

Boundary Science Group Agendas

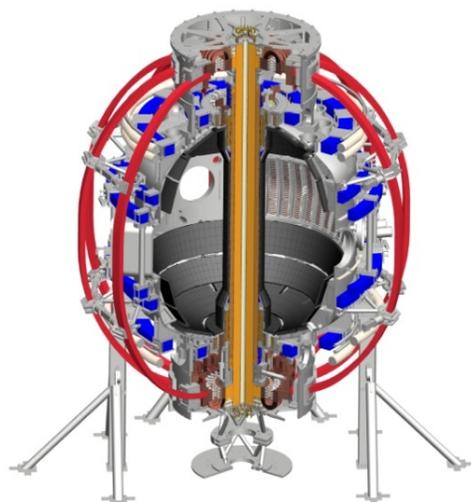
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Input from Ped, DivSOL, M&P, PC-TF

NSTX-U Research Forum
PPPL MBG

February 24, 2015

Coll of Wm & Mary
Columbia U
CompX
General Atomics
FIU
INL
Johns Hopkins U
LANL
LLNL
Lodestar
MIT
Lehigh U
Nova Photonics
Old Dominion
ORNL
PPPL
Princeton U
Purdue U
SNL
Think Tank, Inc.
UC Davis
UC Irvine
UCLA
UCSD
U Colorado
U Illinois
U Maryland
U Rochester
U Tennessee
U Tulsa
U Washington
U Wisconsin
X Science LLC



Culham Sci Ctr
York U
Chubu U
Fukui U
Hiroshima U
Hyogo U
Kyoto U
Kyushu U
Kyushu Tokai U
NIFS
Niigata U
U Tokyo
JAEA
Inst for Nucl Res, Kiev
Ioffe Inst
TRINITI
Chonbuk Natl U
NFRI
KAIST
POSTECH
Seoul Natl U
ASIPP
CIEMAT
FOM Inst DIFFER
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
ASCR, Czech Rep

Boundary Science Group Agendas

- Agendas for three TSGs and Task Force
 - Pedestal group (Diallo, Maingi, Smith, Canik)
 - Divertor/SOL (Soukhanovskii, Ahn, Schmitz, Stotler)
 - Materials & PFCs (Jaworski, Skinner, Allain, Wirth)
 - Particle Control Task Force (Maingi, Canik) [includes B->Li]
- Goal of presentations in each TSG is to identify highest priority experiments (4-5 days), consistent with stated milestones
 - Individual presentations, followed by priority discussions
 - Reach consensus on top priority
 - Discuss highest second tier experiments, which may be awarded run time (~ 3 days)

NSTX-U capabilities for first 2 run-months campaign

- Facility capabilities
 - RWM coils; boronization (and later lithium); standard core fuelling; SGI
- Diagnostics
 - 42-Channel MPTS (with pedestal enhancement), CHERS with Beam 1, filterscopes, tangential ME-SXR, BES, Up & Down SXR, Reflectometer, tangential bolometer, magnetics for EFIT reconstruction, LADA in bolometer mode, MSE.
- Useful machine parameters
 - $I_p = 0.5 - 1.6$ MA, $B_t = 0.5 - \sim 0.65$ T, PNBI = 4 - 12 MW, Low to mid triangularity, LSN, DN
- Analysis tools
 - Python tools refurbishment (Osborne & Canal will be visiting PPPL in Feb.)

Ped-TSG collected 21 proposals

Topic #	Title of proposal	Proposer last name	Contributions to milestones or ITPA	Run days requested	Pre-lithium run days	Minimum useful run days
Impurities, neutrals, turbulence, pedestal stability						
1	Understanding impurity transport mechanisms in the plasma pedestal	Loarte	ITER request	2	0	1
2	Effect of neutral particles on upstream and pedestal turbulence	Chang	R15-1, R16-1	1	1	0.5
3	Effects of different impurities on pedestal structure	Osborne	None	2	1	1
4	Understanding of pedestal anomalous transport reduction/increase from L-mode to Type I ELMy H-mode and back	Loarte	TC-22	2	0	1
5	ELM-induced fueling effects on the pedestal evolution [1]	Diallo	none	1	1	1
6	Investigations of nonlinear ELM dynamics	Smith	R15-1 for H-mode confine	1	1	0.5
7	Pedestal peeling-ballooning mode stability along the ballooning boundary	Osborne	None	1	0	1
3D Fields						
8	Resonant ELM frequency behavior as a function of q_{95} with 3D fields	Lore	R(15-1): Assess H-mode	1	1	0.5
9	ELM suppression with mid-plane coils	Ahn	none	1	1	1
10	Impact of 3-D fields on pedestal profiles under varying wall conditions and collisionality.	Canik		1	0.5	0.5
11	Pedestal rotation shear enhancement with high-n NTV braking and 2nd NBI	Menard	R(15-3), JRT-15	1.5	0	0.75
12	Interaction of LGI with 3D fields	Gan	none	1	0	0.5
Pedestal structure and LH Transition						
13	Multi-machine studies of the L-H power threshold dependence on aspect ratio	Bongard	R(15-1), R(15-3), NSTX-U	1	1	0.5
14	Effect of beam tangency radius on H-mode access and quality with XGC simulations	Churchill	None	1	0.5	0.5
15	Characterization of the Pedestal Structure as function I_p , BT, and Pnbi	Diallo	R15-1	1.5	1.5	1.5
16	Effects of B-> Li transition on the pedestal structure	Maingi	None	0.5	0.5	0.5
Alternative scenarios						
17	Comparison of H-mode pedestal with RF and NBI	Maingi	None	1	0	1
18	Exploration of I-mode regime on NSTX	Hubbard	ITPA PEP-31, TC-19	2	0	1
19	Can SOL heating from HHFW improve pedestal stability?	Smith	R16-3 for fast-wave SOL I	0.5	0	0.5
20	Effect of poloidal variation of gas fueling on H-mode access and sustainment	Churchill	none	0	0	0
21	Generating and Characterizing the Edge Harmonic Oscillation via Counter- I_p Torque Injection	McKee	R(16-1)	2	0	1

- Proposals address most of the key topics of PED -TSG
 - rearranged in four groups

Title of proposals	Proposer	Topics grouping	Time
Introduction	Diallo		13:30 - 13:40
Understanding impurity transport mechanisms in the plasma pedestal	Loarte	Impurities, Neutral and Turbulence, Pedestal Stability	13:40 - 13:45
Understanding of pedestal anomalous transport reduction/increase from L-mode to Type I ELMy H-mode and back	Loarte	Impurities, Neutral and Turbulence, Pedestal Stability	13:45 - 13:50
Effect of neutral particles on upstream and pedestal turbulence	Chang	Impurities, Neutral and Turbulence, Pedestal Stability	13:50 - 13:55
Exploration of I-mode regime on NSTX	Hubbard	Alternative Scenarios	13:55 - 14:00
Effects of different impurities on pedestal structure	Osborne	Impurities, Neutral and Turbulence, Pedestal Stability	14:00 - 14:05
Pedestal peeling-ballooning mode stability along the ballooning boundary	Osborne	Impurities, Neutral and Turbulence, Pedestal Stability	14:05 - 14:10
Investigations of nonlinear ELM dynamics	Smith	Impurities, Neutral and Turbulence, Pedestal Stability	14:15 - 14:20
ELM-induced fueling effects on the pedestal evolution	Diallo	Impurities, Neutral and Turbulence, Pedestal Stability	14:20 - 14:25
Coffee Break			
Resonant ELM frequency behavior as a function of q_{95} with 3D fields	Lore	3D Fields Physics	14:45 -14:50
ELM suppression with mid-plane coils	Ahn	3D Fields Physics	14:50 -14:55
Impact of 3-D fields on pedestal profiles under varying wall conditions and collisionality	Canik	3D Fields Physics	14:55 -15:00
Interaction of LGI with 3D fields	Gan	3D Fields Physics	15:05 -15:10
Multi-machine studies of the L-H power threshold dependence on aspect ratio	Bongard	Pedestal structure and L-H Transition Physics	15:10 -15:15
Effect of beam tangency radius on H-mode access and quality with XGC simulations	Churchill	Pedestal structure and L-H Transition Physics	15:15 -15:20
Characterization of the Pedestal Structure as function I_p, BT, and P_{nbi}	Diallo	Pedestal structure and L-H Transition Physics	15:20 -15:25
Effects of B-> Li transition on the pedestal structure	Maingi	Pedestal structure and L-H Transition Physics	15:25 -15:30

Title of proposals (cont.)	Proposer	Topics grouping	Time
Pedestal rotation shear enhancement with high-n NTV braking and 2nd NBI	Menard	3D Fields Physics	15:30 - 15:35
Comparison of H-mode pedestal with RF and NBI	Maingi	Alternative Scenarios	15:35 - 15:40
Can SOL heating from HHFW improve pedestal stability?	Smith	Alternative Scenarios	15:40 - 15:55
Effect of poloidal variation of gas fueling on H-mode access and sustainment	Churchill	Alternative Scenarios	15:55 - 16:00
Generating and Characterizing the Edge Harmonic Oscillation via Counter-I_p Torque Injection	McKee	Alternative Scenarios	16:00 - 16:05

Group discussion to start at 16:15

DivSOL agenda (1)

- SOL transport and turbulence
 - Heat flux and SOL width Scaling in NSTX-U, Travis Gray
 - Relaxation of the interchange instability and effect on SOL width with Li wall conditioning, Travis Gray
 - Relationship between λ_q , S and Connection Length, Travis Gray
 - Initial NSTX-U edge characterization, Vlad Soukhanovskii
 - Relation between the midplane SOL pressure width and the divertor heat flux width, Robert Hager
 - SOL Width Scaling: Goldston's Heuristic Drift Model vs Critical Pressure Gradient Model, Egemen Kolemen
 - Investigation of ELM heat flux footprints with the variation of ELM regime, Kaifu Gan
 - Parallel Correlation of SOL Turbulence, Stewart Zweben

DivSOL agenda (2)

- Radiative divertor
 - Radiative divertor experiments, Vlad Soukhanovskii
 - Toroidal divertor flux deposition asymmetries due to localized gas injection, Jeremy Lore
- Impact of 3D fields on divertor
 - Interaction of applied 3D fields with detachment, Joon-Wook Ahn
 - Role of plasma response in the formation of lobe structures by 3D fields, Joon-Wook Ahn
 - Distinguishing between 3d magnetic field structures and transport, John Canik
 - S parameter under 3D perturbations, Egemen Kolemen
 - Divertor conditions and detachment characteristics in plasmas with 3-D fields, Alberto Loarte

DivSOL agenda (3)

- Snowflake divertor
 - Clarifying Snowflake divertor configuration physics, Vlad Soukhanovskii
 - Assessment of 3D field effects on the properties of the snowflake divertor, Gustavo Canal
 - Compare alternative advanced divertor configurations: X-divertor, Snowflake, Egemen Kolemen
 - Detachment comparison study for Snowflake, X-divertor, Standard Divertor and long/short divertor leg, David Eldon
 - Performance optimization of divertor detachment, Joon-Wook Ahn

DivSOL agenda (4)

- **Miscellaneous**

- Boundary diagnostic-optimized configuration (BDOC) for model comparisons, Vlad Soukhanovskii
- ENDD Midplane Neutral Density Profiles in NSTX-U, Daren Stotler
- Obtain 2D divertor density image using lithium emission, Oliver Schmitz
- Effect of Lithium on SOL Power Balance, Travis Gray
- Transport and radiation in the high flux expansion divertor configuration with cusp-like fields, Vlad Soukhanovskii
- Studies of low- and high-Z dust transport in NSTX-U, Roman Smirnov

Materials & PFC agenda

- Session tomorrow morning
- Centerpiece: Materials Analysis Particle Probe (MAPP)
- Centerpiece: development of discharges with outer strike points on row of future high-Z tiles which will be installed in FY16

M&P Agenda 1/2

- 9:00 – 9:14
- Introduction - Jaworski

XMP and XP presentations (2 hours total)

- 9:14 – 9:22
- MAPP Commissioning XMP (Allain)
- 9:22 – 9:30
- B-zation optimization XMP (Skinner)
- 9:30 – 9:38
- High-Z reference discharge development XMP (Jaworski)

XP Group 1: Milestone R16-2 preparation

- 9:38 – 9:46
- Establish heat transmission pathways... (Jaworski)
- 9:46 – 9:54
- Leading edge power loading... (Gray)
- 9:54 – 10:04
- Boundary diagnostic optimized... (Soukhanovskii)
- 10:04 – 10:12
- Comparison of material migration... (Nichols)
- 10:12 – 10:20
- ELM effects on mixed material... (Nichols)
- 10:20 – 10:30
- Break

M&P Agenda (2/2)

XP Group 2: M&P TSG Thrusts 1 and 2

- 10:30 – 10:38 •Surface Science (Koel)
- 10:38 – 10:46 •Textured Mo surface (Skinner)
- 10:46 – 10:54 •Ex-situ IBA of targets... (Wright)
- 10:54 – 11:04 •Connecting MAPP measurements... (Scotti)
- 11:04 – 11:12 •Periodic evaluation of PFC... (Scotti)
- 11:12 – 11:20 •Understanding the longevity... (Scotti)

- 11:20 – 11:30 Break (~10 minutes)

- 11:30 – 12:30 •Open prioritization and run-time allocation discussion for M&P TSG (1 hour)

Particle Control Task Force (PC-TF) Guidance

- Co-Leaders: Rajesh Maingi, John Canik
- Task force goal:
 - “Develop pumping and fueling tools, operating scenarios, and control systems to achieve main-ion and impurity density control for long-pulse”
- Scope includes XPs related to:
 - Main-ion fueling optimization via PCS and/or real-time control
 - Wall coating and preparation optimization for increased particle pumping
 - Reduction / control of impurity ion source rates
 - Natural and paced ELMs for impurity and main ion flushing
 - Real-time density measurements for density feed-back control
 - Physics design and performance characterization of divertor cryo-pump (if/as resources permit implementation of cryo-pump)
- Due date: ASAP, end of FY16 run for non-cryo elements

PC-TF Draft agenda

Time	Presenter	Title	Category
9:00	Maingi	Agenda and guidance	
9:10	Lunsford	Multi-species particle injection for ELM pacing and impurity transport	Particle control: B phase
9:15	Lore	ELM pacing with 3D fields in boronization operational phase for main ion control	Particle control: B phase
9:20	Canik	Characterize plasma near planned plenum entrance position	Particle control: B phase
9:25	Battaglia	Optimize gas fueling for low density startup and H-mode access	Particle control: both B/Li
9:30	Battaglia	Establish minimum SOF density vs Ip ramp rate	Particle control: both B/Li
9:35	Gray	Development of Small ELM regimes	Particle control: both B/Li
9:40	Soukhanovskii	Divertor gas puff effect on impurity reduction	Particle control: both B/Li
9:45	Soukhanovskii	Assess high-Z granule injection	Particle control: Li phase
9:50	Lunsford	Lithium granule injection into ELM free H-modes with lithium conditioned walls	Particle control: Li phase
9:55	Lore	Combining ELM pacing with divertor gas injection for impurity control	Particle control: Li phase
10:00	Scotti	Characterization of carbon and lithium sources following first introduction of lithium in NSTX-U	Particle control: Li phase
10:05	Canik	Re-establish ELM pacing via 3-D fields in NSTXU	Particle control: Li phase
10:10	Goldston	EHO Scoping Study	Particle control: Li phase
10:15	Koleman	EHO 3D coil interaction (possible control)	Particle control: Li phase
10:20	Koleman	Core, Edge and Divertor Radiation variation with respect to different species and gas injection locations	Particle control: Li phase
10:25	Maingi	Controlled introduction of Lithium into NSTX-U	B->Li transition
10:30	Soukhanovskii	Recycling and pumping with lithium coatings	B->Li transition
10:35	Allain	Study of the chemical evolution during transition from B to Li-based conditioning on D retention in NSTX-U with the Materials Analysis Particle Probe (MAPP)	B->Li transition
10:40	Scotti	Optimization of helium-dispersed lithium evaporation to understand role of PFCs without direct lithium evaporation	B->Li transition
10:45	Scotti	Characterization of carbon and lithium sources following first introduction of lithium in NSTX-U	B->Li transition
10:50	All	Discussion of related proposals submitted to other TSG's	
11:10	All	Discussion and prioritization	