NSTX

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Impact of 3-D fields on pedestal profiles without and with lithium

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XP Group Discussion

6/22/2011

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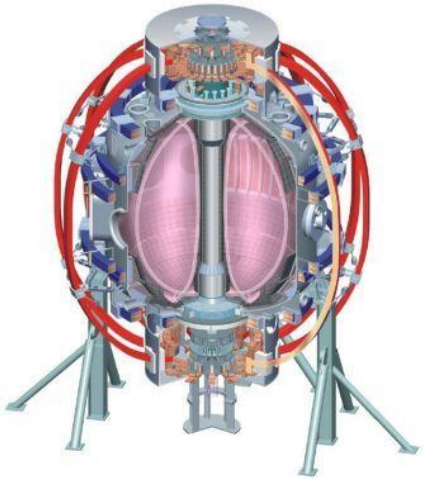

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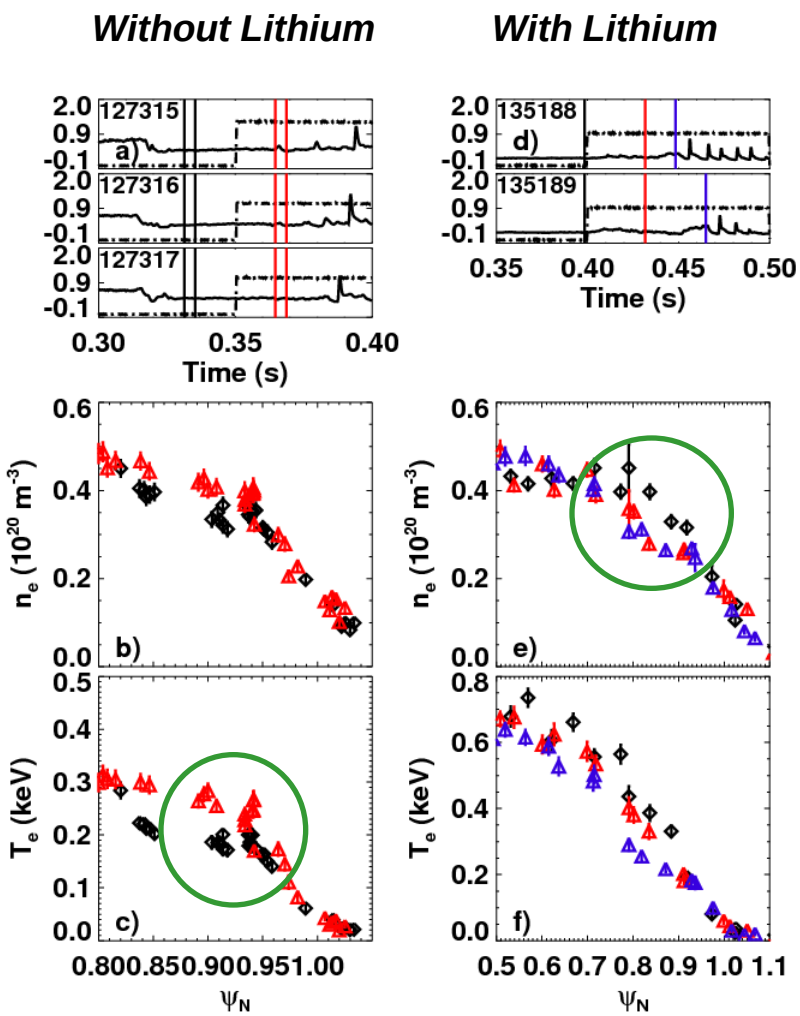
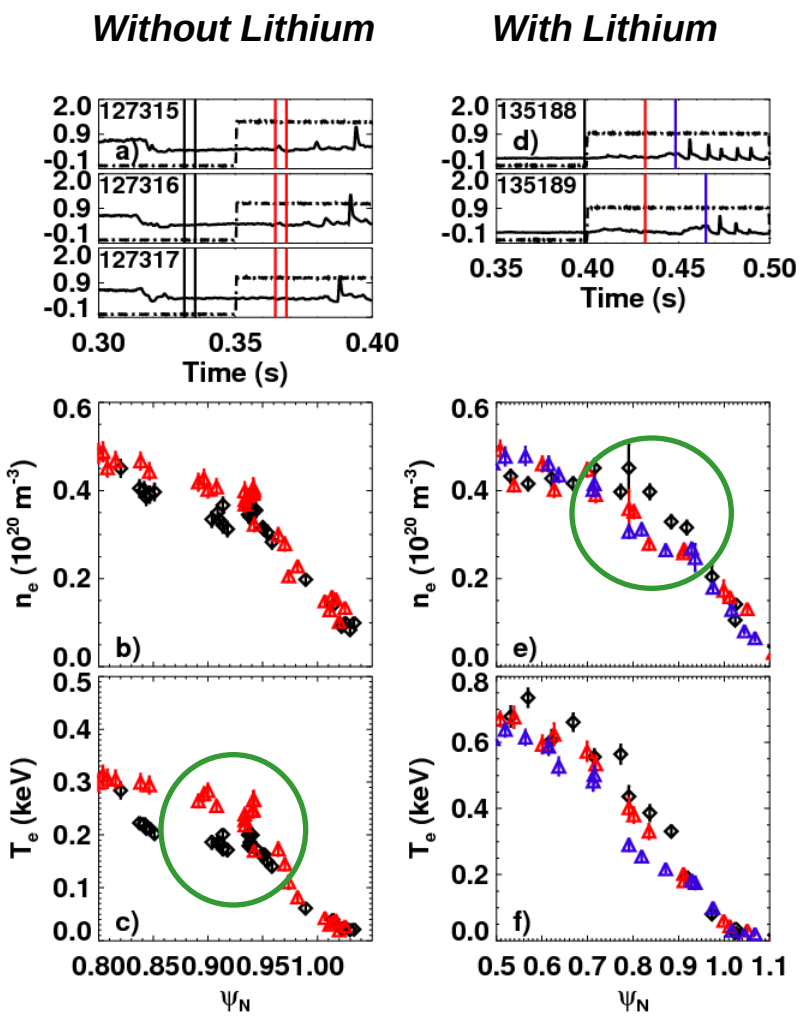
Pedestal profiles show varying response to n=3 field with/without lithium

- Without lithium: T_e goes up, with lithium: T_e/n_e go down
- Some possible causes
- Collisionality
- Shape
  - Similar δ, κ~2.0 (without) vs 2.4
- Rotation
  - Existence/position of magic point?
- Divertor conditions
  - T_e increase seen with lithium when 3D field reattaches divertor
- Pedestal structure
  - Flattening becomes more visible due to wider gradient region?

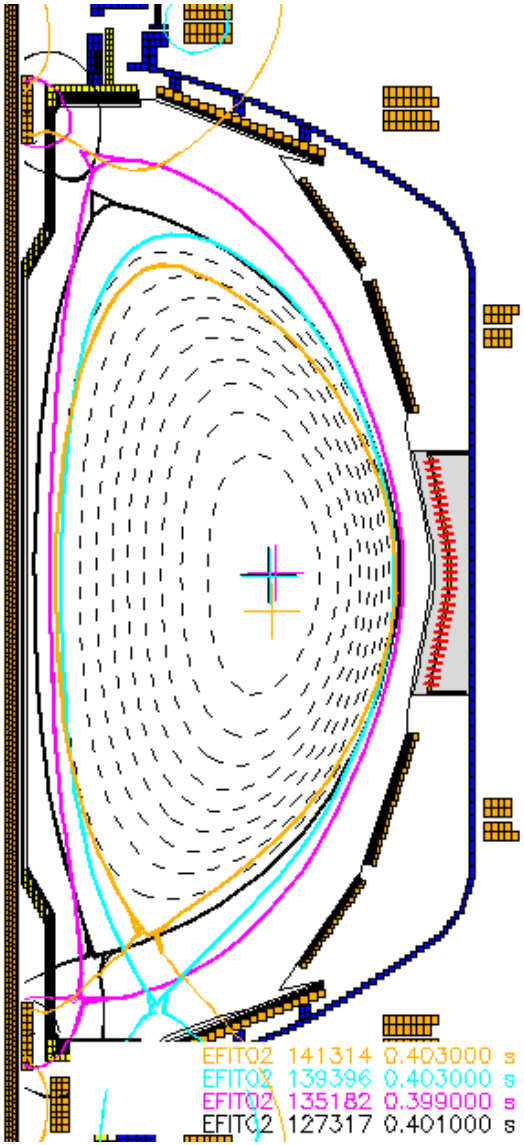


Pedestal profiles show varying response to n=3 field with/without lithium

- Without lithium: T_e goes up, with lithium: T_e/n_e go down
- Some possible causes
- Collisionality
- Shape
  - Keep constant
- Rotation
  - Vary beyond changes due to Li: High P_{NBI} without, low with Li
- Divertor conditions
  - Keep strongly attached (J-W will vary)->low delta, high P without Li
- Pedestal structure
  - Maximize P without Li, reduce with



Possible shapes to run XP in



- High triangularity
  - Make contact with previous results
  - More likely to inform future high performance shots
- Medium triangularity
  - More amenable to P-B analysis
  - More strongly attached without Li (?)
  - HDLP can measure divertor profiles
  - OSP on LLD might complicate Li/non-Li
- Low triangularity
  - More conventional P-B operating point
  - OSP past LLD
  - Most thorough documentation of how Li affects pedestal
  - Restricted to low I_p (?)

Shot plan

- Load medium triangularity shot (e.g., 139396)
- Measure pedestal profiles with/without 3D fields without Li
  - Maximum power tolerable, hopefully P_{NBI}=6MW
  - One control shot (no n=3 at all)
  - Apply n=3 square waves 50 ms on, 100 off), start at 1kA and go up by 250 until ELMs are triggered during pulses->aiming for 3 shots
  - Repeat at P_{NBI}=4 MW (4 shot)
- Add sufficient lithium to go ELM-free, and repeat
  - Start at 4MW (4 shots)
  - Reduce PNBI to try to match T_e, V_t edge profiles to the extent possible, repeat (4 shots)
- Highest priority comparison: highest P_{NBI} without lithium and lowest P_{NBI} with lithium

Diagnostics

- Edge profiles
  - ChERS, Thomson, SXR?
- Turbulence
  - BES, reflectometers, Firetip, GPI?
- Magnetics, MSE, etc for reconstruction