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 17, 2010
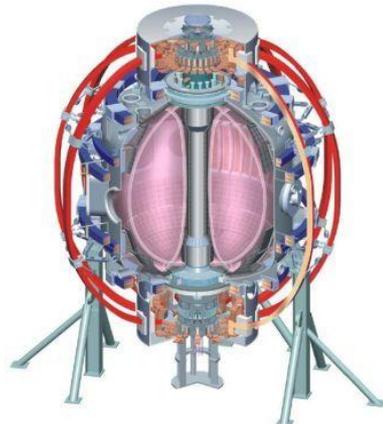
Culham Sci Ctr
U St. Andrews
York U
Chubu U
Fukui U
Hiroshima U
Hyogo U
Kyoto U
Kyushu U
Kyushu Tokai U
NIFS
Niigata U
U Tokyo
JAEA
Hebrew U
Ioffe Inst
RRC Kurchatov Inst
TRINITI
KBSI
KAIST
POSTECH
ASIPP
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
ASCR, Czech Rep
U Quebec

Agenda – 3 hrs presentation + 1hr prioritization
4 mins presentation + 2 mins discussion per idea

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		

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

Previously proposed strategy for R(11-4) is well aligned with proposals ~5 run days total (3 transport, 2 stability)

1. Develop/utilize 2-4 scenarios where 3D δB induced transport modification is likely, compatible w/ broad diagnostic coverage
   – Reproduce shots with varied n_e, T_e profiles with/without Li and 3D fields
   – Reproduce shots with varied ELM triggering threshold vs q_{95}
   – Develop L-mode target, also lower-collisionality H-mode
   – Develop targets w/ slow time-varying q_{95}, J_{edge} to look for "resonances"

2. Perform perturbative transport experiments using scenarios
   – Vary amplitude, phase, n-number (n=2 and 3) of 3D δB
   – ME-SXR + impurity puffs with varied species to extract impurity D, v
   – SGI for Δn_e, heat pulse propagation using ME-SXR, MPTS, reflectometry
   – BES, high-k, GPI, FIReTIP to look for changes in edge turbulence
   – SXR imaging to detect edge islands
   – HDLP array to measure changes in SOL hot electron fraction
   – SOLPS (b2/EIRENE) to model edge transport vs. q, Li, 3D δB

Research Priorities for ITER/CC TSG

- R11-4 - Investigate H-mode pedestal transport, turbulence, and stability response to 3D fields

  - Especially the influence of 3D fields on ion/impurity particle transport

- 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

- Oversee ELM research to ensure a coherent research program and minimize experimental overlap

- Other cross-cutting research?