

NSTX-U Weekly Report (November 14, 2014)

NSTX-U is in the Upgrade Project outage in FY 2014

The paper, “Broadening of divertor heat flux profile with increasing number of ELM filaments in NSTX” by J-W. Ahn (ORNL) et al, was published in Nuclear Fusion 54 (2014) 122004, and is available at <http://stacks.iop.org/0029-5515/54/122004>. It describes detailed divertor heat flux dynamics during the ELM observed in NSTX, and reports the increase of ELM heat flux profile width with the number of filamentary striations observed, i.e. profile narrowing is observed with zero or very few striations. The smaller number of filaments observed, compared to other tokamaks, is ascribed to the fact that NSTX lies on the long wavelength current-driven kink/peeling mode side with low n number ($n = 1-5$) while higher n ($n = 10-20$) peeling/ballooning mode is most commonly observed in many machines. As ITER is presently predicted to lie on the kink/peeling mode side, this work points to the need of detailed projections of the unstable modes expected in ITER. (J-W. Ahn)

Members of NSTX-U research and engineering team attended the American Nuclear Society 21st Topical Meeting on the Technology of Fusion Energy (TOFE) on 9 – 13, 9-13 November 9 – 13, 2014, Anaheim, CA. Three NSTX-U related invited talks were presented: “NSTX Upgrade for Establishing Physics and Technology Basis for FNSF” by Masayuki Ono (PPPL), “Configuration Studies for an ST-based Fusion Nuclear Science Facility” by Jonathan Edward Menard (PPPL), and “The Present Status and Future Perspective of the Application of Liquid Metals for Plasma-Facing Components in Magnetic Fusion Power Reactors” by Yoshi Hirooka (NIFS). An oral presentation “Engineering Challenges and Opportunities with Liquid Metal Plasma-Facing Components by Michael A Jaworski (PPPL), and poster presentations “Design Description for a Coaxial Helicity Injection Plasma Start-up System for a ST/FNSF” by Roger Raman (U. Washington) and “NSTX-U (Title III) Analysis Issues” by Peter H. Titus” were also given. Rajesh Maingi (PPPL) served as a Technical Program Committee co-Chair of the conference. (M. Ono)

Steve Sabbagh and Young-Seok Park of Columbia University continued running an experiment on the KSTAR tokamak attempting to access higher normalized beta. Record values of normalized beta for the device exceeding 4.3 were reached at low plasma internal inductance, yielding normalized beta to internal inductance ratios exceeding 6. These values are expected to be at least 50% over the $n = 1$ ideal no-wall beta limit computed from past analysis. Termination of these KSTAR plasmas at the highest normalized beta may be due to the appearance of a global MHD instability. Related analysis continues. (S. Sabbagh)

Masayuki Ono (PPPL) visited UCLA on November 14, 2014. He met with the UCLA researchers including Profs. Troy Carter, Walter Gekelman, Tony Peebles, and Mohamed Abdou. He toured the LAPD and related facilities and the Microwave laboratory. He gave a plasma physics seminar entitled “NSTX Upgrade for Establishing Physics and Technology Basis for FNSF”. (M. Ono)

Physics Analysis (S. Kaye)

Work has continued on optimizing the “**B**etween and **A**mong **S**hots **T**ransp” runs (BEAST). Using a 1.1 sec duration NSTX H-mode as a base case, the execution time (wall time) of the

TRANSP run has been reduced to 3.1 min when using a 16-processor GPU server when the beam time step is set to 20 msec. With a beam time step of 10 msec, the wall time increases to 5.3 min. The 20 msec beam time step is acceptable for adequate statistics. On the present server, the times do not decrease with an increased number of CPUs. In fact, going to 32 processors increases the wall time.

Experimental Research Operations (S. Gerhardt, R. Kaita)

The MPTS collection optics were installed after its modification for the new laser beam path; a sharp focus was obtained. A radial array calibration was performed. Assuming that stray laser light does not impede deployment, we expect to have 42 major-radius channels ranging from 39.4 cm to 155.4 cm. Work is continuing on the laser-beam path hardware. A theodolite has been installed in the new south-wall laser enclosure, which will be used to align the flight-tube baffles. Part of fiber-bundle protection hardware is inducing unwanted torque on elements of the collection optics and palliative measures are being considered. (B. LeBlanc, PPPL)

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

NSTX Upgrade activities continued with the completion of the Multi-Pulse Thompson Scattering (MPTS) diagnostic in-vessel alignments, and the start of preparations to install the MPTS flight tube. Final diagnostic installations are in progress in preparation for vessel pump down. In vessel photographs will be taken early next week, and the NB1 duct will be moved into the NSTX-U test cell south high bay in preparation for lifting it into place and sealing off the vessel by the end of the week.

The Digital Coil Protection System (DCPS) and the Power Supply Real Time Control (PSRTC) development efforts are working towards the start of Field Coil Power Conversion System dummy load testing. Installation of the DCPS has been completed, and operational testing is in progress. PSRTC software development is nearing completion, and the portable firing angle recorder for PSRTC to FCPC Firing Generator has been installed and is successfully relayed test data. In-sit testing of the new system latency tester is in progress.

Preparations for plasma operations in the NSTX-U configuration also continued. Diagnostic preparations this week included the re-installation of the MAPP probe, a Reflectometer tile modification, the replacement of the MSE shutter, and the change-out of the Bay BCHERS window. Final fit-up of the CHI bus inside the umbrellas is in progress, and a work package is in place to install equipment for the high speed Voltage measurements required for CHI operations. Primary power has been energized for pre-operational testing of the second neutral beam (NB) power systems, and the NB helium compressors are being started in preparation to begin cleaning up process gas on 12 hour/day shifts next week.

Access to the NSTX test cell will be available only through previous arrangement with the Upgrade Work Control Center.

NSTX-U Neutron Calibration (Oct. 24, 2014)

