

PRINCETON PLASMA PHYSICS LABORATORY

WEEKLY highlights



The PPPL Highlights for the week ending June 20, 2014, are as follows:

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

The full design team for the ITER Low-Field-Side Reflectometer met, in a kickoff meeting at General Atomics in San Diego, California to discuss near-term plans for the development of this diagnostic. Also discussed were processes for tracking costs and performance. An updated schedule is being prepared that will incorporate activities of the full team, including work at PPPL, ORNL, GA, and UCLA.

The US ITER Diagnostics WBS Manager has expressed interest in U.S. involvement in pooling of DA/IO resources to prototype "standard" electrical feedthroughs to serve diagnostic components mounted in port plugs. These feedthroughs would be based on various sizes of mineral insulated cable brazed into a standard ITER vacuum flange in such a way to create a "guard vacuum" between primary and secondary seals. This region could be pumped or filled with helium, if a leak develops in one of the seals.

NSTX (M. ONO):

Two NSTX papers merited an Editor's Choice designation by Physics of Plasmas. "Measured improvement of global magnetohydrodynamic mode stability at high-beta, and in reduced collisionality spherical torus plasmas" by J.W. Berkery (Columbia University) et al. Phys. Plasmas 21, 056112 (2014)

<http://scitation.aip.org/content/aip/journal/pop/21/5/10.1063/1.4876610>, and "Differentiating the role of lithium and oxygen in retaining deuterium on lithiated graphite plasma-facing components" by C. N. Taylor (Purdue University) et al., Phys. Plasmas 21, 057101 (2014) <http://dx.doi.org/10.1063/1.4874340>. The full short list of Editor's Choice papers can be found at: <http://aip-info.org/1XPS-2IU9R-11C9QFXH6B/cr.aspx>.

ITER & TOKAMAKS (R. HAWRYLUK):

DIII-D (R. Nazikian):

D. Battaglia, working with the DIII-D experimental team led the second half-day of an experiment designed to measure the edge ion flow layer with main-ion CER and plunging Mach probes.

E. Kolemen led an experiment aimed at testing beta control in high beta poloidal discharges using $n=3$ perturbation with the I-coils. At high $q_{95} (\approx 12)$ the impact of the 3D field was weak however at $q_{95} \approx 6$ beta control was observed and ELM suppression was achieved with odd parity of the I-coils.

The Gyrotron 8 vacuum system parts have all been received. A test fit-up of the vacuum manifold was successful. Final installation of the manifolds, vacuum pumps and gauge components will take place after the Gyrotron assembly is complete. Gyrotron 8 delivery is expected in FY15.

A. Nagy is currently integrating the design of the fast analogue control with the slow digital control system for the neutral beam power supplies as part of a plan to accelerate the fast analogue control system implementation.

The DIII-D patch panel finger stock silver-plating test pieces were received from the vendor. The next step is resistance checks for comparison to the worn finger stock. If this method works it will result in a substantial savings over replacing the existing worn finger stock.

International (D. Mansfield):

D. Mansfield and L. Roquemoire are at EAST preparing to install the lithium granule injector (LGI), which is nearing completion. A new baffle has been installed that will allow a wider field of view for the radially viewing camera. The lithium filter wheel has been activated and impeller spin-up tests have been performed. As soon as the vacuum threshold has been reached lithium granules will be loaded.

ADVANCED PROJECTS (H. NEILSON):

D. Gates participated in an international Preliminary Design Review (PDR) panel for the ITER ex-vessel magnetics diagnostics (magnetic pickup coil groups A3/A4/A9). The review was conducted on June 17-18 at the ITER site in Cadarache, France. The PDR was judged successful pending resolution of the level 1 chits. These diagnostics are high priority for review as they will be mounted directly to the vessel exterior which will be covered with a thermal shield relatively early in the construction activity.

PPPL physicist E. Edlund, with MIT colleagues, have proposed an innovative phase contrast imaging (PCI) diagnostic for Wendelstein 7-X (W7-X). It is argued that such a diagnostic could be an excellent addition to W7-X, particularly for its ability to simultaneously detect density fluctuations from the edge and core with great sensitivity. A supporting white paper outlines the phase contrast method and some of its major scientific contributions to the Alcator C-Mod and DIII-D tokamak programs. Discussions with W7-X scientific leaders are planned over the next two weeks to discuss access requirements and identify any feasibility issues.

THEORY (A. BHATTACHARJEE):

E. Belova presented Theory Department Research & Review Seminar entitled "Using the HYM code for numerical simulations of NSTX and FRC" on June 20. Abstract reads: "The talk outlines progress in simulation studies of the effects of energetic beam ions on stability properties of sub-cyclotron frequency Alfvén eigenmodes in the NSTX and global modes in FRCs, and numerical studies of FRC rotation control. Experimental observations from the NSTX have linked strong activity of global (GAEs) and compressional (CAEs) Alfvén eigenmodes with a flattening of the electron temperature profile in beam-heated plasmas in NSTX. Previous theoretical studies attributed this effect to an enhanced electron transport due to these modes. This work presents self-consistent simulations of neutral-beam-driven AEs demonstrating an alternative mechanism, namely an energy channeling mechanism that will occur for any unstable CAE in NSTX or other toroidal devices. Also, the stability properties of a hybrid FRC in which field reversal is created both by plasma currents and by a low-density energetic component of large-orbit ions, have been studied by means of a generalized energy principle, and also by using three-dimensional numerical simulations using the HYM code. Effects of various boundary conditions on FRC spin-up and stability of the $n=2$ rotational and the $n=1$ wobble mode have been studied using the hybrid version of the HYM code."

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: The tFIDA fibers have been re-installed at the vessel and the calibration is in progress. The CHERS calibrations also continue. Diagnostics are being installed to evaluate interferences in bays G, I and J. Work continues on the old RWM coils. Work continues on installing the MPTS optics box and fabricating the support for the MPTS flight tube. Cables for the vacuum and gas injection systems are being installed, terminated and verified. Electrical work for the IR camera is in progress. The south high bay has been cleared so work on the centerstack casing can resume the week of June 23. The casing lift fixture has been fabricated and load tested. New bushings and o-rings are being made for the centerstack ceramic breaks. The installation of the centerstack pedestal will begin in one week.

CS Upgrade: The VPI of the OH coil was completed this week. There were a couple of small leaks in the mold that were repaired after the VPI in preparation for the cure cycle that will commence the afternoon of June 20 and run throughout the weekend. The cycle should complete late on June 23. The covers for the PF1A coil were fitted up in the winding area and are ready for welding. The Kapton and wet wrap insulation of the CHI Bus bars started this week and will continue the week of June 23. The last PF1 coil was completed and tested at Everson and paperwork to release it for shipment is underway. Hollis completed welding and heat treatment of the outer TF Finger supports. The type A supports are undergoing Dye Pen testing and Type Cs are in final Machining. The first set of TF Lead Extensions have been received from Martinez and Turek.

NBI Upgrade: The decon and survey of equipment out of the TTC continued this week with the goal of finishing this month. The NB platform and support from NTC 109L to BL2 source platform was installed. Progress continued on other platform modifications and the gas system

installation is complete. Work on the vacuum system roughing line and SF6 fabrication and installation continued this week. The armor thermocouple installation is complete. The thermocouple scanner installation for the Armor is complete. Reactivation of FVI fast switch circuits continued in preparation of powering the NBPS high voltage. The Mod/Reg preparations continue. NB Controls cabling work continued in NTC and gallery. Telemetry fiber optics connections and testing continued. Additional NB installation procedures are in development and review.

Digital Coil Protection System: The review and refinement of torque algorithms is in progress. DCPS PTP testing in FCC continued this week using the autotester and input files; additions were made to PTP-DCPS-001 accordingly. Successful software builds to address code and parameter tree issues were completed. The DCPS overcurrent protection was discussed for implementation and interaction with RTC and ISTP-001 testing using an interface to set and adjust limits. The hardware interface progress on drawings, orders, fabrication, and testing continues. Changes in FCPC required for DCPS interface have been completed. Progress continues on the AT interface panel and RCIM interface. Water PLC testing continues. Lemo connector cable orders are in progress; testing on received orders is in progress. DCPS PTP and OP procedure development continues. Development of a System Design Description including reliability, failure modes, and administrative control continued. Review of open chits is in progress. A DCPS Code Peer Review has been scheduled next month; details regarding the review format and content were discussed.

BUSINESS OPERATIONS (K. FISCHER):

PPPL is a collaborator on a proposal submitted by Quantal Technology LLC to the Defense Advanced Research Projects Agency (DARPA) in response to a Broad Agency Announcement on the topic of "Power and Energy." The PPPL Principal Investigator is Sam Cohen. The PPPL budget request is \$170,000.

DIRECTOR'S OFFICE (C. AUSTIN):

On June 18, Dr. Alan Robock of Rutgers University, presented a colloquium entitled, "Nuclear Famine: The Threat to Humanity from Nuclear Weapons".

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