

NSTX Weekly Report (April 30, 2004)

FY 2004 weeks of operation planned: - 18 weeks, Completed: - 11 weeks

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

- There will be an NSTX Physics meeting on Monday, May 3, beginning at 1:30 P.M. in LSB B-318. Because this is a maintenance week, there will be two physics presentations: Fred Levinton will present "Initial results from the MSE-CIF diagnostic on NSTX". David Gates will summarize the "Status of NSTX plasma control". This meeting will be available for remote participation. (C. K. Phillips)

Run Coordination (S. Kaye, J. Menard)

The last week of operation before the maintenance week was another successful one. Five experiments were performed and mostly completed. These included work on scoping out the stability boundary for neoclassical tearing modes, characterizing edge plasmas, achieving early L-H transitions, and further development of highly shaped Lower Single Null and Double Null discharges. Among the highlights of the results of these experiments were reproducible and robust L-H transitions at 85 msec into the pulse, 1.0 MA discharges lasting for 1 sec in DND and over 1 sec in LSN discharges, sustained control of the plasma at elongations of 2.6 and little or no confinement degradation in long pulse discharges close to the Greenwald limit. Helium conditioning shots, instead of between-shots He glows, were used to condition the vessel and resulted in discharges which approached steady-state line-averaged densities. At 1.2 MA, toroidal beta values approaching 40% were achieved.

- Center stack limited discharges were run in L-mode in order to scope out the neoclassical tearing mode stability boundary. A reproducible target with sawteeth to act as triggers for the NTMs was developed, and there was some success in pushing up toroidal beta in order to study the destabilization of these modes. Some instances of limiter H-modes were observed.
- Development of long-pulse Double Null Diverted plasmas continued, and 1 MA discharges lasting 1 sec with controlled current ramp-downs were achieved. Elongation of 2.2, with poloidal beta of 1.2 and over 300 kJ of stored energy (EFIT) were obtained. During the course of this experiment, 500 kA helium conditioning shots were used instead of helium glow, and this resulted in producing a discharge in which the density increase was halted, and confinement times were approximately 1.5 to 2 times L-mode through the discharge, even as the density approached the Greenwald limit. Little or no global confinement degradation was observed.
- The first half of the edge characterization experiment was successfully executed, with a detailed power scan, a basic configuration scan, and a limited plasma current scan. These data will be reported at the PSI meeting next month. During the course of the experiment, possible Type III or Type II ELMs were observed in DND, but not LSN discharges, possibly indicating a very sensitive existence dependence on triangularity. The soft X-ray arrays showed these ELMs to be initiated on the midplane.
- There was good success in achieving robust and reproducible L-H transitions early ($t \sim 85$ msec) in LSN discharges during the current ramp. This was done by introducing a short period of constant I_p during the ramp. With the transitions occurring at lower I_p and requiring only one neutral beam source, plasmas developed with significant reduction in volt-sec consumption and 800 kA current flat-tops of 850 msec. These discharges lasted over 1 sec and were limited by the toroidal field pulse length capacity (there was OH flux remaining). The discharges were found to be insensitive to whether the gas fueling was on the low field or the high field. Sustained elongations of 2.6 were achieved during these long pulse discharges, which were diamagnetic.
- Further development of the long pulse LSN discharges utilizing new poloidal field shaping capability (coil PF1B) with early H-mode transitions continued, with 1.2 MA discharges being developed and lasting for up to 0.8 msec (1 MA for 1 sec). With 7 MW of neutral beam powers injected, toroidal beta values of $\sim 40\%$ (EFIT02) were achieved with a TF rampdown to 3.0 kG.

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

NSTX plasma operations continued this past week after completing a vacuum vessel boronization over the weekend. . The facility operated with high availability averaging 8.5 hours per day supporting five separate experiments. An experiment on neoclassical tearing modes (XP-427) was completed and an experiment on long pulse double null plasmas (XP-402) produced a 1 sec discharge at 1MA, which maintained a stable density in 7MW of neutral beam injection. Power scans were completed for an edge characterization experiment (XP-434) which also provided comparisons of double null and lower single null plasmas. Mickey Wade of General Atomics led the effort to produce early H-mode transitions by introducing neutral beam steps in the current ramp up (XP-440) and was successful in saving solenoid flux for longer pulse lengths. This provided good background for the experiment on long pulse single null plasmas (XP-432) performed at the end of the week.

The new controller for the center stack shoulder gas injector has been installed and testing is in progress. This will allow alternate or combined operation of the shoulder and midplane gas injectors. A one week maintenance period began on Friday and NSTX test cell access will be available around the clock until Friday, May 7th, at the start of the machine area scrubs. (A. von Halle)

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- TMB Boronization-25 was applied on April 24.
- Data from the boundary physics characterization (XP #434) and the early H-mode access XP #440 proved that a 15 minute HeGDC between shots was needed for reproducible timing of the L-H transition. Shorter glows delay the L-H transition and may eventually result in a higher L-H power threshold by mid or latter part of run day. (R. Maingi, ORNL)
- A direct comparison of the 15 minute HeGDC glow and a technique with two 5 minute HeGDC surrounding a Helium conditioning discharge showed that the latter prescription provides better density control. (R. Maingi, ORNL)
- A final Peer Review for the new controls for the Center Stack Upper Shoulder Gas Injector installation was successful and final off-line testing was completed. (R.Gernhardt)