

NSTX Weekly Report (April 28, 2006)

FY2006 weeks of research operations

Planned: 11 weeks

Completed: 6.22 weeks

M. Ono attended the Korean Physical Society Plasma Physics Division Conference in Pyung Chang, Korea on April 20 – 21, 2006. He gave an invited talk entitled “National Spherical Torus Experiment: Research Status and Plans.” Prior to the KPS conference, he visited KSTAR at the National Fusion Research Center, KBSI, and KAERI, Daejeon, Korea. He also gave a presentation on NSTX at NFRC.

Tom Osborne (GA) visited NSTX for 1 week to co-lead the ITPA endorsed DIII-D/MAST/NSTX pedestal similarity experiment, which was successfully executed. Tom also continued the porting of his profile analysis and kinetic EFIT tools for use in assessing the NSTX edge pedestal characteristics and stability.

Run Coordination (R. Raman, S. Sabbagh)

Good progress was made in one Machine Proposal and four Experimental Proposals.

XMP026: HHFW conditioning - J. Hosea (April 20): Prior to running this XMP, the antennas had been conditioned in vacuum twice during the evening after normal plasma operations. This served to condition antennas, measure RF voltages across DC breaks and CHI vessel gaps, and to make operational and calibrate the new RF voltage feedback system. During this run, the power was increased to 2.3 MW. The electron temperature increased to above 3 keV in some shots. The voltage feedback for source 3 was used during this conditioning to prevent its antenna voltage from exceeding 14 kV. This voltage feedback was demonstrated to be ready for limiting the antenna voltages during planned experiments on RF-assisted plasma current sustainment and ramp-up.

XP607: Transport of Fast Ions by Fishbones and TAEs – W. Heidbrink (April 21): The goal of the experiment was to measure simultaneously the internal structure and fluctuation amplitude of both TAEs and fishbone instabilities and the fast-ion transport they cause. Helium L-mode plasmas with deuterium NBI were used throughout the experiment. Three different beam conditions were used to excite the instabilities which were measured by soft x-ray arrays, reflectometers, and magnetic coils. The fast ions were measured by the E||B neutral particle diagnostic, the solid state neutral particle analyzer array, neutrons, and loss probes. All of these diagnostics performed well and measurements of key plasma parameters (including MSE) were also obtained. The first NBI condition used only Source C operated at 90 keV. Coherent oscillations measured by a 50 GHz reflectometer from the plasma core showed activity in the TAE-band (~100 kHz) from 200 to 290 ms. After 290 ms, the strong frequency chirping associated with fishbones dominated the spectrum at ~20 kHz. The second condition used Source A at 90 keV and had strong frequency chirping in the TAE band. The third condition used Source C at

70 keV and had weaker activity in both phases of the discharge. These data should enable a quantitative comparison of the observed fast-ion transport with theory.

XP533: CHI into an ohmic discharge - D. Mueller (April 24): Target development for this experiment proceeded well. A 600 kA. LSN target plasma heated by a single NB source using PF1B was developed that appears to have a large area of low flux in the absorber and is a good candidate for CHI edge current drive. It remains to produce a similar plasma using PF2L and PF1AL rather than PF1B as an alternative reference discharge.

XP529: Dependence of the H-mode pedestal dependence on aspect ratio – R. Maingi, T. Osborne (DIII-D), A. Kirk (MAST) (April 24, 25): The goal of this experiment was to perform a neutral beam heating power scan and a density scan in NSTX with a plasma shape similar to the cross-sectional shape obtained in DIII-D and MAST. A good match to the shapes was obtained. A neutral beam heating power scan was performed between 2 and 6 MW in 1 MW increments. In addition, a partial heating power scan was performed at a reduced density. Analysis of the edge density and temperature profiles and edge stability will be performed to determine the effect of the aspect ratio on the H-mode pedestal heights, widths, and gradients. Based on its recent success in producing H-mode transitions, the low field side supersonic gas jet was used for fueling. Reliable transitions to the H-mode were obtained.

XP617: HHFW power balance vs B at approximately constant q – J. Hosea (April 26): The goal was to investigate scaling of surface loss of the RF power with magnetic field as the toroidal field was varied from 0.3 T to 0.55 T. The results show that at 0.55 T, as for the lower fields, the 14 m^{-1} phasing gives a greater increment in central T_e than -7 m^{-1} and that higher field appears to improve the heating at -7 m^{-1} . MHD activity affects the heating and comparisons need to be made in periods of low activity. Analysis of the increments of stored energy will be performed to determine the possible effect of magnetic field on power deposition.

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

NSTX plasma operations continued this week, making progress on several experiments. The TF coil was operated to 0.5 T and then to 0.55 T for experiments conducted this week. Also this week, work continued on establishing patterns of deposition from the LITER lithium evaporator in a test chamber at various oven temperatures. A conceptual design review of a proposed upgrade to the real-time control system computer was held.

Plasma operations will continue this coming week, and the NSTX Test Cell will be locked-up until 5PM each day. Access to the test cell will be available from 5PM to 9PM each evening. The next NSTX maintenance week is scheduled for May 8-12.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

The second lithium evaporator has been operated extensively in the laboratory vacuum chamber. The rate and spatial distribution of the lithium deposition were measured as functions of the lithium reservoir temperature between 450°C and 600°C. The shape of the distribution was almost unaffected by the lithium temperature but the total rate showed the expected strong dependence on temperature of the lithium reservoir. The first experiments were also conducted to develop a method to evaporate very rapidly from the “snout” lithium which had previously been condensed in it by operating it below the temperature of the lithium in the main reservoir.

Diagnostic Operations (R. Kaita)

- The diagnostics continue to function well in support of the experimental program. The dual-radiometer for mode-converted thermal EBW emission from the plasma was fully commissioned for use in experiments.
- Plasma images with good signal-to-noise were obtained during helium discharges using a helium interference filter on a fast visible camera. These measurements are part of a collaborative effort with Hiroshima University to develop a diagnostic for two-dimensional flow imaging.