NSTX-U Weekly Report (January 15, 2016)

FY 2016 NSTX plasma operations
Operation Targets: Total - TBD
Completed: 1.74 run week and 170 plasma shots

J. Menard (PPPL) attended the Fusion Energy Sciences Advisory Committee (FESAC) meeting held in Bethesda, MD on January 13-14, 2016 and gave a presentation entitled "Motivation, Status, and Plans for NSTX Upgrade" (J. Menard).

A press release has been published this week in the ITER Newsline website on the modeling of non-inductive ramp-up for NSTX-U by Francesca Poli (PPPL) and it can be accessed at the link http://www.iter.org/whatsnew. The work highlighted in the release has been published recently in the Nuclear Fusion journal and shows the advantages of using electron cyclotron heating to increase the electron temperature and improve the absorption of High Harmonics Fast Waves (HHFW). (F. Poli)

Run Coordination (J. Menard, S. Gerhardt)

A full bottle boronization was performed on 1/11/2016, following the repair of the failed TF water fitting.

XMP128 [Increase the Elongation in L-Mode] was run on 1/12/2016 and 1/13/2016. This XMP targeted the development of diverted L-mode scenarios, as a means of moving from the previous inner-wall-limited cases to full H-mode scenarios. NB #1 sources were used with a total injected power up to ~2.5 MW, and the high field side fuelling injectors were used for the first time. These experiments had great success, resulting in both longer pulse, very well controlled diverted L-mode scenarios, and the first H-mode discharges in NSTXU. (D. Battaglia, D. Muller, PPPL)

XMP116 [Initial H-mode Development] was run on 1/14/16 and 1/15/16. The efforts on 1/14 were aimed at moving the H-mode timing earlier in the discharge, and increasing the early plasma elongation. Also, the impact of the timing and flow rate of the high field side (HFS) and early low field side (LFS) fueling on the discharge evolution was investigated and nearly the full ohmic precharge was used routinely. While progress was made in achieving H-mode before the start of the plasma current flattop, vertical control in these scenarios remained a challenge. Continued improvement in wall conditions should lower the internal inductance and improve the reliability of these scenarios. Neutral Beam #2 was used for the first time in regular operations on this day. Operations on 1/15 was limited to five plasma shots due to technical issues, however, the final shot of the day leveraged 3 MW of beam heating from NB source #1 and achieved an ELMy H-mode with the lowest value of the sustained internal inductance yet in NSTX-U. This is a positive result upon which to build experiments in the following week. (D. Battaglia, D. Muller, PPPL)

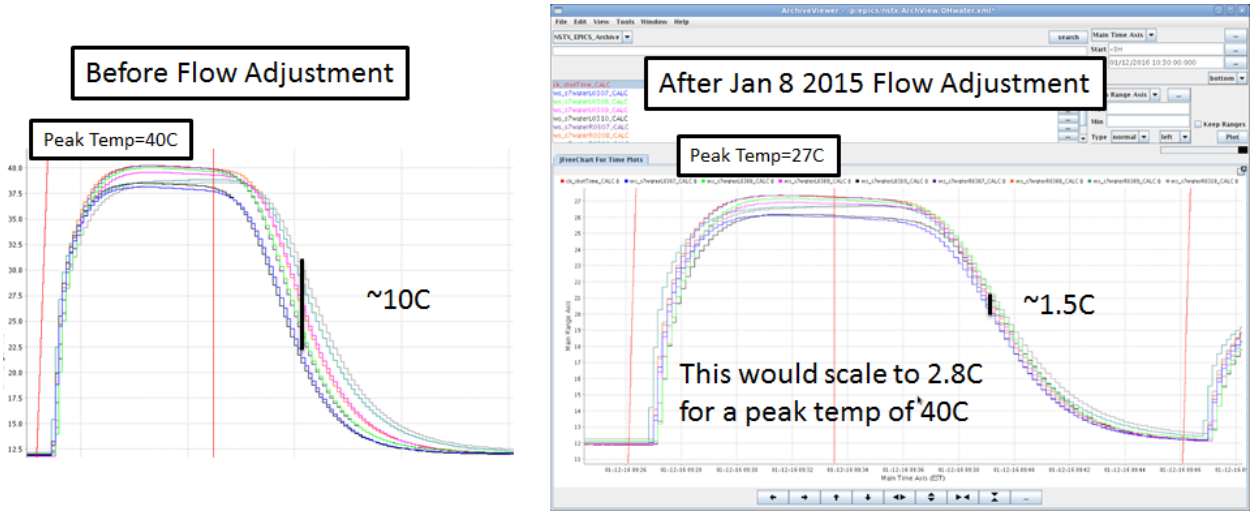
Note that operations started at ~10:00 AM on 1/131/ 15 in order to provide ~1.5 hours of dedicated NB conditioning time each day.

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

NSTX-U plasma operations resumed this week after replacing a leaking TF water fitting, and then completing a vacuum vessel boronization using the deuterated trimethylboron (dTMB) injection system. The new dTMB system is also being used for the between shot helium glow discharge cleaning (GDC), which has allowed for better gas control to reduce He loading and pump-out time. Operations this week utilized neutral beam injection, and added coils PF1A, PF3 & PF5 for plasma elongation and gap control. We routinely saw diverted plasmas, and successfully transitioned to H-modes. High-field side gas injection was used for both He and D2 discharges. Also this week, OH coil parallel cooling paths were further calibrated, and initial temperature measurements indicate good thermal balance. Another vacuum vessel boronization will be performed over this coming weekend.

The NSTX-U Test Cell will be in restricted access this coming week during plasma operations. Access will be available during the evening shifts for approved work.

Coolant Flow in the OH solenoid was adjusted successfully over the Jan 8 weekend. Subsequent shots exhibited much improved differential temperature at the exit of the OH coolant channels. This is one of the areas where efforts are being made to mitigate exposure of the OH winding to thermal strains. Because to the different path lengths at the ID and OD layers of the coil, the inner layer at the top of the coil would be substantially cooler than the outer layer if flow rates were similar in each channel. This would cause the inner layer to pull inward from the rest of the winding. With the successful flow adjustment, exit temperatures are much closer as shown in the attached figure.



Testing continues on the OH cooling water preheater, which is the second part of the OH thermal strain mitigation effort. This system extends the cooling wave height and lessens the winding pack bending strain as the cooling wave progresses up the coil. (P. Titus, PPPL)