The PPPL Highlights for the week ending June 20, 2020, are as follows:

NSTX-U RECOVERY (J. GALAYDA) AND RESEARCH (S. KAYE)

Recovery (J. Galayda):

**Coils** — Sigmaphi prepared the PF1B lower coil for shipping to PPPL in the near term once the shipping paperwork is completed. The PF1A lower coil electrical testing and leak test was completed and the results are in review. The PF1A upper coil winding was completed, the flags were brazed, and preparations for vacuum pressure impregnation (VPI) continued. The PF1B upper coil was wound and layer one was started. The PF1C lower coil VPI continued and the coil was filled with epoxy. The PF1C upper winding was completed and preparations for VPI began this week.

**Center Stack Casing (CSC)** — The machining of the center stack casing continued on two shifts and weekends at the Holtec facility in Camden. This phase of machining will continue through July 7, when the CSC will be shipped to Turtle Creek to attach the collar pieces on each end. It will be returned back to Camden on July 20 for more machining, which will continue into August.

**Machine Core Structure (MCS)** — Many fabrication activities continued at the three facilities currently making sling parts. Precision Boring in Michigan shipped the preload parts to Magnaplate for coating. PF1B sling component parts were rapidly completed, with shipping of the lower parts scheduled for the end of the month, and the upper parts to follow in mid-July. In addition, the PF1A and PF1B capture and common flanges and PF1C capping flanges for the sling supports were fabricated. In South Carolina, Carolina Fabricators fabricated the first articles for the PF1A sling parts. Also, G. J. Oliver began machining the welded parts of the PF1C supports. Additional procurement activities to award contracts for the remaining MCS components neared completion.

U.S. ITER FABRICATION (H. NEILSON)

Low Field Side Reflectometry (A. Zolfaghari):

The LFSR team completed its preparations for the final design review of its in-vessel antenna assembly, to be held June 24-26 with dry runs for 16 team presentations. The team will present a mature design that is fully integrated with its enclosing shield, meets all performance requirements, and will operate safely in the harsh environment of an ITER diagnostic port where it is directly exposed to the plasma. The design is shown to satisfy demanding antenna-pointing accuracy requirements for measurement performance and to be compatible with replacement of the water-cooled parts of assembly by remote handling, should it be necessary. The presentations conclude with
plans for manufacture, installation in the shield module, and testing to ensure achievement of alignment requirements when installed in the ITER tokamak.

**Motional Stark Effect (A. Cohen):**

The Laboratory’s ITER team has transferred ownership of the MSE CAD models back to PPPL and is working to bring the configuration up to date. Designers are outlining the optical path and ensuring that the models are compatible with the current configuration of the enclosing shield module. The engineering team is analyzing options for mirror supports and mounts to minimize thermal deflections and to take into account their influence on mirror cooling.

**Toroidal Interferometer Polarimeter (M.-A. de Looz):**

Revision of the piping and instrumentation diagram (P&ID) for the Toroidal Interferometry Polarimeter (TIP) is in progress. The aim is to capture both previous comments and feedback from a previous design review and a new labeling method for the infrared laser light tubes. Several of the laser light tubes need to be installed in penetrations that separate different buildings of the ITER complex. These tubes must be installed as part of ITER building construction and must relate directly to the P&ID. The P&ID is being updated with new unique labels for tubes that are directly installed in said penetrations, with help from engineers in the U.S. ITER Project Office.

**ITER & TOKAMAKS (R. NAZIKIAN)**

**DIII-D (B. Grierson):**

*Research:*

The paper, “Wide operational windows of edge-localized mode suppression by resonant magnetic perturbations in the DIII-D tokamak” by Q. Hu, R. Nazikian, B. Grierson, N. Logan, D. Orlov, C. Paz-Soldan, and Q. Yu has been accepted for publication by *Physical Review Letters*. In this paper, narrow and wide “windows” of ELM suppression are explained by the density dependence of resonant field penetration at the pedestal top, and captured by nonlinear two-fluid MHD simulations. As the plasma density is lowered, the threshold for field penetration decreases and ELM suppression will occur over a wider range of q95. At sufficiently low density, multiple magnetic islands can form near the top of the pedestal producing continuous and wide q95 windows of ELM suppression. High toroidal mode number RMPs (n=4) are predicted to achieve RMP ELM suppression at substantially higher pedestal pressure in DIII-D.

The paper “Identification of a network of nonlinear interactions as a mechanism triggering the onset of edge-localized modes,” by J. Dominski and A. Diallo has been accepted for publication by Plasma Physics and Controlled Fusion: https://doi.org/10.1088/1361-6587/ab9c48. The paper reveals a mechanism by which a nonlinear perturbation involving many active triads — a network of nonlinear interactions — leads to the triggering of ELMs. During neutral beam perturbations, the nonlinear interaction is triggered and identified near the magnetic surface of q=5, which also coincides with a mode at the low-frequency GAM oscillation.

**THEORY (S. HUDSON)**


C. Clauser presented studies on C-pellet injection simulations in NSTX-U in support of an electromagnetic pellet injector (EPI) proposal. To do this, we have implemented a C ablation model in M3D-C1 and tested it with an AUG-like discharge in which data exist. Next, we have conducted a convergence study in NSTX-U scanning over several relevant parameters to evaluate the thermal quench sensitivity during the injection. The presentation can be downloaded from https://ctts.pppl.gov/Sherwood2020/Clauser.pdf

E. Belova gave a talk at TAE (Tri-Alpha Energy Inc) on June 11 titled, “Energetic particle effects on FRC stability.”


**COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)**

Communications (L. Bernard):

A. Zwicker and L. Bernard attended the inaugural meeting on June 16 of the Fusion Communications Council, a nationwide group in fusion and plasma science organized to communicate to all stakeholders the value and benefits of research in these areas. Both are on the group's founding Steering Committee.
L. Bernard participated in the U.S Department of Energy Headquarters Office of Public Affairs and National Laboratory Communicators virtual meeting on June 16.

The Office of Communications posted three news stories to the PPPL website this week. The first focused on research led by F. Laggner into developing a control scheme to optimize the levels of magnetic fields injected into fusion plasma to cause heat to leak controllably. The second reports that M. Kunz has been awarded a National Science Foundation five-year grant to research magnetic fields throughout the early universe and to establish a summer school on plasma physics aimed at attracting women and underrepresented minorities to the field. The third reports the publication of the 2020 edition of Quest. The research magazine summarizes in a short, easy-to-digest format notable examples of PPPL accomplishments over the last year and major new initiatives currently underway. These stories were also posted to the Newswise and EurekAlert press release distribution services.

**DIRECTOR’S OFFICE (S. COWLEY)**

C. Ferguson hosted the monthly supervisors meeting on June 16.

On June 18 and 19, S. Cowley participated virtually in the National Laboratory Directors Council (NLDC) retreat.

On June 19, J. Menard participated virtually in the National Laboratory Chief Research Officers (NLCRO) monthly meeting.

For the first time, PPPL celebrated Juneteenth, commemorating the end of slavery in the U.S., with a virtual lunch and learn on June 19. Justin Dunnavant, an anthropologist and historian, presented, “Til the Well Runs Dry: The Environmental Legacy of Slavery.” The event was sponsored by PPPL’s new Black Leadership Alliance Committee (BLAC).

**This report is also available on the following web site:**

http://www.pppl.gov/publication-type/weekly-highlights