

## **NSTX-U Weekly Report (October 3, 2014)**

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

The Topical Review paper, "Solenoid-free plasma start-up in spherical tokamaks," by R. Raman (U-Washington) and V F Shevchenko (CCFE, Culham Science Centre), was published on-line in Plasma Physics and Controlled Fusion 56 (2014) 103001, <http://iopscience.iop.org/0741-3335/56/10/103001/article>. The paper reviews research to-date in the areas of helicity injection, radio frequency and outer poloidal field induction for initiating plasma currents in spherical tokamaks. (R. Raman)

Steve Sabbagh and Young-Seok Park of Columbia University visited NFRI to run an experiment on the KSTAR tokamak attempting to access higher normalized beta and to extend past  $n = 2$  non-resonant neoclassical toroidal viscosity (NTV) studies in the device. The machine was successfully operated at reduced toroidal field as low as 0.9T, and record values of normalized beta for the device reaching 4 were produced transiently in a range of internal inductance from 0.75 – 0.85 as computed using full KSTAR equilibrium reconstructions. These values are expected to be at least 30% over the  $n = 1$  ideal no-wall beta limit computed from past analysis. Initial examination of the non-resonant  $n = 2$  NTV indicates a favorable lack of hysteresis as the applied 3D field magnitude is changed. (S. Sabbagh)

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

NSTX Upgrade activities continued with the completion of the installation of diagnostics and then the micro-therm blankets on the TF/OH centerstack assembly (see photo below). The centerstack assembly is now being moved out of the C-Site Coil Shop, and will be mounted in the South High bay adjacent to the NSTX Test Cell in preparation for the installation of the centerstack casing which is now complete with tiles and diagnostics. The ceramic break/PF1C lower coil assembly has been installed on the centerstack pedestal under the NSTX-U vessel and is undergoing vacuum leak checking and electrical insulation testing. In the shops, welding of the PF1C upper coil can has been completed, and machining is in progress.

Commissioning of the new Digital Coil Protection System (DCPS) continued with ongoing pre-operational testing of software and hardware. A draft pre-operational test procedure of the combined DCPS Computer and hardware interconnection systems is under review. DCPS interconnection drawings should be finalized in drafting in the next couple of weeks. The development of the specification for the Power Supply Real Time Control (PSRTC) software continues, including details of SPA control.

Preparations of non-upgrade equipment for plasma operations in the NSTX-U configuration also continued. Preparations are underway to restore the fixed frequency primary power to the Neutral Beam (NBPC) and Field Coil (FCPC) power conversion power systems for the start of power testing. A contractor has begun the replacement of the D-MG#1 stator cooling water isolation valves as needed to complete the chemical cleaning of the stator heat exchangers as part of our recommissioning of the variable frequency primary power. Procurement actions for the new deuterated trimethylboron (dTMB) gas injection system are in place, and are consistent with a January, 2015 system start-up. MPTS diagnostic work continues, and the MPTS collection optics box will be ready for installation in the NSTX-U test cell next week.

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