



**The PPPL Highlights for the week ending January 24, 2014, are as follows:**

**U.S. ITER FABRICATION (D. JOHNSON):**

SPEB meetings were held considering proposals for the RFPs associated with design support for the Upper Camera and ECE diagnostics.

Discussions were held with the IO and PPPL port engineering teams regarding the prerequisites and timing for the Preliminary Design Review for Equatorial Port Plug 9. The IO is recommending delaying the PDR, currently scheduled for late summer, until December 2014 to allow interfacing systems to be more mature.

An amendment to the existing Task Agreement was drafted proposing additional work in support of the diagnostic first wall final design. This will be sent to the IO for comment prior to submission for approvals.

Meetings were held with vendor representatives to discuss mechanical feedthroughs for the ECE shutters and the compatibility of vendor designs with the ITER environment.

An internal PPPL engineering peer group reviewed recent transient electromagnetic and thermohydraulic analysis of the low-field-side reflectometer front-end antennas, which penetrate through the diagnostic first wall and are water-cooled.

**NSTX (M. ONO):**

NSTX-U is in the Upgrade Project outage in FY14. NSTX Upgrade construction activities continued this week and are highlighted in the Engineering section below.

NSTX-U researchers Joon-Wook Ahn (ORNL), R. Goldston and M. Jaworski (PPPL) attended the ITPA DivSol meeting in Kanazawa, Japan. Joon-Wook Ahn presented the talk "Impact of ELM filaments on divertor heat flux dynamics in NSTX" and Jaworski presented the talk, "Material erosion and migration studies for NSTX-U".

Preparations for plasma operations in the NSTX-U configuration also continued

with the ongoing preparations to contract weld repairs of the spider arms on MG Set #1. Additional metal samples were taken from MG#1 this past week, as needed by the PPPL weld engineer to make final refinements to the weld procedure details in the Statement of Work (SOW). The SOW has now been revised and is ready for sign-off. Also, In Field Coil Power Conversion, new firing generators have been installed in rectifiers, and control power testing is in progress. New fiber-optics for control connections to the junction area are on site, and the procedure to install them is in review. Individual rectifier power testing is expected to start next month.

### **ITER & TOKAMAKS (R. HAWRYLUK):**

#### **DIII-D (R. Nazikian):**

Preparation of the charge-exchange recombination (CER) spectroscopy system on DIII-D is being finalized for the 2014 experimental campaign. New fiber optics for edge tangential and vertical sightlines have been connected to spectrometers in preparation for final spatial and absolute intensity calibration. Fiber optics for four new sight lines for the main ion system have been connected for assessing edge main ion measurements.

Princeton and DIII-D researchers held a videoconference with ITER this week to discuss opportunities and issues regarding the latest X-ray imaging technology for the detection of runaway electrons. The discussion focused on the measurement needs and physics relevant to the detection of the seed current following the thermal collapse, the plateau regime of the avalanche electrons and finally the termination phase of the runaway column and interaction with the walls.

A. Nagy supported the I-coil fabrication process this week by developing a method to quickly and successfully produce braze material rings for the I-coil braze joints. Once the method was established the needed 80 rings were produced, enough for the I-coil repair and spares. A. Nagy also developed a thermodynamic I-coil simulation to test cooling with gas instead of water. There are two other coils that have water leaks that induce ground faults when wet. The suggestion is to run the I-coils with gas cooling instead of water. Analysis shows that the coils will reach steady state at 195C, at full current and for a 12-minute rep rate after several shots. Preliminary bench test results show cooling from 200C to below 100C in 12 minutes using a 300 SCFH Nitrogen flow, in agreement with the analysis.

### **ADVANCED PROJECTS (H. NEILSON):**

In the Laboratory's collaboration with the Wendelstein 7-X (W7-X) project at Germany's Max Planck Institute for Plasma Physics (IPP), a conceptual design review of the x-ray imaging crystal spectrometer (XICS) project was held. An international review team with members from IPP, PPPL, and Japan's National

Institute for Fusion Sciences examined the physics basis, design requirements, conceptual solutions, and plans for completion. A series of presentations by the joint PPPL-IPP team showed an instrument design concept that follows that of the very successful U.S. XICS operating on LHD, and solutions for integrating the equipment into the W7-X facility. Committee members and other participants offered several suggestions in the form of chits for consideration by the project team. The review committee's report is in preparation, and the project is developing disposition plans in response to the chits.

## **ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):**

### **NSTX Upgrade (R. Strykowski, E. Perry, L. Dudek, T. Stevenson):**

Construction: In-vessel installation of passive plates and the TAE antenna continued this week. Thermal putty has been installed between the bakeout tubing and the vacuum vessel exterior so insulation can be re-installed on the vessel exterior. Work continues on the centerstack casing studs. Fabrication and trial fits for the PF4/5 supports at bays L and B continues. The tFIDA tube has been modified to accept the as-built dimensions of the window. Work on the replacement RWM coils for bays J - A continues. Category 3 cables are being installed and terminated at the 119' EL racks and category 4 cables are being cleaned up.

CS Upgrade: In spite of the snow closing and several crew absences, the OH winding proceeded smoothly this week with the completion of layer 1. The crew is now in the process of measuring and cutting the conductors over the next few days for the transition to layer 2. At Everson the first PF1B coil rework was completed. Once the shipping release is completed the coil will be shipped to PPPL for installation of diagnostic coils and installation of the cover. The pre-bid conference for the fabrication of the PCHERS passive plates was held on Tuesday.

NBI Upgrade: Progress on DI water manifold fabrication and installation continued for BL2 but at reduced levels due to other priorities. The NBI Armor shinethrough tile bakeout is planned for the week of January 27 with final assembly to follow. Work continues on the subcontract cable installation with major cable pulls to locations complete, final installation nearing completion, and with termination planned and imminent. Fiber optics cable pulls started, are in progress, and are nearing completion. Contact with the subcontractor for the triax terminations indicated that a February schedule is appropriate for termination work. Control rack wiring continues in the Gallery racks and the NBPC Building 138L. Packages are ready to install the NB Duct but are briefly on hold while RWM coil fit-up is in progress to allow access to the JK area. A few final duct support parts are going in as Tech Shop work orders. The vacuum system installation procedure is complete and packages are being prepared and need final drawings. A review of HP costs and ETC was held last week and adjustments were identified to cover expected needs through the fiscal year and to CD-

4. Progress continues on RWM coil fit-up and installation at Bay J-K.

**BUSINESS OPERATIONS (K. FISCHER):**

The Accounting Division submitted PPPL's International Transaction Report for the 1st quarter of FY14 to Department of Energy. This data is forwarded to the Department of Commerce and is used in the calculation of U.S. government miscellaneous services account payments and receipts.

PPPL submitted a proposal titled "Hierarchical Materials and Multi-Phase Systems for High Heat-Flux Applications" in response to the Department of Energy, Office of Science, Energy Frontier Research Center solicitation. The Principal Investigator for this collaborative proposal is R. Goldston. The total budget request for the project is approximately \$17M for the five-year period of performance.

**INFORMATION TECHNOLOGY (S. BAUMGARTNER):**

S. DeLuca integrated a Manchester Decoder FPGA code segment into the Reconfigurable Timing Unit. The decoder programming was originally developed for the NSTX-U (FCPC) Fault Detector project.

P. Sichta remotely attended an ITER FDR (part 1) for the central Controls and Data Access system (CODAC).

**OFFICE OF COMMUNICATIONS: (K. MACPHERSON):**

K. MacPherson assisted Alan Neuhauser, a reporter covering energy and the environment for U.S. News & World Report, with an interview with S. Prager about the current U.S. budget for fusion.

**BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):**

On January 25, Peter DeCarlo from Drexel presented The Atmosphere as a Laboratory: Aerosols, Air Quality, and Climate to 280 individuals at the Science on Saturday program.

The Science Education Department welcomes it's newest member, Shannon Greco, the new Program Leader for the Science Education Department.

A. Zwicker will be the featured speaker at a TedX conference held at Princeton Charter School in Princeton, New Jersey. His talk entitled "Global Change: Clean Energy by Creating a Star on Earth", will speak about fusion energy and the future.

## **PUBLICATIONS:**

The latest issue of Fusion Science and Technology, January 2014, appeared online this week. It contains tutorial or didactic articles based on the ITER International School 2012 lectures. The ITER School (IIS2012) was held in December 2012 in Ahmedabad, India, with the theme, "Radio-Frequency Heating and Current Drive in Plasmas." Contributions from PPPL Theory Division Members include: N. J. Fisch, "Methods of Radio-Frequency Current Drive", Fusion Science and Technology 65, 1--9 (2014).  
I. Y. Dodin, "On Variational Methods in the Physics of Plasma Waves," Fusion Science and Technology 65, 54--78 (2014).  
N. J. Fisch, "Some Unsolved Challenges in Radio-Frequency Heating and Current Drive", Fusion Science and Technology 65, 79--87 (2014).

State of the Art Neoclassical Tearing Mode Control in DIII-D Using Real-time Steerable Electron Cyclotron Current Drive Launchers PPPL-4978  
Authors: Egemen Kolemen, et. al.  
Submitted to: Nuclear Fusion (January 2014)

Particle Heating and Acceleration During Magnetic Reconnection in a Laboratory Plasma PPPL-4979  
Authors: Jongsoo Yoo, et. al.  
Submitted to: Physics of Plasmas (January 2014)

Response of Impurity Particle Confinement Time to External Actuators in QA-mode Plasmas on DIII-D PPPL-4980  
Authors: B.A. Grierson, et. al.  
Submitted to: Nuclear Fusion (December 2013)

The Double Well Mass Filter PPPL-4981  
Authors: Renaud Gueroult, et. al.  
Submitted to: Physics of Plasma (December 2013)

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