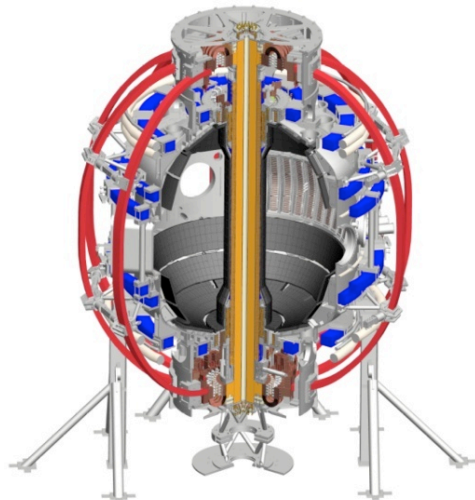


NSTX-U Pedestal Structure & Control TSG

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NSTX-U Pedestal NSTX-U Forum
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
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SNL
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U Tennessee
U Tulsa
U Washington
U Wisconsin
X Science LLC



Culham Sci Ctr
York U
Chubu U
Fukui U
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Hyogo U
Kyoto U
Kyushu U
Kyushu Tokai U
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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

NSTX-U capabilities (Brief overview)

- 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 enhancements (Osborne & Canal are currently PPPL)

NSTX-U PED research topics for FY 15 (I)

Early in the run

- H-mode access and power threshold (L-H transition physics with T&T)
 - Explore H-mode access, variation with R_{tan}
 - Measure L-H threshold dependencies (power, R_{tan} , etc...)
- Characterize the H-Mode pedestal structure at increased BT, I_p , and NBI heating power, -- **R15-1**-- and shaping (triangularity, DN vs LSN vs USN) may require dedicated time beyond R15-1
 - Map out the stability diagram for three I_p and 2 shaping parameters
 - Determine the pedestal scaling with β_{pol}
 - Pedestal structure and evolution after L-H transition and between ELMs
 - Turbulence characterization to understand the pedestal dynamics
 - Generate database for testing EPED on ST and for gyrokinetic codes

To be performed in boronized
and lithiated wall

NSTX-U PED research topics for FY 15 (II)

Early in the run

- Identifying common characteristics in the phenomenology of different ELM types (DivSol & MP)
 - RMP impact on the pedestal stability
 - Effect of (Boron)-Granule-Injection for increasing the ELM frequency
- Exploit the transition from Boronized PFCs to lithium coatings
 - Compare intrinsic and triggered ELM_{My}-H mode in Boron vs Li
 - Document transition from ELM_{My}-ELM-free transition and then scan in Li ELM-free
 - Document the pedestal structure impact during the transition Boron to Li

To be performed in boronized
and lithiated wall

NSTX-U PED research topics for FY 15 Mid-late run

- Refine pedestal characterization with low triangularity discharges
 - Attempt to access the ballooning side of the stability diagram
- Investigate/characterize ELM-free regimes such as EPH mode, I-mode, etc...
- Pedestal destabilization physics using LGI in ELM-free regimes
- Snowflake impact on the pedestal stability
- Develop optimum discharges for simulation-experiment comparison in pedestal region
 - Discuss with theory team for adequate discharges for simulations
 - Optimize cross-diagnostics (BES, GPI, reflectometry, and probes) in the edge region
- Transition from lithiated to boronized walls (with MP)
 - Impact on pedestal structure/evolution and ELM characteristics (hysteresis study)

Ped-TSG collected 21 proposals

idea #	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 q95 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 Ip, 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 q95 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 Ip, BT, and Pnbi	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-Ip Torque Injection	McKee	Alternative Scenarios	16:00 - 16:05
Ideas for Control of Pedestal	Kolemen	Control	16:05 - 16:10

Group discussion to start at 16:15