

Weekly

HIGHLIGHTS



The PPPL Highlights for the week ending June 27, 2020, are as follows:

NSTX-U RECOVERY (J. GALAYDA) AND RESEARCH (S. KAYE)

Recovery (J. Galayda):

Coils — The PF1B lower coil was shipped to PPPL and is in the receiving warehouse. PF1A lower coil electrical testing and leak test were completed in France, with acceptable results. The PF1A upper coil flags were brazed and preparations continued for vacuum pressure impregnation (VPI). The PF1B upper coil was wound, with layer 1 started this week. The PF1C lower coil VPI was completed and the coil was taken out of the mold and prepared for electrical testing. The PF1C upper winding had the flags brazed on and preparations for VPI began this week.

Center Stack Casing (CSC) — The machining of the center stack casing continued on one shift and weekends at the Holtec facility in Camden, New Jersey. This phase of machining will continue through July 7, when the CSC will be shipped to Turtle Creek to attach the collar pieces on each end. It will then be returned back to Camden on July 20 for more machining into August.

Machine Core Structure (MCS) — Many fabrication activities continued at the three facilities currently making sling parts. Precision Boring in Michigan shipped the preload parts to Magnaplate for coating. PF1B sling component parts are nearly completed; the lower parts are on schedule to ship by the end of the month, with the upper parts to follow in mid-July. In addition, the PF1A and PF1B capture and common flanges and PF1C capping flanges for the sling supports were fabricated. In South Carolina, Carolina Fabricators continued fabricating first articles and some production parts for the PF1A slings. G. J. Oliver began machining the welded parts of the PF1C supports and started fabrication of the ceramic break mounting flange and outer skirt. Additional procurement activities to award contracts for the remaining MCS components neared completion this week.

Center Stack Casing Collar Modification Peer Review — A peer review was held June 23 to resolve issues with the microtherm tight fit between the casing collar and organ pipe for the casing assembly. During the machining phase for the center stack casing, machining vendor Holtec discovered their outside vendor couldn't supply a verifiable mill certificate. It was also discovered there would be a challenge with the microtherm fit between the collar and the organ pipe on the casing due to size. Holtec requested a deviation acceptance in order to provide appropriate material certification and requested a design deviation to address the fit issues. The peer review was held to formally answer Holtec's requests.



U.S. ITER FABRICATION (H. NEILSON)

Low Field Side Reflectometer — LFSR (A. Zolfaghari):

An ITER Organization final design review of the LFSR in-vessel antenna assembly was held June 24-26. The PPPL-led U.S. team made 16 presentations, demonstrating compliance with all of the system requirements applicable to this assembly. These include measurement performance; protection against stray radiation; integration with the port shielding, water supply, and windows; compatibility with remote handling; and structural integrity against system loads. The team also addressed manufacture, assembly, testing, and decommissioning of the assembly. At the closeout briefing, the chair noted “the quality and depth of the presentations given and the high technical level of the team who demonstrated their sound technical knowledge and coherency throughout the design review.”

Upper Wide Angle Viewing — UWAV (M. Smith):

Meetings between the UWAV team and the Russian Federation’s port integration team focused on issues of space allocation among UWAV components, other diagnostics, and port structures inside two of the upper ports. A revised configuration management model incorporating the conclusions is in preparation by the ITER central team.

Toroidal Interferometer Polarimeter — TIP (M.-A. de Loos):

Passing the TIP laser light through penetrations in the ITER complex requires safety barriers to inhibit the spread of fire and potential tritium contaminants. The barriers include windows that must be robust enough to handle both pressure differentials and temperature, as well as ensuring the highest possible transmission to ensure measurement performance. While barium fluoride (BaF_2) is a leading choice for window material, a mounting configuration that can withstand the required three-bar pressure differential is needed. The TIP team is investigating the applicability of a non-bonded, metal-sealed solution developed by the ITER diagnostic windows team.

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ITER & TOKAMAKS (R. NAZIKIAN)

DIII-D (B. Grierson):

Research:

During the DIII-D startup period, S. Haskey, B. Grierson, and C. Collins (General Atomics) have led two experimental tasks for the CER group as session leaders on DIII-D. The first experiment focused on assessing how Zeeman broadening affects ion temperature measurements for different ion species using emission from Ne-X, C-VI, and D-I for a range of plasma density to vary the relative population distribution of upper sub-levels. The second obtained active and passive Balmer-alpha and Balmer-beta spectra for comparisons with collisional radiative models of the beam and thermal charge exchange related emission.

THEORY (S. HUDSON)

This week a major milestone has been achieved within the ongoing SciDAC Integrated Simulations of Energetic Particles (ISEP) center. The numerical implementation of a fully two-dimensional solver for the (previously one-dimensional) Resonance Broadened Quasilinear (RBQ) code has been completed. This new module allows for the redistribution of energetic particles upon their resonant interaction with multiple Alfvénic eigenmodes in both canonical toroidal momentum and particle energy while keeping their magnetic moment constant. The implementation utilizes a generalized implicit algorithm to study the detailed relaxation of the fast ion distribution function in the presence of non-uniform sources and sinks due to drag and scattering collisions and micro-turbulence. This accomplishment, in addition to new analytic formulation developments and the RBQ integration in TRANSP, will be presented by V. Duarte as an invited talk at the APS DPP 2020 meeting.

The journal *Physics of Plasmas* published, "Examination of synthetic gas puff imaging diagnostic data from a gyrokinetic turbulence code," by D. Stotler, S. Ku, S. Zweben, C.S. Chang, R. Churchill, and J. Terry: <https://doi.org/10.1063/5.0002876>. The paper describes a synthetic gas puff imaging diagnostic constructed with the DEGAS 2 Monte Carlo neutral transport code. The turbulence characteristics obtained by applying it to the output from an XGC turbulence simulation are compared with those found using a simpler, more direct analysis of the XGC data. The researchers found that for some quantities (such as the fluctuation level and radial correlation length), the two can differ substantially. The conclusion is that when one goes to perform dedicated tests of XGC



against experimental GPI data, one should use this synthetic diagnostic, or at least one that incorporates the same physics.

A paper by J. Domiski titled, "Identification of a network of nonlinear interactions as a mechanism triggering the onset of edge-localized modes," has been accepted by *Plasma Physics and Controlled Fusion*: <https://iopscience.iop.org/article/10.1088/1361-6587/ab9c48>.

COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

Communications (L. Bernard):

The Office of Communications posted one press release to the PPPL website. It focused on research by M. Cole and others into expanding the capabilities of the XGC code, allowing it to calculate the stellarator shape that most effectively retains heat and maintains conditions for fusion. The story was also posted to the *Newswise* and *EurekAlert* press release distribution services.

DIRECTOR'S OFFICE (S. COWLEY)

Laboratory leadership has been communicating ongoing updates to staff regarding the COVID-19 virus and PPPL.

S. Cowley and J. Menard participated in the virtual Fusion Energy Sciences Advisory Committee (FESAC) meeting on June 23 and 24.

C. Ferguson participated in the virtual TSDD Project CD-1 IPR on June 23 and 24.

S. Cowley, C. Austin, and J. Menard participated in the virtual American Physical Society webinar, "Making Physics Inclusive and Equitable," on June 24.

J. Menard participated in the weekly National Virtual Biotechnology Laboratory (NVBL) working group conference call on June 26.

This report is also available on the following web site:

<http://www.pppl.gov/publication-type/weekly-highlights>