



The PPPL Highlights for the week ending December 12, 2020, are as follows:

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

Recovery (J. Galayda):

Bus Supports — The water-cooled power cables were sent back to the vendor for repair. 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 for machining the six production coils continued at PPPL. The PF1B-S (spare) coil from Sigmaphi was received at PPPL this week. The PF1A-S (spare) coil was shipped from Sigmaphi and is en route from France to the US. It is expected to be delivered at PPPL early next week.

Center Stack Casing (CSC) — Finish machining of the CSC continued in Camden, New Jersey, and engineering oversight continued at Turtle Creek. At Turtle Creek, an issue was found with distortion in the bellows mockup welding; the issue was reviewed by PPPL Engineering and by Holtec machining. Two options were pursued including a new mockup at Holtec and analytic work at PPPL. Stud installation prototyping and organ pipe welding continued with leak testing performed in concert to the completion of organ pipe welding.

IVPS — Installation of the pump and electrical and control packages were approved for near term installation. The pre-job brief was held so that work could begin.

Machine Core Structure (MCS) — Precision Boring in Michigan continued with fabrications. The capture flanges were completed and the common flanges neared completion (one in inspection and the other finishing machining). Fabrication also began on the fixture plates. In South Carolina, Carolina Fabricators continued production of PF1A sling base parts, with 34 parts completing phase 1 machining and all are into phase 2 machining. G. J. Oliver completed the MRR and machining continued on the outer skirt support. In addition, the PF1C upper support was coated and will be shipped next week. The ceramic break flange was machined. At PPPL, mockup activities lessons learned were incorporated into assembly procedures. PF1B lower slings welding was completed and post-weld inspection and heat treating began. Upper PF-1B sling fixturing began. The PF1C support was dimensionally checked and moved into welding, cleaning, and testing.

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Alstom Addition for the Shorted Turn Protection (STP) Peer Review — A peer review was held Dec. 10 to review the design for adding the Alstom TF Bundle protection system output to the shorted turn protection (STP) in a way that does not jeopardize the defined (and reviewed) functionality of the STP system, yet uses the additional protection the Alstom system may provide for the TF bundles. The peer review briefly evaluated the Alstom TF Bundle protection as it will be installed, followed by the results of the evaluation which took place in Sept. 2020. The necessary steps to integrate the fault output of the Alstom system to the STP were presented during the review.

PF1A and PF1B Sling Bottom Modification and Sling Assemblies Final Design Review — A final design review (FDR) was held Dec. 11 to evaluate the PF1A mockup findings, sling weld analysis, and the design modifications on the PF1A and PF1B coil sling bottom to provide the strain control needed for preloading the coil.

Research (S. Kaye):

S. Kaye participated in the virtual ITPA Coordinating Committee meeting, which was held Dec. 8 and 9. Presentations included an update on the ITER status and summaries of the individual ITPA topical science groups.

R. Maingi served on Fusion Energy Sciences Advisory Committee (FESAC) as it evaluated and unanimously approved a subcommittee's report on a strategic plan for plasma and fusion science and technology. The plan was based on the community-led report from a yearlong community planning process. Maingi also served on the subcommittee that produced the report.

R. Maingi and A. Diallo served on an Office of Science panel that evaluated the effect of COVID-19 on "User Research in Physically Distanced Contexts."

ITER PROJECTS (H. NEILSON)

Low Field Side Reflectometer — LFSR (A. Zolfaghari, S. Shirey):

The design team continues to make progress toward closure of final design for the in-vessel antenna assembly. The electromagnetic analysis report was revised by A. Zolfaghari in response a reviewer comment to include a study of the effects of the thermal quench, and this week was submitted for approval. Reports documenting resolution of several chits were submitted for review and approval. The team's revised maintenance plan was approved by the ITER Organization.

In the LFSR manufacturing development program, the team completed multiple successful trials of expanding a CuCrZr bushing within a 316 stainless steel groove.

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Inspection of the mechanical interface between the components will ensure that the bushing remains operable within the antenna block assembly (ABA). Along with ABA development, the thermal strap design with Thermal Space is maturing to meet the performance requirements with minimal interference of the backfill space claim.

Upper Wide Angle Viewing — UWAV (M. Smith):

The UWAVS team is exploring innovative options for actuation of in-vacuum shutters and met with an engineer from NASA Glenn Research Center to discuss a collaboration project for using shape memory alloys in ITER. In addition, the team reviewed results from the optical layout work being performed by IO's contractor Iridescence. While the work has progressed, alternatives are being investigated to develop a solution that fits the available space. The front end and near-closure plate optics currently extend beyond their space allocations.

Electron Cyclotron Emission — ECE (G. Paraiso):

The team is investigating two shutter actuation concepts that were presented at the recent ITER shutter workshop by other ITER parties. A design presented by Russia for their CXRS diagnostic employs a rotary vacuum feedthrough and is driven by an ex-vessel electric motor. An in-vessel pneumatic actuation design for Russia's H-alpha could be coupled with the push-rod mechanism that the ECE team is currently designing. However, since pneumatically driven systems are less preferred due to safety concerns, the team is also exploring a rotary rod mechanism concept that could adapt to the CXRS actuator, as an alternative. It is thought that these actuation mechanisms could be applicable to ECE with only a customized shutter mechanism design.

ITER & TOKAMAKS (R. NAZIKIAN)

DIII-D (B. Grierson):

Research:

O. Nelson, a graduate student at Princeton University, published the paper, "Interpretative SOL modeling throughout multiple ELM cycles in DIII-D" in *Nuclear Materials and Energy*: <https://doi.org/10.1016/j.nme.2020.100883>. A new algorithm is developed to automatically adjust transport parameters in UEDGE to match experimental profiles as a function of time over an entire discharge. The workflow is applied to a DIII-D H-mode plasma with long inter-ELM periods, predicting an extended period of increased divertor density after large type-I ELMs. Agreement between the 2D modeling results and diagnostic measurements in the SOL show that inter-ELM diverter behavior is closely linked to upstream profile evolution.

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F. Laggner presented a (remote) talk at the ASDEX Upgrade Edge Physics Forum titled, “LLAMA — A Diagnostic to Measure Edge Neutral Density Profiles in DIII-D,” introducing the new concept of an absolutely calibrated Lyman-Alpha profile measurement. Laggner discussed the concept’s advantages and potential avenues to implement it on a metal wall machine.

International EAST (F. Poli):

W. Choi gave a virtual seminar titled, “Exploring synergy between two frequencies of lower hybrid power on EAST” to MIT-PSFC on Dec. 11. The TRANSP code, coupled with GENRAY/CQL3D, was used to interpret an experiment in which two different frequencies of lower hybrid (LH) power were injected. It was found that, at low density, a 65/35 mix of 2.45 GHz/4.6 GHz power achieved an LH current drive efficiency that was 30% higher than what should be expected based on linear interpolation. This is the first observation of synergy between LH waves on EAST.

ADVANCED PROJECTS (D. GATES)

Stellarators (D. Gates):

E. Gilson, F. Nespoli, and R. Lunsford participated remotely in experiments on LHD on Dec. 8. The PPPL impurity powder dropper (IPD) was operated locally by collaborators S. Masuzaki and N. Ashikawa (NIFS) and was used to inject tens of milligrams of boron and boron nitride powder into LHD discharges, following two experimental proposals by E. Gilson and F. Nespoli titled, respectively, “Detachment experiments using boron nitride delivered by an impurity powder dropper” and “Towards real-time boronization in steady state operation.” The objectives of the two experiments were to investigate the possibility of inducing divertor detachment by the injection of BN powder into the plasma and to characterize the effect of IPD-delivered boron on wall conditioning in real time, extending the parameter space from similar previous experiments. Preliminary results were presented at the LHD science meeting the following day.

HUMAN RESOURCES (J. VANNOY)

All staff should have their default [@princeton.edu](mailto:princeton.edu) email accounts set to forward email to their [@pppl.gov](mailto:pppl.gov) account. This reduces chances of missing any important all-staff University messages. This is particularly important for training coordinators who create GAP accounts to ensure that you receive confirmation emails when those GAP accounts are activated. To adjust your forward settings please follow these steps:

https://ppplprod.service-now.com/kb_view.do?sysparm_article=KB0010372.



COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. Bernard):

The Office of Communications posted three press releases to the PPPL website. The first summarizes recent PPPL research advancing the development of a new type of stellarator fusion facility that relies on permanent magnets. The second reports that PPPL has received two national awards for its sustainability efforts this year for instituting a more sustainable water treatment method that is safer for wildlife and for its green electronics purchasing. The third notes connections between the Arecibo Observatory, which recently collapsed, and former PPPL physicist R. Hulse. These stories were also posted to the *Newswise* and *EurekAlert* press release distribution services.

C. Cane participated remotely in the U.S. Department of Energy (DOE) Office of Public Affairs Social Media meeting on Dec. 9.

C. Cane participated remotely in the DOE Office of Public Affairs Web Council on Dec. 10.

DIRECTOR'S OFFICE (S. COWLEY)

J. Menard, M. Zarnstorff and S. Cowley participated in the US Department of Energy Fusion Energy Sciences Advisory Committee (FESAC) meeting which was held virtually on Dec. 7, 8 and 10. The focus of the meeting was discussion and approval of the US fusion community planning effort report, of the "long-range strategic plan" for the US fusion energy program.

This report is also available on the following web site:

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