



The PPPL Highlights for the week ending November 30, 2012, are as follows:

NSTX (M. ONO):

NSTX-U is in the Upgrade Project outage in FY 2013

M. Ono (PPPL) attended the 29th annual meeting of Japanese Society of Plasma Physics in Kasuga Conference Center, Fukuoka, Japan, November 27-30. He gave an invited talk entitled "Plasma-Wall Boundary Control With Lithium Divertor and Associated Plasma Confinement Improvements in NSTX". He also participated in a conference symposium organized on the plasma-wall interaction, and gave a symposium plenary talk, which was a modified version of his invited talk. Ono also visited the nearby QUEST Facility during the conference and discussed the NSTX-U – QUEST collaboration activities with Professor Hanada.

NSTX Upgrade construction activities continued this week and are highlighted in the Engineering section below.

Preparations of non-upgrade equipment for plasma operations in the NSTX-U configuration also continued with the analysis of data from the recent successful power testing of a field power conversion system equipped with a prototype fault detector and the new firing generator. Electrical insulation testing of hot and ground sticks used for safe access to NSTX power equipment was also performed this week.

ITER & TOKAMAKS (R. WILSON):

DIII-D (R. Nazikian):

On November 30, D. Gates gave a seminar at General Atomics entitled "Origins of the Tokamak Density Limit". In addition, he met with several DIII-D researchers and discussed issues associated with a proposed experiment to investigate the predictions of this theory.

International (R. Wilson):

S. Sabbagh and Y.S. Park visited NFRI to run experiment MP2012-04-23-021 on KSTAR. ELMs were mitigated using $n = 2$ applied fields using midplane coils alone, without particular alignment to the pitch of the confining field. Plasma stability parameters have reached and exceeded the $n = 1$ ideal no-wall limit, computed and published for H-mode profiles - a significant milestone for advanced tokamak operation. Initial analysis shows the ratio of

normalized beta to β_{Li} to exceed 4, which marks a 100% increase in this parameter compared to the 2011 run campaign. Plasma rotation was significantly altered in a controlled fashion using $n = 2$ applied fields, allowing study of the underlying physics, and providing a tool to access reduced plasma rotation.

ADVANCED PROJECTS (H. NEILSON):

The Laboratory hosted three visitors from Korea's National Fusion Research Institute (NFRI) for a three-day working meeting to discuss the design and engineering analysis for the K-DEMO device being planned in Korea. The K-DEMO would be a fusion nuclear facility designed to generate 300 to 800 MW of net electricity. The design is based on the tokamak concept, and is assumed to operate steady-state in an advanced tokamak mode. It is currently foreseen to be similar to ITER in its physical dimensions but with a higher magnetic field. The meeting opened with a presentation by K-DEMO Project Leader Dr. Keeman Kim on the current status of the design, emphasizing the design point, system code predictions, and magnet design. After that, there was a series of presentations by PPPL participants, addressing the design point and performance predictions, configuration design, structural analysis, and superconducting cable analysis. Preliminary work plans for 2013, including an update of the design point and papers at engineering conferences, were documented, anticipating approval of a collaboration agreement between NFRI and PPPL.

A paper, "A Magnetic Diagnostic Code for 3D Fusion Equilibria," by S. Lazerson, et al., was accepted for publication in *Plasma Physics and Controlled Fusion*. The paper documents work performed under our collaboration with the LHD stellarator program in Japan.

D. Mikkelsen visited the National Institute for Fusion Science (NIFS) in Japan to work on GS2 microinstability calculations for LHD experiment conditions. He also worked on benchmarks of the gyrokinetic codes GKV-X (NIFS), GS2, and GENE (Max Planck Institute for Plasma Physics, Germany) as well as the respective geometrical input data. A high ion-temperature, or ion internal transport barrier, discharge was chosen for study, and data files for it were obtained. The work plan includes visits to PPPL by Kenji Tanaka and Masanori Nunami in early 2013. The benchmarks will include collisionless electron kinetic effects, and use the new multi-ion-species capability of the GKV-X code.

R. Goldston has been working closely with the ITER IO, the JET Team, and Dr. Peter Stangeby to try to understand the cause of higher-than-expected heat flux on JET's Be start-up limiters. Results from JET reported at the IAEA meeting showed localized heating resulting in melting at the limiter crown. This occurred even though the design was optimized for a narrower scrape-off width than measured experimentally, which should have caused the heat flux to peak away from the crown region. The extra heating at the crown may be related to results from the toroidal TFTR bumper limiter, where significant recycling was observed at the toroidal midplane. This was explained by the "funnel" effect, which is challenging to apply to a poloidal limiter with a peaked crown. The JET and TFTR results are also in agreement with a "heat attraction" model that Rob has published, but the JET results appear to be in too low a collisionality regime for the heat attraction model to be fully relevant.

FUSION SIMULATION PROGRAM (W. TANG):

B. Tang visited the Culham Science Center (CSC) in the UK from September 28-December 1 and was hosted by CSC Director Steve Cowley. He provided advice on strategic linkages being planned between the CSC and HPC centers in the UK and presented an invited talk on "High Performance Computing in Fusion Plasma Physics." He also had productive discussions with JET Director Francesco Romanelli and some members of JET on developing future collaborations with JET and the EU with focus on experimentally-validated integrated modeling. Dr. Romanelli is also Head of EFDA, the European Fusion Development Agreement between the European fusion research institutions and the European Commission.

THEORY (A. BHATTACHARJEE):

The initial meeting of the Theory Department Plasma Material Interaction (PMI) Working Group was held on November 29 at PPPL. The objective of the group, led by D. Stotler, is to identify one or more PMI or materials related problems that can be solved by small teams within the Theory Department in conjunction with PPPL experimentalists. This first meeting consisted of presentations by Stotler, M. Jaworski, R. Goldston, and C.S. Chang in which each briefly described their current research interests.

On November 29, Professor Nobumitsu Yokoi gave a theory seminar entitled "Cross-helicity effects in turbulent dynamo and magnetic reconnection." Importance of cross-helicity due to the fact that, unlike helicity, it can lead to non-vanishing mean Lorentz force, was emphasized. Various mechanisms for generation of cross-helicity were given, and possible application to magnetic reconnection and solar dynamo were discussed.

N. Gorelenkov gave an informal space seminar within the theory department. The presentation was on the "Fusion Kinetic Ballooning Formalism in Applications to Alfvén Instabilities of the Magnetosphere". The work was focused on the numerical formalism as well as on its theoretical approach. It covers earlier application of the HINST code to the NSTX with strong trapped electron component. It also shows the initial applications to the magnetosphere and the possibility to broaden this study.

COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):

E. Feibush presented "Scientific Visualization with VisIt" as a mini-course sponsored by the Princeton Institute for Computational Science and Engineering on November 28. This workshop provided hands-on training in using the VisIt visualization software including parallel rendering on the Princeton University High Performance Computing Center. The training emphasized how to represent simulation data in the visualization software. The session was attended by graduate students and staff members from 16 different University departments and GFDL.

A delegation from Lehigh University, led by Arnold Kritz and including two visitors from EAST (Jun Ma and Guanqiong Wang) and Jan Weiland from Chalmers University in Sweden visited on Monday to discuss issues related to the PTRANSP code, and incorporating the Multimode model in the new solver option, PTSOLVER. The Chinese visitors obtained TRANSP accounts so that

they can submit jobs remotely. Professor Weiland presented a theory seminar on the theoretical basis for the Multimode transport model: "Advances in a Theory Based Reactive Fluid Anomalous Transport Model."

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

The upper umbrella legs should be completed November 30.

Work continues on modifying the vacuum vessel leg mounts to accommodate the last four TF clevis blocks.

The last parts of the old bay K nozzle are being ground off the vessel so the final cut of the vessel for the new JK cap can be done in a few days.

Three (3) new TF conductors were delivered to PPPL this week, one TF conductor is being soldered on November 30. Enough conductors are now on site to complete the TF bundle, the remaining conductors being machined at MTM will provide a spare quadrant contingency.

Request for quotations has been submitted to three vendors for the replacement quadrant mold cover - bids are due back next week. In house alternate design is being pursued using schd 5 pipe and supporting ribs. All of the material for the internal design are in house and fabrication of a mockup in addition to the final design is underway. The cover plate for the mockup was cut, water jetting of the ribs is being run over the weekend. New clamps to help in seating the conductors in the quadrant mold were completed and delivered to the winding area.

Final welding of the CS casing components at Martinez is underway.

The first production flex connector was tested and approved. The next four OTF weldments were completed and shipped by the manufacturer. The next lot of four have completed fabrication and are awaiting final QC inspection at the vendor.

NBI Upgrade: The Tech Shop completed the BL Exit spool piece that attaches to the end of the BL. Leak checking was completed in the NB Shop. The spool piece has been installed on the BL Exit flange in the NTC. The TIV can now be installed onto the spool piece to close the exit end of the BL box. Refurbishment of 90 inch flange and ion dump continued in the TTC with installation, brazing, and leak checking of water lines. Fabrication of cryolines continued in the NBPC shop. The calorimeter drives will be replaced. Delivery is expected this month. Preparations continue for the Bay JK weldment installation including final metrology check, fabrication of the cutting template, lift fixture calculations and load testing. The final finish cut on the vessel is planned to begin next week. Work continues on NBI Armor backing plate final machining and two of four are complete. In-vessel fit-up of armor plates to check supports is imminent after which final structural welding may proceed. Presentations for the upcoming Office of Science review were developed and presented to lab management for critique.

Office of Project Management (T. Stevenson):

Development of the Work Planning online system revision 6.0 continues. Testing in the development area is being prepared.

The Work Planning Review Board was held and evaluated Work Plans 1800 - 1836. Problems with email notifications were noted and will be investigated by IT.

The System Engineer list changes are in progress.

Facilities and Site Services (M. Viola):

Work continues on the Mockup Building Clean Room HVAC System at D-Site. Work has resumed on the HP Offices and Conference Room renovations. The supply vent for the EVAPCO Cooling Tower MER was installed. The GPP List was submitted for FY13 Project Review.

Telecommunications Office: Avaya is still on track to provide PPPL the new phone system software revision in December. The new revision is expected to eliminate the intermittent problem of voicemail message waiting lights staying on after the user has checked all new voicemail messages. After approximately two months the phone system problem of intermittent dead analog phone lines has not occurred.

The electricians have completed the ground re-wiring project in the phone room. The ground wire to the Verizon UPS system, which provides backup power to the Verizon (4) T1 voice circuits, was wired to building steel.

Fire Protection: A fire protection review has been scheduled for the week of January 14. December Fire PM's are complete. The first draft of a PowerPoint presentation for Halon/FM-200 Training for Area Occupants is complete.

BUSINESS OPERATIONS (E. WINKLER):

Members of the Business Operations Department and Business Computing Division met with a representative from the Princeton University Financial Systems group to discuss the status of the new chart of accounts design structure project. The primary purpose of the meeting was to provide a brief overview of the new chart of accounts project with a discussion of its impact on our systems.

Members of the Business Operations Department conducted a telephone conference call with DOE PSO and Chicago finance staff to better understand the recently published DOE guidelines on "Accounting for Work Stoppages".

N. Gnyp participated in the monthly ITER procurement status meeting with representatives from the PPPL ITER Project Office and the US ITER Project Office at Oak Ridge.

PPPL submitted five proposals to DOE in response to Program Announcement LAB 12-751, Office of Science Early Career Research Program.

A work-for-others proposal to support Princeton University on a grant received from the Department of State was submitted to DOE for approval. The PPPL Principal Investigator for this effort is R. Goldston; the funding to be provided by Princeton University is \$70,000 for the one-year period of performance.

A work for others proposal with Lockheed Martin (LM) Corporation Space Systems Company was submitted to and approved by DOE. LM has requested PPPL's participation in its study of the effects of a Hall Effect Thruster or Hall Current Thruster on an operating spacecraft solar array. The PPPL Principal Investigator for this effort is Y. Raitses; the funding to be provided by LM is \$75,000 for the ten-month period of performance

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

The DOE Office of Science and Office of Health, Safety and Security visited PPPL for a DOE Peer Review Risk Assessment of PPPL on November 26-29. The reviewers toured the Laboratory and assessed the risk to departmental assets and the physical protection of those assets. During the outbrief, the team shared positive observations about our personnel, practices, and operation. The Site Protection Division (SPD) will receive feedback and recommendations to enhance and calibrate our security posture with the threats and risks we face at PPPL.

On November 29, the asbestos removal subcontractor, AES, and Briggs, the air monitoring subcontractor (under the direction of Environmental Services Division personnel), removed an elevated transite panel from the outside of the MG Building. This panel was damaged during the recent storm. The Facilities and Site Services Division will replace this panel.

A management safety walkthrough of the D-Site MG Building was held on November 28. Safety conditions in this area were found to be very good.

ESU Engine 66 responded to Plainsboro for four mutual aid assignments, to Princeton for two mutual aid assignments and to C-Site CS Building for a smoke detector activation. Ambulance A166 responded to Plainsboro for one mutual aid assignment.

SPD responded to one data call from DOE/PSO and the Office of Emergency Management regarding SPD staff that have been trained in NIMS and ICS.

Draft DOE Order O206.2, Identity, Credential, and Access Management (ICAM) was reviewed and comments were provided for the DOE RevCom system.

PPPL Counterintelligence Officer P. Moskal visited the Laboratory on November 19-21.

The DOE Office of Science, Chicago Office Security Operations Team provided comments to SPD on the draft Site Security Plan.

Building Evacuation Program: The Designated Evacuation Assembly Area map has been updated and provided to all staff. Several new Building Evacuation Monitors (BEMs) have been added to the Program. New procedures for Shelter In Place and Lockdown have been added. You can review the changes to the BEM Program at <http://siteprotection.pppl.gov/buildingevacuation.html> . Please post the new assembly area map in your work areas and conference rooms, and have copies available for any visitors.

SPD distributed an all-staff message on November 26 regarding the expected winter weather this week and preparatory actions for staff to consider.

ESU Driver/Operator S. Galie provided classroom and practical fire extinguisher training on November 28 for four students (two employees and two subcontractors).

INFORMATION TECHNOLOGY (S. BAUMGARTNER):

For the NSTX-U Plasma Control System, problem analysis revealed incompatibilities with the input-output hardware. Corrective actions are underway.

NSTX-related web and database resources have been ported off of pppl-appsrv which is being retired.

A requisition has been submitted for Overvoltage-protected Termination Panels, which are needed for NSTX-U CAMAC retirement efforts.

OFFICE OF COMMUNICATIONS: (K. MACPHERSON):

C. Cane gave a presentation on November 29, during a teleconference to the Communications and Information Technology groups of ORNL at the request of David Keim, Director of Communications of ORNL, who expressed interest in PPPL's newly redesigned external website. Cane gave an overview of the design approach and answered questions from ORNL staff about information architecture, workflow issues, editorial guidelines and information migration. K. MacPherson also participated in the teleconference.

J. Greenwald and J. Jackson DeVoe attended a meeting at Princeton University's School of Engineering on November 28, with other research writers on campus to share best practices and discuss story topics.

K. MacPherson hosted a teleconference with other members of the Magnetic Fusion Communications Group on November 30, to discuss information strategies with other communications leaders at MIT, General Atomics and U.S. ITER. Rezwan Razani gave a presentation on social media techniques that are part of her outreach through the Fusion Energy League. John Greenwald also participated in this meeting.

E. Starkman took a group photo of a Korean delegation from K-DEMO visiting PPPL. She also photographed PPPL's annual United Way event.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

G. Kramer attended Family Science Day at Mercerfield Elementary School where he demonstrated various plasma displays. About 20 students and family were present.

A. Dominguez and S. Zheng visited Thomas Grover Middle School in Princeton, New Jersey, where they gave a talk about plasma and provided a demonstration of various plasma displays including the plasma speaker. Sylvan, an intern with Science Education, attended Thomas Grover Middle School just a few years ago.

The following PPPL Reports were posted to the web:

Comparing Linear Microinstability of the National Compact Stellarator Experiment and a Shaped Tokamak PPPL-4832

Authors: J.A. Baumgaertel, G.W. Hammett and D.R. Mikkelsen
Submitted to: Physics of Plasmas (October 2012)

The Dependence of H-mode Energy Confinement and Transport on Collisionality in NSTX PPPL-4833

Authors: S.M. Kaye, S. Gerhardt, W. Guttenfelder, R. Maingi, R.E. Bell, A. Diallo, B.P. LeBlanc and M. Podesta
Submitted to: Nuclear Fusion (November 2012)

Formation and Sustainment of ITPs in ITER with the Baseline Heating Mix PPPL-4834

Authors: Francesca M. Poli and Charles Kessel
Submitted to: Physics of Plasmas (November 2012)

DIRECTOR'S OFFICE (B. SOBEL):

M. Zarnstorff visited NIFS on November 28-December 2 to discuss LHD experiments and serve on the NIFS External Peer Review Committee.

On November 28, Wayne Reiersen, Princeton University presented a colloquium entitled "Progress in U.S. ITER Magnet Systems".

This report is also available on the following web site:
<http://www.pppl.gov/polWeeklyHightsExternal.cfm>