NSTX

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Boundary Physics Topical Science Group Plan and Agenda

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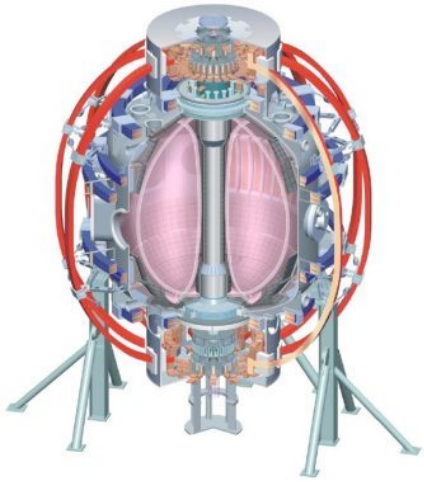
FY11-12 NSTX Research Forum
B318
March 15, 2011



Research Activities in Boundary Physics Priorities are Guided by

- **DOE and NSTX milestones:**
  - FY2011 OFES Joint Theory-Experiment Research Milestone

    Conduct experiments on major fusion facilities to improve the understanding of the physics mechanisms responsible for the **structure of the pedestal** and compare with the predictive models described in the companion theory milestone.
  - Assess very high flux expansion divertor operation (R11-3)

    "… high flux expansion divertor concepts, e.g. the **"snowflake"**, will be assessed. The magnetic control, divertor heat flux handling and power accountability, pumping with lithium coatings, impurity production, and their trends with engineering parameters will be studied in this configuration."

10 JRT & 6 R11-3 Ideas

- **NSTX-U planning and ST, and others**

9 Ideas

- **ITPA activities and ITER urgent needs.**

2 ITPA & 2 ITER Ideas

FY11JRT- Target Topics

- Continue documentation of the dependence of the pedestal structure with I_p, B_t, and shape parameters
  - Pedestal structure on X-point height.
  - Testing several pedestal models (e.g.,EPED2).
  - Stability analysis (ELITE).
- Quantify edge transport rates and correlate with turbulence
  - Investigate different transport channels through EPH and I- mode.
  - Effect of recycling and fueling and role of lithium.
  - Assess the role of ETG in limiting edge T_e gradient.
  - 3D effects in pedestal thermal transport.
  - Measure the edge parallel vs perp. temperature for (XGCO)
- ELM physics
  - Continue studies on role of n_e and T_e gradients on ELM stability.
  - Assess EHO.
  - ELM dependence on shape.

28-Proposals Requested a total of 29.25 Run-Days (with minimum of 17.3) vs. 13.5 run-days allotted

1) [**T. Gray**] Achieving I-mode on NSTX	*1*
2) [**A. Diallo]** Aspect Ratio Effects on the Pedestal Structure in ELMy discharges	*0.25*
3) [**D. Smith**] Assess pedestal_SOL fluctuations and poloidal flow fluctuations across LH transitions and ELMs	*2*
4) [**R. Maingi**] Dependence of density profile modification, and pedestal_core performance on amount of lithium evaporated between discharges	*1*
5) [**V. Soukhanoskii**] Development and assessment of X-divertor configuration on NSTX	*0.5*
6) [**M. Jaworski**] Divertor electron temperature and EEDF modification due to connection length modification	*1*
7) [**V. Soukhanoskii**] Divertor heat flux mitigation with impurity seeding in high-performance discharges	*1*
8) [**T. Munsat**] Dynamics of Zonal Flow-Drift Wave System Preceding L-H Transition	*0.5*
9) [**A. Diallo**] Effects of Triangularity and Toroidal field on the Pedestal Structure in ELMy H-mode	*1*
10) [**A. Diallo**] Elongation Effects on the Pedestal Structure in ELMy H-mode	*0.5*
11) [**S. Kaye**] L-H Threshold Power Study_ Ramp-Up vs Steady Ip Phase	*1*
12) [**D. Battaglia**] LH power threshold and H-mode pedestal height versus X-point height	*1*
13) [**R. Maingi**] Reproduce medium triangularity Enhanced Pedestal H-mode Discharge	*1*
14) [**T. Gray**] Scrape-off Layer Particle and Energy Transport with varying SOL Collisionality	*0.5*
15) [**D. Smith**] Searching for EHOs in low triangularity plasmas with early RMP	*4*
16) [**V. Soukhanoskii**] Snowflake divertor configuration studies in support of R11-3 and NSTX-U divertor options	*0.75*
17) [**R. Raman**] Steady state discharges with LFS fueling	*0.25*
18 [**R. Maingi**] Triggered ELMs in the snowflake configuration – do they burn through	*0.5*
19) [**H. Takahashi**] Optimal Positioning of ELM Triggering Electrodes	*0.5*
20) [**H. Takahashi**] Validation of SOLC-based ELM-triggering Model	*0.5*
21) [**H. Takahashi**] Distinguishing between Two SOLC-Based ELM-Models Inter-Divertor Flux Tube and Homoclinic	*1.5*
22) [**A. Sontag**] Effect of toroidal flow shear on edge stability	*0*
23) [**A. Sontag]** Edge oscillations during Type-V and ELM-free H-mode	*1*
24) [**J. Clementson**] Development of Spectroscopic ITER Divertor Diagnostics	*1*
25) [**K. C. Lee**] Turbulence and transport measurement on Enhanced Pedestal H-mode triggered by 3-D field	*2*
26) [**A. Loarte**] Access and sustainment of H-mode confinement in ramped phases of ITER scenarios	*1*
27) [**V. Soukhanovskii**] Development of early snowflake-minus configuration for impurity control	*3*
28) [**A. Loarte**] Compatibility of Radiative Divertor Operation with High Confinement H-mode Plasmas	

BP TSG at Forum is on March 17, 9am- 1pm B318

Ideas by Topics
5 min/talk with a total of 15 min/speaker!

[**T. Gray**] Achieving I-mode on NSTX
[**A. Diallo]** Aspect Ratio Effects on the Pedestal Structure in ELMy discharges
[**D. Smith**] Assess pedestal_SOL fluctuations and poloidal flow fluctuations across LH transitions and ELMs
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JRT11

[**V. Soukhanoskii**] Development and assessment of X-divertor configuration on NSTX
[**M. Jaworski**] Divertor electron temperature and EEDF modification due to connection length modification
[**V. Soukhanoskii**] Divertor heat flux mitigation with impurity seeding in high-performance discharges
[**V. Soukhanoskii**] Snowflake divertor configuration studies in support of R11-3 and NSTX-U divertor options
[**R. Maingi**] Triggered ELMs in the snowflake configuration – do they burn through
[**V. Soukhanovskii**] Development of early snowflake-minus configuration for impurity control
[**A. Loarte**] Compatibility of Radiative Divertor Operation with High Confinement H-mode Plasmas

R11-3, Divertor Physics

[**D. Battaglia**] LH power threshold and H-mode pedestal height versus X-point height {Note Overlap above}
[**S. Kaye**] L-H Threshold Power Study_ Ramp-Up vs Steady Ip Phase

ITPA

[**A. Loarte**] Access and sustainment of H-mode confinement in ramped phases of ITER scenarios
[**J. Clementson**] Development of Spectroscopic ITER Divertor Diagnostics

ITER

[**T. Gray**] Scrape-off Layer Particle and Energy Transport with varying SOL Collisionality
[**T. Munsat**] Dynamics of Zonal Flow-Drift Wave System Preceding L-H Transition
[**R. Raman**] Steady state discharges with LFS fueling
[**H. Takahashi**] Optimal Positioning of ELM Triggering Electrodes
[**H. Takahashi**] Validation of SOLC-based ELM-triggering Model
[**H. Takahashi**] Distinguishing between Two SOLC-Based ELM-Models Inter-Divertor Flux Tube and Homoclinic Tangle
[**A. Sontag]** Edge oscillations during Type-V and ELM-free H-mode
[**A. Sontag**] Effect of toroidal flow shear on edge stability

ELMs, Zonal Flows, Stability, transport, etc...

Agenda Draft

09:05 - 09:10 [R. Raman] Steady state discharges with LFS fueling
09:10 - 09:20 [R. Maingi] Dependence of density profile modification, and pedestal_core performance on amount of lithium evaporated between discharges
[R. Maingi] Reproduce medium triangularity Enhanced Pedestal H-mode Discharge
09:20 - 09:25 [K. C. Lee] Turbulence and transport measurement on Enhanced Pedestal H-mode triggered by 3-D field
09:25 - 09:30 [T. Gray] Achieving I-mode on NSTX
09:30 - 09:45 [A. Diallo] Aspect Ratio Effects on the Pedestal Structure in ELMy discharges
[A. Diallo] Effects of Triangularity and Toroidal field on the Pedestal Structure in ELMy H-mode
[A. Diallo] Elongation Effects on the Pedestal Structure in ELMy H-mode
09:45 - 09:50 [D. Battaglia] LH power threshold and H-mode pedestal height versus X-point height
09:50 - 10:00 [D. Smith] Searching for EHOs in low triangularity plasmas with early RMP
[D. Smith] Assess pedestal_SOL fluctuations and poloidal flow fluctuations across LH transitions and ELMs
10:00 - 10:15 [V. Soukhanoskii] Divertor heat flux mitigation with impurity seeding in high-performance discharges
[V. Soukhanoskii] Snowflake divertor configuration studies in support of R11-3 and NSTX-U divertor options
[V. Soukhanovskii] Development of early snowflake-minus configuration for impurity control
[V. Soukhanoskii] Development and assessment of X-divertor configuration on NSTX
10:15 - 10:20 [A. Loarte] Compatibility of Radiative Divertor Operation with High Confinement H-mode Plasmas
10:20 - 10:25 [M. Jaworski] Divertor electron temperature and EEDF modification due to connection length modification
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10:30 - 10:35 [T. Gray] Scrape-off Layer Particle and Energy Transport with varying SOL Collisionality
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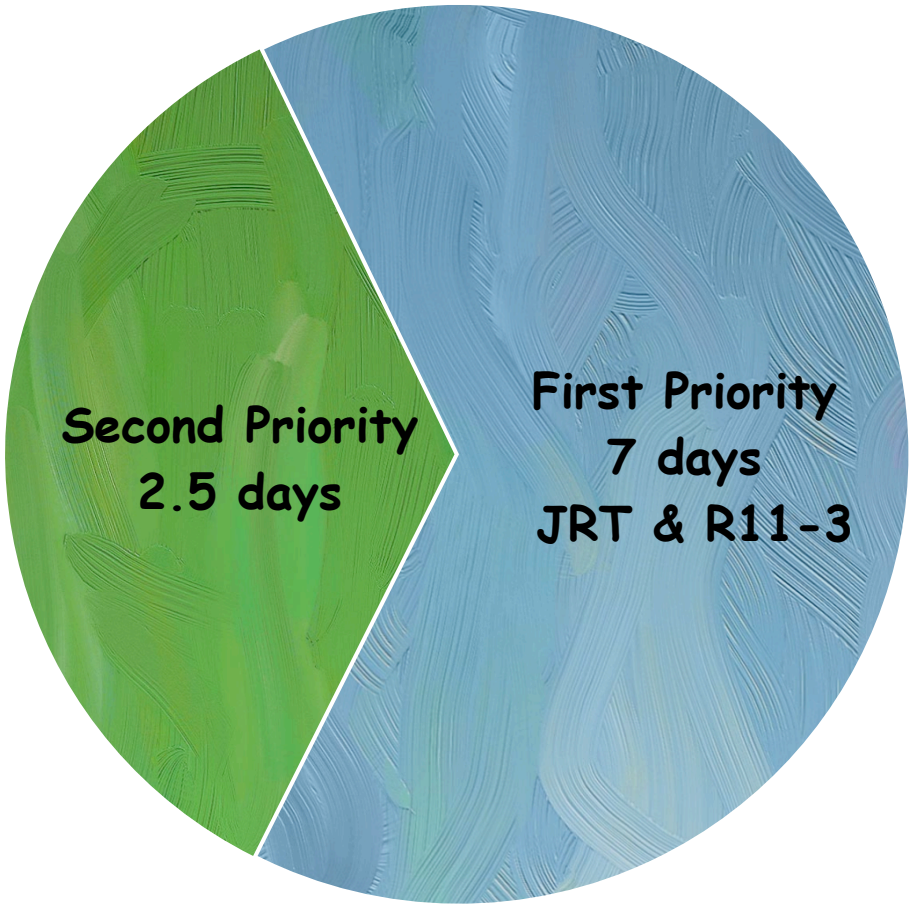
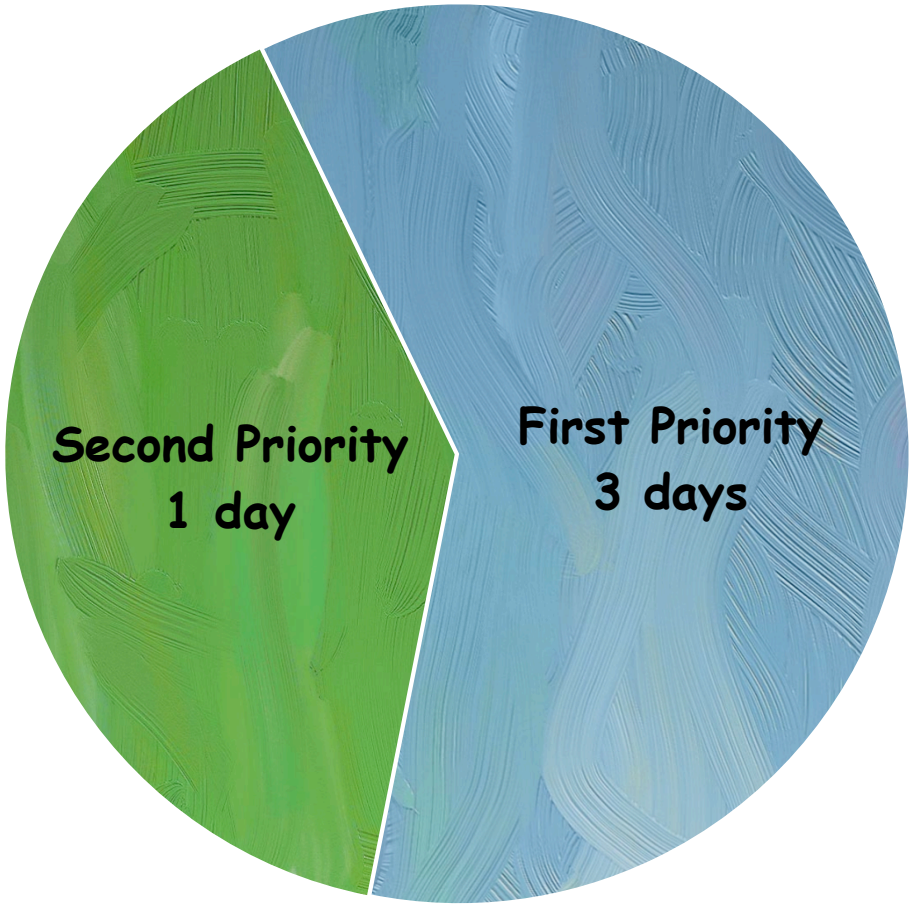
[H. Takahashi] Distinguishing between Two SOLC-Based ELM-Models Inter-Divertor Flux Tube and Homoclinic Tangle
10:50 - 11:00 [A. Sontag] Edge oscillations during Type-V and ELM-free H-mod
[A. Sontag] Effect of toroidal flow shear on edge stability
11:00 - 11:05 [T. Munsat] Dynamics of Zonal Flow-Drift Wave System Preceding L-H Transition
11:05 - 11:10 [A. Loarte] Access and sustainment of H-mode confinement in ramped phases of ITER scenarios
11:10 - 11:15 [J. Clementson] Development of Spectroscopic ITER Divertor Diagnostics

NSTX Boundary TSG Run Time Guidance

FY 11



FY 12



Assess high flux expansion divertor operation in milestone R(11-3)

- Snowflake divertor research
  - Shape control
  - Divertor physics
  - Pedestal stability and ELM control
- Radiative divertor research
  - Long-pulse H-mode with divertor impurity seeding (neon, argon).
  - Radiative divertor in NSTX-U shape.
  - Assessment of radiative divertor feed-back control.

Boundary Physics TSG is actively involved in varieties of ITPA-JEX

- **ITPA activities**
  - PEP-19 Basic mechanisms of edge transport with RMP
  - PEP-23 Quantification of the requirements for ELM suppression by magnetic perturbations from off-midplane coils
  - PEP-25 Inter-machine comparison of ELM control by magnetic field perturbations from midplane RMP coils
  - PEP-26 Critical parameters for achieving L-H transitions
  - PEP-27 Pedestal profile evolution following L-H/H-L transition
  - PEP-28 Physics of H-mode access with different X-point height
  - PEP-29 Vertical jolts/kicks for ELM triggering and control
  - PEP-31 Pedestal structure and edge relaxation mechanisms in I-mode
  - PEP-33 Effects of current ramps on the L-H transition and on the stability and confinement of H-modes at low power above the threshold
  - PEP-34 Non-resonant magnetic field driven QH-mode
  - DSOL-21 Introduction of pre-characterized dust for dust transport studies in divertor and SOL