



The PPPL Highlights for the week ending May 12, 2018, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

One prototype coil vendor has commenced the vacuum pressure impregnation (VPI) process for the inner poloidal field (PF) coils. The PPPL prototype coil is expected to undergo VPI soon.

Significant progress has been made in developing a turn-to-turn insulation test method for PF1 prototype and production coils. A unique surge test device, developed in conjunction with CERN, was procured from Elytt Energy in Spain. Since arrival at PPPL several weeks ago, it has been commissioned using test coils similar to NSTX-U inner PF coils. The fault detection sensitivity was evaluated by artificially introducing faults of varying resistance between turns and between layers of the coils. The tester will be available for use beginning with the first prototype coil.

A preliminary design review (PDR) was completed on May 10 for the Bakeout PLC Upgrade.

Research:

M. Podestà presented a poster at the US-TTF meeting (San Diego, California) titled, "Development of a reduced model for energetic particle transport by fishbones for integrated tokamak simulations." Podestà also chaired the plenary and working group sessions on energetic particles and participated to the TTF executive committee coordination meeting.

U.S. ITER FABRICATION (H. NEILSON)

A paper by A. Ouroua, *et al.*, "Prototype Design of a 700°C In-Vacuum Blackbody Source for In Situ Calibration of the ITER ECE Diagnostic," has been published in the journal *IEEE Transactions on Plasma Science*. The paper describes the preliminary design of a hot calibration source, two of which will be installed in vacuum in Equatorial Port 9 to generate blackbody radiation for calibrating the radial and oblique views of the ITER electron cyclotron emission diagnostic. The source will operate in conjunction with two remotely retractable mirrors. The main requirements include a high-emissivity surface heated to 700 degrees Celsius or higher, the ability to perform the calibration in high vacuum and in the presence of a magnetic field, and a 5000-hour operational lifetime over 20 years. The design is supported by analyses as well as test results of using a prototype source that was developed to address the requirements and constraints



experimentally. The work was led by Ouroua and other researchers at the University of Texas at Austin, under a subcontract to PPPL. A. Khodak and G. Taylor of PPPL are co-authors on the paper.

A subcontract deliverable for the low-field-side reflectometer (LFSR) project, “Software, Network and Data Storage Architecture,” was received from General Atomics of San Diego, California. The document describes the software, network and data storage architecture for the LFSR, as well as details of system requirements for these functions. The information in this report is represented in an Enterprise Architect model of the LFSR system, which in turn is used to generate the System Requirements Specification and System Design Specification required for design development.

ADVANCED PROJECTS (H. NEILSON)

Stellarators (D. Gates):

Physicist N. Pablant participated in the recent W7-X program workshop, presenting a talk titled, “Neoclassical transport studies,” summarizing the neoclassical transport experiments conducted during the first two W7-X campaigns. The program workshop represents the start of detailed experimental planning for the next W7-X experimental campaign, known as OP1.2b. Pablant has been heavily involved in the planning and proposal process in the topics of core heat and impurity transport.

System Studies (C. Kessel):

A paper by A. Khodak, *et al.*, “3-D Unsteady Model for Be-Steam Reaction in Water-Cooled Ceramic Breeder Blanket,” has been published in the journal *IEEE Transactions on Plasma Science*. The reports on analysis of a situation that can occur in a water-cooled ceramic breeder blanket in the case of the rupture of one of the cooling pipes in the blanket module, releasing steam into the module. At elevated temperature, beryllium reacts with steam in an exothermic reaction producing beryllium oxide and hydrogen. In order to perform a detailed analysis of this process, the authors developed a model of the reacting flow-through porous media of the pebble bed and introduced it into a 3-D computational fluid dynamics code. Analysis results show that high-temperature zones are mostly located in the breeder regions, whereas in multiplier zones the temperatures stay below 600 degrees Celsius. The model is validated using experimental data on beryllium steam reaction for granular bed samples. The work was performed in collaboration with graduate student X. Cheng from the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP) while Cheng was a visiting student at PPPL, and was partially sponsored by ASIPP under a Strategic Partnership Project agreement with the Laboratory.



THEORY (A. BHATTACHARJEE):

C. Liu, Y. Zhou and E. Belova attended the 12th West Lake International Symposium on Plasma Simulation, held in Hangzhou, China. They presented the following invited talks: “Excitation and propagation of plasma waves excited by runaway electron,” “Wave kinetics of drift-wave turbulence and zonal flows beyond the ray approximation,” and “Numerical simulations of GAE stabilization in NSTX-U.”

N. Gorelenkov attended the U.S. Transport Task Force (TTF) and gave a presentation titled “Resonance Broadened Quasi-linear (RBQ) model for fast ion relaxation due to Alfvénic instabilities.”

Copies of the above mentioned Invited Presentations are available at <https://theory.pppl.gov/news/seminars.php?scid=3&n=invited-talks>

On May 9, F. Ebrahimi presented a plasma physics seminar at the University of Maryland titled, “Onset and nonlinear relaxation of coherent current-carrying edge filaments during transient events in tokamaks.” The abstract and a copy of the presentation are available here:

<https://theory.pppl.gov/news/seminars.php?scid=6&n=external-seminars>

A heliophysics seminar titled, “Magnetic Reconnection during Turbulence and the Role it Plays in Dissipation and Heating,” was given by M. Shay, from the University of Delaware. The abstract and a copy of the presentation are available here:

<https://theory.pppl.gov/news/seminars.php?scid=9&n=heliophysics-seminars>

SITE PROTECTION (F. WHITE)

PPPL participated in the 2018 DOE Eagle Horizon National Exercise simulating a severe weather event impacting the Laboratory. Several meetings with key division heads took place to discuss preparation measures if such an event were to occur. The PPPL Emergency Response Organization (ERO) was also activated for this drill and convened at the Emergency Operations Center located at the Emergency Services building to address the injects that were a result of the simulated storm affecting the Lab. The Site Protection Division also conducted personnel accountability drills in an effort to determine the status of PPPL employees and to ensure the safety of our staff.

Engine 166 responded to three (3) mutual aid assignments in Plainsboro Township.



COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

A. Zwicker and D. Ortiz attended the DOE Lab Education Director's meeting in Gaithersburg, Maryland, May 7-9.

COMMUNICATIONS (L. BERNARD)

The Office of Communications posted one press release to the PPPL website. The story focuses on an award given by the DOE's Office of Science to PPPL physicists L. Delgado-Aparicio, B. Stratton, and K. Hill to develop new X-ray diagnostics for WEST, the Tungsten (W) Environment in Steady-state Tokamak, located in Cadarache, France. The three-year, \$1-million award will support construction of two new devices at PPPL, plus collaboration with French scientists and deployment of a post-doctoral researcher to test the installed devices at CAE Laboratories, the home of the WEST facility. The story was also posted to the *Newswise* and *EurekAlert!* press release distribution services.

DIRECTOR'S OFFICE (R. HAWRYLUK)

On May 9-10, a meeting of the bi-annual PPPL Advisory Board was held. The purpose of the PPPL Advisory Board is to provide an outside independent review of PPPL science and operations; the committee then provides Princeton University with feedback and recommendations.

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