



The PPPL Highlights for the week ending October 24, 2020, are as follows:

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

Recovery (J. Galayda):

Management — The project is evaluating the impact of more protective COVID-19 work controls for work-to-go. On-site management presence will be reduced. The project will revise its work plans immediately to comply. The effect on project cost/schedule will be assessed as part of the bottoms-up budget review.

Coils — All six production coils (PF1B#1, PF1C#1, PFC#2, PF1A#1, PF1A#2, and PF1B#2) are at PPPL in preparation for machining. Coil PF1C-S (spare) was shipped from Sigmaphi in France. Coil PF1B-S (spare) successfully underwent vacuum pressure impregnation (VPI) and was in the curing phase. The last spare coil will be brazed in the near future.

Center Stack Casing (CSC) — The CSC was in Camden, New Jersey, for the final four weeks of finish machining. Additionally, welding of the organ pipes occurred at Turtle Creek, and welding of the mockup bellows to the flange neared completion.

IVPS — Installation of piping and racks started and will continue for approximately three more weeks.

Machine Core Structure (MCS) — Many fabrication activities continued at the three facilities currently making sling parts. Precision Boring in Michigan continued fabrication of the PF1A and PF1B capture and common flanges, with good progress on both. The PF1C capping flanges were receipt inspected at PPPL. In South Carolina, Carolina Fabricators' production of PF1A sling base parts continued. The PF1A hanger parts were in receipt inspection at PPPL. G. J. Oliver delivered the lower PF1C support and inspection continued, as did preparations for leak testing. The upper PF1C support was at the vendor for coating. The ceramic break flange was machined and the outer skirt was forged. The on-site mockup activities were completed when the belt was installed, and the engineers and techs fine-tuned the application of the preload. Qualification of the sling welding procedure was completed, and the assembly and welding process of the PF1B lower slings began; the assembly and welding of the PF1A lower slings will follow.

Upper Bay L Helium Tube Support Bracket Weld Modification Peer Review — A peer review (PR) was held on Oct. 20 to evaluate the technical solution to the Bay L helium tube bracket installation that involves shifting the weld plate and tilting the support bracket at an angle to capture the tube for the installation. During the preparation for the in-vessel helium tube support bracket weldment, it was found that the in-field



condition does not provide sufficient room for welding the support bracket at Bay B, G, and J in the lower secondary plate area. The peer review addressed the design solution described in the ECN.

Research (S. Kaye):

R. Maingi (PPPL), F. Poli (PPPL), and N. Mburu (Oxford U., UK) participated in a Girl Scout STEM career outreach video meeting. The scouts asked the three panelists and one other panelist about their scientific choices and career progression, along with advice on how to succeed in a career in STEM. The discussion lasted a full 90 minutes, and the scouts sent their thanks for the panelists' participation in the outreach. Both Maingi and Mburu mentioned working on liquid metals as plasma-facing components, and NSTX-U was shown as a targeted device for such testing.

M.-G. Yu (PPPL) gave a seminar entitled, "First systematic theory of ohmic breakdown in a tokamak: A turbulent ExB mixing avalanche" at the NSTX-U/Magnetic Fusion Science Meeting on Oct. 19. He described the crucial role of the plasma response in the breakdown process in which the self-electric fields can cancel external electric fields and result in slow plasma formation. He also discussed the role of ExB drifts being a dominant transport mechanism during breakdown, resulting in a homogenous plasma structure along the magnetic field lines. The presentation can be found here: https://nstx.pppl.gov/DragNDrop/NSTX_Meetings/Monday_Physics_Meetings/2020/2020_10_19/2020.10.19.MGYOO_NSTX-U_meeting_NoMovies.pdf

ITER PROJECTS (H. NEILSON)

The PPPL team provided updates of accomplishments and issues, as well as plans for the next several weeks at the U.S. ITER monthly review meeting. Also, the team attended a training session on U.S. ITER's Systems Engineering program, conducted by Systems Engineering Head H. Bailey. The session covered the role of ITER Procurement Arrangements as the agreement between U.S. ITER and the ITER Organization that governs the team's work and deliverables.

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

Welding trials are underway, one of the critical processes being developed for the LFSR in-vessel antenna assembly. Currently, the team is developing the initial welding parameters for round plug welds that are used throughout the Antenna Weldment. Preliminary results look promising, although refinement of the root pass is necessary to ensure full penetration throughout. Quality development is also moving forward with full reviews of the preliminary non-destructive evaluation (NDE) report as well as a



gundrill inspection method that is applicable to the ~600m length gundrilled holes of the Antenna Weldment.

ITER & TOKAMAKS (R. NAZIKIAN)

DIII-D (B. Grierson):

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

R. Maingi hosted a periodic meeting of the domestic liquid metal plasma-facing component design activity. Participants shared progress that was reported in the FY20 year-end report, made plans for dissemination of results in FY21, and discussed the next set of technical activities for FY 21.

THEORY (S. HUDSON)

I. Dodin gave a virtual seminar at the University of California-Berkeley on Oct. 16. The talk, titled, "Plasma physics of waves and turbulence," presented recent advances in basic wave-kinetic theory of inhomogeneous turbulence.

S. Ethier and J. Halverson (PICSciE) gave a workshop entitled, "Leveraging the advanced capabilities of the Traverse supercomputer" as part of the training series from the Princeton Institute for Computational Science and Engineering. The new Traverse supercomputer, which is composed of 46 IBM POWER9 nodes with 4 NVIDIA V100 GPUs per node, has an impressive peak performance of over 1.4 PFLOPS. However, to take full advantage of this computational power, one must have specialized knowledge of both the hardware and software. This workshop showed PPPL and Princeton University participants how to leverage the advanced capabilities of Traverse including GPU Direct, NVLink, CUDA Multi-Process Service (MPS), CUDA-Aware MPI, NVIDIA V100 GPU Tensor Cores, Scalable Hierarchical Aggregation Protocol (SHArP), IBM POWER9 architecture, VSX vectorization, Simultaneous Multithreading (SMT), GPU-enabled IBM Engineering and Scientific Subroutine Library (ESSL), IBM XL and PGI compilers, and NVMe storage.

COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. Bernard):

The Office of Communications posted two press releases to the PPPL website this week. The first notes that S. Cohen and three collaborators will receive the New Jersey Research & Development Council's 2020 Thomas Edison Patent Award for Emerging Technology for their invention of a compact rocket engine thruster propelled by a small fusion reactor. The second reports that a new method for verifying a widely held but



unproven theoretical explanation of the formation of stars and planets has been proposed by PPPL researchers. The method grows from simulation of the Princeton Magnetorotational Instability (MRI) Experiment, a unique laboratory device that aims to demonstrate the MRI process that is believed to have filled the cosmos with celestial bodies. The stories were also posted to the *Newswise* and *EurekAlert* press release distribution services.

L. Bernard participated remotely in the National Laboratories Chief Communications Officers (NLCCO) monthly meeting on Oct. 22.

DIRECTOR'S OFFICE (S. COWLEY)

C. Ferguson hosted the Critical Infrastructure Recovery & Renewal (CIRR) review Oct. 20-23. The purpose of this review was to concurrently assess the project's readiness for Critical Decision (CD)-1 and approve the alternative selection and cost range.

P. Natarajan of Yale University presented a colloquium on Oct. 21 titled, "Probing the Dark Universe with Light."

Laboratory leadership hosted a virtual all-hands meeting on Oct. 23 to provide various updates about the Laboratory and answered questions from employees.

This report is also available on the following web site:

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