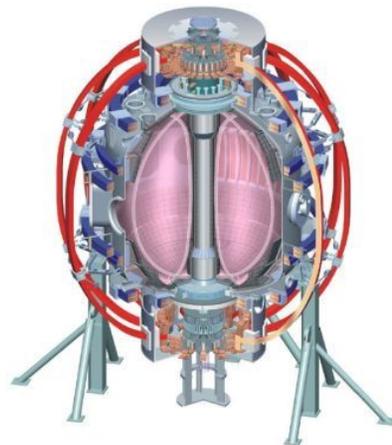


Development of Upper Single Null H-modes with Large δ_r^{sep}

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 U Washington
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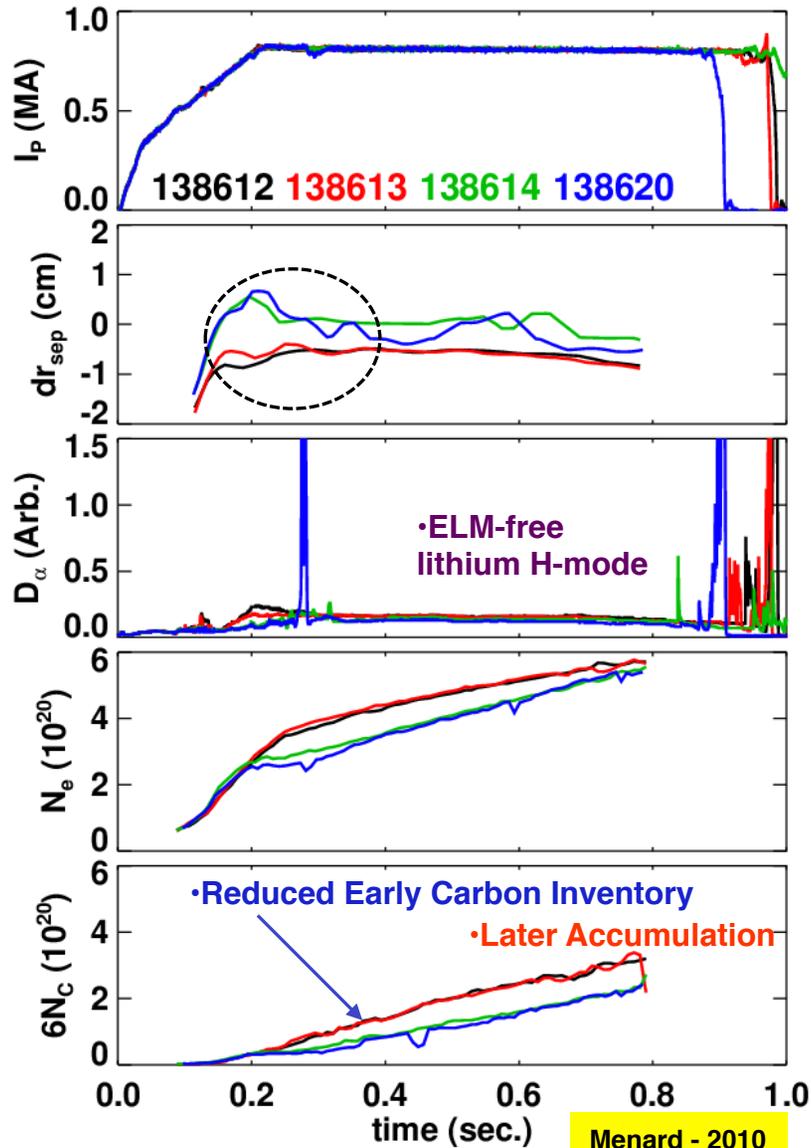
Rajesh Maingi, 

NSTX Research Forum: ITER and CC&E
 Princeton NJ
 15-18 Mar 2011

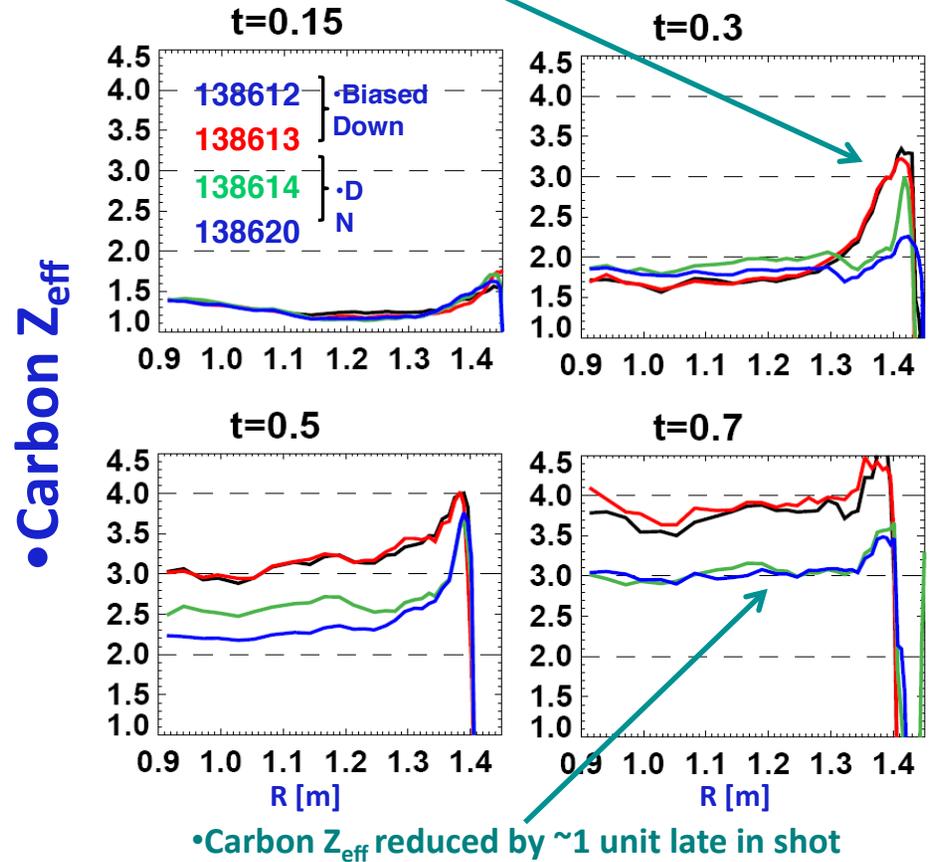


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Biasing upward (unfavorable ∇B) reduces early carbon, but impurities still increase in time



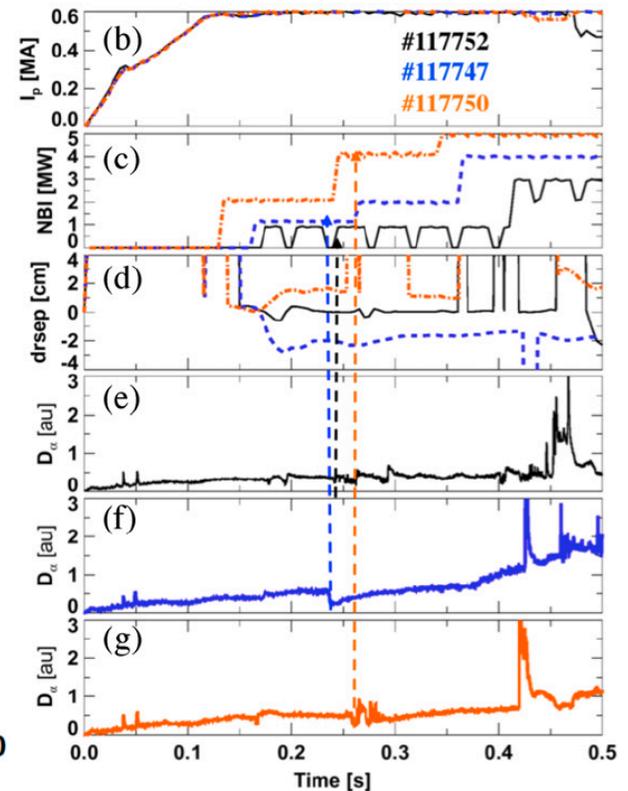
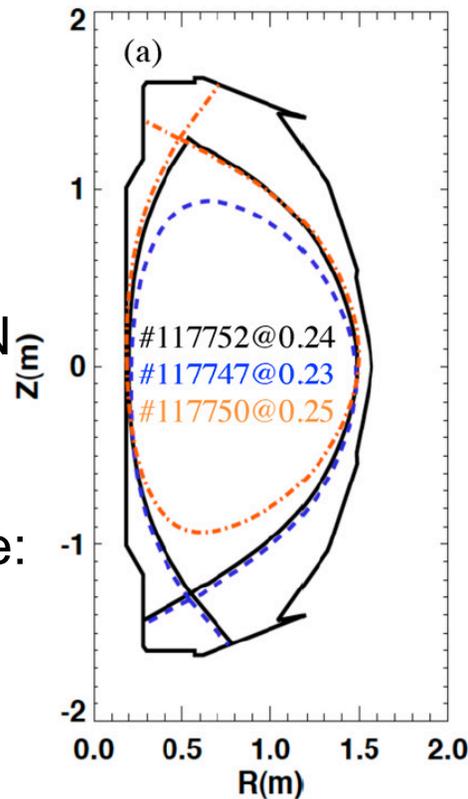
- Size of H-mode C impurity “ear” near $t=0.3s$ influences late Z_{eff}



- Is larger δ_r^{sep} better?

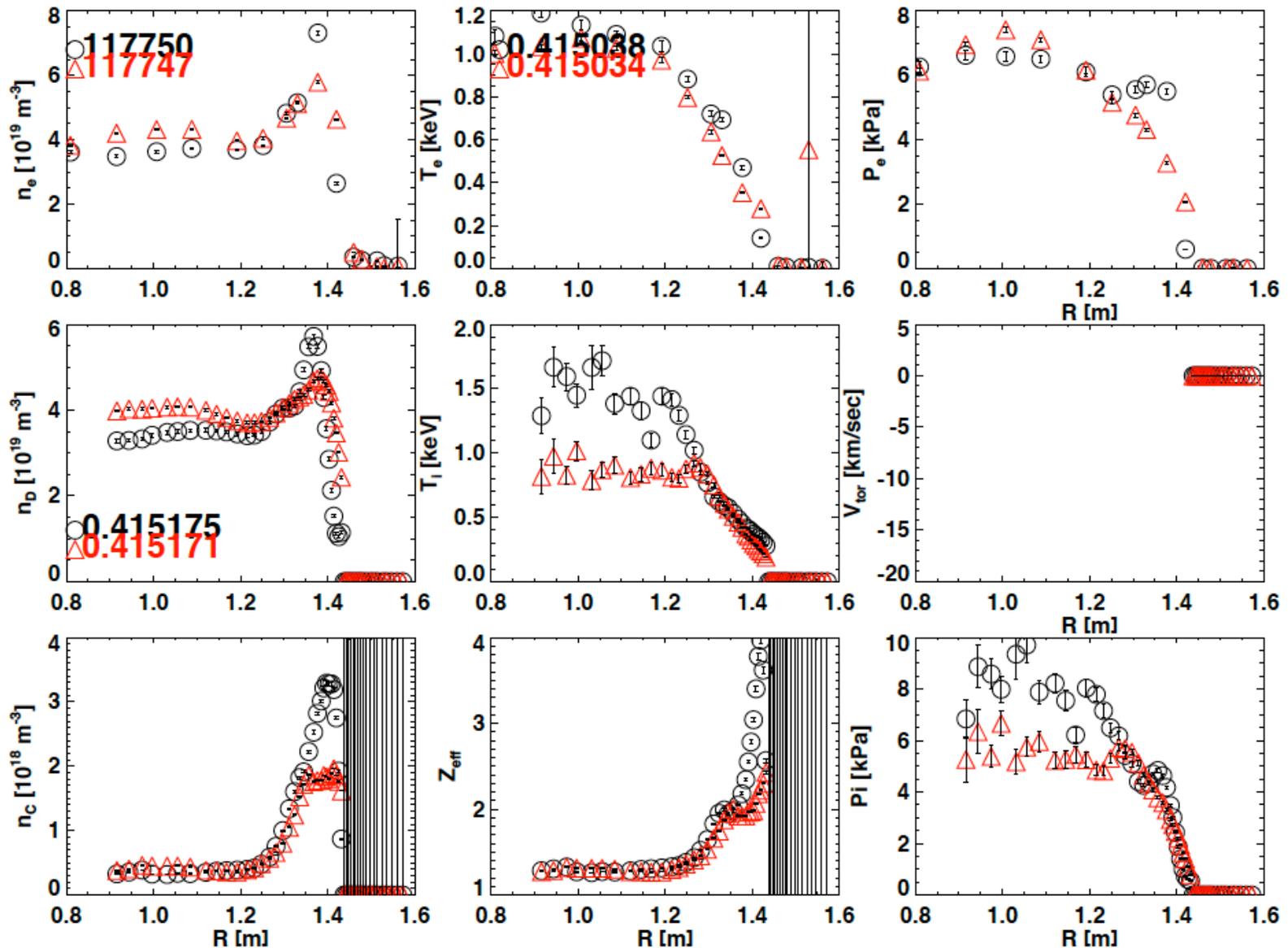
Goals and Background

- Goal: develop USN H-mode discharges with large δ_r^{sep} and high I_p , and with the grad-B drift toward the lower X-point
 - Ramp I_p to ~ 0.6 MA, transition to H-mode, and resume the I_p ramp in H-mode
- Difficult to run USN H-mode with large δ_r^{sep} and high I_p . Typically δ_r^{sep} is limited to 0-5 mm, i.e. very close to DN, at our normal values of $I_p \sim 0.8$ MA. This was also true in LSN discharges with grad-B drift upward in XP 956.
- Example of large δ_r^{sep} H-mode: 117750 (2005, pre-li).
- High $q_{95} \sim 10$ important?
 - $I_p = 0.6$ MA at $B_t = 0.45$ T
 - 117750 died when $\beta_N \sim 6$



Maingi, NF 2010

Plasma performance was relatively good (e.g. high T_i) in USN H-mode (low I_p , low δ)



Proposed Experimental Plan (1/2 - 1 day)

- Reproduce 117750 with new control system feedback gains, and using ~ 50-100 mg lithium between discharges
- Trigger the H-mode earlier by moving NBI earlier, and drop late NBI to avoid the beta limit and create long pulse discharge
- Tweak the I_p higher to see how far one can push the H-mode access without running into problems
- Add an I_p ramp 50-100ms after L-H transition to go to target I_p of 0.8-0.9 MA; increase B_t if desired for additional q95
- Repeat the process starting from a fiducial, but make δ_r^{sep} positive early (e.g. 135853, which had rev. B_t), and stop the I_p ramp at 0.6-0.7 MA; repeat development to get long pulse USN H-mode with low impurity content