# XP529 Update: Dependence of the H-mode Pedestal Structure on Aspect Ratio DIII-D/MAST/NSTX Joint Experiment

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NSTX Results Review
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# Investigation of R/a dependence of pedestal could aid in understanding of multi-machine comparisons


- Previous studies from JT-60U(Hatae) indicate aspect ratio dependence of temperature width
- Recent JET/JT-60U similarity expt. yielded different pedestal/ELM regimes (Saibene, PPCF 2004)
- MAST found poor correlation with empirical scaling of $T_e$ width in pedestal database (Kirk, PPCF 2004)

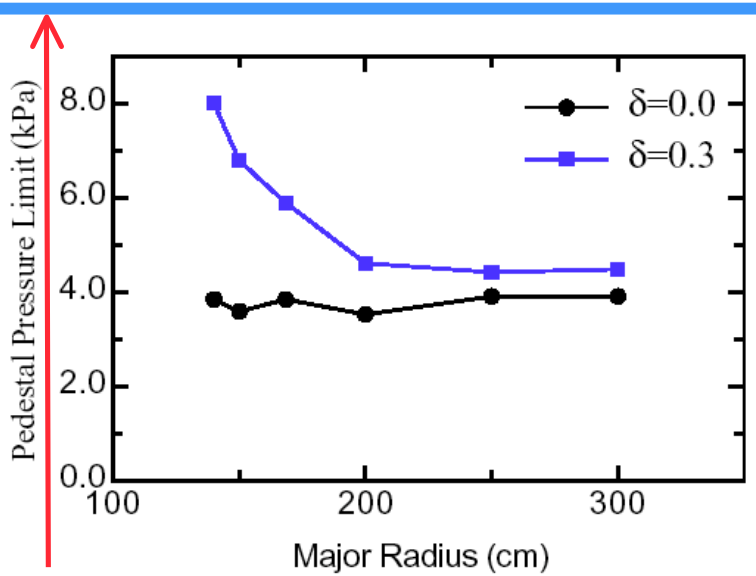
  $\Rightarrow$ What is the aspect ratio dependence of pedestal width?

- NSTX and MAST have many of the same shape parameter windows as DIII-D (minor radius, $\kappa$, $\delta$)
- Major radius of both machines ~ 1/2 of DIII-D

  $\Rightarrow$ ideal aspect ratio scan candidates

# Edge Stability Calculations Show Aspect Ratio Dependence of Maximum P (P') in Certain Shapes

## Parameter Scans: Aspect Ratio




MAST, NSTX

P. Snyder, PPCF 2004

- Aspect ratio varied via R scan at $B_t$=2T, $I_p$=1.225 MA , $n_{ped}$=8 $10^{13}$ $cm^{-3}$, a=0.603m, κ=1.77, δ=0.0, 0.3, Δ=5%
- q and epsilon decrease ~linearly with R (constant a)
- For δ=0 "Poor shaping" case, pped is relatively insensitive to R
- Stronger shaped case (δ=0.3), 2nd stability closed off by low q for high aspect ratio, dramatic decrease in pped with R [pped~(a/R)^0.9±0.2]
- Again complex multi-parameter dependencies enter, complicating parameterization

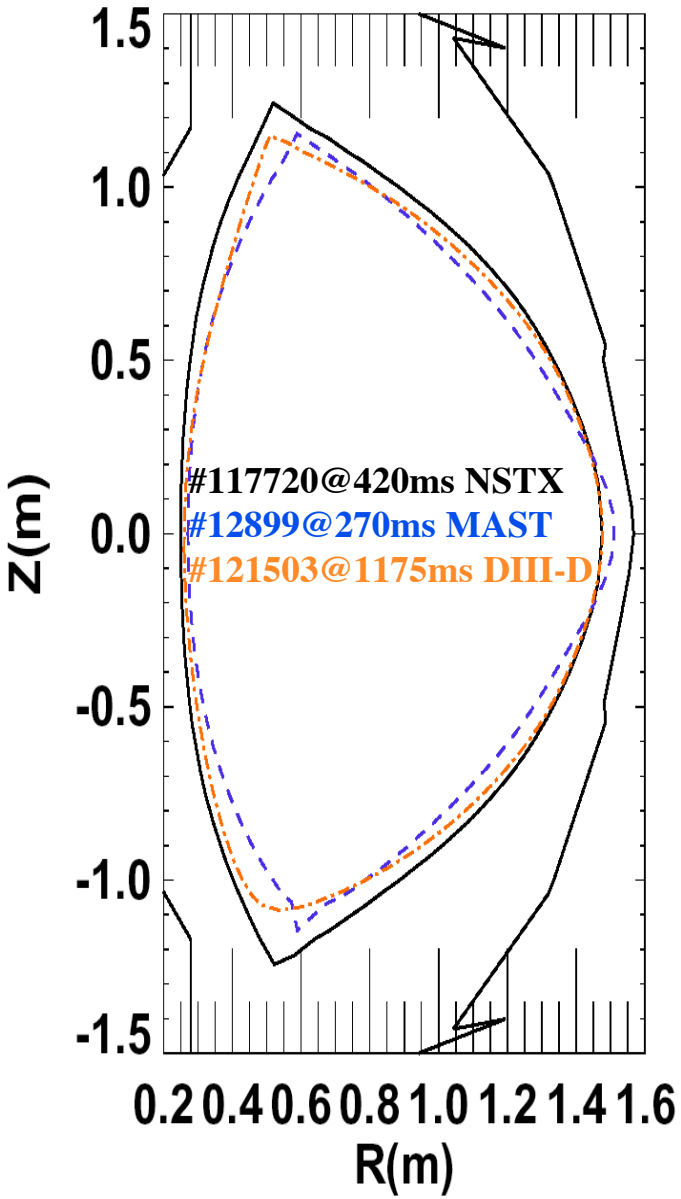
# Goal and Execution of Experiments

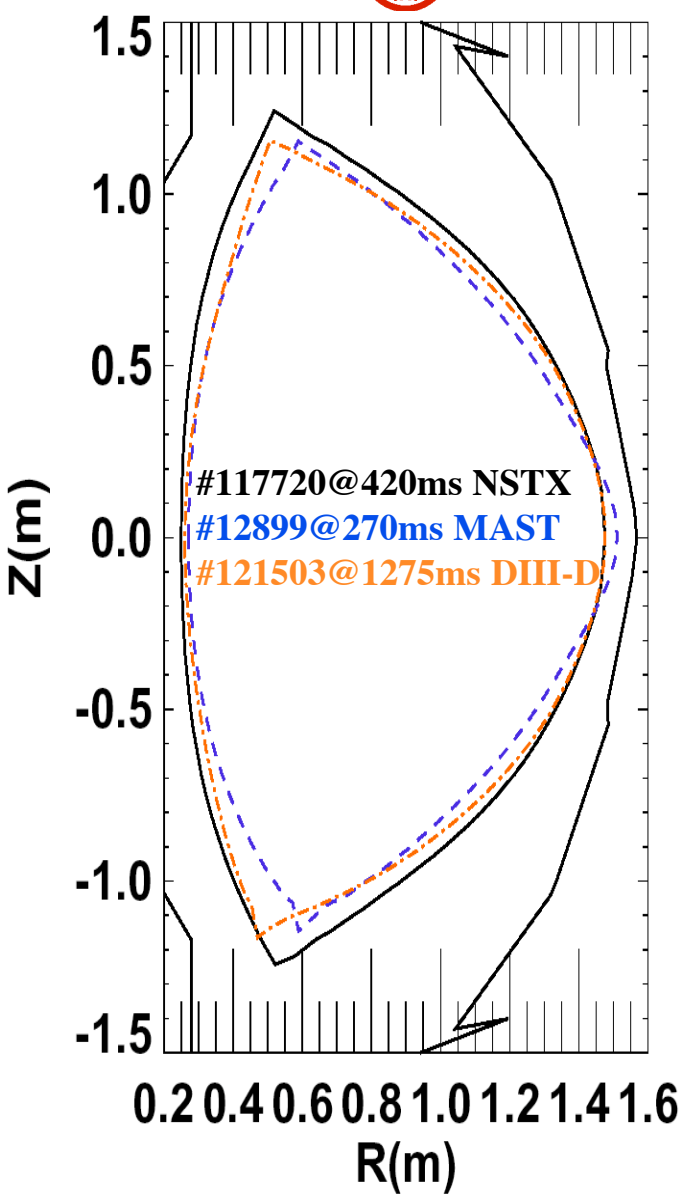
Goal: assess the effect of aspect ratio and wall proximity on pedestal height, widths and gradients in ELMy H-mode

Status: good data obtained from all machines

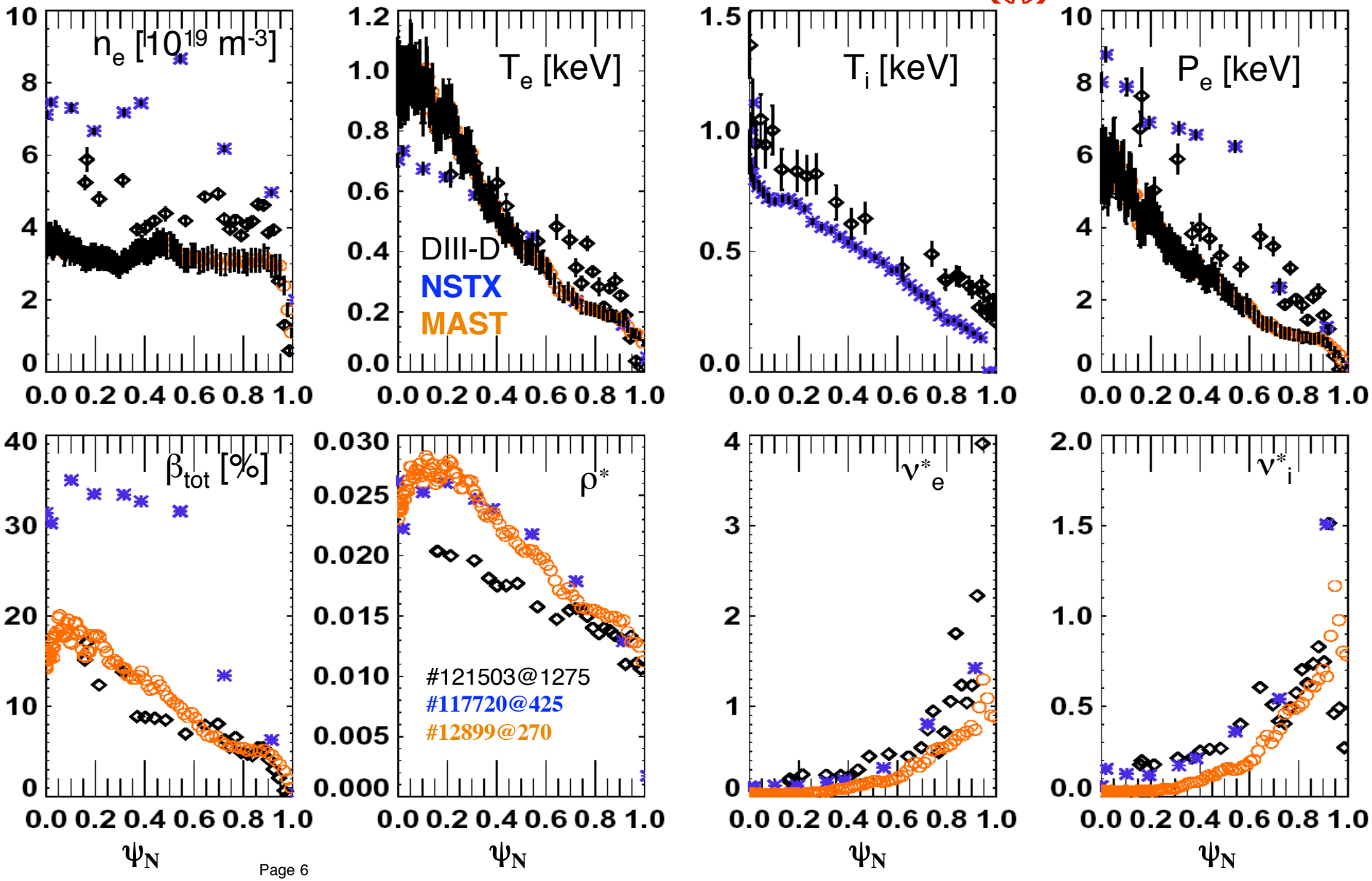
- DIII-D: Outboard pedestal top $\nu^*_e \sim 0.5–1$, $\rho^* \sim 0.011$, and local $\beta_{tot} \sim 4$-5% achieved at apparent edge $\beta$ limit
  - ➢ Pedestal/stability analysis in progress
- MAST: dedicated experiments to create a larger minor radius plasma
  - ➢ Pedestal comparison shows widths decrease with a/R!
- NSTX: dedicated experiment to create low and high squareness shapes
  - ➢ Pedestal analysis to commence 1/2006
  - ➢ Desire data over wider collisionality - in 2006 run

# Similar shapes achieved in DIII-D/MAST/NSTX pedestal similarity experiment

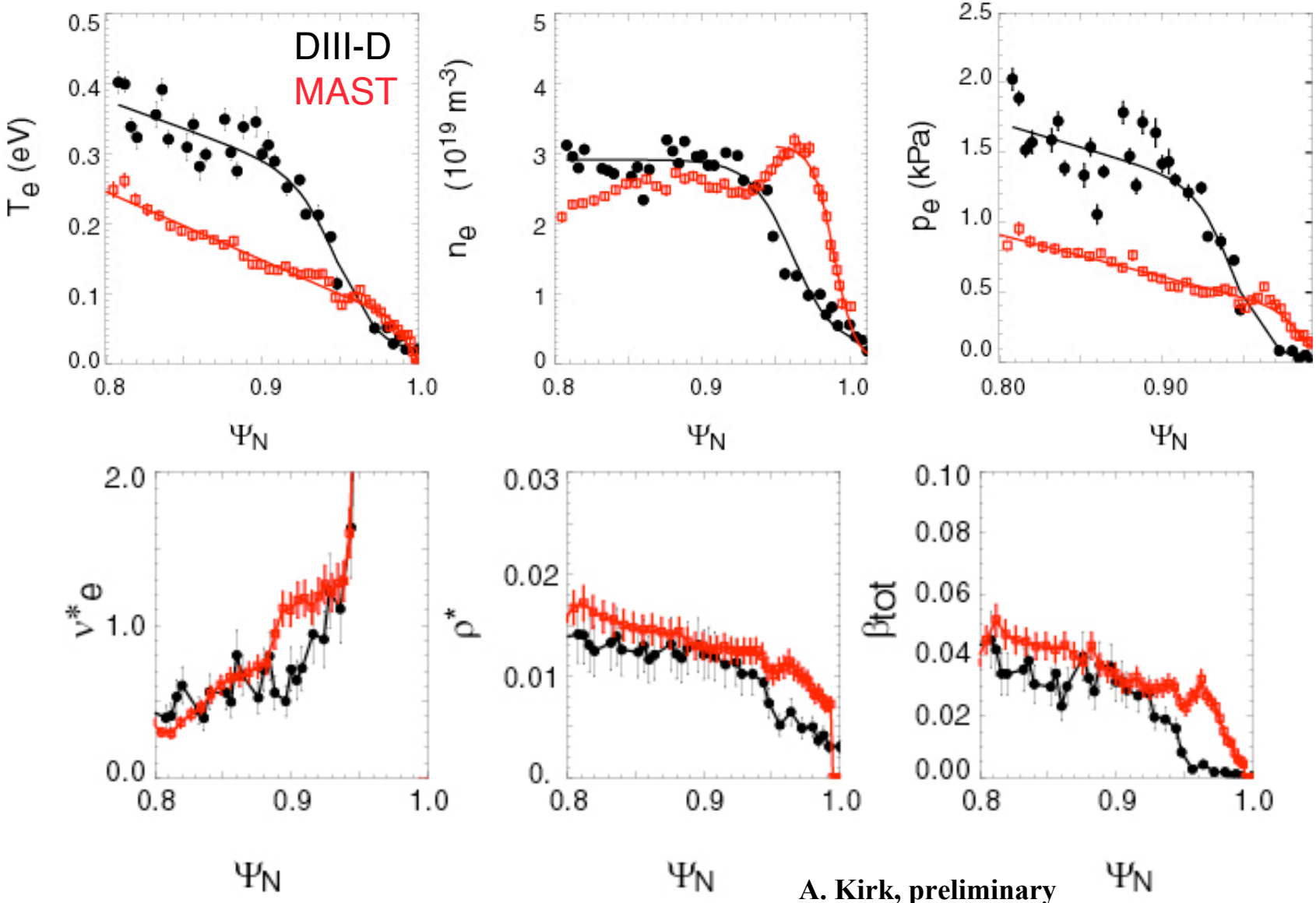


# Similar Dimensionless Profiles Achieved in Edge Plasma in DIII-D/MAST/NSTX Pedestal Similarity Experiment



# Pedestal Width in DIII-D Larger Than in MAST!? (Larger width here than at higher $B_t$ for DIII-D)




A. Kirk, preliminary

# XP 529 Analysis Plan

DIII-D

- Analyze widths relative to ELM cycle for 2 squareness
- Finish kinetic EFITs and edge stability analysis with ELITE
- Assess need for lower $\delta \sim 0.5$ shape

MAST

- Good data at $\nu^*_{e,ped} \sim 1$; obtain $\nu^*_{e,ped} \leq 0.5$ with new PINI
- Assess edge stability analysis plan

NSTX

- Good data at $\nu^*_{e,ped} \sim 1$; obtain $\nu^*_{e,ped} \leq 0.5$ by achieving target shape early in discharge and/or using Li pumping
- Analyze pedestal widths with new edge Thomson channels
- Analyze edge stability with ELITE and DCON (others?); requires adaptation of GA kinetic EFIT tools to NSTX (Osborne, Sabbagh in progress)