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H-mode pedestal versus X-point height (*Towards FY11 JRT*)

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and the NSTX Research Team

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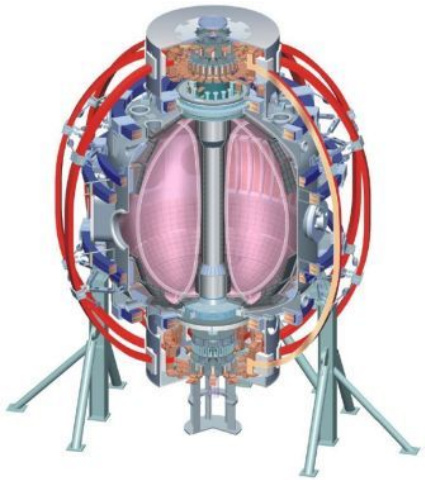
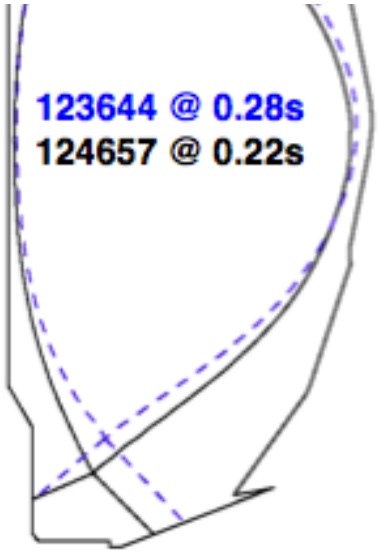
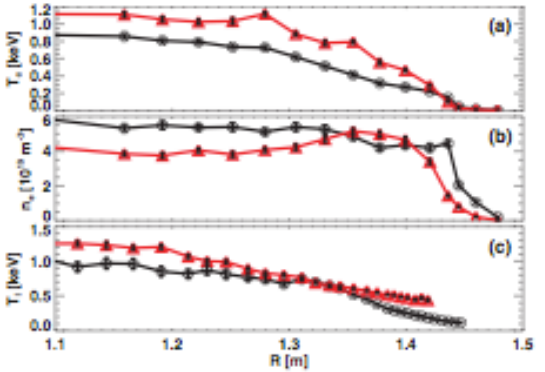


Use X-point height as a tool to explore the effect of neutral penetration on the H-mode pedestal

- What leads to increase in n_e profile after LH or ELM and sets ultimate n_e width?
  - Neutral penetration or particle pinch?
  - Most neutral penetration past SOL is recycled neutrals from divertor plate
  - Vary distance between separatrix and outboard divertor plate with low neutral density
    - Low n_0 leads to wider gradients in n_0 near divertor



- NSTX: Achieve low recycling regime via lithium coatings
  - Pedestal and ELM stability influenced by recycling changes
  - Unique regime can be used to help decouple pinch vs neutral penetration effects



R Maingi, et al., PRL **103** (2009)

Goal: measure the pedestal pressure profile prior to type-I ELM and assess ELM cycle vs X-point height

- ELM cycle
  - Timing of T_e, n_e build-up to saturating pressure
    - Does neutral penetration impact n_e recovery?
  - Edge fluctuations: density fluctuations prior to ELM crash and flow shear prior and during ELM crash
- Inter-ELM profile analysis
  - Need frequent type-I ELMs to get profile composite
    - Does neutral penetration impact saturated n_e profile?
  - Aided by MPTS upgrade
- Shot development
  - Upgraded X-point height, outer strike-point controller
  - Could follow Ahmed's XP that establishes ELMy low-δ discharge

Experimental plan for ½ day XP

- Establish low-δ shape with large X-point height — 4 – 6 shots
  - Low-δ reference, with X-point height ramp after SOFT
    - X-point height and strike point control
    - Align outer strike point with tile probes
  - Need well-spaced Type-1 ELMs
    - Modest lithium
    - Tricks: d_{rsep}, NBI power, fueling
- Establish matched shape with small X-point height — 4 – 6 shots
  - Match elongation, aspect ratio and strike-point locations
- If time
  - Repeat with reduced inter-shot lithium (or no lithium — 6 – 10 shots
  - Intermediate X-point height (Ahmed's XP) — 4 – 6 shots

Diagnostic needs, planned analysis

- Required
  - Profiles: MPTS, CHERs, magnetics
  - ELMs: D_alpha, SXR diode array
- Desired
  - Edge modes / flows: GPI, reflectometer, BES, high-K
  - Recycling: 1D D_alpha CCD, filterscopes
  - Reconstructions: MSE
  - SOL currents: Shunt measurements
  - Additional profile information: Multi-color SXR, ERD
- Analysis
  - Osborne profile analysis tools
  - ELITE, PEST, TRANSP