

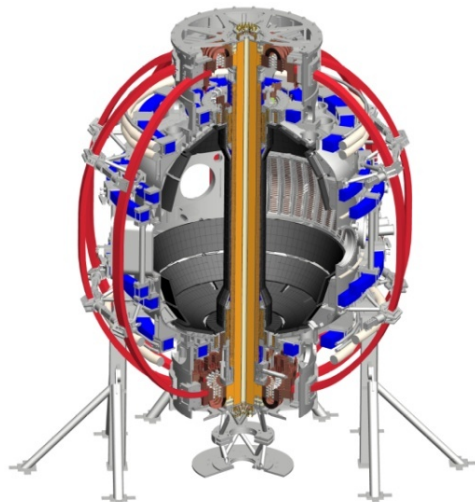
# Combining ELM pacing with divertor gas injection for impurity control

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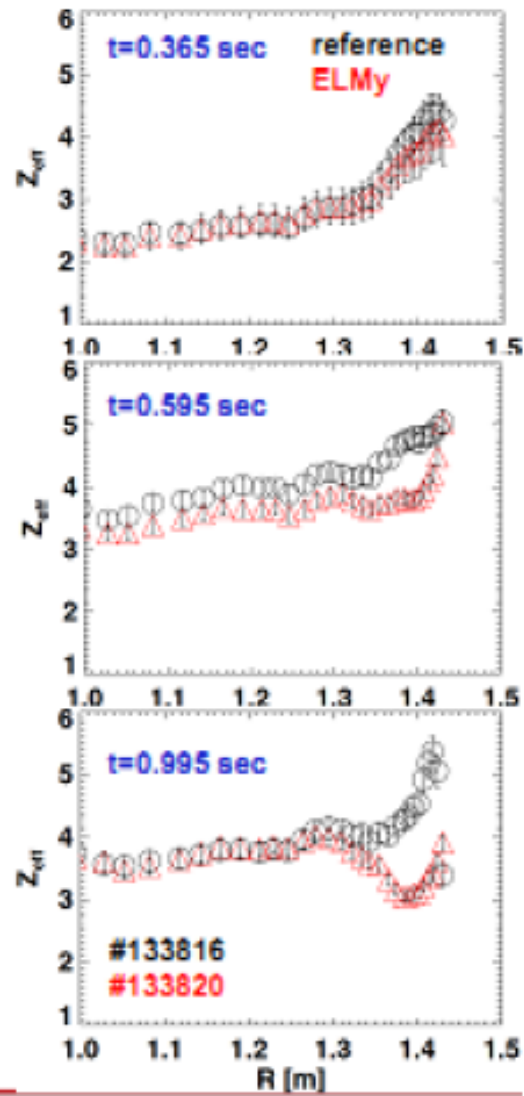
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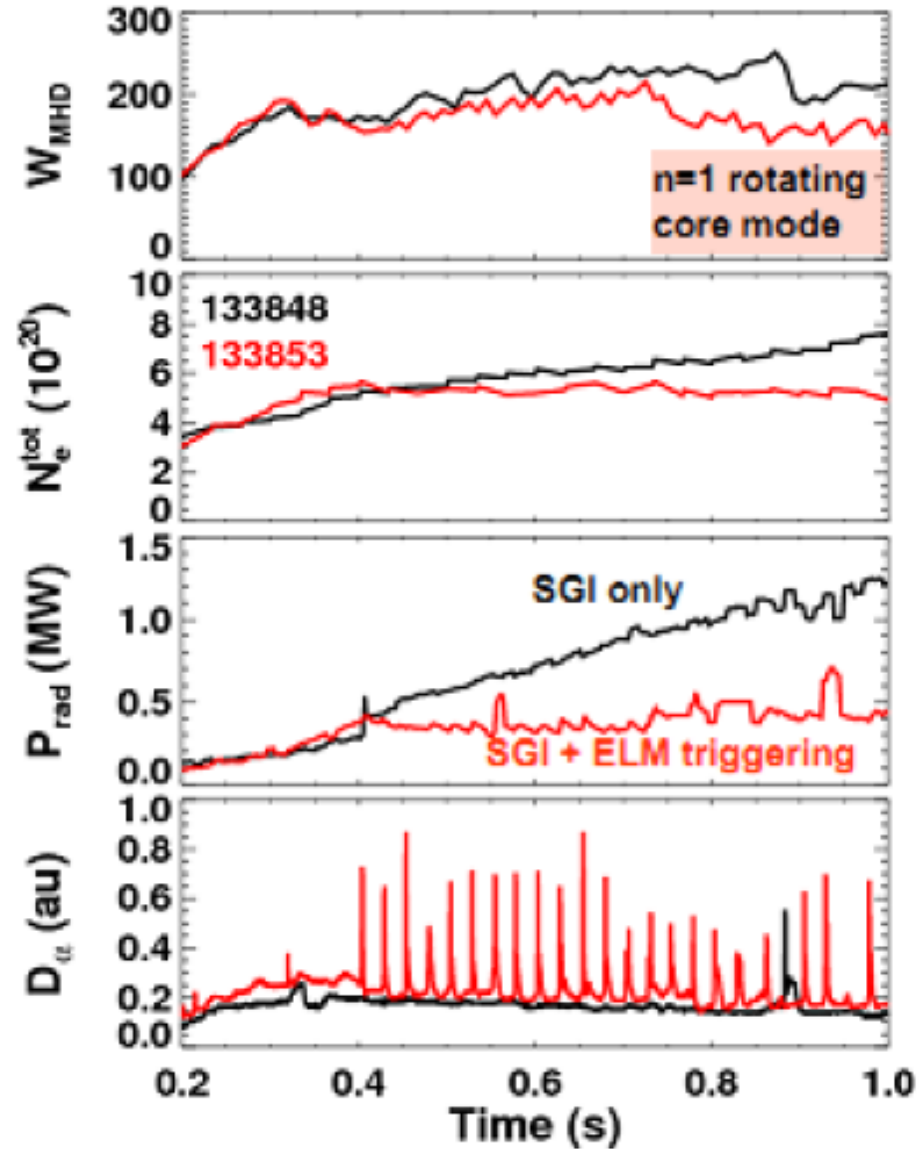
# Background and shot plan

- Background
  - ELM pacing w/ 3D fields can provide particle control, however at frequencies required confinement degraded, core modes triggered
  - Divertor gas puff reduces core carbon density and ramp rate
- Experimental goal: Combine techniques to get same effect with reduced demands on ELM triggering, may be able to halt density ramp without triggering core modes
  - Dependent upon establishing ELM pacing and gas puff impurity control techniques in previous experiments
- Shot plan (1/2 day)
  - Start with  $n=3$  3D field pacing shot
  - Perform coarse pacing freq. scan, get baseline impurity flushing vs core degradation
  - Add gas puff and adjust parameters to maximize impurity reduction
  - Scan pacing freq., test if control achieved at lower frequency

# ELM pacing with $n=3$ fields can provide global particle control, at a price

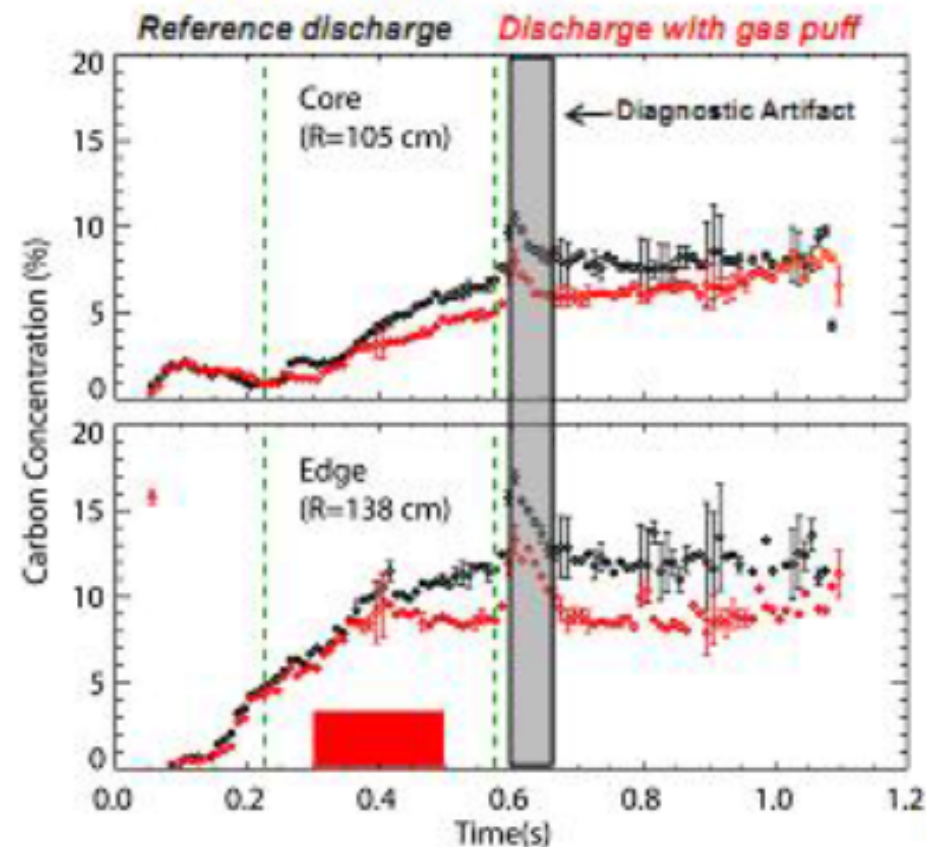


- $n=3$  pulses trigger individual ELMs
- Ramp of  $n_e$  and  $P_{\text{rad}}$  can be stopped
- But at frequencies necessary confinement is degraded, core tearing modes triggered
- Central impurity accumulation is still strong



# Divertor D<sub>2</sub> puffing reduced core carbon density and ramp rate

- Drop attributed to reduced sputtering
- Central  $f_C$  and  $Z_{\text{eff}}$  still rising
  - *Need to develop ways to reduce central impurities*



Scotti, APS 2010

## Deuterium Gas Puff From CHI Gap

