

PRINCETON PLASMA PHYSICS LABORATORY

WEEKLY highlights



The PPPL Highlights for the week ending April 4, 2014, are as follows:

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

PPPL is reviewing Release for Manufacture documents from several vendors supplying ITER components for the Steady State Electric Network.

A Readiness Review in preparation for the ITER divertor Residual Gas Analyzer system Final Design Review was held, and the panel decided that more time was needed to prepare for the Final Design Review for this system.

A meeting was held with the EU-DA design team working on the Wide Angle Viewing (WAV) Diagnostic to discuss the integration of the US port E9, which houses the WAV system as well as two US diagnostics.

PPPL engineer A. Basile organized a kick-off meeting with PPPL physicists involved with the conceptual design of the ITER Core Imaging X-ray Spectroscopy system to discuss the current design, which is about to be passed from the ITER Organization to PPPL, following the signing of the Procurement Arrangement for this system.

NSTX (M. ONO):

Two recent NSTX papers were featured among papers of other top authors in the 2013 Nuclear Fusion Highlights collection: (1) "Overview of physics results from the conclusive operation of the National Spherical Torus Experiment, by S.A. Sabbagh (Columbia University), et al.", and (2) "Dynamics of the disruption halo current toroidal asymmetry in NSTX" by S.P. Gerhardt (PPPL) et al. The entire list of papers can be found on the Nuclear Fusion website here: <http://iopscience.iop.org/0029-5515/page/Highlights-of-2013>

R. Goldston and R. Maingi of PPPL served as expert speakers for a fusion technology panel at the ANS Student conference at Penn State University Park on April 4. Goldston presented a talk "Basics of Magnetic Confinement Fusion", in which both basic principles and a few details of ITER were covered. Maingi presented "Fusion Technology and Science: Control of Transients in the Plasma-Material Interface", partly highlighting anticipated NSTX-U contributions to ELM control physics. Both talks prompted additional discussions with students following the panel presentations.

ITER & TOKAMAKS (R. HAWRYLUK):

DIII-D (R. Nazikian):

The article "Response of impurity particle confinement time to external actuators in QH-mode plasmas on DIII-D" by B. Grierson et al. was accepted for publication in Nuclear Fusion. This work details the confinement time of the non-intrinsic, non-recycling impurity fluorine in QH-mode plasmas under a range of plasma densities, toroidal rotation, energy confinement and applied 3D magnetic perturbations. A comparison is made between matched QH-mode and ELMing H-mode plasmas, where it is demonstrated that the particle transport driven by the EHO expels the fluorine impurity as rapidly, or even more rapidly, than in corresponding ELMing H-mode plasmas.

A. Diallo visited DIII-D this week to collaborate on pedestal physics on DIII-D and present results of his analysis on the pedestal recovery between ELMs. The analysis demonstrates that there is a substantial difference in the recovery time of the density and temperature of the pedestal at high current where the density gradient recovers substantially faster than the temperature gradient. Work is in progress to model the pedestal evolution using XGC0 code and to compare to experiment.

C-Mod (R. Hawryluk)

C. Kessel and F. Poli attended the ITPA-IOS meeting at MIT in Boston, Massachusetts. Kessel reported on the particle transport activity and on the IAEA-FEC contribution on entry to burn. Poli reported on pedestal effects on advanced scenario simulations, comparing the EPED1 calculations with other pedestal scalings. Poli extended her visit to MIT to work with P. Bonoli on the implementation of GENRAY in TRANSP for the LH component and to discuss with the C-Mod LH team the integrated modeling activity in support of experiments.

Anne White from MIT held a training session for PPPL staff to access C-Mod data to prepare TRANSP runs and to generate input files for GYRO.

ADVANCED PROJECTS (H. NEILSON):

The Laboratory submitted a report documenting work performed through February 28 under a Research Agreement with South Korea's National Fusion Research Institute (NFRI). PPPL's work consists of engineering and physics analyses supporting an NFRI concept study for a next-step fusion nuclear experiment, K-DEMO. The report documents work carried out in five task areas: system code analysis, configuration layout, structural analysis, conductor assessment, and advanced divertor configurations. The last was performed as a voluntary contribution by a team from the University of Texas at Austin. An amendment to the Research Agreement, providing additional funding to PPPL and extending the performance period through February 2015, was approved. PPPL will continue to support the K-DEMO study with physics and engineering analysis, emphasizing an evaluation of heating and current drive options.

In its collaboration with the Wendelstein 7-X stellarator program at Germany's Max Planck Institute for Plasma Physics (IPP), PPPL participated in an IPP configuration control board

meeting that was convened to finalize certain details of the port interface for the U.S. x-ray imaging crystal spectrometer (XICS). The presentations included one by PPPL's M. Mardenfeld, "Structural Acceptability of W7X-XICS Connection Points," which described the support structure geometry and calculated stresses and deflections on the various components. An issue was identified regarding the adequacy of the diagnostic attachment point on the port cover. However, solutions to mitigate this issue are available and should provide a satisfactory path forward.

PPPL contributed to a Conceptual Design Report for a "TDU Scraper Element," currently being designed within the framework of the U.S. collaboration on Wendelstein 7-X. During operation, the scraper element will help U.S. researchers validate physics and technology models for stellarator power exhaust, and validate understanding and control of the edge magnetic configuration, including error field compensation with trim coils. The design report was issued by Oak Ridge National Laboratory in preparation for a Conceptual Design Review scheduled for April 9. PPPL's contributions included a chapter on engineering analysis, a cost estimate for fabrication, and a preliminary project execution plan.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: The in-vessel installations of Langmuir probes, the reflectometer, and sFLIP continued this week. The removal of the RF antennas has been completed. The bay H and K lower port covers have been installed. The RWM coil for H/I continued and this coil should be installed next week allowing the bay I port cover. Preparations are underway to install new fiber runs for MSE-LIF. The repair of centerstack casing tubing was completed and all tubes passed hydro tests and leak checks and the centerstack casing will now be cleaned to remove the oil from the manufacturing process. Work continued on the gas injection system solenoid box on the 119' platform and on maintenance tasks in the power cable termination structure. Bus bar fabrication and trial fit-ups continue and many interferences with existing equipment are being identified. Trials for potting the TF outer leg aluminum blocks to the umbrella structure have been completed.

CS Upgrade: Staff completed the winding of layer three of the OH winding and the crew is now in the process of cutting and brazing the transition to layer 4. The PF1B lower coil was mounted to the turntable and is being prepped for the flux loop and cover installation. The first batch of outer lead extensions are expected to be delivered the week of April 7, however, the Ebeam welding company is having trouble reworking a piece that had failed inspection. The parent material next to the reworked weld cracked during welding. PPPL will work with the vendor to develop a solution. The RFQ for the new segmented G10 crown pieces is out on the street. The CHI and TF bus bars fit up in the test cell started this week and few interferences were discovered with PCHERS and the TF support structure. A meeting is being planned for April 4 to develop a work around.

NBI Upgrade: Armor thermocouple feedthrough wiring is being prepared for terminations at Bay H. BL2 Optical Multichannel Analyzer (OMA) box leak checking was completed successfully. HVE water line installation has been completed in NTC. Flexible hoses for the HVE lines can

now be measured and fabricated. The pipe connections to the DI water pumps continued in the pump room. Transmission line relocations are planned to start the week of April 7. The Mod/Reg controls work and preparation continues. NBPS water skid maintenance is in progress. VV RWM coil evaluation and fabrication continues for the Bay JK area. The NBI Duct installation is complete and the duct supports were anchored to the floor. The TVPS turbopump tubes were installed. Flange rework is also in progress but awaiting parts. NB Controls work on interconnecting wiring on racks in the gallery continued. Additional NB installation procedures are in development and review.

Digital Coil Protection System: The DCPS stage I testing continued this week using the Autotester (AT) to explore issues. All of the test plan sections were attempted and open issues captured for resolution. The input files were prepared and used and MDSplus data results were partially evaluated. Testing using the NSTX Facility clock was attempted and timing results are being compared with AT data and comments were collected to fold into the Test Plan PTP. Hardware and I/O layout and design continues. The work on drawings continues. The PCB design and procurement is in progress. Progress continued on the Water system PLC bench and system testing and documentation.

BUSINESS OPERATIONS (K. FISCHER):

PPPL's report on its FY13 Laboratory Directed Research and Development (LDRD) program was submitted to the DOE. The report includes an overview of the program and individual technical reports for each of the LDRD projects funded in FY13.

PPPL and the National Fusion Research Institute in South Korea executed an amendment to the existing Work for Others Agreement to expand the scope of work to include physics and engineering analyses to support the K-DEMO Concept Study. The budget is \$150,000 and the period of performance is one year for the additional scope.

DIRECTOR'S OFFICE (C. AUSTIN):

DOE hosted a review of the Contractor Assurance System - the system by which Princeton University, the DOE Princeton Site Office and PPPL work together to ensure the mission of the Laboratory is delivered and the Prime Contract requirements are met. The review team comprised two DOE Site Managers, two DOE subject-matter experts from DOE-CH and two members of the PSO staff, who collectively spent the week holding interviews, reviewing documents, and offering opportunities for improvement to CAS.

PUBLICATIONS:

The following PPPL Reports were posted to the web:

Runaway Generation In Disruptions Of Plasmas In TFTR PPPL-5010
Authors: E.D. Fredrickson, M.G. Bell, G. Taylor, S.S. Medley
Submitted to: Nuclear Fusion (March 2014)

Parametric Dependence Of Fast-ion Transport Events On The National Spherical Torus
Experiment PPPL-5011

Authors: E.D. Fredrickson, N.N. Gorelenkov, M. Podesta, A. Bortolon, S.P. Gerhardt, R.E. Bell,
A. Diallo and B. LeBlanc

Submitted to: Nuclear Fusion (March 2014)

Safety Culture And Best Practices At Japan's Fusion Research Facilities PPPL-5012

Authors: K. Rule, L. Cadwallader, M. King, Y. Takase, Y. Oshima, K. Nishimura, and A.
Sukegawa

To be Submitted to: ANS Conference Proceedings, Anaheim, CA (November, 2014)

This report is also available on the following web site:

<http://www.pppl.gov/publication-type/weekly-highlights>