

NSTX-U Weekly Report (December 16, 2016)

FY 2017 status: NSTX-U is in a maintenance and repair outage.

NSTX-U Recovery Project (R. Hawryluk)

The recovery project Responsible Engineer's continued preparing System Design Descriptions (SDDs) as the first step in preparing for Design Validation and Verification Reviews (DVVRs). A centralized document gathering effort continued this week. A global spreadsheet has been developed which allows each Responsible Engineer to request documentation to support their DVVR. The QA branch is supporting this effort.

The lift/removal of the NSTX-U centerstack casing from the TF/OH coil bundle was successfully completed this week. Lift and Removal procedures for the disassembly of the PF1aL coil from the centerstack casing have been developed and are out for review. The PF1A-L coil removal is planned for this coming week.

The PF1A-U coil was further disassembled in the vicinity of the fault, which will enable a detailed inspection next week.

A video-conference call was organized by J. Menard with the MAST team to compare lessons learned regarding the design and fabrication of the magnets. The discussion was very productive and a follow on meeting will be held.

C. Neumeyer had a conference call with Stefan Fink from the Karlsruhe Institute of Technology (KIT) to discuss analysis of coil impulse testing.

Preparations continue for the removal of the lower ceramic break from the vacuum vessel.

Recommissioning of the coil winding facility continued with vacuum leak checking of the VPI system, and weld inspections of the roller system and structures. An electrical engineer has inspected the taping machine operation.

Magnetic testing of an ITER diagnostic Piezo Actuator was successfully completed on the Field Coil Power Conversion (FCPC) Test Stand with a scan of 18kA shots at various ramp rates and flat-tops. The Test Stand will now be reconfigured for power testing of PF Inner Coils. The procedure for individual PF Inner Coil Power Testing is out for review. Simulations of test scenarios are planned, and will include coil protection systems.

The first spare neutral beam (NB) ion source has been assembled, and is being prepared for hydrostatic testing scheduled for next week. That source will then be installed in an enclosure, and be prepared for electrical testing. A second source is in the shop, and a third has been brought into the Decon Facility for disassembly and cleaning. Also this week, the off-site rebuild of the two NB LHe compressors was completed.

NSTX-U Research (J. Menard)

Yang Ren gave an NSTX-U physics meeting presentation on HL-2A 2017 experimental campaign opportunities and capabilities. HL-2A at Southwestern Institute of Physics in Chengdu, China is a medium-sized conventional tokamak with a range of auxiliary heating systems, and profile and fluctuation diagnostics. The HL-2A team is interested in establishing a strong collaborative relationship with NSTX-U and is offering run time in 2017 to the NSTX-U team. Click [here](#) for more information.

Ian Waters (PhD student at UW Madison) completed a two week visit to Oxfordshire, UK to initiate a collaboration on 3-D modeling of RMP pump out physics with the MAST team at CCFE. The goal is to gain insight into the mechanism behind the observed RMP induced density pump out at MAST, and compare it to ongoing studies of neutral fueling and exhaust for NSTX-U. This on-site collaboration identified three MAST shots for detailed study, integrated MARS-F plasma response results into a 3D computational grid generator, and yielded initial EMC3-EIRENE modeling for axisymmetric MAST plasmas.

Members of the Univ. of Washington CHI team traveled to the QUEST ST from Dec 5 to 16 to commission the newly installed Transient CHI system on QUEST (R. Raman and J. Rogers to Dec 13). The first week was spent commissioning the CHI capacitor bank and the two fast CHI gas injection systems, both of which were attached to the QUEST machine. During these non-plasma tests remote control operation of both systems was tested, and the QUEST vessel was subjected to the CHI voltage potential of 600V for the first time. During the second week, reliable plasma breakdown was demonstrated for the first time in the new ST-FNSF relevant CHI electrode configuration used on QUEST. During these tests, the QUEST vessel was subjected to the full 2kV CHI voltage potential. This was followed by operation with increased capacitor bank energy using two switching ignitrons to generate at least 18 kA of toroidal current (possibly as high as 30kA - to be determined after additional data analysis). A slow visible camera showed plasmas detaching from the CHI electrode and drifting up. The magnitude of the toroidal current is similar to that achieved on NSTX during first CHI commissioning tests on NSTX. With the successful completion of these tests, the QUEST CHI system is now ready for CHI physics studies. These tests represent the effort of over three years of activities by the University of Washington, PPPL and Kyushu University groups to design, implement and test a new-design (much more reactor relevant) CHI configuration on QUEST. Successful gas breakdown and toroidal current generation, in this configuration, are major accomplishments for the Transient CHI effort to test solenoid-free plasma current generation in an electrode configuration in which the CHI insulator is not part of the vessel vacuum boundary and the injector current needs to be fed to the electrodes using a custom-designed vacuum feedthrough that can withstand large $J \times B$ forces. During over 150 CHI pulses on QUEST; the CHI engineering systems operated with 100% reliability with no issues. The CHI capacitor bank and the large primary CHI insulators are in-kind USA contributions to CHI effort on QUEST. Members of the QUEST Team and from Himeji University participated and provided dedicated support during the plasma initiation tests.

M. Ono (PPPL) visited the QUEST group at the Kyushu University on Dec. 12 – 16, 2016. The primary purpose of his trip was to participate in the first experimental run of the coaxial helicity injection (CHI) experiment on the QUEST facility with the University of the Washington group led by Roger Raman (see the detail of the initial CHI operation by R. Raman above). M. Ono also discussed during his visit possible QUEST Electron Cyclotron Heating (ECH) and Hot Wall physics collaboration areas with Profs. K. Hanada and H. Idei.

Clayton Myers led a meeting on December 14 summarizing NSTX-U error field metrology results and preliminary analysis, and outlined next steps for analysis and plans for reducing NSTX-U intrinsic error fields.

Stefan Gerhardt attended the Fusion Power Associates 37th Annual Meeting and Symposium in Washington, DC on December 13, 2016 to receive his Fusion Power Associates 2016 Excellence in Fusion Engineering [Award](#). Jon Menard also attended the Fusion Power Associates meeting and presented “Progress and Plans on NSTX-U” on behalf of the NSTX-U research team.