Weekly HIGHLIGHTS

PPPL PRINCETON PLASMA PHYSICS LABORATORY
U.S. DEPARTMENT OF ENERGY

The PPPL Highlights for the week ending February 8, 2020, are as follows:

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

Recovery (J. Galayda):

PF-Coil — The project conducted a first-pass review of the PF-coil test plan. Delivery and test of a PF-coil is designated a notable outcome for FY 2020.

NSTX-U Text Cell Shielding — After completing the scaffolding installation, BOA subcontractor 3BD resumed installation of the shielding in the upper elevations of the test cell shield walls.

Radiation Monitoring System — Powers Electric continues with final circuit terminations of the radiation monitoring system.

PF4 and PF5 Coil Realignment Peer Review II — A peer review was held on Feb. 5 to review the PF 4/5 realignment fixture design and to verify that the realignment strategies can achieve key performance parameter (KPP) goals. A successful final design review (FDR) was held on Aug. 9, 2019, that covered the design and installation of the PF 4/5 pancake clamps and electrical testing. Another FDR was held on Jan. 16, 2020, to cover the PF 4/5 radial constraining pin design.

DC Power Supply Platform Modification Peer Review — A peer review was held on Feb. 6 to assess and finalize the work needed for structural modifications of the NSTX-U platform. The need to modify the platform at the 119' level was identified during recent Recovery Project design activities. In order to meet bakeout requirements in the allotted space, the platform will need to be structurally reinforced in order to handle the load.

PF1CU&L Bus, PF4 and Bakeout Bus FDR — A final design review (FDR) was held on Feb. 7 to assess the design of the PF 1C coil terminal support structure, the PF1C bus bars, and the upper and lower region bus support structures. An FDR was completed for the inner PF replacement coils that included significant design improvement to the coil terminal supports on March 30, 2018. The project also completed two preliminary design reviews (PDR-I and PDR-II) on the inner PF bus on Feb. 28, 2019, on the bakeout Bus, the PF4 Bus support, and the remaining Bus scope on Oct. 14, 2019.

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Passive Plate Bracket Modification Peer Review — A peer review was held on Feb. 7 to evaluate the technical solution for the support bracket design modification, along with analysis validation of final design review solutions. A conceptual design review (CDR) and a preliminary design review (PDR) were held in 2019, and an FDR was held on Aug. 21, 2019.

Research (S. Kaye):

M. Podesta and F. Poli traveled to Germantown, Maryland, this week to attend a meeting of the US Paper Selection Committee for the IAEA-FEC 2020 Conference. The conference is scheduled to take place in Nice, France, later this year.

V. Soukhanovskii (Lawrence Livermore National Laboratory) spent the week of Feb. 3 at the Culham Centre for Fusion Energy (CCFE), Culham, United Kingdom. He worked with CCFE staff on the development and installation of two LLNL divertor spectrometers on the MAST-U tokamak as part of the DOE FES sponsored LLNL-CCFE collaboration in spherical tokamak divertor physics. He also discussed the ongoing Lawrence Livermore National Lab (LLNL) modeling of snowflake divertor experiments and divertor Lyman opacity measurements planned for the first experimental campaign in 2020.

NSTX-U researchers N. Bertelli and M. Ono traveled to QUEST (a spherical torus at Kyushu University), Fukuoka, Japan, to attend the 8th QUEST workshop on plasma start-up and sustainment in spherical tokamak (ST) configuration by RF on Jan 30 and 31. Bertelli gave an invited presentation entitled, “3D Full Wave Simulations in NSTX-U Plasmas (And Beyond) with the Recent Developed Petra-M Code.” Ono gave an invited presentation entitled, “Update of Modeling of 2nd Harmonic ECH & ECCD Solenoid-free Start-up Experiment in QUEST.” After attending the workshop, Bertelli spent a few additional days at Kyushu University to work with H. Idei (Kyushu University), T. Onchi (Kyoto University) and Ph.D. student S. Kojima (Kyushu University). The researchers worked to establish a benchmark between the ray tracing codes GENRAY, TASK-WR, and RT-4 for a QUEST plasma with a high energy relativistic bi-Maxwellian electron population. During the visit they also discussed future collaborations on QUEST and TST-2 experiments. Ono spent the remainder of the week in Kyushu University participating in the CHI experiments in collaboration with the QUEST team and R. Raman (University of Washington).

The PPPL Instrumentation and Control Group has been working with Tokamak Energy to establish a direct link between the PPPL cluster and the ST40 MDSplus data server. The connection to the ST40 MDSplus data was established.

U.S. ITER FABRICATION (H. NEILSON)

The Low Field Side Reflectometer (LFSR) in-vessel antenna assembly includes waveguide systems to transmit signals between the plasma-facing wave launchers and windows in the vacuum closure plate more than two meters away. Accurate alignment of the waveguide with the vacuum window depends on accuracy in manufacturing and assembly of the waveguides and their supports. The waveguides include a periscope formed by back-to-back miter bends to inhibit neutron streaming, which can be a source of alignment error. In a bi-weekly meeting with the ITER Diagnostics Division, PPPL engineer M. Sibilia reported progress in a tolerance stackup study to determine the risk of adverse performance impacts due to misalignment of the waveguide and the window. Preliminary findings, based on a statistical analysis of potential errors within tolerance bands, indicate that the risks are likely to be acceptably low. A report documenting the work, which is being led by Sibilia in collaboration with engineer W. Harris, is in preparation.

ADVANCED PROJECTS (D. GATES)

Stellarators (D. Gates):

E. Gilson and R. Lunsford visited the National Institute for Fusion Science (NIFS) in Toki, Japan, this week to join F. Nespoli as he completed a three-week stay at NIFS to conduct impurity powder dropper experiments on LHD. Boron powder was injected into low-power, ECRH-heated, 40-second-long plasmas to tune the boron powder mass flow rate and burst duration in advance of long-pulse experiments. In long-pulse discharges, lasting up to nine minutes, several ten-second-long bursts of boron powder were dropped on command to reduce recycling when incipient density increases were detected. Plans for future experiments during the next LHD campaign were discussed.

THEORY (S. HUDSON)

On Jan. 31, M. Cole gave a talk to the IPP Greifswald Stellarator Theory Department entitled, “The whole volume gyrokinetic code XGC with a stellarator focus.”

M. Churchill gave a *Science on Saturday* lecture at PPPL titled, “Artificial Intelligence and Machine Learning in Fusion Energy: Gotta Catch 'Em All.”

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DIRECTOR'S OFFICE (S. COWLEY)

J. Menard participated in the International Atomic Energy Agency's (IAEA) Consultancy Meeting held in Vienna, Austria, Feb. 3-6, to strengthen Coordinated Research Project (CRP) activities on the development of steady-state compact fusion neutron sources. He gave a presentation entitled, "Fusion Nuclear Applications using the Spherical Tokamak (ST)."

This report is also available on the following web site:

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