



**The PPPL Highlights for the week ending November 9, 2012, are as follows:**

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

ECE experts in the U.S. were briefed on developments since the Conceptual Design Review last December. Since that time, a close look at the shielding effectiveness of the labyrinth proposed at the CDR indicates that some of the penetrations through the shield will need to be eliminated. The impact on the ECE diagnostic is that the hot calibration sources will need to be relocated within the diagnostic shield module, where they will be more difficult to maintain.

In preparation for a System Integration Review to be held November 20 for equatorial port plug E11, the corrugated waveguide runs for the LFS Reflectometer are being remodeled, this time not simply as pipes, but including proper space for miter bends, valves, and windows.

A second iteration on a draft Task Agreement on development of the conceptual design for the Motional Stark Effect Diagnostic was circulated among stakeholders, and reviewer's comments incorporated.

### **NSTX (M. ONO):**

NSTX-U is in the Upgrade Project outage in FY 2013.

A special issue of the International Symposium of Lithium Application for Fusion Devices was published on [Fusion Engineering and Design Volume 87, Issue 10](#), Pages 1709-1800, October 2012. The NSTX related articles in the special issue are: "Modification of the Electron Energy Distribution Function During Lithium Experiments on the National Spherical Torus Experiment," by M.A. Jaworski (PPPL), "[NSTX plasma operation with a Liquid Lithium Divertor](#)," by H. W. Kugel (PPPL), "[Dynamics of deuterium retention and sputtering of Li-C-O surfaces](#)," by P.S. Kristic (ORNL), "[Modeling of plasma/lithium-surface interactions in NSTX: Status and key issues](#)" by J.N. Brooks (Purdue U.), "[Recent progress of NSTX lithium program and opportunities for magnetic fusion research](#)" by M. Ono (PPPL), and "Characterization of Transient Particle Loads During Lithium Experiments on the National Spherical Torus Experiment" by V. Surla (U. of Illinois).

A paper entitled "Two-dimensional Characterization of ELM Precursors in NSTX" by Y. Sechrest (University of Colorado), et al., was published in Nucl. Fusion 52 123009 (2012), <http://iopscience.iop.org/0029-5515/52/12/123009/>. The article details the observation of coherent intensity fluctuations preceding ELM events in the NSTX edge. The Gas Puff Imaging

(GPI) system captured the evolution of these precursors in two-dimensions through the ELM filamentation and crash. ELM precursors are characterized by short-lived, coherent intensity fluctuations visible in the outer few centimeters of the plasma, and the intensity oscillations are observed to grow in strength preceding the ELM crash. Intensity fluctuations measured by the GPI system were also strongly correlated with magnetic fluctuations, and magnetic pick-up coils estimate intermediate toroidal mode numbers. A detailed characterization of the precursor mode and discussion of the nature of the precursors can be found in the full article.

S. Kaye (PPPL) participated remotely in a portion of the RLPAT International Advisory Committee Meeting and Workshop on the Scientific Basis and Roadmap Towards a Neutron-Source Based on the Spherical Tokamak Concept that was held in St.Petersburg, Russia on October 31-November 3. RLPAT stands for Research Laboratory for the Physics of Advanced Tokamak Physics, whose purview is to interconnect the fusion research efforts of the Ioffe Institute and the St. Petersburg Polytechnic University. The RLPAT is headed by Prof. F. Wagner. S. Kaye and C. Neumeier of PPPL gave remote presentations at the Workshop entitled "From NSTX to ST-FNSF" and "Technical Challenges of Spherical Tokamaks" respectively. The first talk focused on how NSTX and NSTX-U will address physics issues critical to the development of an ST-based FNSF design, and the second focused on the engineering issues in constructing both NSTX-U and an ST-FNSF. S. Kaye is also a member of the RLPAT International Advisory Committee, and will be working with the other committee members to develop a set of recommendations for the RLPAT.

Jon Menard (PPPL) participated in the Research Councils UK (RCUK) Fusion Advisory Board November 5-6 and presented a summary of the MAST PAC held this past May.

NSTX Upgrade construction activities continued this week and are highlighted in the Engineering section below.

Preparations of non-upgrade equipment for plasma operations in the NSTX-U configuration also continued with the ongoing testing of the prototype fault detector in conjunction with the new firing generator in a field coil power conversion rectifier. The primary power breaker has been racked-in for that rectifier, and faults/trips are being simulated and tested. A final design review of the proposed reconfiguration of the PF1 power systems is scheduled for next week.

Access to the NSTX test cell will be available only through previous arrangement with the Upgrade Work Control Center.

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

### **Alcator C-Mod (R. Ellis III):**

A preliminary design review for the Advanced Divertor Upgrade was held at MIT. R. Ellis and Han Zhang traveled to MIT for the review, and others from PPPL participated by videoconference. The major technical issues and challenges were discussed thoroughly. A report from the review panel was issued on November 8.

C. Kessel attended the APS-DPP meeting in Rhode Island, and presented the progress on ITER similarity experiments in Alcator C-Mod. Experiments demonstrate that allowing an H-mode to form late in the ramp-up phase could save 50% more V-s than just heating in L-mode, and another 50% could be saved by increasing the heating while in the H-mode. The flattop experiments targeting the ITER values for  $q_{95}$ , shape,  $\beta_N$ ,  $n/n_{Greenwald}$ , and H98, were extended in 2012 to higher net power to the plasma, however the energy confinement was degraded strongly as the  $n/n_{Greenwald}$  ratio went from 0.65 to 0.85. From profile measurements this could be seen to be a severe cooling of the pedestal temperature region by  $> 2x$ , while the core temperature changed only weakly. The ramp-down phases of these flattop experiments were used to examine the higher density range, and all guidance established for ITER from earlier rampdown experiments were confirmed. The H-mode ramp-down approach was found to have the density pedestal following the plasma current downward, while the temperature pedestal has a strong drop early and very slow drop after that. The H-L back transition in the H-mode rampdown phase was found to occur at ratios of net power to LH threshold power of  $\sim 0.5$ , indicating a hysteresis.

S. Zweben presented a poster entitled: "Edge Turbulence Flows at Two Different Poloidal Angles in Alcator C-Mod", by S.J. Zweben, J.L. Terry et al. Related to this work, Jim Myra of Lodestar gave an invited talk based on his C-Mod and NSTX blob studies, "Edge Sheared Flows and Blob Dynamics", by J. R. Myra, W. M. Davis, D. A. D'Ippolito, B. LaBombard, D. A. Russell, J. L. Terry, and S. J. Zweben.

At APS, L. Delgado-Aparicio presented a paper, "On the Kink Formation and Stability of Long-lived Impurity 'Snakes' in Alcator C-Mod." S. Scott presented a poster, "Performance Assessment of C-Mod MSE Upgrades." S. Harrison presented a poster, "Design, Engineering and Testing for the Alcator C-MOD Outer Divertor Upgrade."

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

Progress in our collaboration with the LHD stellarator at the National Institute for Fusion Sciences (NIFS) in Japan was reported by Novimir Pablant. A new dual crystal was installed in the U.S. x-ray imaging crystal spectrometer (XICS) diagnostic, enabling the system to resolve Ar16+ and Ar17+ spectral lines. First data were obtained immediately after installation, a clear Ar16+ spectrum from plasmas with electron temperature around 2 keV. The work is being performed by Pablant, who is on assignment at NIFS for the 2012 experimental campaign, in collaboration with NIFS colleagues Drs. Morita and Oishi.

Advanced Projects work was represented in several papers at the Annual Meeting of the APS Division of Plasma Physics in Providence, Rhode Island. Papers included "3D Equilibrium Reconstruction in Stellarators and Tokamaks with STELLOPT," by S. Lazerson et al.; and "Origin of Tokamak Density Limit Scalings," by D. Gates, et al.

### **THEORY (A. BHATTACHARJEE):**

Many researchers from the theory department attended the Annual Meeting of the APS Division of Plasma Physics in Providence, Rhode Island October 29-November 2. Three theory

department members gave invited talks; Ilya Dodin "[Quantum Physics of Classical Waves in Plasma](#)", Guoyong Fu "[M3D-K Simulations of Beam-Driven Alfvén Modes in DIII-D](#)" and Igor Kaganovich "[Plasma-Wall Interaction in Presence of Intense Electron Emission from Walls](#)". A recent Princeton University graduate, theory department student Dr. Paul Schmit presented an invited talk titled "New Wave Effects in NonStationary Plasma".

### **COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):**

Professor Mo and his group visited PPPL and gave a seminar on JASMIN (J Adaptive Structured Meshes applications INfrastructure) on November 8. JASMIN is a parallel software platform using adaptive multi-level structured grids. It has been developing in the Laboratory of Computational Physics (Beijing, China) led by Professor Zeyao Mo. The main objective is to accelerate the large scale simulations of complex on parallel computers. Written in C++ and Fortran mixed-language model and built on public domain standards of MPI, OpenMP, C++, HDF5, it is layer and component designed to facilitate and ease the learning curve of user application code development. Tens of parallel programs have been reconstructed or developed to achieve high performance on thousands of processors with major applications in ICF and CFD. JASMIN promotes a new paradigm of parallel programming in the Chinese scientific community.

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

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

The preliminary vessel cut for the Bays JK nozzle for NB2 was completed this week. Final cutting should occur next week.

Installation of the new umbrella legs continues and is nearing half way complete.

Straightening and drilling of the TF flags has been completed.

Four (4) new bars were delivered to the soldering area. Four TF conductors have been post solder cleaned and transported to C-site MG room for temporary storage. Work continues on aligning the previously installed Quadrant 1 conductors in the mold. Three conductors have been sandblasted, and five TF conductors were post solder baked. A total of 30 TF conductors are now on site.

PPPL visited Martinez-Turek for final inspection of the CS casing prior to final welding of main components.

Procedures for the Quad Mold Assy, VPI, and VPI Emergency Response Procedure have been approved. Mfg. Spec and SOW for Inner PF coils is out for review.

Zenex delivered the MPTS optics box alignment fixture and Cu-Cr-Zr test coupons. The first production TF flex connector will be completed in two weeks. Carolina Fabricators began fabrication on the TVPS vacuum pump magnetic shielding.

NBI Upgrade: The monthly job status meeting took place this week with active jobs reporting earned value. Refurbishment activities continued on the 90 inch flange. The calorimeter has been reassembled and operated but corrections on drive screws will be required. Cryo line fabrication continues in the NB shop. The Bay JK weldment final machining was completed. The lift fixture modifications are complete; the lift procedure has been developed and is in review. The load test is imminent.

**Facilities and Site Services (M. Viola):**

Operations: F&SSD cleaned up after the Nor'easter snow storm. Demolition phase for HP Office renovations is essentially complete. Next week installation of electrical lighting, HVAC ductwork and fire protection sprinkler piping will commence. Under floor HVAC condensate piping redistribution system in the PPLCC is being reworked along with a new sump pump for next week. Insulation work on the Eng. Wing roof continues. The Commons patio work should resume next week and require about three weeks for completion.

Fire Protection: Ray Jeannes checked and approved drawing revisions for Engineering Print Room card reader and assisted plumbers with dry valve restoration of the HazMat Sprinkler System.

Telecommunications: The telecommunications office is looking into a telecommunications service offered from Verizon under DOE's Network Agreement for phone and data circuits. This service offers its customers special priority response time and restoration for services critical to agencies operations. There is an additional fee for this priority service, which could be approved by management. As a preventive maintenance action plan, Altura, our phone system vendor, replaced Gateway #1 in the phone system the evening of November 8. Gateway 1 supports approximately 168 analog phone users. Prior to the system firmware and wiring upgrade, station cards on Gateway 1 had the majority of the problems. Twelve (12) new portable radios were received for SPD.

Steam Plant: Cooling systems at C-Site have been reconfigured for winter operations. Contact Henry Carnevale x3039 if there are any cooling needs at C-Site not accounted for this winter.

Project Management and Energy Management: Federal Information Management System (FIMS) data entry is complete. Ana Pinto is working on the site sustainability plan and the CEDR.

Material Services: We are working on the Site Sustainability plan.

**Office of Project Management (T. Stevenson):**

Development of the work planning online system revision 6.0 continues. On page format changes are in progress. Testing in the development area is planned.

A System Engineer presentation for an online training package on ENG-016 was completed and forwarded to the Training Office for development.

An EVMS surveillance self-assessment took place this week with primary focus on NSTXU. Project Office and CAM interviews took place to assess EVMS integrity.

#### **BUSINESS OPERATIONS (E. WINKLER):**

The PPPL Travel Office has reported conference attendance data to DOE for all conferences PPPL participants are planning to attend during January-February 2013. This information was submitted using a new automated conference management database system developed by DOE.

Natalya Gnyp attended the National Contract Management Association's Annual Government Contract Management Conference, held in Washington, DC. As a member of this year's highly selective NCMA Contract Management Leadership Development Program (CMLDP) class, Natalya participated in a special Covey leadership training program, and was an observer at the NCMA Board of Directors meeting.

Rod Templon participated in the monthly Procurement Evaluation and Re-engineering Team (PERT) telephone conference. Agenda topics included a wrap-up on FY2012 site purchasing system peer reviews; a look ahead at the ten peer reviews scheduled for FY 2013; and updates on subcommittee activities for establishment of a PERT Strategic Advisory Council and transition of the PERT Internet home page from the Hanford website to OMB.max (a secure Government site).

Rod Templon issued his annual reminder memorandum on the proper handling and disposition of supplier gifts and gratuities.

#### **ENVIRONMENT, SAFETY, HEALTH & SECURITY (J. LEVINE):**

ESU Engine 66 responded to Princeton for three mutual aid assignments and to PPPL for one assignment (odor of smoke in the PPLCC). ESU Ambulance A-166 responded to Plainsboro for two mutual aid assignments.

Fran White has been invited to serve as a member of the DOE Office of Science Safeguards and Security Advisory Committee for a two year term effective November 26. As a committee member, Fran will serve as a special consultant to the Office of Science. The committee provides significant advice and recommendations on technical issues and on other matters relating to the safeguards and security programs at DOE non-weapons laboratories.

The DOE Office of Science and Office of Health, Safety and Security rescheduled their visit to PPPL for a DOE Peer Review Risk Assessment of PPPL to November 26-30. The reviewers will tour the Laboratory and assess the risk to Departmental assets and the physical protection of those assets.

In preparation for a Nor'easter, SPD distributed several weather advisories to staff. As per EPIP-06, Natural Emergencies, a storm preparatory meeting was held on November 6 with Laboratory departments and subject matter experts to discuss situational awareness and plans to deal with any physical impacts to the Laboratory.

SPD hosted a "Lessons Learned" meeting to discuss the physical impacts of Hurricane Sandy, our response, recovery and after-action activities. Several items were brought up for discussion and will be considered.

The US Flag was lowered to half-staff on November 9. New Jersey Governor Christie ordered the flag of the United States of America flown at half-staff to honor the service and sacrifice of United States Navy Petty Officer 2nd Class Matthew G. Kantor. Officer Kantor, 22, a resident of Gillette and graduate of Watchung Hills Regional High School, tragically lost his life while supporting stability operations in Zabul, Afghanistan on November 1.

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

The first of four software requirements documents for the NSTX-U Coil Protection System has been approved. This enables preliminary design activities to proceed.

Recovery of NSTX-U computer systems following the Sandy-related power outage is complete; only minor issues.

Bill Davis presented a poster at the APS meeting entitled "Visualizing and Quantifying Blob Characteristics on NSTX."

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

The Laboratory, in concert with the Princeton University Office of Communications, hosted a national meeting of Ivy Plus Social Media, a group of new media specialists from Ivy League Universities plus several others from across the country, at PPPL on October 25. C. Cane represented the Lab and the PPPL OoC, giving a presentation to the group about PPPL's social media presence. The group also held two roundtables at PPPL as part of a two-day meeting that spanned the main and Forrestal campuses. J. DeLooper gave the group a tour of the NSTX control room and portions of C- and D-sites. During the tour by DeLooper, two members of the group posted Instagram images with positive comments on the tour. Cane, in turn, retweeted those remarks. In addition to PPPL and Princeton, the group included digital communications leaders from Caltech, Duke University, the University of Chicago, the University of Pennsylvania, Yale University, Dartmouth University, MIT, and Cornell University.

Cane also participated in the DOE Web Council meeting on November 8. A presentation was given on Drupal search capabilities on [energy.gov](http://energy.gov) and there was a discussion on the web council charter.

G. Czechowicz conducted design and layout of the ESH&S Newsletter. J. Jackson DeVoe provided editing expertise.

J. Jackson DeVoe did press outreach on behalf of the site protection division to alert the surrounding communities via blogs and newspapers and other online entities that PPPL was serving as a Warming Center in the aftermath of Hurricane Sandy. She wrote a story about PPPL's response to the storm and worked with J. Greenwald, who wrote a story about visitors to

the Warming Center. Greenwald reached out to several radio stations, which in turn ran on-air announcements about PPPL's efforts.

J. Greenwald wrote a summary of the October 29-November 2 APS-DPP Annual Meeting for the Weekly and the ITER Newslite. In addition, he tracked down a PPPL news release that had gone missing from the APS-DPP website and has now been restored to the site. (The PPPL Communications Department produced seven of the 15 highlighted releases on the APS-DPP site.)

Greenwald also met with Colleen Finnegan, at the Princeton Alumni Weekly, as well as K. MacPherson, to discuss paper options for the PPPL magazine that Greenwald is overseeing and that is scheduled to run as a PAW insert next June.

K. MacPherson participated in a monthly teleconference with ITER Communications in Cadarache, France, on November 5. Communicators from throughout the world participated and gave reports, including those in China, France, India, Japan, Korea Spain, the United Kingdom, U.S. ITER in Tennessee and PPPL. She reported that those managing the PPPL site prepared wisely for Hurricane Sandy and the site was spared the worst of it. All expressed support and best wishes to PPPL and its staff during this difficult time. She also described PPPL's extensive participation in the APS-DPP meeting and was asked if PPPL's OoC could prepare a story for an upcoming ITER newslite. J. Greenwald prepared a story and filed it with ITER. E. Starkman, using photos kindly provided by science education of the APS Science Expo, processed the images so that they would meet the resolution requirements of the ITER newslite.

MacPherson assisted a student journalist from the Daily Prince with a request for information for a story about the Lab's response to Hurricane Sandy. Story here:

<http://www.dailyprincetonian.com/2012/11/08/31739/>

She also assisted Seth Borenstein, an AP National Science Writer, with a request for an interview with a Laboratory expert on computer modeling and simulation. Bill Tang was interviewed by Borenstein, as a result.

<http://www.wistv.com/story/20061065/predicting-presidents-storms-and-life-by-computer>

E. Starkman attended the Photo Plus International Expo and Trade Show at the Jacob Javits Center in New York on October 25-October 26. She attended three different seminars. One was related to using speed lights, a second one involved hands-on training in editing videos using Photoshop, and the third, also hands-on, delved deeper into video editing using Adobe Premier Pro.

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

A. Zwicker participated in a conference call as part of the planning of an APS/AAPT Joint Undergraduate Curriculum Task Force. The proposed task force would look at recommendations for coherent and relevant undergraduate curricula (including course work, undergraduate research, mentoring, etc.) for different types of physics majors in collaboration with the APS and AIP and with developing recommendations for the implementation and assessment of such curricula.

**DIRECTOR'S OFFICE (B. SOBEL):**

On November 7-8, the Princeton Plasma Physics Laboratory's Advisory Committee met for its bi-annual meeting. On November 9, the chairmen of the Science and Operations Committees delivered their findings to Princeton University.

On November 7, Dr. John Lindl, Lawrence Livermore National Laboratory, presented a colloquium entitled "New Results from the National Ignition Facility (NIF)".

On November 9, Mike Zarnstorff held a meeting of the Research Department heads.

This report is also available on the following web site:

<http://www-local.pppl.gov/director/highlights/2012-highlights.htm>