The PPPL Highlights for the week ending August 22, 2014, are as follows:

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

The RGA design team discussed chits generated at the FDR held on July 20 for the DRGA sampling tube. Chits were grouped and actions were assigned to begin resolution.

The ECE diagnostics design support subcontractor Quality Plan was submitted to the IO for approval.

A meeting was scheduled for October 27-29 in Cadarache, France, to discuss the integration of the diagnostics within US equatorial port 3 among the tenants (US MSE system, EU wide angle viewing system, and RF CXRS system).

Two assumptions employed in the baseline design of the retroreflectors for the toroidal interferometer polarimeter were proposed to be tested with a single prototype. These assumptions are 1) the heat transfer characteristics of the grafoil used between the passively cooled retro and the actively cooled blanket module and 2) the ability to manufacture and the retros to suitable optical quality. Recently, it was decided that it would be more prudent to do separate prototypes in sequence, and do the easier test of assumption 1) first.

Weekly progress meetings are now being held with the subcontract teams working with PPPL on the design of the ECE and the LFSR systems.

NSTX (M. ONO):

N. Bertelli hosted the "Annual RF SciDAC Project Workshop" on August 19–21 at PPPL. Thirteen visiting SciDAC members attended from PPPL, ORNL, XCEL, TechX, MIT, Lodestar, IMSOL-X, and CompX..

Development of the new Digital Coil Protection System (DCPS) continued with the completion of pre-operational testing of the DCPS computer and preparations to move the computer and autotester to its final location in the FCPC junction area. The installation of the DCPS interconnection subsystem hardware in the junction area has also started.

Preparations for plasma operations in the NSTX-U configuration also continued with the ongoing recommissioning of the Plasma Control System (PCS). Input/output testing of the PCS communication links is in progress, and the first of the new PCS timing units is being commissioned in the FCPC Junction Area.

ITER & TOKAMAKS (R. HAWRYLUK):

DIII-D (R. Nazikian):

Recent experiments on DIII-D have used lithium injection to improve performance by modifying the edge pedestal. Interpretation of the changes in the pedestal and core requires estimates of the lithium density profile. One complication is that the lithium charge-exchange emission has an overlapping carbon charge-exchange line. In order to determine the photon yield from only lithium and calculate the lithium density, another carbon charge exchange line must be monitored simultaneously to remove the time-varying carbon contribution to the total emission. The main-ion CER system's scanning spectrometers and wide CCD chips can perform the task of monitoring both the combined Li+C line and the more usual C-VI line, removing the ambiguity in interpretation of the lithium emission. Recent upgrades to T. Osborne's pedestal python suite have incorporated radial profiles of lithium density measured by the main-ion CER system, allowing impurity concentration and overall Zeff calculations including both carbon and lithium in DIII-D.

N. Atnafu visited General Atomics this week to explore the 30 deg TF coil bus redesign/ fabrication for job estimation. He began with a site tour and survey of the existing bus and then attended a brainstorming session focused on ideas for NB co/counter rotation integrated with off-axis movement. One 3D model option indicated a large interference with the top coil/bus connection, something that Neway would have to consider in his design. In spite of this, the best approach appears to be a vertical section design supported by a coaxial cylindrical straight bus that would null the error fields and minimize field stresses. Neway is now tasked with developing a cost estimate for consideration in the FY15 budget.

International (R. Hawryluk):

D. Mansfield returned from a two and a half months trip to EAST and gave a presentation entitled "Long-term (18s) suppression of ELMs by injection of Li aerosol into the upper X-point of EAST double-null plasmas: What role is played by quasi-coherent mode excitation?"

ADVANCED PROJECTS (D. GATES):

As part of its collaboration with Wendelstein 7-X (W7-X), the Laboratory is participating in the design of an instrumented TDU Scraper Element, which will be used to support U.S. edge physics studies on W7-X. Recently, the Laboratory has investigated material options for the unit's graphite plasma-facing armor. Thermo-mechanical analyses by P. Titus show that the properties of an existing and available supply of graphite would provide acceptable performance. Manufacturing assessments by S. Langish indicate that the available quantity is sufficient for fabricating two units, with adequate margin for losses during manufacture. The material is

available in blocks whose dimensions, though not optimum for the TDU design, may be acceptable with modest design changes; this is being investigated by the ORNL TDU Scraper design team.

As part of a collaboration with the HSX group at the University of Wisconsin-Madison, Aaron Bader, a post-doctoral researcher working with Professor Chris Hegna, has been visiting PPPL to work with S. Lazerson. Dr. Bader has been learning various stellarator tools at PPPL during this two-week visit. The primary focus has been to support a potential upgrade to the HSX device, where a tangentially injected neutral beam is being proposed for installation. This installation requires the removal and redesign of two stellarator coils on the device. Aaron's role is to leverage the new capabilities in COILOPT++, developed by J. Breslau and N. Pomphrey as part of a LDRD project, to redesign these coils. This week, he has been working with Breslau to install COILOPT++ on the Wisconsin machines and learn how to use it. The need for an accurate HSX winding surface has been identified, and work is underway to develop such a surface.

D. Mikkelsen and co-authors at NIFS have submitted a paper to Physics of Plasmas on benchmark calculations with the gyrokinetic codes GS2 and GKV-X. The benchmarks are based on an ion-ITB plasma in LHD, and there is very close agreement in the two independent calculations of the geometric coefficients in the gyrokinetic equation. The linear stability results for ITG modes (with adiabatic electrons) agree very closely for lower poloidal wavenumbers and agree to better than 10 percent at the peak growth rate, but growth rates differ significantly for higher wavenumbers. Eigenfunction shapes agree well, with only localized differences, for all wavenumbers.

THEORY (A. BHATTACHARJEE):

The theory seminar on August 21 was presented by Clément Moissard, a summer Master student working at PPPL, entitled "Magnetic field generation and evolution in high-energy-density plasmas". The abstract of the talk is "Magnetic reconnection has been proposed to account for many astrophysical phenomena such as solar flares, pulsars, or magnetospheric substorms, and is inferred to play an important role in both inertial and magnetic confinement fusion. Recent experiments have studied magnetic reconnection in high-energy-density (HED) plasmas at the Vulcan, Omega and Shenguang laser facilities. Plasma bubbles are created by laser irradiation of solid targets. These bubbles self-generate MG-scale magnetic fields, and the collision of pairs of bubbles drives reconnection of this magnetic field. 2D first principles particle-in-cell (PIC) simulations with a collision operator have been used to study the evolution of the magnetic field in these experiments. The ablation of the target is modeled by a gaussian heating function acting on an initially cold, high density plasma. The plasma expands from the target creating a density gradient perpendicular to it, while the heating operator creates a temperature gradient parallel to it. It is shown that the Biermann battery effect can account quantitatively for the magnetic field produced. However, special attention must be given to the off-diagonal terms of the temperature tensor, which can no longer be considered as a scalar in the regime of the experiments. In simulations with a collision operator, the evolution of the magnetic field is compared to Braginskii's transport theory."

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: The welding of the PF1B coils to the centerstack casing has been completed and the casing has been stood up to its final position. Setup is underway for the installation of tiles on the casing and the actual installation will start on August 25. The lower ceramic break has been assembled and meggered. The welding of the lower PF1C coil continues in the Tech Shop. The trial fit-up and installation of TF bus, flex bus and CHI bus continues. Diagnostic windows and shutters continue to be installed. The support for the MPTS box has been installed on the south wall and MPTS alignments continue.

CS Upgrade: The OH ground plane paint was applied and the OH/TF coil was ping tested this week. In addition, the installation of the magnetic diagnostics on the OH coil started this week. The G10 crown pieces are being fit up to the ends in preparation for drilling to commence with the parts in place on the TF bundle. At Martinez and Turek, six (6) of the lead extensions had the flags welded to the wrong side, which resulted in a minor error in the hole positions. A NCR was written and dispositioned. The upper end of the PF1C can was trimmed and fit to the ring and welding of the can continues on schedule.

NBI Upgrade: All three ion sources were installed on BL2 platform. The platform was cleared and assembly work continued. The relocation job has been completed and closed. The beamline refurbishment job has also been completed and closed. TVPS fore and exhaust line installation continues. TVPS table and turbopump installation continues. BL Platform drawings are in progress. NB Controls fabrication and installation cabling work on rack connections, cable runs, and BL wiring continued in NTC and gallery. Telemetry fiber optics end-to-end testing and rework continues in NTC and are complete in N2C. Preparatory activities related to reactivation of the NBPS Switchyard, Surge Room, and Modulator/Regulator are nearing completion. Additional NB installation procedures are in development and review. The NBI Cryogenics effort continues with pump down of cryogenic lines for upcoming operations.

The Digital Coil Protection System software efforts include registry of bugs and recommendations related to Autotester user interface, clock issues, and other operational human interface details. Autotester troubleshooting and restart took place and it was returned to service. The junction area rack preparation continues and is virtually complete for DCPS computer and hardware in conjunction with the real time system reconfigurations.

OFFICE OF COMMUNICATIONS (K. MACPHERSON):

J.J. DeVoe arranged interviews for Times of Trenton reporter Brielle Urciuoli on the Center for Heliospheric Physics. Urciuoli interviewed A. Bhattacharjee and E. Kim on the telephone on August 15. The front-page story, which also included a photo of Bhattacharjee by E. Starkman, appeared on August 20.

J.J. DeVoe hosted Times of Trenton reporter Kelly Johnson and photographer Martin Grime during an August 19 visit to the Laboratory to report on the status of the NSTX upgrade. Johnson interviewed A. Cohen, M. Williams, M. Ono and J. Menard. Menard, with the help of Ono and

A. Von Halle led a tour of NSTX-U and the coil-winding facility. The story appeared on the front page August 25.

This report is also available on the following web site:
http://www.pppl.gov/publication-type/weekly-highlights