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Draft NSTX Program Plan FY07-09

- NSTX Mission
- Research Milestones
- ITPA, Collaboration
- PAC-19 Recommendations

Martin Peng

Draft talk for PAC-21

PPPL, January 17-19, 2007

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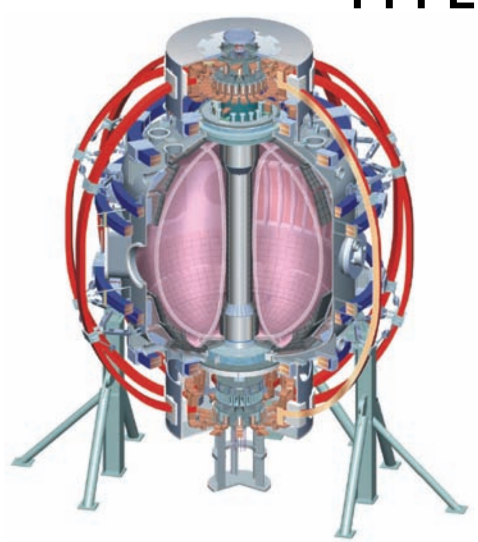

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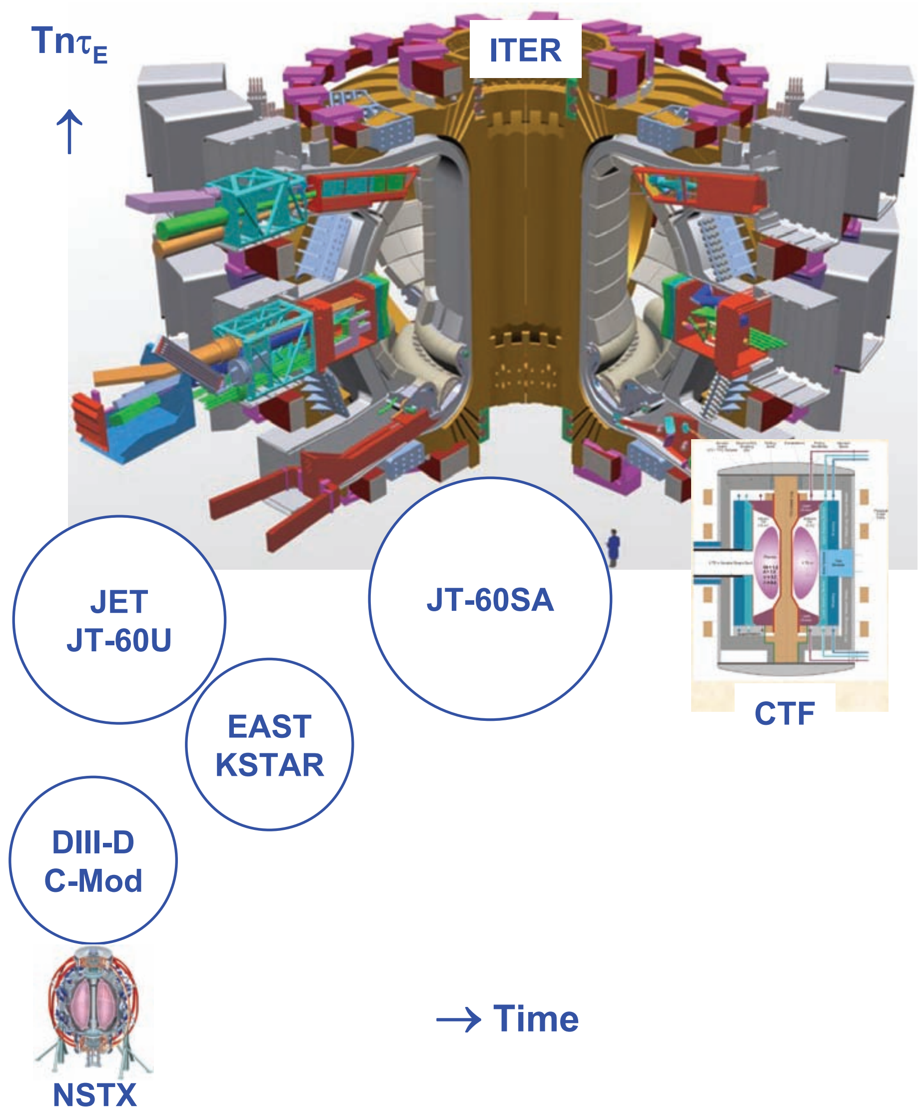
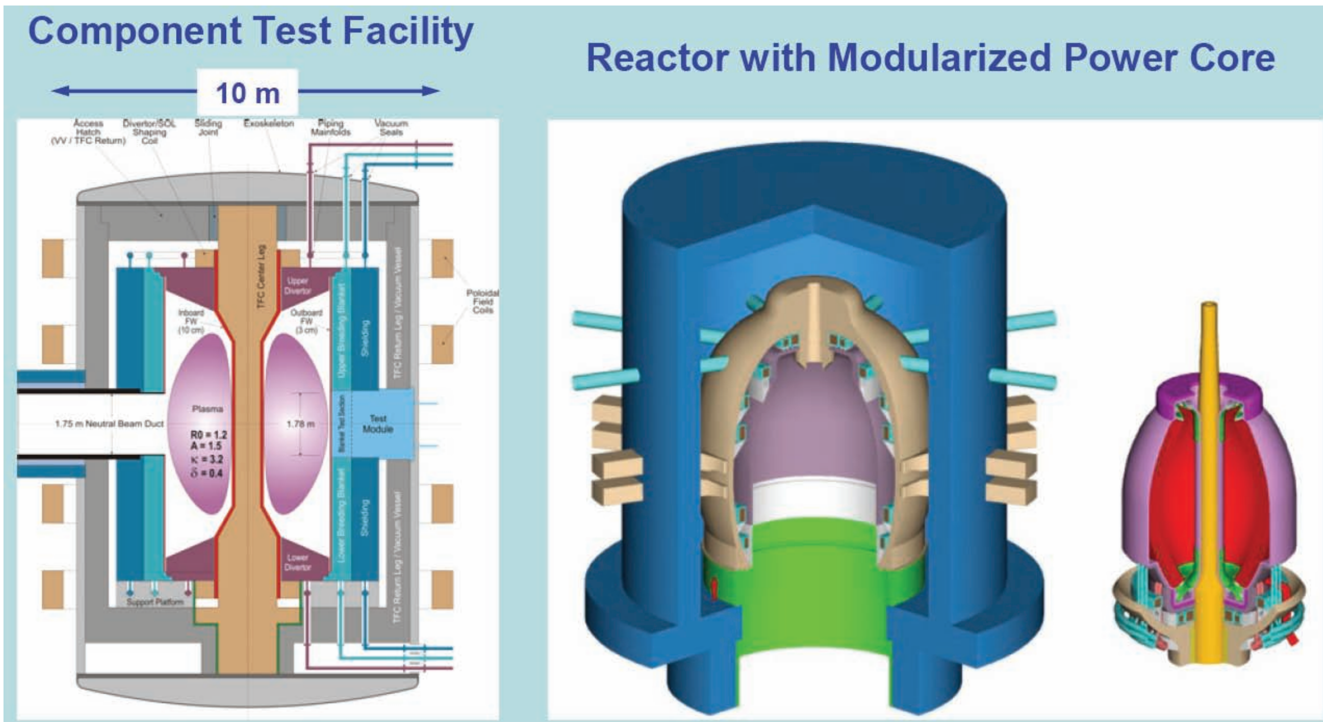
Mission: NSTX addresses key issues for fusion energy development, ITER burning plasma, and plasma science

- **Enable attractive CTF to ensure Demo success,** addressing unique ST development issues and benefiting from common ST-tokamak database.
- **Support and benefit from USBPO-ITPA activities,** using the physics breadth provided by ST to prepare for burning plasma research in ITER.
- **Complement and extend toroidal plasma science,** maximizing synergy in investigating key scientific issues of toroidal fusion plasmas.



NSTX leads to attractive fusion systems & motivates research on start-up & ramp-up using limited induction

- CTF will be needed after ITER to carry out integrated Demo power component testing and development.
- ST enables highly compact CTF with full remote maintenance and high duty factor, and provides potentially attractive reactor configuration.



- Very low A and high β lead to compact modular CTF that allows high duty factor
- Require plasma start-up & ramp-up using limited induction (VF, small iron core)

Start-up & ramp-up research tests CHI, RF, NBI, VF, small central induction, etc. (PAC)

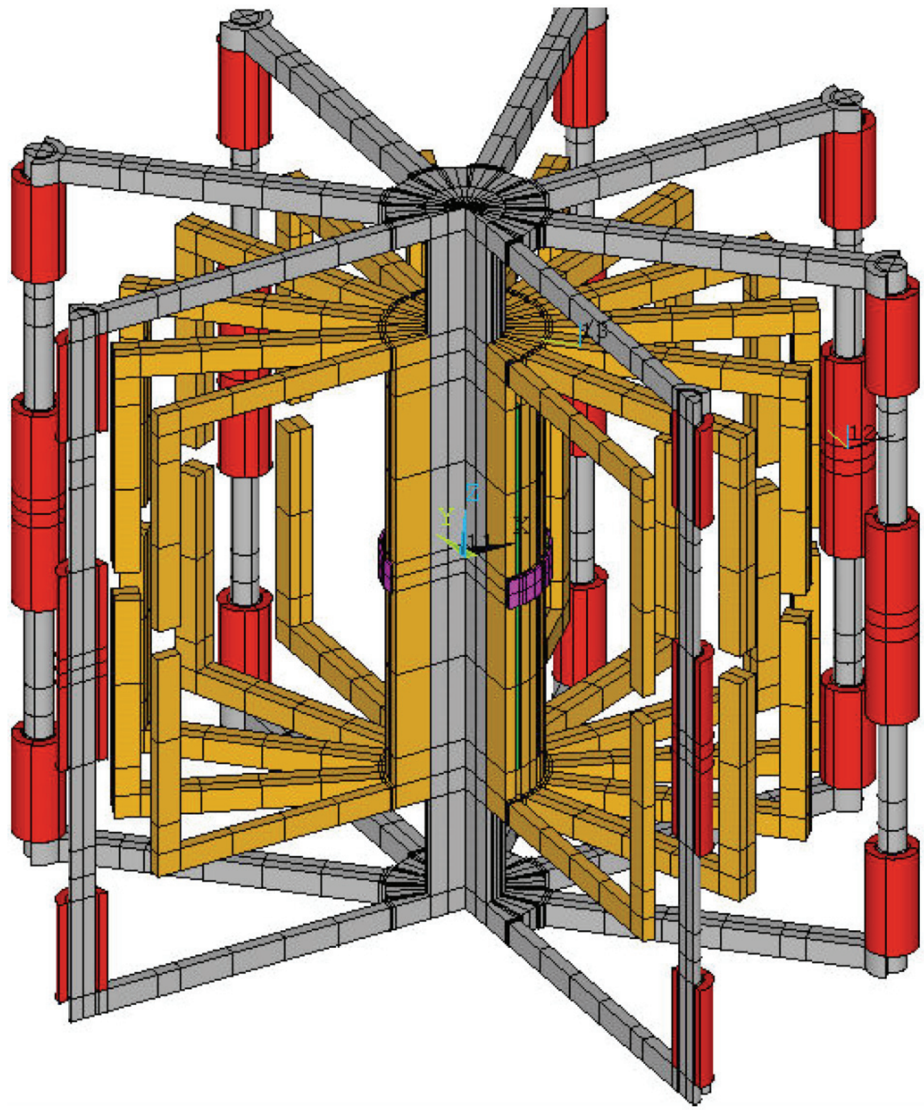
NSTX

Technique	Database	Use in CTF (~10MA)	NSTX Strategy
Transient CHI	HIT-II (~100kA); NSTX (~160 kA)	Compatible; insulator survivability	**Test for 2 kV & 300 kA ('08); couple to solenoid induction ('08); apply ECW* heating ('09)**
Plasma gun	CDX-U (~kA); Pegasus (~25kA~2I_{TF})	Compatible	**Encourage '08-'10 collaboration grant proposal**
Merging Compression	MAST (~500kA)	Requires internal poloidal field coils	**Collaborate on MAST**
HHFW + VF		Improves with B_T	**Continue testing; apply ECW/EBW* heating ('09)**
ECW/EBW + VF	TST-2 & LATE (~10kA); JT-60U (≤ 200 kA)	Compatible	**Collaborate on LATE, TST-2, JT-60U; apply ECW/EBW* ('09);**
LHW + VF	PLT (~100kA)	Compatible (>2T)	**Collaborate on JET & C-Mod (XP's submitted)**
NB + BS + VF	JT-60U (≤700kA)	Compatible (E_{NB}~ 100-300kV)	**Test 400kA → 600kA ('07-'09)**
Small iron core	e.g. JET	Can provide ~ 0.8 Vs (~1 MA with ECH)	**Simulate using partial solenoid swing**
Integrated Scenarios	HIT-II (CHI+OH); JT-60U (RF+NB+VF+BS)	Small induction+ (CHI/RF)+VF+NB+BS	**Test integrated scenarios to minimize induction ('08-'09)**

***Collaboration proposal pending DOE review & decision pending**

All metal center ST stack

- Full 3D ANSYS model of the iron core plus copper TF with inconel spacers
- Initial model has:
  - 16 fold TF symmetry
  - 8 fold Iron symmetry
- Results similar to 2D model with ~0.4V of loop voltage for ~2s for an A~1.9 device
- Further design work required



ST needs steady state high-heat-flux divertor physics data to enable projections to fusion applications

NSTX

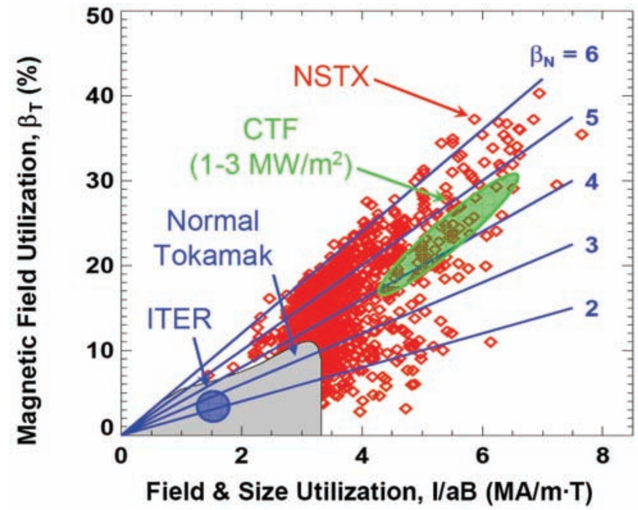
Sustained Parameters	NSTX long pulse ($\kappa \leq 2.5$, $\tau > \tau_{skin}$)	CTF (1-2MW/m^2) ($\tau >$ weeks)
P/R (MW/m)	$\leq$ 9	40 – 70
SOL expansion factor	~ 5	~10
β_{ped} / ELMs	~ 5% / all types	~ 5% / small ELMs

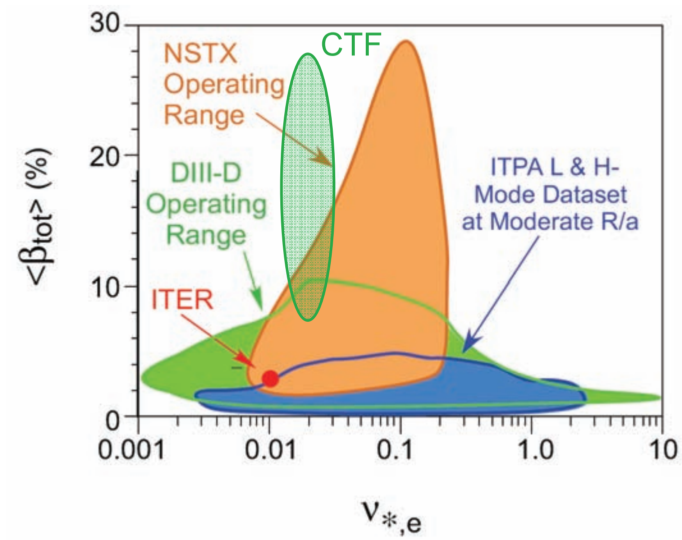
- **High priority for ITER (P/R ~24 MW/m), JET (~16 MW/m), S/C tokamaks (KSTAR/JT-60SA: ~16/13 MW/m), and new long-pulse ST (QUEST) in Japan**
- **Understand physics and determine scaling of divertor heat fluxes**
- **Requires improved edge and particle control**
- **NSTX to investigate physics solutions via**
  - **Divertor heat flux variations ('08)**
  - **Lithium coating and liquid lithium divertor targets ('09)***

***collaboration proposal under DOE review and decision pending.**

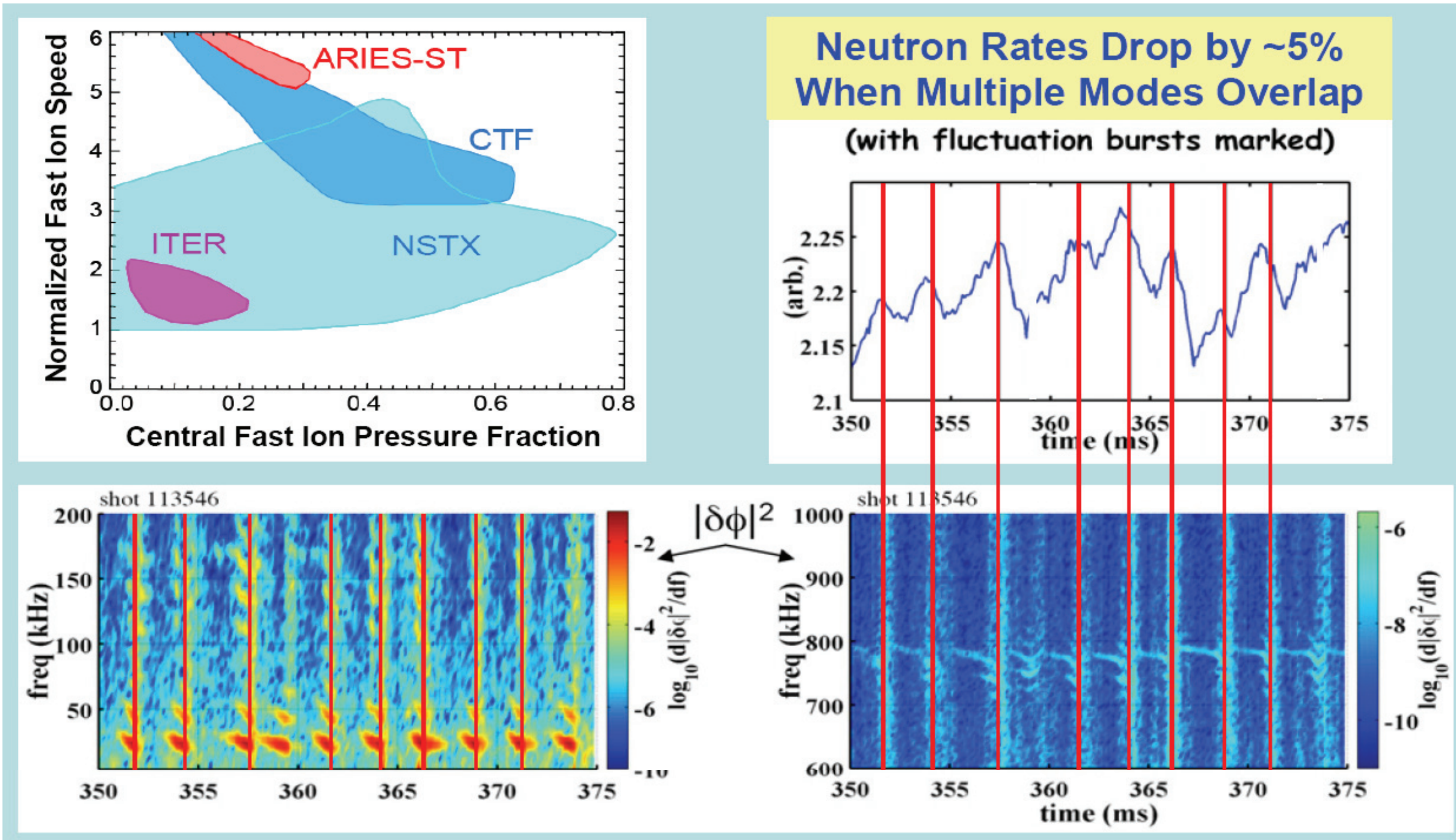
NSTX greatly extends stability and confinement parameters to support and benefit from tokamaks

- **Utilize high beta to strengthen the common stability physics basis**
  - **RWM control vs. rotation ('07)**
  - **RWM stabilization physics vs. rotation ('09)**
- **Utilize extended ε, β_{th}, ρ^*, ν^* to strengthen the common turbulence and transport physics basis**
  - **Variations of local high-k turbulence ('07)**
  - **Poloidal rotation to compare with theory ('08)**
- **Establish stability and confinement physics principles for projections to CTF**





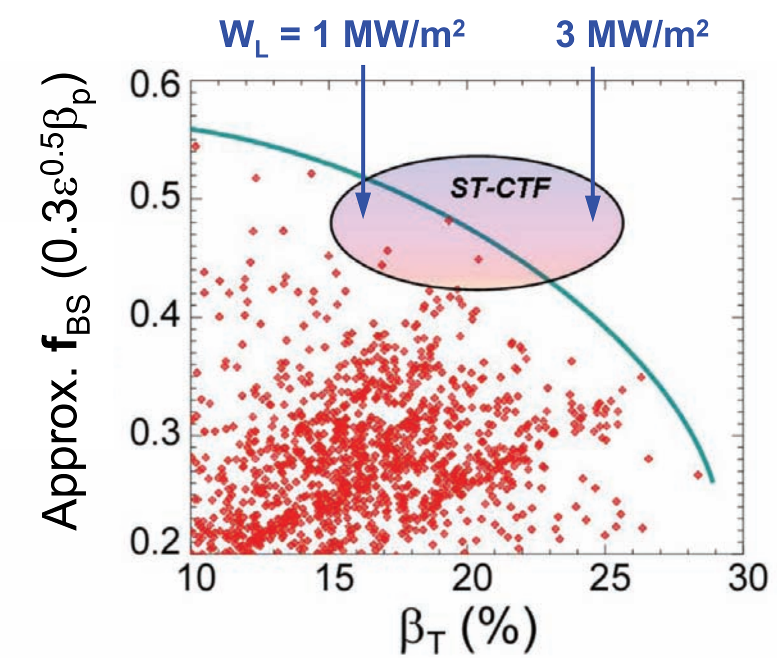
NSTX contributes unique data to ITER on super-Alfvénic ion physics: overlapping modes can lead to fast ion loss

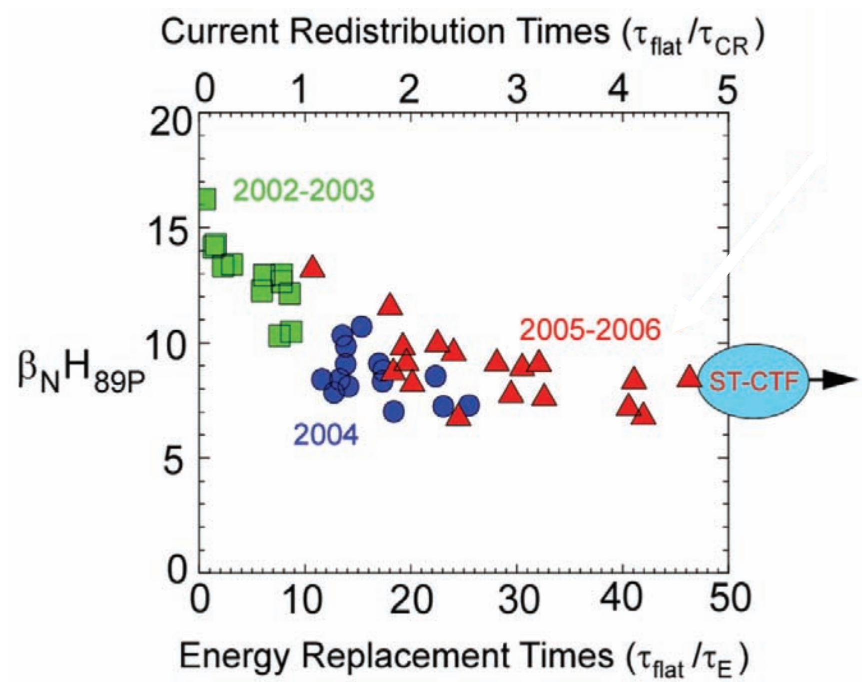


- Utilize this ST-ITER regime to shed light on fusion α heating physics
  - Research and Joule milestones, in concert with theory Joule milestone ('07)
  - Mode-modification of NBCD J(r) ('09)

NSTX continues to extend the physics toward the normalized conditions of basic CTF performance

- **Optimize integration of start-up, ramp-up & sustainment**
  - **Perform high-κ wall-stabilized operation ('09)**
  - **Enable HHFW H&CD capabilities ('09 incremental)**
  - **Integrate mode modification of NBCD J(r) ('09 incremental)**





FY07-09 research and DOE “Joule” milestones address these critical elements of NSTX mission

	FY07	FY08	FY09
Exp. Run-Weeks:	10-11	12	12
1) Transport & Turbulence: Physical processes that govern heat, particle and momentum confinement			
	Study variation of local high-k turbulence with plasma conditions	Measure poloidal rotation at low A and compare with theory	
2) Macroscopic Stability: Role of magnetic fields on plasma pressure and bootstrap current			
	Characterize effectiveness of closed-loop RWM control & dependence on rotation using ITER-like control coils		Understand physics of RWM stabilization and control as a function of rotation
3) Wave-Particle Interaction: Role of electromagnetic waves & modes in sustaining and controlling hot plasmas			
	Measure, identify & characterize modes driven by super-Alfvénic ions		Study how j(r) is modified by super-Alfvénic ion driven modes
4) Start-up, Ramp-up, Sustainment: Understand magnetic reconnection to simply fusion device configuration			
		Couple inductive current ramp-up to CHI plasma	
5) Boundary Physics: Interface between fusion plasmas and normal temperature surroundings			
		Study variation and control of heat flux in SOL	
6) Physics Integration: Integrated plasma operation scenarios to optimize CTF and ITER operations			
			Perform high-kappa wall-stabilized plasma operation
“Joule” Milestones:	Super-Alfvénic ion driven mode physics	Tentative: Rotation & momentum transport physics	TBD

20 run-weeks in FY08 and FY09 would accelerate start-up, HHFW, liquid Li, and integration of *AE modification of J(r)

NSTX

	FY07	FY08	FY09
Exp. Run-Weeks:	10-11	20	20
1) Transport & Turbulence: Physical processes that govern heat, particle and momentum confinement			
	Study variation of local high-k turbulence with plasma conditions	Measure poloidal rotation at low A and compare with theory	
2) Macroscopic Stability: Role of magnetic fields on plasma pressure and bootstrap current			
	Characterize effectiveness of closed-loop RWM control & dependence on rotation using ITER-like control coils		Understand physics of RWM stabilization and control as a function of rotation
3) Wave-Particle Interaction: Role of electromagnetic waves & modes in sustaining and controlling hot plasmas			
	Measure, identify & characterize modes driven by super-Alfvénic ions		Characterize & optimize edge plasma-HHFW interactions
4) Start-up, Ramp-up, Sustainment: understand magnetic reconnection to simply fusion device configuration			
		Couple inductive current ramp-up to CHI plasma	
5) Boundary Physics: Interface between fusion plasmas and normal temperature surroundings			
		Study variation and control of heat flux in SOL	Characterize performance of a liquid lithium divertor
6) Physics Integration: Integrated plasma operation scenarios to optimize CTF and ITER performance			
		Perform high-kappa wall-stabilized plasma operation	Integrate *AE modification of j(r) into optimized operation
"Joule" Milestones:	Super-Alfvénic ion driven mode physics	Tentative: Rotation & momentum transport physics	TBD

ITPA 2007 Joint Experiments are important opportunities to support and benefit from ITER burning plasma research

NSTX

ID No	Proposal Title	Participating Experiments	07 Priority
CDB-2	Confinement scaling in ELMy H-modes: β degradation	AUG, DIII-D, JET, JT-60U, Tore-Supra(L), MAST, NSTX	1
CDB-6	Improving the condition of Global ELMy H-mode and Pedestal databases: Low A	MAST, NSTX, DIII-D	1
TP-8.2	Investigation of rational q effects on ITB formation and expansion	JET, DIII-D, T-10, TEXTOR,NSTX	1
PEP-6	Pedestal Structure and ELM stability in DN	AUG, MAST, NSTX, JET	1
PEP-16	C-MOD/NSTX/MAST small ELM regime comparison	NSTX, MAST, C-Mod	1
MDC-2	Joint experiments on resistive wall mode physics	DIII-D, JET, NSTX, JT-60U, MAST, AUG, TEXTOR	1
MDC-5	Comparison of sawtooth control methods for neoclassical tearing mode suppression	AUG , DIII-D, JET, NSTX, TCV, HL2A, Cmod, FTU, JT-60U	1
MDC-10	Measurement of damping rate of intermediate toroidal mode number Alfvén Eigenmodes	JET, C-Mod, MAST, NSTX	1
MDC-12	Non-resonant Magnetic Braking	JET, DIII-D, C-Mod, NSTX, TEXTOR, MAST	1
SSO-2.2	MHD in hybrid scenarios and effects on q-profile	AUG, JET, DIII-D, JT-60U, NSTX, C-mod	1
TP-6.1	Scaling of spontaneous rotation with no external momentum input	CMOD, DIII-D, JET, JT-60U, TCV, MAST, NSTX, AUG, TEXTOR, Tore-Supra	2
TP-6.3	NBI-driven momentum transport study	DIII-D, JT-60U, NSTX, MAST, AUG, JET	2
DSOL-15	Inter-machine comparison of blob characteristics	C-Mod, PISCES, TEXTOR, VTF, NSTX, TJ-II,JET, TCV, HT-7, Tore-Supra, AUG, JT-60U, MAST, FTU	2
MDC-3	Joint experiments on neoclassical tearing modes (including error field effects)	C-mod, JET, AUG, DIII-D, NSTX	2
MDC-4	Neoclassical tearing mode physics - aspect ratio comparison	AUG, MAST, NSTX, DIII-D	2
MDC-11	Fast ion losses and Redistribution from Localized AE's	JET, DIII-D, JT-60U, NSTX, MAST, AUG	2
CDB-8	ρ^* scaling along an ITER relevant path at both high and low beta	JET, DIII-D, C-mod, AUG, NSTX	TBD
CDB-9	Density profiles at low collisionality	JET, DIII-D, C-mod, AUG, JT-60U, TCV, Tore-Supra, MAST, NSTX	TBD
TP-8.1	NSTX/MAST ITB Similarity Experiments	MAST, NSTX	complete
TP-9	H-mode aspect ratio comparison	NSTX, DIII-D, MAST	TBD
PEP-9	NSTX-MAST-DIII-D pedestal similarity	DIII-D, MAST, NSTX	TBD
DSOL-17	Cross-machine comparisons of pulse-by-pulse deposition	NSTX, AUG, JET, TEXTOR	piggyback
DSOL-19	Impurity generation mechanism and transport during ELMs for comparable ELMs across devices	AUG, JET, DIII-D, C-mod, JT-60U, MAST,NSTX	TBD
DIAG-2	First mirror Qualification	T-10, TEXTOR, LHD, JET, DIII-D, TCV, AUG, LHD, HL-2A, Aditya, NSTX, HT-7, Tore-Supra	piggyback

Details @ http://http://nstx.pppl.gov/DragNDrop/Research_Forum_2006/

Joint NSTX-NCSX 4-year collaboration proposals on major diagnostic collaborations are expected in 2008

- **NSTX research collaboration effort: ~$5M/yr**
- **NSTX national collaboration renewed in 3-year cycles**
  - **2004; 2007:** University and industry grants
    - Present collaborators: Columbia U, Comp-X, GA, Lodestar, MIT, Old Dominion U, U Wash, U, Wisc
  - **2005; 2008:** Major diagnostic collaborations
    - Present collaborators: JHU, Nova, UC-Davis, UC-Irvine, UCLA, UCSD
  - **2006; 2009:** Laboratory collaborations
    - Proposals in review by DOE; results to be announced in January 2007
- **2008 proposals will begin NSTX-NCSX joint planning, as NCSX plans to start full research program in 2011**

Responses to PAC-19th meeting recommendations – I

NSTX

PAC-19 Report	Response
More run time than three days may be necessary. The PAC feels that the NSTX team needs to develop a clear strategy, including options and decision points, for how to achieve the goal of non-inductive start-up and ramp-up. The PAC is concerned that these important ST-related tasks might not get the run time needed for success. The NSTX team does plan to re-examine this question at the time of the FY06 mid-run assessment.	**Peng**
The PAC continues to wonder whether results in the next few years will support a decision for an expensive EBW system. As perhaps the only radio-frequency current drive scheme, EBW seems critical for the spherical torus as a reactor. Whether EBW would be critical for a spherical-torus Component Test Facility—e.g., for start-up and for high-power-flux/off-axis current drive to maintain stability—needs to be clarified. Adequate resources should be allocated to EBW studies in order to permit an informed decision about the EBW strategy at the end of FY06.	
An engineering assessment of an iron core is needed, with plasma included in the analysis. Also, boundary conditions for the poloidal field at low aspect ratio with an iron core should be considered.	
If 28 GHz is going to be the frequency of choice for future NSTX upgrades, it would be wise in present-day experiments to concentrate on 28 GHz emission experiments over a wide range of machine conditions and thus map out where 28 GHz EBW can be used. It is therefore important to ensure, by means of further comprehensive emission measurements and detailed modeling, that the choice of optimum EBW heating frequency is robust against variations in plasma parameters. The good agreement of initial EBW emission measurements with modeling results from the CQL3D/Genray codes is encouraging. Further verification of theory with respect to the emission view angle, scheduled for FY06, is a logical follow-up. Collaboration with the MAST EBW effort, in code benchmarking and current drive experiments, is to be encouraged.	**Ono**
Quite a few of the proposed new installations are leveraged on incremental funding in the FY2007–08 timeframe. For heating and current drive, two examples are the 1-4 MW EBW system and the k|| = 14 m-1 HHFW antenna. In view of the high cost of some of these components (e.g., gyrotrons) and the continuing tight budget situation, the practicality of the proposed FY07-08 research plans is somewhat dubious. The proposed activities may need to be prioritized in terms of their potential impact on ITER and/or on the development of the spherical torus concept.	
The lithium program is rightly given high priority: NSTX needs to make sure that this receives sufficient attention to support the pumping/fueling decision point. The NSTX team is aware that they must do more than remove particles; they must learn how to control the density. This may require a fair amount of effort and run time. Divertor operation (e.g., on CTF) compatible with low-density operation will be another severe challenge. As the lithium program is carried out and data are obtained, NSTX should be thinking about particle control schemes—e.g., liquid lithium or cryopumping—that extrapolate to long pulse.	

Responses to PAC-19th meeting recommendations – II

PAC-19 Report	Response
The work on electron transport takes advantage of the NSTX unique regimes and the new scattering diagnostic. The MSE system will also be of great value in this investigation. NSTX contributions to the ITER scaling efforts have been very useful; however, the point of diminishing returns may soon be reached. The PAC encourages the NSTX program to ensure that in these scaling studies, sufficient focus is paid to understanding the underlying physics mechanisms.	Tritz
However, controversies within the theory community about ETG transport, some of which hinge on whether there are radial streamers, will likely make comparisons with theory difficult unless the experiments can characterize anisotropy, i.e., the ratio of poloidal to radial wave number. This is an important consideration that should be part of the decision point on new diagnostic development. The PAC suggests an early evaluation of the prospects for measuring anisotropy in the scattered spectrum, which is probably the outstanding theoretical issue for ETG turbulence. (Note: NSTX has plans to study anisotropy at the end of the FY07 run.)	
Turbulence modeling (e.g., with the use of the GYRO code) will be crucial for deriving maximum benefit and information from the high-wave-number fluctuation measurements. It is not clear that this effort is moving forward commensurately with the diagnostic development, experimental plans, and milestones. The PAC feels that the modeling efforts should be accelerated, subject to the availability of human and computational resources. The PAC encourages work on a number of interesting avenues of study with nonlinear gyrokinetic analysis. Comparisons with measured R/Lted might shed light on electron transport questions; the results seem to be markedly different than those from standard aspect ratio machines. The effect of magnetic shear is another area where quantitative comparisons might be possible. Inter-machine comparisons could also be useful, since there are now high-k fluctuation diagnostics on all three major US experiments. A first step might be to identify operational regimes in which some of these devices are predicted to be in the same regime with respect to electron transport.	
Particle transport is a key process in efforts on particle control; however, particle transport studies on NSTX were not described to the PAC. It is understood that such studies are not of the same priority as electron thermal transport. Nevertheless, the NSTX focus on particle control makes it worthwhile to ensure that opportunities to advance the understanding particle transport are not missed.	

Responses to PAC-19th meeting recommendations – III

PAC-19 Report	Response
The PAC suggests one issue for further consideration. In ITER, the RWM coils must be behind the port shield modules, which are about 500 mm thick. The response speed for penetration of either an error field signal from the plasma or a correction (feedback) field from the RWM coil will be limited, due to the eddy currents generated in the shield modules. NSTX could provide useful information to ITER if it would explore the effect of bandwidth on the ability to control RWMs—in particular, the limitation of bandwidth to low frequencies, i.e., the minimum bandwidth needed. (The high frequency cut-off in ITER will likely be around 20 Hz.)	**Sabbagh**
The PAC encourages the NSTX team to follow through on providing data and analysis to the ITPA disruption database.	
The PAC does urge the NSTX team to keep the neoclassical tearing mode experiment on the schedule for 2007. Although neoclassical tearing modes are apparently not common on NSTX, there are cases where experimentally observed MHD activity has not yet been identified and could potentially correspond to neoclassical tearing modes; the "possible hybrid" regime seen late in sustained high beta discharges is such an example. Clear identification of this MHD activity could provide useful information both for the study of neoclassical tearing modes and for comparison of this regime to hybrid scenarios obtained in other devices.	
An intriguing pair of questions emerges: First, why has there been no observation in NSTX—and also in MAST—of any Alfvén cascade modes in reversed-shear operation? In contrast, DIII-D has seen multiple cascade modes with reversed shear. Second, why does NSTX see multiple Alfvén modes with normal (non-reversed) shear operation—whereas DIII-D does not? The answers to both questions are likely related to the special low-aspect-ratio nature of NSTX, which causes its plasmas to have high beta, large fast ion beta fraction, and low shear. These two questions pose interesting challenges to theory and experiment.	**Gorelenkov**

Responses to PAC-19th meeting recommendations – IV

NSTX

PAC-19 Report	Response
However, it is unclear how much priority the SciDAC project is giving to this work; it appears to be starting to pay some attention, but otherwise NSTX will need to expend its own effort. Going to a directed high-$k_\parallel$ (14 m-1) antenna might mitigate the problem with edge absorption, but it may result in lower current drive efficiency during ramp-up. Thus, were funding to become available, a careful analysis will be needed to decide if the HHFW antenna should go forward. The PAC feels that NSTX needs to figure out what the long-term role of HHFW will be. Although its wave-particle physics is interesting, how HHFW fits into the long-term vision for NSTX or for a Component Test Facility (CTF) is unclear. The PAC wonders if the HHFW system is receiving enough run time to allow it to become a useful tool. The PAC notes that later this year, some HHFW studies that piggyback on edge coupling experiments will be carried out.	
However, there may be some value in exploring—at least theoretically in the first instance—possible synergistic effects of HHFW and EBW heating and current drive. The PAC suggests an investigation of the scheme of *combined EBW current drive and HHFW heating and current drive* to see whether current drive performance in NSTX might be improved.	**Hosea**
Improvements to the HHFW antenna voltage feedback should improve reliability of coupling to such plasmas. HHFW has already been successfully used to generate high bootstrap fraction in 250 kA discharges. Given the strategic importance to the ST concept, it is appropriate that high priority—even a milestone—be given in FY06 to improved CHI start-up and, in particular, the hand-over to efficient auxiliary heating and further plasma current ramp-up.	
The poor absorption of high-harmonic fast waves at low $k_\parallel$ may be explained, at least partially, by parametric decay instabilities near the plasma edge. Although these instabilities are expected to be weaker at high toroidal field, the NSTX team would be wise to explore the possibility of a revised antenna design that could allow higher $k_\parallel$. This would also be beneficial for coupling to target plasmas generated by the coaxial helicity injection (CHI) method.	
Improvements to the HHFW antenna voltage feedback should improve reliability of coupling to such plasmas. HHFW has already been successfully used to generate high bootstrap fraction in 250 kA discharges. Given the strategic importance to the ST concept, it is appropriate that high priority—even a milestone—be given in FY06 to improved CHI start-up and, in particular, the hand-over to efficient auxiliary heating and further plasma current ramp-up. More run time than three days may be necessary.	**Raman**
The PAC also recommends that the FY08 Integrated Scenario Development physics milestone be clarified so as to explicitly include start-up and ramp-up issues, which are crucial for the ST. The PAC suggests broadening the internal research goals associated with this milestone to include a statement about "Assessing the hand-off and ramp-up of non-inductively produced plasma current."	

Responses to PAC-19th meeting recommendations – V

PAC-19 Report	Response
Plans to study *momentum transport* on NSTX will be aided by the capability to infer flow fluctuations and Reynolds stress. Efforts to extract this kind of information from the gas-puff imaging measurements, while obviously subject to resource limitations, are laudable and should be encouraged. The null result on bi-coherence at the L-H transition is particularly intriguing, since it is different from published DIII-D results.	
It would be advisable to begin with modest amounts of lithium evaporation in order to touch base with the pellet experiments. The NSTX team should be careful not to take too small steps on the path to lasting effects (for many shots) on the plasma density. Simple estimates indicate that a quantity of about 0.5 gm is required for long-lasting effects. Hopefully, such a magnitude of evaporation could be tested before the end of the three-day initial run period.	
The new Enhanced Pedestal H-mode regime (EPH) with a proper Te pedestal is very interesting. Will there be enough run time to follow up on these interesting results? Allocating some of the contingency run time for EPH studies might be a good idea. These experiments are included in the ITPA list of things to be done.	
The PAC encourages the work carried out with the *gas-puff imaging diagnostic* and the analysis of these results. Even though no entirely satisfactory edge model exists, comparisons with code models could still be useful. Two questions about the codes have to do with whether synthetic diagnostics for these codes are practical, and whether the codes are mature enough yet to be compared with brightness measurements.	**Soukhanovski**
It is important to make sure that the *scrape-off layer turbulence/transport studies* are accomplished. This is a high leverage activity for scaling/prediction of power deposition width, recycling, density limits, and other boundary related topics. Comparison with standard-aspect-ratio devices could help elucidate the underlying mechanisms. Another area for comparison is the role of topology and edge flows in the H-mode threshold and ELMs.	
An example is reflectometry (from inside the pedestal), which shows a reduction in radial correlation length with no change in amplitude, and GPI (from outside the pedestal), which shows no change in correlation length and a reduction in amplitude. The reciprocating probe offers the possibility of sorting out these puzzles. Discharges that allow the probe to bridge these regions should be sought and studied. Probe studies should also take full advantage of the ability to measure the density/potential cross-phase—and, therefore, particle transport—in the context of differences between L-mode and H-mode.	
The *dRsep scan* for locating the large versus small ELM boundary and for diagnosing material migration experiments could be important, since these issues are neither boundary nor wall. Because many ELM investigations are ongoing, some attention should be paid to locating the large versus small ELM boundary. These experiments are included in the ITPA list of things to be done.	

Responses to PAC-19th meeting recommendations – VI

PAC-19 Report	Response
The PAC encourages activities in *integrated modeling* for start-up and long-pulse operation. This could provide an organizing principle for what is a fairly broad and not entirely coherent program. Right now there are too many options and too many threads to follow—probably too many to work through exhaustively. The PAC also notes that integrated modeling tools that can work starting from breakdown are needed not only for NSTX, but also for producing a target plasma for "advanced tokamak" operation in ITER. Specific application of such modeling tools to NSTX would be useful for evaluating ST start-up issues and also for developing and verifying these modeling techniques for broader utility beyond the ST program. The PAC requests that, at its January 2007 meeting, the NSTX provide an update about the work on start-up/long-pulse integrated modeling and how it relates to future plans.	**Maingi**