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Influence of LLD induced collisionality and profile effects on ST MHD stability

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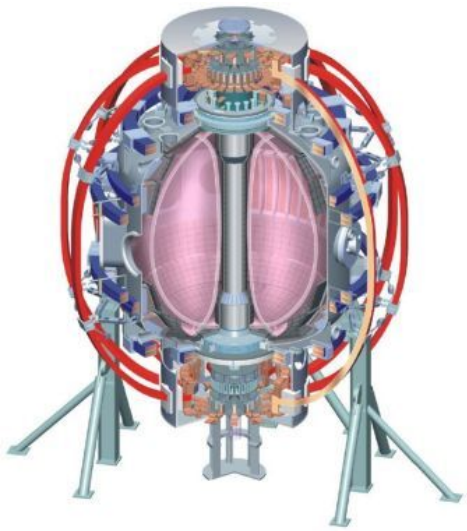

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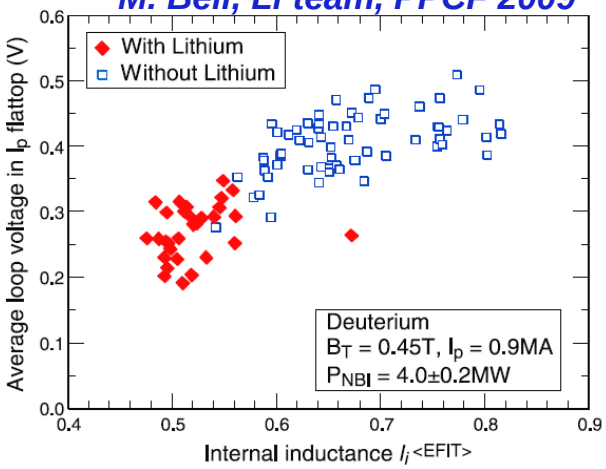
Goal: Assess impact of reduced density and collisionality on global MHD stability using LLD

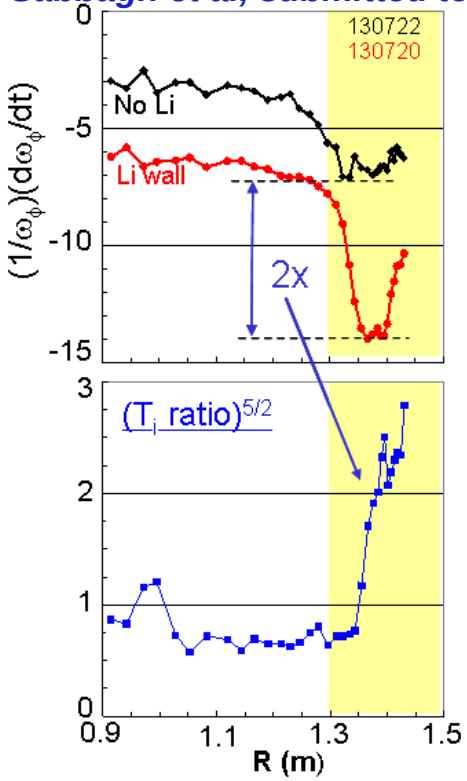
- Background:
  - LITER resulted in temperature profile broadening and reduced internal inductance
  - LITER reduced edge and core collisionality and increased NTV flow damping
  - The effect of the LLD will likely be more pronounced
  - Dedicated scans of plasma density and collisionality are warranted in order to understand the broader impact of LLD on MHD stability

- Experimental questions:
  - Will pressure profile broadening be beneficial?
  - Will this out-way destabilization from broader J?
  - Will lower ν^* increase NTV braking from error fields and RWM, or favorably reduce tearing drive?
    - Low ν^* could modify optimal EFC due to different flow-damping profile from plasma and coil δB
  - How will RWM stability change?

M. Bell, Li team, PPCF 2009



Sabbagh et al, submitted to NF



Experimental Approach/Plan:
(1.5 day request, 1 day minimum useful)

- Develop reference non-LLD discharge operating above n=1 no-wall limit
  - Use n=3 EFC, but no (or slow) n=1 feedback
  - Measure ideal-wall beta-limit – use NBI pulses to exceed β limit, induce partial β collapse
  - Apply n=3 pulse and measure rotation and flow damping rate
  - Apply n=1 pulse to measure n=1 RFA, measure decay to obtain stable RWM γ
    - Could also use n=1 travelling wave + frequency scan
- Reduce density with LLD by 20-40% - use NBI feedback to control β
  - Compare q and rotation profiles with and w/o Li/LLD
    - Try to find time in lower n_e shot with similar q profile as higher n_e case
  - Re-measure β limits with NBI pulses
  - If plasma remains n=1 RWM stable
    - Measure n=3 rotation damping
    - Measure n=1 RWM stable growth rate
  - If plasma becomes n=1 RWM unstable, activate n=1 feedback control
    - If plasma still unstable, scan n=1 feedback gain and phase to re-establish stability
    - Measure n=3 rotation damping rate
    - Transiently turn off n=1 feedback and measure intrinsic RWM growth rate
  - Document changes in tearing mode behavior