

PRINCETON PLASMA PHYSICS LABORATORY

WEEKLY highlights



The PPPL Highlights for the week ending September 12, 2014, are as follows:

NSTX (M. ONO):

NSTX-U is in the Upgrade Project outage in FY14. NSTX Upgrade construction activities continued this week and are highlighted in the Engineering section below.

Preparations for plasma operations in the NSTX-U configuration also continued. The new FCPC firing generator communication links are undergoing pre-operational testing in preparation for open circuit power testing of the rectifiers. The analog link receiver chassis for the new plasma current (I_p) Calculator are being installed in the FCPC Junction Area, and are also undergoing pre-operational tests.

ITER & TOKAMAKS (R. HAWRYLUK):

D-III-D (R. Nazikian):

An article by B.A. Grierson, et al. entitled "High Speed Measurements of Neutral Beam Turn-on and Impact of Beam Modulation on Measurements of Ion Density" has been accepted for publication in Review of Scientific Instruments. The article details high-speed measurements of the beam emission and thermal main-ion emission in DIII-D using the main-ion CER diagnostic when neutral beams are repeatedly pulsed. The paper introduces new analysis in this regime that significantly reduces the scatter in the derived impurity and ion densities from charge-exchange spectroscopy.

An article by W. Solomon et al., entitled "Access to a new plasma edge state with high density and pressures using Quiescent H-mode" has been accepted for publication in Phys Rev Lett. The paper describes access to a new regime identified as Super H-mode, characterized by pedestal pressures twice that of standard ELMing H-mode under similar plasma conditions. The paper also demonstrates that a high-density operation is compatible with the QH-mode regime.

R. Maingi and D. Mansfield visited DIII-D to serve as co-session leaders, along with the main session leader Gary Jackson, for the Li induced pedestal bifurcation experiment. The main goals of the experiments were accomplished. Bifurcations were reproducibly obtained, and the pedestal profiles were documented with high-resolution CER measurements using plasma jogs. In addition the operational window of the bifurcations was expanded to higher power and density plasmas.

B. Tobias visited UC Irvine to present a seminar on recent observations of NTM mode coupling using the MIR/ECE-I system on DIII-D.

C-Mod (S. Scott):

R.T. Mumgaard, R. Vieira, W. Parkin, and S.D. Scott published in Fusion Engineering and Design an article entitled "A small, novel, remote in-vessel inspection system for the Alcator C-Mod tokamak". A small robust system has been constructed for in-situ visual inspection of the Alcator C-Mod tokamak. The system provides improved characterization of the interior components and surfaces of the tokamak with a modest engineering and operational effort.

ADVANCED PROJECTS (D. GATES):

PPPL researchers R. Goldston and C. Kessel have been appointed by DOE to be U.S. representatives to the International Energy Agency's (IEA) Implementing Agreement on Environmental, Safety, and Economic Aspects of Fusion Power (ESEFP). The U.S. is one of seven parties to the ESEFP agreement, which currently coordinates international activities in nine R&D task areas. Goldston is appointed to Task 7, "Socio-Economic Aspects of Fusion Power," which aims to address the role of fusion in timely addressing cost-effective global energy needs and climate change. Kessel is appointed to Task 9, "Fusion Power Plant Studies," which aims to define and evaluate pathways to fusion power while outlining requirements for DEMO and beyond.

THEORY (A. BHATTACHARJEE):

A series of Theory Research & Review-Talks were continued by F. Ebrahimi's seminar, "Extended MHD Studies of Flow-Driven and Reconnecting Instabilities in Toroidal Plasmas". Reconnecting instabilities has been demonstrated to be critical in the nonlinear dynamics of many processes in toroidal fusion plasmas, such as sawtooth oscillations, saturation of internal kink modes, plasma disruption, and relaxation during non-inductive current drive. As advanced fusion plasmas move toward operating in high-beta regimes using non-inductive current-drive techniques and neutral-beam injection, plasma flows are also expected to have an increasing impact on MHD instabilities, and ultimately on plasma transport. In this high-beta regime (with high Alfvén Mach numbers), instabilities may also transition to flow-driven type instabilities. Flow-driven instabilities are also believed to play an important role in the nonlinear dynamics of some astrophysical settings. Resistive MHD and extended MHD have proven to be powerful models for understanding these physics problems. However, MHD simulations are characterized by both spatial and temporal multi-scale problems and require advanced algorithms and solvers. Both the M3D-C1 and NIMROD codes take advantage of an implicit split-time advance, and can be run for long, experimentally relevant, times scales. Within the framework of extended MHD, I will present my experience over the years in understanding some of these problems using nonlinear simulations with the NIMROD and DEBS codes, with a wide range of applications to RFPs [F. Ebrahimi et al., PRL, 99 (075003) 2007] and NSTX, as well as astrophysically relevant experiments and astrophysical disks. Examples of validation/verification exercises of the NIMROD/DEBS codes for these applications will be presented.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Construction: Installation of tiles on the centerstack casing continues and is nearing completion. Vacuum Laboratory preparation of shutters and windows is in progress, and installation on the vessel has started. Installation of hoses for the PF coils continues.

CS Upgrade: Installation of the water connections on both ends of the TF/OH Coils continued and the water fittings were soldered and hydrotested. The OH and PF1A coil impulse tests were repeated after consulting with the manufacturer of the tester. This input provided improved test results of the coils. The first lot of TF Lead Extensions were received from Martinez and Turek. The second lot is also completed and going through final approval for shipping. The PF1C Lower can fabrication and installation has been completed. It will now go to D-site for final vacuum leak checks and silver plating of the leads.

NBI Upgrade: The NB2 gas injection system installation is complete. Junction boxes for beamline controls are being installed on NB2, and cabling has started. Good progress is being made on the testing of NB fiberoptic telemetry. Cables from the NBPC 138' level were successfully tested, and work is now concentrating on the vacuum feedthroughs. The NBI Cryogenics effort continues with compressor maintenance.

Digital Coil Protection System: The DCPS computer has been moved into its permanent location in the Field Coil Power Conversion System Junction Area and pre-operational testing/software checks are in progress. DCPS computer interconnections to the Hardware User Interface are being prepared for pre-operational testing via the autotester. The DCPS Data Dictionary is being finalized.

BUSINESS OPERATIONS (K. FISCHER):

PPPL submitted a proposal to NASA titled "Investigation of EMIC Wave Characteristics under Different Plasma Conditions." The Principal Investigator is E.-H. Kim. The total budget request is \$400,000 for the three-year period of performance.

OFFICE OF ACADEMIC AFFAIRS (N. FISCH):

N. Fisch visited USTC and ASIPP in Hefei, China. On September 9, he participated in an informal workshop on runaways in tokamaks. On September 10, he gave a lecture at ASIPP on "Maintaining Steady State Current with LH Waves in Tokamaks."

DIRECTOR'S OFFICE (C. AUSTIN):

September 9-10, S. Prager presented colloquia on fusion energy at Renaissance Technologies and at the American Physical Society office in Long Island, NY.

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