

NSTX Weekly Report (Aug. 26, 2005)

FY2005 Planned Operations: 17 weeks

Completed: 17.13 weeks producing 2086 plasmas

Featured Highlights: NSTX achieved the 17 run week DOE/OFES milestone on Friday, Aug. 26. Thus far, NSTX operated 17.13 weeks with 2086 plasmas. Thirty-three experimental proposals and seven experimental machine proposals were performed. Together with the first data on high-k scattering system obtained last week, NSTX completed all of the NSTX FY 05 Facility/Diagnostic Milestones on or ahead of schedule. The NSTX Run Log is available on the NSTX web.

NSTX Department, Project, Program (M. Ono, M. Peng, E. Synakowski)

- Three additional Summer Undergraduate Laboratory Intern students worked on NSTX completed their respective research projects this summer. Justin Stimatze (University of Chico) under the advisorship of Jon Menard modularized and automated an IDL code used for determining magnetic island structure from Ultra-Soft-Xray data. This modularization now allows multi-dimensional island parameter searches to be performed and visualized much more easily. Jonathan Huang (University of Dartmouth) under the advisorship of Jon Menard has implemented a simple but accurate matrix approach to computing the plasma poloidal flux on the computational boundary using the Von Hagenow method. This new algorithm will be used to improve the efficiency of the ISOLVER free-boundary equilibrium code. Anne White (UCLA) under the advisorship of Steward Zweben has been analyzing gas puff imaging turbulence data from the 2004 run. She has been calculating the bicoherence of the time series from the discrete fast chords to look for possible coupling between high frequency (high-k) and low frequency (low-k) modes, especially just before the L-H transition. Increased coupling before the L-H transition was observed in probe data from DIII-D (Moyer et al, PRL 2001), but never confirmed on another device to our knowledge.

- There will be an NSTX Physics Meeting on Monday, 8/29 at 1:30 pm in LSB318. The agenda will be: 1) First results from high-k scattering (anticipated) – D. Smith (20 min), 2) XP Status Reports (2 vugraphs/5 min each), XP534 – S. Stutman, XP539 – K. Tritz, XP537 – J.R. Wilson, XP538 – B. LeBlanc, XP514 – G. Taylor, XP531 – R. Raman (J. Menard)

Run Coordination (J. Menard, S. Sabbagh)

The sixteenth week of operation was completed successfully with six experimental proposals.

XP-514: EBW O-X-B emission measurements

Emission data at $I_p = 800\text{kA}$ and 900kA was obtained, but 1MA discharges had an early plasma termination event, and locked modes precluded completion of the full plasma current scan to 1.2 MA . At the lower current values the radiometer acquired good EBW emission data, Thomson scattering data, and EFIT data on all shots of interest. Interestingly, some very intense EBW emission bursting events were observed, particularly immediately prior to locked modes. This data will be analyzed during the coming weeks and the results will be compared to full wave mode conversion and 3-D ray tracing modeling.

XP-516: Plasma fueling with supersonic gas jet

Fueling optimization in H-mode plasmas was attempted during this portion of the experiment. Several shots were spent redeveloping small ELM H-mode plasma with 1 NBI source (2 MW) which reached line-averaged density close to the Greenwald density. As a result, total radiated power was 44-50 % of the total input power. Additional fueling of these plasmas with SGI lead to a prompt development of a locked mode, a large reconnection event, or a density limit and termination. In most cases SGI fueling did not directly cause H-L transitions. At an SGI flow rate of $5.3\text{e}21$ molecules/s and a SGI-separatrix distance of 6-12 cm electron density profiles from MPTS indicated a small, if any, density increase in the edge "ears", within 0-10 % of the peak "ear" density. This flow rate would also lead to a confinement degradation within 100 ms or less. At a lower flow rate of $3.5\text{e}21$ molecules/s the "ear" density increase was up to 20 %, and the plasma stayed in the H-mode for a longer duration. More experimental time is needed to develop robust H-mode fueling scenarios with SGI.

XP-537: HHFW CD with MSE

A 1/2 day XP was executed to explore the use of MSE to measure HHFW CD. One NBI source (source at 90 kV) was used to obtain MSE signals. Low current target plasmas (300 kA) were used to maximize the current drive effect while minimizing the NBI effect on the plasma. HHFW power was applied for co and counter current drive phasings as well as a balanced heating phasing. The timing of the beam and rf application was varied in an attempt to optimize plasma performance. Large low frequency MHD modes were found to onset in these plasma affecting the measurement.

XP-538: HHFW heating of reverse shear plasmas.

HHFW power was added to NBI heated (2MW) reversed-shear L-mode plasmas with high central $T_e = 1.8\text{-}2\text{keV}$. The RF power was limited to less than 1 MW because of un-optimized loading conditions associated with the need to maintain a small inner gap and large outer gap to prevent the plasma from entering H-mode. The central electron temperature and neutron production increased by 10-20%, and the stored energy increased by 5%.

XP539 - Type I ELM propagation

This XP focused on analysis of the Type I ELM perturbation of the electron

temperature profile. A scan of I_p was performed in a LSN configuration and a Li pellet was injected towards the end of the shots to compare the two types of perturbations. Though it was difficult to generate the scan with this particular configuration, a few points in the I_p scan were completed and there were significant differences observed in the effect of the ELMs at 0.8-0.85MA and 0.6-0.7MA. The perturbations at the higher current levels showed the typical large drops in stored energy and corresponding drop in the SXR signals, while the ELMs at the lower current demonstrated far smaller effects. Further analysis will be required to characterize the ELM behavior and perturbation propagation in the plasma.

XP 531 - Transient CHI Startup

Scans of injector flux and toroidal field were conducted, and discharges were successfully produced over a range of toroidal fields. Using reduced injector flux, conditions were reached where the CHI produced plasma current persisted past the time of the injector current. Fast camera images consistently showed detachment of the CHI plasma from the injector when the measured plasma current persisted for several ms beyond the end of the injector current phase. CHI produced plasmas were also coupled to induction with 3 loop volts applied to 100kA CHI produced discharges. After loop voltage application, the plasma current was held at 40kA for over 20ms. PF coil current adjustments were used to move the plasma away from the injector and reach a condition close to vertically stable, but more coil current adjustments are needed to make them fully vertically stable. Future studies will focus on using CHI+induction to increase the maximum current above that achieved using CHI or OH alone.

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

NSTX operations continued this past week, and the lithium pellet injector was used to make good progress on XP-539 "Type I ELM heat pulse propagation", and to take some initial shots on XP-534 "Investigation of perturbative electron transport vs. magnetic shear using pellet injection. The HHFW systems were used in support of XP-537 "HHFW-CD with MSE" and XP-538 "HHFW heating of high- T_e reversed-shear plasmas", and the Supersonic Gas Injector for XP-516 "SGI fueling". Current and frequency scans were completed for XP-514 "Thermal EBW Conversion to O-Mode". Field coil power conversion systems were re-configured late in the week to perform toroidal field and poloidal flux scans for XP-531 "Transient CHI". Commissioning of the new high-K scattering diagnostic continued in parallel with machine operations, and that system recorded its first data this week.

NSTX will be off-line for maintenance this coming week. The test cell will be locked up mid-day on Thursday for a vacuum vessel boronization on Thursday evening. Machine area scrubs will be performed on Friday in preparation for resuming operations on Tuesday, September 6th. (A. von Halle)

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- Neil Brooks (GA) visited NSTX on 25 August 2005 to discuss results of GA-LLNL-ORNL-PPPL collaboration on fast filterscope ELM imaging and divertor spectroscopy with R. Maingi (ORNL), L. Roquemore (PPPL) and V. Soukhanovskii. (V. Soukhanovskii, LLNL)