NSTX

Supported by

U.S. DEPARTMENT OF ENERGY | Office of Science

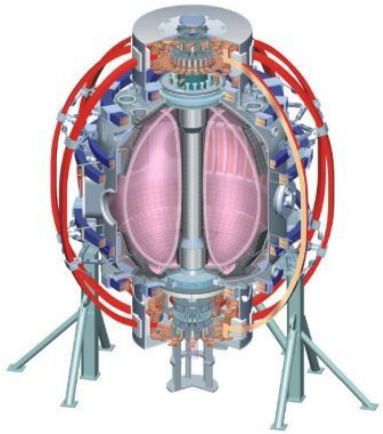
ITER Urgent Needs and Cross-Cutting TSG Session

College W&M
Colorado Sch Mines
Columbia U
CompX
General Atomics
INL
Johns Hopkins U
LANL
LLNL
Lodestar
MIT
Nova Photonics
New York U
Old Dominion U
ORNL
PPPL
PSI
Princeton U
Purdue U
SNL
Think Tank, Inc.
UC Davis
UC Irvine
UCLA
UCSD
U Colorado
U Illinois
U Maryland
U Rochester
U Washington
U Wisconsin

J. Menard, R. Maingi, A. Boozer

NSTX FY2011-12 Research Forum
LSB B318, PPPL
March 18, 2010

*This work supported in part by US DoE contract DE-AC02-09CH11466



Culham Sci Ctr
U St. Andrews
York U
Chubu U
Fukui U
Hiroshima U
Hyogo U
Kyoto U
Kyushu U
Kyushu Tokai U
NIFS
Niigata U
U Tokyo
JAEA
Hebrew U
Ioffe Inst
RRC Kurchatov Inst
TRINITI
KBSI
KAIST
POSTECH
ASIPP
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
ASCR, Czech Rep
U Quebec

Prioritization

- ITER-CC guidance allocation run days: 8.5
- Full run-time request: 34, minimum useful request: 20
- Good coverage of key areas:
  - NSTX-U needs
  - 3D field effects on edge transport
  - 3D field effects on edge stability, equilibrium
  - Impurity reduction and control
- Guidance for FY split and prioritization:
  - FY11 Priority 1 + 2 = 4 + 1
  - FY12 Priority 1 + 2 = 2.5 + 1
- 15+ run days proposed for R11-4 3D-fields milestone
  - Need to combine several ideas into “group” XP(s)
  - Will need future planning meeting(s) to define who does what and identify reduced set of scenarios that can provide data for all involved

Agenda – ~ 4 hrs presentation + 1hr prioritization discussion

3/18/2011

Time (PM-EST)	#	Presenter	Title	Category
1:30	1	Vlad Soukhanovskii	Experiments to support NSTX-U divertor PFC design and operation	NSTX-U support
1:36	2	Stefan Gerhardt	Passive impurity control techniques in NSTX-U scenarios	NSTX-U support
1:42	3	Travis Gray	Development of small ELM regime with minimal lithiumization for edge particle control	NSTX-U support
1:48	4	John Canik	X-point height scan at fixed strike point radius	NSTX-U support
1:54	5	John Canik	Impact of 3-D fields on pedestal profiles without and with lithium	R11-4 - 3D edge transport
2:00	6	J. Menard on behalf of any/all co	Plasma target development for exploring edge transport and stability response to 3D fields	R11-4 - 3D edge transport
2:06	7	Aaron Sontag	Effect of collisionality on edge stability and transport	R11-4 - 3D edge transport
2:12	8	Ahmed Diallo, John Canik	Characterization of the Edge Profile Response Induced by Perturbations on the n=3 Static Fields	R11-4 - 3D edge transport
2:18	9	Dan Clayton, Kevin Tritz, Dan Stu	Effects of 3D Fields on Impurity Transport in the NSTX Plasma Edge	R11-4 - 3D edge transport
2:24	10	G.R. McKee, R.J. Fonck, D.R. Smi	Impact of 3D radial field perturbations on turbulence, pedestal transport and ELMs	R11-4 - 3D edge transport
2:30	11	Michael Jaworski	SOL modifications due to 3D fields and evaluation of baffle-probes for cross-field transport monitoring	R11-4 - 3D edge transport
2:36	12	Rob Goldston	Using Modulated ICRF to Drive EHOs and Modify Edge Transport	R11-4 - 3D edge transport
2:42	13	Rob Goldston	Using Acoustic Frequency RMA to Drive EHOs and Modify Edge Transport	R11-4 - 3D edge transport
2:48	14	S. Kubota	Effect of 3-D Fields on Particle Transport	R11-4 - 3D edge transport
2:54	15	Joon-Wook Ahn	Density pumpout in L-mode plasmas	R11-4 - 3D edge transport
3:00	16	Joon-Wook Ahn	Effect of 3-D fields on the radiative/detached divertor plasmas	ITER Support
3:06	17	Joon-Wook Ahn	Effect of separatrix splitting on the ELM triggering threshold	R11-4 - 3D edge stability
3:12	18	Devon Battaglia, Morgan Shafer	Edge island imaging and ELM stability modification using a vertically shifted plasma	R11-4 - 3D edge stability
3:18	19	Richard Buttery	Try Zero Shear Rational q Model for RMP ELM Suppression	R11-4 - 3D edge stability
3:24	20	Jeremy Lore	Search for q95 resonant effects on ELM frequency during 3D field application	R11-4 - 3D edge stability
3:30	21	Jong-Kyu Park	ELM triggering test using the n=1 or n=2 field	R11-4 - 3D edge stability
3:36	22	Jong-Kyu Park	ELM suppression in low q95 target plasmas	R11-4 - 3D edge stability
3:42	23	S.A. Sabbagh, T.E. Evans, L. Zakh	ELM stability dependence on edge current, q, and collisionality	R11-4 - 3D edge stability
3:48	24	Vlad Soukhanovskii	Early divertor gas injection for early suppression of divertor carbon sources and plasma fueling	impurity reduction
3:54	25	Rajesh Maingi	Combination of applied 3-D fields and snowflake divertor for impurity control	impurity reduction
4:00	26	Amanda Hubbard	Access and characterization of Imode regime on NSTX	impurity reduction
4:06	27	J. Menard	Early H mode impurity confinement reduction combined with snowflake for impurity and density control	impurity reduction
4:12	28	John Canik	Combining ELM pacing with RF for edge and core impurity control	impurity reduction
4:18	29	John Canik	ELM pacing at reduced frequency combined with divertor gas puff	impurity reduction
4:24	30	John Canik	ELM pacing with combined n=3 fields and vertical jogs VJ during lithiumized ELM-free discharges	impurity reduction
4:30		**Prioritization discussion**		

NSTX-U Support: 4 proposals

#	Presenter	Title	Category
1	Vlad Soukhanovskii	Experiments to support NSTX-U divertor PFC design and operation	NSTX-U support
2	Stefan Gerhardt	Passive impurity control techniques in NSTX-U scenarios	NSTX-U support
3	Travis Gray	Development of small ELM regime with minimal lithiumization for edge particle control	NSTX-U support
4	John Canik	X-point height scan at fixed strike point radius	NSTX-U support

R11-4 transport: 11 proposals (+1 ITER support)

5	John Canik	Impact of 3-D fields on pedestal profiles without and with lithium	R11-4 - 3D edge transport
6	J. Menard on behalf of any/all co	Plasma target development for exploring edge transport and stability response to 3D fields	R11-4 - 3D edge transport
7	Aaron Sontag	Effect of collisionality on edge stability and transport	R11-4 - 3D edge transport
8	Ahmed Diallo, John Canik	Characterization of the Edge Profile Response Induced by Perturbations on the n=3 Static Fields	R11-4 - 3D edge transport
9	Dan Clayton, Kevin Tritz, Dan Stu	Effects of 3D Fields on Impurity Transport in the NSTX Plasma Edge	R11-4 - 3D edge transport
10	G.R. McKee, R.J. Fonck, D.R. Smi	Impact of 3D radial field perturbations on turbulence, pedestal transport and ELMs	R11-4 - 3D edge transport
11	Michael Jaworski	SOL modifications due to 3D fields and evaluation of baffle-probes for cross-field transport monitoring	R11-4 - 3D edge transport
12	Rob Goldston	Using Modulated ICRF to Drive EHOs and Modify Edge Transport	R11-4 - 3D edge transport
13	Rob Goldston	Using Acoustic Frequency RMA to Drive EHOs and Modify Edge Transport	R11-4 - 3D edge transport
14	S. Kubota	Effect of 3-D Fields on Particle Transport	R11-4 - 3D edge transport
15	Joon-Wook Ahn	Density pumpout in L-mode plasmas	R11-4 - 3D edge transport
16	Joon-Wook Ahn	Effect of 3-D fields on the radiative/detached divertor plasmas	ITER Support

R11-4 stability: 7 proposals

17	Joon-Wook Ahn	Effect of separatrix splitting on the ELM triggering threshold	R11-4 - 3D edge stability
18	Devon Battaglia, Morgan Shafer	Edge island imaging and ELM stability modification using a vertically shifted plasma	R11-4 - 3D edge stability
19	Richard Buttery	Try Zero Shear Rational q Model for RMP ELM Suppression	R11-4 - 3D edge stability
20	Jeremy Lore	Search for q95 resonant effects on ELM frequency during 3D field application	R11-4 - 3D edge stability
21	Jong-Kyu Park	ELM triggering test using the n=1 or n=2 field	R11-4 - 3D edge stability
22	Jong-Kyu Park	ELM suppression in low q95 target plasmas	R11-4 - 3D edge stability
23	S.A. Sabbagh, T.E. Evans, L. Zakh	ELM stability dependence on edge current, q, and collisionality	R11-4 - 3D edge stability

Impurity Control: 7 proposals

24	Vlad Soukhanovskii	Early divertor gas injection for early suppression of divertor carbon sources and plasma fueling	impurity reduction
25	Rajesh Maingi	Combination of applied 3-D fields and snowflake divertor for impurity control	impurity reduction
26	Amanda Hubbard	Access and characterization of Imode regime on NSTX	impurity reduction
27	J. Menard	Early H mode impurity confinement reduction combined with snowflake for impurity and density control	impurity reduction
28	John Canik	Combining ELM pacing with RF for edge and core impurity control	impurity reduction
29	John Canik	ELM pacing at reduced frequency combined with divertor gas puff	impurity reduction
30	John Canik	ELM pacing with combined n=3 fields and vertical jogs VJ during lithiumized ELM-free discharges	impurity reduction

Research Priorities for ITER/CC TSG

- R11-4 - Investigate H-mode pedestal transport, turbulence, and stability response to 3D fields
  - Slightly higher emphasis: influence of 3D fields on ion/impurity particle transport
  - Secondary emphasis: influence of 3D fields on edge stability
- Investigate combinations of active techniques for reducing core impurity accumulation - especially in ELM-free H-mode
  - Explore the accessibility of reduced lithium evaporation scenarios with high plasma performance and intrinsic small ELMs for particle control
- Organize experiments and analysis in support of cryo-pump design for NSTX Upgrade

High Level Prioritization for ITER/CC TSG

- Guidance: 8.5 total: 6.5 P1, 2.0 P2
- R11-4 - Investigate H-mode pedestal transport, turbulence, and stability response to 3D fields (4 total: 3.25 P1, 0.75 P2)
- Investigate combinations of active techniques for reducing core impurity accumulation - especially in ELM-free H-mode (2.5 total: 1.75 P1, 0.75 P2)
- Organize experiments and analysis in support of cryo-pump design for NSTX-U, + ITER support (2 total: 1.5 P1, 0.5 P2)

High Level Prioritization for ITER/CC TSG by year

	FY11 (P1+P2)	FY12 (P1+P2)
Pedestal transport	1.75+0.5	
Pedestal stability	1.5+0.25	
Impurity Control	0.75+0.25	1.0+0.5
NSTX-U, ITER	0.0	1.5+0.5
Totals	4.0+1.0	2.5+1.0

R11-4 transport prioritization

Presenter	Title	FY11 - P1	FY11 - P2	FY12 - P1	FY12 - P2
John Canik	3-D fields on pedestal profiles wo + with Li				
Group coordinator	Group XP	1.75	0.5		
Aaron Sontag	Effect of collisionality on edge stability				
Ahmed Diallo, John Car	Edge Profile Response with n=3 Static Fields				
Dan Clayton, Kevin Trit	3D Fields on Impurity Transport				
G.R. McKee, R.J. Fonck	3D field on turbulence, transport and ELMs				
Michael Jaworski	SOL modifications due to 3D fields				
Rob Goldston	Using Modulated ICRF to Drive EHOs				
Rob Goldston	Using Acoustic Frequency RMA to Drive EHOs				
S. Kubota	Effect of 3-D Fields on Particle Transport				
Joon-Wook Ahn	Density pumpout in L-mode plasmas				

- Main particle transport XP will be run as a group XP with common conditions, including L-mode
- Need to connect closely with theory, e.g. $\omega_e \sim 0$ region size
- Canik and Goldston may get split off separately

R11-4 stability prioritization

Presenter	Title	FY11 - P1	FY11 - P2	FY12 - P1	FY12 - P2
Joon-Wook Ahn	Separatrix splitting on ELM trigger threshold	PB?			
Devon Battaglia, Morga	SXR + 3D field w/Vertically shifted plasma		0.25		
Richard Buttery	0 Shear Rational q Model for RMP ELM Supp	PB			
Jeremy Lore	Search for q95 resonant effects on ELM freq	0.75			
Jong-Kyu Park	ELM triggering test using the n=1 or n=2 fiel	0.5			
Jong-Kyu Park	ELM suppression in low q95 target plasmas	PB?			
S.A. Sabbagh, T.E. Eva	ELM stability vs edge current, q, and nu	0.25			

- Need to identify piggyback opportunities

Impurity Control prioritization

Presenter	Title	FY11 - P1	FY11 - P2	FY12 - P1	FY12 - P2
Vlad Soukhanovskii	Early divertor gas				
Rajesh Maingi	ELM trigger + sonwflake			0.25	0.25
Amanda Hubbard	Characterization of Imode regime on NSTX			0.5	
J. Menard	Early drsep control +snowflake	0.75			0.25
John Canik	Combining ELM pacing with RF		0.25	0.25	
John Canik	Combining ELM pacing with divertor gas puff				
John Canik	Combining ELM pacing and vertical jogs				

- Practically ELM pacing-making with 3-D fields + various combinations will get 0.5 P1 + 0.5 P2
- I-mode search XP also has an overlapping 1/2 day P1 XP in BP, part of FY11 JRT; focus more on characterization here, if successful in BP

NSTX-U Support + ITER Support prioritization

Presenter	Title	FY11 - P1	FY11 - P2	FY12 - P1	FY12 - P2
Vlad Soukhanovskii	Experiments to support NSTX-U div.			0.5	
Stefan Gerhardt	Passive impurity control in NSTX-U scenarios			0.5	
Travis Gray	Small ELM regime with minimal lithiumization			PB	
John Canik	X-point height scan at fixed strike point rad.			0.5	
Joon-Wook Ahn	3-D fields on the radiative/detached div.				0.5

- Soukhanovskii, Canik's XPs to look at divertor profiles for cryopump design studies
- Small ELM scenarios will also be examined with 1 day + 1 XMP in LiTSG
- Type I ELM scenarios will be investigated as part of the FY11 JRT