



**The PPPL Highlights for the week ending June 13, 2014, are as follows:**

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

Since the PDR for the diagnostic first wall (DFW) in December, the stiffness of the diagnostic shield module (DSM), and its ability to transfer the high disruption loads experienced by the diagnostic first wall panels to the port plug structure has been investigated. The structural design of the DSM must also be consistent with the needs 1) to provide sufficient access for diagnostic components, 2) to provide adequate shielding, 3) to allow for adequate cooling of the DFW and DSM, and 4) to meet the weight limit. The PPPL port plug design team is seeking some generic DSM options that can meet all of these requirements.

Elements of the R&D plan for the Core Imaging X-ray Spectrometer were discussed at a weekly meeting of the CIXS design team.

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

The NSTX Upgrade Program Advisory Committee (PAC-35) meeting was held June 11-13 at PPPL. The PAC was asked to address three charges including assessments of (1) operational preparation and research priorities and preliminary plans for the first two run-years of NSTX-U, (2) a preliminary set of ideas to make NSTX-U more attractive and/or available to university scientists, and (3) progress and plans for establishing and expanding the partnership between the NSTX-U program and the PPPL theory department. The PAC provided excellent feedback on all the charge questions and provided many helpful comments on the results and plans for each NSTX-U topical science area. In addition, three NSTX-U PAC members gave experimental seminars before and after the PAC. On June 11, Dr. Ian Chapman from the Culham Centre for Fusion Energy (CCFE) gave a presentation entitled “Recent MAST results and status of MAST Upgrade project” and Dr. George Sips from JET/CCFE gave a presentation entitled “JET Results and plans for DT operation”. On June 13, Professor Dennis Whyte from the MIT Plasma Science and Fusion Center gave a presentation entitled “Exploring high-field side RF launchers and current-drive in the ADX, Vulcan, ARC conceptual tokamak designs.”

On June 9, M. Ono (PPPL) visited the University of Tsukuba, Japan and met with Professor Imai and his gyrotron development team. He heard the progress on the 28 GHz gyrotron development and also discussed the gyrotron collaboration on NSTX-U. He gave a seminar on the status and plans of NSTX-U to the GAMMA-10 group.

Preparations for plasma operations in the NSTX-U configuration also continued with the ongoing in-vessel installations of the new compliant center conductors on the HHFW Antennas. Calibrations of the MAPP and sFLIP diagnostics continued this week, and the Bay J port cover has been installed on the vessel. Neutral Beam and Field Coil Power Conversion Subsystems are being made ready for power testing with the exercise of pre-operational test procedures. A new layer of new stone has been installed in the NB switchyard. Good progress is being made on the testing of the Stand Alone Digitizer (SAD II) system prototype, and on the design of circuit boards for the new Ip Calculator. Both of these systems should be ready for their final design reviews by late June or early August.

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

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

Experiments on DIII-D last year used gas puffs of carbon tetrafluoride (CF<sub>4</sub>) to measure the confinement time of fluorine impurities in H-mode plasmas. Fluorine (Z=9) was chosen because of its very low recycling and is fully stripped in most high temperature discharges. This year, Brian Grierson worked with the CER group to develop the capability to use dichlorodifluoromethane (CF<sub>2</sub>CL<sub>2</sub>) in order to introduce chlorine (Z=17) for higher-Z transport studies. The first application will be in QH-mode plasmas to investigate the impurity confinement scaling with ion charge. Initial measurements have been taken and suitable charge-exchange emission lines have been identified for physics experiments during this run campaign.

B. Tobias together with S. Zemedkun (U. Colorado) used ECE-Imaging in a new 'interleaved LO' configuration to allow for continuous radial coverage from rho 0.35 to 0.95 in plasmas with core Alfvén eigenmodes. This setup allows for simultaneous imaging of core-localized and global Alfvén eigenmodes for enhanced understanding the combined effects of these modes on energetic ion redistribution and loss. Global mode structures have been obtained for a wide range of plasmas with neutral beam and EC heating.

E. Kolemen worked with the EC group to successfully commission an upgraded NTM real-time control capability using ECCD. In the checkout experiment on the evening of June 12, all the mirrors of the ECH launcher systems were moved to enable tracking at the requested angle and q-surface location using a real-time ray tracing algorithm and real-time Thomson density/temperature measurements. A new feature is installed enabling the gyrotrons to be turned on and off from PCS without pre-programming and was successfully tested.

W. Solomon was responsible for beam programming during a recent experiment to investigate the collisionality scaling of the advanced inductive regime, where the toroidal field was scanned at fixed beta<sub>N</sub>. Adjustments to the beam program were made to try to keep the scaled rotation constant at fixed beta<sub>N</sub> and the early q<sub>min</sub> evolution the same for the different toroidal fields.

D. Battaglia was the first physics operator for three experiments this week. A. Nagy served as chief operator for two sessions this week.

**C-Mod (D. Mikkelsen):**

D. Mikkelsen worked at MIT to select shots and learn how to prepare profile data for transport analysis and turbulence simulations. The focus is on comparable L-mode and I-mode plasmas in C-Mod with measured electron temperature fluctuations. A synthetic diagnostic code will use turbulence simulation output to calculate the 'expected' level of fluctuation, which will then be compared with the measured fluctuation's dependence on minor radius and reduction in I-mode.

**International (R. Maingi):**

D. Mansfield and L. Roquemore are currently visiting EAST and preparing the lithium granule injection for re-installation. The front end of the system, a lithium dropper segmented with four reservoirs, was refurbished, realigned, and is being vacuum tested. The granules to be used in the injector are being sorted, and the impeller that propels the granules radially inward is being prepped.

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

A formal agreement between the Department of Energy and Germany's Max Planck Institute for Plasma Physics (IPP) for collaboration in the Wendelstein 7-X program has been signed by both parties. The objective is "to establish a long-term collaboration in which U.S. fusion scientists will participate in the Wendelstein 7-X (W7-X) project." In the agreement, PPPL is designated as the U.S. lead institution for the collaboration, responsible for coordinating the work among DOE-funded institutions, coordination of all technical and administrative communication with IPP, and coordination of the reporting of progress and issues to DOE.

D. Gates and S. Hudson attended a U.S.-Japan Joint Institute for Fusion Theory Workshop on 3D Physics, held June 3-5 at Kyoto University. Gates presented a talk entitled "The physics of radiation driven islands near the tokamak density limit" and Hudson presented "Constructing chaotic coordinates for HINT calculations".

**ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):****NSTX Upgrade (R. Strykowski, E. Perry, L. Dudek, T. Stevenson):**

Construction: CHERS calibrations continued in-vessel this week. The installation of the new RWM coil at LA was completed and it passed a megger test. The original RWM coils are now being checked to verify that they still pass a megger test. The potting of the TF outer leg aluminum blocks has been completed. The installation of vacuum system and gas injection system cables continues. Additional cables have been pulled from the NSTX DARM to the polychromator room in the gallery. Replacement G-11 bushings are being made for the centerstack ceramic breaks. All bakeout tubing outside the vessel has now passed hydro tests. The valves and diagnostics are being installed on bays G, I and J.

CS Upgrade: The CS TF/OH assembly is now in the OH Mold and has tested leak tight. The several lifts required to place the coil into the oven for VPI started Friday morning. Completion

of the installation of the mold into the oven will continue over the weekend with the VPI planned for next week. Hollis has completed welding and has started final machining of the finger supports. Some trial fit ups of the G10 inserts revealed some minor fit up issues that have been resolved. Delivery schedule is holding for the end of June. Everson has completed the VPI for the last PF1 coil. The coil is now in the cure cycle and is on track to ship next week.

NBI Upgrade: Decon and survey of equipment out of the TTC continued this week with the goal of finishing this month. The vacuum system roughing line and SF6 fabrication and installation continued this week and reactivation of FVI fast switch circuits continued in preparation of powering the NBPS high voltage. The Mod/Reg preparations continue. LCC low voltage power supply installation and reactivation is in progress. NB Controls fabrication and installation cabling work on rack connections, cable runs, and BL wiring continued in NTC and gallery. Telemetry fiber optics termination, polishing, and testing was completed in NTC. A few fibers were found that needed rework. The telemetry testing is imminent. OMA hardware installations continued on BL2 source platform. Additional NB installation procedures are in development and review.

Digital Coil Protection System: DCPS PTP testing in FCC continued this week using the Autotester. Successful software builds to clean up items found through testing were completed. Work continued on the DCPS GUI but will be impacted by changes in personnel. DCPS overcurrent protection was discussed for implementation and interaction with PSRTC and ISTP-001 testing. The successful Hardware Interface FDR cleared the way for further progress on drawings, orders, fabrication, and testing. Progress continues on the AT interface panel and RCIM interface. Water PLC testing continues. HSC testing development continues. Lemo connector cable orders are in progress. DCPS PTP and OP procedure development continues. Review and development of a System Design Description including reliability, failure modes, and administrative control continued. Review of open chits is in progress. A DCPS Code Peer Review has been scheduled next month.

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

PPPL executed a Work for Others Agreement with SRI International titled "Concept Development for Active Magnetospheric, Radiation Belt, and Ionospheric Experiments using In Situ Relativistic Electron Beam Injection." J. Johnson is the Principal Investigator. The budget is \$85,000 per year for three years.

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