

## **NSTX-U Weekly Report (June 19, 2015)**

### **NSTX-U is in the Upgrade Project outage in FY 2015**

The paper "The contribution of radio-frequency rectification to field-aligned losses of high-harmonic fast wave power to the divertor in the National Spherical Torus experiment" by R. J. Perkins, (PPPL) et al. was published by Physics of Plasmas 22, 042506 (2015) (<http://dx.doi.org/10.1063/1.4916034>). The High Harmonic fast wave (HHFW) heating system on NSTX has been known to suffer from parasitic absorption of fast-wave power in the SOL, resulting in a relatively large heat flux on the outer divertor. The paper explores the possibility that RF rectification is the mechanism responsible for converting HHFW power into the observed heat flux. An expression for the heat flux delivered to a material surface in the presence of an RF voltage is developed and applied to Langmuir probe data from the outer divertor. Estimates of the RF voltage and heat flux are made and compared to infrared camera measurements of the heat flux. Unfortunately, due to toroidal separation of the measurement locations and the non-axisymmetric nature of the losses, a rigorous comparison cannot be made at present; however, extrapolations of the existing data do suggest that the heat flux estimates based on probe data compare favorably with the IR camera measurements. This suggests a promising experiment on NSTX-U, where a wide-angle IR camera view of the divertor and a new dedicated set of Langmuir probes will provide an opportunity for rigorous validation. (R. Perkins)

PPPL hosted the 21st meeting of the ITPA Divertor and Scrape-off Layer Topical Group on June 9-12th. The ITPA DivSOL is the forum where the ITER parties work together to address ITER's tough plasma-material interaction (PMI) challenges. The international progress will also benefit the PMI challenges on NSTX-U. Sixty eight scientists attended from China, European Union, Japan, S. Korea, India, Russia, United States. Progress in addressing issues in Edge/SOL physics, modeling, ELMs, and PFC materials were presented in 3.5 days of sessions on: Steady state divertor and 1st wall heat loads, Boundary modeling, Far SOL & turbulence modeling, ELM physics, Heat loads to leading edges, PFC deterioration by ELMs, Synergistic effects on surface dynamics, PMI and dust modeling, Plasma facing components testing, and DSOL joint tasks & ITER action plan. From NSTX-U Jon Menard (PPPL) gave a presentation on the NSTX-Upgrade capabilities, Travis Gray (ORNL) on NSTX heat flux width and diverter spreading, and CS Chang on Heat flux transport studies with XGC. (C. Skinner, PPPL)

Steve Sabbagh (Columbia University) led the Disruption Prediction sub-panel at the DOE Workshop on Transient Events (June 8<sup>th</sup> – 11<sup>th</sup>). The workshop brought together efforts by six subpanels and the fusion community over the past several months to prepare a final document summarizing suggestions for research programs to solve disruption and ELM issues in tokamaks - considered high priority by the FESAC Strategic Planning Priorities Assessment in 2014. The Disruption Panel, consisting of three sub-panels (Prediction, Avoidance, and Mitigation) reviewed draft documents on each topic and brought in further community input and comments on the documents, to prepare for final document compilation. (S. Sabbagh)

### **Experimental Research Operations (S. Gerhardt, R. Kaita)**

Both Lithium Evaporators (LITERs) have been leak-checked, and the bellows were baked out. They were inserted into the vacuum vessel, and it was determined that there were no

interferences with the upper divertor penetrations. The LITERs have been removed, so that the new support brackets can be permanently welded to the upper umbrella structure. (R. Kaita, PPPL)

Installation of support stand for UV spectrometers at Bay "E" started this week, expected completion Wednesday June 24. The Divertor Tangential Imaging diagnostic was disassembled after its test fit. Parts are awaiting vacuum prep and final welding. Fabrication of Bay "H" infrared camera brackets continues in the PPPL shops. Drawings for the Bay "G" IR camera brackets were completed. Drawings for the divertor SPRED stand and flight tube were completed. (R. Ellis, PPPL)

### **Engineering Operations (A. von Halle, P. Titus)**

Recovery from an external arc fault at the Ohmic Heating (OH) coil terminals continued this past week. Reassembly of the OH Cooling Tubes in the upper and lower umbrellas is in progress, and the final design for the lower OH Ground Plate and for the potting of the of the OH Coil Coaxial Connection has been completed. A pre-operational test procedure to document resistance measurements of TF flex bus assemblies has been performed, and previously made up joints were found to be within specs and will be reinstalled as is. A new procedure to verify in-situ high current bolted joint integrity is being developed, and will be performed during reassembly. The vacuum bake of the bay F and Bay K Lithium evaporator (LITER) probes was completed, and the probes have been inserted into the NSTX-U vacuum vessel to successfully complete alignments. The probes have now been temporarily removed from the vessel to be prepared for permanent installation/welding. Dummy load testing of the FCPC rectifiers resumed this week on parallel TF Rectifiers, and recommissioning of the auxiliary systems for the Resistive Wall Mode (RWM) Coil Switching Power Amplifiers (SPAs) continued to make good progress. Alignments of the Multi-Pulse Thompson Scattering (MPTS) diagnostic flight paths continue. Electrical insulation tests (Hi-Pots) of the probe rack for the Purdue MAPP diagnostic have been successfully completed.

Access to the NSTX-U Test Cell is expected to be available this coming week. Access must be arranged through Work Permits approved by the D-Site Shift Supervisors.