



The PPPL Highlights for the week ending August 26, 2017, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

Metrology of the PF 3, 4, and 5 upper and lower coils has been completed. Four sets of measurements were taken, and included radial deviations of PF5, vertical plane measurements of all coils, and alignments of the vessel and upper/lower nozzles to gravity. These measurements will benefit magnetic diagnostics.

A successful conceptual design review (CDR) for the FCPC test stand pump cart redesign was held on Aug. 19.

A successful final design review (FDR) for the insulation co-winding & inspection station was held on Aug. 22.

Research:

Graduate student Hibiki Yamazaki from the University of Tokyo returned to Japan after a stay at PPPL working with Luis F. Delgado-Aparicio on multi-energy soft x-ray (SXR) modeling for tokamak plasmas. They developed a new computational tool that can be used to calculate how many x-ray photons will impinge on the new multi-energy cameras to be installed in MST in Wisconsin, DIII-D in GA, as well as NSTX-U. This capability will also be used for designing SXR systems for either small or large tokamaks in Japan. This work was sponsored by a partnership between Princeton and the University of Tokyo as well as Delgado-Aparicio's early career research award from DOE FES.

As part of the collaboration with PPPL, MIT graduate student Juan Ruiz has completed a verification of a new GYRO-based synthetic diagnostic for the NSTX/NSTX-U high-k scattering system used to measure high k turbulence. The verification exercise used baseline parameters to numerically verify analytic theory for the synthetic model, which will now be applied to electron-scale simulations of NSTX H-mode plasmas.



U.S. ITER FABRICATION (H. NEILSON)

Steady State Electrical Network (J. Dellas)

The Laboratory's Title III support contractor traveled to the supplier's facility in Zurich to witness the factory acceptance test for the third of four uninterruptible power supply (UPS) units. The final test is expected to be conducted next week. In addition, the supplier continues to address punch list items from its internal tests and to assemble the documentation packages for the UPS units.

Diagnostics (R. Feder)

The low field side reflectometer (LFSR) team has accomplished a DOE Level 3 milestone on schedule by completing full-length transmission line testing with frequency-modulated transceivers. A report has been issued by General Atomics, the Laboratory's partner in the LFSR project. Testing of components such as the Gaussian telescope and windows are to follow.

The disruption loads on the LFSR diagnostic components in the ITER interspace were calculated using the Maxwell electromagnetics analysis code for the first time. The calculated loads were shown to be small and manageable for the Gaussian telescopes and mounting hardware that are situated radially just outside of the toroidal magnetic field coils. Although the port (#11) integrator (Russian Federation Design Agency) has not finalized the interspace structure design, the low calculated loads give us confidence in our current design of ex-vessel components' arrangement and functionality.

ITER & TOKAMAKS (R. NAZIKIAN)

Valeria Riccardo, head of PPPL engineering, visited DIII-D this week to discuss engineering practices at DIII-D, including QA, document control, operations, electrical systems, pit work control, and other topics.

International (R. Maingi)

A final design review was held for the third generation flowing liquid lithium limiter to be deployed on EAST. The FDR was deemed a success, and the project will move to the procurement stage, with a target delivery of December 2017 - January 2018.

DIII-D (B. Grierson)

F. Poli visited DIII-D to work with the steady-state operation group on plans for optimizing the ramp-up phase of high q_{\min} steady state plasmas aimed at accessing high beta operation. She worked with the TRANSP group at DIII-D on free-boundary predictive simulations of DIII-D plasmas to demonstrate the capabilities for evolving the poloidal field diffusion starting from a limited plasma configuration for the application to scenario development and optimization.

ADVANCED PROJECTS (H. NEILSON)**Stellarators (D. Gates)**

S. Lazerson is chairing a Wendelstein 7-X (W7-X) working group tasked with planning the use of the W7-X multipurpose manipulator during the OP1.2 campaign. The multipurpose manipulator provides a platform for “hot swapping” (rapid changeout) of diagnostic probe heads in W7-X. In particular, it was used in the previous experimental campaign to perform edge measurements of the scrape-off layer. This versatile system is a collaboration between the Max Planck Institute for Plasma Physics (IPP) and Research Center Jülich (FJZ) and is a resource for the entire W7-X team. Lazerson's leadership is part of his two-year extended assignment on W7-X and exemplifies the project's one-team approach.

Fusion Energy System Studies (C. Kessel)

Members of the national System Studies team made presentations at the recent Magnetic Fusion Research Strategic Directions Workshop in Madison, Wisconsin. In so doing, these speakers brought the findings from the recently-completed fusion nuclear science facility (FNSF) study and previous power plant studies to bear on community strategic planning. In addition to PPPL contributions previously highlighted, there were several important presentations from the national team. P. Humrickhouse (INL) presented a discussion of fusion reactor licensing and the complex and time-consuming issues associated with safety, tritium, and nuclear facilities. S. Smolentsev (UCLA) presented a compelling case for the U.S. to continue its liquid metal leadership with experiments and computational developments, noting the strong collaborations already in place. Y. Katoh (ORNL) presented a broad range of materials topics, emphasizing their importance in many parts of a fusion facility, as well as frontier material science that could contribute to fusion. J. Rapp (ORNL) presented the motivation for linear plasma facilities and their upgrading and integrating, a critical element in the plasma-material interaction pathway to power plants and long pulse operation. P. Ferguson (ORNL) presented an overview of the fusion nuclear science, materials and enabling technology subprograms and how our



leadership in these areas can be sustained and enhanced with appropriate focus and support.

THEORY (A. BHATTACHARJEE)

This week, some members of the Theory Department attended the Joint Institute for Fusion Theory (JIFT) meeting in Boulder, Colorado. Robert Hager gave a talk titled “Multi-Scale Time Integration with the Gyrokinetic Codes XGC1 and XGCa.” Ben Sturdevant gave a talk titled “Progress on Equation-Free Projective Integration in XGCa.” Toseo Moritaka, a visiting research scholar from Japan, presented “Development of a Particle-In-Cell Gyrokinetic Code for Stellarator Geometries.”

On Thursday, Aug. 24, Ralph Kube (University of Tromso, Norway) presented a theory seminar on “Stochastic modelling of fluctuations in scrape-off layer plasmas.” The abstract and presentation are available on the Theory Department website, <http://theory.pppl.gov/news/seminars.php?scid=1&n=research-seminars>.

Computational Plasma Physics Group (S. Jardin)

A. Yao completed his summer internship under the supervision of E. Feibush and S. Ethier. Yao developed a new workflow for visualizing variables generated by various simulations. The workflow is written in Anaconda Python using Tkinter for the graphical user interface, matplotlib for the rendering, and ffmpeg for creating the movie file. Developed at PPPL, the code runs on Edison at NERSC where the data is computed and stored. The movie file is only 2 MB in size compared to the 2 GB simulation data, significantly reducing data transfer and local storage. Sample movies are in <http://w3.pppl.gov/~efeibush/gtvis>.



COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

COMMUNICATIONS (L. BERNARD)

PPPL posted and distributed two press releases this week. One focused on the poster session on August 16 for the 21 Science Undergraduate Laboratory Internship (SULI) students who spent the summer at PPPL conducting research. Another focused on research by PPPL physicist F. Ebrahimi showing how ELMs in fusion plasmas can ultimately extinguish themselves. Both press releases were posted on www.pppl.gov and distributed to the media.

SITE PROTECTION (F. WHITE)

Members of the Site Protection Division conducted an Emergency Management Review Committee meeting to discuss the 2017 emergency exercise.

This report is also available on the following website:

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