



The PPPL Highlights for the week ending November 16, 2012, are as follows:

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

In preparation for a System Integration Review to be held November 20 for equatorial port plug E11, meetings were held with the IO integration team to understand the proposed integration and its impact on the LFS Reflectometer performance. It is likely that there will be an action at the SIR to more fully optimize the transmission line routing to minimize the number of miter bends in the system.

At a meeting with Nova Photonics, progress in the optical design for the MSE view of the diagnostic neutral beam was reviewed, and modifications to improve the shielding effectiveness were discussed.

A draft Task Agreement on development of the conceptual design for the Motional Stark Effect Diagnostic was posted on IDM for IO approvals before being sent to the US-DA.

A PPPL requisition was submitted for a sole-source contract with UCLA for R&D for the LFS Reflectometer to prepare a case for a monostatic approach for the ITER system, and to use an existing test stand to test the useable bandwidth of new optimized corrugated waveguide (to be supplied by ORNL).

NSTX (M. ONO):

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

Members of NSTX-U research team participated in the 17th Workshop on MHD Stability Control at Columbia University on November 5-7, and gave the following invited presentations: "Avoiding RWMs in ITER" "RWM Stabilization and Control in NSTX (and DIII-D) – Implications for ITER" by Steve Sabbagh (Columbia University) and "Characteristics of Disruptions in NSTX: Disruptivity, Precursors, Detection, and Halo Currents" by S. Gerhardt (PPPL). The following contributed talks were also given: "Global Mode Control and Stabilization for Disruption Avoidance in High- β NSTX Plasmas" by Jack Berkery (Columbia University), "NTV calculation with particle simulation and its validation in NSTX and DIII-D" by K. Kim (PPPL), and "Electromagnetic Particle Injector for NSTX-U" by R. Raman (University of Washington).

NSTX-U Research Team members S. Sabbagh and J. Berkery of Columbia University submitted an APS DPP Press release titled: "Fusion Plasma Works Best Just Where You Least Expect It", which demonstrates using low frequency MHD spectroscopy in dedicated experiments, the very positive result that NSTX plasmas at very high stability parameters (e.g. $\beta_N/\beta_i > 10$) are measured to be *more* stable than plasmas below this value. This result directly and independently supports a similar conclusion made two years ago in dedicated experiments focussed on RWM active control. The press release can be found at:
(<http://www.aps.org/units/dpp/meetings/vpr/2012/upload/fusionplasma.pdf>)

S. Gerhardt (PPPL) submitted an APS-DPP press release titled: "Halo-Current Effects in Tokamak Reactors: Hardly Heavenly". This paper described measurements of disruption halo currents in NSTX, focusing on the spatial structure and dynamics of the currents. It was shown that the dominant structure of the halo current is a toroidally localized lobe, which can rotate up to 8 times around the torus. The press release can be found at:
<http://www.aps.org/units/dpp/meetings/vpr/2012/upload/halocurrents.pdf>

Princeton University graduate student F. Scotti and his advisors V. A. Soukhanovskii (LLNL) and R. Kaita (PPPL) submitted an APS DPP Press release titled: "Elements Duke it out to Penetrate Hot Plasma". The press release followed an Invited talk G12.00005 "Modifications of Impurity Transport and Divertor Sources with Lithium Wall Conditioning in NSTX" that was presented by F. Scotti at the APS DPP meeting in Providence, Rhode Island. This work focused on the changes of carbon and lithium divertor sources, and impurity scrape-off layer and core transport due to lithium wall conditioning in NSTX H-mode discharges. Moderate reduction in divertor carbon influx and the disappearance of ELMs resulted in core carbon accumulation. In contrast, better divertor retention and the higher core lithium neoclassical particle diffusivity prevented lithium accumulation in the core. The analysis employed divertor and core plasma diagnostic data and modeling using neoclassical codes NEO, NCLASS, as well as TRANSP and impurity transport code MIST. The press release can be found at:
<http://www.aps.org/units/dpp/meetings/vpr/2012/upload/hotplasma.pdf>.

J. Menard (PPPL) participated in the Conceptual Design Review (CDR) of the ITER Plasma Control System (PCS) held at the Chateau de Cadarache on 13-15 November. He served as an external reviewer of the identification of requirements and interfaces in the areas of non-axisymmetric MHD control, disruptions and runaway electron control, and associated interfaces to the ITER Central Interlock System.

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 ongoing testing of the prototype fault detector in conjunction with the new firing generator in a field coil power conversion rectifier. Individual faults and breaker trips have been generated, and the rectifier power tested into a local dummy load. Also this week, a final design review of the proposed PF1 coil system feed changes was held.

ITER & TOKAMAKS (R. WILSON):

DIII-D (R. Nazikian):

E. Kolemen, R. Cohen and B. Duval attended the R&D 100 Awards in Orlando, Florida for their work in development of the Snowflake Power Divertor. R&D Magazine recognized this work as one of the 100 most technologically significant new products of the year.

B. Tobias attended the annual MHD Workshop at Columbia University and presented work related to ECE-Imaging of coupled core and boundary MHD perturbations in DIII-D, with implications for non-axisymmetric equilibrium reconstruction, NTM control and disruption avoidance. Michio Okabayashi presented a paper at the same workshop on the excitation of a density snake by off-axis fishbone and the interaction with ELMs in DIII-D. E. Kolemen presented a paper titled "Suppression of NTMs Before Full Saturation."

D. Battaglia travelled to NFRI in Korea with D. Mueller, T. Evans and P. Gohil to collaborate on KSTAR experiments. Battaglia lead an experiment to measure the impact of X-point height on the L-H transition power threshold on KSTAR. Only a few shots were available for the initial run of the experiment, and the goal of demonstrating adequate control of the X-point height was achieved.

B. Grierson has recently reported on the collisionality scaling of main-ion toroidal and poloidal rotation in DIII-D. The measurements indicate that the rotation of deuterium is nearly neoclassical at high collisionality. At low collisionality, the inferred deuterium poloidal rotation is significantly more ion-diamagnetic than neoclassical prediction. For low rotation, low collisionality plasmas, the contribution to the radial electric field from the main-ion poloidal rotation is significant. The effects of anomalous poloidal rotation in ITER scenarios is being investigated through use of TGYRO-TGLF simulations.

W. Solomon presented the year-end review and high level 2013 program priorities for the Dynamics and Control group at DIII-D.

ADVANCED PROJECTS (H. NEILSON):

The Department of Energy and Germany's Max Planck Institute for Plasma Physics (IPP) signed a project agreement under which the U.S. will provide power supplies for U.S.-supplied trim coils for the Wendelstein 7-X stellarator. With this agreement (an amendment to the existing agreement covering the coils), the U.S. will provide a complete trim coil system, including coils and power supplies, for W7-X. U.S. engineers will oversee the installation of the supplies and will lead the in-situ commissioning of the power supply units, to complete a U.S. commitment to deliver a working system. The trim coils are an important control actuator, providing experimental flexibility that will be used to optimize W7-X performance and a tool that U.S. scientists, as partners in the W7-X research program, will use to support research in the control of 3D toroidal plasmas. The trim coil power supplies will be manufactured under a contract with Applied Power Systems, Inc. A supplier final design review is scheduled to be conducted on November 28 at the supplier's Hicksville, New York facility.

Manufacture of the fifth and final trim coil continues at Everson Tesla, Inc., of Nazareth, Pennsylvania. Konrad Risse, IPP responsible officer for the trim coils, presented the results of a recently completed confirmation test on the resistance temperature detectors (RTDs) on second trim coil. The results were very good and they fulfill the AA class criteria. M. Mardenfeld has completed the final analysis report and will be forwarding the document for signature by the end of the week.

FUSION SIMULATION PROGRAM (W. TANG):

W. Tang co-organized the G8 Exascale Project Workshop, and gave a summary presentation on the G8 Nuclear Fusion Simulations @ Exascale ("NuFuSE") Project on November 12 in Salt Lake City, Utah. He also chaired the Panel Discussion between the G8 Project PI's and the international agency representatives which concluded this meeting. While in Salt Lake City, he participated in the 2012 International Supercomputing Conference (November 13-16), and presented an invited talk at the NVIDIA GPU Technology Theater on "Progress on Path to Exascale Computational Challenges in Fusion Energy Sciences" on November 14.

THEORY (A. BHATTACHARJEE):

On November 14, Professor A. Boozer gave a theory seminar entitled "Magnetic Reconnection in Space." The talk emphasized the importance of three-dimensional models in representing magnetic field evolution of realistic space plasmas. Realistic space plasmas lack the symmetry required to make two-dimensional concepts such as X-points and tearing modes applicable. The concept of mixing, when the perimeter of the contours enclosing the magnetic field lines times the interdiffusion distance of the field lines becomes greater than the cross sectional area of the reconnection region, was identified to be important in three-dimensional models in which the magnetic field lines exponentially separate from each other. The relation between with two- and three-coordinate concepts was explained and possible research directions were discussed.

On November 5, L. Zakharov and X. Li attended Workshop on MHD Control and Joint U.S.-Japan Workshop at Columbia University. Zakharov presented a talk "Halo Currents in Disruptions - Is it a Reality or a Fantasy of Interpretations and "First Principle" Simulations", where he explained the theory of plasma-wall interactions during Wall Touching Kink and Vertical Modes. While earlier Zakharov analysis of JET disruption data dismissed any role of "halo" currents in kink modes, the recent measurements of Hiro currents during vertical instability on EAST confirmed the theory and dismissed the "halo" currents even in $n=0$ modes. In his opinion not only 3-D MHD codes with boundary conditions in their present form are invalid for disruption simulations, but even 2-D codes, also employing "halo" currents are incapable to simulate the Hiro currents, cannot be used for modeling even the simplest vertical instability.

On November 12, L. Zakharov gave a talk "The Basics of LiWall Fusion" to UK Fusion Theory Meeting at JET, CCFE, Abingdon UK. He explained that it is no longer possible to rely on enhancement of device (tokamak) size, toroidal magnetic field, plasma current, and heating power for making progress in magnetic fusion. It is much more efficient to renew the original idea of magnetic fusion in preventing plasma edge cooling by arranging absorption of the plasma

particle flux. The Li surface is well suitable for the implementation of this approach. Zakharov pointed out that while the recent first flowing lithium experiment on HT-7 has confirmed the theory and extended the series of successes of LiW fusion, the conventional approach fails understanding the plasma confinement.

COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):

S. Ethier attended the International Conference for High Performance Computing, Networking, Storage and Analysis (<http://sc12.supercomputing.org/>). He was a co-author on a paper entitled "Byte-Precision Level of Detail Processing for Variable Precision Analytics", presented by first author John Jenkins from NCSU, as well as on a poster entitled "Advances in Gyrokinetic Particle-in-Cell Simulation for Fusion Plasmas to Extreme Scale", presented by Dr. Bei Wang of Princeton University.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Installation of new umbrella legs continues for both the upper and lower umbrellas. Half of the new legs have been installed so far.

Re-enforcement welding of the south vessel leg bracket continues. Modifications to the vacuum vessel legs are required to fit in the new TF clevis blocks in the locations of the legs.

Ultrasonic testing of uninstalled umbrella legs showed no issues with the braze joints. Ultrasonic testing of the TF flags showed no issues from the flag straightening activity.

PF5 hardware removals have been started.

Removal of the water cooled cables on NSTX is progressing.

The electricians are installing category three (3) racks on the new 119' platform.

Five (5) new TF conductors were delivered to PPPL on November 15, three TF conductors have been soldered, two conductors have been sandblasted and five TF conductors will be primed and cured on November 16. A total of 35 TF conductors are now on site.

Reviews have been held to review plans to fabricate a new lid for the TF Quad mold. Two options are being pursued, one to machine a new cover from thick plate similar to the original design and a second to fabricate a cover using Sch5 pipe and backing it up with ribs.

CS casing components have been assembled and ready for final welding at Martinez.

Zenex delivered the first production flex connector, dimensional and cyclic testing are planned for acceptance. The next four OTF weldments are on track for shipment by the end of the month from Carolina fabricators.

NBI Upgrade: A WAF Review and Change Board meeting was held for three jobs including an ECP for the NBI armor. The armor ECP covers installation work and on vessel testing not originally envisioned at Bay H. Refurbishment activities continued on the 90 inch flange, the calorimeter, and the ion dump. The deionized water system installation procurement package is being developed. Cryogenic line fabrication continues in the NB shop. Penetration filling in NBPC after cable removals is in progress. The Bay JK weldment metrology was completed and adjustments to the installation procedure and welding are being evaluated. Details for weld prep and reinforcement of the Bay JK cap installation were discussed and will be added to the drawings. The lift procedure for the JK cap is completed and in review. Shop work continues on the BL short spool section and the duct large spool section. BL and TVPS Turbomolecular pump procurement is in progress.

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 System Engineer list and the training module are being reviewed.

The monthly Project Status Review Board meeting took place with 12 high profile jobs reporting technical, cost, schedule, and resource progress.

Facilities and Site Services (M. Viola):

America Recycles Day: Facility and Site Services and the Material and Environmental Services group teamed together to organize the America Recycles Day, celebrated on November 15. Employees brought in their personal electronics to be recycled by UNICOR. Employees visited the lobby to learn more about recycling at home and at PPPL. Eighty employees pledged to learn more about recycling and reduce personal waste by recycling.

Construction Management: The construction work on the commons deck was restarted on November 15 and is scheduled to be completed by December 14, weather permitting. Work commenced on replacing the D-Site Mock-up Clean Room HVAC System. HP Office and conference room renovations continues into the installation phase next week. Engineering wing roof steam and condensate piping insulation work continues. Laboratory wing MER condensate pipe repairs are complete. C and D winterizing work is complete for the winter. Hurricane Sandy damage assessment has commenced.

Telecommunications: The Telecommunications Office de-installed and requested that Verizon cancel service to six (6) unneeded ISDN circuits that were used for videoconferencing at the Lab. The Telecommunications Office installed a patch panel that will now be used by VCS to route the three (3) remaining ISDN circuits to the video conferencing equipment that is needed for a meeting. The new configuration and patch panel eliminates six (6) Verizon data circuits, which will save the Lab \$350 per month and \$4,200 annually.

The Telecommunications Office installed a backup phone and line in the LSB Command Center. The new phone line bypasses the phone system and our normal Verizon calling circuits. The idea is that if the Verizon phone circuits go down due to Verizon troubles or a natural disaster

situation, the Command Center would have an option to place and receive calls at the Laboratory. The Telecommunications Office is looking into a telecommunications service offered from Verizon under DOE's Network agreement for phone and data circuits. This service offers its customers special priority response time and restoration for services critical to agencies operations. There is an additional fee for this priority service, which could be approved by management.

The Laboratory's phone system is performing as expected with the installation of a new Gateway, which connects (168) Lab phones to the phone server. The Telecommunications office will continue to monitor the performance.

Fire Protection: We began review of relevant NFPA standards as it pertains to Lithium experiments. The first meeting of the Lithium Committee took place. Four people have been selected for the Fire Protection Review. We received a proposal from Siemens for duct smoke detector and programming for the new carpenter shop. Sprinkler drawing information for the HP Renovations was provided. We responded on site to help identify unknown wires and to consult on smoke detector remount and EVES conduit relocation.

BUSINESS OPERATIONS (E. WINKLER):

PPPL's Budget and Human Resources Committee met to establish FY2013 budgets and indirect/overhead rates, and to review the staffing levels.

The PPPL Business Operations Department received updated guidance on conference related activities and spending from the Department of Energy. The intent of this new guidance is to ensure that the DOE's spending on conference related activities is limited to that which is necessary and prudent. The Accounting Division will work on revising the current policies and procedures to incorporate the changes in this guidance, and evaluate the resources required to implement the new guidance.

R. Templon conducted a training class for new Princeton Technical Representatives (PTRs). Four individuals successfully completed the course. Two were immediately added to the list of qualified PTRs. Two others must complete the Hazard Awareness training course currently scheduled for mid-December before they will be qualified as PTRs. To date, 116 active PPPL employees have completed PTR training. A list of active PTRs is posted on Procurement's internal web page, via the link "Training Resources/Help".

The Procurement Division submitted its FY 2012 balanced score card self assessment results and its FY 2013 balanced score card self assessment plan to DOE.

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

The annual ISO-14001 audit of PPPL's Environmental Management System took place on November 12-16. Representatives of UL-DQS, our independent ISO registrar reviewed the documents, programs and processes used by PPPL to minimize its impact to the environment. The auditors complimented PPPL on its progress in reducing greenhouse gas emissions and its

numerous DOE and Federal awards. The auditors identified one finding and made several recommendations for improvement. PPPL's Environmental Management System remains certified to the ISO-14001:2004 standard.

ESU Engine 66 responded to Plainsboro for two mutual aid assignments and to PPPL C-Site for one assignment. Ambulance A-166 responded to Plainsboro for one mutual aid assignment and to PPPL C-Site for one assignment.

ESU and SPD staff members received training on the PPPL Spill Prevention Control and Countermeasure (SPCC) Plan. The training was provided by M. Pueyo of Environmental Services.

The DOE Office of Science and Office of Health, Safety and Security rescheduled their visit to PPPL for a DOE Peer Review Risk Assessment of PPPL to November 26-30. The reviewers will tour the Laboratory and assess the risk to departmental assets and the physical protection of those assets.

DOE-PSO has reviewed and approved the PPPL Emergency Readiness Assurance Plan and Continuity Readiness Assurance Report FY2012-FY2013.

SPD responded to one data call from the Government Accountability Office (GAO) regarding their audit of the "Security of Federal Facilities not Protected by the Federal Protective Service."

The annual "Severe Weather Information" message was distributed to all staff. The message contained a call for Department Heads to update their Departmental Calling Trees and provide them to SPD.

F. White, D. Stevenson and J. Alkhateeb met with staff from Princeton University's Department of Public Safety (Captain D. Reichling) and the High Performance Computing Research Center (Manager M. Petty) to review several areas that may be designated as space for an Alternate Emergency Operations Center in the HPCRC.

ESU Driver/Operator Wesley Foraker completed Strategies and Tactics Training at Mercer County Fire Academy.

INFORMATION TECHNOLOGY (S. BAUMGARTNER):

GA Type 1D Integrator boards have begun fabrication. A prototype is expected at GA on November 28.

EPICS databases were loaded for NSTX-U Neutral Beam #2.

A series of short, online training videos are being made in preparation for deployment of the new online Property Pass system. This includes a web-based user interface and database back-end for tracking off-site property.

Business Computing Systems released a new Great Plains dictionary with enhancements supporting accounting and material control.

An updated PCard reconciliation report was released to production.

IT Managers attended a requirements workshop for ServiceNow. ServiceNow is a 'cloud' service which will be used to replace our current Helpdesk system and software.

96 additional CPUs have been added to the dawson cluster. This 10Gb interconnected low latency cluster now has over 2500 CPUs available for job runs.

ESnet switched PPPL's 10Gb connection over to their new 100Gb network backbone. While PPPL's connection speed remains at 10Gb, the new network will result in less network contention.

S. Baumgartner and J. Hirsch presented PPPL's Information Security Continuous Monitoring update to the PSO and DOE Chicago office representatives.

OFFICE OF COMMUNICATIONS: (K. MACPHERSON):

Chris Cane led an effort by the communications team to produce a redesigned external-facing website for PPPL. Cane, along with K. MacPherson, fielded queries from the Laboratory's Peer Review Committee on November 13 about the new website, and responded to queries with multiple revisions.

G. Czechowicz gathered information and prepared a three-year printing and publishing plan about PPPL for DOE and submitted it within the deadline.

J. Greenwald wrote several fusion science-related stories, including one on the EPRI report on fusion.

K. MacPherson, joined by J. Greenwald, conducted a national teleconference on November 15, with other members of the Magnetic Fusion Communications Group (MFCG), a group newly formed to share best practices in fusion communications initiatives for the U.S. domestic program.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

The Science Education Department went live with the "Princeton Plasma Physics Laboratory's Science Education Department" facebook page. Within two weeks of making the page public, Science Ed garnered almost over 75 likes and the public reach has been to over 800 unique facebook users.

D. Ortiz attended Princeton University's first ever "All-Princeton Resource Fair for Summer Internships and Funding" hosted by Career Services to promote PPPL's NUF program. The purpose of this fair is to hold one event that brings together all Princeton-affiliated entities who have summer internship programs and/or funding research.

A. Merali and A. Zwicker met with Professor Kathy Browne of Rider University to discuss an educational partnership between PPPL and Rider University.

The Science Education Department met with PPPL head of Security, to discuss alternate security and sign-in options for 2013 Science on Saturday.

The following PPPL Reports were posted to the web:

On the Toroidal Plasma Rotations Induced by Lower Hybrid Waves PPPL-4831

Authors: Xiaoyin Guan, Hong Qin, Jian Liu and Nathaniel J. Fisch

Submitted to: Physics of Plasmas (November 2012)

Recent Progress in the NSTX/NSTX-U Lithium Program and Prospects for Reactor-Relevant Liquid-Lithium Based Divertor Development PPPL-4830

Authors: M. Ono, et al.

Submitted to: IAEAConference Proceedings (September 2012)

Laser Cleaning of ITER's Diagnostic Mirrors PPPL-4829

Authors: C. Skinner, C.A. Gentile and R. Doerner

Submitted to: Fusion Science and Technology (October 2012)

Comparison of Gas Puff Imaging Data in NSTX with the DEGAS 2 Simulation PPPL-4828

Authors: B. Cao, D.P. Stotler, S.J. Zweben, M. Bell, A. Diallo and B. Leblanc

Submitted to: Review of Scientific Instruments (October 2012)

Toroidal Alfvén instabilities in ITER PPPL-4827

Authors: N.N. Gorelenkov, R.B. White

Submitted to: Plasma Physics and Controlled Fusion (October 2012)

DIRECTOR'S OFFICE (B. SOBEL):

On November 13, Adam Cohen attended a DOE safety training meeting held in Washington, DC.

On November 13, S. Prager, M. Zarnstorff, and A. Bhattacharjee met with John Mandrakis and others from OFES in Germantown, MD.

On November 14, Dr. Kenneth Jensen, Makani Power, Inc., presented a colloquium entitled "Airborne Wind Energy - A Renewable Energy Source".

On November 16, a Budget and Human Resources Committee meeting was held.

This report is also available on the following web site:

<http://www.pppl.gov/polWeeklyHightsExternal.cfm>