



The PPPL Highlights for the week ending November 16, 2019, are as follows:

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

Recovery (J. Galayda):

Staffing for Installation — Project personnel have been reviewing applicants for temporary positions, selected from CVs provided by BOAs. These include resources to fill key positions in areas such as mechanical field engineers, electrical designers, outage planners, and project controls specialists.

Beam Emission Spectroscopy (BES) FDR — A final design review (FDR) was held for the Beam Emission Spectroscopy (BES) on Nov. 14 to review the final design of the BES shuter upgrade. After the 2016 NSTX-U run campaign, it was discovered that the boron nitride (BN) covers for the BES had failed, and fragments from the covers were found on the lower inboard diverter. A proposed redesign will reduce stresses experienced by the BN during operation. The design will also implement a procedure to install and tune the shutter to prevent future failure and mitigate risks of the shutter slamming closed. This review showed the design progression and chit resolution since the conceptual design review completed on Sept. 19.

Center Stack Casing — The forgings for the center stack casing (CSC) were completed in Italy, and non-destructive examination, ultrasonic testing NDE (UT) was performed successfully. These parts are being packaged for shipping to the Holtec Turtle Creek fabrication facility near Pittsburgh for the welding and machining activities required during assembly.

HTT/HTP — Progress continues with the fabrication of the heat transfer plate and heat transfer tubing. PPPL successfully fabricated two sets of HTT coils. One set of tubing has been successfully heat-treated and the second coil is currently being heat-treated. Hollis Line has also successfully employed e-beam welding to attach tubes onto the HTP and all NDE testing has been satisfactorily completed.

Machine Core Structure Flange Sub-Assembly Peer Review - A peer review was underway at the time of this report to review design modifications of the upper flange sub-assembly. This review included changes made to address field technician concerns about assembling the upper flanges onto port flanges on the machine core structure (MCS) since an FDR held Aug. 5 and 6. This peer review covered design modification to attachment hardware for the MCS upper flanges and flange sub-assembly, evaluated the impact to interface requirements of other NCS components, and a structural



assessment of the flange assembly. Results for this review will be summarized next week.

PF Coil Fabrication — The vendor has provided a revised schedule for coil production that includes modification of the first coil mandrel to rectify out-of-tolerance inspection results. Project personnel are evaluating the proposed schedule.

Research (S. Kaye):

Nothing to report for this week

U.S. ITER FABRICATION (H. NEILSON)

A U.S. ITER Diagnostics delegation visited the project site in St. Paul-lez-Durance, France, for a week-long series of discussions on ongoing project work. In meetings with the Equatorial Port 11 (EP11) integration team, the two teams continued to make progress on the resolution of interfaces between EP11 and the U.S. Low Field Side Reflectometer (LFSR). Advances were made in the routing and support arrangements for ex-vessel waveguide transmission lines, and in increasing the margin against overheating of in-vacuum components due to stray microwaves from the electron cyclotron heating (ECH) system. The scope of preparation for a final design review (FDR) of the LFSR in-vessel assembly were finalized with agreements on the system requirements, deliverable documents, and closure requirements for open chits from a prior review. Discussions on detailed manufacturing issues focussed on welding standards and lessons learned from the experience of other groups with manufacturing processes similar to those required for LFSR.

ITER & TOKAMAKS (R. NAZIKIAN)

DIII-D (B. Grierson)

Research:

A dedicated experiment to investigate pedestal neutral fueling has been performed on DIII-D with the newly installed LLAMA diagnostic (LLAMA is the Lyman Alpha Measurement Apparatus). The LLAMA allows scientists to measure the Lyman-Alpha emissivity profiles at inboard and outboard sides to infer neutral density profiles. It has been implemented through a collaboration with the MIT PSFC. A. Rosenthal (MIT graduate student) lead this initial half-day experiment supported by A. Bortolon, F. Laggner (PPPL), J. Hughes, and T. Wilks (MIT). The initial observations indicate inboard-outboard asymmetries in the Lyman Alpha brightness that varies as the edge neutral density is modified by external gas puffs.



G. Kramer visited DIII-D in San Diego, California, this week to work with S. Haskey on the interpretation of the observed difference between the carbon and main ion temperature at the plasma edge using the full-orbit following code SPIRAL on the thermal distribution. Good progress has been made toward understanding this observed difference when including charge-exchange losses.

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

A. Bortolon, A. Diallo, and E. Gilson visited NFRI to lead experiments with the impurity powder dropper on KSTAR. Five hours over two shifts were allocated to the experiment, which focused on injecting boron nitride into ELMy H-modes. Further experiments are anticipated in early 2020.

P. Rindt, a recent Ph.D. from the Univ. of Eindhoven, the Netherlands, presented a seminar titled, "The potential for liquid metal 3-D printed heat shields for fusion reactors." Results from conventional manufactured tungsten targets with surface liquid lithium were compared with 3-D printed tungsten targets with surface liquid lithium. The performance of the 3-D printed targets far exceeded the conventionally manufactured targets, with exhausted heat fluxes in the range of 20 MW/m² on the MAGNUM-PSI linear test stand.

International Long Pulse (F. Poli):

W. Choi visited EAST this week to collaborate with ASIPP colleagues. As part of the follow-up to the previous lower hybrid (LH) synergy experiment in May 2019, additional experiments have been performed to collect missing data for the reference discharges. This will expand the basis for LH physics model validation, which will then be used for projections of using LH in CFETR.

THEORY (S. HUDSON)

M. Churchill attended the Joint US-Japan Workshop on Post K-ECP Collaboration and 5th JIFT Exascale Computing Collaboration in Kobe, Japan, Oct. 28-29 and presented a talk titled, "Accelerating simulation with machine learning."

F. Ebrahimi attended the 3rd Asia-Pacific Conference on Plasma Physics in Hefei, China, Nov. 4-8. She presented an invited talk entitled, "Plasmoid-mediated magnetic reconnection: From space to fusion plasmas." She also chaired a session on MFE/stability.



P. Trivedi attended the AAPPs-DPP 2019, Hefei, China, last week and gave an invited talk titled, "Kinetic Eulerian Simulation of Electrostatic Phase Space Vortices (PSVs) in a Driven-Dissipative Vlasov-Poisson System."

On Nov. 8, T. Stoltzfus-Dueck published a review article titled, "Intrinsic Rotation in Axisymmetric Devices" in *Nuclear Fusion*. The article presents a pedagogical introduction to the physics of intrinsic rotation in tokamaks, including both the core and the edge region. The review includes both experimental and theoretical work, with a focus on the underlying concepts.

COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. Bernard):

The Office of Communications posted three press releases to the PPPL website. One noted that researchers at PPPL had recently built and tested a prototype of a robot that could detect sources of neutrons and whether they had been shielded. Another noted that PPPL received the 2019 Business Partner of the Year Award from the Mercer County Technical Schools for its new apprenticeship program, which provides paid on-the-job training and free technical courses to train early-career technicians in cutting edge skills. The third announced that PPPL will expand an entrepreneurship "lunch and learn" program pioneered at PPPL last year and appoint mentors to help and encourage potential entrepreneurs in the Laboratory through two DOE projects totaling \$70,000 awarded to PPPL's Technology Transfer Office. These stories were also posted to the *Newswise* and *EurekaAlert* distribution services.

DIRECTOR'S OFFICE (S. COWLEY)

J. Menard attended a DOE Basic Energy Sciences Advisory Committee meeting on Nov. 14 in Washington, D.C.

M. Zarnstorff attended the Princeton Innovation Celebration at Frick Chemistry Laboratory on the main campus on Nov. 14.

This report is also available on the following web site:

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