



**The PPPL Highlights for the week ending March 30, 2019, are as follows:**

**NSTX-U RECOVERY (R. HAWRYLUK) AND RESEARCH (J. MENARD)**

*Recovery:*

Center Stack Casing — Sub-contracts were awarded March 29 for procurement of the integrated casing assembly, including the heat transfer tubing and plates and associated attachment hardware, the vertical and angled sections of the center stack casing, and the horizontal divertor end-flanges, bellows, collars, and organ pipes. The awarding of these sub-contracts before March 31 supports fulfillment of an FES notable outcome.

Plasma Facing Components — A successful plasma-facing components (PFCs) diagnostics and plasma current Rogowski final design review (FDR) was held on March 28. The FDR was held to confirm the final design and was deemed successful pending resolution of chits. Diagnostic sensors in the plasma-facing components of NSTX and NSTX-U have been used for machine control, equilibrium reconstruction, and other research purposes. Changes in the design of the PFCs during the NSTX-U recovery project have prompted changes to sensor designs. The plasma current Rogowski coil was included in this FDR because an existing proven design is being reused, and an FDR under these circumstances is appropriate to satisfy QAPD requirements.

*Research:*

Presentations — S. Kaye and W. Guttenfelder attended the Transport and Confinement ITPA meeting at the University of Texas, Austin, March 25-27. Kaye represented the ITPA H-mode Database Working Group and gave a presentation entitled, "ITPA Global H-mode database update."

Program — An NSTX-U team meeting was held on March 29 to provide a program update and describe organizational changes, describe recovery project status and plans, and provide a recovery project management perspective.

**U.S. ITER FABRICATION (H. NEILSON)**

The Low Field Side Reflectometer (LFSR) project continues to make progress toward approval of its preliminary design review (PDR) deliverable documents and closeout of Category 1 PDR chits. A revision to the deliverable report, "Low Field Side Reflectometer (LFSR) Safety Barrier Design Approach," was approved by the ITER organization this week. The document includes a description of the configuration and operating logic of pneumatically operated shutters in the microwave transmission path. With the approval



of this report, closure of one of the Category 1 chits, “Layout of commanding solenoid valves for shutters,” was also approved.

The ITER team has made progress in performing the software validation runs for the analysis tools used in its LFSR structural integrity reports. Validation runs for the Attila neutronics code were completed several months ago and validation of several ANSYS installations is currently in progress.

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

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

*Research:*

G. Kramer gave a Friday Science Meeting presentation titled, “Why are Alfvén eigenmode wavefronts curved in the radial direction?” ECE-I measurements have shown that AE wavefronts are radially curved. This curvature is not well reproduced by gyrokinetic simulations. Using ideal MHD eigenmodes with an extra radial phase factor to reproduce the observations show that the curvature is caused by a spatial separation of the regions where the mode is driven and damped.

B. Grierson attended the ITPA Transport and Confinement Meeting in Austin, Texas. He presented progress on three ITPA tasks related to impurity transport, confinement across the linear ohmic to saturated ohmic confinement transition, and proposed activities for hydrogen isotope experiments on DIII-D in support of ITER pre-fusion power operation first campaign (PFPO-1).

#### **International PMI (R. Maingi):**

The article, “Real-time wall conditioning by controlled injection of boron and boron nitride powder in full tungsten wall ASDEX Upgrade,” by A. Bortolon et al. has been published in *Nuclear Materials and Energy*: <https://www.sciencedirect.com/science/article/pii/S2352179118302199>). The article reports on the first experiments utilizing the impurity powder dropper in AUG to inject a boron compound into tokamak plasma to improve wall conditions. The results, which were also presented orally at the PSI 2018 conference, indicated positive effects similar to boronization could be obtained with a modest injection of boron powder, allowing execution of ELM-suppressed scenarios on non-freshly-boronized plasma-facing components.

Weekly

# HIGHLIGHTS



R. Maingi attended the Brightest Light Initiative workshop in Washington, D.C., as an observer from FESAC. In 2017, the National Academy of Sciences (NAS) released *Opportunities in Intense Ultrafast Lasers: Reaching for the Brightest Light*, its report concluding that the U.S. has fallen behind in this important scientific and technical capability. This workshop was attended by leading scientists and technologists to make the scientific case to advance scientific and technical capabilities as advocated by the NAS report. Experience from this workshop will help inform the FESAC strategic planning process in 2020.

## ADVANCED PROJECTS (D. GATES)

### Stellarators (D. Gates)

N. Pablant and S. Lazerson attended the “E3 Klausur” March 28-29 at the invitation of R. Wolf of IPP-HGW. This meeting served as a strategy meeting for the E3 Core and Heating Division of the Wendelstein 7-X project. Lazerson presented plans for a fast-ion-loss detector array for W7-X that is under development by PPPL, and a status report on validation of the BEAMS3D code energetic particle code. Pablant advised on the status of the X-ray imaging crystal spectrometer and the status of profile evaluation. Pablant and Lazerson were the only attendees invited from outside of IPP, highlighting the strength of the collaboration and the large part the US plays in the W7-X program.

D. Gates and C. Zhu attended the first annual meeting of the Simons Collaboration on Hidden Symmetries in Fusion Energy on March 28-29 at the Simons Foundation’s Gerald D. Fischbach Auditorium in New York City. The meeting consisted of several tutorial talks given by experts in different fields relating to stellarator optimization. Zhu presented a poster entitled, “Quick identification of dangerous coil deviations using a Hessian matrix method.” The meeting was very useful in establishing new contacts in applied mathematics and optimization theory.

The Laboratory reported progress in the development of an instrumentation and controls (I&C) emulator for the Wendelstein 7-X Continuous Pellet Fueling System (CPFS). The recently acquired National Instruments Compact DAQ (data acquisition) device has now been integrated with LabVIEW software. Two pellet injector functions, namely manual I/O control and tank pressure, have been described, coded, and successfully tested. In addition, an I&C Integration Guidance document was issued for comment. The document addresses key I&C topics and describes a proposed approach for I&C integration into the W7-X engineering environment. Finally, the Laboratory has ordered the programmable logic controller that will be delivered with the system and has made necessary staffing arrangements for programming it with the CPFS control functions.



### **THEORY (S. HUDSON)**

The M3D-C1, XGC1, and GTS codes have been selected as Tier 2 NERSC Exascale Science Applications Program (NESAP) applications. These are the only three OFES simulation codes so designated. The NESAP program provides access to vendors including Cray, NVIDIA, and AMD to assist in optimizing the codes on the next NERSC supercomputer, Perlmutter, a pre-exascale Cray Shasta system. Besides having access to prototype hardware for code optimization, the codes will be given early access and significant hours on the full Perlmutter system (expected delivery 2020).

I. Dodin gave a talk titled, "Structure from turbulence, or why you might want to care about plasma physics even if you are not a plasma physicist," at the Max Planck Institute for Gravitational Physics in Potsdam, Germany.

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

#### **COMMUNICATIONS (L. Bernard)**

The Office of Communications posted two press releases to the PPPL website. One noted that female engineers at PPPL have formed a Women in Engineering group aimed at recruiting more female engineers, supporting outreach efforts to inspire girls and young women to consider STEM careers, and providing support to each other. The other focused on PPPL's Young Women's Conference in Science, Technology, Engineering, and Mathematics, which took place on the Princeton University campus on March 22. Both stories were also posted to the Newswise press release distribution service.

#### **DIRECTOR'S OFFICE (S. COWLEY)**

On March 28 and 29, M. Zarnstorff and S. Cowley attended the Simons Collaboration on Hidden Symmetries and Fusion Energy Annual Meeting in New York City.

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

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