NSTX-U Weekly Report (June 27, 2014)

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

Several members of the NSTX-U research team participated in the European Physical Society (EPS) meeting held June 23-27, 2014 in Berlin, Germany at the Berlin Conference Center (BCC). A. Bortolon (UT Knoxville/PPPL) gave an invited talk "Mitigation of Alfvénic activity by 3D magnetic perturbations on NSTX" and NSTX-U researcher V. Soukhanovskii (LLNL) gave an oral presentation "Radiative snowflake divertor studies in DIII-D". Posters on NSTX science or on research performed by NSTX-U research team members were also presented including: "Stochastic heating of thermal ions by compressional Alfvén eigenmodes in NSTX" by H. Smith (MPPC), "Physics of forced magnetic reconnection in coaxial helicity injection experiments in NSTX" by F. Ebrahimi (Princeton University), "Kinetic resistive wall mode stability evaluation and physics insight application in NSTX" by J. Berkery (Columbia University), "Understanding ion cyclotron harmonic fast wave heating losses in the scrape off layer of tokamak plasmas" by N. Bertelli (PPPL), "Investigations of pedestal turbulence and ELM bursts in NSTX H-mode plasmas" by D.R. Smith (University of Wisconsin), "Rotation and kinetic effects on ideal and resistive-wall modes in NSTX" by J. Menard (PPPL), "Predictions of Vrf on a Langmuir probe under the RF heating spiral on the divertor floor on NSTX-U" by J. Hosea (PPPL), "Pedestal evolution and scaling with plasma current on MAST" by A. Diallo (PPPL), "Locked-mode avoidance and recovery with ICRH and LHCD in Alcator C-Mod" by L. Delgado-Aparicio (PPPL), "Suppression of TAE and GAE with HHFW heating" by E. Fredrickson (PPPL), "Characteristics of Fluctuation-induced Plasma Flows and Implications to Experimental Observations" by W. Wang (PPPL), and "Fast Time Response Electromagnetic Disruption Mitigation System" by R. Raman (University of Washington). (J. Menard)

Steve Sabbagh (Columbia University) visited General Atomics last week to run MP2014-22-07 "Testing kinetic RWM stability theory at marginal stability in high beta, tearing mode stabilized plasmas". The experiment successfully produced high betaN (up to 4 transiently), high qmin > 2 plasmas to study RWM stability and mode dynamics over a wide range of toroidal rotation profiles, and with variations in betaN and qmin. RWM activity was not observed when n = 1 tearing modes were present. However, when NTMs were stabilized or actively controlled by pre-emptive ECCD aimed at the q = 3 surface, large betaN collapses (up to 80% drop in Wtot) and full current-quench disruptions were produced at various stability parameters, correlated with RWM activity and indicating that the marginal stability point was reached. High time resolution (1 ms) CER data was specifically set to capture the detailed evolution of the toroidal rotation profile approaching significant fast betaN collapses and leading up to full current-quench disruptions. Early (unaimed) ECRF with current drive phasing vs. heating phasing lead to greater central q shear reversal and lower rho_qmin making NTMs less stable. The lithium dropper was used to attempt creation of ELM-free periods and to change collisionality in the high normalized beta plasmas created in MP2014-22-07. Lithium rates of 40mg/s and 80mg/s were tolerated by the target plasma with no H-L back-transition. When n = 1 NTMs were stable, modest changes to pedestal T, collisionality, and ELM frequency were found. With a strong n = 1 NTM present, the mode amplitude was halved during the period when lithium was dispensed at the 80mg/s rate. These experiments provide a unique data set for understanding the somewhat complex kinetic RWM marginal stability boundary (e.g. non-monotonic dependence on plasma rotation speed), and provide a greater understanding of the significant beta-limiting / disruption producing events in high betaN plasmas when NTMs are stabilized. (S.A. Sabbagh)

Experimental Research Operations (M. Ono, Acting)

Installation of the HHFW antenna, with compliant sections added to the center conductors of the RF feedthroughs, was completed. The compliant center conductor sections decouple the increased mechanical forces on the antenna straps from the electrical feedthroughs. Electrical and mechanical analyses were used to develop the design of the compliant conductors, and they were tested on an antenna mockup in the RF test stand. (R. Ellis, PPPL)

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

NSTX Upgrade activities continued with the completion of the vacuum impregnation with epoxy (VPI) of the TF/OH coil assembly. The TF/OH coil and mold is currently still in the oven after the thermal cure cycle, which is also now complete and the temperature ramping down. TheTF/OH coil assembly will be removed from the oven next week and will be hydro-statically tested. Work on the new centerstack casing continues in the South High Bay, and the centerstack casing is being laid down horizontally to accommodate the installation of new PF coils.

Development of the new Digital Coil Protection System (DCPS) continued with ongoing testing of system software and user interfaces, and the design/fabrication of hardware and I/O layouts.

Preparations of non-upgrade equipment for plasma operations in the NSTX-U configuration also continued with the completion of the installation of the new compliant center conductors for the HHFW Antennas. In the NSTX-U Test Cell, calibrations of the spectrometer-based tFIDA and CHERS diagnostics have been completed. Neutral Beam and Field Coil Power Conversion (FCPC) Subsystems are being made ready for power testing with the exercise of pre-operational test procedures. Weld repairs of the D-MG#1 rotor are now about 30% complete, and measured distortion at eight locations on the rotor are all well within specified levels.

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