23rd meeting of the NSTX Program Advisory Committee

Princeton Plasma Physics Laboratory
Conference Room LSB-318
January 22-24, 2008

BACKGROUND and CHARGE

During the last year, many of the design issues for ITER have reached, or have nearly reached closure, and the final design for ITER is expected to be completed in 2008. Also during the last year, there has been increased effort within the U.S. fusion community through the FESAC priorities panel to identify gaps between the anticipated scientific achievements and fusion performance of ITER and what is needed for a successful demonstration power plant (Demo). The two most prominent gaps identified by the FESAC panel - plasma facing components and materials - fall under the theme of "Taming the plasma material interface". Another FESAC theme is "creating predictable high-performance steady-state plasmas". Anticipating the importance of these two themes and utilizing many favorable ST features, the National High-power advanced-Torus eXperiment (NHTX) was proposed with a mission to integrate a fusion-relevant high-power plasma-material interface with sustained high-performance plasma operation. Major gaps were also identified under a third theme of "harnessing fusion power", and the FESAC panel identified 7 major contributions of a Component Test Facility (CTF) across all three themes. Recent design studies indicate that an ST-based CTF could lead to a compact nuclear component testing (NCT) device which minimizes electricity and tritium consumption.

NSTX has been productive in advancing fusion physics understanding for the Spherical Torus (ST) and for the broader range of magnetic configurations – including ITER. In 2007, NSTX achieved significant advances in understanding electron energy transport, error field correction and RWM control, divertor heat-flux mitigation and characterization of Lithium PFCs, Alfven Eigenmode avalanche physics, enhanced Electron Bernstein Wave (EBW) coupling and High-Harmonic Fast Wave (HHFW) coupling and heating, began integration of Coaxial Helicity Injection (CHI) into inductive operations, and accessed high q_{min} plasmas enabling studies of advanced scenarios. This deepened understanding has improved ST plasma performance for eventual fusion applications, and fully non-inductive ST operation with sustained high plasma beta and confinement are within reach. Thus, the ST concept in general and NSTX in particular, are well positioned to play a very important role in the advancement of magnetic fusion.

Consistent with these considerations, the NSTX research team has developed a draft 5 year plan aimed largely at addressing key issues for NHTX and ST-CTF, while also contributing strongly to ITER and fundamental toroidal confinement science. More recently, DOE asked the newly constituted ST coordinating committee (STCC) and the NSTX research team to formulate a focused and prioritized research plan for FY2008-10 to address the most critical needs for the design of next-step STs while also preparing for the possibility that operation of both NSTX and NCSX may not be possible after FY2010.

In view of these considerations, we ask the NSTX Program Advisory Committee to address the following questions, taking into account budgetary constraints:

1) Does the FY2008 research plan provide the correct balance and focus to optimize the contributions of NSTX in the areas of: next-step ST development, resolution of remaining ITER design issues, and fundamental toroidal confinement science?

2) Do the proposed research and upgrade plans for FY2009–10 maximize NSTX contributions toward ST development and fundamental toroidal confinement science?

3) Does the proposed 5yr plan appropriately address high-priority issues for next-step STs and toroidal confinement science beyond those that can be addressed by the end of FY2010?

Additional information:

NSTX 5-year plan presentations from the Sept. 2007 MIT workshop are archived at:

http://nstx.pppl.gov/DragNDrop/Five_Year_Plans/2009_2013/Three_tokamak_workshop/2007_09_17_final_presentations

Information on NHTX can be found at:

http://nstx.pppl.gov/DragNDrop/NHTX_Information/

Information on ST-CTF can be found at:

http://nstx.pppl.gov/DragNDrop/CTF_Information/