XP530 Update: Stability of Different ELM Types in NSTX

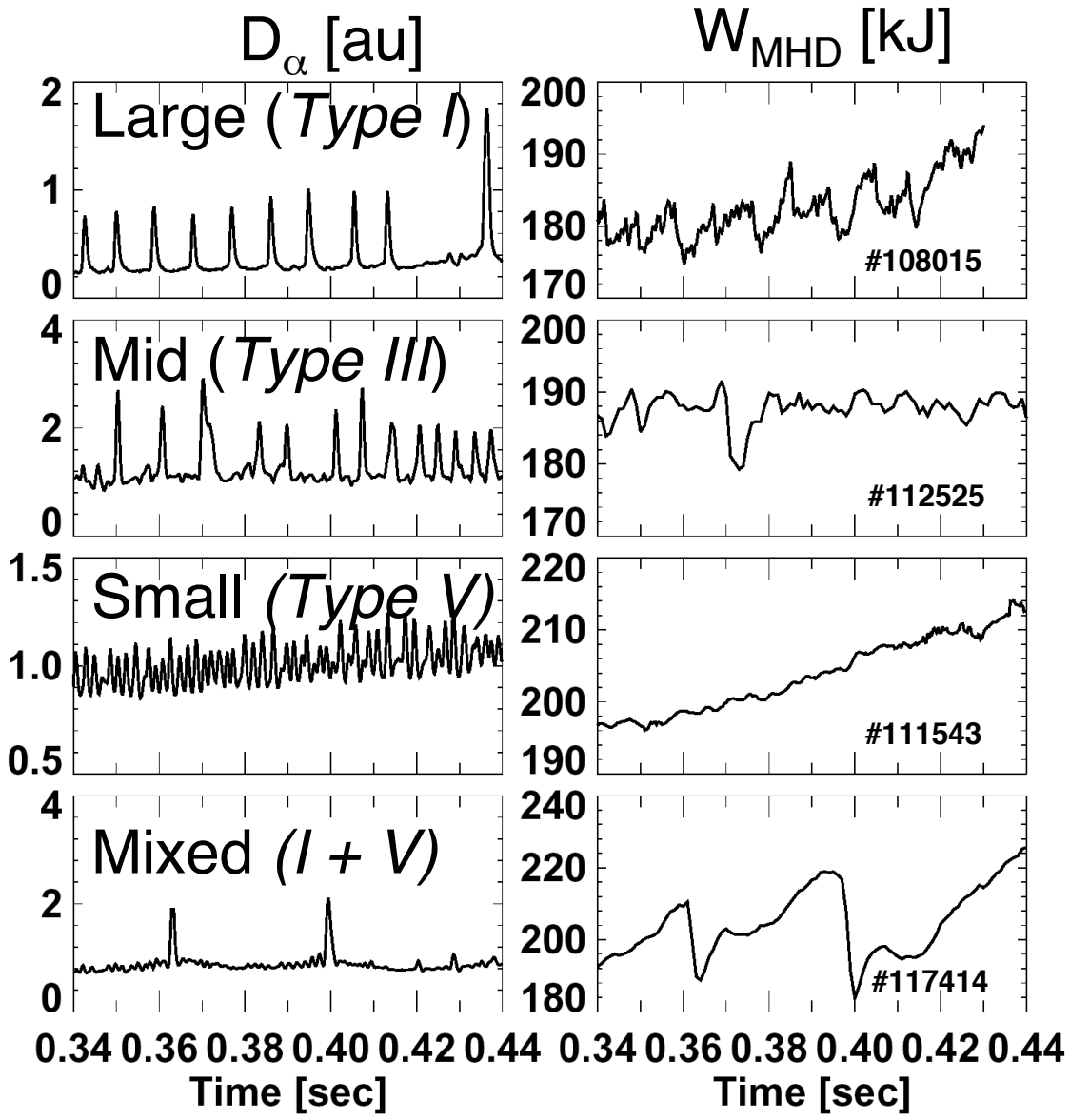
R. Maingi
Oak Ridge National Laboratory

NSTX Results Review
Princeton, NJ
Dec. 12, 2005

Execution of XP 530

- Goal: assess edge stability of different ELM types by measuring profiles just before and after ELMs
- Execution: obtained excellent before/after profiles
  - Mixed Type I + Type V ELM regime - $\delta \sim 0.4$, LSN
  - Type I ELM regime - $\delta \sim 0.8$, DN
  - New Type V ELMs with drsep $\leq$ -0.3 cm and $\delta \sim 0.8$, DN (are these really Type II ELMs?)
  - Type I with transition to Type III ELMs - $\delta \sim 0.4$, DN
- Extensive data with Nova Photonics camera viewing lower divertor, FIReTIP, and new filterscope array (collaboration with N. Brooks, GA) - assess ELM structure
- Elements presented in APS 2005 invited talk (Maingi)

Wide Range of Energy Loss per ELM Observed in NSTX



$\Delta W_{MHD}/W_{MHD} \sim$ 3-15%

$P_{heat} >> P_{L-H}$

$\Delta W_{MHD}/W_{MHD} \sim$ 1-5%

$P_{heat} \geq P_{L-H}$

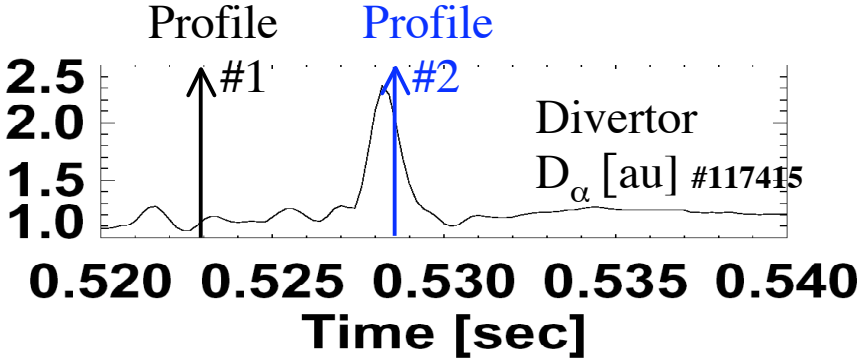
$\Delta W_{MHD}/W_{MHD} \leq$ 1%

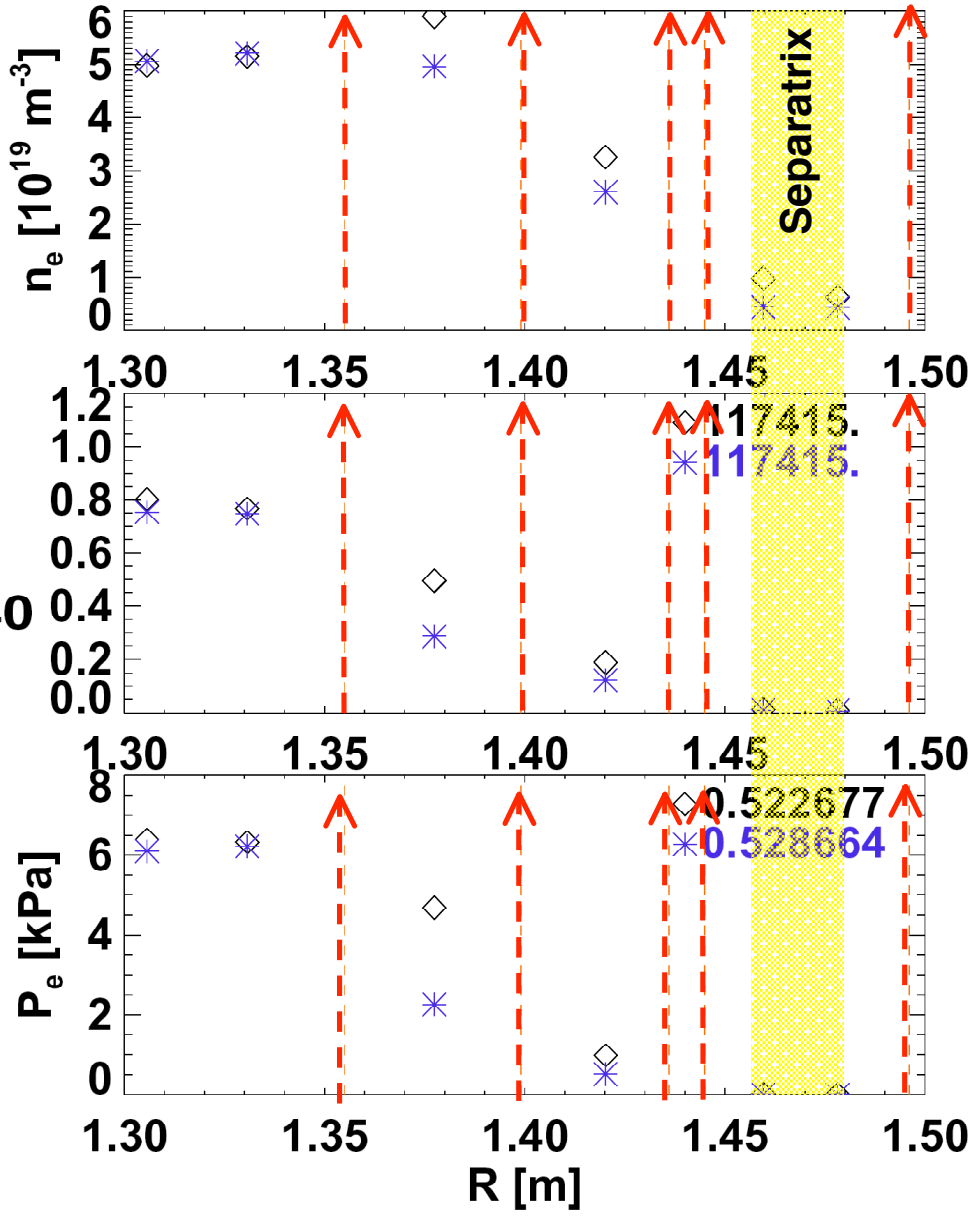
Wide P_{heat} range

$\Delta W_{MHD}/W_{MHD} \leq$ 30%

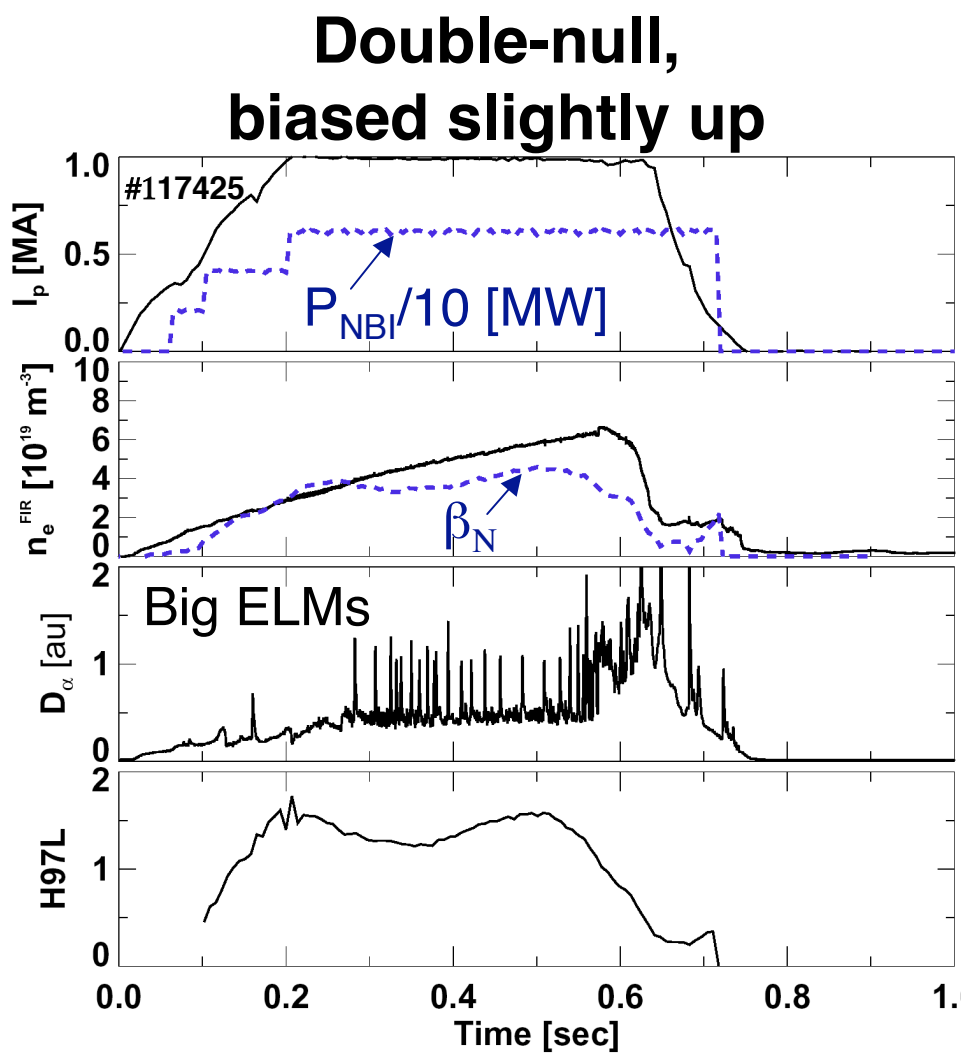
High P_{heat}, β_N

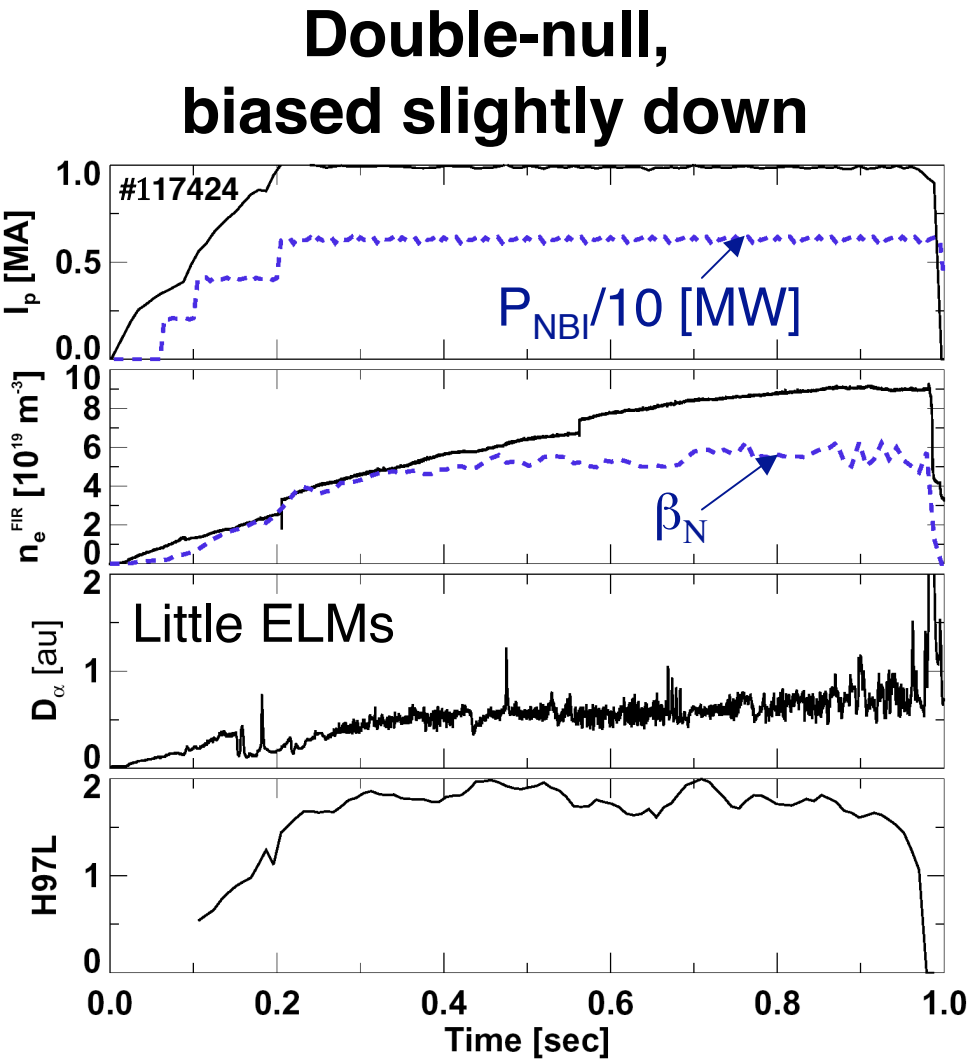
Thomson Profiles Obtained Before and After Large, Type I ELM in Mixed Type I/V Discharge





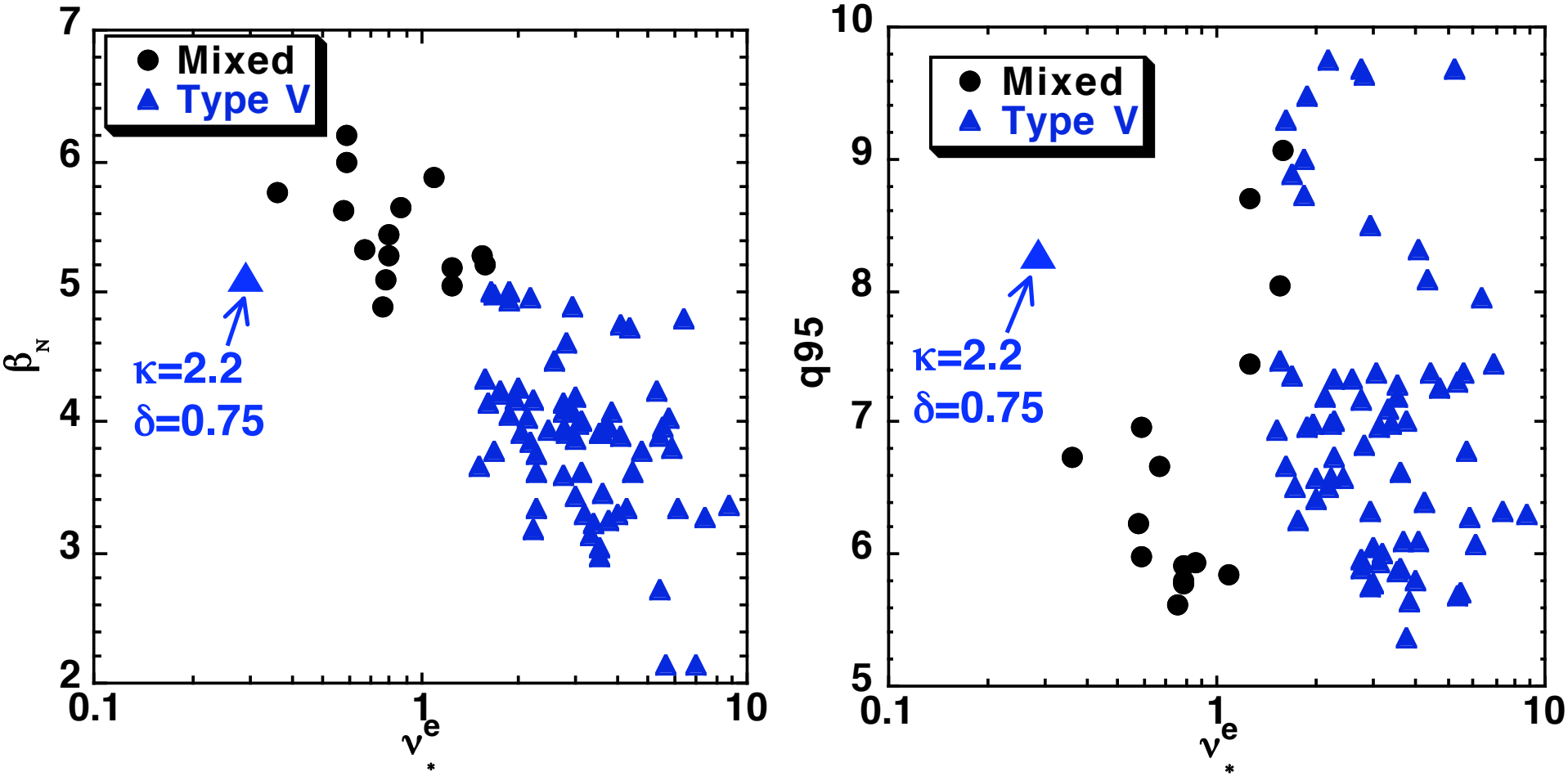
Little ELMs Observed with Slight Downward Bias in High $\delta \sim 0.7$ Double-Null Shape (Type II or V?)





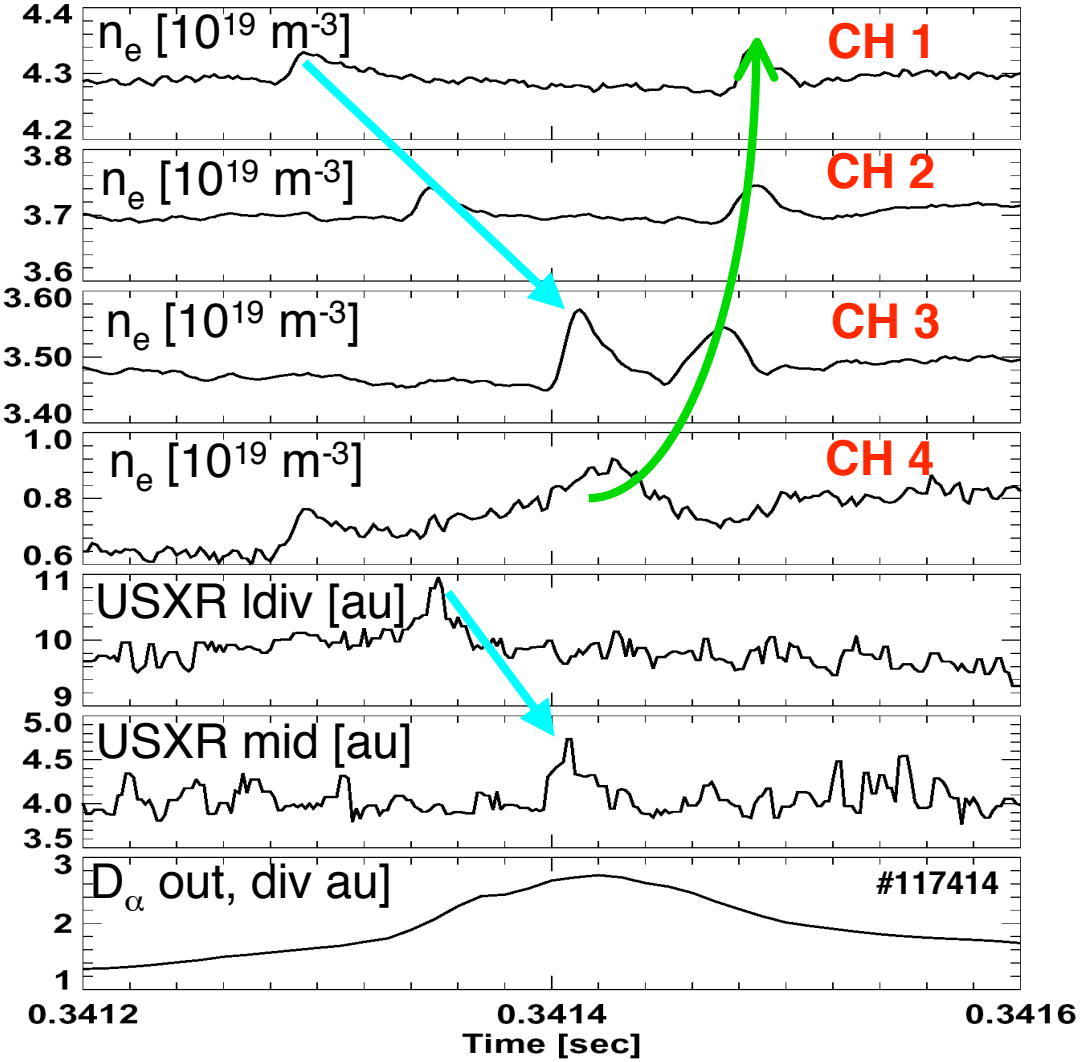
Type V and Mixed (Type I + V) ELM regimes separated by β_N and/or pedestal ν_*^e

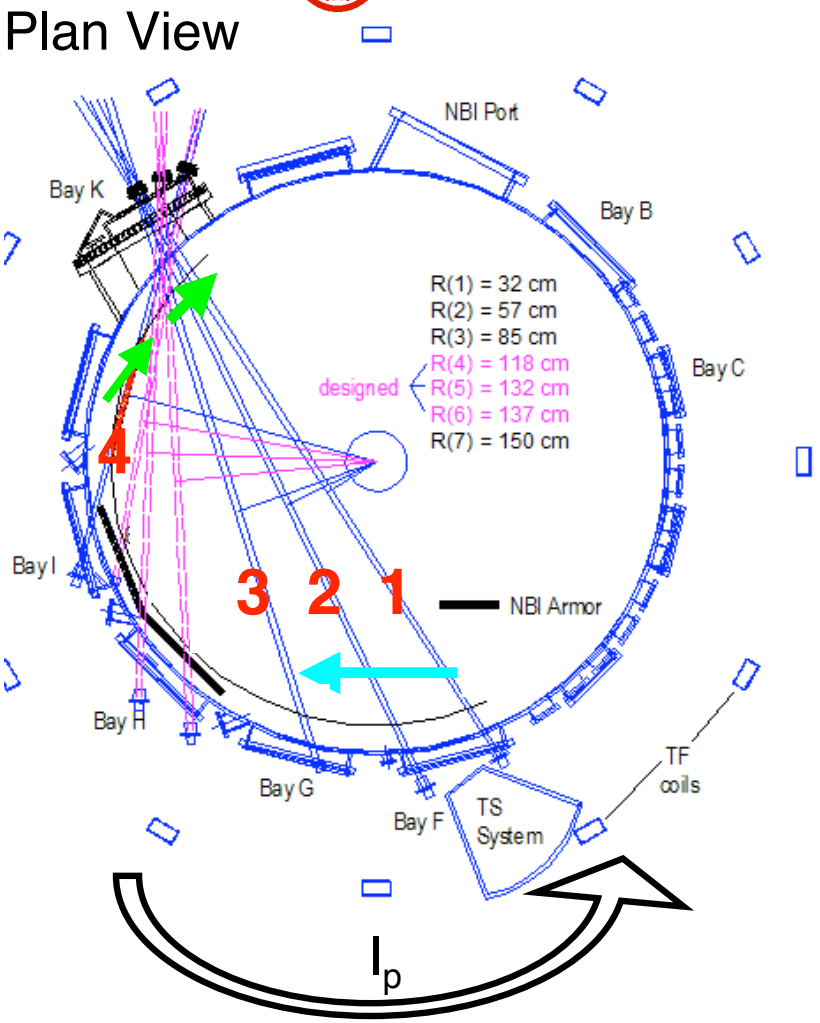
- Minimum ν_*^e for Type V may decrease with shaping



I_p: 0.6-0.9 MA, B_t=0.45 T, P_{NBI}: 2-6 MW, LSN, κ=2.0, δ=0.4

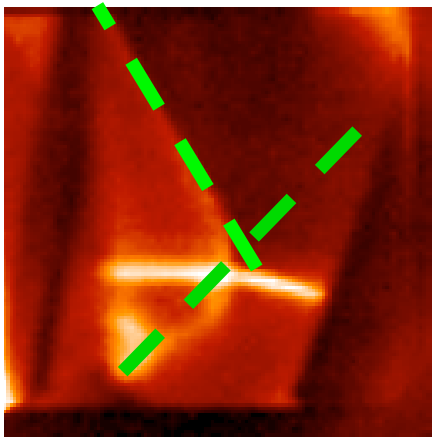
Filamentary structures observed in interferometry, propagating counter to plasma current



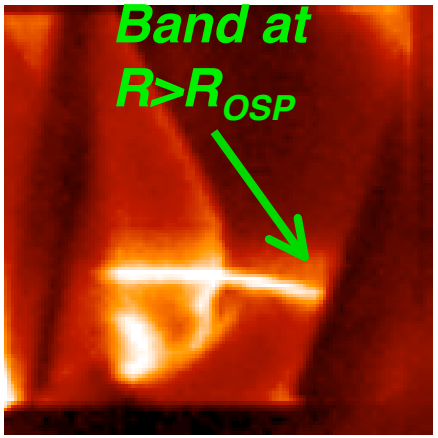


- Perturbation extends ~1/3 toroidal circumference and propagates ≤ 1 toroidal revolution

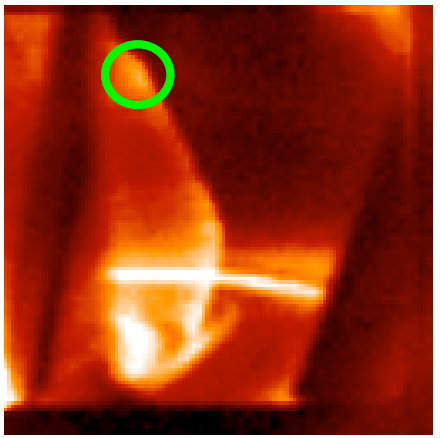
Type V ELM observed as a single (or double) propagating perturbation in the scrape-off layer



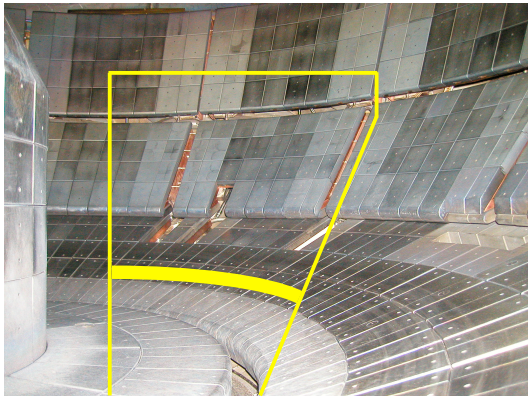
254.707 ms
(0.000 ms)

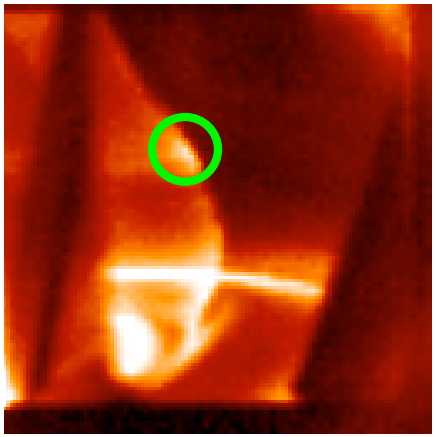


255.347 ms
(0.640 ms)

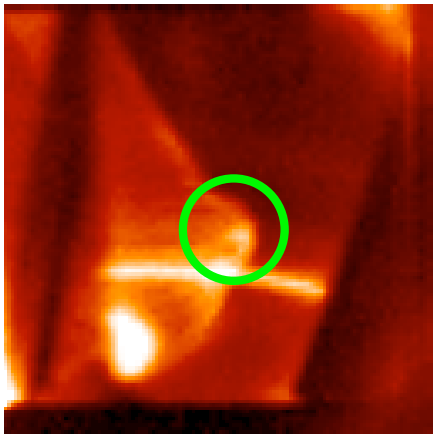


255.517 ms
(0.810 ms)

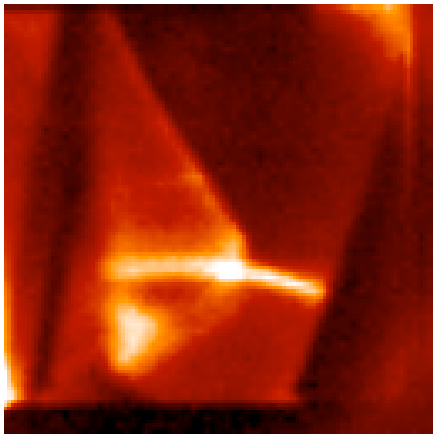




255.577 ms
(0.870 ms)



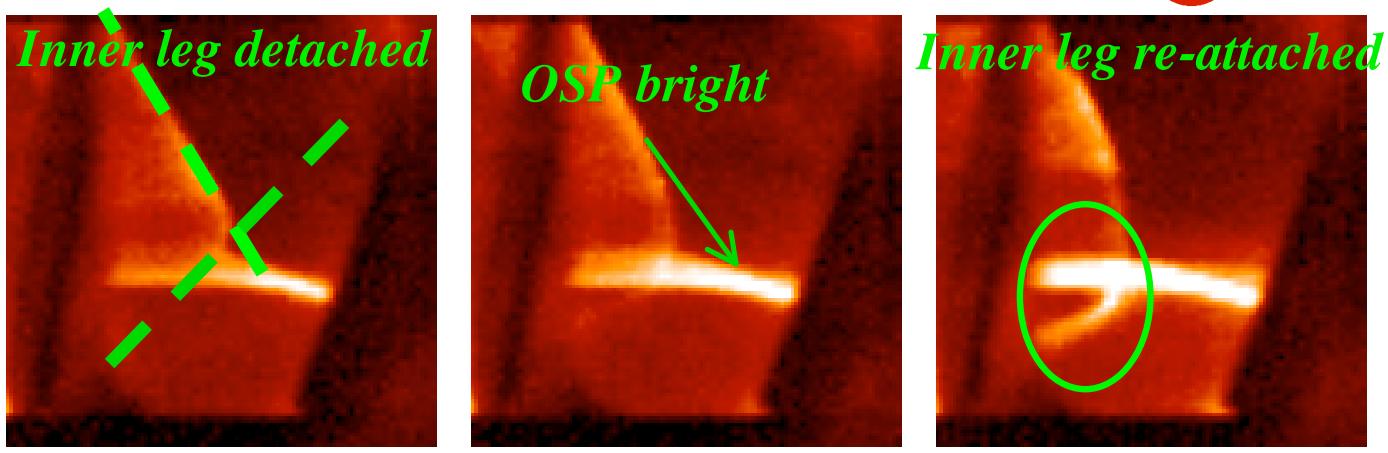
255.717 ms
(1.010 ms)

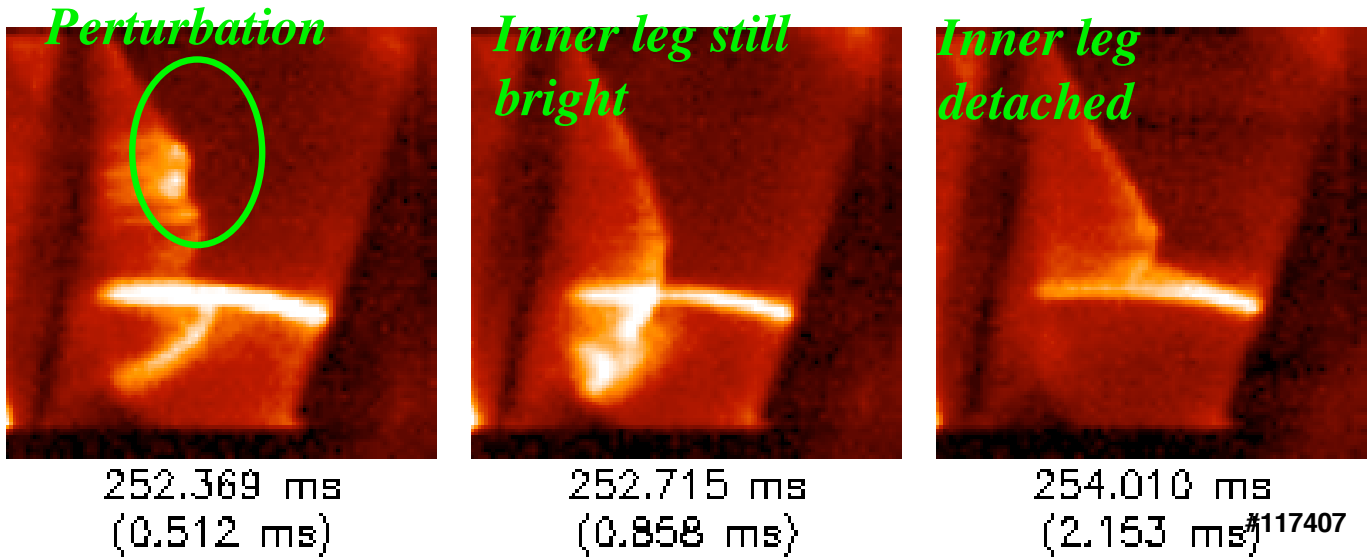


256.217 ms
(1.510 ms)

#117407

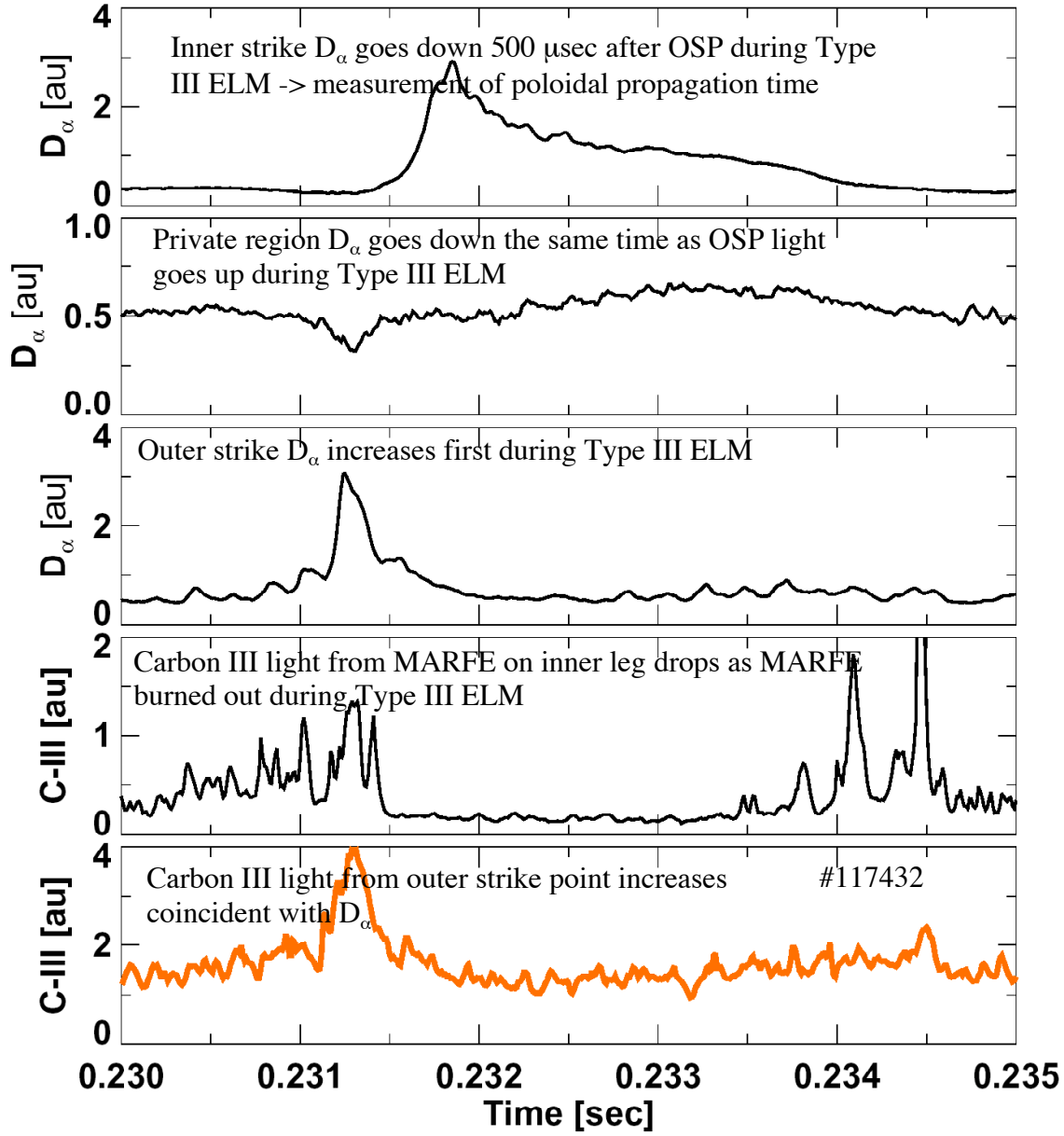
Type III ELM consists of multiple phases





#117407

New filterscope system allows analysis of poloidal propagation time of ELM perturbation



* Collaboration with Neil Brooks, GA

XP 530 Analysis Plan

- Analyze pedestal characteristics with new edge Thomson channels
- Analyze edge stability with ELITE and DCON (others?); former requires adaptation of GA kinetic EFIT tools to NSTX (Osborne, Sabbagh in progress)
- Analyze SOL characteristics of ELMs, using filterscopes and Nova Photonics camera