Report of NSTX Program Advisory Committee
(PAC-24 – Conference Call)

August 28, 2008

Committee Members Present:
Michael E. Mauel (Columbia University)—chair
Paul Bonoli (Massachusetts Institute of Technology)
Jeffrey Brooks (Purdue University)
Ronald H. Cohen (Lawrence Livermore National Laboratory)
Donald L. Hillis (Oak Ridge National Laboratory)
Bruce Lipschultz (Massachusetts Institute of Technology)
Hendrik Meyer (UKAEA Culham)
Richard P. Majeski (Princeton Plasma Physics Laboratory)
Mickey Wade (General Atomics)

Ex-officio:
Stephen A. Eckstrand (DOE Office of Fusion Energy Sciences)
Stan Kaye (Princeton Plasma Physics Laboratory)
Masayuki Ono (Princeton Plasma Physics Laboratory)

Committee Members Absent:
Riccardo Betti (University of Rochester)
Xavier Garbet (CEA Cadarache)
Jiangang Li (Institute of Plasma Physics, Hefei, China)
Haruyuki Kimura (Japan Atomic Energy Agency)
John S. Sarff (University of Wisconsin)
James W. Van Dam (University of Texas)
Hartmut Zohm (Max-Planck Institute for Plasma Physics)

1. Introduction

The NSTX Program Advisory Committee (PAC) held its 24th meeting via teleconference on August 28, 2008. The purpose of the meeting was to give advice and comment regarding the NSTX Program Letter for Research Collaboration for Employing Innovative Diagnostics for FY09-11. In particular, the PAC reviewed the Program Letter and sought to make constructive comments that improve the letter's clarity and that provide additional information useful for those considering preparing diagnostic collaboration proposals.

The Program Letter consisted of three main parts: (1) an introduction to NSTX collaboration and to the NSTX mission, (2) a listing of priorities and key collaboration opportunities within each of six topical research areas, and (3) an appendix listing current and underway measurement capabilities of NSTX.

The PAC was pleased with the positive and constructive discussion with the NSTX program leadership regarding these comments during the PAC-24 teleconference. Overall, the PAC was pleased with the quality of the Program Letter, and we appreciate the efforts by the NSTX Team

in both preparing it and soliciting PAC comments. The PAC was particularly grateful for the clear and informative presentation by Stan Kaye, who described the motivation and intention of each of the key collaboration opportunities.

After a brief discussion by the PAC, the PAC made two introductory recommendations aimed to strengthen this and future Program Letters and six helpful comments and suggestions pertaining to each of the six research priorities detailed in the Program Letter.

2. Introductory Recommendations

The PAC suggests two introductory recommendations to strengthen and clarify the Program Letter. These are:

1. Before detailing the diagnostic opportunities in each research area, take the opportunity to encourage proposals that address your highest diagnostic needs. The PAC noticed that the language used to describe key diagnostic opportunities did not differentiate between low and high-priority needs. The PAC suggests an additional sentence be added to the top of page 2 that "especially encourages" proposals addressing your greatest needs. These might include diagnostics needed to measure and better understand the LLD, HHFW, and electron transport, or fast-ion redistribution during NBCD.

2. For future Program Letters, consider strengthening your letter by adding practical details that could be used by the research community to better understand and assess your diagnostic requirements. Diagnostic opportunities were described qualitatively and without mention of quantitative requirements, like spatial resolution. The PAC believes by adding diagnostic requirements, at the level used to prepare Appendix A, would actually generate a more favorable response by the research community to the proposal solicitation.

3. Recommendations Regarding Specific Key Diagnostic Opportunities

The PAC suggests the following minor additions or changes to each of the six NSTX priority research areas to strengthen and clarify the Program Letter. These are briefly summarized below:

1. Macroscopic Plasma Physics. To be consistent with your diagnostic opportunity, include characterization of disruption evolution in Research Priority I-3. Amend Appendix A to include your halo current diagnostics. Rephrase your diagnostic need to measure 3D magnetic fields in order to more properly refer to measurement of the non-axisymmetric plasma structure and modes that underpin macroscopic plasma behavior.

2. Multi-Scale Plasma Physics. Include magnetic fluctuation measurements as an important element of understanding long and intermediate scale fluctuations at high beta, and expand your description of the need to improve edge diagnostic resolution with mention of properties in addition to impurity and particle transport and by referring to related diagnostic needs in the following research area.

3. Plasma Boundary Interfaces. Simplify your listing of key diagnostic opportunities by listing just two key diagnostic opportunities: (i) high spatial and temporal resolution measurements of the edge profiles of ion temperature, plasma flow, density, fluctuations, radiation, and plasma current, and (ii) improved diagnostics of the plasma-material-interface with particular attention to the characterization of the liquid lithium surface. The first diagnostic opportunity addresses research priorities III-1, III-2, and III-3. While we recognize "edge kinetic measurements" (in the first opportunity) refer to edge profiles of temperatures, densities, and flows, the PAC supports your efforts to encourage innovative diagnostic approaches to measure possible non-Maxwellian deviations of the edge particle distributions. The second opportunity is needed for Research Priority III-1.

4. Waves and Energetic Particles. Expand the diagnostic opportunity description for HHFW by also including the need to measure the RF-induced changes in the edge plasma near the antenna.

5. Plasma Start-up and Ramp-up without a Solenoid. The PAC believes the investigation and demonstration of non-inductive plasma current ramp-up to be a high priority. Additionally, the PAC believes the use of HHFW to achieve significant current ramp will be challenging. As a consequence, the description of the diagnostic opportunity related to HHFW current drive and ramp-up should be expanded. For example, in the absence of MHD, it may be possible to determine RF-induced changes in the radial loop voltage profile through the time-rate-of-change of the MSE data.

6. Physics Integration. The PAC suggests that a near-term diagnostic opportunity relating to real-time diagnostics should be listed in addition to the more general statement of plasma profile evolution. A call for diagnostic collaboration for real-time diagnostics would aid efforts at plasma discharge control and efforts to detect and prevent conditions that might lead to plasma disruptions.