



The PPPL Highlights for the week ending January 20, 2018, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

A peer review was held on Jan. 18 to discuss the alignment of the toroidal field / ohmic heating coil bundle relative to the center-stack casing. Co-wound tape to support the fabrication of all of the poloidal field coil prototype coils has been fabricated. The conductor for the PPPL poloidal field coil prototype has been loaded onto the tensioning skid in preparation to being winding once the PPPL manufacturing readiness review (MRR) has been completed. An MRR was held on Jan. 18 for Everson-Tesla.

Research:

L. Delgado-Aparicio has been granted a Chinese Academy of Sciences President's International Fellowship Initiative (PIFI) award to perform medium- and high-Z impurity transport experiments on the EAST tokamak.

U.S. ITER FABRICATION (H. NEILSON)

The Laboratory's ITER Diagnostics team participated in the first Global Domestic Agency Monthly Meeting (GDAMM) of 2018, hosted by the ITER Organization's (IO) Central Diagnostics Team. Participants provided an update on open action items, including progress and plans for flow-down of requirements for the Low Field Side Reflectometer. In addition, PPPL's D. Johnson provided feedback on an IO-initiated risk assessment addressing the impacts of work suspension on several U.S. diagnostics systems, necessitated by funding reductions. Johnson's system-by-system response to the IO's initial assessment was well received; after further review and iteration between PPPL and the IO, the risks will be formally entered in the IO's risk register.

ITER & TOKAMAKS (R. Nazikian)

DIII-D (B. Grierson)

Research:

A new article titled, "Multi-Scale Transport in the DIII-D ITER Baseline Scenario with Direct Electron Heating and Projection to ITER," by B. Grierson has been selected as a "Featured Article" by the editors of *Physics of Plasmas*. The article will be featured on the journal homepage and circulated through social media by the AIP.

Weekly

HIGHLIGHTS



M. Knolker led an experiment on DIII-D on impurity transport, ELM mitigation and radiative divertor in Super H-mode plasmas. The experiment was planned and executed through the newly formed Core-Edge Integration Task Force co-led by B. Grierson and A. Jarvinen. A pedestal pressure of 30 kilopascals was achieved, which is among the highest ever seen on DIII-D. The injection of neon into the plasmas was used to assess compatibility of this high-performance scenario with radiative impurity injection. The effectiveness of 3D field perturbations for stationarity, energy confinement and impurity transport will be the primary focus of detailed analysis.

E. Kolemen, F. Laggner, and A. Diallo traveled to General Atomics to lead experiments on pedestal turbulence and transport. Diallo led an experiment aimed at modifying the edge profile gradients and the plasma rotation. B. Grierson developed a neutral beam program for the experiment which enabled a torque variation at constant injected power. Also, ECH and gas puffs were used to modify the edge electron temperature and density profiles. Laggner led a half-day experiment aimed at the control of the inter-ELM pedestal fluctuations through modifications to the edge current density. Fast vertical plasma oscillations were used to induce edge currents and assess their effects on ELMs and inter-ELM fluctuations.

Operations:

A proposal to install a new multi-impurity powder dropper on a dedicated port on DIII-D was approved and is now scheduled for installation for early April 2018. The installation, which requires in-vessel entry for replacing a number of wall tiles, will allow the simultaneous use of the powder dropper and divertor SPRED to study the energy dissipation by boron and boron nitride injection in the SAS divertor.

After a year in storage, the redesigned PPPL Impurity Granular Injector (IGI) was re-assembled. The injector will use an improved quasi-period granule feeder for more regular granule delivery. The unit will be installed on DIII-D in February.

A. Nagy and student interns have successfully demonstrated a viable powder injector concept that can shoot powder horizontally instead of drop powder vertically. This side launch technology will be used on W7-X. The requirement is to inject powder horizontally approximately 4 to 6 centimeters from a horizontally inserted probe head. The successful test demonstrates the proof of concept and paves the way for a next step design using a vibratory feeder coupled with a piezo motor in a compact configuration.



EAST/AUG Plasma Materials Interactions: (R. Maingi)

R. Maingi presented a talk at the monthly technical meeting of the Virtual Laboratory for Technology (VLT) on real-time wall conditioning with boron and boron nitride in ASDEX-Upgrade. The talk described a new four-chamber impurity injector implemented on AUG in a PPPL-IPP collaboration. Boron injection improved wall conditioning, while boron nitride injection increased radiated power and energy confinement, similar to nitrogen gas injection. This work will be highlighted in an oral presentation at the international PSI conference by A. Bortolon.

The delivery of the EAST powder dropper will be completed by February. The installation is planned for the week of March 5, with subsequent experiments to follow around May. This will be the second international powder dropper installation using this latest four-chamber design. The EAST dropper will contain boron and lithium powder.

ADVANCED PROJECTS (H. NEILSON)

Stellarators (D. Gates)

A paper entitled “Stellarator Research Opportunities: A Report of the National Stellarator Coordinating Committee,” has been accepted for publication in the *Journal of Fusion Energy*. The report, authored by researchers representing a large cross-section of the U.S. stellarator community and edited by NSCC chair D. Gates, was the final product of a workshop held at MIT in February 2016. The report highlights numerous research opportunities and outlines a proposed program for the U.S. stellarator research endeavor for the next several decades. Stellarator research was recently identified as a potentially transformative strategic element for the fusion program at a recent Community Workshop in Madison, Wisconsin, following presentations of the material in this report.

Registration is now open for the next Coordinated Working Group Meeting (CWGM), which is part of the International Energy Agency’s (IEA) Stellarator/Heliotron Technical Cooperation Program (TCP). The CWGM functions in a manner similar to the International Tokamak Physics Activity (ITPA), except it focuses on stellarator research. The meeting will be held at PPPL on April 10-12 and will feature presentations from many international stellarator experiments.

D. Gates, in his new position of editor-in-chief of the new online journal *Plasma*, authored an editorial entitled “*Plasma: An International Open Access Journal for All of Plasma Science*,” which has been published as the inaugural letter. The journal is an open access, cross-disciplinary scholarly publication of scientific studies related to all aspects of plasma science, such as plasma physics, plasma chemistry and space plasma. It



publishes reviews, research articles, short communications, and letters. The editorial is now available online at <http://www.mdpi.com/2571-6182/1/1/4/pdf>.

THEORY (A. BHATTACHARJEE)

The paper titled, "Modeling of reduced secondary electron emission yield from a foam or fuzz surface," by C. Swanson and I. Kaganovich, was published as featured article in *J. App. Physics* (2018). The article can be accessed at <https://doi.org/10.1063/1.5008261>.: <http://aip.scitation.org/journal/jap>

The papers (1) "A maximum entropy principle for inferring the distribution of 3D plasmoids," by M. Lingam and L. Comisso [*Phys. Plasmas* **25**, 012114 (2018)]; (2) "Generation of forerunner electron beam during interaction of ion beam pulse with plasma," by K. Hara, I. Kaganovich, and E. Startsev [*Phys. Plasmas* **25**, 011609 (2018)]; and (3) "Generalized parametrization methods for centroid and envelope dynamics of charged particle beams in coupled lattices," by M. Chung and H. Qin [*Phys. Plasmas* **25**, 011605 (2018)] have been published in a special issue of *Physics of Plasmas* devoted to R. Davidson. Links to all of the above articles are on the Theory website: <http://theory.pppl.gov/news/seminars.php?scid=4&n=publications>

PLASMA SCIENCE & TECHNOLOGY (P. EFTHIMION)

A paper titled, "Investigation of the short argon arc with hot anode. I. Numerical simulations of non-equilibrium effects in the near-electrode regions," was published by A. Khrabry, I. D. Kaganovich, V. Nemchinsky and A. Khodak in *Physics of Plasmas* **25**, 013521 (2018).
<http://scitation.aip.org/content/aip/journal/pop/25/1/10.1063/1.5007082>
DOI: 10.1063/1.5007082

A paper titled, "Investigation of the short argon arc with hot anode. II. Analytical model," by A. Khrabry, I. D. Kaganovich, V. Nemchinsky, and A. Khodak was published in *Physics of Plasmas* **25**, 013522 (2018).
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DOI: 10.1063/1.5007084

DIRECTOR'S OFFICE (R. HAWRYLUK)

Each year the Department of Energy's (DOE) Office of Science conducts an evaluation of the scientific, technological, managerial and operational performance of its national laboratories. The appraisal process uses a scoring system structured around eight performance goals. On Jan. 18, D. McComas and R. Hawryluk hosted an all-hands meeting to discuss PPPL's FY17 PEMP (performance evaluation and measurement plan)



scores from the DOE. PPPL's grades improved in five of the eight performance goals, and PPPL performed slightly better overall.

This report is also available on the following web site:

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