

PRINCETON PLASMA PHYSICS LABORATORY

WEEKLY highlights



The PPPL Highlights for the week ending February 21, 2014, are as follows:

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

C. Skinner (PPPL) participated in the Erosion, Deposition, Dust and Tritium workshop held at the ITER organization February 12-14. The goal of the meeting was to assess the diagnostic requirements for erosion/deposition/dust and tritium diagnostics in light of the change in ITER divertor PFC material and in preparation for conceptual design reviews scheduled for the near future. He gave two presentations: 'Experience with IVVS-like systems' and 'TFTR experience with tritium accounting and tritiated dust' and chaired the session on 'Dust Measurements'.

At an ECE Progress Meeting, the IN-DA presented waveguide layout models for four waveguide runs between equatorial port plug 9 and the diagnostic hall. Also discussed was the need for fire-resistant window seals in these transmission lines at the port cell and gallery confinement boundaries.

The PPPL port engineering group made several presentations to a web-meeting with representatives from the IO and the IN-DA addressing various integration issues for equatorial port plug 9. This included updated models of the diagnostic shield modules, made from welded plates, and of the port plug closure plate.

NSTX (M. ONO):

Wonho Choe (Director, Fusion Plasma Transport Research Center, KAIST, Korea) and his associates visited PPPL during the week of February 17 to discuss the KSTAR x-ray diagnostic and tungsten impurity injector designs with the NSTX research team and Johns Hopkins University researchers. During their visit, they gave the following presentations: "Research Activities in KAIST-FPTRC" by Wonho Choe, "Design and tomography test of Soft X-ray Array diagnostics on KSTAR" by Seung Hun Lee, "Design and tomography test of Edge Multi energy Soft X-ray Array diagnostics on KSTAR" by Juhyuk Jang, "Impurity transport analysis and preparation of W injection experiments on KSTAR" by Joohwan Hong, "Development of tungsten injection system for high Z impurity study on KSTAR" by Joohwan Hong.

S. Gerhardt (PPPL) visited General Atomics to participate in the DIII-D physics advisory committee (PAC), from February 11-13. The committee was given presentations on the planned FY14 DIII-D run campaign, the DIII-D 10 year vision, and the role of DIII-D in national and international collaborations; the PAC provided comments and advice in these three areas in answering the committee charge.

The University of Wisconsin group (D. Smith, G. McKee, R. Fonck) has delivered to PPPL all the custom hardware for the BES (beam emission spectroscopy) expansion to 48 detection channels. The hardware includes detector modules, optical modules, conditioning electronics, and digitizer. The expansion to 48 detection channels will better utilize a new 2D layout of BES sight lines in the pedestal/SOL region. The Physical Sciences Laboratory at University of Wisconsin is presently performing the design and fabrication of the 2D fiber assembly.

Preparations for plasma operations in the NSTX-U configuration also continued with the ongoing preparations of the Field Coil Power Conversion (FCPC) rectifiers for upcoming power testing. All drawings and procedures required to complete fiberoptic connections between the FCPC rectifiers and the controls junction area have been completed.

ITER & TOKAMAKS (R. HAWRYLUK):

DIII-D (R. Nazikian):

R. Ellis visited DIII-D to install new, faster motors on the poloidal mirror drives of the ECH launchers. The motors were tested successfully during the visit. Another trip is planned for installation of new encoders on the poloidal and toroidal mirror drives.

A success design review was held on the indexing system in support of the ECEI diagnostic. Parts fabrication and procurements are commencing in support of installing it by March 5.

ADVANCED PROJECTS (H. NEILSON):

Progress was reported in the Laboratory's collaboration with Korea's National Fusion Research Institute (NFRI) on a scoping study for a next-step fusion nuclear facility, KDEM0. PPPL's P. Titus presented recent structural analysis results incorporating modifications to the TF case thickness intended to reduce peak stresses. While only a negligible reduction in peak stresses was seen, it was pointed out that further analyses and optimization of the structure could well show the design to be within safe limits. A study by a University of Texas at Austin team was updated to examine a range of possibilities for incorporating an X-divertor configuration in the KDEM0 design. It was found that high-triangularity, X-divertor plasmas are easiest to produce while still satisfying space constraints for KDEM0's vertical maintenance arrangement. The cost-benefit tradeoffs were quantified, providing designers with information that can be used to support future design decisions. The PPPL-Texas team is currently completing a report of its recent analyses for submission to NFRI for use in their KDEM0 conceptual studies report.

PPPL work plans for the next phase of the collaboration were confirmed.

In the Laboratory's collaboration with the Wendelstein 7-X project at Germany's Max Planck Institute for Plasma Physics (IPP), progress was made in defining the structural support arrangement for the U.S. x-ray imaging crystal spectrometer (XICS), now in design. The IPP team presented a concept for a mounting adapter welded to the port cover, to which the XICS structure would be attached via a bolted connection. Early definition of this interface is critical for supporting the W7-X schedule for closing and pumping down the outer vessel. With the

support structure welded to the port cover, the remainder of the project can be completed without affecting machine status. It is planned that IPP will fabricate and install the support plate while PPPL will design and fabricate the remainder of the support and diagnostic system.

D. Gates participated in the US paper selection committee for the IAEA Fusion Energy to be held in St. Petersburg, Russia in October. Gates chaired the review of submissions in the "Plasma Overall Performance and Control" (PPC) category.

THEORY (A. BHATTACHARJEE):

A publication appeared online this week: E. A. Startsev and W. W. Lee, "Finite-beta simulation of microinstabilities," *Physics of Plasmas*. The paper describes a new split-weight perturbative particle simulation scheme for finite- β plasmas in the presence of background inhomogeneities.

P. Damiano presented an Engineering Physics seminar entitled "Kinetic simulations of multi-scale electron acceleration by Alfvén waves" in the Thayer School of Engineering at Dartmouth College on February 18 and engaged in research discussions with colleagues in both the Thayer School and the Department of Physics and Astronomy on topics including auroral physics, magnetosphere-ionosphere coupling and global magnetospheric MHD simulations.

W. Fox, L. Gao and C. Liu attended the NNSA Stewardship Science Academic Symposium in Bethesda, Maryland on February 19-20. Fox presented a talk on recent results from experiments on OMEGA EP and associated simulations, "Dynamics and Instability of Magnetic Reconnection Current Sheets in High-Energy-Density Plasmas", and a poster, "Astrophysical Weibel Instability in Counterstreaming Laser-Driven Plasmas." PPPL graduate student, Liu presented poster titled "Magnetic Field Reconnection Driven by Heat Flux in Laser-Produced Plasmas". Princeton University post doc in Astrophysical Sciences, Gao, presented a talk and a poster on the progress of PPPL experiments on OMEGA EP, "Particle Acceleration and Small-Scale Structures of Collisionless Magnetic Reconnection Driven by High Energy Petawatt Lasers".

COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):

The QSOLVER inverse equilibrium code, which constructs an accurate plasma equilibrium in which the q-profile and p-profile are specified has been upgraded in several ways. It now works in a non-symmetric option in which the ellipticity and triangularity in the upper and lower half can be different. The input and output have been improved, and the numerical parameters that affect convergence have been made more transparent. Anyone wishing to use these new capabilities should contact ngorelen@pppl.gov.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: Re-installation of flanges, connection to feedthroughs and cable terminations continued in and on the vacuum vessel this week. Vessel insulation has been re-installed in many places and cabling is being installed over it. Work on the new RWM coils continues, as does the fabrication and trial fit-up of the PF4/5 supports at bays B and L. Tubing on the centerstack casing is being re-worked. Re-installation of TIV and shutter cables is in progress. Trial fit-up of bus work mock-ups is underway. The trial fit of the new centerstack pedestal will occur in the coming week.

CS Upgrade: OH Coil layer 2 is about 60% wound. During the testing of the second pair of layer 2 inline braze joints, a joint was rejected for porosity and a negative leak test. The joint was cut out and replaced. Taping and winding restarted on Friday. The rework of coil PF1B upper at Everson was completed and successfully tested. Delivery is expected the week of February 24. Everson believes one of the insulators in PF1B upper may have shifted during winding or potting and caused the short. A NDE vendor is being contacted by PPPL to determine the practicability of X-raying the PF coils to see the final locations of G10 insulators. The material for the PCHERS passive plates was shipped to Major Tool and is scheduled to arrive on February 24. Their MIT plan was approved and the drawing changes requested by Major Tool have been incorporated into the drawings.

NBI Upgrade: The NBI Armor shinethrough tile bakeout RGA results were compiled and are under review. The tiles are ready for installation on the armor in the VV. The Bay H port cover lift fixture preparation has been completed; calculations are being checked. Installation is planned next week. Concrete pads were installed in the pump room for the water system pumps. Water pumps for ion source and ion dump DI systems were trial fit on their respective concrete pads; some pad height adjustment is required. One pump is in its final location. Subcontractor triax terminations were completed and successfully tested. Final triax cable supports were installed. Mod/Reg controls work and preparation continues. NBPS water skid maintenance is in progress. VV RWM coil fit-up continues for the Bay JK area. The two TVPS duct flanges require improvement to achieve vacuum due to flange deflections. Differing seal thicknesses will be tried and leakchecked. Copper seal material is on order. NB Controls is on hold awaiting resources.

INFORMATION TECHNOLOGY (S. BAUMGARTNER):

A new tape library capable of backing up 600TB of data was added to the Storage Area Network.

A new network access control system was installed that will speed new registrations, and provide better wired and wireless services .

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

The DOE Middle School Science Bowl and High School Science Bowl was held on February 21 and 22 respectively. Over 40 volunteers from PPPL, Princeton University and other high tech organizations supported this program. Winners of both programs will travel to Washington to compete in the national program.

DIRECTOR'S OFFICE (C. AUSTIN):

A. Cohen participated in meetings at General Atomics, San Diego, California on February 18, and also participated in Laboratory Operations Board meetings at Stanford University, Stanford, California on February 20-21.

On February 19, Professor Stephen Pacala, Princeton University, presented a colloquium entitled, "The Fate of the Land Carbon Sink".

PUBLICATIONS:

Startsev, E.A.; and Lee, W.W., "Finite-beta Simulation of Microinstabilities," [Physics of Plasmas 21, 022505 \(2014\)](#)

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