

## **NSTX Weekly Report (March 14, 2008)**

### **FY 2008 NSTX plasma operations**

**Planned: 15 weeks**

**Completed: 3.82 weeks (through March 12, 2008)**

Yoshi Hirooka from the National Institute for Fusion Science (NIFS) Nagoya, Japan, visited NSTX as part of the US-Japan collaboration. The purpose of the visit was (1) to discuss recent LITER evaporation and preliminary lithium-powder results, (2) to review NSTX/LTX off-line lithium wetting tests in progress, (3) to plan for near-term complementary experiments with candidate LLD Mo-SS-Cu samples to be tested in the Vehicle-1 facility at NIFS to measure liquid lithium wetting characteristics, (4) to inspect NSTX, LTX, and the Lithium Test Facility, and (5) to plan for a possible NSTX Dec 2008 Research Forum visit and Experimental Proposal (XP) for the 2009 Campaign. (H. Kugel)

There will not be an NSTX Physics meeting today, 3/17. We will have summaries of last week's XPs at next week's meeting. (S. Kaye)

The March NSTX Team Meeting will be held on Friday, March 21, 2008 at 1:30 P.M., in B318. We will update the team on the NSTX Plasma Operations, the recent Budget Planning Meeting, and the programmatic items.

### Run Coordination (M. Bell, R. Raman)

On Thursday 3/6, we performed XP-804 "Comparison of neoclassical toroidal viscosity among tokamaks" [S. Sabbagh, Columbia U.]. This experiment made use of applied fields with toroidal mode number  $n = 2$  for the first time in NSTX, complementing the odd- $n$  applied fields previously used. The  $n = 2$  field succeeded in braking the plasma rotation with relatively modest applied currents. The apparent profile of the  $n = 2$  braking torque was broader than that of the  $n = 3$  field configuration, as expected, and far broader than the resonant braking previously observed at specific rational surfaces

The experiment XP-818 "ELM mitigation using midplane coils" [S. Sabbagh, Columbia U.] was continued on Friday 3/7. Even-parity fields ( $n = 2$  with strong  $n = 4$  component, and  $n = 6$ ) were applied during ELMy H-mode discharges, following similar work performed earlier in the week with odd parity fields. DC, AC non-rotating, and rotating (both co and counter) fields were applied. With  $n = 3$  AC fields, the ELM frequency was reliably reduced from 100 - 150Hz to ~50 Hz with high correlation to the timing of the applied field. The D-alpha signal also developed a longer relaxation time after each ELM. These results supported those found earlier in the week with  $n = 3$  applied fields. The observed effect on the ELMs was highly reproducible and not highly sensitive to  $q_{95}$  or the exact configuration of the applied field. Additionally, the 50Hz ELM frequency during application of the field is independent of the applied frequency and so must be set by intrinsic plasma parameters.

Monday 3/10 through Wednesday 3/12 were devoted to XP-817 "Flux savings from inductive drive of a transient-CHI started plasma" [R. Raman, U. Wash.] - The first two days were used for commissioning the newly installed staged firing capability for the capacitor bank and investigating conditioning methods for the lower divertor plates. Reference CHI-only and CHI plus inductive discharges from 2007 were initially run. These were followed by fifteen conditioning shots in which the CHI was operated to produce high injector current on the lower divertor plates to ablate surface contaminants. During these shots, high levels of oxygen-II line emission were measured from the lower divertor indicating that

oxygen was indeed being removed. After the conditioning, the reference CHI-only and CHI plus inductive discharges improved. The system was further conditioned by performing a one hour deuterium glow discharge followed by 30 minutes of HeGDC and then, on Tuesday evening, a boronization was performed using 5g of TMB. On Wednesday morning, inductive discharges were successfully run in which the pre-charge in the central solenoid was reduced to 9kA to make it easier to produce the divertor flux pattern needed for initiating a CHI discharge. The conditions needed for establishing a successful CHI breakdown in the presence of the remaining OH fringing field were then established for future use. CHI-only discharges with zero pre-charge on the central solenoid were then repeated and optimized using the staged firing capability of the capacitor bank for the first time. The staged firing compensated for the changed divertor surface conditions and allowed us to re-establish the breakdown conditions of the 2006 experiments. The reduced growth rate of the CHI discharge and the much lower total energy used (about 20kJ), resulted in the CHI discharge consistently reaching temperatures of 10-20eV. These discharges are now a good target for inductive coupling.

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

NSTX Plasma operations continued this week with the use of the machine's error field coils in various configurations along with neutral beam heating in support of experiments on ELM mitigation. Machine fields were then configured for a Coaxial Helicity Injection (CHI) experiment, eventually using the new capability of staged firing of the three CHI cap banks, and comparing performance before and after a vacuum vessel boronization. NSTX returned to ohmic operations with neutral beams at the end of the week, using the error field coils to manipulate the rotation profile to further characterize momentum transport.

NSTX will be off-line for scheduled maintenance this coming week. Access to the test cell should be available throughout the week, with some local restrictions associated with the LITER installation at bay K.

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

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

- Liquid Lithium Divertor Target (LLD-I)

-Liquid lithium wetting tests of evaporated lithium on to a thin porous molybdenum on stainless steel sample neared completion. Useful wetting results were obtained as a function of substrate temperature. The LITER evaporator used for this work evaporated 37 g of lithium, about 25% of which was incident on the masked sample.

- Candidate LLD heaters were received for testing.

- Lithium Evaporator (LITER) FY08

-Installation of limit switches on the LITER Bay K unit was completed. A trial fit up of the LITER-to-Umbrella support was started in preparation for installation during the maintenance week.

- Lithium Powder

-Tests of 40 micron lithium powder coated with a thin-as-possible special protective hydrocarbon layer successfully demonstrated its stability in a vacuum of  $2 \times 10^{-8}$  torr without any observable impurity outgassing. (D. Mansfield)