

## NSTX-U Weekly Report (September 25, 2015)

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

Young-Seok Park and Steve Sabbagh of Columbia University visited the National Fusion Research Institute in Daejeon, South Korea and ran two experiments MP2015-06-02-037 to determine  $n = 1$  error field thresholds at high normalized beta, and MP2015-05-23-001 to isolate and measure the neoclassical toroidal viscosity (NTV) profile for various 3D field spectra in the KSTAR superconducting tokamak in the past two weeks. High normalized beta plasmas were created and extended to 10 second pulse duration, and  $n = 1$  error field thresholds were determined. In the NTV experiment, a very large database was created by leveraging the long pulse capability (20 second plasma duration) and the new (for 2015) fast power supply capability (IPS) of the device. Several key plasma parameters were varied in the study including the applied 3D field strength,  $q_{95}$ , plasma collisionality,  $T_i$ ,  $n_e$ , and plasma rotation speed and profile. Six different 3D field spectra were run, which included  $n = 2$ ,  $n = 1$  field pitch-aligned, and  $n = 1$  field pitch-non-aligned configurations. Resonant MHD modes were absent and the new IPS capability in combination produced excellent signal to noise for the NTV profile measurement. Along with charge exchange spectroscopy diagnosis of the plasma rotation and  $T_i$  profiles, new profile diagnostic data including motional Stark effect (magnetic field pitch angle) and Thomson scattering were collected for this experiment. (S.A. Sabbagh)

Joon-Wook Ahn (ORNL) visited KSTAR and participated in 3D TF experiments for Sep 14 – 21. He led two experimental sessions, one for the effect of plasma response on separatrix splitting and the other for ELM suppression with high plasma density. Divertor IR camera and LP data have been taken during the experiments to monitor divertor plasma conditions. Pitch angle alignment was varied both by  $q_{95}$  scan and by changing spectrum of applied RMP fields. Experiments were performed for  $n=1$  and  $n=2$  and both configurations were able to produce ELM mitigation. It was found that  $n=2$  at  $90^\circ$  phasing was very resonant and produced strong density pump-out and reduction in  $T_i$  and  $V_t$ . Surprisingly,  $n=2$   $0^\circ$  phasing, mostly non-resonant, produced the strongest ELM mitigation even with no density pump-out. Data analysis is in progress to find best conditions for ELM control in future experiments. (J-W. Ahn)

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

The bake of the NSTX-U vessel was interrupted this past week to modify the PF1b water system to better balance temperatures, to re-insulate manifolds showing high thermal leakage, to address a leak at the helium skid, and to replace/align a blower motor coupling. All work was completed by the end of the week, and temperatures were ramped up over the weekend. Also this week, Gas Injection System (GIS) and Massive Gas Injection (MGI) commissioning continued, and additional Physics Operator training sessions were held.

The NSTX-U Test Cell will be in restricted access this coming week due to the vessel bake.