

NSTX Weekly Report (Apr. 23, 2010)

FY 2010 NSTX plasma operations

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

Completed: Base - 0.99 run week and 157 plasma shots

Completed: ARRA - 1.01 run week and 171 plasma shots

The NSTX ARRA Enhanced Operation Milestone was completed. NSTX plasma operations achieved 1.01 run-week during the period starting Monday April 5th and ending Friday April 9th utilizing the remaining funds provided under the ARRA Enhanced Operation of Major Fusion Facilities. (The total enhanced NSTX run-weeks accomplished with the ARRA Enhanced Operation of Major Fusion Facilities funds now totals 6.96 run weeks {5.95 in FY2009 and 1.01 in FY2010}.) (T. Egebo)

Jon Menard attended the "Workshop on TBM Impact on ITER Plasma Physics and Potential Countermeasures" held April 13-15 in Cadarache, France. A talk entitled "DIII-D TBM mock-up error field correction modeling using IPEC and implications for ITER" was presented based on work by J.K. Park, H. Reimerdes, M. Schaffer, and the international TBM team. It is found that the observed changes in the locked mode threshold and correction of the TBM resonant error field are largely consistent with predictions with the IPEC code. Analysis also indicates that both resonant and non-resonant components of the TBM magnetic field appear to play a role in the observed rotation damping at higher beta in H-mode. Menard also participated in discussions of possible future analysis and experimental work, and the potential implications and countermeasures for ITER. (J. Menard)

Luis F. Delgado-Aparicio presented a talk entitled "Multi-energy soft X-ray (ME-SXR) imaging for magnetically confined fusion studies" at the Physics Department at the University of Wisconsin - Madison on April 19, 2010. The talk mainly emphasized the work done on NSTX during the last three years utilizing the ME-SXR diagnostic in different NSTX (impurity) transport and Resistive Wall Mode and Neoclassical Tearing Mode experiments. (L. F. Delgado-Aparicio)

J-W. Ahn (ORNL) and R. Maingi (ORNL) presented talks remotely at the ITPA pedestal physics meeting in Japan: "Strike point splitting by the intrinsic or applied 3-D fields in NSTX" and "Enhanced temperature pedestals and improved confinement in NSTX" respectively. The first talk described striations in the divertor heat and particle flux profiles in discharges with applied 3d fields, and the second talk described the spontaneous transition to enhanced confinement and improved H-mode pedestal temperatures in NSTX. Both talks were received with considerable interest from ITPA and ITER participants. (R. Maingi)

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

[Addendum to the April 16 weekly report] On Thursday, April 9, Experimental Proposal (XP) 1023 "Optimized RWM feedback for high pulse-averaged beta_N at low n and I_i" (S.A. Sabbagh - Columbia University, et al.) was started after 2:30 pm, with the goal of exercising Resistive Wall Mode (RWM) feedback algorithms and evaluating plasma performance at low internal inductance. Fairly good plasmas were made, with I_i low enough to significantly reduce the n=1 no-wall beta normalized limit during the plasma current flat-top to less than

2.6 %m.T/MA (from the usual limit of ~ 4.2).

On Thursday, April 15, two experiments were run. XP1023 “Optimized RWM feedback for high pulse-averaged β_N at low n and I_i ” (Sabbagh, et al.) developed a 1 MA low I_i plasma target with reduced $n = 1$ no-wall normalized beta limit for use in XP1020. Pulse lengths of 1s were reached, and unstable RWMs were generated with sufficient NBI power. XP1020 “RWM Passive stability: Determination of, navigation through weak RWM stability $V_f(\psi)$ ” (J.W. Berkery - Columbia University, et al.) was started. Good progress was made in detecting changes in the resonant field amplification (RFA) response as plasma rotation and normalized beta were varied. However, machine conditions were not optimal for the experiment, either because only one Lithium Evaporator (LITER) was available, or because of deconditioning during the MSE calibrations on the preceding day.

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

The planned NSTX maintenance week has been extended to address an OH coil water leak due to a crack at the end of the top face of the OH coil lead conductor. Drawings and procedures for an in-situ repair are expected to be available by early next week, and will be practiced in the shop before implementing on NSTX. In parallel with this effort, plans to complete testing of the spare OH coil manufactured by ASIPP and the fabrication of support structures needed to install this coil on NSTX are underway, although they are not expected to be needed for this run. Also this past week, procedures and equipment were prepared for an argon vent of the vessel to replace the Bay K Liter torus isolation valve, and equipment lay-outs were prepared for the installation of a house air based heating system for one of the Liquid Lithium Divertor plates. Testing of a new design for a double-bellows calorimeter drive system successfully reached 10K cycles on a vacuum test stand.

Access to the NSTX test cell will be available this coming week during this extended maintenance period.

Research Operations (M. Bell)

Boundary Physics Operations (H. Kugel)

- Liquid Lithium Divertor (LLD)
 - The LLD plates were operated at 320°C to evaporate all uncombined lithium prior to the planned argon vent. During this process, the vessel plasma facing graphite tiles were heated by thermal radiation from the LLD to about 40°C, thereby providing a mild bakeout that accelerated degassing of surfaces. Residual Gas Analyzer (RGA) measurements were performed during this operation.
- LLD Diagnostics
 - The fiber bundle for DIMS (Divertor imaging spectrometer) was installed through a test cell wall penetration, and the penetration was sealed. Work is in progress on the final assembly and adjustments. (V. Soukhanovskii, LLNL)
- Material Analysis Particle Probe (MAPP)

- Purdue University students C.Taylor and B.Heim visited NSTX to perform inspections and take measurements of the lower Bay-K area of the present Sample Probe and plan for its replacement with MAPP for use in 2011.
- Lithium R&D
- Installations in the lithium vacuum test chamber were completed. This included a 13cm x 30cm molybdenum coated sample of the LLD with internal heaters. The sample is presently being operated at 405°C and degassing of the chamber internal components is in progress.

Diagnostic Upgrades (B. Stratton)

- Installation of the BES diagnostic on NSTX is now complete and off-line commissioning is well underway. It is ready to take initial plasma data with eight spatial channels when NSTX resumes operation. This has largely been the work of D. Smith (University of Wisconsin-Madison) and a PPPL team lead by G. Labik. Sixteen more spatial channels will be installed in the near future so that data can be taken with 24 spatial channels later in the NSTX run. G. McKee (University of Wisconsin-Madison) visited PPPL for the week of April 19 and worked on porting analyses codes to PPPL computers and making modifications necessary for them to be used with NSTX BES data.