Weekly HIGHLIGHTS

PPPL PRINCETON PLASMA PHYSICS LABORATORY
U.S. DEPARTMENT OF ENERGY

The PPPL Highlights for the week ending April 18, 2020, are as follows:

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

Recovery (J. Galayda):

Sigmaphi is resuming work after a COVID-19 stand-down. Engineers assigned to NSTX-U will spend the coming week preparing procedures for NSTX-U approval. The Project office interviewed candidates for on-site quality control monitoring at Sigmaphi. Two candidates, selected from a number of CVs, were interviewed. The Project will arrange for the selected candidate to start work in Vannes on April 27.

Project personnel will participate in the PPPL COVID-19 recovery planning group.

The personnel safety system, PF1b bipolar circuit, shorted turn protection, and bakeout design teams are busy preparing for the CDE-3B IPS. The teams are preparing procurement documents and installation procedures in preparation to begin material procurements and field work upon CDE-3B approval.

Coils — As stated above, Sigmaphi is making preparations to restart coil winding in concert with PPPL oversight. Details are being worked out to ensure oversight is safely in place and all workers are kept safe.

Center Stack Casing (CSC) —The center stack casing (CSC) machining continues at the Holtec facility in Camden, New Jersey. The inner diameter of the casing is being bored out to the designed dimension, and one end is complete. Work will continue until final dimensions are achieved and then the CSC will be shipped back to Turtle Creek for final assembly. In parallel, a mockup of the diverter flange/bellows welding is ongoing in Turtle Creek to refine the technique of final welding.

Research (S. Kaye):

NSTX-U researchers are continuing to write the 2021-2025 Five Year Plan document and also prepare for the FES budget and manpower meetings.

U.S. ITER FABRICATION (H. NEILSON)

The ITER diagnostics team is resuming its design work on the electron cyclotron emission (ECE) system. The ECE diagnostic, which will use broadband microwaves emitted by the plasma to measure the electron temperature profile, is an essential diagnostic for basic plasma characterization and understanding. The system features *in-situ* hot sources for periodic absolute temperature calibration and shutters to switch between measurement and calibration modes of operation. The team, led by PPPL

engineer G. Paraiso, has identified an urgent need to select among a range of possible shutter actuation concepts, and is reviewing the ongoing development work across the ITER project before choosing a path for its own development work. In addition, with the support of PPPL Senior Scientist G. Taylor, the team is preparing the procurement package for re-engagement of its design partner in the project.

The upper wide angle viewing (UWAV) diagnostic is a system of cameras installed in five upper ports that will be used for visible and infrared imaging of the divertor targets. The UWAV team, led by PPPL engineer M. Smith, is reviewing design developments in neighboring equipment, notably the upper port diagnostic shield modules (DSM) which will house the front-end optics. It has been determined that changes in the arrangement of and mechanical support concept for the optical elements will be necessary in order to adapt to changes in the DSM. As with others, the UWAV team is preparing the procurement package for re-engagement of its design partner in the project.

ITER & TOKAMAKS (R. NAZIKIAN)

DIII-D (B. Grierson):

Operations:

In collaboration with the DIII-D computing group, K. Erickson has developed a parallel build of the DIII-D plasma control system (PCS) to reduce development time overhead from ten minutes to 30 seconds per build. This factor of 20 reduction in compilation time improves the efficiency of creating new physics algorithms for the DIII-D collaboration. Building the PCS is a routine, daily activity to test new algorithms for controlling the tokamak and ensure robustness of the control system. The newly developed parallel build improves on previous approaches that relied on partial builds to test individual components, allowing the entire PCS to be tested more rapidly.

International PMI and FES LM PFC Development Program (R. Maingi):

A periodic meeting of the domestic liquid metal plasma-facing component (PFC) development program was conducted on April 17 and hosted by R. Maingi. Two talks were presented: A. Khodak (PPPL) presented the first results from computational fluid dynamics calculations for a flowing liquid lithium PFC; and S. Smolentsev (UCLA) presented, “Design window for flowing lithium divertor with helium-cooled RAFM substrate.”

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ADVANCED PROJECTS (D. GATES)

Stellarators (D. Gates)

Y. (Eugene) Yakusevitch, a SULI student working with N. Pablant, has completed his internship with PPPL. Yakusevitch began working with Pablant in August 2019 to develop an advanced X-ray ray-tracing code, XICSRT, and then use this code to validate a new design for the ITER XRCS-Core spectrometer. This week, he gave his final presentation twice, once for the ITER X-ray diagnostic teams and once for PPPL research staff. His presentation is entitled, "XICSRT: Ray-Tracing Software for the ITER X-Ray Core Spectrometer." Yakusevitch's work has been been extremely valuable to the ITER XRCS-Core project and has allowed the design activities to continue after demonstration that the diagnostic concept of using HOPG pre-reflectors in the ITER geometry is sound and can be expected to allow for sufficient photon throughput. The development of XICSRT is also currently being applied to characterization of the W7-X XICS spectrometer and to modeling of advanced crystal shaping for the PPPL X-ray group with M. Bitter.

THEORY (S. HUDSON)

D. Schaeffer, W. Fox, J. Matteucci, K. Lezhnin, A. Bhattacharjee, and co-authors published a paper in *Physics of Plasmas* titled, "Kinetic simulations of piston-driven collisionless shock formation in magnetized laboratory plasma:" https://doi.org/10.1063/1.5123229. The paper presents particle-in-cell simulations of laser-driven collisionless shock formation using the code PSC, which includes a model of laser-driven plasmas that can be well-matched to experimental conditions. The results identify distinct regimes during piston-driven shock formation and key observables that can provide a reference for laser experiments.

C. Dong accepted an invitation from NASA Headquarters to join the executive committee of the *Living with a Star* program analysis group (LPAG).

Dong also accepted an invitation from the steering committee of the NASA Astrobiology Research Coordination Networks (RCNs).

COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. Bernard):

The Office of Communications posted two press releases to the PPPL website. The first focused on research by B. Sturdevant into borrowing a technique from the field of applied mathematics to accelerate the time needed to predict plasma behavior using supercomputers. The second noted that I. Ochs, a graduate student in the Program in

Plasma Physics, has won a Porter Ogden Jacobus Fellowship, the most prestigious of the honorific fellowships that the University awards annually for academic excellence. The stories were also posted to the *Newswise* and *EurekAlert* press release distribution services.

DIRECTOR'S OFFICE (S. COWLEY)

Laboratory leadership has been communicating ongoing updates to staff regarding the COVID-19 virus and PPPL.

J. Menard led several Research Council meetings to review Field Work Proposal goals and budget planning information for FY21 and FY22.

This report is also available on the following web site:
http://www.pppl.gov/publication-type/weekly-highlights