

Supported by



# NSTX Organization & PAC-11 Action Items

Martin Peng

**NSTX Program Advisory Committee Meeting (PAC-12)**

January 10-11, 2002

PPPL

Princeton, NJ



**Los Alamos**  
NATIONAL LABORATORY



# Research Program Organization for FY02



- Changes and addition in program leadership
  - [Rajesh Maingi \(ORNL\)](#) assumes the Run Coordinator position for FY '02, after serving as deputy.
  - [Stan Kaye](#) assumes the position of Deputy Run Coordinator for FY '02.
  - [Cynthia Phillips](#) assumes the new role of Deputy Physics Analysis head.
- Experimental Task groups, leaders and deputy
  - [Roger Raman \(U. Wash\)](#), [Dennis Mueller](#): CHI
  - [Jon Menard](#), [Eric Fredrickson](#): MHD
  - [Doug Darrow](#), [Dan Stutman \(JHU\)](#): Transport & Turbulence
  - [Randy Wilson](#), [Dave Swain \(ORNL\)](#): HHFW/RF
  - [Henry Kugel](#), [Charles Bush \(ORNL\)](#): Boundary Physics
  - [Dave Gates](#), [Steve Sabbagh \(Columbia U\)](#): Integrated Scenario Development

# PAC-11 NSTX Action Items and Status - I

PAC-11 Advice	Status
<b>Charge #1: ST Theory Panel Report</b>	
We concur with the recent decision to fund larger chunks of fewer people at PPPL.	There are 2.15 FTEs of PPPL Theory spread over 10 people. An additional 1.8 FTE for four CPPG folks at PPPL (this is for non-physics work; e.g., code maintenance, etc.)
J. Manickam to serve as ST theory coordinator, etc.	<p>Manickam and Kaye</p> <ul style="list-style-type: none"> <li>• Started reviewing ST theory needs and encouraging community support for these efforts (CHI, MHD, RF).</li> <li>• Planned future discussion (Transport, Wave-particle interactions and boundary physics).</li> <li>• Proposed talks at Sherwood and at the 11th International Congress on Plasma Physics (ICPP 2002).</li> <li>• To prepare an update assessment of ST theory needs.</li> </ul>
We recommend that the ST theory coordinator seek to generate interest by these ( <i>SciDAC</i> ) groups in applications to the key ST issues...	<ul style="list-style-type: none"> <li>• To rely on SciDAC projects (RF, reconnection, T&amp;T) for more demanding modeling efforts.</li> </ul>
Several recommendations on the content and use of ST Theory Panel report.	<ul style="list-style-type: none"> <li>• ST Theory Panel Report still being finalized.</li> </ul>

# PAC-11 NSTX Action Items and Status - II

PAC-11 Advice	Status
<b>Charge #2: FY02-03 NSTX Research Program</b>	
<p>We believe that the present program properly balances these tensions, but we are concerned that the current drive experiments may be of limited value until the MSE current profile diagnostic comes on line.</p>	<ul style="list-style-type: none"> <li>• De-scope FY02 milestone on “Assess HHFW current drive efficiency” to “Test HHFW Current Drive Efficiency.”</li> <li>• Carry out substantive J measurements during subsequent years – FY03: “Extend startup &amp; sustainment to 1 s” and FY04: “Measure <math>\Delta J</math> from RF, NBI, &amp; BS.”</li> </ul>
<p>We are pleased that the project ... first characterize and then to apply active control to limiting MHD modes. We support ... correcting the observed PF5 error fields.</p>	<ul style="list-style-type: none"> <li>• FY02 – “Study MHD modes without active feedback”</li> <li>• PF5 field errors reduced by an order of magnitude.</li> </ul>
<p>The PAC encourages the NSTX group to carry out more routine and more complete analysis for the routine ST shot (e.g., to routinely carry out data analysis to at least the TRANS level).</p>	<ul style="list-style-type: none"> <li>• Kaye: TRANSP run results available as “data tree.”</li> <li>• McCune: physics module updates continue</li> <li>• Code available to Team to carry out TRANSP and add to “data tree.”</li> </ul>

# PAC-11 NSTX Action Items and Status – II (cont.)

PAC-11 Advice	Status
<b>Charge #2: FY02-03 NSTX Research Program</b>	
<p>We also support the plans for beginning scaling experiments comparing NSTX confinement and H-mode thresholds with DIII-D and other tokamaks, but suggest this activity should first be focused on working with the MAST team to develop an appropriate ST transport and confinement database.</p>	<ul style="list-style-type: none"> <li>• NSTX-MAST collaboration for FY02 includes the start of ST database (Kaye leads).</li> <li>• To include Pegasus, HIT-II, CDX-U, Globus-M, etc. in preparation.</li> <li>• A few collaboration with DIII-D are being planned.</li> </ul>
<p>We agree with the plan to increase time for CHI experiments and explore coupling with RF and OH drive, but feel that the project should more clearly define the physics and diagnostic requirements needed for developing this non-inductive startup tool. In parallel, the group should work with the theory community to apply or develop predictive models for CHI.</p>	<ul style="list-style-type: none"> <li>• De-scoped FY02 milestone on “Demonstrate CHI startup” to “Test CHI startup,” in anticipation of improved absorber capabilities available in FY03.</li> <li>• FY02 research to focus on developing CHI plasma control to achieve flattop and enable key physics investigations.</li> <li>• Work with ST Theory Coordination and SciDAC for models for CHI physics</li> </ul>

# PAC-11 NSTX Action Items and Status – II (cont.)

PAC-11 Advice	Status
<b>Charge #2: FY02-03 NSTX Research Program</b>	
<p>We are pleased to see work beginning on alternative non-inductive current drive techniques such as EBW, and support continued effort in this area.</p>	<ul style="list-style-type: none"><li>• Introduce high priority milestone on “Characterize EBW emission, estimate H&amp;CD” for FY03 or FY04.</li><li>• Began EBW scenario development (Taylor, Efthimion, Phillips)</li></ul>
<p>The NSTX team needs to continue their efforts to understand the limits on NSTX performance; i.e., define the modes or events that limit H-mode operation, beta, and confinement. Such an understanding may help in setting program priorities. We further encourage the group to focus more of the operations on the high performance regimes already obtained to better illustrate the advantages of the ST concept.</p>	<ul style="list-style-type: none"><li>• Started feedback and discussion with the ET leaders on appropriateness of high performance regime for each XP.</li><li>• Carry out early reassessment of plasma operational space given the reduced field errors.</li></ul>

# PAC-11 NSTX Action Items and Status - III

PAC-11 Advice	Status
<b>Charge #3: Next Step ST Options</b>	
<p><b>1. Is this a reasonable vision to guide large-scale ST research?</b></p> <p>The committee urges the NSTX group to promote engagement of the rest of the ST community in expanding this into a national vision for the ST research line.</p>	<ul style="list-style-type: none"> <li>• Prepared presentation jointly with Pegasus and HIT-II program leaders.</li> <li>• To use as template for broader ST community discussion.</li> </ul>
<p><b>2. Is the present set of constraints used to define this next step option for ST's appropriate?</b></p> <p>The committee also notes the need for the national ST community to keep a constant watch on developments in the international community so that any eventual design under consideration fits appropriately into a world ST program.</p>	<ul style="list-style-type: none"> <li>• Exchanged preliminary ideas with ST program leaders in U.K. and Japan. Similar discussions on the subject appear to be in progress in E.U. and Japan.</li> </ul>
<p><b>3. Do any considerations of possible NSST options suggest changes in the direction of the NSTX program?</b></p> <p><i>The NSTX group should pursue a modest-scale examination of the needs for and implications of pursuing a slow-start (ARIES-ST relevant) experiment phase.</i></p>	<ul style="list-style-type: none"> <li>• Began EBW scenarios assessment.</li> <li>• Introduced new FY03-04 milestones: "Characterize EBW emission, estimate H&amp;CD" and "Measure <math>\Delta J</math> from RF, NBI, &amp; BS."</li> </ul>
<p><i>The NSTX program should further define the mission and hardware options and plans for NSTX, to be consistent with this evolving ST vision.</i></p>	<ul style="list-style-type: none"> <li>• Carry out full new CS design in FY04 under enhanced program.</li> <li>• Key element of FESAC 10-yr objective.</li> </ul>

# PAC-11 NSTX Action Items and Status – III (cont.)

PAC-11 Advice	Status
<b>Charge #3: Next Step ST Options</b>	
<p><b>4. Does the immature state of knowledge about confinement in STs make this discussion moot for now?</b></p> <p><i>Confinement results from NSTX and MAST, as well as from smaller devices (e.g., Globus, START, Pegasus, etc.) as appropriate, should be combined to form a preliminary ST confinement database. While this database and any resultant scaling may be ST-specific for now, it would be useful to compare these results on a uniform basis to existing large-tokamak scaling models. In addition, the NSTX group should continue its efforts to work with the theory community to come up with appropriate theory-based models which can be evaluated in present in future devices.</i></p>	<ul style="list-style-type: none"> <li>• NSTX-MAST collaboration for FY02 includes the start of ST database (Kaye leads).</li> <li>• To include Pegasus, HIT-II, CDX-U, Globus-M, etc. in preparation.</li> <li>• NSTX Phys Analysis Head and ST Theory Coordinator to develop action plan.</li> </ul>
<p><b>5. Given these initial considerations for NSST, what should the ST community do about Snowmass?</b></p> <p>The committee recommends that the NSTX/NSST groups should approach the Snowmass meeting with a goal of describing the vision for future development of the ST concept. This should include a basic concept and operating point for a ST-next-step. Basic cost and schedule estimates should also be developed and presented to the community discussion. There should be a discussion on how a conceptual plan for NSST fits into an overall community strategy for pursuing a Burning Plasma experiment. Finally, the argument for waiting for the ST line to develop before moving forward to a BP experiment should be presented, including any pros and cons as appropriate.</p>	<ul style="list-style-type: none"> <li>• Started working closely with ICC and Development Path Working Subgroups.</li> <li>• Continue very modest LPDA effort on concept development. Need more?</li> <li>• Friday presentation contains a preliminary template for this fit.</li> <li>• Arguments for “waiting” to be developed with Development Path Subgroup.</li> </ul>