

NSTX Weekly Report (June 25, 2010)

FY 2010 NSTX plasma operations

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

Completed: Base – 4.62 run week and 878 plasma shots

Completed: ARRA -1.01run week and 171 plasma shots

Several NSTX researchers participated in the 37th EPS Conference on Plasma Physics held in Dublin, Ireland June 21-25. There were 3 NSTX contributed oral presentations including: "ELM suppression through modification of Edge Profiles with Lithium Wall Coatings in NSTX" by R. Maingi (ORNL), "Coupling of Coaxial Helicity Injection plasma start-up to inductive ramp-up on the National Spherical Torus Experiment" by D. Mueller, and "Development of High-Elongation, High-Beta Discharges for Steady State Spherical Torus Applications" by S.P. Gerhardt. Twelve (12) posters from NSTX were also represented, including: "Effect of Non-axisymmetric Magnetic Fields on Divertor Profiles in NSTX H-mode Plasmas" by J-W. Ahn (ORNL), "The Role of Kinetic Effects, Including Plasma Rotation and Energetic Particles in Resistive Wall Mode Stability" by J.W. Berkery (Columbia U), "ELM Pacing with 3D Magnetic Perturbations in NSTX" by J.M. Canik (ORNL), "Advances in High Harmonic Fast Wave Heating of NSTX H-mode Plasmas" by P. M. Ryan (ORNL), "Multi-energy SXR measurements of Resistive Wall Mode behavior in NSTX" by L. Delgado-Aparicio, "Dependence of the Scrape-Off Layer heat flux widths on external parameters in the NSTX" by T.K. Gray (ORNL), "Modeling of the SOL and Divertor Region in NSTX and Prediction to KSTAR" by Jin-Woo Park (Seoul U), "Edge turbulence and SOL blobs in the National Spherical Torus Experiment" by R. J. Maqueda, "Physics Design of the NSTX Upgrade" by J. Menard et al, "RWM stabilization and maintenance of high beta plasmas in NSTX" by S.A. Sabbagh (Columbia U), "Edge Stability of Small-ELM Regimes in NSTX" by A. Sontag (ORNL), and "Snowflake Divertor Configuration in NSTX" by V. A. Soukhanovskii (LLNL). (J. Menard)

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

On Thursday June 17, we returned to RF experiments, but most of the day was spent conditioning the antenna. Reliable operation at or above 2MW remains elusive, even into Helium plasmas. From 5-7 we moved on to the BES commissioning XMP (David Smith, "BES Commissioning"). On June 18, we moved on to Egemen Kolemen's XMP68 to commission PF4/PF5 which was successful. Plasmas were produced with good control using PF4 and PF5 with substantial currents in PF4.

On June 21, Vlad Soukhanovskii completed the first half day of XP1002, "Core impurity density and radiated power reduction using variations in LLD divertor conditions". Promising results were achieved in that there seemed to be a clear reduction in plasma carbon contact with the divertor gas puffing. An attempt to make an Ohmic plasma for Adam McLean's XP1021, "Halo current study w/ extended diagnostic capability + LLD" resulted in an underdense, runaway plasma.

On June 22, Steve Sabbagh ran XP1031, "Global MHD and ELM stability vs edge current, n_{qp} , edge ν " with only Bay F LITER. The experiment was successful in altering X-point vertical height and DRSEP independently in plasmas with ELMs excited by the application of an $n = 3$ field. Scans were completed with good shunt tile current data (Gerhardt) and Langmuir probe array current data (Jaworski). Details of changes in SOL currents and ELM evolution for these scans are being examined. Additionally, edge toroidal current density was changed in these plasmas. Positive edge current change led to a clear ELM-free period. This period was

terminated by an H-L back-transition most likely due to the large increase in radiated power during ELM stabilization. This contrasted the constant current and negative edge current change cases, in which ELMs were maintained.

On June 23, additional BES commissioning in the form of a current scan was done in the morning by Dave Smith. Source A was reliable and MSE data is available for these shots. Eric Fredrickson completed XP1011, "H-mode TAE/GAE avalanches". TAE-like avalanches were produced in a 750kA, 4kG plasma. Scans of the outer gap, the density, toroidal field and plasma current were completed to study the parametric dependence of the avalanches.

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

NSTX plasma operations continued this past week on extended run days, and utilized neutral beam heating, lithium evaporation, and the machine's error field correction coils. The spare neutral beam ion source installed in the "A" position was successfully conditioned to a reliable 90keV operating level needed for MSE diagnostic data, and the new Beam Emission Spectroscopy diagnostic was actively used for the first time in support of experimental operations. Vacuum vessel ground currents seen at the termination of a discharge this week are believed to be the cause of a multiple controls failure that impacted the vacuum, gas injection and LITER systems. Systems were quickly restored with the exception of the Bay K shutter, which will be replaced over the weekend. Also this weekend, two freshly filled lithium evaporator (LITER) probes will be installed.

Access to the NSTX test cell will be restricted this coming week during plasma operations. Access is expected to be available each evening. .

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- Liquid Lithium Divertor (LLD)
 - Analysis of the previous hot-air-heating test results is in progress.
 - Two candidate designs for a hot air flow-reversing switch are being analyzed.

- Lithium Evaporators (LITERs)
 - LITER unit K1 was reloaded for a total of 82.40g of Li, and LITER unit F2 was reloaded for a total of 81.87g of Li.
 - LITER units F1 and K2 were removed from NSTX.
 - LITER unit F2 was mounted on the NSTX and its pump-down is in progress.
 - LITER unit K2 exhibited outer shield damage resulting from the malfunctioning of its controls following a plasma current disruption. The unit appears to be operable which is consistent with electrical testing of its internal heaters and thermocouples. The associated damage that occurred to the LITER K2 lithium shutter mechanism was repaired.