



The PPPL Highlights for the week ending January 27, 2018, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

Many members of the recovery engineering team participated in dry runs for the upcoming DOE capability assessment. All of the Kapton/Fiberglass co-wound insulating tape for the prototype coils has been completed. For the PF1A prototype VPI test log, a two-inch-wide section of log was cut out and polished. The quality of the impregnation is good and samples for mechanical tests are being produced. Post-processing of the metrology data for the center-stack casing inner-diameter has been completed and peer-review meetings are being held to assess the results.

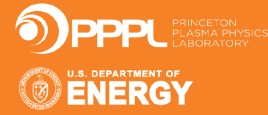
Research:

L. Delgado-Aparicio and M. Ono of PPPL visited Naka Fusion Institute in Naka, Japan on Jan. 26. They toured the JT-60SA construction site and met with Naka Fusion Institute researchers including T. Nakano, Y. Kamada, and N. Oyama. The main purpose of the trip was to discuss the X-ray imaging crystal spectroscopy feasibility study collaboration between PPPL and QST.

A group from NSTX-U visited the Argonne National Laboratory on Jan. 11-12 to learn how their user facilities are operated with the goal of improving NSTX-U operation as a DOE Office of Science user facility. The group consisted of B. Stratton, G. Tchilinguirian, and M. Ono. They visited the Advanced Photon Source, the Center for Nanoscale Materials, the Argonne Leadership Computing Facility, and the Argonne Tandem Linear Accelerator. On Jan. 17-18, the same group, with the addition of R. Kaita, visited the Oak Ridge Leadership Computing Facility, the Center for Nanophase Materials Sciences, the Spallation Neutron Source, and the High Flux Isotope Reactor at the Oak Ridge National Laboratory. In addition to touring the facilities at both laboratories, discussions were held with representatives of the facilities to address specific questions on a number of topics including the experimental proposal process, the structure and functions of the user group, user training, configuration control, the Accelerator Safety Order and best practices. The information gathered on these visits and a similar visit to Brookhaven National laboratory in December will be used to develop recommendations for changes to NSTX-U operations and user support.

Weekly

HIGHLIGHTS



U.S. ITER FABRICATION (H. NEILSON)

The ITER low-field side reflectometer (LFSR) will include a so-called Gaussian telescope (GT) in the transmission line in order to accommodate thermal expansion and contraction of the vacuum vessel. This week a report, “Gaussian Telescope and Vacuum Window Test Report,” was submitted by subcontractor General Atomics (GA). A prototype GT was designed and fabricated by PPPL and tested by GA in their LFSR test stand. Included in the GT assembly is a pair of windows that would separate the vacuum in the ITER port plug from the ambient pressure in the ITER machine hall. The test report described the measured effects of the GT and windows on the reflectometer performance. The tests were performed with the GT in different positions and with and without the windows. The report provided test results and recommendations for improvements in the GT design.

ITER & TOKAMAKS (R. Nazikian)

DIII-D (B. Grierson)

Research:

Real-time disruption prediction using machine-learning ensemble methods was developed and tested at DIII-D by L. Lupin and E. Kolemen. A fast machine-learning algorithm was trained with previous disrupting and non-disrupting DIII-D shots. The algorithm, which gives a probability of disruption every 10 milliseconds, was used in two shots and successfully predicted a flat-top disruption 200 milliseconds in advance and a ramp-down disruption 50 milliseconds in advance. These predictions were sent to an off-normal response algorithm, which can take relevant response such as change I_p or shape. Follow-up planned experiments will use this capability to avoid disruptions.

This week J. Rice from MIT visited DIII-D to collaborate on intrinsic rotation studies with B. Grierson and C. Chrystal (GA). Rice has recently published a paper on the scaling of H-mode intrinsic rotation with ρ -star on the Alcator C-Mod tokamak. Now, Rice, Grierson and Chrystal are applying the same scaling to recent DIII-D intrinsic rotation experiments operating in H-mode.

S. Haskey visited PPPL to work with D. Battaglia on continuing XGC0 simulations of a low-power H-mode and a higher-power low-torque ITER baseline plasma. These simulations are being compared with direct measurements of the deuterium properties which were obtained using the main ion CER diagnostic on DIII-D. Additionally, the functionality of the OMFIT kineticEFITtime and TRANSP modules were tested and improved for NSTX-U cases with the help of B. Grierson, J. Sachdev, X. Yuan, and S. Smith (GA).



A new article by N. Logan, B. Grierson, S. Haskey, and General Atomics collaborators entitled, “OMFIT Tokamak Profile Data Fitting and Physics Analysis” has been published in *Fusion Science and Technology*. The article documents the next-generation tool for interfacing with, mapping, visualizing, and fitting tokamak profile measurements developed within the One Modeling Framework for Integrated Tasks (OMFIT). This work integrates the many diverse diagnostics on multiple tokamak devices and provides the critical link between raw tokamak data and simulations necessary for physics understanding. This tool is publicly available and is helping the community address the DOE OFES workshops' prioritization of Whole Device Modeling (WDM) capability through seamless integration of tokamak data and simulation.

Operations:

This week the NB calorimeter plates passed the DIII-D QC detailed inspection with only one threaded hole needing chasing. These plates were redesigned to eliminate a systemic failure mode in the old calorimeters. The thermocouple array on the back of the calorimeter plates was doubled in density to provide a higher-resolution thermal image of the beam footprint. These plates will be installed in the 210 Co/Ctr Off-Axis neutral beam during the LTO. Another set of plates will be fabricated by PPPL for the 150 neutral beam which is being considered for disassembly during the LTO for refurbishment of both pole shields (already in-house) and calorimeter.

ADVANCED PROJECTS (H. NEILSON)

Stellarators (D. Gates)

The Laboratory is collaborating with Oak Ridge National Laboratory (ORNL) and other partners in developing a conceptual design and project plan for a continuous pellet fueling system for the Wendelstein 7-X (W7-X) stellarator at Germany's Max Planck Institute for Plasma Physics (IPP). This week, PPPL's H. Neilson, the project team leader, visited ORNL for a two-day working meeting with the ORNL pellet fueling team led by L. Baylor. The group conducted a detailed review of the draft project specification developed by IPP staff; an update incorporating all U.S. comments was subsequently distributed by IPP. Also, writing assignments for design documentation were agreed upon, and a draft project execution schedule was developed. The very productive visit concluded with a tour of ORNL's pellet fueling technology development laboratory

THEORY (A. BHATTACHARJEE)

Congratulations to E. Belova on being named to the editorial board of *Physics of Plasma*. A Newswise media article has the full information here:

<http://theory.pppl.gov/news/seminars.php?scid=8&n=in-the-media>



A research and review seminar titled, “Energetic Particle-Driven Fishbone Instability: Theory and Simulation,” was presented by G-Y. Fu. The abstract and slides (soon) can be found on the Theory website:

<http://theory.pppl.gov/news/seminars.php?scid=2&n=rr-seminars>

The following papers appeared online: (1) “Stochastic effects on phase-space holes and clumps in kinetic systems near marginal stability” by B. Woods, V. Duarte *et al.*, *Nucl. Fusion*, in press (2018); (2) “Investigation of a short argon arc with hot anode. Part I: numerical simulations of non-equilibrium effects in the near-electrode regions” by A. Khrabry, I. Kaganovich *et al.*, *Phys. Plasmas* **25**, 013521 (2018); and (3) “Investigation of the Short Argon Arc with Hot Anode, Part II: Analytical Model A. Khrabry, I. Kaganovich *et al.*, *Phys. Plasmas* **25**, 013522 (2018). The abstract and links for these papers can be found on the Theory website:

<http://theory.pppl.gov/news/seminars.php?scid=4&n=publications>

DIRECTOR’S OFFICE (R. HAWRYLUK)

On Jan. 24, L. Pueyo, from the Space Telescope Science Institute, presented a colloquium entitled, “Exoplanet Snapshots, from Precision Optics to Precise Astronomical Measurements.”

On Jan. 26, the Laboratory hosted a party to celebrate the contributions of 38 colleagues who are leaving the laboratory, many of whom have been at the Laboratory for decades, and all of whom have contributed greatly to our work here at PPPL.

This report is also available on the following web site:

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