The PPPL Highlights for the week ending September 14, 2012, are as follows:

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

In an effort to improve the shielding efficiency for the Core Imaging X-ray Diagnostic, experts at PPPL have considered the possibility of much narrower viewing apertures and use of the "von Hamos" configuration for these spectrometers rather than the baseline "Johann" configuration. A CAD model was created that permits determination of the basic geometrical parameters of the new design. With these parameters, the reduction in the signal-to-noise can be determined.

D. Johnson provided detailed comments on a draft common Annex B for upper port plug integration, and participated in a meeting to identify and resolve the main issues. This document is under review by all the DA Diagnostic Heads, in order to reach a common approach on shared responsibilities. He also provided detailed comments on third iterations of draft Annex Bs for the ECE and TIP diagnostics.

A meeting of ROs at the IO and US for the RGA was held to discuss how to best to recover the schedule to meet the milestone for a March 2013 Preliminary Design Review.

In preparation for completion of the Annex B for integration of Equatorial Port Plug E9, US and IO neutronics results were compared and illustrated problem areas in the present diagnostic labyrinths associated with the ECE and TIP diagnostics.

NSTX (M. ONO):

NSTX-U is in the Upgrade Project outage in FY 2012.

Professor Jean-Paul Allain from the Department of Nuclear Engineering at Purdue University met with members of the LTX and NSTX-U teams and Princeton Professor Bruce Koel's surface science group on September 6. The Materials Analysis and Particle Probe (MAPP), developed at Purdue, enables sample exposure to tokamak plasmas and immediate study in a separate analysis chamber with a variety of surface diagnostics. The details of calibrating the MAPP diagnostics, testing on LTX, and implementation on NSTX-U were discussed. Professor Allain also made a presentation on recent measurements and modeling of deuterium uptake with lithium-coated carbon and refractory metal substrates.

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. Painting and general maintenance of outdoor equipment continued, and the installation of a new cooling system for the 2600kW standby diesel generator was completed.

Access to the NSTX test cell will be available only through previous arrangement with the Upgrade Work Control Center.

ITER & TOKAMAKS (R. WILSON):

Alcator C-Mod (R. Ellis III):

The Motional Stark Effect group successfully carried out mini-proposal 705, “Current Profile Measurements in Plasmas with Strong Lower Hybrid Current Drive”. The plasma’s q-profile was measured with the MSE diagnostic during lower hybrid current drive at four different LH phases (75, 90, 105 and 115 degrees) in plasmas at 5.4 Tesla, Ip=600 kA, NeL = 4.e19 m^-2. Additionally, the q-profile was measured during a single discharge in which the LH phase was varied in time. For this experiment the recently-repaired diagnostic neutral beam (DNB) functioned flawlessly, successfully injecting a neutral beam for 14-16 pulses on each of the 28 plasmas, at full DNB current.

Two (of three) channels of the MSE real-time background polychrometer were operated this week for the first time. These channels are dedicated to the measurement of partially-polarized background light at wavelengths near those of the MSE spectrum. Measured signal intensities were consistent with expectations, and we observed clear responses to plasma behavior such as transitions from L- to I/H mode. The photon detector for a third channel, which will measure the actual MSE signal, appears to suffer from a DC offset. We are working with the vendor and manufacturer to either repair this detector or obtain a new one.

Subsequently, the bandpass filters for the two channels of the background polychrometer were replaced with filters chosen to pass the MSE-pi and MSE-sigma lines. The observed sigma line was twice as bright as the pi line and has a polarization angle offset by 90 degrees; both observations are consistent with expectations from atomic physics.

David Mikkelsen worked with the group that developed the GENE gyrokinetic turbulence simulation code at the Institute for Plasma Physics in Garching, Germany. He learned about the input generation program, how to run the output visualization, and set up a 'global' simulation of an I-mode plasma experiment from the Alcator C-Mod tokamak.

Bob Ellis visited MIT to work on the Hot Outer Divertor project.

ADVANCED PROJECTS (H. NEILSON):

Mike Zarnstorff, Hutch Neilson and other PPPL representatives visited the DOE Fusion Energy Sciences (FES) office on September 7 to discuss the work in the Laboratory's Advanced Projects Department and the ITER and Tokamaks Department. In explaining the role of

Advanced Projects, Neilson stated that the aim was to be a national resource for the FES program by leading or supporting the development of new research directions and initiatives. Accomplishments and plans in stellarator collaborations with LHD (Japan) and Wendelstein 7-X (Germany) were discussed. In the advanced design area, socio-economic studies, next-step options studies, and PPPL's participation in the national ARIES program were discussed. Future directions in both stellarators and planning for next-step options for the FES program were suggested by PPPL.

Advanced projects collaborations will be represented in papers submitted to the Symposium on Fusion Technology (SOFT), to be held September 24-28 in Liége, Belgium. Mike Mardenfeld and other PPPL staff are co-authors with Max Planck Institute for Plasma Physics staff on "Design and Manufacturing Status of Trim Coils for the Wendelstein 7-X stellarator Experiment," by K. Risse, *et al.* Tom Brown, Peter Titus, and other PPPL staff are co-authors with National Fusion Research Institute staff on "A Preliminary Conceptual Design Study for Korean Fusion DEMO Reactor," by Keeman Kim, *et al.*

THEORY (A. BHATTARCHJEE):

A method[1,2] has recently been developed for evolving stellarators and tokamaks to ones with reduced turbulent transport. The method uses the STELLOPT optimization code with a theory-based "proxy" figure of merit Q_prox for computational speed to stand in for the heat flux Q_GK from nonlinear gyrokinetic (GK) runs, and the GENE GK code for subsequent corroboration. The potential for this method is being investigated and extended, in various directions[3]: Exploring configuration space by evolving from other interesting toroidal configurations, refining and extending the proxy function, extending the exploration to study other transport channels (e.g., from ETG, TEM, and ballooning turbulence), and extending STELLOPT to gain a clearer understanding of the topography of the cost function in the search space.

Starting with the NCSX quasi-axisymmetric (QA) design, the method has produced evolved stellarators with an averaged heat flux Q_GK from GENE reduced by a factor of almost 4, and starting with a D-shaped tokamak with parameters close to NCSX, Q_GK is reduced by a factor of 3. The growing body of results finds that the effectiveness of the current Q_prox used by STELLOPT to estimate transport levels depends on the class of toroidal device considered. Means of understanding this and improving on it are being pursued. A recently-developed theory-based variant of the original Q_prox has resulted in better agreement between it and the Q_GKfor the quasi-omnigenous class of stellarators, while retaining the good agreement on the QA, quasi-helically symmetric, and tokamak classes. Applied to NCSX, this proxy improved the reduction in Q_GK from an earlier 2.5 to the cited factor of 4. In an alternate approach to computing Q_prox, STELLOPT has been extended to use relatively fast linear GENE runs in the optimization loop. The deformation of NCSX produced by early runs with this proxy resemble that from the improved analytic variant.

[1] Mynick, Pomphrey, Xanthopoulos, Phys. Rev. Lett. <105>, 095004 (2010) .
[2] Mynick, Pomphrey, Xanthopoulos, Phys. Plasmas <18>, 056101 (2011) .
[3]Mynick, Pomphrey, Xanthopoulos, Lucia, 2012 IAEA Fusion Energy Conference, Paper TH/P2-04 (San Diego, CA, October, 2012).

Weixing Wang attended the Joint EU-US Transport Task Force Meeting in combination with the EFDA Transport Topical Group Meeting September 3-6, in Padova, Italy. He presented a talk on "Interplay of Turbulence and Toroidal Flow".

COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):

The TGLF transport model [Kinsey, et al, Nuclear Fusion 51 083001 (2011)] has been implemented in the new PTRANSP solver, PT-solver in a way that it is parallel over both wave number (interior to TGLF) and exterior (over flux surfaces). This has now been fully integrated into the TRANSP code and runs have been completed for both DIII-D (0.5 - 6.5 sec) and ITER discharges in which this parallel capability was combined with RF calculations using parallel TORIC and neutral beam calculations using parallel NUBEAM. These and other results will be presented at the upcoming IAEA meeting in paper [ITR/P1-29 by R. Budny, X. Yuan, et. al. "PTRANSP tests of TGLF and predictions for ITER"].

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

The NB2 box was moved from the TFTR Test Cell to the NSTX Test Cell this week. Components that go in the box will be moved over the next few days and then the lid will be placed on the box.

Access to the NSTX Test Cell is limited to those persons working on this relocation of NB2.

The center upper flag on outer TF coil #4 was inspected this week based on observations from a machine technician during modification to the flag. Cracks in the braze were confirmed so this outer leg will be replaced with a spare.

TF Conductors: Three TF conductors have been sandblasted and primed in the coil area. The last two TF conductors for quadrant 2 have been soldered. The first Aquapour trial was conducted on Friday, the viscosity of the liquid was too high to fill the mold completely. The next trial will be conducted with a thinner mix to improve mold filling. We are expecting delivery of five TF conductors from Major Tool early next week (quadrant 3).

Manufacturing documents: VPI Emergency response procedure has been reviewed- comments are being incorporated (D-NSTX-OP-EO-42). VPI procedure for the TF quadrant was sent out for review.

Procurements: PF 4 and 5 support clamps are completed and inspected at Carolina Fabricators. The PF 4/5 Slide Groove Plates, based on the current run times, will finish late September 18 and ship on September 19. The PF4/5 slide Clamp Plates and Column Weldments are behind schedule because they are awaiting the parts above to complete. They are currently scheduled for delivery at the end of September.

OH Coil: Samples of the OH Copper conductor (44) samples have been radiographed by an outside test facility and verified that they are all acceptable. This supports the analysis that has been completed.

Facilities and Site Services (M. Viola):

GPP: Work on the MG Low Roof is progressing with only detail work remaining. The project will be completed by Sept 20. Work on correcting the drainage problem at the Commons Deck was started on September 10, with the "Hot Melt" waterproofing application during the weekend of September 15-16. The project is scheduled to be completed by September 27, weather permitting.

Fire Protection: ACAMS - Problems previously reported with ACAMS which appeared to be associated with the recent upgrade have been resolved. SIC replaced the hardware security key for the Continuum software and the problems have not reoccurred. We trouble shot and corrected a couple minor ACAMS issues.

Simplex Fire Alarm System: Follow up on the problems of September 12-13 continues. Simplex replaced the master controller in node 25 and the report has been finalized.

Fire Damper Testing: Fire damper testing completed except for three that could not be done this week for operational reasons. They will be done at a later time.

Card Reader for Drafting Print Room: We worked on the design and parts order and submitted a work order for strike installation.

Independent Fire Protection Review: The first draft of a statement of work has been prepared.

CCTV: We met with Fran White on CCTV proposals. Fran would like to move forward with a proposal to provide cameras in the CAS and the CS High Bay and to replace the existing DVR with an NVR.

Operations: Three of four boilers have been successfully test-fired. Thirteen facilities technicians attended on-site OSHA Construction Training.

BUSINESS OPERATIONS (E. WINKLER):

Members of The Accounting Division issued the annual letter to subcontract vendors to request fiscal year-end accrual information.

NSF provided PPPL with fourth year funding of $100,000 for the project titled "GEM: Ion Outflow Effects on Plasma Sheet Filling and Transport". The Principal Investigator is Jay Johnson. The period of performance is through September 30, 2013.

NSF provided PPPL with first year funding of $100,000 for the project titled "GEM: Modeling How Substorm Induced Waves Power Broadband Aurora". The Principal Investigator is Jay

Johnson. The period of performance for this work is through September 30, 2016. The total expected funding for the project is $400,000.

Representatives from PPPL Procurement and DOE-PSO participated in the monthly telephone conference of the DOE Procurement Evaluation and Re-engineering Team (PERT). Agenda items included the news that all scheduled FY 2012 peer reviews have been completed and the ten scheduled FY 2013 reviews have been fully staffed, with the exception that a team lead is required for the NNSA Kansas City Plant review. Subcommittee chairs reported on progress in various policy and procedure improvement intiatives currently underway within PERT. Rod Templon reported that the Peer Review Handbook subcomittee had completed its work in updating guidance for the conduct of peer reviews, and that the revised handbook had been submitted for posting on the PERT web site.

The Procurement Division received DOE approval to issue Revision 5 to Procurement Policies and Procedures Manual Section 3-61, "Areas of Responsibility; Technical-Administration". This revision was made in response to a corrective action arising from the Skidsteer Accident investigation. In response to the CA, this section has been revised to more fully describe requisitioner duties and responsibilities; better align its language with recent changes in Laboratory Policy P-072, "Procurement Assurance (ES&H, Quality and Technical Requirements)"; and require responsible line manager (RLM) concurrence in Princeton Technical Representative appointments.

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

A management safety walkthrough of the D-Site Grounds, Radioactive Waste Handling Facility and Cooling Tower Pump Houses took place on September 12. Safety conditions were found to be good to very good in most areas.

The Health Physics/MC&A Division provided extensive support to the NSTX Upgrade Project this week for moving the neutral beam box from the TFTR Test Cell into the NSTX Test Cell.

The annual safety seminar was provided to seven new graduate students on September 11. M. Zarnstorff and A. Cohen discussed the importance of safety in work and research. The students were also provided with information about the Laboratory's application of ISM and hazard awareness, and took tours of D-Site and several C-Site shops and experiments. An emphasis was placed on hazard identification and mitigation. J. Alkhateeb presented instruction on safety and security.

ESU Engine 66 responded to Plainsboro for two mutual aid assignments, one call on C-site for the RF smoke detector investigation, and one call on D-Site for the order of smoke in the Mock Up Building. ESU Ambulance A166 responded to Plainsboro for three mutual aid assignments.

On September 14, SPD participated in a fire suppression system teleconference with the Deputy Director, Heads of Engineering and Safety, the PPPL fire marshal, members from PSO, and fire suppression technicians from the DOE Office of Science and Chicago to discuss the recent halon discharge and the current state of the Simplex Fire Suppression system.

Captain Kevin Rhoades and J. Alkhateeb attended a Emergency Response and Coordination Meeting with the Geophysical Fluid Dynamics Laboratory on B-Site.

ESO Robert Walker completed his testing for the New Jersey Fire Inspector Program.

OFFICE OF COMMUNICATIONS: (K. MACPHERSON):

Leaders in fusion energy science and communications came together at Princeton University on September 12-13 for the Communications Summit on U.S. Magnetic Fusion to discuss a national vision to inform the public, other scientists, and public officials about the promise that fusion energy holds for the future. A.J. Stewart Smith welcomed the group, composed of scientists and communicators from General Atomics, MIT, ORNL, U.S. ITER, Los Alamos, TRIUMF and PPPL. Tim Myer gave a talk on communications in particle physics. Other attendees included leaders from Princeton University, including Emily Carter, Joyce Rechtschaffen, Lauren Ugorji, and Ruth Stevens, as well as leaders from industry, including The Star-Ledger and PSE&G. Stewart Prager talked about the scientific challenges facing fusion energy scientists. The meeting was professionally facilitated by a strategic communications firm, the McGraw Group. Kitta MacPherson and John DeLooper organized the meeting and were assisted by Pamela Hampton and Carol Ann Austin. Elle Starkman recorded the event with photos. John Greenwald and Jeanne Jackson Devoe attended and participated, as well.

Chris Cane virtually attended the DOE's monthly Web Council meeting on September 13. Here are some of the items that occurred and were reported: Melvin G. Williams Jr., Vice Admiral, U.S. Navy (retired), now serving as the Associate Deputy Secretary of Energy, spoke to the Web Council and thanked the group, and Cammie Croft in particular, for forging ahead for change; DOE Live-casting on UStream the Higgs Boson discovery (Secretary Chu to speak) on September 14; DOE is using Drupal to establish micro-sites and to do event registration; a DOE Web Council mailbox was created, ("doewebcouncil@energy.gov"); DOE 35th anniversary - October 2012 - HQ celebration October 4th -- slideshow image assets available displaying history of DOE; GSA negotiating with several social media companies for software agreements.

This report is also available on the following web site:
http://www-local.pppl.gov/director/highlights/2012-highlights.htm