

NSTX-U Weekly Report (October 11, 2013)

NSTX-U is in the Upgrade Project outage in FY 2013

A number of NSTX-U papers were presented at the 3rd International Symposium on Lithium Applications for Fusion Devices, October 9-11, 2013, C.R. ENEA Frascati, Italy. Invited talks were “Radiative liquid lithium divertor concept” by M. Ono, “High-temperature, liquid lithium plasma-facing component research for NSTX-U and next step device” by M. A. Jaworski (PPPL) given remotely, and “Lithium sputtering from lithium-coated graphite plasma facing components in the National Spherical Torus Experiment (NSTX) divertor” by F. Scotti (Princeton University). Oral presentations were “Divertor deuterium recycling and oxygen influxes in lithium experiments on NSTX” by V. A. Soukhanovskii (LLNL) given by F. Scotti, “Measurements and Interpretive 2D Edge Modeling of Lithiated NSTX Discharges” by T.K. Gray (ORNL), “Erosion and re-deposition of lithium coatings on TZM molybdenum and graphite during high-flux plasma bombardment” by T. Abrams (Princeton University) given remotely, “An apparatus for the repetitive injection of spherical lithium granules into fusion research devices” by D. K. Mansfield, “A liquid dripper for fueling and ELM pacing in NSTX-U” by D. Andruczyk (University of Illinois) given by A.L. Roquemore (PPPL), and “E-beam flash evaporator for NSTX-U” by A.L. Roquemore. M. Constantin (Princeton University) gave a poster presentation on “Effect of Charge Exchange on Lithium Cooling in the Tokamak Scrape-Off Layer near the Divertor Surface.” R. Nygren (SNL) led a special session on Lithium-Safety and Lithium Handling, and R. Goldston (PPPL) led a Panel Discussion on lithium feasibility for fusion reactors. (M. Ono)

R. Maingi (PPPL) was selected as chair of the ITPA Pedestal and Edge Physics group, succeeding the outgoing chair, N. Oyama. Maingi organized the program of the PEP group meeting following the H-mode workshop in Fukuoka, Japan, Oct. 7 – 9, 2013, and presided over a couple of sessions. In this meeting, J.W. Ahn (ORNL) presented "Progress in the study of footprint pattern with 3D fields and comparison with field line tracing in NSTX". (R. Maingi)

Walter Guttenfelder and Rory Perkins of PPPL visited General Atomics Sept. 30 - Oct. 2 to participate in the DIII-D National Fusion Science Campaign experiment "Controlling H-mode particle transport with ECH" led by Darin Ernst (MIT). The experiment was carried out in QH-mode plasmas with the density profiles sufficiently peaked that the density gradient driven trapped electron mode (TEM) was predicted unstable inside $r/a = 0.35$, determined using between-shots linear GYRO stability analysis. With the application of ECH, decreases in the density gradient and increases in electron density fluctuations were observed, consistent with theoretical expectations. Modulated ECH and modulated gas puff perturbations were applied, and fluctuations were documented at several radii and wavenumbers from DBS, CECE, BES, ECE imaging, and PCI, while high resolution density profiles were acquired by the profile reflectometer. (W. Guttenfelder)

Mario Podestà led an experiment on DIII-D on Fri. 10/04 to investigate the effect of Alfvén eigenmodes (and other plasma instabilities) on Neutral Beam current drive. Scenarios with balanced, on-axis and off-axis NB-CD have been investigated for two values of toroidal magnetic field, namely $B_t=1.5T$ (with $q_{min}>2$) and $B_t=1.2T$ (with $q_{min}\sim 1$). In both cases, toroidal Alfvén eigenmodes with $n=4-7$ were destabilized along with lower-frequency MHD modes. Analysis has started to assess the non-inductive current profiles resulting from the

different NB injection parameters and their modifications based on properties of the observed plasma instabilities. (M. Podestà)

Calculations as a function of normalized poloidal magnetic flux have been made for various configurations of the primary passive plate “Non-axisymmetric Control Coil” (NCC) as part of a General Atomics collaboration on NSTX-U. In these configurations, $n=3$ is the only significant toroidal mode but by varying the coil pattern in the 2x12 configuration from 6 evenly spaced coils toroidally i.e., c,s,c,s,c,s,c,s,c,s,c,s where c=coil and s=space, to c,s,c,s,c,s,c,s,c,s,c,s a relatively well balanced $n=3$ and $n=4$ spectrum is produced. Other NCC configurations with reduced sets of coils are being studied in order to identify profiles to produce a broad edge stochastic layer width while falling off rapidly in the radial direction to minimize the impact of the non-axisymmetric field on the core plasma (T. Evans, General Atomics).

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

NSTX Upgrade construction activities continued with the successful completion of electrical insulation tests (hiPots) of the freshly epoxy impregnated full TF inner bundle. Electrical isolation was found to be very good at 1kV between conductors and at 4.5kV from quadrant to quadrant. Preparations are now underway to lift the TF bundle into the vertical position for the application of the Aquapour base for OH winding. The OH winder assembly is being fine tuned, and OH brazing certifications are in progress. In the NSTX-U test cell, power has been restored to the category 3 (referenced to inner vacuum vessel) and category 4 (outer vacuum vessel) diagnostic racks.

Preparations for plasma operations in the NSTX-U configuration also continued with a successful review of the conceptual design for the proposed new plasma current calculator. Also, tests to qualify a proposed new compliant center conductor for the High Harmonic Fast Wave (HHFW) system center post are being prepared. The RF test stand is under vacuum and wave guides are in place to first baseline the original rigid center conductor, and then move to a series of tests with the compliant version.

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