NSTX Program Update

Martin Peng, 12/15/04 Team Meeting

- **Up-Coming NSTX Meetings and Preparation**
- **ITPA 2005 Joint Exp of NSTX Interests**

(consistency with our developing plans?)

Upcoming NSTX Meetings

Quarterly Review	1/17, PM	Tele-video: outage status, **FY05 FEAs**
PAC-17	1/20-21/05	PPPL: **charge, agenda**
MAST Forum	2/1-2/05	Culham: remote possible
FY05-07 BPM	3/15-16/05	Germantown: **milestones**

Draft FY05 Science Fusion Execution Agreements Being Vetted (HR, ET Leaders)

1: Phys Integration	*Plasma stability and confinement of strongly shaped high-beta plasmas for increased durations will be characterized.*
2: MHD Stability	*Produce and characterize strongly shaped ST plasmas approaching the "wall-stabilized" pressure limits.*
3: Wave-Particle	*Assess the requirements for the high-power Electron Bernstein Wave (EBW) heating and current drive systems on NSTX.*
4: Boundary Phys	*Characterize the plasma edge pedestals and scrape-off layer in high performance spherical torus plasmas.*
5: Turbulence & Transport	*The effects of variations in the magnetic shear and gradients in Te on electron transport will be characterized.*

Charge to the NSTX PAC-17th Meeting

Substantial evolution in the priorities of the U.S. Fusion Energy Sciences Program has occurred during 2004. Key elements in this evolution include the recent scientific recommendations of the FESAC Priorities Panel, and the approaching U.S. participation in the ITER Project with the associated increased importance of the International Tokamak Physics Activities (ITPA). The NSTX Program plans for FY2005 – 2007 and the specific FY2005 run plan need to be examined in light of these developments. The NSTX Team is preparing to present to the PAC for advice an updated description of these plans. It would be helpful if the PAC could address the following two questions:

1) Does the proposed research and facility plan for FY2005 – 2007 appropriately address the evolving priorities of the U.S. Fusion Energy Sciences Program?

2) Does the proposed FY2005 experimental run plan make good use of the available capabilities to achieve the FY2005 research milestones and support the FY2006 and FY2007 plans?

Thanks Speakers for Willingness and Planned Hard Work

Martin Peng	**Action Items and Introduction**
Ed Synakowski	**Research Plan for FY2005 – 2007**
J. Manickam	**Planned Contributions from Theory and Computation**
Masa Ono	**Facility Plan for FY2005 – 2007**
Bob Kaita	**Plans for Particle Control**
Jon Menard	**FY2005 Run Plan**
Steve Sabbagh	**Equilibrium Reconstruction Accounting for MSE Data**

Draft Baseline FY06-07 Research Milestones Are Subject of Discussion Now; Issues to Be Resolved

	FY05	FY06	FY07
Exp. Run-Weeks:	17	12	10

1) Transport & Turbulence: Physical processes that govern heat, particle & momentum confinement

- (05-5) Characterize q' effects on electron transport
- (06-1) Characterize high-k turbulence
- (07-1) Characterize local electron transport

2) Macroscopic Stability: Role of magnetic structure on plasma pressure & bootstrap current

- (05-2) Study plasmas ≤ "wall-stabilized" pressure limit
- (06-2) Identify tearing mode & onset conditions

3) Wave-Particle Interaction: Use of electromagnetic waves to sustain and control high-temperature plasmas

- (05-3) Assess EBW H&CD requirements
- (06-3) Characterize HHW-plasma edge interactions
- (07-2) Optimize HHFW CD properties

4) Start-up, Ramp-up and Sustainment: Physical processes of magnetic flux generation

- (07-3) Test solenoid-free ramp-up to high current

5) Boundary Physics: Interface between fusion plasmas and normal temperature surroundings

- (05-4) Characterize edge of high-performance plasmas
- (06-4) Characterize Li pellet & coating effectiveness
- (07-4) Assess long-pulse heat & particle control requirements

6) Integration: Integration of external control and self-organization physics

- (05-1) Characterize high-bs & low-induction plasmas

Assuming Fuller Funding, What Should be Added?

	FY05	FY06	FY07
Exp. Run-Weeks:	17	17	17

1) Transport & Turbulence: Physical processes that govern heat, particle & momentum confinement

- (05-1) Characterize q' effects on electron transport
- (06-1) Characterize high-k turbulence
- (07-1) Characterize local electron transport

2) Macroscopic Stability: Role of magnetic structure on plasma pressure & bootstrap current

- (05-2) Study plasmas ≤ "wall-stabilized" pressure limit
- (06-2) Identify tearing mode & onset conditions
- (07-2) Characterize effectiveness of active RWM control

3) Wave-Particle Interaction: Use of electromagnetic waves to sustain and control high-temperature plasmas

- (05-3) Assess EBW H&CD requirements
- (06-5) Optimize HHFW CD properties
- (06-3) Characterize HHW-plasma edge interactions

4) Start-up, Ramp-up and Sustainment: Physical processes of magnetic flux generation

- (07-3) Test solenoid-free ramp-up to high current

5) Boundary Physics: Interface between fusion plasmas and normal temperature surroundings

- (05-5) Characterize edge of high-performance plasmas
- (06-4) Characterize Li pellet & coating effectiveness
- (07-4) Assess long-pulse heat & particle control requirements

6) Integration: Integration of external control and self-organization physics

- (05-4) Characterize high-bs & low-induction plasmas
- (07-5) Evaluate $V_L = 0$ plasmas for $\geq \tau_{skin}$

NSTX Interests in ITPA-IEA LT 2005 Joint Experiments

Meeting: December 8-10, 2004

ID No	Topical Group	Proposal Title	Keypersons [1]	Devices [2]	NSTX
CDB-2	Conf DB & Mod	β confinement scaling in ELMy H-modes: β degradation	F Ryter, C C Petty, D. C. McDonald, T. Takizuka, G. T. Hoang(TS), M. Valovic	AUG, DIII-D, JET, JT-60U, Tore-Supra(L), MAST, NSTX	NSTX interest?
CDB-6	Conf DB & Mod	Improving the condition of Global ELMy H-mode and Pedestal databases: Low A	R Akers, S Kaye, C. Petty, M.Valovic, E. Synakowski	MAST, NSTX, DIII-D	S Kaye
TP-8.1	Transport Physics	ITB Similarity Experiments	M. Peng (NSTX), A. Field (MAST)	MAST, NSTX	M Peng
TP-9	Transport Phsyics	H-mode aspect ratio comparison	E. Synakowski (NSTX), C. Petty (DIII-D), M. Valovic(MAST)	NSTX, DIII-D, MAST	E Synakowski
PEP-9	Pedestal and Edge	NSTX-MAST-DIII-D pedestal similarity	T Osborne, A Kirk, R Maingi	DIII-D, MAST, NSTX	R Maingi

NSTX Interests in ITPA-IEA LT Meeting 2005 Joint Experiments

December 8-10, 2004, continued

PEP-16	Pedestal and Edge	C-MOD/NSTX/MAST SMALL ELM REGIME COMPARISON	A. Hubbard, R. Maingi, H. Meyer	NSTX,MAST, C-mod	R Maingi
DSOL-9	Divertor & SOL	^{13}C injection experiments to understand C migration	Guy Matthews, JET , P. Stangeby (DIII-D), V. Philipps (Textor), K. Tsuzuk, V. Rohde, C. Skinner	JET, DIII-D, TEXTOR, ASDEX-Upgrade, JT-60U, NSTX?	C Skinner: new joint proposal on micro-balance deposition studies
DSOL-15	Divertor & SOL	Inter-machine comparison of blob characteristics	J. Terry (C-Mod), S. Zweben (NSTX), C. Hidalgo (TJ-II), R. Maqueda (NSTX), O. Grulke, D. D'Ippolito, J. Myra, P. Ghendrih(TS), N. Asakura	C-Mod, NSTX, TJ-II, Tore-Supra(06), JT-60U	S Zweben
MDC-2	MHD, Disruptions & Control	Joint experiments on resistive wall mode physics	H Reimerdes, M Okabayashi (DIII-D), M Gryaznevich(JET), S D Pinches (JET), R Koslowski (TEXTOR), M Takechi (JT60-U), S Sabbagh (NSTX), H Zohm (AUG)	DIII-D, JET, TEXTOR, JT-60U, NSTX. AUG	S Sabbagh

NSTX Interests in ITPA-IEA LT Meeting 2005 Joint Experiments

December 8-10, 2004, continued

MDC-4	MHD, Disruptions & Control	Neoclassical tearing mode physics - aspect ratio comparison	M Maraschek (AUG), D Howell (MAST), E. Frederickson, R. LaHaye	AUG, MAST, NSTX(05,06), DIII-D (05/06)	E Fredrickson
MDC-6	MHD, Disruptions & Control	Low beta error field experiments	S Wolfe, I Hutchinson (C-Mod), T Hender, T Scoville (DIII-D), R Koslowski (TEXTOR), D Howell (MAST), (NSTX?)	C-mod, TEXTOR, MAST, DIII-D, NSTX, JET	NSTX interest?
MDC-9	MHD, Disruptions & Control	Fast ion redistribution by beam driven Alfvén modes and excitation threshold for Alfvén cascades	A.Fasoli, D.Borba(JET/AUG), S.Pinches and D.Testa (JET), K. Shinohara (JT60-U), W.Heidbrink (DIII-D),R. Nazikian(DIII-D) E. Frederickson	JT-60U, JET, AUG, DIII-D, NSTX	E Fredrickson
SSO-2.1	Steady-State Operation	Complete mapping of hybrid scenario	E. Joffrin(JET), S. Ide, M. Wade, A. Sips, J. Menard	JET, JT-60U, DIII-D, AUG, NSTX	J Menard

Up-Coming 2005 ITPA Topical Group Meetings

TG	I	II
CDB	4/18-21, Kyoto	10/3-6, St. Petersburg*
TP	↑	↑
PEP	↑	↑
DSOL	7/4-6 (post-EPS)?	–
MDC	7/4-6 (post-EPS)?	–
SSO	?	?
Diag	?	?

* IAEA TM on H-Mode & Barriers: 9/28-30, St. Petersburg

*** Joint Int. ST Workshop & IAEA TCM on ST: 10/3-6, St. Petersburg!**