vessel will be partially vented with nitrogen next week to begin the Rayleigh and Raman scattering calibrations of the MPTS. The interlocks between the LLD controls and the EPICS computer were successfully tested this past week. Also this week, the NSTX gas injection system was configured for operations, and preparations began for the upcoming vacuum vessel bake.

Access to the NSTX test cell will be restricted during the 1st shift this coming week during MPTS diagnostic operations.

## **Research Operations (M. Bell)**

### **Boundary Physics Operations (H. Kugel)**

- Liquid Lithium Divertor (LLD)
  - The integrated system test procedure for the LLD under vacuum conditions was started.
  - A meeting was held to discuss the startup XMPs for LITER and the LLD.
- Lithium Evaporator (LITER)
  - Preliminary results from Purdue University (C. Taylor, J. P. Allain) of X-ray Photoelectron Spectroscopy (XPS) measurements of dissected oven parts from the LITER 2009 units indicated predominantly the presence of lithium hydroxide (LiOH) and lithium carbonate (Li<sub>2</sub>CO<sub>3</sub>) complexes. Additional analysis of candidate impurity sources is in progress.
  - The machining of 4 ceramic connectors for connecting the 2010 ovens to the probe cabling was completed.
  - The fabrication of 2 umbrella support structures for attachment to the 2 new probes was completed.
  - The assembly of the first LITER unit for use during the 2010 Run was started.