



**The PPPL Highlights for the week ending January 23, 2021, are as follows:**

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

#### **Recovery (J. Galayda):**

**Bus Supports** — The water-cooled power cables were repaired at the vendor with an improved closure design. The materials required for the PF extension and OH coax bus connection were inspected and prepared for fabrication of the supports in conjunction with the work packages.

**Coils** — Preparations continued at PPPL for the machining of the six production coils. Commissioning of the new rotary table was also completed.

**Center Stack Casing (CSC)** — Finish machining of the center stack casing OD continued in Camden, NJ. In Turtle Creek, work continued between Holtec and PPPL Engineering on the bellows mockup welding distortion issue with the diverter flange. A new mockup at Holtec was in progress, and PPPL supported the design and development of the process to resolve the distortion.

**Machine Core Structure (MCS)** — Precision Boring in Michigan continued with fabrications. The capture flanges were completed, and the common flanges underwent final inspection. PPPL requested enlargement of several flange holes to improve clearances, which will be accomplished in the next two weeks, and then all four flanges will be shipped to PPPL. Fixture plates fabrication was also inspected and spare PF1B coil components were fabricated. In South Carolina, Carolina Fabricators continued production of PF1A sling base parts, with drilling of the base plates to be completed via contract modification in the near term. G. J. Oliver continued with the machining of the outer skirt support. The ceramic break flange was shipped on Jan. 21. At PPPL, assembly procedures were in review for PF1A and PF1B coil assemblies. PF1B lower slings welding was completed, base plate drilling continued, and post-weld inspection and heat treating began. Upper PF1B sling welding began, along with preparations to weld the PF1A slings. The PF1CL support was dimensionally checked and moved into welding, cleaning, and testing. PF1CU was dimensionally checked.

### **ITER PROJECTS (H. NEILSON)**

#### **Diagnostics Progress and Planning:**

The monthly meeting with the IO Diagnostics Division on Jan. 14 featured progress reports by PPPL team members in several areas of joint work. S. Shirey and A. Buahin reported work in collaboration with industry to develop a compact thermal strap,

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designed to conduct heat away from the LFSR in-vessel waveguides to nearby cooled structures. A. Cohen reported progress in recent MSE design work aimed at securing space reservations and service connections within Equatorial Port 01 to satisfy an urgent need to freeze interfaces in that port. M. Messineo reported on CAD model transfers between PPPL and IO, and G. Tchilinguirian reported on plans being developed, in collaboration with IO counterparts, to address instrumentation and control requirements within PPPL's Diagnostics design scope.

The week of Jan. 18 featured a series of meetings with U.S. ITER Project Office management to discuss strategies for updating cost and schedule estimates for U.S. Diagnostics scope. Team members reported the status of requirements documentation and of deliverables lists and explained their strategies for preliminary and final design reviews. The discussion included a sharing of ideas for accelerating design schedules and for improving the cost efficiency of the design process. Cost and schedule risks were also identified, along with measures to mitigate those risks.

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

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

*Research:*

### **International PMI and Liquid Metal PFC Concept Development (R. Maingi & A. Diallo):**

PPPL researchers G. Bodner, R. Lunsford, and A. Diallo led a session remotely using Impurity Powder Dropper (IPD) on the WEST tokamak in collaboration with local research staff as well as ORNL staff. The goal of the experiment is to use IPD for wall conditioning in order to access H-mode. One of the observations made was that IPD injection was effective at reducing some tungsten influx from the lower divertor. While more analysis is required for assessing the effectiveness of the IPD injection, WEST granted the PPPL team another half-run day next week to continue our experiment.

R. Maingi conducted a periodic planning meeting of the domestic liquid metal plasma-facing component design program, to coordinate the set of activities for CY21. A particular emphasis will be placed on experiments that test design features of the current (draft) flowing liquid lithium PFC design for FNSF.



## **ADVANCED PROJECTS (D. GATES)**

### **Stellarators (D. Gates):**

Development of the PPPL virtual engineering analysis workflow processes continues in the DOE Advanced Research Projects Agency-Energy (ARPA-E) permanent magnet (PM) stellarator program.

Ansys Minerva Analysis Tool Architecture Implementation meeting with the Ansys implementation expert D. Powell and PPPL IT/Cluster Team (P. Bisbal and D. Ascione) took place on Jan. 19 with installation scheduled for Jan. 22. The team worked through infrastructure hurdles regarding storage, bandwidth, cyber preparation, and other items. Upon install, Bisbal will get the handoff to coordinate cluster linkages. The Ansys Minerva, optSLang, Digital Twin coordination to develop ARPA-E workflows has progressed through steering meetings/information exchanges and upon install specific task workflows have been identified for integration. Permanent Magnet Isolated Magnet Field (No TF) data analysis comparison from physics to engineering with comparison feedback has continued and currently a fourth iteration is being conducted to determine plasma magnetic field errors between physics and engineering models.

F. Nespoli, E. Gilson, and R. Lunsford participated remotely in experiments on LHD on Jan. 19. The PPPL impurity powder dropper (IPD) was operated locally by collaborators S. Masuzaki and N. Ashikawa (NIFS) and was used to inject boron powder into LHD discharges, following an experimental proposal by NIFS collaborator M. Shoji. This was the second part of experiments performed on Jan. 14 aiming at depositing a boron layer on two material samples located in the LHD divertor for validation of ERO2.0 simulations. Additional experiments were performed to investigate plasma temperature increase during boron powder injection, leading to observation of temperature improvement in NBI heated plasmas.

C. Zhu attended the Virtual MPPC Annual Meeting and gave a plenary talk titled, "Stellarators with permanent magnets." In this talk, he reviewed the recent advances in designing permanent magnets for stellarators. The progress of the two permanent magnet stellarator projects at PPPL, PM4STELL and MUSE, was also introduced.

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

B. Sturdevant participated in the 14th World Congress in Computational Mechanics and ECCOMAS Congress. Benjamin gave an invited talk titled, "A Fully Implicit Particle-in-Cell Method for Gyrokinetic Electromagnetic Modes in Tokamaks."



E. Feibush presented a seminar about scientific visualization at the Princeton University Research Computing Bootcamp on Jan. 21. The talk covered visualization in the computational workflow, applications to the compute grid, and techniques for exploring data. Examples were shown for the VisIt and Paraview software packages, along with information about how to prepare data for visualization. He also discussed the dimensionality of data from various sources, including time-step animation. Sample files were provided so attendees could begin using the software tools.

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

#### **Communications (L. Bernard):**

L. Bernard participated remotely in the U.S. Department of Energy Office of Public Affairs monthly meeting on Jan. 19.

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

T. Carter of the University of California-Los Angeles presented a virtual colloquium titled, "Powering the Future: Fusion & Plasmas, the FESAC Long Range Planning Report" on Jan. 20.

S. Cowley participated virtually in the National Laboratory Directors Council (NLDC) coordination meeting on Jan. 22.

The PPPL executive management team (EMT) hosted a virtual all-hands meeting on Jan. 22 for PPPL staff. Topics presented for discussion included laboratory updates, the annual letter of integrity and ethics training requirements.

PPPL received Energy Systems Acquisition Advisory Board (ESAAB) CD-1 approval for Princeton Plasma Innovation Center (PPIC) on Jan. 22.

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

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