

Action Items from NSTX PAC-17th Meeting, January 20-21, 2005

| Regarding | PAC Comments / Suggestions | Status |
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| Priorities | PAC feels that research specific to spherical tori (ST) should also be kept prominent as an important “evolving priority” for the NSTX program. | (Presentations by Peng, Menard, Raman) |
| Research in General | From the presentations, the PAC did get the impression that the proposed research plan may be overly ambitious. | (All presentations) |
| Balance between ITPA and ST specific needs | While NSTX can certainly contribute to ITPA, it should carry out the research specifically needed for spherical tori—such as solenoid-free startup and sustainment, radio-frequency current drive with EBW and HHFW, and heat and particle handling at the divertor. | (Presentations by Peng, Menard, Raman, Mueller, Taylor, and Maingi) |
| Wave-Particle Interactions plans | EBW implementation should be given higher priority to ensure the timely attainment of long pulse, high-beta operation on NSTX. | (Presentations by Ono, Taylor) |
| Fast-Ion MHD | The effects of fast-ion MHD on flux-balance transport analysis and driven currents should be investigated further. | (Presentations by Menard, Frederickson) |
| HHFW modeling | The PAC recommends that the CQL-3D code be incorporated with TRANSP; this will allow integrated modeling for some important scenarios involving HHFW, EBW, and NBI and also aid the analysis of experiments. Resources should be applied to accomplish this soon. Code comparisons for NSTX and DIII-D, with both fast wave RF and neutral beams included in the computations, are also encouraged. | we are developing a collaborative proposal with C-Mod to increase resources in order to get this done in a timely fashion (Presentation by Taylor) |
| HHFW edge-coupling | Related to edge coupling degradation, efforts should be made to map out the observed regimes of HHFW heating and current drive, in terms of the launched wave spectrum and plasma beta, in order to facilitate the modeling and design of NSTX current ramp-up scenarios. The PAC recommends increased effort in FY 2005 on HHFW theory and modeling of the problem of poor coupling to the core at low parallel wave numbers and in the presence of neutral beam ions. | (Presentation by Ono, Menard, Taylor) |

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| Electron Thermal Transport | It is important to develop contingencies if high-k fluctuations are not the source of anomaly for electron thermal transport. NSTX seems to be doing this with respect to measuring both low-k and high-k fluctuations. With the high beta plasmas in NSTX, another mechanism to consider is that of magnetic fluctuations, for which diagnostic capabilities at a variety of scales would need to be developed. | FY06 and FY07 milestones (Presentation by M. Bell) |
| Electron Thermal Transport | Comparisons of radial wave number spectra and diffusivity profiles do not provide sufficiently stringent tests of the underlying physics models; more detailed diagnostic measurements would be helpful. Also, for isolating physical mechanisms, the comprehensive code effort should be complemented with the use of reduced codes and analytical theory—e.g., to explain why the simulations show that non-adiabatic electrons enhance the low-k transport. | FY06 and FY07 milestones (Presentation by M. Bell) |
| Momentum Transport | The plans to “develop a fully nonlinear treatment with self-consistent momentum transport” in a simulation code are laudable, but rather ambitious, since not much is yet known about momentum transport in fusion plasmas. This could likely become a multi-year project. Direct experimental measurements of fluxes and flux correlations would be helpful, for example, to obtain a well-characterized χ_ϕ . One suggestion from the PAC is to utilize transient experiments (such as used on C-Mod), with braking coils and neutral beams turned on and off. A particular project would be to develop methods to measure the Reynolds stress, which may govern anomalous momentum transport. | We plan to participate in ITPA joint experiment on NBI-driven momentum transport studies, beginning in 2006. Much effort will be required to make substantial progress. (Presentation by M. Bell) |
| SOL and Pedestal Physics | One of the high-priority ITER needs is that of SOL/main chamber interactions, which is related to the question of SOL transport. NSTX should take the opportunity to study it. | (Presentations by Menard, Maingi) |
| Edge Turbulence | Experimental studies on NSTX could help resolve the question through measurements of the basic properties of the turbulence, such as the equipartition of velocity and magnetic field fluctuations and the phase angle. It would also be worthwhile to explore collaborations with other machines (e.g., LAPD and MST) for which shear Alfvén turbulence is known to be important. | Discussion with LAPD and MST researchers is yet to take place. |

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| Wall Pumping and Particle Control | <p>it would be prudent to conduct the lithium pellet preparation experiments as early as possible during the run in order to allow maximal opportunity for realization of particle and density control under a variety of plasma conditions. Injection of lithium pellets may provide sufficient wall pumping capability; however, NSTX should be ready to implement lithium evaporation at the time of the checkpoint near the middle of the run period. If there are plans to use the lithium evaporator technique in other devices, it would be useful to measure the poloidal and toroidal coverage of the lithium coating.</p> | (Presentations by Menard, Kugel) |
| Wall Pumping and Particle Control | <p>Some density control is obtained from glow discharge cleaning between shots, at least for short pulse lengths; this should be quantified. It would be interesting to explore whether lithium deposition is related to glow between shots</p> | <p>Needed work during this year to be determined. (Presentation by Kugel)</p> |
| Wall Pumping and Particle Control | <p>The trade-off between particle pumping and stability benefits with high elongation and high triangularity should be looked at.</p> | (Presentation by Gates, Kugel) |
| Wall Pumping and Particle Control | <p>An idea proposed for long-pulse pumping is to put a cryo-pump either below the CHI injector slot or above the CHI absorber slot.</p> | Idea to be explored. |
| Neutral Transport Modeling | <p>A suggestion from the PAC is to take the supersonic gas injector to the point where it condenses via nozzle expansion, for possibly better penetration with micro-droplets.</p> | Idea to be explored. |
| Solenoid-Free Startup | <p>In FY 2005 the primary goal with CHI is to form a startup closed-flux current with the use of a capacitor bank. With the improvements of lower pre-ionization at lower fill, higher capacitor bank voltage, and faster bank turn-off, this goal should be achievable. The key measure of success will be the formation of closed-flux current, persisting after the injector current ceases. The primary goal of PF-only startup will be the demonstration of plasma current generation, to be subsequently optimized. With increased HHFW power, local pressure enhancement, and higher toroidal field capability, this goal should also be achievable.</p> | (Presentations by Menard, Mueller) |

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| Integrated Scenario Development | The PAC is interested in whether realistic scenarios could be developed with higher bootstrap fraction than at present. It appears that the bootstrap current is limited because the amount of neutral beam current drive is fixed by the heating needed to achieve the desired beta value. Higher bootstrap fraction may involve replacing some NBI power with HHFW. This might be used to justify future consideration of a counter beam. At the same time, however, reduced neutral beam current drive goes hand in hand with reduced rotation, thereby raising concerns about resistive wall mode stability, which would need to be studied. | (Presentations by Menard, Gates, Taylor, Sontag) |
| Edge Physics (2005 run plan) | the PAC thinks that lithium evaporation looks promising for particle control; however, since it is still a new method, acceptable cryo-pump geometries should continue to be evaluated, so that at the 2007 decision point, no time be lost in providing particle control for long-pulse NSTX operation. | (Presentations by Ono, Kugel, Raman) |
| Solenoid-Free Startup (2005 run plan) | There is a concern that eight days of run time in FY 2005 may not permit enough progress for the FY 2006 and FY 2007 assessments to be positive. | (Presentation by Menard, Mueller) |
| PAC meeting schedule | At a previous meeting (PAC-15, January 2004), common consent had been reached that a single annual PAC meeting would be sufficient, since NSTX has now developed into a mature program. At the present meeting, the PAC affirmed this sentiment. The PAC, furthermore, suggested that the NSTX management consider a two-day format spread over three days (i.e., beginning at noon of Day One and ending at noon of Day Three) for the annual meeting. If the NSTX program were to desire feedback from the PAC about the mid-year collaboration proposal renewal process, this could probably be accomplished by means of a teleconference call. | We complied. |
| Topics of interest | the PAC would like to hear about the NSTX overall plan for solenoid-free startup and sustained-pulse operation (from plasma breakdown, through initiation and ramp-up, to current flat top), including a discussion of the requirements for high bootstrap current fraction and a discussion of the role of current drive tools needed for long-term NSTX integrated scenario goals and their development schedule (with decision points). | (Presentations by Peng, Ono, Gates) |