The PPPL Highlights for the week ending July 21, 2017, are as follows:

**NSTX-U RECOVERY PROJECT (R. HAWRYLUK)**

The Neutral Beam 1A source isolation valve was successfully removed for evaluation and repair. All six neutral beam ion source steering systems have been tested and found to be fully functional, addressing one of the DVVR chits.

A Draft Notable Report was submitted to the DOE Office of Fusion Energy Sciences.

**U.S. ITER FABRICATION (H. NEILSON)**

**Steady State Electrical Network (J. Dellas)**

Uninterruptible power supply (UPS): Factory acceptance testing of the 900 kVA uninterrupted power supply was conducted at the supplier’s facility in Switzerland. While the test was successful, a component problem occurred during a temperature rise test, which was not part of the testing but included in routine testing internally performed by the supplier. The supplier is pursuing a solution (cabinet cooling modifications), after which the test will be repeated. Manufacture and testing of remaining equipment items continues on track for completion in the current fiscal year.

**Diagnostics (R. Feder)**

Low Field Side Reflectometer (LFSR): Transceivers produced by Virginia Diode, Inc. (VDI) were integrated with a quasi-optical triplexer on the high frequency test stand at General Atomics. Alignment and optimization were performed. Frequency modulated continuous wave (FMCW) tests began with the upgraded VDI transceivers. Direct comparison of measured absolute intermediate frequency with theoretical prediction showed good agreement.

An updated layout for the LFSR diagnostic room was completed. The layout contains all the components and arrangement of transceivers, mitters, switches, polarizer rotators, and beam combiner relevant to the antenna configuration selected by ITER.

**ITER & TOKAMAKS (R. NAZIKIAN)**
DIII-D

Y. Ren gave a talk entitled “Overview of High-k Scattering Diagnostics on NSTX and NSTX-U” at the DIII-D Friday science meeting and detailed two different scattering schemes to achieve localized electron-scale turbulence measurements and how these scattering schemes are applied to NSTX and NSTX-U.

A new impurity granule dropper capable of dropping a single granule for the first time for perturbative transport studies was designed and fabricated.

"The Energy Confinement Response of DIII-D Plasmas to Resonant Magnetic Perturbations” by L. Cui was accepted for publication in Nuclear Fusion.

"A High Power Helicon Antenna Design for DIII-D" by A. Nagy was accepted for publication into the special edition of Fusion Science & Technology associated with the TOFE conference.

S. Scott began a visit to KSTAR for calibration of the MSE system.

ADVANCED PROJECTS (H. NEILSON)

STELLARATORS (D. Gates)

PPPL network engineer S. Kampel completed a four-week visit to the Wendelstein 7-X project site in Greifswald, Germany, as part of the Laboratory’s collaboration to improve remote collaboration capabilities for the U.S. team. Kampel’s assignment focused on tasks required to implement a new 10 Gb/sec internet link for the Greifswald site, specifically the installation and configuration of more than 50 “network switches.” These are units that receive, process, and forward data to destination devices on a computer network. Substantial progress was made, leaving a relatively small fraction of the work to be completed by local staff following Kampel’s departure. In addition, the visit allowed for a vigorous exchange of ideas for improving networking solutions at both institutions and of possibilities for continued collaboration.

The process of selecting proposals for the upcoming Wendelstein 7-X campaign (OP1.2) was completed during the last week. This will be the first W7-X campaign to feature a completed first wall and an island divertor. Thirteen proposals submitted by PPPL researchers N. Pablant and S. Lazerson have been formally accepted for experimental time during this upcoming campaign. Pablant’s ten accepted proposals addressed a range of transport-related research topics, including important issues in both heat and impurity transport. A joint experiment with LHD on plasma in the core electron root confinement (CERC) regime is included. Lazerson’s three accepted proposals address topics related to error fields and use of the U.S.-provided trim coils to control heat-load distributions among the ten divertor chambers. In addition, both Pablant and Lazerson are coauthors on several accepted proposals led by other team members.

SYSTEM STUDIES (C. Kessel)
C. Kessel chaired the Fusion Energy Systems Studies face-to-face meeting, held July 12-14 at the DOE FES office. Presentations featured a comprehensive update of the team’s current study of liquid-metal plasma-facing components for fusion systems. Kessel presented an overview of the team’s progress in the identification and assessment of liquid metal candidates. R&D needs already identified include data on corrosion compatibility between liquid metals and fusion relevant ferritic steels; refractory metals and insulators; additional data on the the interface between a liquid metal layer and plasma interface to better characterize losses and property changes; and properties data for tin-lithium alloy, as well as other liquid metals where it is sparse. The team began to examine design concepts with several presentations and extended discussions.

THEORY (A. BHATTACHARJEE)

A paper titled “Astrophysical particle acceleration mechanisms in colliding magnetized laser-produced plasmas,” authored by W. Fox et al. has been accepted for publication in Phys. Plasmas.

T. Stoltzfus-Dueck published an article in Nuclear Fusion titled “Momentum flux parasitic to free-energy transfer.” The article derives the behavior and scaling of a residual stress driven by symmetry-breaking due to ion Landau damping.


I. Dodin returned from his month-long trip to the National Institute for Fusion Science (NIFS), Japan, where he worked as a Visiting Associate Professor. Dodin's work at NIFS was focused on improving the modeling of electromagnetic wave propagation at the Large Helical Device (LHD), the second-largest superconducting stellarator in the world, for the purpose of electron cyclotron heating of LHD plasma. It is anticipated that the theoretical results produced by Dodin at NIFS will be implemented by the LHD team in a code that will model paraxial propagation of cold waves in magnetized plasma and capture mode conversion at the low-density plasma periphery. Dodin also presented results at NIFS seminars titled “Extended geometrical optics and corrections to ray equations,” and “Extended Geometrical Optics for diffracting waves and its application to the LHD.”

ENGINEERING & INFRASTRUCTURE (V. RICCARDO)

Superconductor Tests:

The superconducting coils fabricated at PPPL were successfully tested this week at the University of Geneva high field test facility. The current ramp test went up to ~700 A and the 1.5" diam coil self field reached up to ~2.65 T before first quench. This is not yet the coil critical current limit, which is expected to be about 850 A at ~3 T.

MINDS:

At the request of the U.S. Air Force, a MINDS unit was sent to the McGuire Air Force Base in support of its annual emergency drill scenarios. Next steps include mounting a MINDS on an Air Force drone.

Project Management Office:

The Project Management Office (PMO) has completed the templates for the both the Project Execution Plan and the Quality Plan.

The PMO processed a temporary change request to redefine the work approval form review board constituents and titles in support of the NSTX-U recovery reviews. Four reviews have been completed.

Heating Systems:

The RF Building clean-out completed the RF capacitor bank and partition removals. Clean-out of an additional 3rd-floor caged area for PS&T has begun. Trailer removals continued including the RF trailers. Hot weather required hiatuses to avoid heat related issues.

COMMUNICATIONS & PUBLIC OUTREACH (A. ZWICKER)

COMMUNICATIONS (L. Bernard)

The Communications Department posted and distributed two press releases: one about the first laboratory-generated high-energy shock waves, featuring research by D. Schaeffer et al, and another about a new machine-learning technique that could help stabilize fusion plasmas based on research of graduate student M. Parsons, working under W. Tang and E. Feibush.
Press releases from the Communications Department inspired a story in the Daily Mail titled, “The AI that could make fusion power a reality,” as well as a story in the Register titled, “Physicists send supersonic shockwaves rippling through a lab.”

PUBLIC OUTREACH (A. Zwicker)

A. Dominguez, in collaboration with Prof. J. Williams of Wittenberg University, led a 3-day workshop for university physics faculty and staff members. The workshop had a theoretical and experimental component and revolved around an inexpensive DC discharge setup that they can construct at their home institutions.

A. Dominguez, in collaboration with Prof. J. Williams of Wittenberg University and Prof. M. Alfred of Howard University, led a second workshop for physics faculty members of minority-serving institutions (e.g. historically black colleges and hispanic serving institutions). The purpose of this workshop is to give the faculty members tools with which to prepare their students for internships and graduate school in plasma physics and fusion energy sciences. The workshop was funded by the DOE Office of Workforce Development for Teachers and Students.

DIRECTOR’S OFFICE (S. ZELICK)

SITE PROTECTION (F. White)

Emergency Services Unit (ESU) responded to two incidents at PPPL. Ambulance 66 responded to Plainsboro for one mutual aid assignment. Engine 66 responded to Princeton for four mutual aid assignments. Engine 66 responded to Plainsboro for one mutual aid assignment.

Members of the Site Protection Division conducted an Emergency Management Review Committee forum this past Thursday. A member of Site Protection Division visited Brookhaven National Laboratory to obtain training and collaborate on the implementation strategy for a comprehensive emergency management system. A member of Emergency Services Unit completed over 72 hours of training to become an Acting Lieutenant/Driver.

This report is also available on the following web site:

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