

PRINCETON PLASMA PHYSICS LABORATORY

WEEKLY highlights



The PPPL Highlights for the week ending April 19, 2013, are as follows:

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

An RFP package was issued for the "Physics and Engineering Design Support and Diagnostic Hall Instrumentation Development for ITER Low-Field-Side Reflectometry (LFSR) Diagnostic System". A Pre-proposal Teleconference was scheduled for April 30.

In an effort to reduce the complexity of party-to-party interfaces between the US and the EU, a proposal was discussed to swap responsibilities for providing diagnostic shield modules. The present scope allocation gives the responsibility for provision of the diagnostic shield modules to the party providing the port plug. For some shield modules, this party would also be responsible for integrating the diagnostic front-end components of tenant parties. The new proposal, discussed with the EU domestic agency this week, is for the tenant diagnostic provider to deliver the fully integrated shield module rather than simply the diagnostic components. The proposal also calls for relocation of some diagnostics to further reduce party-to-party interfaces.

Subcontract Proposal Evaluation Board activities for the ITER High Voltage Transformer procurement were completed, which included PPPL sign-off. The documentation package is now at DOE and the IO for review.

NSTX (M. ONO):

M. Ono (PPPL) visited Columbia University on April 19. He met with the Columbia University plasma program faculty members and students, and visited the plasma facilities at the university. Ono gave a plasma colloquium entitled "NSTX Upgrade: Status and Plan".

Preparations for plasma operations in the NSTX-U configuration also continued with tests of the SF6 recovery system to evaluate and streamline operations in the interest of minimizing SF6 losses. Five new firing generators for the field coil power conversion (FCPC) system rectifiers are now complete and bench tested. Power testing of the firing generators is scheduled to start this coming week.

ITER & TOKAMAKS (R. WILSON):

DIII-D (R. Nazikian):

The IPEC code is being used to simulate the plasma response to a rotating $n=2$ perturbations of the I-coils on DIII-D, with the results being compared to 2D ECE-Imaging data. Applying the same analysis to the IPEC simulation as used for the experimental data allows for direct comparison of the dominant poloidal mode structure between simulation and experiment. Modeling these cases is advancing our understanding of how ECE-Imaging data may be used to identify the formation of important structure, such as magnetic islands and the plasma kink response.

N. Greenough presented two CDRs to a joint PPPL/GA review committee this week. The first covered a design for ECH RF noise suppression. The EMF noise associated with the gyrotron operation can cause certain ECH systems to either trip or affects their calibrated response. A second review covered a magnet current monitoring and power supply interlock system using a microcontroller that controls all 5 gyrotron magnets. Both reviews were successful. The RF noise suppression task is expected to complete in FY13 and the second will complete in FY 14.

Alcator C-Mod (R. Ellis):

A successful final design review for the Advanced Outer Divertor was held on April 11-12. Chaired by P. Heitzenroeder of PPPL, the review panel included participants from MIT, PPPL, and DIII-D. Presentations covered project motivation, halo currents, project status, electromagnetic analysis, heat load analysis, current shunt designs, heater details, controls, schedules and budgets, divertor diagnostics, safety, and chit resolution. The review panel noted that significant progress had been made in many areas of the design.

A careful examination of halo currents in C-MOD, and an evaluation of likely operating scenarios, led to a relaxation of the halo current specification. Specifically, given the ability to measure currents flowing through the current shunts, the C-Mod team showed that the tokamak would not be operated in the case with one of the two shunts in each divertor segment failed. This led to reduced halo current forces on the divertor, and reduced design requirements on the current shunts.

Electromagnetic and thermal analyses showed that the design can withstand the specified loading conditions. An axisymmetric thermal model, presented by H. Zhang of PPPL, showed the transient and steady state response of the divertor and vacuum vessel under various operating scenarios, and showed that typically planned experiments could be conducted while maintaining vacuum vessel temperatures and stresses at a safe level.

As recommended by the PDR, an improved pin shunt design, using different material combinations, was presented along with a flex strap shunt design. Both were deemed feasible.

Additional heater tests, including successful rapid up-to-air tests, had been completed by the FDR. A new, improved heater connector design was presented. A system for controlling heater, and divertor, temperatures was presented.

Brian LaBombard of MIT presented a detailed plan for divertor diagnostics. Schedule, budget and safety presentations were made by the MIT team.

A presentation showing that all of the PDR CHITs were resolved was given. The review was judged to be successful.

ADVANCED PROJECTS (H. NEILSON):

A paper by D. Gates, L. Delgado-Aparicio, and R. B. White entitled "Physics of Radiation-Driven Islands Near the Tokamak Density Limit" was accepted for publication in Nuclear Fusion. The paper investigates the behavior of the modified Rutherford Equation including radiation drive terms for current profiles that are expected near the density limit. The results confirm the assumptions of a paper entitled "Origin of Tokamak Density Limit Scalings", which previously published in Physical Review Letters.

In the Wendelstein 7-X (W7-X) trim coil project, a procurement action has been initiated to acquire 1 km of electrical cable that will interconnect the power supply units, DC switches, and coils. This represents the last major procurement for the trim coil system.

THEORY (A. BHATTACHARJEE):

The April 12 issue of Physical Review Letters contains an article by V. Geyko (graduate student) and N. Fisch, titled "Reduced Compressibility and an Inverse Problem for a Spinning Gas". Geyko and Fisch show that a rapidly spinning ideal gas exhibits the counter-intuitive property that by putting more energy into the spinning, the gas becomes easier to compress. They also show that the spinning breaks an important symmetry, so that gas constituents in a mixture of spinning gases can be determined through pressure measurements only.

Many Theory department members attended the U.S. - E.U. Joint Transport Task Force Workshop in Santa Rosa, California, April 9-12. C.S. Chang presented a talk "Status of the Theory/Simulation on Multi Scale 3D RMP Penetration and Plasma Transport Physics", G. Fu presented a talk titled "Energetic Particle Effects on Non-resonant Kink Mode in Spherical Tokamaks" and N. Gorelenkov presented a talk titled "Validating The Critical Gradient Model for AE Fast Ion Relaxation in DIII-D". Posters were presented by W. Deng, B. Faber, R. Hager, S.H. Ku, J. Lang and H. Mynick.

Several theory department members attended the International Sherwood Fusion Theory Conference in Santa Fe, MN April 15-17. Poster were presented by J. Burby, F. Ebrahimi, S.Jardin, W. W. Lee, B. Lyons, J. Parker, J. Squire, W. Wang, R. White. L. Zakharov and X. Li also attended the Sherwood meeting.

COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):

The semi-annual meeting of the SciDAC Center for Extended Magnetohydrodynamics was held on Sunday April 14 in Santa Fe, New Mexico, preceding the Sherwood meeting. There were 15

presentation made as well as three discussion sessions on (1) RMP modeling, (2) sawtooth modeling, and (3) kinetic MHD. All of the presentations can be found on the CEMM web site: <http://w3.pppl.gov/CEMM> under the "workshops" tab.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: The welding of upper and lower umbrella arch reinforcements has been completed. TF12 was installed in the "L" position to verify clearance to the NB2 duct and it was then installed in position "A". The PF4/5 supports which are welded to the vacuum vessel are being drilled and tapped to accommodate the new struts. The modification to two passive plates has been completed in the shops and the plates are now in the Vacuum Prep Lab. The cable tray that goes on top of NSTX is being assembled in the south high bay. It will be lifted into place next week.

CS Upgrade: The third quadrant conductors have been installed in the quadrant mold. The conductor ends have been aligned and the indexing blocks installed. The next step will be to align the middle section of the conductors and installed the shim plates. The last six remaining conductors to make up the full TF bundle were primed and readied for insulation wrapping. The Centerstack Casing is being prepared for the final vacuum leak test by installing two large flanges on each end. The first blank flange was successfully installed on April 18. The OH Winding station and spool station fabrication continued throughout the week in RESA. The top rails to support the tensioning assembly were installed. Work on the electrical system started this week. The passive plate straps fabrication was completed in the S109 machine shop. Everson has closed up the Outer TF VPI mold and is preparing for the first VPI. They have found a vacuum leak in the mold and are in the process of troubleshooting. They now expect to perform the VPI next week. Electron Beam Welding completed weld test samples and have shipped the test coupons to PPPL for inspection.

NBI Upgrade: HP has started the process of revising Radiation Work Permits and posting some new ones in support of the relocation. HP support continues to keep pace with activities and progress. The BL2 source platform transmission line pressure plate fixture was moved into the NTC to be mounted behind the source platform. Water manifold installation underneath the source platform continued. BL2 lid decon was completed and the area reposted. Decon of the BL2 surround was completed sufficiently to make way for HVEs. Decon in the TTC reached the point that the floor plug area was clean and de-posted to allow HVE relocation. The first HVE was moved from TCB into TTC, South High Bay, and into NTC between the BLs. The HVE was reassembled and bolts were torqued. The second HVE has been disassembled and moved into position for lifts in the TCB. Preparations to move the third HVE into position for disassembly has started. Fabrication and leakchecking of LHe cryo line continues in the NB shop. LHe cryogenics line installation, welding, and leakchecking on the TFTR Test Cell South and East wall continues. Fabrication continues on the NB/TVPS duct components in the Tech Shop. Procurement activity for the water system piping subcontract is in progress. Work continued on the SOW and drawings for the power supply cable and tray subcontract requisition package. Tray supports were being analyzed and drawing changes are in progress. The NBI Armor work

in the Braze Shop has been completed and the four backing plate units are ready for leakcheck. Leakchecking is planned in the NBI Shop.

Office of Project Management:

The COG/RLM online training package narration was completed and released for COG and RLM annual update training. Training is in progress. The monthly Project Status Review Board meeting was held this week with all active jobs reporting. Progress has been good and in most cases noteworthy including performance indices. Work Planning system upgrade requirements continue to be gathered from input from a widening array of stakeholders. Focus continues on form, features, and functions. Preparation of a requirements and scoping document has started.

Facilities and Site Services (M. Viola):

Engineering Services: A market survey was held with about seven contractors who expressed an interest in performing the demolition of the C-Site MG Foundations. The goal was to make the job public and obtain feedback from various contractors to determine if the vendors will come up with innovative techniques/methods to save money and accomplish the task with our needs in mind. This represents a large cost item in the project to re-purpose the C site MG Building but a necessary item.

Telecom: The Telecommunications Office will begin to publish a 'Tip of the Month' article in the PPPL Online News Letter. The article will provide Laboratory staff with helpful tips on using telecom equipment, operational shortcuts and features for phones, voicemail, wireless devices, radios, etc. Also, staff will be alerted to any phone fraud or phone system hacker attacks. Safety advice as it relates to technology, and new technology gadgets to help users work more efficiently will also be included.

The Telecommunications Officer has recommended that the PPPL Travel Policy include phone calling options, such as, the use of Lab loaner cell phones and wireless devices, calling cards, and the use of Google Talk software as a means for Lab staff to communicate more effectively while on business travel.

Fire Protection: Efforts continued on identifying and interviewing candidates for the Fire Protection Engineer position. A contractor was on site to gather information on warehouse combustible loading calculation to address item 10.1 of the Fire protection audit action items.

Material Services: Loan Agreement 11-06-1, Addendum 1, for items to MIT - was approved by DOE this week. The "Controlled Accountable" Statistical Sampling Inventory is beginning April 19 in conjunction with the ongoing "Other Accountable" Inventory currently in process. Property pass approvers not initialized in the new property pass system will be visited by Property Management this week for completion of system set-up.

BUSINESS OPERATIONS (E. WINKLER):

J. Peterson worked with Procurement staff to draft a quick closeout desktop guide and flowchart to clarify what level of audit work or desk review is required to validate "unsettled" direct and indirect costs and to close out cost-type contracts.

J. Peterson developed standard PPPL template subcontract audit programs for Incurred Cost Audits and Accounting System Reviews.

E. Winkler met with M. Dikeakos and members of her staff to discuss the Laboratory's financial results through March 2013 fiscal year-to-date.

The Accounting Division responded to a data call by the Department of Energy to provide information for a Benefits Metrics survey.

T. Bleach participated in a conference call with other members of the Contractor Financial Management Alliance (CFMA) Council. The purpose of this call was to discuss current issues between the DOE and the Contractor community. The CFMA is a self-directed group of senior financial managers from M&O contractors of the U.S. Department of Energy (DOE).

PPPL maintenance cost data was provided to the DOE for inclusion in the Office of Science Quarterly Maintenance Report for the second quarter of FY2013.

R. Templon conducted a training class for new Princeton Technical Representatives (PTRs). Three individuals successfully completed the course. To date, 119 active PPPL employees have completed PTR training.

The combined annual PCardholder refresher and ethics training Course has been made available online at the HR Training website. To date, 17 of 45 active pcardholders have taken the training, which includes a comprehension examination.

ENVIRONMENT, SAFETY, HEALTH & SECURITY (J. LEVINE):

On April 17, nearly 30 volunteers fanned out across the PPPL campus to collect trash and litter. They collected 350 pounds of trash and 35 pounds of compostable yard waste. The outside cleanup activity was part of the Laboratory's Earth Day celebration.

On April 18, PPPL held its annual Earth Day observance which included vendor displays, raffle prize drawings and special presentations. The Four Directions Native American Dancers performed traditional dances from several Native American cultures. Seventeen employees were recognized for their efforts to save energy and reduce waste with PPPL Green Machine Awards. Dr. John Dunne of NOAA's Geophysical Fluid Dynamics Laboratory gave a special colloquium presentation on studies addressing the impact of global climate change on heat stress, worker safety and productivity.

R. Sheneman attended a briefing on "Emerging Threats Affecting Academia" sponsored by The University of Medicine and Dentistry of New Jersey and the Newark Division of the Federal

Bureau of Investigation. The symposium is part of the FBI's Strategic Partnership Program Academic Alliance Initiative.

UNICOR conducted a home electronics waste collection event for PPPL employees and collected 2,840 pounds of electronic devices for recycling.

Emergency Services Engine 66 responded to Plainsboro for one mutual aid assignment and to Princeton Township for one mutual aid assignment. Emergency Services Ambulance A166 responded to Plainsboro for three mutual aid assignments.

Platoon B completed the annual Physical Agility Test. This test is completed by all ESU Operations personnel while wearing full turn-out gear and self-contained breathing apparatus (SCBA). This nine-station test contains various Fire, EMS and Security components.

SPD staff met with PPPL senior management to review the design for a new ESU identity and patch. When finalized, the new identity will be used on uniforms, vehicles, bicycles, etc.

SPD issued four all staff e-mail messages regarding Campus Road Closures, Flag at Half-Staff for Victims of Boston Tragedy, Security Awareness Alert, and the Annual PTENS Test.

President Obama ordered all US flags throughout the United States to be lowered to half-staff on April 16 through April 20, as a mark of respect for the victims of the senseless acts of violence perpetrated on April 15, 2013 in Boston, Massachusetts. Please visit <http://www.whitehouse.gov/the-press-office/2013/04/16/presidential-proclamation-honoring-victims-tragedy-boston-massachusetts> to view the Presidential Proclamation.

A management safety walkthrough of the PPPL Computer Center, Furth Library, High Resolution Visualization Wall Room and Fitness Center took place on April 17. Safety conditions in these areas were found to be very good.

INFORMATION TECHNOLOGY (S. BAUMGARTNER):

Members of IT held a meeting with representatives from the Engineering Department to discuss issues and questions regarding IT services and possible resolutions. The meeting was held as a follow up to "Skip-Level" meetings conducted by S. Prager. The meeting was well received by the Engineering representatives and future meetings will be held on a bi-weekly basis or as needed.

Oracle Insight program was completed with the final presentation to senior management including recommendations/roadmap to move forward regarding new business systems.

The NSTX Diagnostic network's address space was successfully upgraded to support 500 network devices.

Two equipment racks for the NSTX-U Digital Coil Protection System's computer and instrumentation were received. Installation procedures are being written to install them at D-Site.

A meeting was held to collect requirements for a web-based Cyber Security Exclusions management system.

OFFICE OF COMMUNICATIONS: (K. MACPHERSON):

J. DeVoe and G. Czechowicz edited and designed the PPPL Weekly, which included a column by S. Prager, and stories by J. Greenwald including a profile of R. Hawryluk, a story on PPPL's partnership with China on a new center for fusion research and an obituary of Edward Frieman.

J. DeVoe wrote a press release on PPPL's upcoming Open House. She also met with F. Cahill, C. Canal, G. Tchilinguirian and A. Massry to discuss communications initiatives for the new property pass system on the Web. As part of her Earth Day committee duties, she edited the slide show for the Earth Day event. She also met with A. Moten on April 19 to discuss a communications plan for PPPL's diversity plan.

J. Greenwald and J. DeVoe attended the first conference call meeting of the DOE's SC Writer's Group on April 17.

J. Greenwald attended and prepared a summary of a Magnetic Fusion Communications Working Group teleconference, and also worked with the Princeton Digital Print Center on design matters related to Quest, the PPPL magazine that will be inserted in the Princeton Alumni Weekly in July.

E. Starkman managed both in-house and external photography requests. She photographed individuals and activities including P. Heizenroeder, the Laboratory Clean Up, Earth Day, R. Maingi and C. M. Cheung in Procurement.

J. DeVoe organized the following tours: On April 17, J. DeLooper led a tour of 12 people from AMEC Environmental. They viewed the film in the auditorium, and the NSTX Control Room & Annex and the NCSX Bay. On April 18, A. Von Halle led a tour of 15 students from the TCNJ IEEE Club and the Physics Club. They started in the auditorium and visited the NSTX Control Room & Annex, the TFTR Test Cell, FCPC Supplies and the MG set and the NCSX site. On April 19, A. Dominguez led a tour of 11 people from the Villanova University Physics Club. They visited the auditorium, the NSTX control room & annex and NCSX.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

A. Zwicker gave a tour of the lobby and Science Education Laboratory, and talked about fusion as well as 3D printing to the Princeton Women's Investment Group.

A. Zwicker continued his collaboration with Sam Abbay, a jewelry designer in New York City, studying how a variety of precious metals and alloys have an effect on plasma startup and stability in a coronal discharge. Initial results have focused on 24K gold and a mixture of 95% palladium and 5% ruthenium as providing a stable discharge for a variety of electrode shapes.

The following PPPL Report were posted to the web:

Effects of Magnetic Field on the Turbulent Wake of a Cylinder in MHD Channel Flow PPPL-4866

Authors: John Rhoads, Eric Edlund and Hantao Ji

Submitted to: Journal of Fluid Mechanics, Cambridge University Press (April 2013)

Numerical Verification of Bounce Harmonic Resonances in Neoclassical Toroidal Viscosity for Tokamaks PPPL-4867

Authors: Kimin Kim, Jong-Kyu Park and Allen H. Boozer

Submitted to: Physical Review Letters (November 2012)

DIRECTOR'S OFFICE (B. SOBEL):

On April 16, the quarterly Laboratory Management Review (LMR) meeting was held.

On April 16, Professor Steve Koonin, NYU, presented a colloquium entitled "The Promise of Urban Science".

On April 17, M. Zarnstorff attended the LERDWG Meeting held in Washington DC.

On April 17, Professor Nima Arkani-Hamid, Institute for Advanced Studies, presented a colloquium entitled "Fundamental Physics and the LHC: A Progress Report".

On April 18-19, S. Prager, M. Zarnstorff, H. Neilson, D. Gates, and J. Menard attended a joint PPPL/MIT/GA meeting held in San Diego, CA.

This report is also available on the following web site:

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