NSTX Weekly Report (October 7, 2011)

NSTX is in the Upgrade Project outage in FY 2012

NSTX submitted the fourth and final report for the FY2011 Joint Research Target on Pedestal Structure. The NSTX portions of the targeted goals for the fourth quarter and for the entire year were achieved. The research was focused in two main areas: pedestal and stability characteristics in ELMy H-mode, and in the transition from ELMy to ELM-free H-mode enabled via lithium wall coatings. Experiments supporting each area were conducted in early FY2011, and the analysis was completed during the remainder of the Fiscal Year. In the first main area, we analyzed the evolution of pedestal, height, width, and gradients, as well as density fluctuations, during the inter-ELM cycle as a function of plasma current, Ip. In the second main area, we analyzed the evolution of global and edge plasma parameters during scans of increasing lithium deposition, during which plasmas transitioned slowly from ELMy to ELM-free. Finally additional work was done to characterize the profiles and turbulence in Enhanced Pedestal H-modes. The research resulted in four refereed journal articles already out in print, two more manuscripts being readied for submission, and an invited talk at the coming 2011 APS DPP conference. (R. Maingi, ORNL)

S. Kaye (PPPL) attended and chaired the 7th meeting of the Tranpsort and Confinement ITPA Topical Group in Cadarache,France, April 5-7, 2011. Subjects covered at the meeting included Model Validation, Turbulence in the Core-Edge Transition Region, Impurity Transport and Transport and Turbulence in 3D Systems. NSTX results on the variation of confinement with collisionality were presented. The collisionality was varied by application of varying amounts of Lithium between plasma discharges in a dedicated scan. (S. Kaye)

The article "The continuous improvement of H-mode discharge performance with progressively increasing lithium coatings in the National Spherical Torus Experiment" by R. Maingi (ORNL), et. al., was published in Physical Rev. Lett. **107**, 145004 (2011). In this paper, it was shown that global energy confinement, electron temperature and pressure profile peaking, divertor recycling, and ELM frequency depended nearly continuously on the amount of pre-discharge lithium evaporation, with the best performance correlated with the highest lithium amounts. These correlations challenge basic expectations, given that even the smallest coatings in these experiments exceeded that needed for a nominal thickness of order the ion implantation range in the divertor plasma-facing components, which is < 10 nm. (R. Maingi)

J. Ahn (ORNL), A. Diallo (PPPL), and R. Maingi (ORNL) attended the ITPA Pedestal Edge Physics group meeting in York, UK from 10/5-10/7. The following NSTX talks were presented: "The continuous improvement of H-mode discharge and pedestal performance with progressively increasing lithium coatings in NSTX" and "PEP-6 update: Pedestal structure and ELM stability as a function of drsep"by R. Maingi, "Progress in the study of 3D field effect on the divertor and pedestal plasmas in NSTX" by J. Ahn, and "Turbulence correlation and thermal transport in the pedestal region during the inter-ELM phase" by A. Diallo. In addition, D. Battaglia presented a talk remotely, "PLH scaling with RX and the connection to X-transport." (R. Maingi)

J. Menard (PPPL) visited Seoul National University (SNU) in South Korea on October 3-4 and toured the SNU plasma research facilities including the new Versatile Experiment Spherical

Torus (VEST). Jon also presented a seminar entitled "NSTX Research Highlights and Future Plans" and discussed possible collaboration opportunities on VEST. On October 5, J. Menard visited the EAST, HT-7, and other research facilities at ASIPP in Hefei, China and discussed future plans for the NSTX Upgrade and EAST/HT-7 research programs and near-term and longer-term collaboration opportunities. (J. Menard)

M. Ono (PPPL) visited Kyushu University (QUEST) on October 3. He toured the QUEST facility and held discussions with the QUEST staff including collaboration opportunities. He gave a seminar entitled "NSTX Overview and Upgrade Status and Plans" for the Kyushu / Okinawa / Yamaguchi Regional Group of the Japanese Plasma Physics and Nuclear Fusion Society. He then visited the University of Tokyo (TS-2, UTST) and Tsukuba University (GAMMA-10) on October 5-6 and discussed on various research topics including collaboration opportunities. (M. Ono)

On Sept 30th 2011, Ahmed Diallo (PPPL) attended the 100th anniversary of the department of physics and astronomy at the University of Montana, where he gave an overview talk on the paths toward magnetic fusion energy. The talk laid out the timeline of magnetic fusion science in which NSTX mission elements were described. This talk was well attended and drew some interest from the general physics audience. (A. Diallo)

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

Preparations for the NSTX Upgrade continued this week with the completion of electrical insulation testing (HiPots) to document the insulation quality of the outer TF windings and the PF2, 3, 4 & 5 coils. Vacuum vessel thermal insulation and diagnostic equipment is now being removed in preparation for photogrammetry measurements of vessel, TF and PF structure and supports. Evaporation of lithium from the two new LITER probes has been completed, and the probes are being mothballed and safely stored for future use. Preparations are also underway in the D-Site Basement and DARMs for NSTX storage during the upgrade work.

Access to the NSTX test cell is expected to be available throughout most of this coming week.