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Modifications to the early discharge evolution to reduce late impurity content

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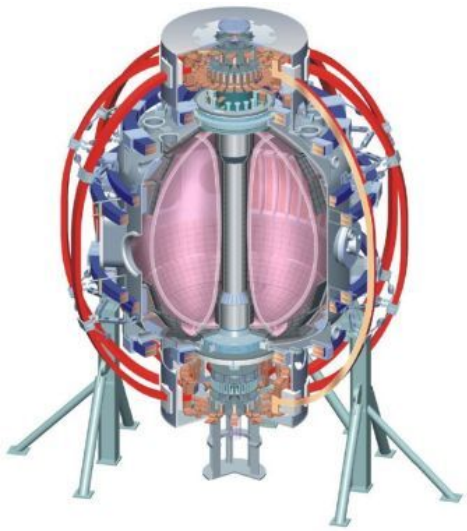
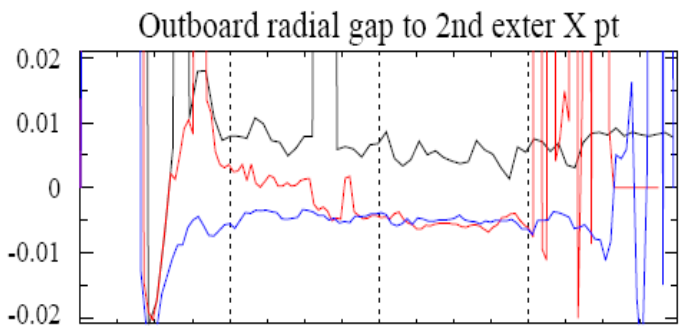
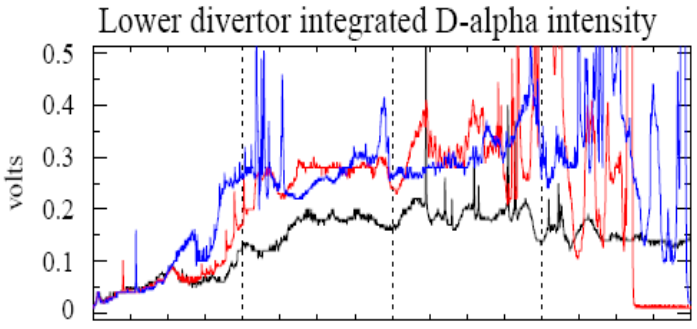


Particle/radiation evolution sensitive to ΔR_{SEP} evolution
(shots shown purposely have no/few-small ELMs due to Li-conditioning)

∇B drift down + USN | ***∇B drift down, USN → LSN*** | ***∇B drift down + LSN***

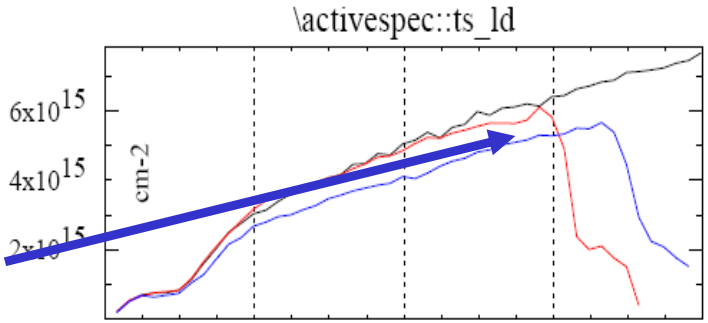
ΔR_{SEP} scan

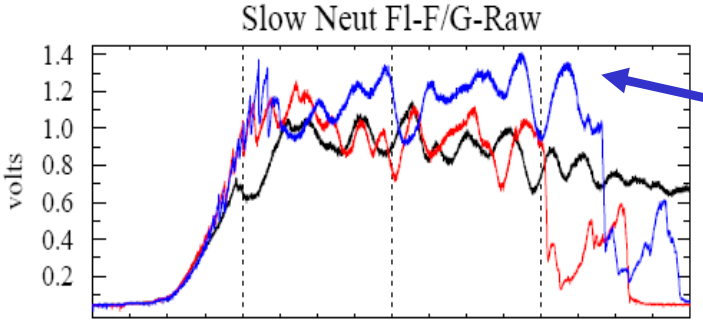




Lower div. D_α increased by 50% for $\Delta R_{sep} < 0$

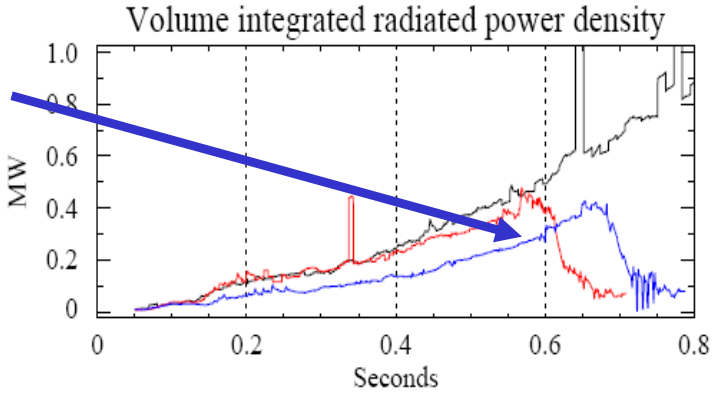
Density reduced 20%

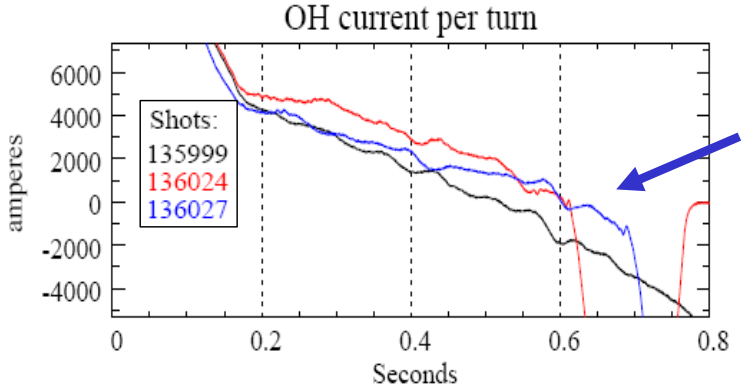




Neutron rate increased

P_{RAD} reduced 40%



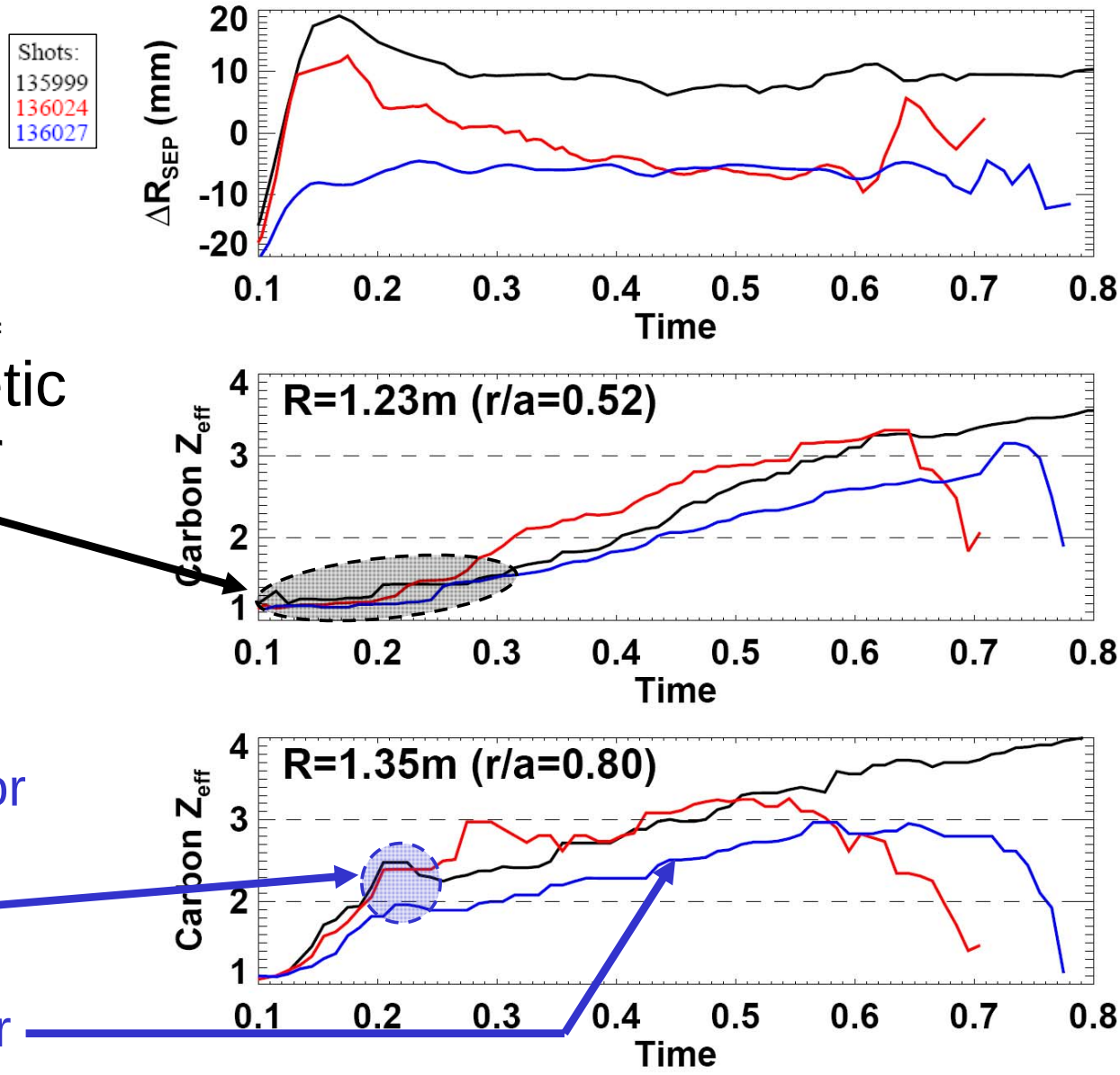


Flux consumption reduced

"Unfavorable" ∇B drift down (away from X-point) with LSN has several favorable properties

Carbon Z_{eff} evolution sensitive to magnetic balance during ramp-up (immediately following early H-mode)

∇B drift down + USN | ***∇B drift down, USN → LSN*** | ***∇B drift down + LSN***

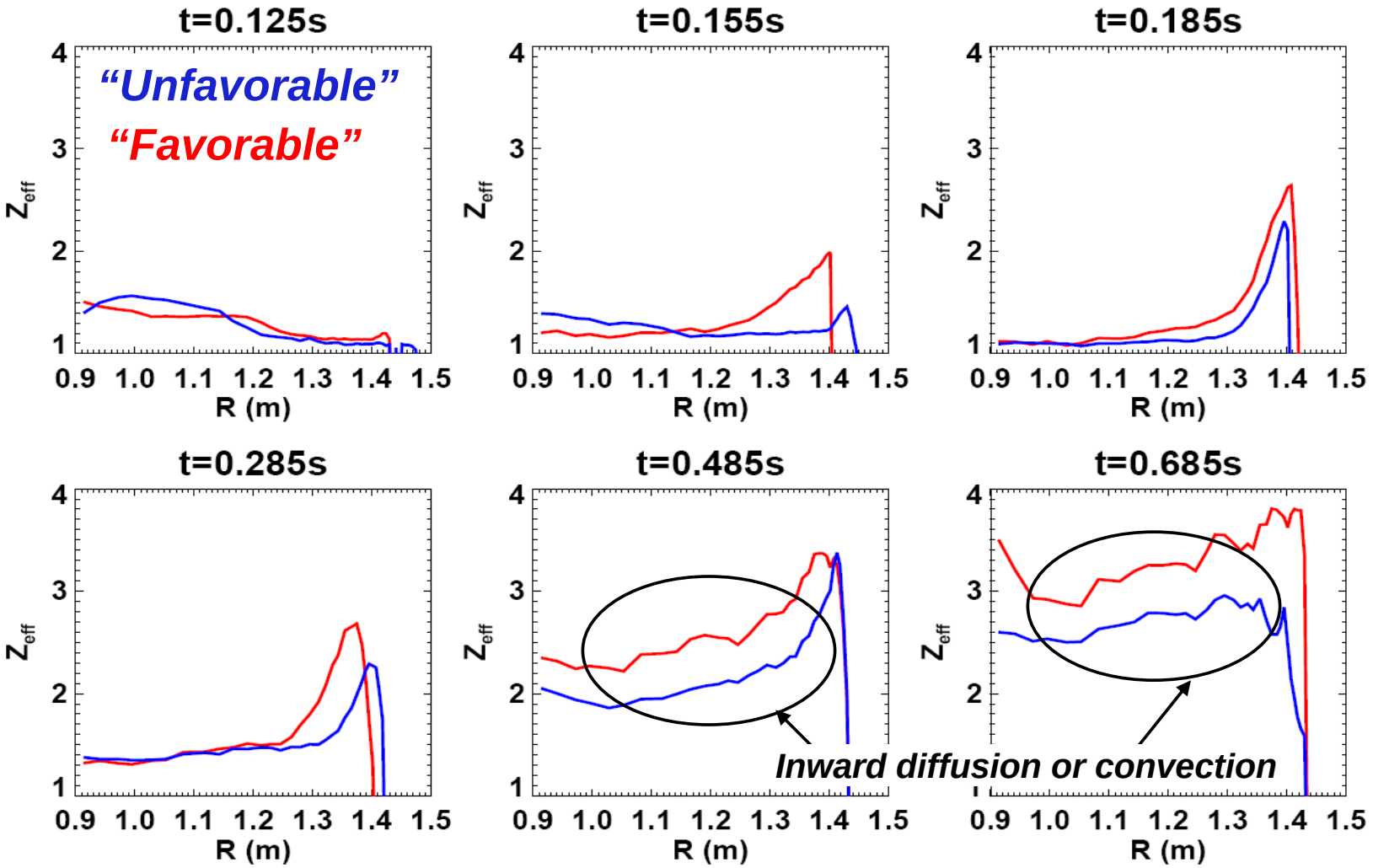


- Core/mid-radius C Z_{eff} similar for all 3 magnetic bias configurations for first ~300ms of shot

- **∇B drift down + LSN:**
  - Reduces C influx and/or confinement **at top of pedestal** immediately after early H-mode
  - Lowers C Z_{eff} thereafter

"Unfavorable" direction reduces width and height of edge region where carbon is concentrated

- Question for XP: Can minimizing / flushing the C early keep it from diffusing into the core later in the discharge?



Experimental Approach/Plan:

(1.5 day request, minimum useful = 0.5 day DRSEP + 0.5 nRMP day)

- Develop/reproduce reliable scenario with LITER and/or LLD which is ELM-free and exhibits strong C impurity accumulation in edge region
- Scan magnetic balance (grad-B drift direction) before, during, and after the early H-mode transition to assess impact on early impurity accumulation
  - Scan DRSEP = -2, -1, 0, 1, 2 cm
  - Test before and after transition separately, and combined
  - Also test fixed DRSEP during entire ramp-up (do this first?)
  - From this data, determine which phase of discharge is most responsible for C accumulation
- In conditions with minimized C impurities, add n=3 RMP pulses during ramp-up + early flat-top, i.e. t=150-300ms
  - Optimize amplitude and frequency to reduce impurities during ramp
  - Avoid adversely impacting early rotation and MHD stability