



The PPPL Highlights for the week ending October 10, 2014, are as follows:

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

Two meetings were held this week with the port integration team at the Budker Institute in Novosibirsk, Russia, which is responsible for the integration of equatorial port plug 11. This plug houses the US Residual Gas Analyzer and Low-Field-Side Reflectometer diagnostics.

A U.S. Deviation Request changing the Low-Field-Side Reflectometer design approach to the monostatic from the bistatic configuration was discussed with the responsible officers at the ITER Organization, who requested minor changes. It is expected that this request will be submitted formally the week of October 13.

NSTX (M. ONO):

Preparations for plasma operations in the NSTX-U configuration also continued. Recommissioning of the Motor Generator Set (D-MG#1) is making good progress with the completion of the replacement of the stator cooling water isolation valves and the resumption of the chemical cleaning of the stator heat exchangers. The manufacturer of the new deuterated trimethylboron (dTMB) injection system has released mechanical drawings for the gas controls cabinet, and required vacuum pumps for the dTMB system are on order. The Final Design Review of the Stand Alone Digitizers (SAD2) will be held the week of October 13.

ITER & TOKAMAKS (R. HAWRYLUK):

DIII-D (R. Nazikian):

B. Tobias has performed momentum transport analysis using TRANSP of discharges with a strongly coupled 3/2 and 2/1 tearing modes. The analysis demonstrated that anomalous torque is generated by the island interaction that is comparable to the local torque generated from the neutral beam injection. Under some circumstances the inter-island torque can produce a hollow rotation profile in the plasma core.

International (R. Ellis):

A steady-state water-cooled fixed mirror for the PPPL-designed ECH launchers at KSTAR was shipped to Korea. This mirror uses the additive manufacturing [3-D printing] approach to

fabrication. As printed, the mirror was in near final condition, requiring only polishing of the reflecting surface, copper plating, welding of tube stubs, and drilling and tapping mounting holes. At the same time, we received from a vendor another, improved assembly based on a 3-D printed mirror. This will also be sent to KSTAR after additional testing at PPPL. It is planned to use these mirrors in the next KSTAR campaign in 2015.

ADVANCED PROJECTS (D. GATES):

A PPPL magnet engineering team of M. Mardenfeld, M. Kalish, P. Titus, and P. Heitzenroeder is supporting the Wendelstein 7-X project in the commissioning of the U.S.-supplied trim coil system. To date, all of the equipment has been installed at the Greifswald, Germany project site, the power supplies have been commissioned into a dummy load, and cooling water flow through the coils has been established. In preparation for energizing the coils for the first time, the Max Planck Institute for Plasma Physics (IPP) engineering team consulted PPPL for advice on the need to monitor mechanical displacements during commissioning and for suggestions on methods to check water flow balance among the parallel cooling circuits. With PPPL concurrence, IPP decided to limit operation of the coils to half current as a prudent measure for the first plasma campaign, while postponing displacement measurements until after that campaign. Flow balance test procedures are still under discussion.

THEORY (A. BHATTACHARJEE):

Harold Weitzner, Professor emeritus of Mathematics at New York University, discussed possibilities for non-symmetric toroidal ideal MHD equilibria with good flux surfaces. In his talk, a variant representation of ideal MHD equilibria is developed and applied for two problems. The first examines equilibria in the topological torus, a slab with periodicity in the y and z coordinates. An expansion of the equilibrium in terms of the amplitude of the helical fields is carried out. Magnetic resonances appear and limit the possibility of constructing solutions. For zero or low shear systems it is shown that for appropriate boundary data, solutions with no resonant destruction of surfaces in all orders are possible. Convergence is not proven. Secondly, solutions in a true torus are similarly constructed for the case of a circular magnetic axis. The solutions found in both cases do not vary smoothly with the data, which prescribe them. Speculation concerning the case of a more complex magnetic axis is offered.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: The centerstack has been moved into the south high bay of NSTX and has been stood up. The casing is being installed and the PF1A upper coil will be installed next. The centerstack pedestal is ready for the centerstack installation. The category 3/4 ground bus modifications have been completed. The wiring for the new vacuum system continues.

CS Upgrade: The centerstack casing installation began on October 9, but was halted when the Rogowski coils began to bind between the PF1A and PF1B coils. The casing has been lifted up

and temporarily supported so that the area can be inspected. A peer review was held October 10 to discuss the options to modify the PF1A to gain back some clearance. A peer review was also held October 10 to go over the cleanup operations to be made to the TF Lead Extensions. The PF1C Upper coil can flange sealing surface machining was completed and the welding of the final joint was started. Installation of the water system upgrades began on second shift this week. The bending of the PF coil busywork was completed at Martellis Metal Fabrication.

NBI Upgrade: BL2 turbopump installation was completed and the backing line installation package is ready for NTC installation based on welder availability. The platform support column fit up took place and changes are required for the NSTX Test Cell as built and found conditions. Small adjustments to the drawings are needed. Parts fabrication continues based on welder availability. Power system work continued on fiber optic termination testing and telemetry has been completed and verified for HVEs. Steady progress has been made on other power supply telemetry. Some Switchyard, Surge Room, and Mod/Reg work was completed in anticipation of Accel reactivation. Bending magnet tests are planned. A high voltage transmission line instrumentation connector was replaced. Controls work continues with installation of cable tray, cabling, installation of junction boxes, and gallery rack wiring. PLC to LCC interconnection wiring continues. Several LCC oscilloscope installations have been completed. Progress continues on developing the North door shield wall statement of work for use with an existing BOA and a senior review of particulars is planned. Cryogenics maintenance and repairs in preparation for operations continues. Preoperational Test Procedure continues for an ACC meeting the week of October 13. Management attended the monthly status meeting and reported steady progress toward CD-4.

Digital Coil Protection System: Work continues on a few minor software fixes to support testing.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

A. Zwicker and D. Ortiz attended a two-day Department of Energy meeting of the Laboratory Education Directors for Workforce Development for Teachers and Scientists (WDTS) in Gaithersburg, Maryland.

DIRECTOR'S OFFICE (C. AUSTIN):

On October 8-9, M. Zarnstorff attended the National Laboratory Chief Research Officer (CRO) meeting in Washington, DC.

On October 7-11, A. Cohen visited the Lawrence Berkeley National Laboratory in Berkeley, California to participate in a DOE Chief Operating Officer (COO) meeting and an SLI Project Directors Review.

PUBLICATIONS:

Authors: Seth Davidovits, and Nathaniel J. Fisch
Fusion Utility in the Knudsen Layer PPPL-5052
Submitted to: Physics of Plasmas

Authors: Yao Zhou, Hong Qin, J.W. Burby and A. Bhattacharjee
Variational Integration for Ideal MHD with Built-in Advection Equations PPPL-5053
Submitted to: Physics of Plasmas

Authors: V.I. Geyko and N.J. Fisch
Enhanced Efficiency of Internal Combustion Engines by Employing Spinning Gas PPPL-5054
Published in: PHYSICAL REVIEW E 90, 022139 (2014)

Authors: Yuhu Zhai, Ciro Calzolaio, and Carmine Senatore
Understanding Irreversible Degradation of Nb₃Sn Wires with Fundamental Fracture Mechanics
PPPL-5055
To be published in: IEEE Transactions on Applied Superconductivity

Author: Robert D. Woolley
Optimal Shielding for Minimum Materials Cost of Mass PPPL-5056
Published in: Nuclear Technology (ANS)

Authors: Andrew P. Zwicker, Josh Bloom, Robert Albertson, and Sophia Gershman
The Suitability of 3D Printed Plastic Parts for Laboratory Use PPPL-5057
Submitted to: American Journal of Physics

Authors: E. D. Fredrickson, G. Taylor, N. Bertelli, D. S. Darrow, N. Gorelenkov, G. Kramer, D. Liu, N.A. Crocker, S. Kubota, R. White
Suppression of Energetic Particle Driven Instabilities with HHFW Heating PPPL-5058
Submitted to: Nuclear Fusion

Authors: R. Kaita, T. Abrams, M. Jaworski, M. Lucia, J. Nichols, C. H. Skinner, D. Stotler, J-P. Alain, F. Bedoy, and the NSTX-U Team
Addressing the Challenges of Plasma-Surface Interactions in NSTX-U PPPL-5059
Submitted to: IEEE Transactions on Plasma Science

Authors: J. Squire and A. Bhattacharjee
Statistical Simulation of the Magnetorotational Dynamo PPPL-5060
Submitted to: Physical Review Letters

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