

NSTX-U Weekly Report (August 30, 2013)

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

D. Darrow (NSTX-U/PPPL) visited MAST August 12-23 to contribute to tests of the Florida International University (FIU) MeV proton detector on MAST plasmas. This detector system aims to measure the radial profile of the DD fusion reactivity of the plasma through detection of the 3 MeV protons and 1 MeV tritons produced in DD reactions. The testing was conducted in conjunction with Prof. W. Boeglin and R. Perez (FIU), and the MAST team. All 4 channels of the system registered clear signals from both types of fusion product ions. Data on the radial profiles were obtained under a wide variety of conditions, including quiescent plasmas, sawtooth discharges, and during fishbone modes. In all cases, data from radial scans of the MAST neutron camera was also acquired. This camera also measures the fusion rate radial profile, but by means of the neutrons emitted by the fusion reactions. Comparison of the profiles produced by the two diagnostics is underway. These initial results are encouraging for the development of a system with more channels to measure the fusion rate profile in NSTX-U plasmas. (D. Darrow)

Steve Sabbagh and Young-Seok Park of Columbia University ran the KSTAR tokamak experiment MP2013-05-03-003 for two sessions last week (August 19 – 23, 2013) at the National Fusion Research Institute (NFRI) in Daejeon, South Korea, which addressed high normalized beta plasmas and studied several aspects of non-resonant $n = 2$ magnetic braking by neoclassical toroidal viscosity (NTV) in the device. Various magnetic field spectra were applied by utilizing the flexible capabilities allowed by KSTAR's in-vessel control coils over pulse lengths (~ 10 seconds) much longer than the momentum confinement time (~ 100 ms). Plasma collisionality was effectively changed by supersonic molecular beam injection of deuterium during the period of the applied $n = 2$ field, and rotation profile control by the combined effect of 110 GHz second harmonic and 170 GHz third harmonic electron cyclotron heating in the plasma core, and $n = 2$ NTV was examined. Along with the strong effect of $n = 2$ NTV to reduce plasma rotation in KSTAR, the various combinations of rotation control tools stated above were also used to change the toroidal rotation profile shear. Experiments by S.A. Sabbagh, et al. on both the National Spherical Torus Experiment (NSTX) at PPPL, and at KSTAR have shown significant controlled modification of plasma rotation by non-resonant NTV in each device ($\sim 100\%$ reduction in NSTX, $\sim 50\%$ reduction in KSTAR). As NSTX and KSTAR differ significantly in aspect ratio, comparison of KSTAR data to the NSTX data will provide important physics insight on the effect, and comparisons to NTV theory. (S.A. Sabbagh)

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

NSTX Upgrade construction activities continued with the completion of ground wrapping on the new TF inner bundle, and the lift of the completed TF bundle into the full mold in preparation for the final vacuum impregnation with epoxy (VPI) is scheduled for next week. Crews are in the process of removing the priming room from the coil winding facility to make way for equipment needed to wind the new OH coil onto the TF inner bundle after the VPI. In the test cell, the welding of the in-vessel J-K stiffeners continues, as does the installation of the upper outer TF support ring. The optics box for the Multi Pulse Thomson Scattering (MPTS) diagnostic is being assembled.

Preparations for plasma operations in the NSTX-U configuration also continued with the retrofitting of the new firing generators into the field coil power conversion system rectifiers. Also, antenna boxes have been assembled in the RF test stand to qualify a proposed new compliant center conductor HHFW center post. A resonant loop is being configured 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.