

PRINCETON PLASMA PHYSICS LABORATORY

WEEKLY highlights



The PPPL Highlights for the week ending October 4, 2013, are as follows:

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

PPPL awarded the eighth of eight contracts for ITER Steady State Electric Network on September 30, satisfying a Notable Outcome for FY13.

The RFP package for design of the in-vessel endoscope and ex-vessel relay optics for the ITER Upper Visible/IR Cameras was sent to DOE for approval prior to release.

A kickoff meeting was held to discuss stray ECH loading on vacuum windows for the ITER ECE and LFSR diagnostics, in order to evaluate the need for fast shutters to protect the windows if a stray radiation threshold is exceeded. Another approach is to edge-cool the windows.

The SPEB Report recommending the award of the LFSR Design Support subcontract was signed by PPPL Management prior to submission to DOE for approval.

NSTX (M. ONO):

S. Gerhardt (PPPL) submitted the FY13 Joint Research Target (JRT) report to the Office of Fusion Energy Sciences on September 30. This report was compiled by the JRT team, composed of Max Fenstermacher (LLNL) and Andrea Garofalo from DIII-D, A. Hubbard and Dennis Whyte from C-Mod, and S. Gerhardt and R. Maingi from NSTX-U. The report focuses on both the operational space and underlying physics of high-confinement regimes with no large ELMs and stationary conditions. The NSTX-U contribution presented results on the Enhanced Pedestal H-mode, on the pedestal transport characteristics in ELM-free regimes, and on observed low-amplitude edge harmonic oscillations. Many members of the NSTX-U team contributed to the report, including participation in DIII-D and C-mod experiments and analysis.

The NSTX-U Team Meeting was held on October 4. The meeting material is available on http://nstx.pppl.gov/DragNDrop/NSTX_Meetings/Team_Meetings/2013/2013_10_04/.

ITER & TOKAMAKS (R. HAWRYLUK):

An informal meeting on ITER modeling was held at PPPL September 30 - October 1, which included Vassili Parail, Arnold Kritz, Tariq Rafiq, and PPPL physicists. The following topics were discussed: 3D edge work modeling edge displacements in ITER, Multi-Mode Anomalous

Transport Module MMM8.1, steady-state modeling, implications of C-Mod ITER-like experiments on modeling, DEMO modeling, coupled core-SOL modelling of JET plasma with W-wall as well as ITER, RF-kick operator and predictions for ITER, and edge-core physics from XGC1.

DIII-D (R. Nazikian):

R. Maingi, D. Battaglia and B. Grierson attended the H-mode Workshop in Fukuoka, Japan. Rajesh delivered a review of ELM control techniques for ITER and results from regimes with small or no ELMs. Brian Grierson delivered a presentation on recent impurity transport studies in QH-mode plasmas, and Devon Battaglia presented XGC0 modeling of the QH-mode pedestal.

The PPPL supplied Gyrotron 8 Water manifold, which arrived mid-September, is now ready for installation into the ECH Vault after being fitted with additional gauges, valves, and attachments.

B. Tobias visited the Linac Coherent Light Source at the Stanford Synchrotron Radiation Laboratory to participate in their annual User's Meeting Workshop and High Power Laser Workshop.

ADVANCED PROJECTS (H. NEILSON):

Dr. D. Gates, Stellarator Physics Leader at PPPL, was named a fellow of the American Physical Society. The citation on the Fellowship Certificate reads as follows: *For innovation and leadership in the understanding and control of limiting phenomena in toroidal plasmas*. The certificate will be presented at the upcoming meeting of the APS division of plasma physics meeting to be held November 11-15 in Denver, Colorado.

Dr. A. Lumsdaine, Oak Ridge National Laboratory, visited PPPL on October 2-3 for discussions regarding the Wendelstein 7-X Scrapper Element project. The project's purpose is to develop the design and an implementation plan for an inertially cooled in-vessel component for the Wendelstein 7-X (W7-X) stellarator at the Max Planck Institute for Plasma Physics (IPP) in Greifswald, Germany. The component, known as the "TDU scrapper element (TDU-SE)," is a physics and engineering prototype of a steady-state, high heat flux version that has been designed to protect sensitive equipment near the W7-X divertor under certain conditions. During his visit, Lumsdaine presented a seminar, "W7-X Divertor Scrapper Element Program," and led discussions on project planning and engineering issues with the PPPL stellarator team.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

A successful Lehman review was conducted for the NSTX-U project on October 2-3. Overall conclusions were positive on safety, technical quality, cost and schedule performance.

Construction: The welding of ports at bay L continues and should be completed in a few days. The permanent shims have been installed in all of the upper outer TF supports. The upper scaffolding can now be removed to allow starting work on the lower outer TF supports. PF4/5 modifications continue. The first new support assembly has been installed at JK. Welding of the centerstack casing studs continues. Bus bar fabrication continues in the Tech Shop.

CS Upgrade: The requisition for the procurement of the TF Lead Extensions has been approved. The OH Winding station in the CS Coil Shop is now ready to begin load testing of the tensioning equipment. The TF bundle has been removed from the mold and is in the process of being cleaned in preparation for the aqua pour fill process. The tile studs on the CS casing are being reworked and are expected to be completed next week. The Tech-Shop has been fabricating the CHI Rings, OH Co-Ax, OH Bus, Flags and Supports. The last piece of buss bar procurement (Copper bar and plate) has been ordered. Shrink Tubing for the insulation of TF Bus Bars has also been ordered. Analysis is being concluded and a meeting was held yesterday to discuss hot spot areas on the TF Bus. Design changes were proposed and an iteration is being performed to verify the improvement. Design changes to the CHI bus proposed by the analysis results have been incorporated to the Pro-E design. Drawings have been generated and a bill of materials for hardware and stainless steel is being prepared.

NBI Upgrade: Decon of the TTC East wall for cable tray installation continues in preparation for cable tray support installation. Flanges in the NTC have been made and installation in NTC is in progress. The Ion Source and Ion Dump DI H2O Pump procurement continues. BL2 alignment of 90-inch flange, OMA scrapers, and source platform rails continues. Source platform modifications to achieve the appropriate adjustment were made similar to BL1. The power system cable and tray subcontract installation work has started in the TCB. Scanning for wall and ceiling mounts continues. Thermocouple fabrication for the armor tiles continues. Final welding of t-bar studs is imminent. Controls tray installation in the NTC continued under the beamlines. Management participated in the Office of Science Lehman review this week.

OFFICE OF COMMUNICATIONS: (K. MACPHERSON):

Following DOE guidance, the Communications team posted a message on the Lab's external website, "Due to the U.S. government's lapse in funding, information on this website is currently not being updated." The office, also following DOE guidance, suspended public tours starting October 7.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

A. Zwicker was the keynote speaker at the kick-off for a new pilot STEM program entitled "Lift Off to Mars," at the Newtown Friends School in Newtown, Pennsylvania. The program will show eighth grade students how to use science, technology, engineering and math to figure out how to get to Mars. It is supported by PPPL and scientists from Enterra Solutions LLC, Lockheed Martin, Bristol Meyer Squibb Corp. as well as local business leaders.

PUBLICATIONS:

The paper 'Edge microstability of NSTX plasmas without and with lithium-coated plasma-facing components' by J.M. Canik (ORNL) et al., Nuclear Fusion 53 (2013) 113016, is now published online at <http://iopscience.iop.org/0029-5515/53/11/113016/article>. The article reports on linear gyrokinetic simulations of the NSTX pedestal in discharges with and without lithium.

Microtearing is found to be unstable at the pedestal top without lithium, and is stabilized by the increased density gradient when lithium is applied. This correlates with a reduction in the electron heat transport inferred from experiment in the pedestal-top region. In the region outside of $\psi_N=0.95$, ETG is found to be driven strongly unstable in the case with lithium, suggesting a possible role of ETG transport in the stiffness of the Te profile observed near the separatrix. Kinetic ballooning mode stability was analyzed, with KBM onset found to strongly track the ideal ballooning stability boundary. At NSTX pedestal parameters, the pedestal is in the second-stable region, with growth rates that decrease as the pressure gradient is increased.(NSTX)

B. Tobias was a co-author on "Radial Localization of Toroidicity-Induced Alfvén Eigenmodes" with Zhixuan Wang, Zhihong Lin, Ihor Holod, W. W. Heidbrink, Benjamin Tobias, Michael Van Zeeland, and M. E. Austin in Phys. Rev. Lett. 111, 45003 (2013). The abstract states: "Linear gyrokinetic simulation of fusion plasmas finds a radial localization of the toroidal Alfvén eigenmodes (TAEs) due to the nonperturbative energetic particle (EP) contribution. The EP-driven TAE has a radial mode width much smaller than that predicted by the magnetohydrodynamic theory. The TAE radial position stays around the strongest EP pressure gradients when the EP profile evolves. The nonperturbative EP contribution is also the main cause for the breaking of the radial symmetry of the ballooning mode structure and for the dependence of the TAE frequency on the toroidal mode number. These phenomena are beyond the picture of the conventional magnetohydrodynamic theory." (ITER & Tokamak)

This report is also available on the following web site:

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