NSTX

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# Characterization of magnetically triggered ELMs in lithium-conditioned discharges

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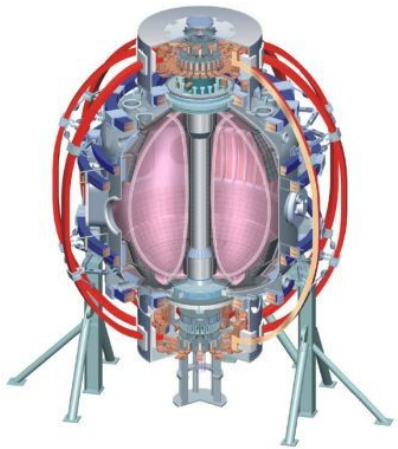
**J.M. Canik, ORNL**

**NSTX Boundary Physics TSG Meeting**
**Princeton, NJ**
**April 17, 2009**



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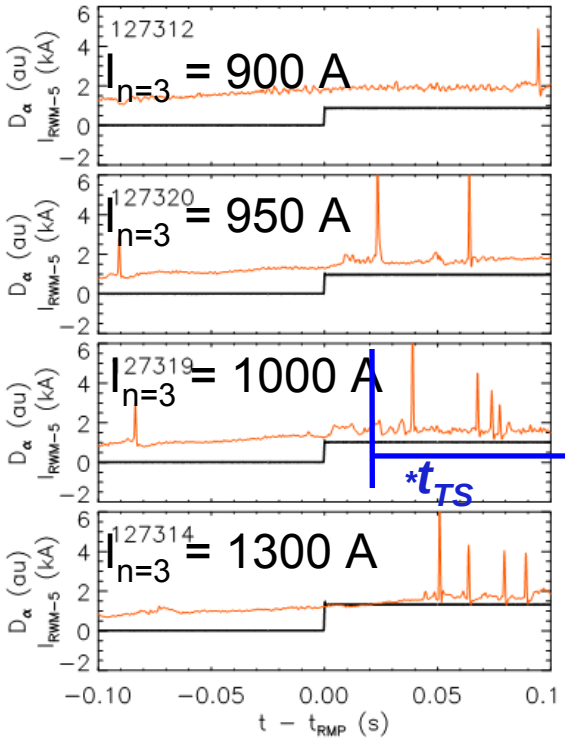
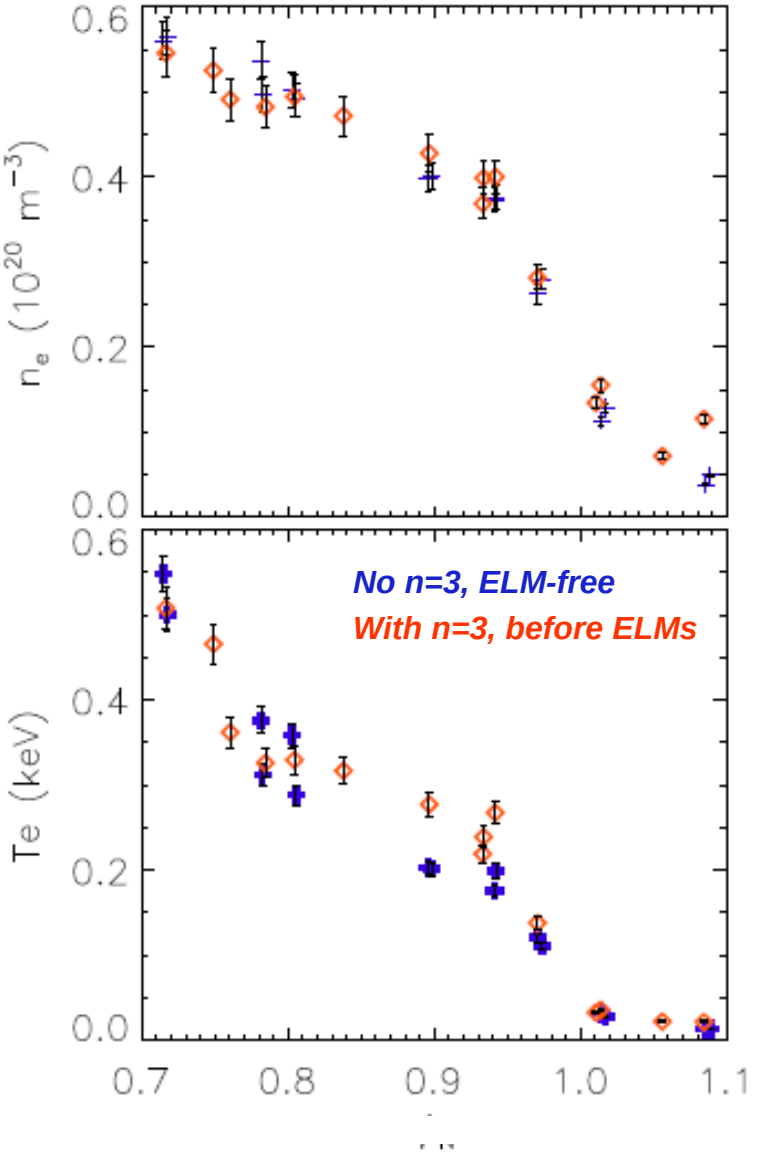
# 3D magnetic perturbations can trigger ELMs in NSTX

- DIII-D: resonant magnetic perturbations are used to suppress ELMs (starting from Type I ELMy H-mode)
  - Similar result at JET (mitigation, not full suppression)
  - ELM mitigation/control is critical for ITER
- NSTX: 3D fields (largely, but not entirely non-resonant) trigger ELMs during Type-V or ELM-free H-modes
  - Also seen in JFT-2M, COMPASS, and MAST (Type-III ELMs triggered)
- This effect was successfully used to reduce impurity accumulation in Li-enhanced discharges

# Most of the data on n=3 ELM-triggering was gathered *without* Li-conditioning

- Threshold n=3 perturbation for triggering
- Profile steepening seen after n=3, before ELMs
  - Stability calculations show trend towards instability due to pressure steepening
  - No equivalent data exists for the Li case



# Proposed shot list to characterize ELM triggering with Li conditioning (1 day)

- Produce reference discharge (2 shots)
  - Reload of 130669: $\kappa \sim 2.4$, $\delta \sim 0.7$, $P_{NBI} \sim 3$MW, LITER at ~250 mg/shot, no n=3
- RWM coil current scan 1: find threshold (4 shots)
  - DC current scan at low currents: 300-1200 A in increments of 300
- Pedestal profile measurements throughout ELM cycle (10 shots)
  - n=3 applied as square wave, synchronize 1st TS laser to beginning of SPA pulses
    - SPA current chosen to give ~20-30 ms ELM onset time, if possible
  - March 2nd laser between SPA turn-on and first ELM (5 shots)
  - Continue through subsequent ELMs (is 2nd ELM like the first?) (3 shots)
  - 1st laser just before ELM, 2nd during ELM to measure radial structure for comparison to PEST/ELITE (2 shots)
- Reduce kappa to 2.0 (reload of 130652), repeat measurement of radial ELM structure (3 shots)
- RWM coil current scan 2: test if ELMs triggered faster at higher SPA current (4 shots)
  - Back to high kappa
  - High SPA current pulses: 2, 3 kA
  - Test sinusoidal SPA waveform, as DIII-D uses
- Shift toroidal phase of n=3 field to check for 3D profile effects (2 shots)

# Diagnostics desired

- Goal is to characterize ELMs, want as many diagnostics running as possible
  - TS (both lasers)
  - CHERS (toroidal and poloidal), ERD
  - $D_\alpha$ detectors (filterscopes, HAIFA)
  - 1D CCD divertor cam ($D_\alpha$)
  - Tangential X-pt visible cam
  - USXR (one filter on 100 micron, one on 5/10)
  - IR cameras, esp. fast cams
  - GPI camera for ELM structure
  - Firetip
  - Reflectometers (ORNL and UCLA)
  - LP to measure currents in SOL
  - Anything else?