# Lithium Research Topical Science Group

- Overarching goal of Li on NSTX is to develop lithiumization as a tool to
  - enhance the plasma performance of NSTX and
  - support the design of NSTX upgrade, a future high heat flux facility and/or a CTF (FESAC - TAP).

- Provide reduction in density for increased NBI-CD capability.
- Reduce impurities (even with ELM reduction).
- Approach flat temperature "Li-wall" regime.
- Longer term: steady state high heat flux handling.

- LRTSG aims to provide forum for physics understanding of
  - lithium effects on plasma, lithium surface chemistry…
  - support for design decisions for LLD upgrade and NSTX upgrades
  - Role of Li-C interaction by comparisons to LTX results.
  - related XP development.

- Near term: Review XPs for remainder of 2009 campaign.
- Note:
  - Mid-run assessment coming up in June.
  - Teleconference with modellers June 16th.
  - APS abstracts (due July 17)
  - PSI19 abstracts (due ~ Nov)
  - PAC recommendation to measure particle confinement time

# PAC25 recommendations on lithium research (1/3)

NSTX PAC-Comments on Lithium Research and Plans

- We commend the NSTX team for their response to the challenge of understanding the role of lithium in plasma performance, and to some of their specific responses to the 2008 PAC report.
- We note the present and planned activities for LLD, and for lithium-related diagnostics (diagnostic probe, tile sensors, etc.), planned integrated modeling of NSTX plasma/Li-boundary (HEIGHTS package, UEDGE/DEGAS/REDEP, etc), and formation of the Lithium Thrust Group with dedicated run-days planned.
- We note also the implementation and encouraging initial results from the lithium/canister powder drop technique, pellet injection, with ELM suppression, low core Li accumulation (but high Zeff), etc. results.
- We remain concerned about the pace of physics understanding (and modeling efforts), both in-house and w/ collaborators; and over-committed PPPL personnel. This point must be emphasized due to the exceptional importance of LLD to the NSTX program.

# PAC25 recommendations on lithium research (2/3)

- High heat flux divertor with sufficient particle control is critical to the NSTX Program.
  Therefore, the PAC recommends:
- Greater emphasis on Li divertor issues be placed in your program/run/diagnostic implementation plan.
- For next PAC, we request explicit presentation detailing what will be the heat flux targets required in post- upgrade discharges and identification of high-heat flux with density control targets.

- Suggest more systematic characterization of differences/similarities of effects on edge plasma with different Li approaches (LITER, dropper, LLD) would be good goal. Unique contribution.
- Endorse further studies to understand Li elimination of ELMs (a unique capability), and expand research to control particle rise.
- With CS and NBI upgrade new power levels will require more emphasis on experiments and modeling in boundary physics area; Boundary area research performed by collaborators; Will benefit from additional collaborator support after upgrades.

# PAC25 recommendations on lithium research (3/3)

Recommendations and Concerns

- LLD design:
  - Creep of lithium over the edge of the SS surface requires shield
  - Lithium passivation (D or water), reactivation or refill over course of run
  - Thermal excursion of lithium surface
  - Carbonization of surface
- Lithium coatings
  - Mechanism behind increased electron confinement
  - Quantitative estimate of global recycling
  - Experimental determination of particle confinement times
- Lithium powder
  - Mechanism for performance enhancement
  - Does SOL lithium bury D?
- Extension of LLD to upgrade-need for engineering R&D
  - Pulse length vs. power density for present design, with active cooling
- Modeling Cross-Cut:
  - Should/can blob-transport code results be integrated with Li boundary response modeling?