



**The PPPL Highlights for the week ending August 24, 2012, are as follows:**

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

NSTX-U is in the Upgrade Project outage in FY 2012.

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. Painting and general maintenance of outdoor power system transformers, the RF transmission line bridge, and the helium tank catwalks is in progress. Installation and test procedures for a prototype field coil power conversion system fault detector are being developed and reviewed.

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

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

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

Egemen Kolemen led an experiment to "Catch and Subdue" the 2/1 NTM. In the experiment, NTMs were identified in real-time using real time magnetic spectrum calculations. Real-time steerable mirrors were controlled to follow the  $q=2$  surface throughout the shot. When the mode passed a given threshold amplitude, the ECCD was deposited at the 2/1 island location. Partial suppression was observed at high plasma density however there was insufficient power to suppress the mode. The method should be effective to suppress the mode at lower density where the ECCD efficiency is higher.

The Fast Wave system ran for two experimental days this week. Transmitter output power on Thursday's run day was ~2.2 MW combined, and ~1.6-1.9 MW coupled. The FMIT system ran very well, conditioning up to 32 kV in about 10 vacuum conditioning shots. Off-site collaborators from PPPL, ORNL, and MIT attended this week's run. The next scheduled Fast Wave run day is a full day Thursday August 30.

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

Machining of components for the background light subtraction system on the Motional Stark Effect diagnostic is almost complete. Assembly of the system is expected to take place before September.

Papers on several aspects of the Hot Outer Divertor were prepared for the American Nuclear Society meeting on the Technology of Fusion Energy, in Nashville August 27-30.

A preliminary evaluation of the current shunt pin prototype for the hot outer divertor was performed at PPPL. The pin was tested at its full rated current, on a fixture that allowed one end of the pin to be moved, simulating the thermal expansion of the divertor. Motion equivalent to three years of operation was simulated. The pin maintained its ability to transmit its full current, despite evidence of mechanical wear at the contact area.

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

Rob Goldston, in collaboration with Professor Alexander Glaser of Princeton University, has been awarded a \$100k grant from the State Department to develop techniques for Warhead Verification using Zero-Knowledge Proof algorithms and 14.1 MeV neutron tomography. The challenge is to verify that warheads removed from missiles are indeed real, without ever making measurements that would need to be classified. The project is a spin-off from the Fusion Socioeconomic study program that FES has supported.

In the Wendelstein 7-X collaboration, Thomas Rummel of the Max Planck Institute for Plasma Physics (IPP) visited PPPL for discussions concerning the W7-X Trim Coil collaboration. The visit included a site visit to Everson Tesla, Inc.'s (ETI) facility in Nazareth, PA to review progress in the manufacture of five W7-X trim coils. Coil #3 is fully assembled and awaiting a final water flow test with equipment recently procured by ETI to support the trim coil project. Coil #4 has been wound and prepared for resin impregnation, scheduled for next week. Pre-impregnation flow tests were observed. Test data from all coils tested to date were reviewed and found to be satisfactory. All coil services components have now been delivered to ETI. Two completed coils have been delivered to IPP. Overall, the manufacturing process was judged to be proceeding well, with no quality or schedule issues at this time.

### **THEORY:**

Dr. Ihor Holod of University of California at Irvine is currently visiting PPPL for the implementation of the double split weight (DSW) scheme into Gyrokinetic Toroidal Code (GTC). GTC is a global nonlinear Particle-In-Cell (PIC) code for simulating turbulence in fusion plasmas, which has recently been extended to include the electromagnetic capabilities based on the fluid-kinetic hybrid (FKH) electron model by using the expansion of the electron response into adiabatic and nonadiabatic part, and by treating electrons in the lowest order as a massless fluid. This allows the relaxation of the numerical restrictions associated with the electron Courant condition and removes unnecessary high-frequency modes. However, the FKH model excludes the microtearing physics, for which the electron response expansion breaks down near

the mode rational surface. To improve the electromagnetic capability of GTC, the UCI team headed by Prof. Zhihong Lin is now working with E. Startsev and W.W. Lee of PPPL to implement the DSW scheme into GTC. The DSW scheme retains electron inertia near the mode rational surface by treating the electron response non-pertubatively. The most important step would be the implementation of the Ampere's law to determine the vector potential, which is currently calculated from the Faraday's law in GTC. In the next step, the additional Poisson-like equation will be introduced to calculate the effective potential. Simple test case will be designed to test the new capabilities. If successful, the scheme can also be incorporated into GTS and XGC codes at PPPL in the future.

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

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

Construction: Measurements continue for the Bay L cut now planned for the week of September 3. The mock-up of the JK cap was trial fit on the vessel so access for welding could be reviewed. The repair of the welds on the JK cap and duct extension continue. Drilling of additional holes in the upper TF flags continues on second shift. Cryo line work on the north wall of the NTC will create NTC access restrictions - the north door will be out of service at various times. External decon will continue in the TTC. The installation of sprinkler piping under the 118' and 119' EL platforms has been completed and tested. The system is now back in service.

Centerstack fabrication: To date 18 inner TF conductors have been delivered to PPPL. This represents one-half of the full inner TF bundle. 14 bars have had their cooling tubes soldered and 8 bars have been taped to date. The TF quadrant mold modifications continue with the machining of new end caps.

PFC tiles: Further analysis of the edge tiles on the inboard and outboard divertor have concluded that the current tile material (ATJ or POCO) would not withstand thermal shock. Investigations are underway to find an alternate material. Bids are due the first week of September for the machining of the centerstack PFC tiles (excluding the CHI gap tiles.)

OTF Weldments: The first of 12 weldments is being reworked by an outside vendor. This first part will be shipped to PPPL next week for inspection before the remaining units are repaired.

NBI Upgrade: 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 tentatively planned for September 8.

NBI Services: Fabrication and installation of cryo lines continues.

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

Roof repairs: The installation of the lightning protection system on the LSB roof has been completed. PPPL is working with Aetna Roofing and URS to resolve the unforeseen drainage

issues on the Commons Deck project. The design details and cost estimates are being finalized. The work on replacing the Low-Roof of the MG Building has started and is progressing nicely. The protective structure over the switchgear is working as required. The project should be completed by September 7, weather permitting.

Material Control: Fran Cargill and Chris Canal attended a meeting last week at Argonne National Laboratory with DOE and HQ personnel in regards to implementing DOE Order 580.1A. Addressed were edits that will be implemented to the Order in the near future along with guidance/clarification to be in compliance.

Fire Protection: Problems continue with ACAMS which appear to be associated with the upgrade recently accomplished. SIC suspects the hardware security key for the Continuum software or the parallel port driver for the card supporting it. Ray Jeanes trouble shot and corrected a couple of minor ACAMS issues.

Follow up on the Simplex Fire Alarm System problems of August 12-13 continues. The PPLCC under floor FM-200 and fire initiated power shut down were put back on line on August 17. The Simplex branch manager was here and reviewed the panel history for his investigation. An interim report was completed.

Fire Systems: NSTX Platform Sprinklers project was briefed on August 17. The project is substantially complete with the new work now in service and just a few punch-list type items to complete. A statement of work and requisition for the HP Conference Room Sprinklers was prepared and submitted.

Maintenance: Completed maintenance on D-Site Experimental Area HVAC Systems. Fire system testing on D-Site Experimental Area was also completed. Central Plant annual maintenance work and insulation repairs in the Boiler and Chiller areas are essentially complete. State inspections of boilers and chillers are expected to be completed next week. Piping insulation work was completed in the C-Site MG Basement. Insulation work continues in the LSB basement and first floor mechanical rooms. Contracts for HP Offices and Conference Room renovations were sent for procurement with work expected to commence in late August. Platform work on the main Cooling Tower was completed.

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

The Procurement Division's compliance consultant Ms. Mary Faith Westervelt, Esq., conducted a review of transaction files selected from the universe of procurements placed during the third quarter of FY 2012 (April-June). After completing the reviews, she met with the Procurement Division staff to discuss her draft observations and recommendations. She stated that she found no significant issues in the files reviewed.

Rod Templon chaired a teleconference of the subcommittee charged with the revision of the Independent Peer Review Handbook. The Handbook provides policy and procedural guidance to the DOE Procurement and Evaluation and Reengineering Team (PERT) teams that conduct triennial reviews of DOE contractor purchasing systems. Revision 3 of the Handbook is expected to be published next week, and will be used for all FY 2013 peer reviews.

The Accounting Division submitted revised information on conference activity to DOE. Specifically, PPPL submitted a listing of international conferences with cost estimates as requested by the DOE Office of Science.

DOE approved a work for others agreement between Tri Alpha Energy and PPPL for the project titled "Plasma Topics of Importance to Advancing the C-2 Program." The Principal Investigator is Lane Roquemore. The budget is \$627,000 for the one-year period of performance.

DOE approved a work for others agreement between Alameda Applied Sciences Corporation (AASC) and PPPL titled "High Separative Power Vacuum Arc Centrifuge". The total funding to be provided to PPPL by AASC is \$44,000. The PPPL Principal Investigator is Nat Fisch.

This report is also available on the following web site:

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