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NSTX Boundary Physics Topical Science Group Summary

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FY 2009 NSTX Midrun assessment meeting

17 June 2009
Princeton, NJ

Culham Sci Ctr
U St. Andrews
York U
Chubu U
Fukui U
Hiroshima U
Hyogo U
Kyoto U
Kyushu U
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U Quebec

Boundary Physics TSG priorities are defined by

- **DOE and NSTX Milestones**

- **FY2009 DOE Joint Facilities JOULE milestone:** Conduct experiments on major fusion facilities to develop understanding of **particle control and hydrogenic fuel retention** in tokamaks.
- **FY2010 DOE Joint Facilities JOULE milestone:** Conduct experiments on major fusion facilities to improve understanding of the **heat transport in the tokamak scrape-off layer (SOL)** plasma, strengthening the basis for projecting divertor conditions in ITER.
- **FY2010 Research Milestone R(10-3):** Assess H-mode **pedestal characteristics and ELM stability** as a function of collisionality and lithium conditioning.

- **ITPA participation, ITER needs**
- **ST development path needs**

Three Boundary Physics TSG priorities have been defined for FY 2009 run

- Assess hydrogenic species retention, and characterize pumping of hydrogenic species by lithium coated plasma facing components (FY2009 Joule milestone)
- Determine the relationship of ELM properties to discharge boundary shape, lithium conditioning, and 3D resonant magnetic perturbations (RMPs), and compare stability of pedestal/ELMs with model calculations (R10-3)
- Compare divertor heat flux widths to midplane density and temperature widths and edge turbulence characteristics, and determine the scaling of SOL and divertor heat transport (FY2010 Joule milestone)

Summary

■ Experiments completed

- C. H. Skinner, FY2009 Retention and pumping milestone
- R. Maingi, FY2010 SOL thermal transport milestone
- V. A. Soukhanovskii, Pedestal fueling comparison with SGI and gas
- B. Nelson, Divertor biasing with CHI

■ Outstanding experiments from original FY 2009 plan

- J. Canik, Magnetically triggered ELMs in Li-conditioned discharges } Tier 1
- A. Sontag, Shear, rotation in ELM and pedestal stability } Tier 1
- V. A. Soukhanovskii, “Snowflake” divertor configuration in NSTX } Tier 2
- C. H. Skinner, Dust transport and modeling } Tier 2

■ Additional proposed experiments

- S. J. Zweben, Ultra-high-speed GPI measurements of the L-H transition
- C. H. Skinner and S. Gerhardt, Dust mobilization from ITER-scale castellation gaps
- V. A. Soukhanovskii, Radiative divertor with impurity injection

Candidate experiments for reversed B_t campaign

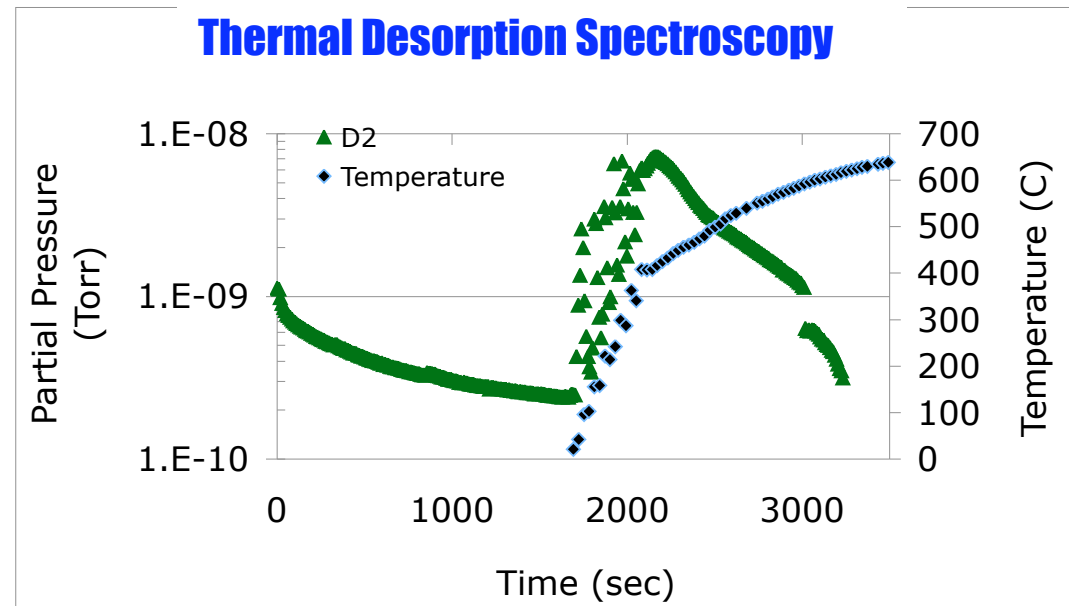
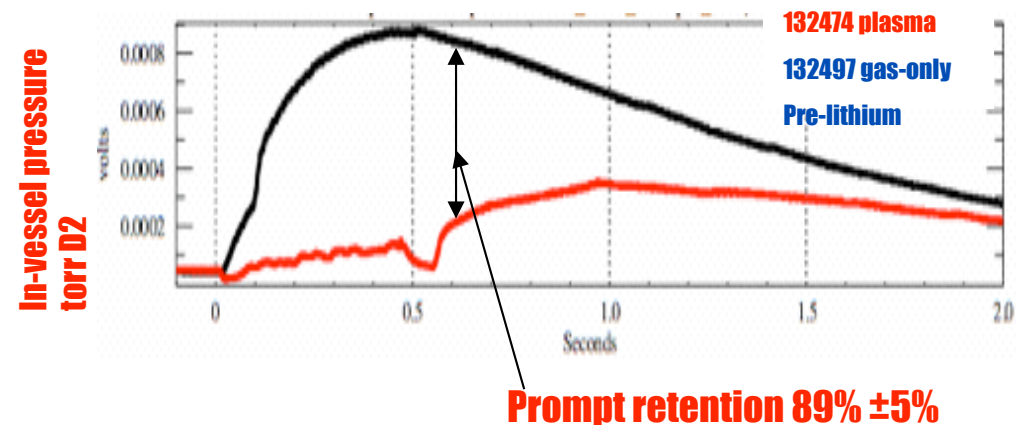
- Edge characterization at reversed B_t (2 days)
 - Assume no shot development
 - Scan P_{NBI} , I_p , n_e (n_i) (*good overlap with T&T ?*)
 - Focus on SOL / divertor measurements for transport and turbulence
 - Divertor detachment with D_2 puffing
 - Need low κ , δ shape to facilitate UEDGE modeling
 - Lithium & pumping part will be addressed in Lithium Research Thrust
- H-mode power threshold (*together with T & T group ?*)
- Pedestal stability and ELMs
- Other proposals?

Summary of completed experiments

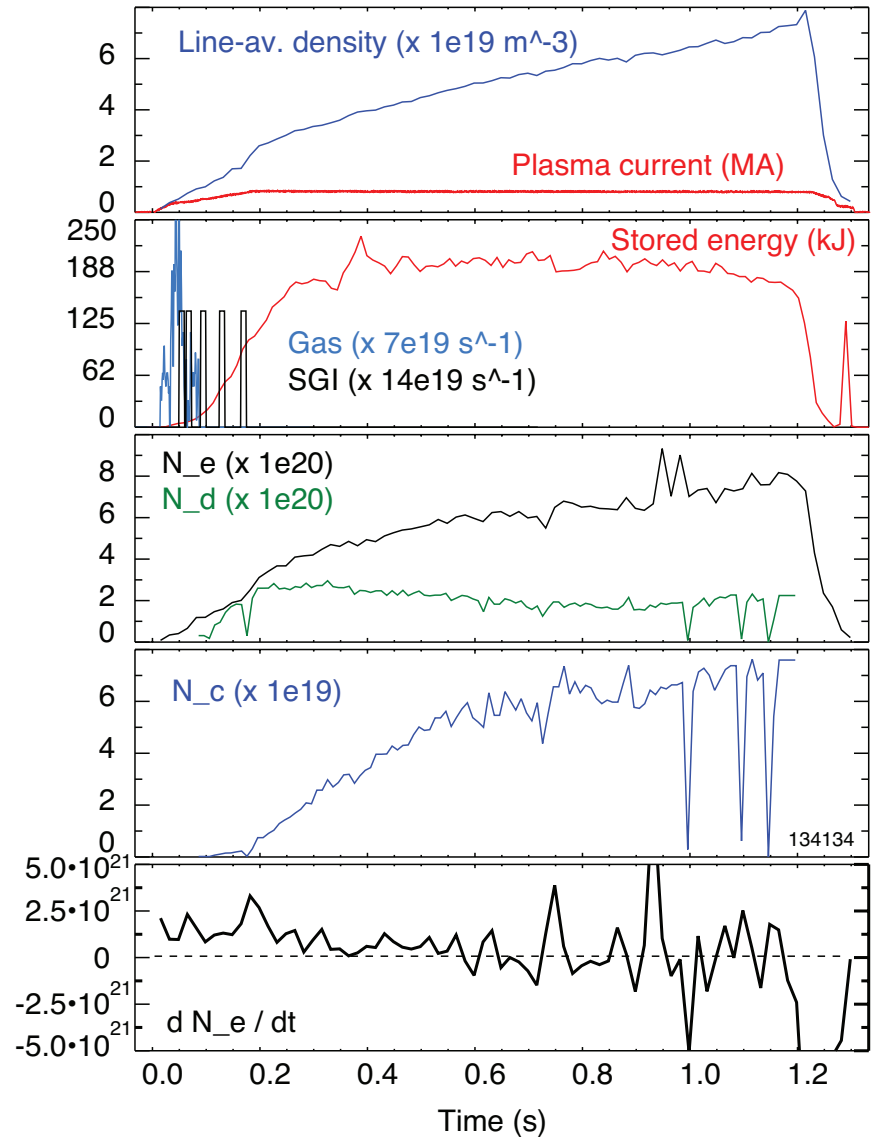
- XP 911 - C. H. Skinner, FY 2009 Retention and pumping milestone
 - Characterize
- XP 923 - R. Maingi, FY 2010 SOL thermal transport milestone
- XP 912 - V. A. Soukhanovskii, Pedestal fueling comparison with SGI and gas
- B. Nelson, Divertor biasing with CHI

XP 911, Lithium pumping and retention, by C. H. Skinner *et al.*

- Gas balance measurements showed high (>90%) prompt retention, that decreased due to post-shot outgassing.
- As part of a collaboration with Purdue University ATJ graphite, Si and Pd samples were exposed to the plasmas by a sample probe at Bay J.
- After exposure, thermal desorption spectroscopy was performed on an ATJ sample. Background thermal desorption from samples unexposed to NSTX plasmas was also measured.
- Twelve samples have been shipped to Purdue University for further surface analysis



XP 912, Pedestal fueling comparison by SGI and LFS gas, by V. A. Soukhanovskii *et al.*



XP 923, Thermal SOL transport studies, by R. Maingi et al.

Proposed prioritized plan for FY 2009

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- J. Canik, Magnetically triggered ELMs in Li-conditioned discharges
- A. Sontag, Shear, rotation in ELM and pedestal stability
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- C. H. Skinner, Dust transport and modeling

■ Additional proposed experiments

- S. J. Zweben, Ultra-high-speed GPI measurements of the L-H transition
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