DivSOL XP Proposals

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OAK RIDGE National Laboratory

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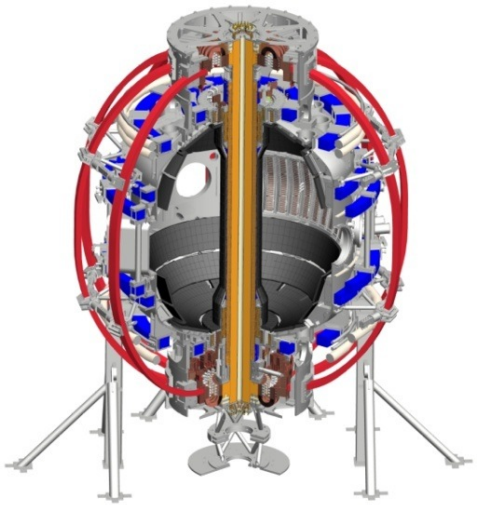

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DivSOL XP Proposals

- Heat flux and SOL width Scaling in NSTX-U
- Relaxation of the interchange instability and effect on SOL width with Li wall conditioning
- Relationship between lambda_q, S and Connection Length
- Effect of Lithium on SOL Power Balance

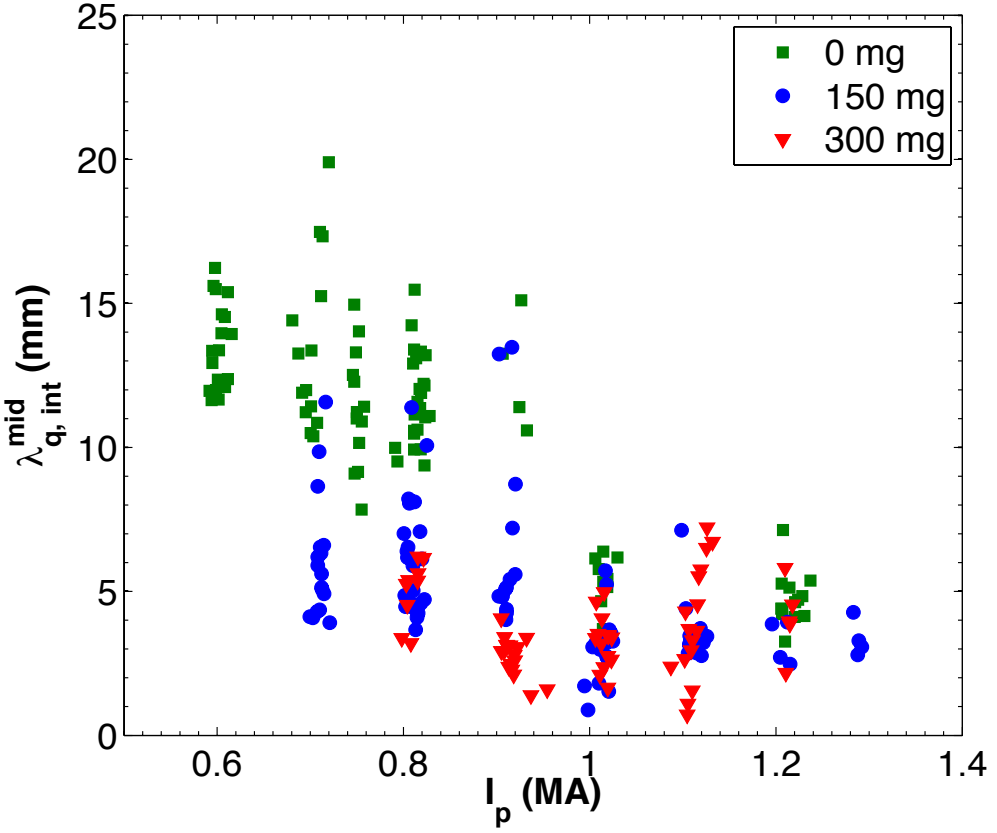
Heat flux and SOL width Scaling in NSTX-U

Co-authors: J-W Ahn, A Diallo, K Gan

Motivation

Previous scaling studies predicted for NSTX-U:

- λ_q ~ 3 mm (boronized)
- q_{peak} ~ 24 MW/m^2
- Assumed DN operation and f_{rad} ~ 0.5, I_p = 2 MA, P_{NBI} = 12 MW
- Milestone 15-1



Goal: Extend scaling study to increased NSTX-U parameters in LSN as well as DN discharges with and without Li

Heat flux and SOL width Scaling in NSTX-U — Run Plan

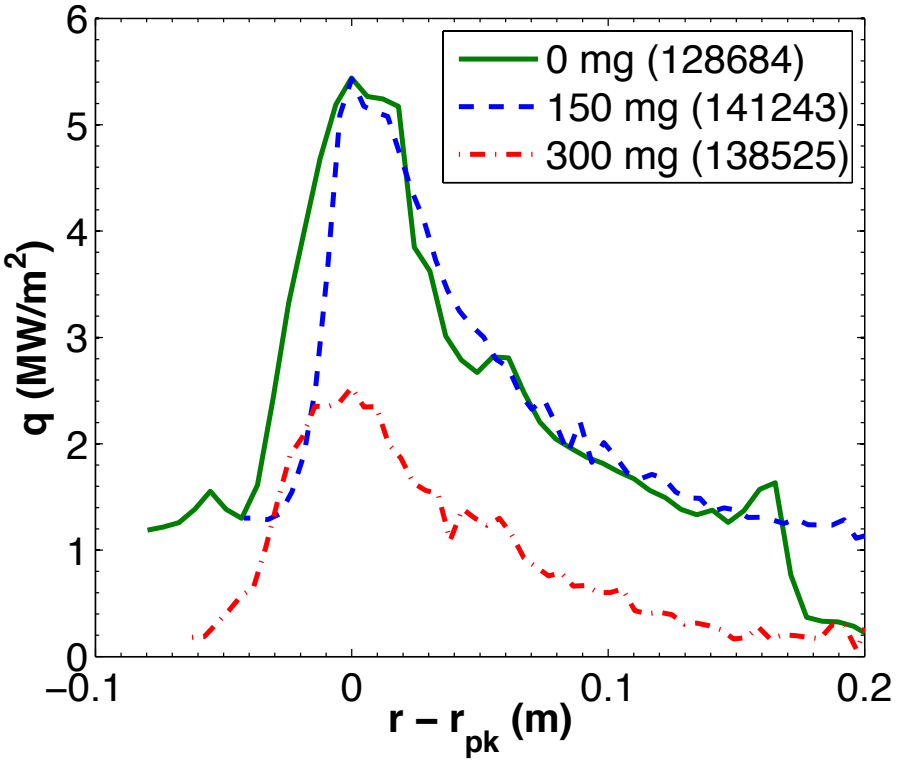
- Boronized Wall Conditions (1 run day)
  - Ip Scan @ Bt = 0.5 T and 2 P_{NBI} (4 and 8 MW)
  - Lower Single-null and double-null
  - high δ
- Repeat Ip Scan with several Li deposition amounts (1 run day)
  - 2 P_{NBI} @ 4 and 8 MW
  - Pre-discharge evaporation: 50 — 500 mg
- Also interested in similar scan in low δ shape …

Relaxation of the interchange instability and effect on SOL width with Li wall conditioning

Co-authors: S. Zweben, M Jaworski, J. Myra, D. Russell, D Smith, A Diallo

Motivation:

- The addition of Li wall conditioning has been observed to reduce SOL width
- Recent simulations from SOLT (D. Russell, Lodestar) suggest a relaxation of the pedestal ∇P with Li reduces the interchange drive therefore reducing λq



Goal: Determine if a reduction in the interchange drive is the cause of SOL width contraction with Li

Relaxation of the interchange instability and effect on SOL width with Li wall conditioning — Run Plan

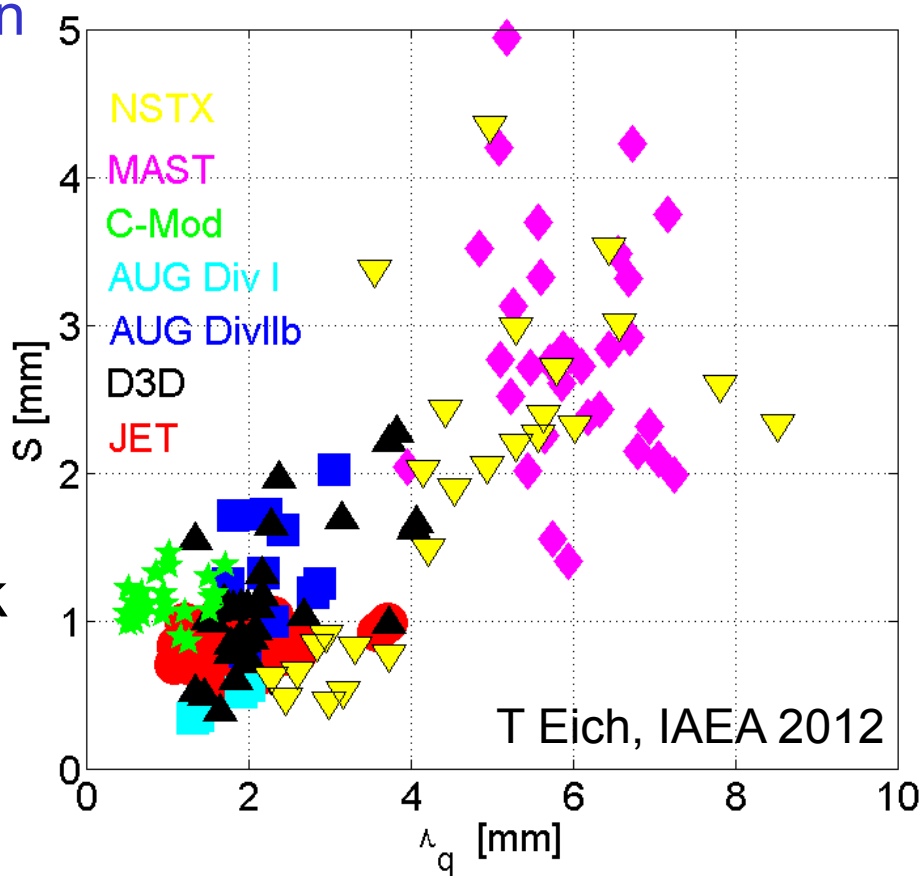
- Establish a baseline discharge with minimal Li (~10-50 mg)
  - Utilize knowledge gained from original Li Introduction to maintain constant CS fueling and PNBI through out discharges
- Field align GPI flux tubes with divertor probes to measure SOL turbulence (low δ shape) [O. Grulke, NF 2014]
  - Plus BES, reflectometry, etc
  - Run fast IR camera w/o dual-band optics and run at ~ 6 kHz for turbulence measurements
- Re-introduce Li to suppress interchange drive
- Reduce Li and see if interchange drive is re-established
- 1 run day requested

Relationship between lambda_q, S and Connection Length

Co-authors: J-W Ahn, J Canik, K Gan

Motivation

- NSTX data contained in the 2010 JRT multi-machine database contains a roughly linear dependence between S and λ_q
- Not seen in any other tokamak

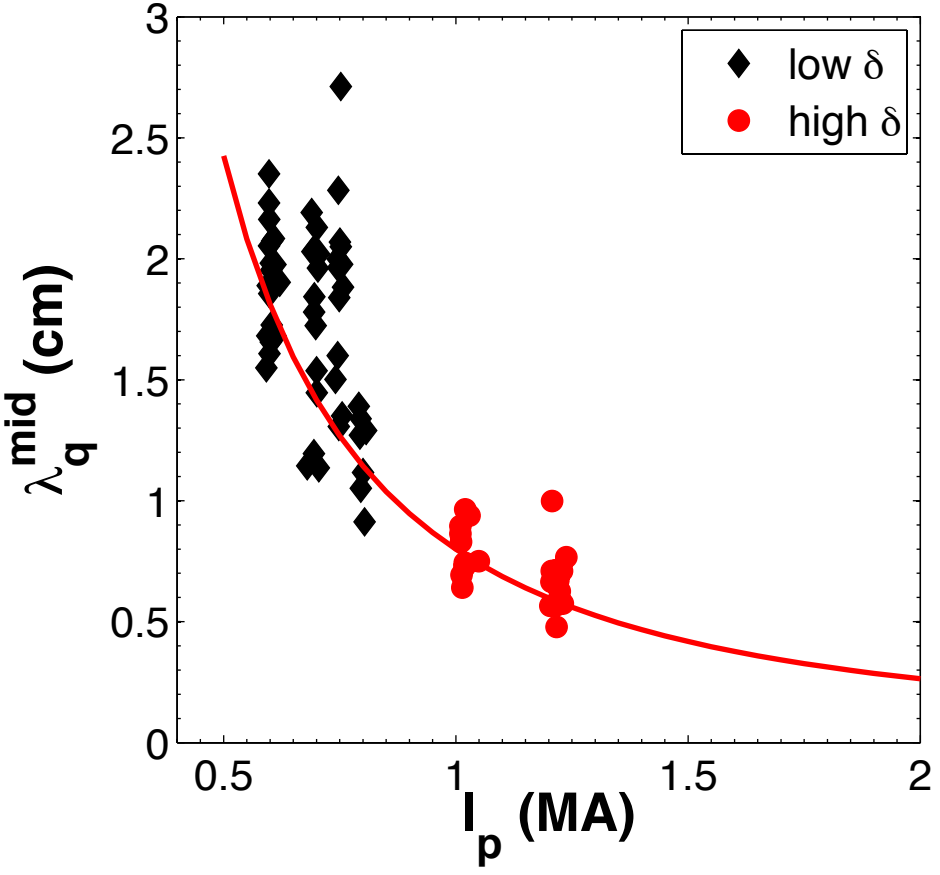


Relationship between lambda_q, S and Connection Length

Co-authors: J-W Ahn, J Canik, K Gan

Motivation

- NSTX data contained in the 2010 JRT multi-machine database contains a roughly linear dependence between S and λ_q
- Not seen in any other tokamak
- The reason: NSTX data also contained a shape scan!
- This suggests a link between SOLPS modeling will be necessary to unfold the interdependences between S, λ_q and $L_{||}$



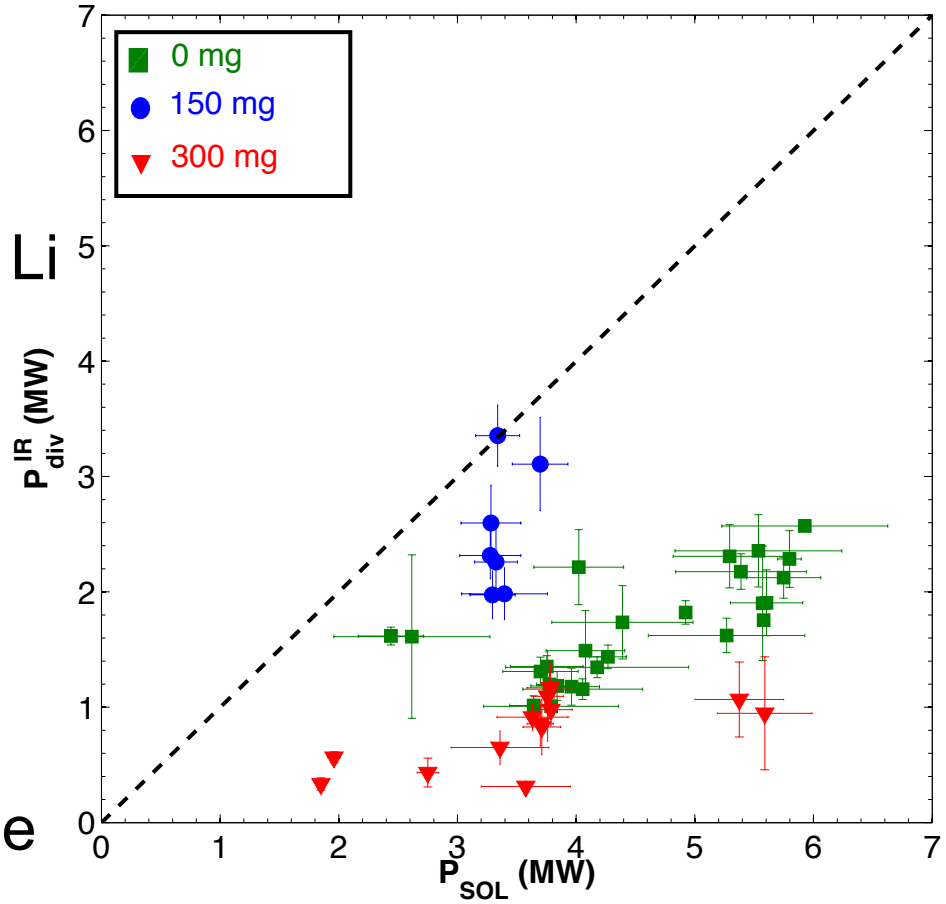
Goal: Study the relationship between S and λ_q and $L_{||}$ via a δ scan under boronized conditions (1 run day)

Effect of Lithium on SOL Power Balance

Co-authors: L Delgado-Aparicio, J-W Ahn, J Canik, K Gan

Motivation

- Experiments in 2010 showed a loss of power accounting at the outer strike point with ~ 300mg Li pre-discharge evaporation
  - When compared to B discharges
  - high δ (eg - not on LLD)
- No reduction in P_{div}/P_{sol} at the OSP seen with ~ 150 mg Li
- No systematic XP during 2010
- "Discovered" during the upgrade outage



Goal: First systematic study of how Li effects the SOL power balance at the outer strike point

Effect of Lithium on SOL Power Balance — Run Plan

- Boronized P_{NBI} and CS fueling scans (~ 1 run day) R15-1
  - Provide a baseline for comparison with Li discharges
  - high δ, high I_p (≥ 1 MA)

- Controlled Li Introduction into NSTX-U [XP proposed by R. Maingi]
  - First time with the dual-band IR optics!
  - Expect increases to fueling during Li introduction and reduction in beam power due to β_N limits
  - Let the Li coating "burn-out" after this initial introduction
  - Repeat Li introduction in low δ shape

- P_{NBI} scan with several Li deposition amounts (1-2 run days) R15-1
  - 150 and 300 mg
  - high δ, high I_p (≥ 1 MA)

- Repeat P_{NBI} Scan after an end-of-run Boronization? (1 day)