



The PPPL Highlights for the week ending September 29, 2018, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

Plasma-Facing Components (PFCs) — A PFC Final Design Review (FDR) was held on Sept. 28 that completed the fifth of five DOE PEMP Notable Outcomes for NSTX-U Recovery for FY2018. This FDR reviewed the PFC design and readiness for procurement and manufacturing. The FDR covered PFCs in both low and high heat-flux areas. The FDR was deemed successful pending resolution of outstanding chits.

Magnets — All electrical tests are finished on all four prototype PF1A coils, and the Tesla coil will be sectioned one more time for further vacuum pressure impregnation (VPI) inspection. The initial PF1A prototype coil evaluation and ranking was developed and a report is currently being drafted. Preparations are underway to begin Corona testing on a prototype coil section, and the draft procedure is currently in review. Punch-out tests for composite shear strength continued, and a punch-out test was completed for the log sample. PPPL prototype coil samples will be cut for the next series of punch-out tests. A draft production inner PF coil procurement plan was written.

U.S. ITER FABRICATION (H. NEILSON)

This week, the System Design Description (SDD) document for the Low Field Side Reflectometer (LFSR) was submitted to PPPL by subcontractor General Atomics (GA). The SDD provides a detailed description of the overall LFSR design as well as key components, summarizes the system performance characteristics, and provides an overview of operation and maintenance. The SDD will be submitted to ITER as one of the key design deliverables for the LFSR project.

The Low Field Side Reflectometer (LFSR) team continues to document the LFSR design's compliance with the more than 280 applicable system requirements. The current status was reviewed in a video conference meeting with U.S. ITER and ITER Central Team stakeholders. The LFSR team continues to advance the maturity of its design compliance matrix in advance of an Oct. 3 deadline for submission to U.S. ITER for formal review.

ITER Diagnostics Team Leader H. Neilson visited GA for discussions with collaborators on the LFSR project. The GA team reported on the status of key design deliverables, notably the system design description and two key instrumentation and controls documents, the system design specification, and system requirements specification. All are nearing completion. These documents will be included in the input data package for the LFSR Preliminary Design Review, scheduled for Nov. 7-8.

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ITER & TOKAMAKS (R. NAZIKIAN)

International PMI (R. Maingi):

IAEA paper preparation continues, with a number of papers based on EAST and other devices being reviewed by co-authors. The IAEA paper highlighting aspects of the US-PRC PMI collaboration by R. Maingi, “Amelioration of plasma-material interactions and improvement of plasma performance with a flowing liquid Li limiter and Li conditioning on EAST,” was reviewed by co-authors and submitted.

The liquid metal PFC strategy seminar series was resumed and organized by R. Maingi. D. Majeski gave a talk titled, “LTX-beta: status, plans, and design implications for future devices.” LTX-beta is nearing resumption of plasma operations, with a target to inject the new heating neutral beam into LTX plasmas by March 2019. The talk highlighted the surface science capabilities and program. Lithium will be provided in the first run with a gravitational dropper, while development of rapid-temperature-control, e-beam-based lithium evaporators continues. The flash evaporators would be useful for NSTX-U in the future, and other devices, when available.

KSTAR Stability (S. Scott):

We recently completed a comparison of the beam-into-gas calibration of the existing KSTAR MSE diagnostic to the new MSE background polychromator. These instruments share the same plasma-facing optics and MSE polarimeter but use different methods to control the center wavelength of the optical filters, which affects the filter transmission curves. There are interesting differences in various trends in the measured quantities (polarization angle and linear polarization fraction) between the two instruments that reflect the importance of the filter transmission curves on the measurement. We are currently planning a second round of beam-into-gas calibration for both systems that will improve the accuracy of pitch angle measurements in plasma. Unfortunately, operation of the beam viewed by MSE has been delayed until Nov. 30 due to technical problems. Whether there will be run time for a second round of beam-into-gas calibrations during this run campaign is uncertain.

ADVANCED PROJECTS (H. NEILSON)

Stellarators (D. Gates):

Physicist J. Lore from Oak Ridge National Laboratory (ORNL) reported that experiments on Wendelstein 7-X (W7-X) to investigate the effects of a divertor scraper element were successfully accomplished this week. The scraper element is a plasma-facing component that was designed by ORNL to protect vulnerable regions of the divertor targets from

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overheating during the startup phase of future long-pulse discharges. Two instrumented prototypes were fabricated by PPPL and installed in W7-X earlier this year in preparation for this week's experimental tests. These short-pulse experiments were run in a magnetic configuration that was specially designed to mimic the loading conditions that exist during long-pulse startup transients, and both electron-cyclotron and neutral-beam plasma heated were studied. High-resolution infrared camera imaging (with equipment provided and operated by Los Alamos National Laboratory) was used to measure heating loading patterns, which were found to be in good agreement with model predictions. Data from Langmuir probes, pressure manometers, H-alpha cameras, and impurity filterscopes will be used to determine the impact of scraper element on pumping and particle control.

THEORY (S. HUDSON)

Computational Plasma Physics Group (S. Jardin):

On Sept. 26, E. Feibush presented a CPPG seminar entitled, "Scientific Visualization Tools and Techniques." Data generated by simulations and acquired from experiments can be categorized by dimensionality, ranging from $f(x)$ to $f(x,y,z,t)$. Python's matplotlib is effective for displaying one- and two-dimensional data sets. Programming examples were shown for reading data from netCDF files or MDSplus, displaying on the screen, and saving multiple graphs to a PDF file. Programs based on the Visualization Toolkit, such as VisIt and Paraview have plot types for more complex data. They can also be scripted (using their built-in Python interpreter) to produce a sequence of image files that can be combined into a movie using ffmpeg. Examples included animations applied to time step simulations from GTS, XGC, and M3D-C1.

ENGINEERING (V. RICCARDO)

C. Gentile made a presentation at the seventh NNSA Mo-99 conference in Knoxville, Tennessee, on the PPPL / PU patented technology for the in-situ production of Mo-99 absent uranium.

The Document Management System initial workflows have been deployed to PPPL's test servers and are undergoing testing and bug fixing.

SITE PROTECTION (M. COHEN)

Ambulance 166 and Engine 66 responded to mutual aid assignments in Plainsboro Township. Members of ESU completed Fire Apparatus Pump Operations Refresher Training.



COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. BERNARD)

The Office of Communications posted three press releases to the PPPL website. The first focuses on a team of physicists led by J. Yoo who correlated magnetic field measurements taken by NASA's four-satellite Magnetospheric Multiscale mission, which is orbiting at the edge of the magnetic field that surrounds the Earth. The findings identified the source of the propagation of whistler waves, whose detection orients the satellites relative to reconnection activity that can affect the Earth. The second notes that PPPL has won a national award from the DOE recognizing the Laboratory's leadership and continuous improvement in buying sustainable products. The final story was an interview of S. Greco, who recently was named the vice chair of the American Physical Society's Forum on Outreach and Engaging the Public. These stories were also posted to the *Newswise* and *EurekAlert!* press release distribution services.

DIRECTOR'S OFFICE (S. COWLEY)

On Sept. 24, D. Sinars from Sandia National Laboratories presented a colloquium entitled, "Pulsed Power Science and Applications on Sandia's Z Machine."

On Sept. 27, M. Zarnstorff attended a meeting at the American Security Project in Washington, D.C.

On Sept. 27-28, S. Cowley met with physicists at UCLA to discuss collaborations with PPPL, and on Sept. 28, S. Cowley met with Dr. M. Binderbauer of TAE to discuss TAE's plans and work with PPPL.

This report is also available on the following web site:

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