

NSTX-U Weekly Report (October 16, 2015)

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

An article "Identification of new turbulence contributions to plasma transport and confinement in spherical tokamak regime" by W. X. Wang (PPPL), et al., has been published online in Physics of Plasmas 22, 102509 (17 pages) (2015) (<http://scitation.aip.org/content/aip/journal/pop/22/10/10.1063/1.4933216>). The paper reports the finding of nontraditional turbulence sources in ST experiments through nonlinear global gyrokinetic simulations. The drift wave Kelvin-Helmholtz (KH) instability is identified in strongly rotating NSTX L-mode plasmas. While the strong ExB shear associated with the rotation leads to a reduction in KH/ITG turbulence, the remaining fluctuations can produce a significant ion thermal transport that is comparable to the experimental level in the outer core region (with no "transport shortfall"). The other new, important turbulence source identified in NSTX is the dissipative trapped electron mode (DTEM), which is believed to play little role in conventional tokamak regime. The normal ExB shear stabilization effect on DTEM is found to be surprisingly weak, which makes DTEM a major turbulence source in the ST regime dominant over collisionless TEM (CTEM). The latter, on the other hand, is subject to strong collisional and ExB shear suppression in NSTX. DTEM is shown to produce significant particle, energy and toroidal momentum transport, in agreement with experimental levels in NSTX H-modes. Moreover, DTEM-driven transport in NSTX parametric regime is found to increase with electron collision frequency, providing one possible source for the scaling of confinement time observed in NSTX H-modes. Most interestingly, the existence of a turbulence-free regime in the collision-induced CTEM to DTEM transition, corresponding to a minimum plasma transport in advanced ST collisionality regime, is predicted. Also presented in the paper is an accurate delta-f particle simulation scheme used for this study. (W. X. Wang)

On October 13-14, 2015 Jon Menard (PPPL) visited Hefei, China to serve as co-chair (H. Zohm from IPP Garching is chair) of the first China Fusion Engineering Test Reactor (CFETR) Physics International Advisory Committee (IAC) to review progress made since the start of group activities in late 2014. On October 15, J. Menard observed presentations by the EAST team from the 6th EAST IAC meeting. (J. Menard)

Francesca Poli (PPPL) attended the 15th ITPA-IOS meeting in Hefei, China, October 12 – 15, 2015. She gave a progress report on an activity on integrating a reduced model based on EPED1 in time-dependent simulations. She worked with O. Meneghini (GA) to generate a lookup table for ITER parameters using OMFIT. She also presented TRANSP simulations of an Helium plasma for the ITER non-active phase, discussing actuator sharing in the different phases of the discharge. (F. Poli)

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

PPPL NSTX-U researchers, B. LeBlanc, M. Coury, and A. Diallo travelled to Madison WI to meet with PSL (Physical Sciences Laboratory) staff (10/8/2015) and Daniel Hartog at the Physics department of University of Wisconsin (10/9/2015). The PSL has been contracted to build the control and power-supply units for the pulse-burst laser system (PBLs). The PSL staff provided a detailed status update on the progress made. The laser head was turned on in flahlamp simmer mode. This first test is crucial to verify the condition of all flashlamps and rods. The six

capacitor banks have been fabricated and one control unit has been built. After the day-long visit at PSL, we met with Daniel the next day to discuss the integration phase between the power supply and laser head and potential tests necessary to characterize the laser system. At the end of our visit, we toured the MST, HSX, and Pegasus facilities. We also toured the MST laser facility. (A. Diallo)

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

The NSTX-U vessel bake continued this past week in parallel with vacuum vessel helium glow discharge cleaning and conditioning operations of the neutral beam # 2 ion sources. Also this week, good progress was made on the dummy load testing of the Switching Power Amplifiers (SPA's) used to power the NSTX-U Resistive Wall Mode coils. Three of the six SPA's have successfully operated into a dummy load, and the other three will be completed by early next week. Pre-operational testing of the Motor Generator's cycloconverter controls was performed, as well as latency measurements of the Plasma Control System (PCS). Physics Operator training was completed this week.

The NSTX-U Test Cell will be in restricted access this coming week during the vessel bake and neutral beam conditioning operations.