



**The PPPL Highlights for the week ending August 17, 2012, are as follows:**

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

NSTX-U is in the Upgrade Project outage in FY 2012, and construction activities continued this week as highlighted in the Engineering section below.

Preparations of non-upgrade equipment for plasma operations in the NSTX-U configuration also continued. Strategies for the recommissioning of the field coil power conversion system are being developed, and the assembly of the new firing generators for these power supplies has started.

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

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

Raffi Nazikian was session leader for an experiment aimed at achieving RMP ELM suppression in the ITER baseline plasma under steady state conditions at 1.6 T,  $q_{95}=3.1$   $\beta_N=1.8$ . ELM suppression was achieved using a single upper row  $n=3$  I-coil configuration. ECCD was required to suppress internal MHD activity. Neutral beams were operated at 65 kV to suppress core fishbone activity. The suppression of core MHD coincided with improved ELM suppression.

Gerrit Kramer visited DIII-D to participate in an experiment to investigate the effect of applied 3D fields on fast ion transport. The experiment used a rotating  $n=2$  magnetic perturbation applied to a low-elongation L-mode plasma. Preliminary analysis indicates that the bulk of the observed coherent fast ion loss at the  $n=2$  rotation frequency is primarily due to modification of prompt beam losses. This is similar to results obtained previously for the coherent losses induced by Alfvén eigenmodes.

Michio Okabayashi participated in an experiment to explore the effect of off axis beams on fishbone induced ELMs. The two dimensional time evolution of the EP profile was documented using the passive Fast Ion D-Alpha (FIDA) diagnostic. Microwave-reflectometer measurements will be used to characterize the ELMs triggered by the EP driven mode.

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

Ahmed Diallo travelled to C-Mod to lead a pedestal experiment (1120815 - MP709). The goal of this experiment was to characterize the pedestal evolution during EDA-H mode and document the transition from EDA-H mode to ELMy regimes using the same plasma shape. After an

unsuccessful attempt to utilize lower hybrid to decrease the collisionality of the pedestal, a density scan was used to achieve ELM regimes. During these regimes, fluctuations were documented using a magnetic probe positioned near the limiter. Good fluctuations data were obtained with relatively fast ELMs.

Bob Ellis traveled to CMOD to work on the hot outer divertor project. Recent results shunt pin tests were discussed Randy Wilson traveled to MIT to work with Greg Wallace on interpreting recent Lower Hybrid results.

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

First results from the PPPL x-ray imaging crystal spectrometer on LHD were published in Reviews of Scientific Instruments; the article is "Layout and results from the initial operation of the high-resolution x-ray imaging crystal spectrometer on the Large Helical Device, by N. A. Pablant (PPPL) and co-workers from PPPL, National Institute for Fusion Science (NIFS), and MIT. This diagnostic system has been operational since the beginning of the 2011 LHD experimental campaign and is the first application of the XICS diagnostic technique to helical plasma geometry. The XICS diagnostic provides measurements of ion and electron temperature profiles in LHD with a spatial resolution of 2 cm and a maximum time resolution of 5 ms (typically 20 ms). The final hardware design and configuration are detailed along with the calibration procedures. Line-integrated ion and electron temperature measurements are presented, and the measurement accuracy is discussed. Finally central temperature measurements from the XICS system are compared to measurements from the Thomson scattering and CXRS systems, showing excellent agreement.

The Project Execution Plan for the Wendelstein 7-X Trim Coil Power Supply Project was approved by PPPL, DOE-Fusion Energy Sciences, and the Max Planck Institute for Plasma Physics (IPP). PPPL is responsible for design, fabrication, acceptance testing, delivery to the W7-X site, and commissioning of five power supply units. PPPL will maintain technical responsibility for the power supply units through completion of commissioning. IPP is responsible for delivering valid requirements and interface information to the U.S. team, and for installing the equipment at the W7-X site. The plan calls for all equipment to be delivered to IPP by August 2013 and for commissioning to be completed in 2014.

### **FUSION SIMULATION PROGRAM (W. TANG):**

Bill Tang participated at the national "Productive Programming Models for Exascale Workshop" hosted by Pacific Northwest National Laboratory (PNNL) on August 14-15, 2012 and presented an invited talk on "Exascale Challenges for Programming Models in Fusion Energy Sciences." The associated agenda and abstracts for this national HPC workshop are posted at: <http://xsci.pnnl.gov/ppme/>.

## **THEORY:**

Mr. Feng Wang, a graduate student from Dalian University of Technology, Dalian, China, returned to China after an extended visit to PPPL from January 2011 to July 2012. During his visit, he worked with his host, Dr. Guoyong Fu, and Josh Breslau on nonlinear simulation of non-resonant kink modes in NSTX using the M3D code. He found that plasma rotation can greatly reduce the  $m=2/n=1$  island width. The fast beam ion distribution is flattened by the saturated  $m=1/n=1$  mode. Feng Wang will continue this collaborative research in China as a part of his Ph.D. thesis work.

Thomas Dickerson of St. Michael's College, a NUF student, worked with Wei-li Lee and Ed Startsev of the Theory Department on some numerical problems associated with shear-Alfvén waves in tokamaks. Specifically he investigated: 1) the time step in the simulation as a function of plasma beta, and 2) the formation of shear-Alfvén eigenmodes in the presence of plasma inhomogeneities, also as a function of plasma beta. Results will be presented at the upcoming APS meeting.

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

This summer, the CPPG mentored two National Undergraduate Fellowship (NUF) program interns, two Science Undergraduate Laboratory Interns (SULI), and two high school science interns. NUF student David Perkins (BYU) worked with S. Ethier and W. Wang on improving the performance and scalability of the GTC-NEO particle code, while Andrew Ritchie worked with S. Jardin on benchmarking M3D-C1 linear resistive results with an asymptotic matching code. SULI student Jeffrey Lestz (Washington University) and high school student Sadik Shahidain (Princeton High) also worked with Stephane Ethier and Weixing Wang on the development of a MATLAB-based analysis tool to explore the microturbulence data generated by the GTS simulation code. SULI student Matthew McMillan (Wheaton College) worked with Sam Lazerson and Eliot Feibush on modeling, benchmarking, and visualizing neutral beams in 3-D MHD equilibria. Finally, high school student Hadar Lazar (Bergen County Academy) was supervised by Eliot Feibush worked with the MRX team investigating the scaling and merging of magnetic islands as guide fields are applied.

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

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

Bay L is being set up for the vessel cut next week. Umbrella leg fit-up continues along with the clearing of interferes with new rib stiffeners. TF clevis pad welding to the vessel continues. The repair of the welds on the JK cap continues - about 75% done. TF quadrant mold repairs continue with the machining of a new end cap.

TF Conductors: Three soldered TF conductors were ground and delivered to the CS Manufacturing Facility. These three (3) conductors have been loaded into the oven for post solder bakeout. Four (4) TF conductors have completed final machining & metrology inspections at Major Tool and will be shipped to PPPL. The fifth conductor is still in inspections and will be

delivered with the next TF delivery. EWI has completed & inspected three (3) conductors with two (2) additional completed FSW's awaiting inspection. Once completed these will be sent to Major Tool for final machining. Two additional conductors were insulated & ready for mold in the coil winding area. This makes six (6) of the nine (9) bars ready for mold assembly.

VPI Activities: VPI trials were completed and the mold was opened for examination. The inspection shows a good quality VPI with no indications of dry areas - the bundle was cross sectioned indicating fill throughout. During the VPI and the inspection indicated no evidence of an exothermic reaction. This completes the VPI trials. An emergency response procedure has been generated and distributed for review. This procedure will cover emergencies during the VPI of any of the CS coils.

Centerstack Casing: Martinez-Turliz the manufacturer for the CS centerstack, has decided to remake the center sleeve instead of attempting a repair. PPPL has agreed with path forward with a revised delivery date of December 1. (This does not delay the overall project schedule)

OTF Weldments: The first of 12 weldments is being reworked by an outside vendor. The vendor reported they ground out all the applicable welds that needed beveling, had the parts "fit-up" and verified by QA. The welds were completed and reinforcement was added to the remaining welds that were undersized. Some small weld issues were detected by the inspection, which determined that the welds can be accepted as-is. Next operation will be the hole drilling next week. This first part will be shipped to PPPL for approval before the remaining units are worked on.

Remaining Outside Structure Part Fabrication: The vertical umbrella stiffeners are nearing completion and are scheduled to complete and ship next week, probably August 23. The PF4/5 Column weldment parts were all completed and are welded. Weld inspection was also completed. The last machining operation to machine the two (2) ends parallel is being set up now and should complete by Tuesday (these will ship next week). The Pf4/5 Clamp Part, slide Groove, and Clamp weldment items are completed and in inspection. One remaining part to this order is waiting for a "special" cutter that is scheduled to arrive late next week, or early the following week. Based on the cutter delivery, it looks like these will ship around August 30.

NBI Upgrade: Activities continue in the NB Shop and Tech Shop, the NTC and MER, and the TTC. Full HP support continues to keep pace with project requirements including the extra coverage required for penetration drilling. Repair of the cap and port extension continues in the Tech Shop with the additional welding nearing completion. Drilling of penetrations has been completed. An alignment drawing, process, and procedure is being developed for the installation alignment of the Bay JK cap, Beamline box, 90 inch flange, the source platform, and its rails.

NBI Armor: Backing plate machining on the second plate continues as a background task in the shop.

NBI Relocation: Progress continues on preparations for the BL and lid moves. Detailed logistics for transport in the TTC, South High Bay, and NTC have been developed. Decon of the box and lid is in progress. The IP for the beam box, lid, and supports has been developed and drafted and will go out for review soon.

NBI Power: All of the power supply cabling penetrations have been completed in the NTC West wall.

NBI Services: Fabrication of cryo lines continues in the NB shop. The services penetration work in the NTC has been completed. With the completion of penetrations, the articulated lift usage will return to cryo line installation.

NBI Controls: LCC controls and wiring modifications continue on the NBPC 138 level.

NBI Duct and TVPS: The Bay JK weldment and port extension welding repairs continue in the effort to correct the many welding errors by the vendor. Essentially all of the welds have been examined and redone. A significant amount of additional weld passes have been added so the repaired unit will be fully satisfactory and probably even superior to the original design. Preparations for leakchecking the weldment are underway. Port extension repairs are also started but focus has been on the JK weldment. Machining of a duct flange is in progress in the Tech Shop. Additional WAF details are being added to the rectangular bellows flange fabrication to improve EVMS tracking of this package.

An installation procedure for the NSTX Platform Sprinklers has been prepared and submitted in preparation for starting work on Monday.

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

The monthly Project Status Review Board meeting was held this week to review projects through July close. Twelve active projects provided status reports indicating good progress and solid performance matrices.

Development of the Systems Engineer training per ENG-016 is in progress and a draft version nears completion.

Development of the revision to the Work Planning online system 6.0 is in progress by IT.

Two COGs have completed training and have been added to the Work Planning system. Editing of the COG/RLM list continues.

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

Roof Project: The PPLCC roof upgrade has been completed with the installation of the skylights. A meeting was held at PPPL with Aetna Roofing and URS to resolve the unforeseen drainage issues on the Commons Deck project. A solution was determined and work will proceed after the design details and cost are finalized. The prep work in the C-Site MG Building has been completed, including the installation of a protective structure over the switchgear. Work on replacing the Low-Roof of the MG Building will start on August 20, weather permitting.

Maintenance: The boiler repairs are complete. We are waiting for the date for annual state inspection.

All D-site steam traps have been rebuilt or replaced and work has begun on C-site traps. Estimate completion in four weeks.

The pump basins at the canal have been cleaned. Preparations are being made to replace Pump 1 with our spare.

The MicroMain Facilities work order system went down and emails are being used instead. This is a global problem with MicroMain and alternative solutions are being considered.

Telecommunications Office: In accordance with a PPPL Procedure, 'Testing of the UPS Systems for the Radio System', this procedure is planned for next week. This is an annual test used to conduct a load test of the UPS systems supporting the Lab's UHF radio system. Key Site Protection personnel are required to sign off and approve the test procedure. The test will de-energize the AC power supply and allow the entire radio system to be powered by the UPS system for 30 minutes.

Bill Bryan confirmed with the DOE's Spectrum Manager, that the Lab's RF Authorization for VHF 164.375 frequency operating PPPL's paging system will be approved for another five years. The license renewal will be good until July 8, 2017. The new license will take about four months to be processed.

The replacement of two (2) console radios seemed to have resolved the 'All Call' feature problem of not transmitting. Since the radios were replaced by our radio vendor, WPCS, under the Lab's maintenance agreement, the feature has not had any problems.

Bill is working with Verizon Wireless to provide a solution for Jim Hirsch in providing a backup wireless Internet access system for the Lab. Verizon Wireless plans to come to the Lab to present and discuss options.

Material Services: The Property Office produced a "Hazardous Review Form" that will be completed by ESH&S for disposition of personal property (requirement of DOE Order 580.1A). This DOE/Princeton Site Office approved form will be shared with other DOE Laboratories. The Material Services Property Office has completed 97% of the Wall-to-Wall Personal Property Inventory with excellent results to date.

Fire Protection: An ACAMS module in the sub-panel at HazMat failed during an electrical storm. There is no evidence of a strike but possibly there was a surge of some sort. The module has been replaced and the system returned to normal. Problems continue with ACAMS possibly associated with the recent upgrade. Major problems with the Simplex Fire Alarm System began Sunday night and continued through Wednesday. Follow-up continues with Simplex.

Cafeteria: The pass-through refrigerator should be completed by Jay-Hill next week, after we receive the gaskets and hardware.

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

PPPL submitted footnote disclosure information to DOE for Contractor Postretirement Benefits Other Than Pensions. This information was prepared by the Princeton University actuary, CASCO, and will be used by DOE in the development of consolidated footnote disclosure information as a basis for reconciling the PRB estimates to the appropriate accounts.

Representatives of the PPPL Procurement Division, the PPPL ITER Fabrication Department, and DOE's Princeton Site Office (PSO) participated in a telephone conference with representatives from the US ITER Project Office (USIPO) at ORNL and DOE's Oak Ridge Operations Office (ORO). Topics discussed included: the status and scope of PPPL's ITER steady state electrical network (SSEN) procurement arrangement with the ITER Organization; coordination of oversight requirements and documentation flow between USIPO and PPPL, and between DOE-PSO and DOE-ORO; and, the possibilities for streamlining the review process for SSEN hardware procurement approvals.

The Procurement Division received a revised purchasing system approval letter from the DOE Contracting Officer. The letter raises the threshold for Contracting Officer review of intercontractor purchases (i.e., agreements between two DOE management & operating contractors) from \$500,000 to \$1,000,000.

Natalya Gnyp has been selected to participate in the National Contract Management Association's 2012-2013 Contract Management Leadership Development Program. This highly competitive program is designed to help develop the next generation of contract management leaders through an intensive, yearlong educational experience. Program participants receive 180 hours of professional training in leadership skills and acquisition management, and are prepared to undertake governance roles in the NCMA's local, regional and national organizations.

PPPL received third year funding of \$124,900 for the work for others project titled Collaborative Research on Electron Dynamics and Waves During Fast Magnetic Connection in Space and Laboratory". The Principal Investigator for this effort is Hantao Ji.

A work for others agreement with Alameda Applied Sciences Corporation (AASC), a small business located in San Leandro, California, was submitted to the DOE for approval. AASC is the recipient of a DOE Phase I SBIR award titled "High Separative Power Vacuum Arc Centrifuge" under which PPPL is a participant. The total funding to be provided to PPPL by AASC is \$44,000. The PPPL Principal Investigator is Nat Fisch.

PPPL is a collaborator on two proposals submitted in response to DOE Funding Opportunity Number DE-FOA-0000744: Diagnostic Systems for Magnetic Fusion Energy Sciences. Brent Stratton is the PPPL Principal Investigator for the proposal titled "Development of Millimeter-Wave Imaging Systems for Multi-Dimensional Measurements" submitted by the University of California - Davis. The PPPL budget request is \$350,000 for the four-year period of performance. Doug Darrow is the PPPL Principal Investigator for the proposal titled "Improvements to JET Faraday Cup Lost Alpha Diagnostic KA2 with Application to ITER" submitted by the Colorado School of Mines. The PPPL budget request is \$44,000 for the three-year period of performance.

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

DOE's Sustainability Performance Office selected PPPL for a 2012 DOE Sustainability Award for our comprehensive greenhouse gas (GHG) management program. The comprehensive laboratory-wide management of GHG emissions has resulted in a 50% reduction of Scope 1 & 2 GHG emissions and a 48% reduction of total GHG emissions in just three years.

ESU Engine 66 responded to Plainsboro for one mutual aid assignment and Ambulance A166 responded to Plainsboro for three mutual aid assignments.

Discharge of the Halon System in the NSTX Control Room occurred on August 13, resulting in submission of an ORPS Report (SC--PSO-PPPL-PPPL-2012-0005).

A Lithium-moist air reaction in the COB Building occurred on August 14, resulting in submission of an ORPS Report (SC--PSO-PPPL-PPPL-2012-0006).

The PPPL Counterintelligence Officer, Paul Moskal, visited the Laboratory on August 14-16.

PPPL ESU and Princeton University Department of Public Safety held a joint training exercise on the evening of August 16 at the High Performance Computing Research Center on B-Site. During this drill, personnel from both units practiced and critiqued security response protocols and interoperability, as described in the Memorandum of Understanding between Princeton University, Princeton Plasma Physics Laboratory and the U.S. Department of Energy.

The biennial DOE Safeguards and Security Survey of PPPL will be held on August 20-22. All staff are reminded to be aware of their security responsibilities (such as wearing your ID Badge in plain view and closing/locking your office door when leaving the facility). In addition, please review PPPL's Computer Use Policy ( <http://www.pppl.gov/eshis/policy/p088.pdf>) and remember to have a password-enabled screen saver set for a maximum of 15 minutes.

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

The throughput of PPPL's edge firewall was upgraded to more fully utilize the 10Gb ESnet link to the Internet. This resulted in a significant boost in performance as noted in speed tests.

Steve DeLuca has updated the parts lists for the GA integrator boards, to replace no-longer-available electronic components.

Comments on the second draft of the NSTX-U DCPS Software Requirements document were sent. Keith Erickson wrote and tested the NSTX-U TF Rampdown algorithm for PCS.

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

On August 15, the Science Education department hosted it's annual Student Poster Session 24 undergraduate students and 10 high school students proudly presented the work they have performed during their time at the Lab this summer.

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

On August 13, Adam Cohen hosted Ed Dickson (Director of NJ Homeland Security) and Dennis Quinn (Chief of Staff for NJ Homeland Security) for a tour and discussions of PPPL activities. Fran White discussed Security technologies at PPPL and provided a description and tour of the new NightOwl asset tracking system.

On August 14, Adam Cohen attended a Contractor's HR Meeting in New York, NY.

This report is also available on the following web site:

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