Overview: D retention with LLD LRTSG XP1057

Milestone FY2011 Research Milestone R(11-3):

- "Develop and understand high-performance operating scenarios utilizing a liquid lithium divertor (LLD) for particle control."
- "D retention will be studied as a function of surface conditions such as lithium coverage and LLD surface temperature."
- "an in-situ materials analysis particle probe placed near the LLD will provide measurements of retention and surface composition in the outer divertor region for selected shots."

Basic Goal:

- Measure difference LLD makes to D retention.
- Repeat parts of 2009 XP911 gas balance but now with LLD.
- Anticipate outer strike point on bull-nose tiles for max LLD effect.
- 1/4 + 1/4 run day ohmic, 1/4 + 1/4 run day NB heated discharges.
- AM LLD unheated, PM with molten Li - see if retention changes.

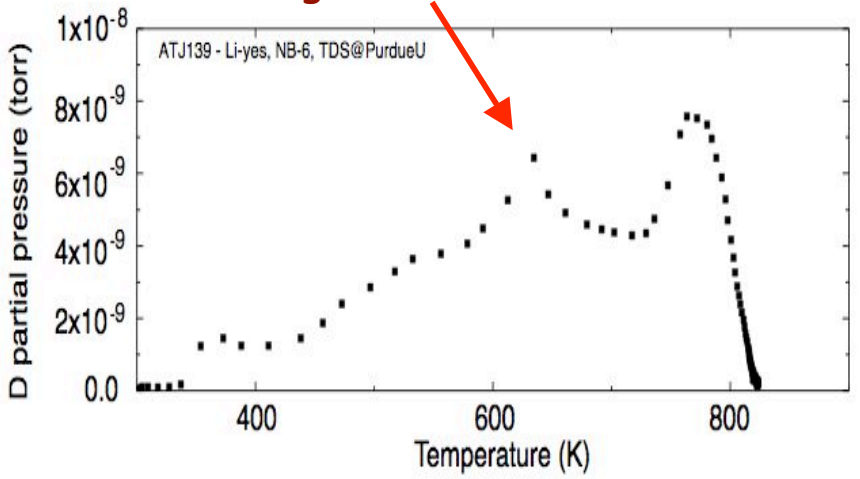
Surface analysis: Sample probe with 2 graphite, LLD and Si/Pd samples.

- Evening in-vacuo Thermal Desorption Spectroscopy of graphite sample.
- Ship to Purdue for XPS…

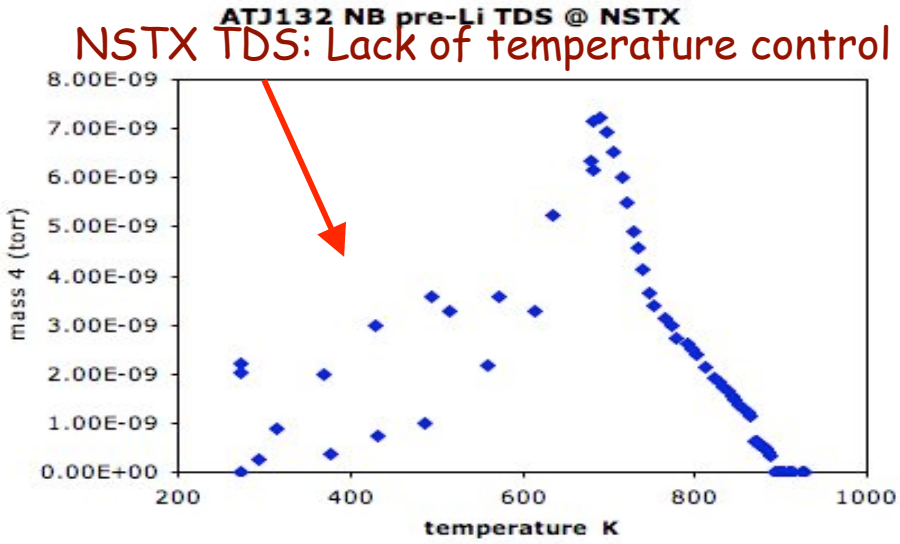
Evening measurement of new 600 K TDS peak

- Completion of FY09 retention milestone for PSI-19 publication.
- Thermal desorption spectroscopy (TDS) at Purdue showed a new low temperature peak that may be behind the prompt D release after NSTX pulse.
- 2009 same-evening TDS at NSTX was compromised by poor temperature control (simultaneous commissioning and experiment) and conduction of heat to other samples.
- Repeat measurements with upgraded equipment. Test beforehand.
- PMI probe exposed piggyback all day.
- No additional shots required. *Do need SS holder machined + tech time.*
- TDS same evening in NSTX cell
- Ship to Purdue for XPS etc…

Purdue TDS: 600 K peak with Li has weaker bonding of D 'in solution'.



NSTX TDS: Lack of temperature control



Gas Balance Strategy:

- Use conditions with maximum LLD effect - strike point on bull nose.
- Compare D retention with LLD unheated and set to 220 C (w/molten Li).
  - Continuous LiTER evaporation both cases.
  - Average over three 'good' shots as differences in retention can be low.
- Ip rampdown programmed for 'soft landing' with minimal W_{tot} and minimal wall heating at termination.
  - Model shots from 2009 are 133014 (ohmic) and 133019 (NB) both with Li.
  - Use results from Henry/Vlad XPs to improve 2009 model shots.
  - Ohmic shots have all pumping valves closed
  - HFS and SGI fueling to get maximum LLD pumping.
  - SP control if indicated by previous experience.
  - No intershot GDC expected (as in 2009).
  - No 'no-Li' comparison possible this year.
- Simultaneous exposure of sample probe. TDS same evening.
- TIVs remain closed to monitor pressure rise for 12 h.

Shot list and analysis:

A. 12 'good' shots LLD unheated:
   - 4 development: ohmic and NB 'soft landing' with SP on bull nose,
     2 gas-only pulses, 3 ohmic, 3 NB heated.

B. 6 'good' shots LLD w/molten Li:
   - 3 ohmic, 3 NB heated.

Diagnostics:

- Usual + all pressure gauges and RGAs
- D emission spectroscopy + divertor Langmuir probes for 'physics' retention (D retained / D fluence to wall).

Analysis:

- Calculation of gas balance retention from mig gauge pressure.
- Wall inventory from Vlad's gas balance model.
- Wall Gas Balance model of Pigarov.