



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

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

Recovery (J. Galayda):

Coils — Winding of the PF-1A Lower coil continues at Sigmaphi in France with no issues. Currently, two of the four layers of conductor have been wound onto the mandrel. Permission has been given to start the winding of the PF-1B lower coil on the second winding line, and that winding process has begun. PPPL continues to have an on-site engineer and Quality Assurance (QA) presence to oversee the fabrication process.

Center Stack Casing —The Center Stack Casing fabrication continued at ORT/Holtec's Turtle Creek facility. Weld prep work on the angled sections and first wall is ongoing, with welding expected to start next week. A cognizant engineer and QA representative are on site at the Turtle Creek facility this week to oversee fabrication activities.

NSTX-U Test Cell — Powers Electric completed installation of the Radiation Monitoring System conduit and began installation of system cabling and associated electrical terminations. 3BD/Reilly Construction continued with installation of the test cell shielding and mobilized the scaffolding subcontractor. Technical Infrastructure Group continues fabrication of test cell shielding components. Quotes were received for the current-limiting reactors for the new PF-1B circuits, and the technical evaluation is in progress. Teams continue preparation to complete all final design reviews (FDRs) in January.

Instrumentation TF Twist Laser Measurement FDR — A successful FDR was held Jan. 13 for the laser measurement system for the TF inner bundle. The bundle will twist under imposed EM loads during operation. The proposed measurement system will use a laser reflector system to assess the twist at the top of the bundle in both the laminated and delaminated coil states. The FDR examined the final design of the selected laser measurement system and to report the progress made since the Nov. 2019 preliminary design review (PDR).

Centralized Control System FDR — A successful FDR was held Jan. 14 to finalize the design of the NSTX-U Centralized Control System (CCS). The CCS directly receives status information from the Personnel Safety System (PSS)-Safety Instrumented System (PSS-SIS) and Trapped Key System (TKS). The CCS interacts with the individual Basic Control Systems (BCSs) by providing permissive for execution on the basic control systems. A successful PDR was held in Oct. 2019.

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PF-4 Coil Radial Pin FDR — A successful FDR was held Jan. 16 to review the design of radial constraining pins to be installed on the PF-4 coil supports. These pins are required to maintain the existing assumptions used for analysis. The review assessed the impact to all related system interfaces/diagnostics and confirmed the final design before fabrication and installation.

Research (S. Kaye):

A number of NSTX-U researchers attended the APS-DPP Community Planning Workshop in Houston, TX during the week of Jan. 13-17. The purpose of the workshop was to discuss and refine priorities for Fusion Energy Sciences and Technology as well as Discovery Plasma Science. The attendees included S. Kaye, A. Diallo, W. Guttenfelder, M. Reinke (ORNL), S. Sabbagh (Columbia Univ.), N. Ferraro, M. Ono, R. Maingi, W. Guttenfelder, and M. Reinke as members of the Workshop Program Committee, and N. Ferraro as a member of the Executive Committee.

U.S. ITER FABRICATION (H. NEILSON)

With the detailed design of the Low Field Side Reflectometer (LFSR) antenna assembly now well established, engineering analyses are moving forward in preparation for a final design review (FDR) this year. Wenping Wang reported on new calculations of LFSR component heating from unabsorbed electron cyclotron heating (ECH) microwaves. A recent change in the arrangement of microwave mirrors in the in-vessel waveguide transmission lines was found to substantially reduce the stray heat flux to the waveguide walls. W. Syed reported calculations of deflections and stresses on the equipment under 240 C bakeout conditions, and under electromagnetic forces due to disruptions. It is found that localized straps designed to conduct heat away from the LFSR waveguide can affect the electromagnetic loading and be overstressed during disruptions, since the straps conduct eddy currents as well. Alternative strap designs are currently being investigated.

Mechanical design efforts on LFSR included advanced design of in-vessel welded water pipe joints towards manufacturable solutions and final configurations. Detailed waveguide tolerance assessments continue with new applications of statistical methods to optimize these microwave components from a manufacturing perspective. Completing these efforts will be a major step in finalizing fabrication drawings.

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ITER & TOKAMAKS (R. NAZIKIAN)

DIII-D (B. Grierson)

Research:

Five members of the research staff attended the final [APS-DPP Community Planning Process](#) (CPP) workshop in Houston, TX. The goals of the workshop were to complete the community process of gathering feedback and refining the community strategic plan that encompasses the Fusion Energy Sciences (FES) program. The workshop was attended by R. Nazikian, B. Grierson, A. Bortolon, F. Laggner, and F. Effenberg, who participated in twice-daily breakout sessions to gather input for how the plan can be improved. Following CPP-Houston, another draft plan will be distributed to the community for feedback before being finalized.

ADVANCED PROJECTS (D. GATES)

Stellarators (D. Gates):

D. Gates and N. Pablant attended the Community Planning Process (CPP) workshop held in Houston, TX, Jan. 13-17, which was organized by the American Physical Society's Division of Plasma Physics (APS-DPP). The purpose of the workshop was to go over the recently released draft plan for fusion energy and to make suggestions for improvement while seeking areas of consensus. Much of the workshop consisted of breakout discussion groups aimed at a particular section of the report. The meeting had much lively discussion and areas of broad consensus were identified. The report, when completed, will be posted for consideration by the Fusion Energy Sciences Advisory Committee (FESAC).

THEORY (S. HUDSON)

The paper titled, "Axisymmetric simulations of vertical displacement events in tokamaks: A benchmark of M3D-C1, NIMROD, and JOREK," by I. Krebs, F. Artola, C. Sovinec, S. Jardin, K. Bunkers, M. Hoelzl, and N. Ferraro, has now been accepted for publication in *Physics of Plasmas*.

H. Qin presented a seminar titled, "Structure-Preserving Geometric Algorithms (I)" on Jan. 10 at the Tokamak Disruption Simulation Center weekly webinar. The historic development of symplectic integrators and discrete exterior calculus solvers for Maxwell equations were reviewed, and recent advances on volume preserving algorithms and symplectic algorithms for non-canonical gyrocenters were presented.



OFFICE OF ACADEMIC AFFAIRS (N. FISCH)

J. Matteucci, a graduate student in the Program in Plasma Physics, successfully defended his thesis, "Magnetic Field Generation and Reconnection in High Energy Density Plasmas," and passed his FPOE on Jan. 7. His thesis advisors were W. Fox and A. Bhattacharjee.

D. Michta, a graduate student in the Program in Plasma Physics, successfully defended his thesis, "Quantum Hydrodynamics: Theory and Computation with Applications to Charged Particle Stopping in Warm Dense Matter," and passed his FPOE on Jan. 7. His thesis advisors were G. Hammett and F. Graziani of LLNL.

COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. Bernard):

The Office of Communications posted one press release to the PPPL website this week. It reported that a team of researchers led by C.S. Chang has been awarded major supercomputer time to address key issues for ITER. The award, from the DOE's Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program, renews the third and final year of the team's supercomputer allocation for the current round. The story was also posted to the *Newswise* and *EurekaAlert* distribution services.

DIRECTOR'S OFFICE (S. COWLEY)

S. Cowley, J. Menard, and M. Zarnstorff participated in the Division of Plasma Physics Community Planning Process (CPP) in Houston, Texas, Jan. 13-17. The goal of the meeting was to receive community input and feedback for a final report to the Fusion Energy Science Advisory Committee (FESAC).

This report is also available on the following web site:

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