

## **NSTX-U Weekly Report (December 4, 2015)**

NSTX-U is in the commissioning phase for the FY16 campaign.

The technical note "Fast Time Response Electromagnetic Disruption Mitigation Concept," by R. Raman (University of Washington), T.R. Jarboe (University of Washington), J.E. Menard (PPPL), et al., was published in Fusion Science and Technology, 68, 797 (2015). It describes a new concept for a disruption mitigation system. The primary advantages of this method are: (1) It can accelerate impurity pellets to the required 1-2 km/s in less than 2ms, (2) the device can be positioned very close to reactor systems, which substantially reduces the overall impurity delivery time to the tokamak plasma, and (3) the external high magnetic fields near a tokamak device significantly improves the system efficiency. (R. Raman)

Color contours of NSTX-U magnetic field fluctuations and density fluctuations from microtearing mode turbulence simulated using GYRO that were provided by Walter Guttenfelder (PPPL) and Filippo Scotti (LLNL) and were selected as the "Image of the Month" in the Nov. 30 issue of the USBPO Newsletter. The magnetic perturbations cause field lines to become stochastic, enhancing the loss of electron energy. Upcoming experiments in NSTX-U will attempt to exploit the distinct structure of these microtearing mode fluctuations (compared to traditional ballooning mode turbulence) in an effort to determine their existence and effect on confinement in high-beta plasmas across a range of collisionality. (Kaye, PPPL)

### **Physics Analysis (S. Kaye)**

Min-Gu Yoo, a student at Seoul Nat. University gave a talk at the NSTX-U Monday Physics meeting on 11/30 entitled "Distinct ohmic breakdown physics in a tokamak". The work focused on the time-varying complex field structures during ohmic breakdown. An interesting physical mechanism of the ohmic breakdown, however, has not been clearly revealed due to lack of observations of cold and rarefied initial plasmas. Previous research usually focused on the characteristics of given electromagnetic structures ignoring plasma response in the Townsend avalanche theory. The avalanche phenomena, however, is significantly affected by plasma response such as self-electric fields produced by the space charge. The work showed detailed physics of the ohmic breakdown including the plasma response via establishing a toroidal symmetric plasma model and particle simulations. It is found that the space charge plays a crucial role by decreasing the plasma density growth rate and by enhancing new perpendicular transport. These effects are key ingredients to understand mysterious experimental results which cannot be explained by previous research.

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

The X-ray photoelectron spectroscopy (XPS) system on the Materials Analysis and Particle Probe (MAPP) was used to provide a baseline characterization of samples prior to their insertion into the NSTX-U vacuum vessel. The samples have been positioned so that their faces are flush with the divertor plasma-facing surface, and will be subject to wall conditioning techniques that include glow discharge cleaning and boronization. (J. P. Allain and F. Bedoya, University of Illinois at Urbana-Champaign, C. Skinner, PPPL)

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

Calibrations of the Motor Generator cyclo-converter and liquid rheostat control systems are being performed per General Electric procedures in response to cyclo-converter control trips during synchronization. Field Coil power testing on individual coils per the Integrated System Test Procedure continued this past week making good progress operating on the fixed frequency bus. Test cell time was spent this week to address a problem in the neutral beam 2A ion source system (all three of the NB 2 ion sources have been conditioned to >50kV operation), and re-commissioning of the NB1 power system continued. Re-commissioning of the High Harmonic Fast Wave (HHFW) power systems continued with work on the final of the six RF sources, and preparations are underway to start conditioning.

The NSTX-U Test Cell will be in restricted access this coming week for field coil testing. Access will be available on the 2nd shifts for approved work.