NSTX-U Weekly Report (October 9, 2015)

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

The Final Report on the FY-15 JRT was sent to DoE/FES, summarizing joint activities by C-Mod, DIII-D and NSTX-U staff to study the impact of broadened current and pressure profiles on tokamak plasma confinement and stability. NSTX-U was the coordinating facility, with M. Podesta' (PPPL) leading the Coordination Committee and redacting the Final Report. Activities by NSTX-U and collaborators included work on all three facilities. Joint research with DIII-D mainly focused on the unification of kinetic RWM stabilization physics and on the assessment of AE mode effects on reduction of plasma performance in high q-min scenarios. Both areas of research are expected to benefit from - and be complemented by - planned experiments on NSTX-U in FY-16. NSTX-U staff also developed improved tools for the analysis of scenarios with LH current drive, with direct applications to C-Mod scenarios. New tools have been developed to (i) quantify LHCD through the TRANSP code and (ii) to assess the role of impurity accumulation and its dependence on heating and non-inductive current profiles. (M. Podesta)

Jong-Kyu Park (PPPL) has participated in various 3D field and momentum transport experiments in the 2015 KSTAR campaign, and led the two experimental sessions (A) MP2015-06-02-030 (Coherent and continuous phase-shift sweeping using all 3 rows of internal coils) and (B) MP2015-06-02-002 (Variation of parametric dependency of magnetic braking). (A) experiments were designed to rotate n=1 field at the top row and counter-rotate n=1 field at the bottom row of coils, while holding the n=1 field phase at the mid-plane coils, in order to effectively create all possible n=1 field configurations periodically during a single discharge. The goal was to identify the optimal n=1 configuration, i. e. phase-shifts (phasing) among 3 rows, for ELM mitigation and possibly full ELM suppression. The experiments show that ELM mitigation, as well as density pumping, can be maximized near 150 phasing. However, the full ELM suppression could not be achieved, mainly because such a favorable phasing for ELM modification was also favorable to mode locking in the studied target discharges. The observation is rather consistent with the ideal response prediction, which indicates the difficulty in separating multi-modes when using n=1, while in the past it was possible to separate coupling to ELMs from coupling to mode locking in the successful n=1 ELM suppression. There are many differences between the present and past discharge conditions, such as shapes and heating powers, which will be further investigated in details. (B) experiments were proposed to establish magnetic rotation braking characteristics in KSTAR and build comprehensive database to verify and validate NTV physics in conventional tokamaks. New 3D-coil power supplies and long shot durations enabled various braking pulse applications during a single shot, and in total near a hundred braking profiles were obtained in various discharge conditions without tearing or mode locking. Interestingly, most of magnetic braking accompanied substantial density pumping, similarly to what has been observed in RMP ELM experiments, except highly non-resonant n=2 zero-degree phasing configuration. NTV alone is typically not expected to provide strong enough particle transport to modify density profiles. Moreover, more resonant configurations led faster evolution and relaxation in density and rotation, possibly also indicating other transport mechanisms. Several response and NTV modeling codes will be applied for comparison, but possibly additional modeling such as fast ion losses might also be important to explain and understand the various observations in both particle and momentum channels. (J-K. Park)

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

High Harmonic Fast Wave (HHFW) transmitters #1 and #2 were operated up to 1MW, 500mS successfully. #2 did show some RF arc-downs at low power as we started it up but "cleaned up" as we went to high power. Some investigations were done at low frequencies with an FFT oscilloscope to see if the "arc-down" might be a low-frequency instability phenomenon. Nothing was observed ~200MHz and below. (CB, NG, AC, GD). We are now ready to begin vacuum conditioning of the HHFW antenna on NSTX-U as soon as bakeout is completed. (J. Hosea, PPPL)

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

The NSTX-U vessel bake resumed this week after the installation of the rebuilt roots blower on the GHe skid. The GHe skid pressures and temperatures have been optimized for peak tile temperatures, and operation has been stable throughout the week. Vacuum vessel helium glow discharge cleaning was also performed once we were up to temperature. This coming week we will lock up the test cell in 4 hour shifts to allow for neutral beam conditioning and Field Coil Power Conversion System power supply testing, as well as continued helium glow discharge cleaning. Testing of the new Skylark computer was completed this week demonstrating CAMAC control, Tree creation, MDS events, and Digital Coil Protection System (DCPS)/ Plasma Control System (PCS) operation. Data access was successfully tested showing solid drops in data acquisition time. Also this week, electrical checks and pre-operational testing of the new deuterated trimethylboron (dTMB) injection system continued, and Physics Operator training sessions were held with lectures on Control System Theory and NSTX-U RF system considerations.

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