

NSTX Weekly Report (June 19, 2009)

FY 2009 NSTX plasma operations

Planned: Base - 11 run weeks, ARRA - 5 run weeks (pending funding approval)

Completed: Base -10.48 run weeks with 1,611 plasma shots, ARRA - 0 run weeks

The paper "Collisional Damping of Electron Bernstein Waves and its Mitigation by Evaporated Lithium Conditioning in Spherical Tokamak Plasmas" by S.J. Diem et al, has been accepted for publication in Physical Review Letters. The paper presents the first experimental verification of electron Bernstein wave (EBW) collisional damping, and its mitigation by evaporated Li conditioning, in an overdense spherical tokamak plasma (NSTX). Initial measurements of EBW emission, coupled from NSTX plasmas via double mode-conversion to O-mode waves, exhibited <10% transmission efficiencies. Simulations show 80% of the EBW energy is dissipated by collisions in the edge plasma. Li conditioning reduced the edge collision frequency by a factor of 3 and increased the fundamental EBW transmission to 60%. The published research work was a part of the Ph.D. thesis research by S. J. Diem in the Princeton University Plasma Program. (S. Kaye)

Run Coordination (R. Raman , University of Washington, Deputy: E. Fredrickson)

NSTX Plasma Experimental Highlights for June 11-12: A novel technique for large surface area deposition of Li from a localized Li source was tested and work in support of the Liquid Lithium Divertor (LLD) was conducted.

On the morning of June 11th, XP950 "Dependence of metallic impurity accumulation on Ip and the outer gap in the presence of lithium deposition – S. Paul" was run. Plasmas were generated at Ip=1200 kA, Bt=0.5T, and Ip=700kA, Bt=0.45T. For each of these cases, the outer gap was scanned, from 5cm to 20 cm, in 5cm steps. Variations in the beam-source mix were also tried. It was found that the large current case had reduced metal accumulation. Analysis is ongoing.

On the afternoon of June 11, XP951 "Diffusive Lithium injection - C. Skinner" was run. This is a new technique for lithium conditioning. Lithium (Li) was evaporated into low pressure helium gas with a mean free path of order 0.1m to promote scattering of Li into previously shadowed areas. Reductions in radiated power and effective charge (Zeff) were observed indicating reduced impurity influx.

On the morning of June 12th, XP945 "ELM pacing by vertical jogs – S. Gerhardt" was run. In the early part of the XP, Edge Localized Modes (ELMs) were difficult to trigger, possibly due to the presence of large amounts of Li evaporated on the previous day; those shots were useful in further optimization of the jogging scheme by removing jogs in the axis position, and jogging only dr-sep. After a couple of hours, the Li was sufficiently passivated that ELM pacing was possible. Example shots were taken with clear ELM triggering, and good comparison cases without jogs were achieved. Analysis is ongoing.

In the afternoon of June 12th, XP919 "Development and characterization of an intermediate triangularity discharge with lithium PFC coatings – J. Kallman" was run. Before lithium introduction, discharges were short with large D-alpha signals. A stable discharge was developed with lithium evaporation rates of >100 mg/shot. The outer strike point was positioned at R=63 cm (the preferred distance for LLD operation) utilizing the strike point

control algorithm previously developed. This control was verified using IR camera measurements and optimized to work in the presence of multiple X-points. Current and power scans were conducted. Discharges at 1MA attained high toroidal beta and high ion temperature (relative to T_e). In the latter part of this run, the XP will be continued with a fueling/Li evaporation scan, utilizing Supersonic Gas Injection (SGI) to avoid density collapse early in the discharge, which occurred during the final two shots that used very high Li evaporation rates.

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

NSTX was off-line for maintenance this past week. The neutral beam calorimeter has been removed from the beam-line to replace the bellows, with plans to complete re-assembly by late next week. Both LITER probes are to be refilled during this period, and the first lithium dropper has been installed at Bay I. Control cabling is being completed in preparation to install the second lithium dropper at Bay C next week. The installation of symmetric-feed resonant circuits for the HHFW system is nearing completion, and pre-operational testing is expected to begin next week. Inspections and re-shimming of Error Field Correction coil mounting brackets are in progress. Also this week, installation and testing of controls to provide remote operation of the Bay J sample probe is in progress.

The NSTX Test cell will be in free (card reader) access during scheduled maintenance this coming week.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- Liquid Lithium Divertor (LLD)
 - A teleconference was held with SNL, PPPL, and the coating vendor to discuss LLD progress and planning.
 - An additional vacuum cleanup of the plates following the first vacuum bake has been in progress. The 2nd vacuum bake will be performed 6/22/09; the first 3 plates will be moly-coated by 6/26/09; the remaining 3 coated by 6/29/09; the plates shipped to PPPL by 7/03/09.
 - The LLD Test Cell AC power, cable tray, and LLD rack installations have started. (M.Viola, F.Jones, H.Schneider)
- Lithium Evaporator (LITER09)
 - LITER-K was removed from the vessel in preparation for lithium reloading. (J.Winston)
- Lithium Powder Dropper
 - Dropper Bay-I has been mechanically installed and is being pumped down. The cabling has been installed and final integration and testing of the remote controls is in progress.
 - Preparations of Dropper_Bay-C for installation during the second week of maintenance are in progress. (D.K. Mansfield)
- Divertor Region Sample Probe
 - The limit switch for the Bay J sample probe has been moved to its final location, and is ready for integration into the remote control for the probe. Preparations are in progress for testing the remote control software. (M.Cropper)