

Shape Effects on the Pedestal Structure in ELMy H-mode

Proposed XPs

Complete triangularity + field scans - 1 run day

Elongation at fixed aspect ratio - 0.5 run day

Aspect ratio at fixed elongation - 0.5 run day

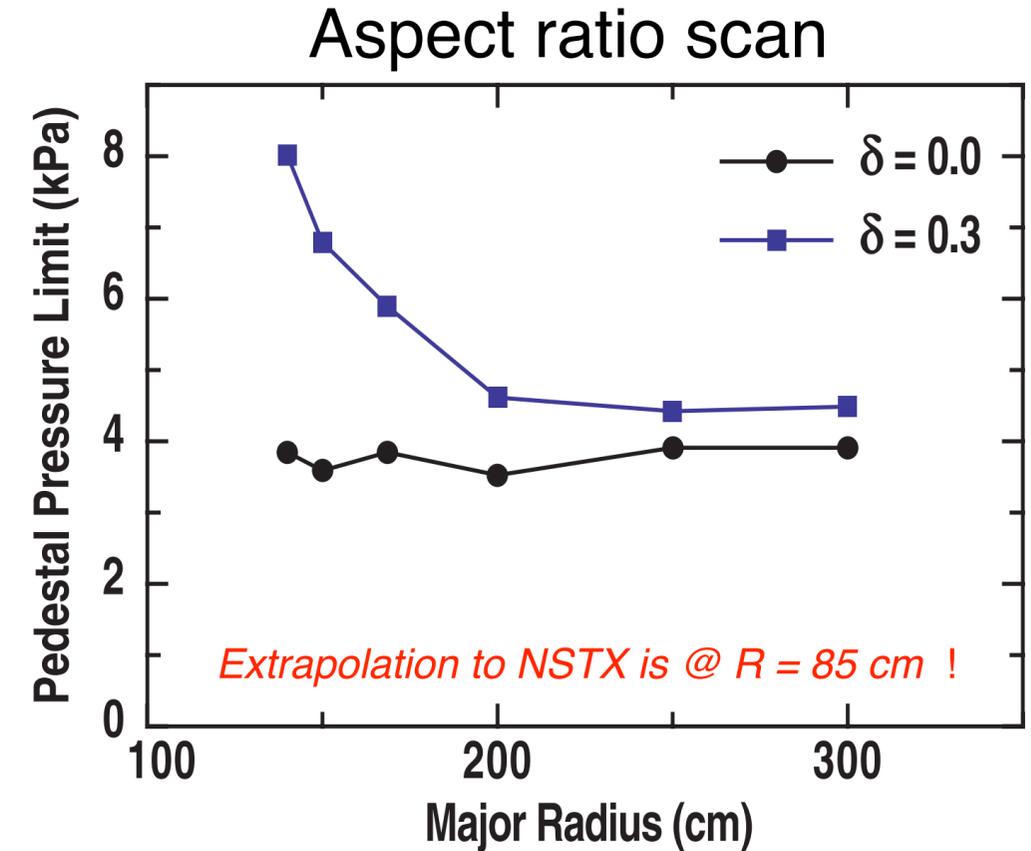
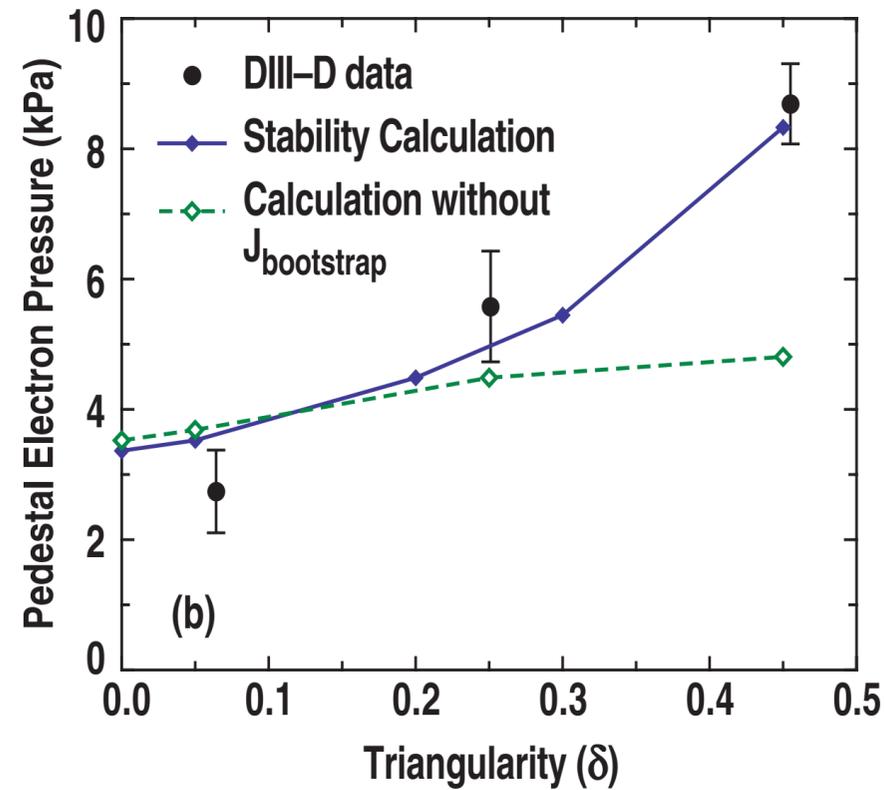
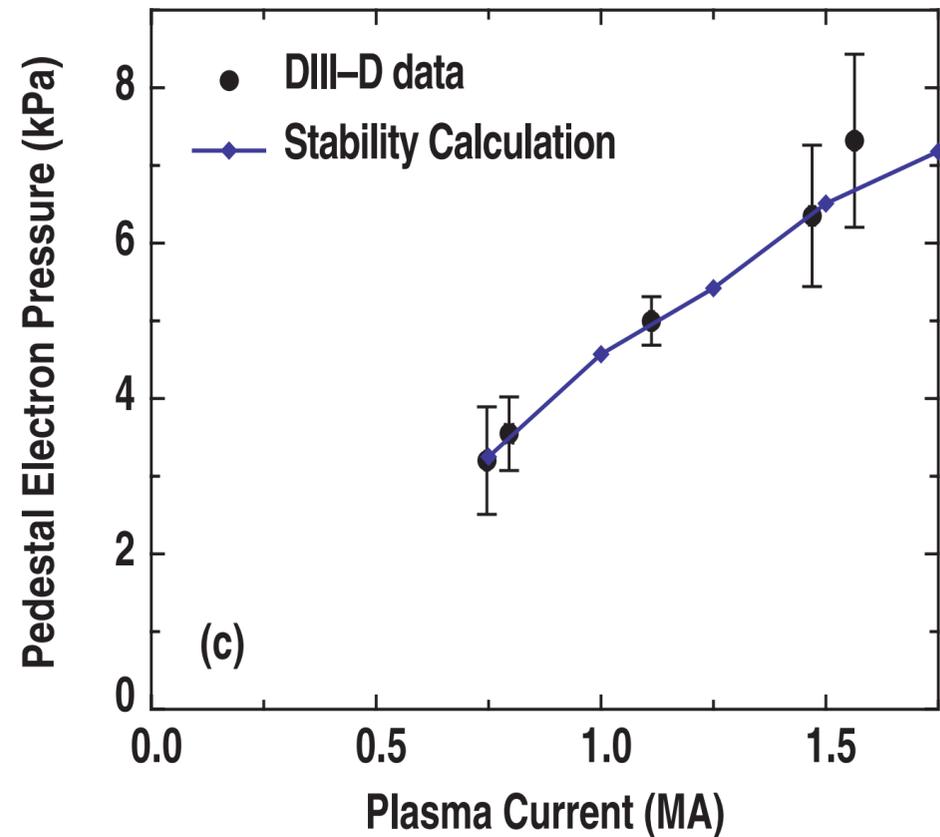
A. Diallo, R. Maingi, S. Gerhardt,

A. Sontag, E. Kolemen

and others.....

NSTX-BP Forum 2011-12

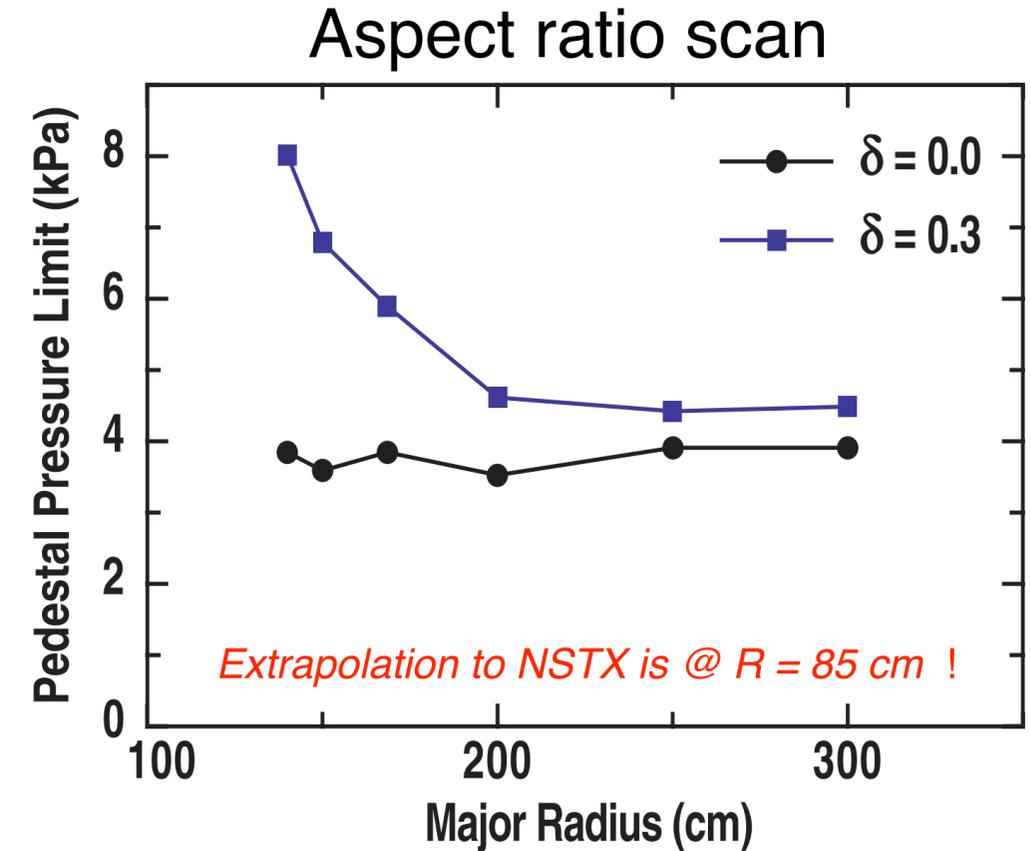
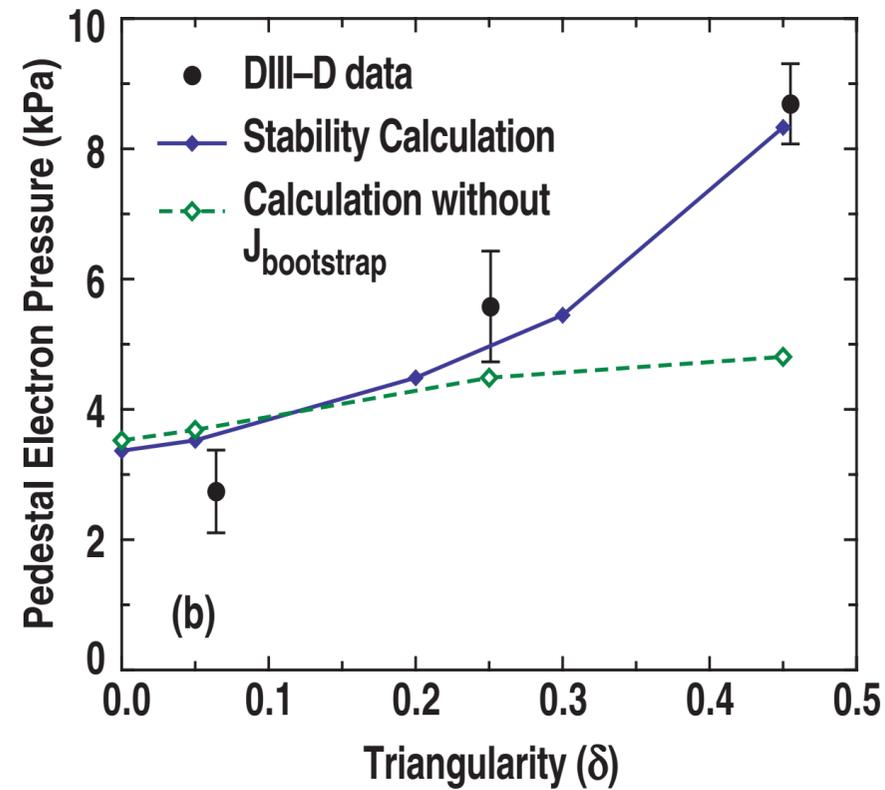
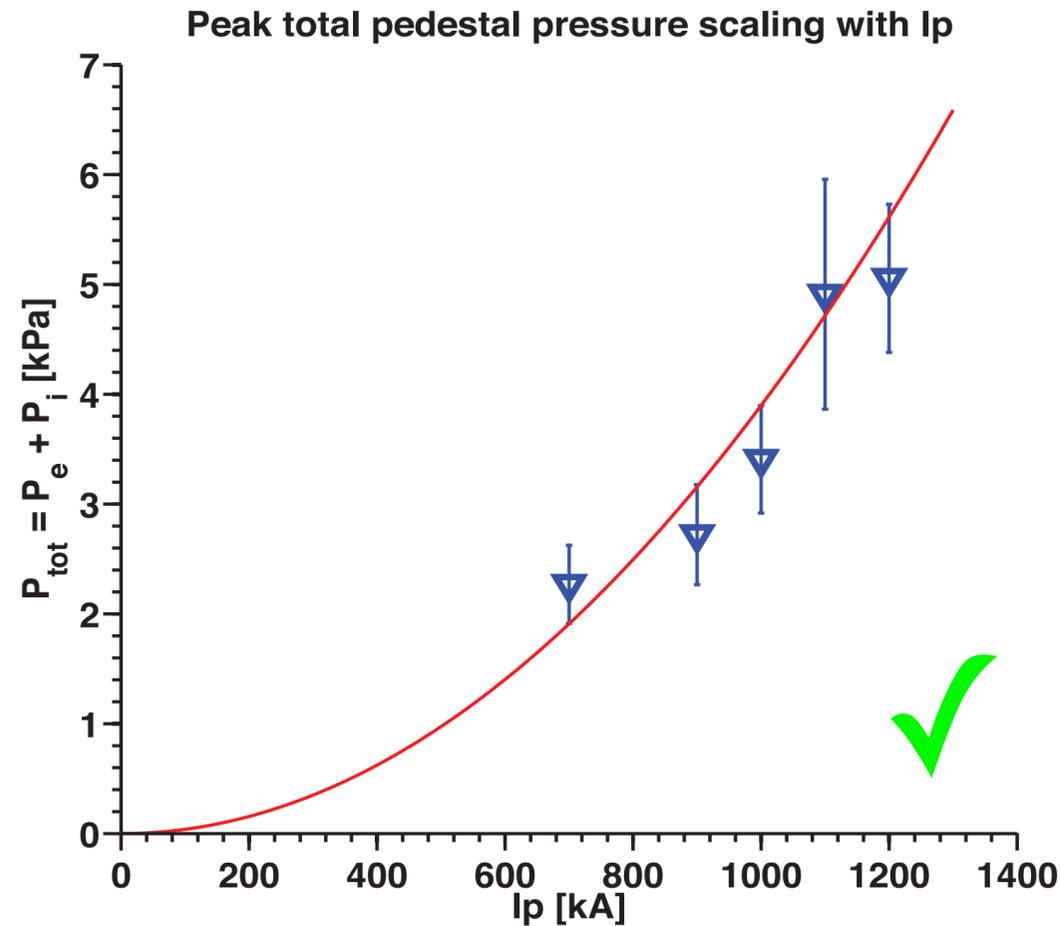
Background: Overview



- ELITE predicts enhanced edge stability at low R/a
 - ELMy discharges in NSTX at the kink/peeling boundary from ELITE R. Maingi, PRL, 103 (2009)
- NSTX has shown the pedestal height increases with triangularity and plasma current (I_p) consistent with higher R/a tokamaks
 - Consistent with ELITE modeling

P. Snyder, PPCF, 46 (2004)

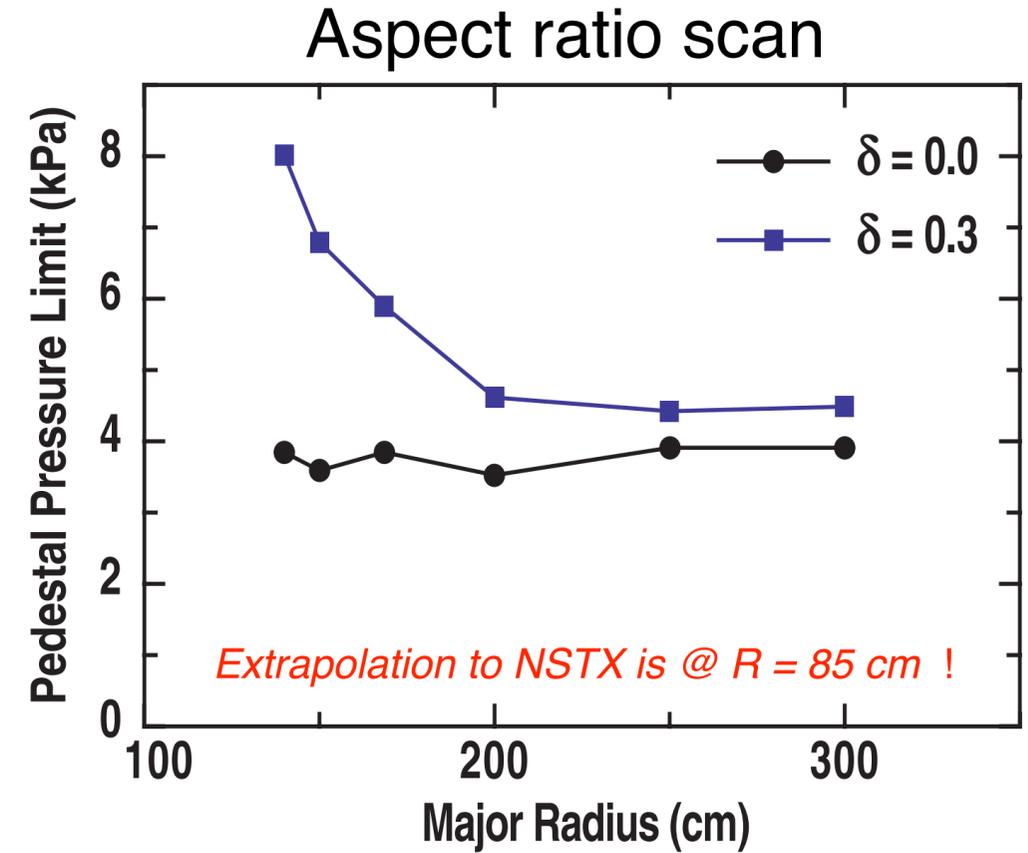
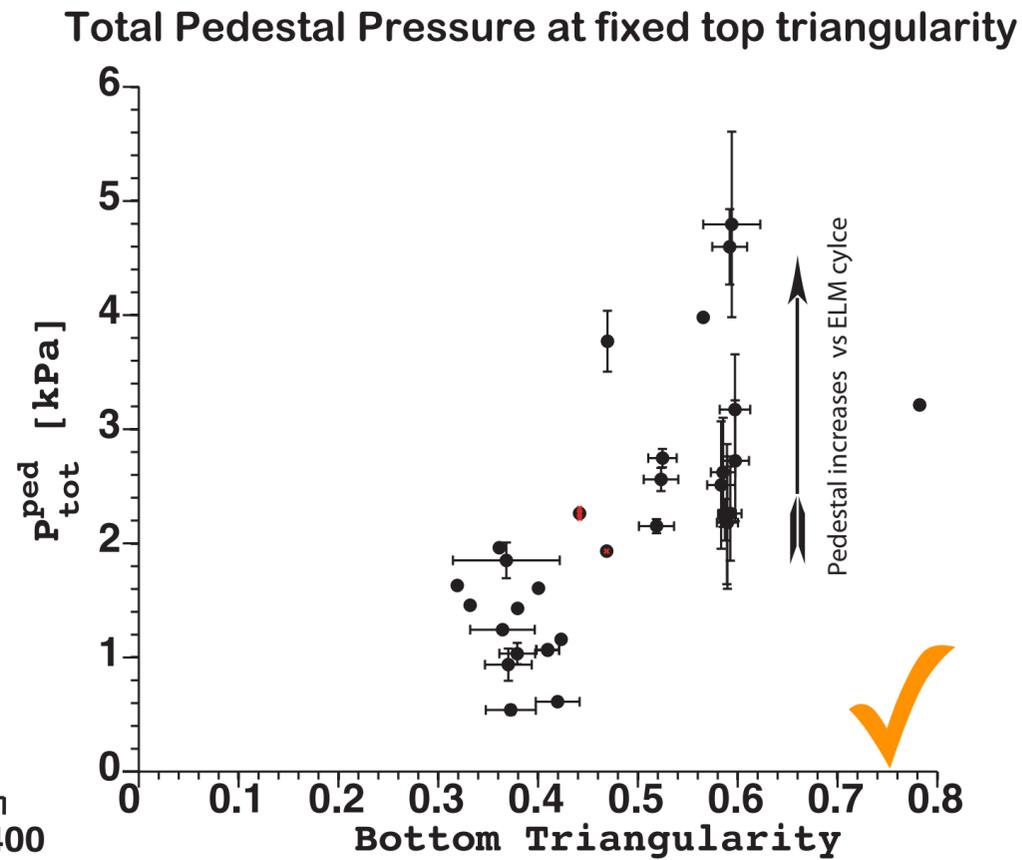
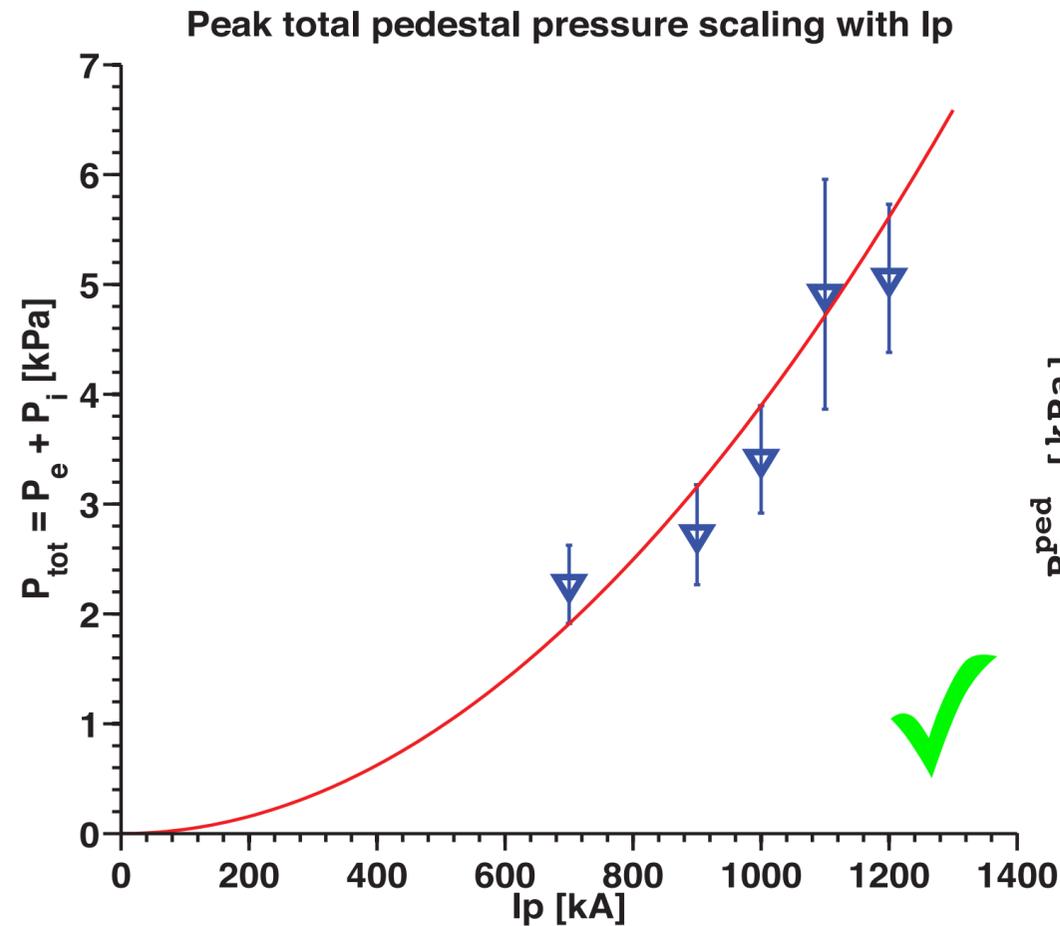
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Understand the pedestal structure prior to the onset of ELMs as a function of key plasma parameters as part of JRM11

- FY10 we completed the plasma current scan and documented the pedestal dynamics
 - Pedestal height scales with I_p^2 consistent with other tokamaks.
 - The dynamical evolution of the pedestal height during an ELM cycle is documented.
 - Observed no clear dependence of the pedestal height with toroidal field.
need to repeat the field scan in FY11 at high plasma current [6 shots]

- Systematic investigation of shape effects on both the pedestal structure and peeling-ballooning stability.

Shaping is known to have an effect in MHD stability

Complete pedestal structure vs triangularity to determine the pedestal width (make use of add'l MPTS).

How does the pedestal structure depend on the bottom triangularity? Pedestal height increases

Is the pedestal buildup during an ELM cycle depending on the shaping? Not enough data at low triangularity

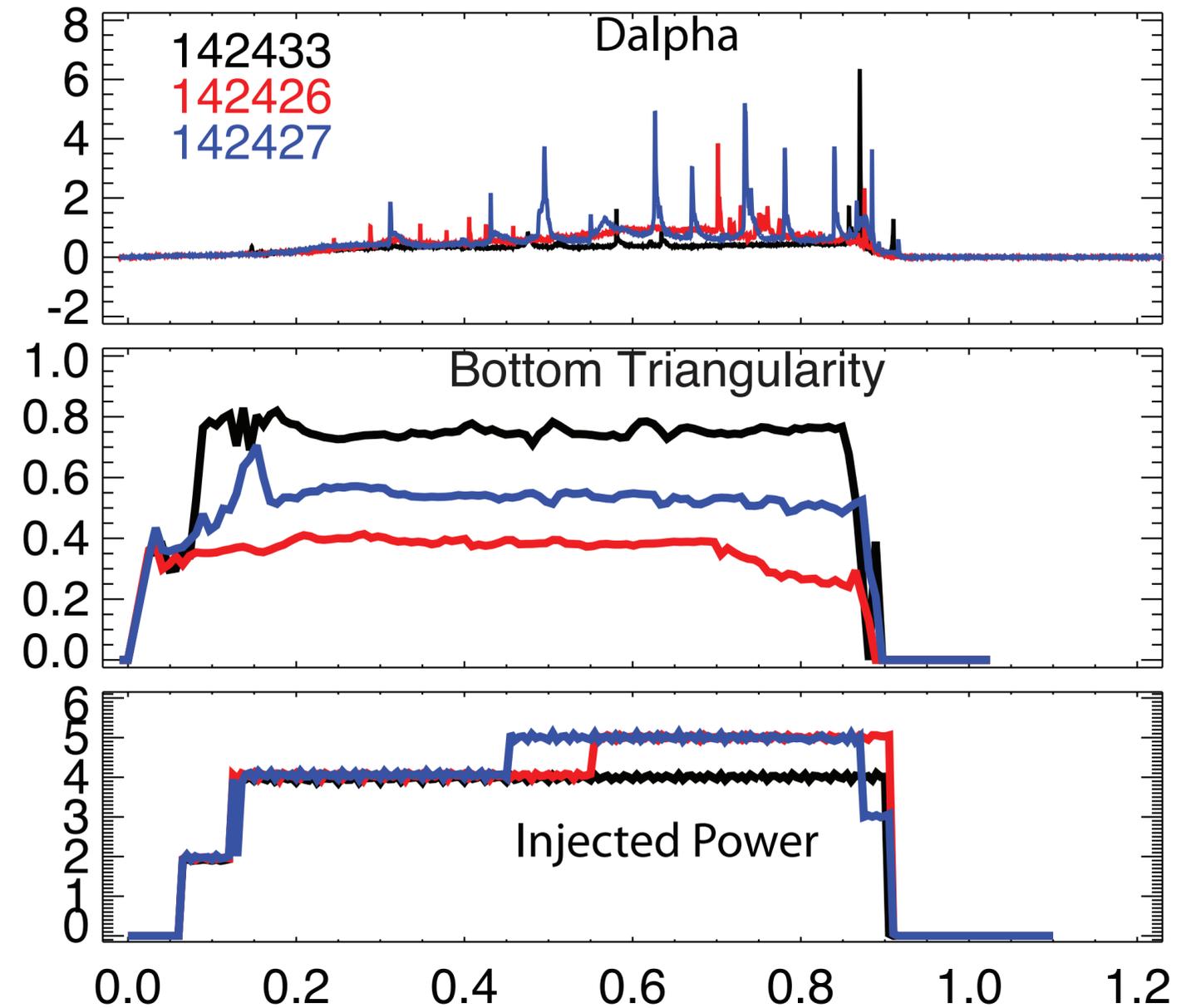
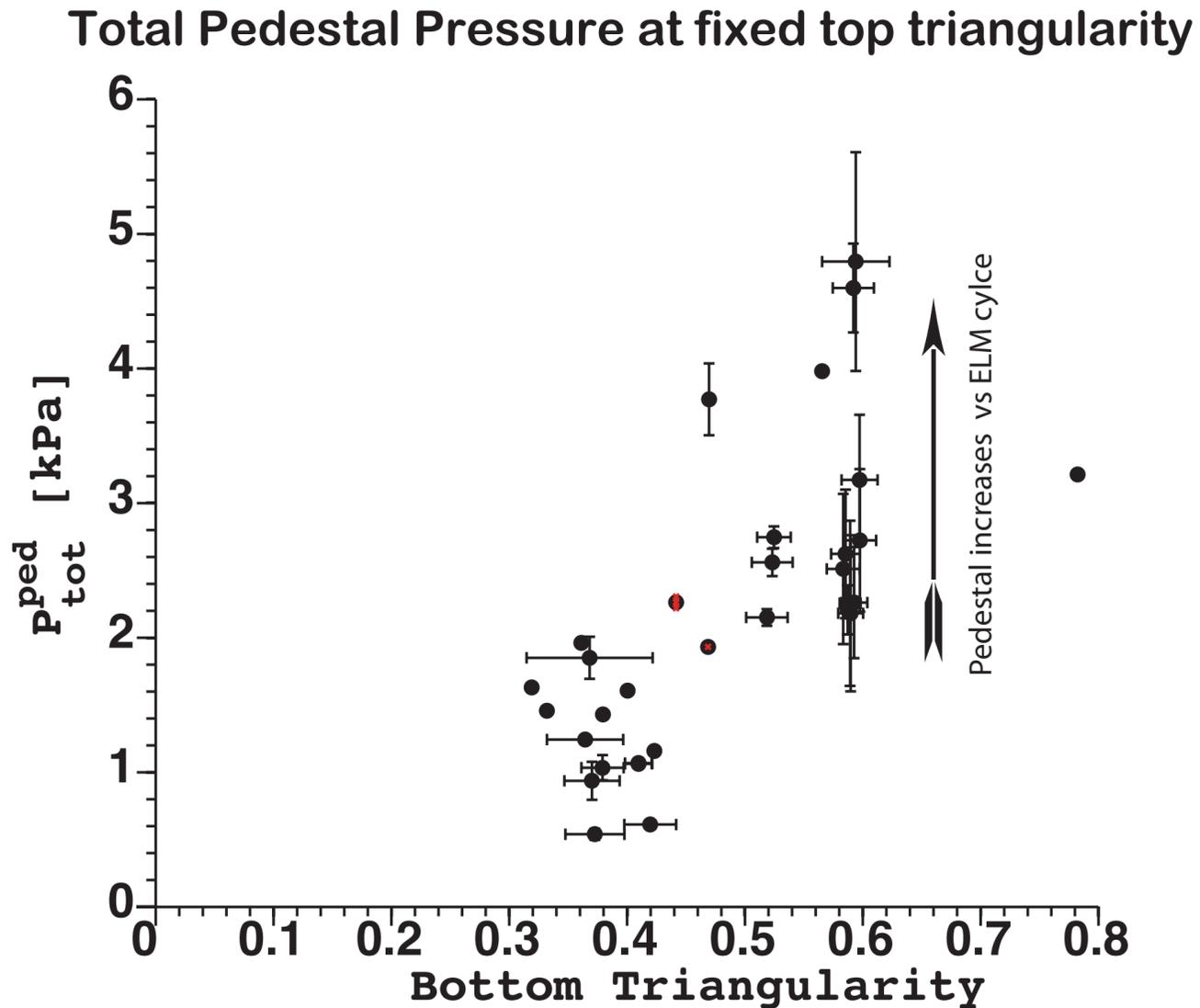
Can we determine the range of values in triangularity enabling to transition from the peeling to peeling-ballooning dominated drive in the stability curve?

What are the fluctuation characteristics during an ELM cycle for high and low triangularity?

Elongation at fixed aspect ratio (to be developed in ASC)

Aspect ratio effects at fixed elongation on the pedestal

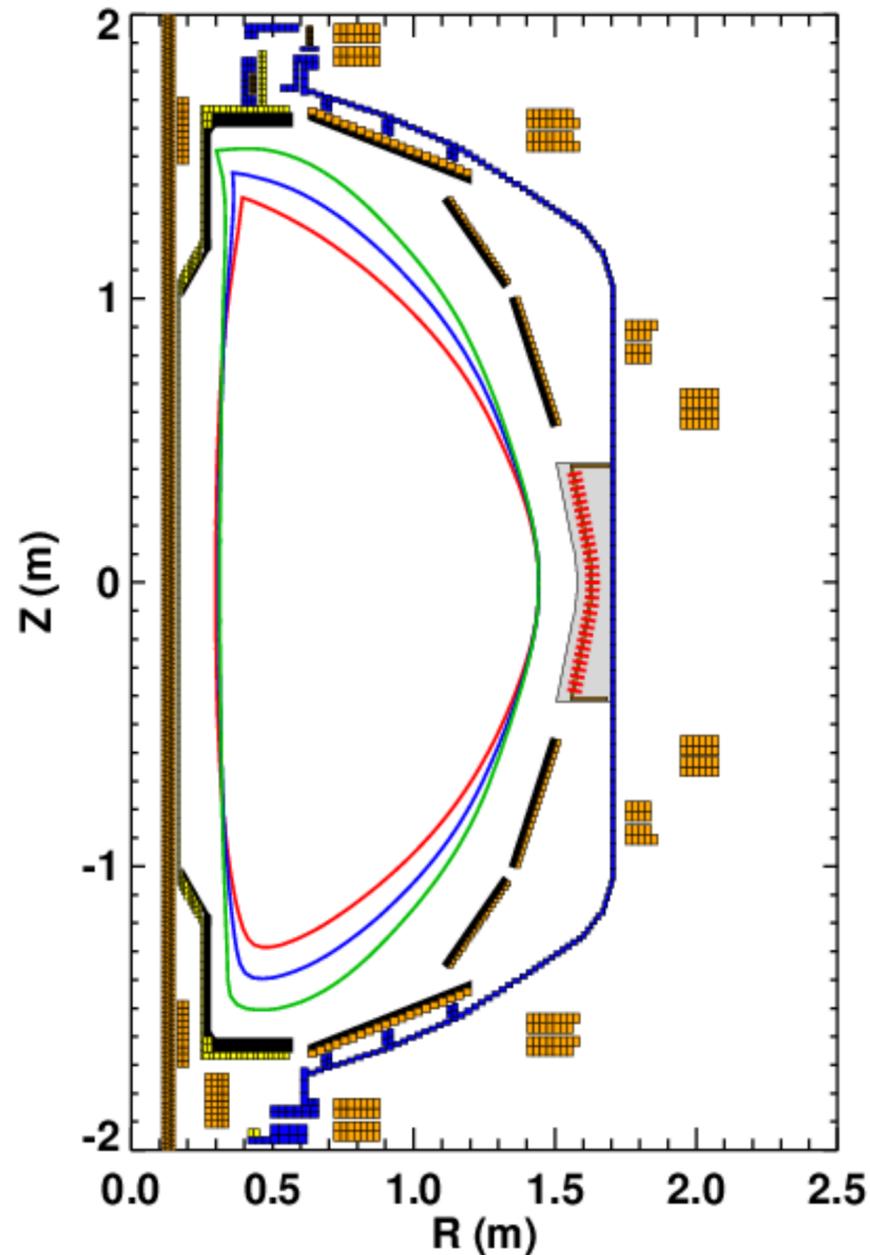
Pedestal pressure height increases with triangularity



Need to determine the pedestal width: requesting 1 day to complete the scan and perform the toroidal field scan at medium current with improved MPTS system.

Effects of Elongation on Pedestal Structure

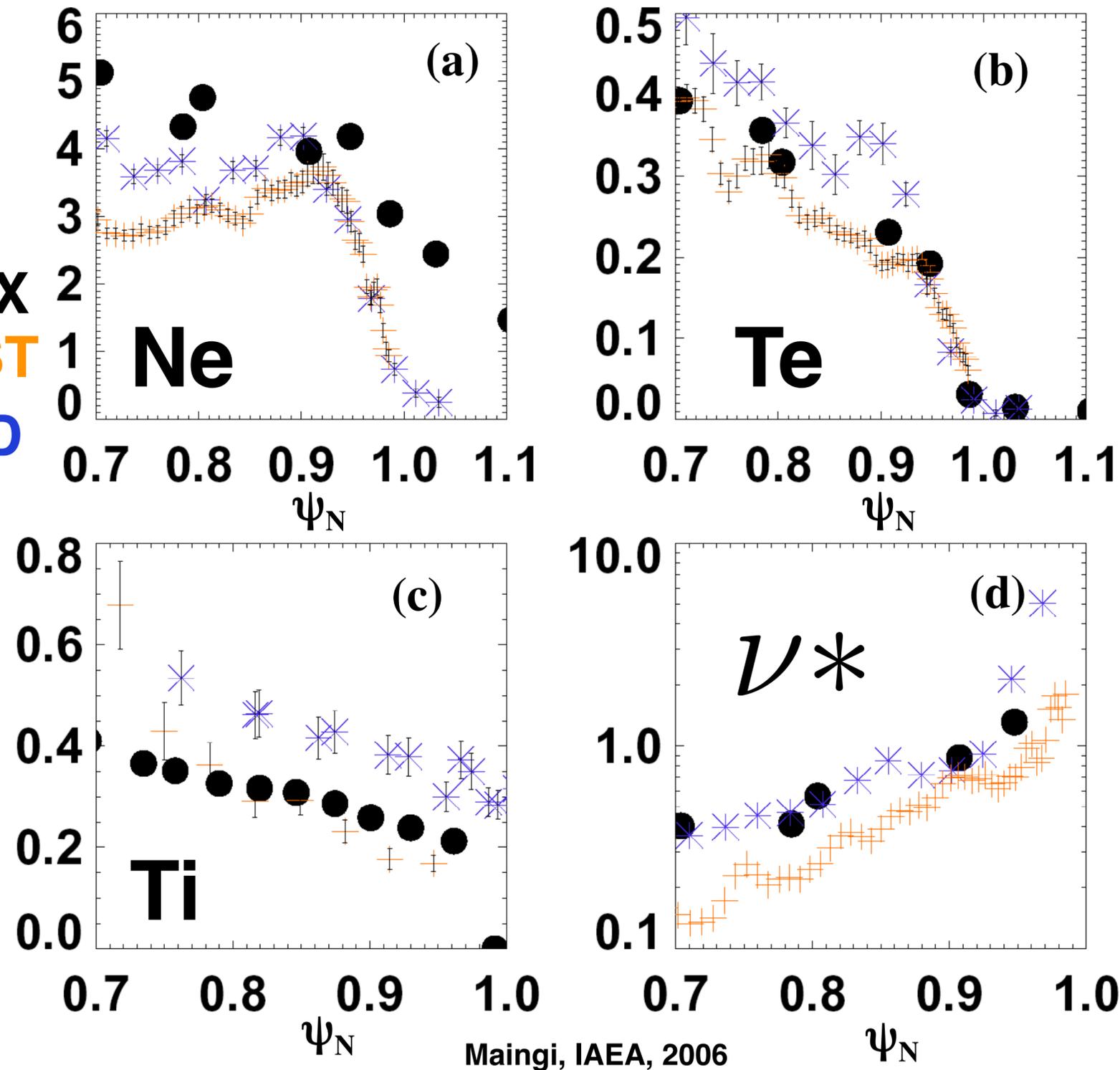
- κ scan at fixed aspect ratio.
- Plasma height changes with fixed inner and outer gaps.



- XGC0-ELITE has found that the effects of triangularity are somewhat weaker compared to the elongation. [Pankin IAEA 2010 THC/P3-05]
- Previous NSTX studies show clear effects of the triangularity on the pedestal height
- What is the relative strength of the two knobs?
- Use the developed scenario from SPG' XP
- Perform elongation scan for low I_p keeping the outer gap fixed.
- Dial down lithium deposition rate to generate ELMy discharges.
- $I_p = 700 - 800$ kA and $\kappa \sim 2.3 - 2.6$
- Request 0.5 day

Little difference in the pedestal structure was observed during cross machine comparison

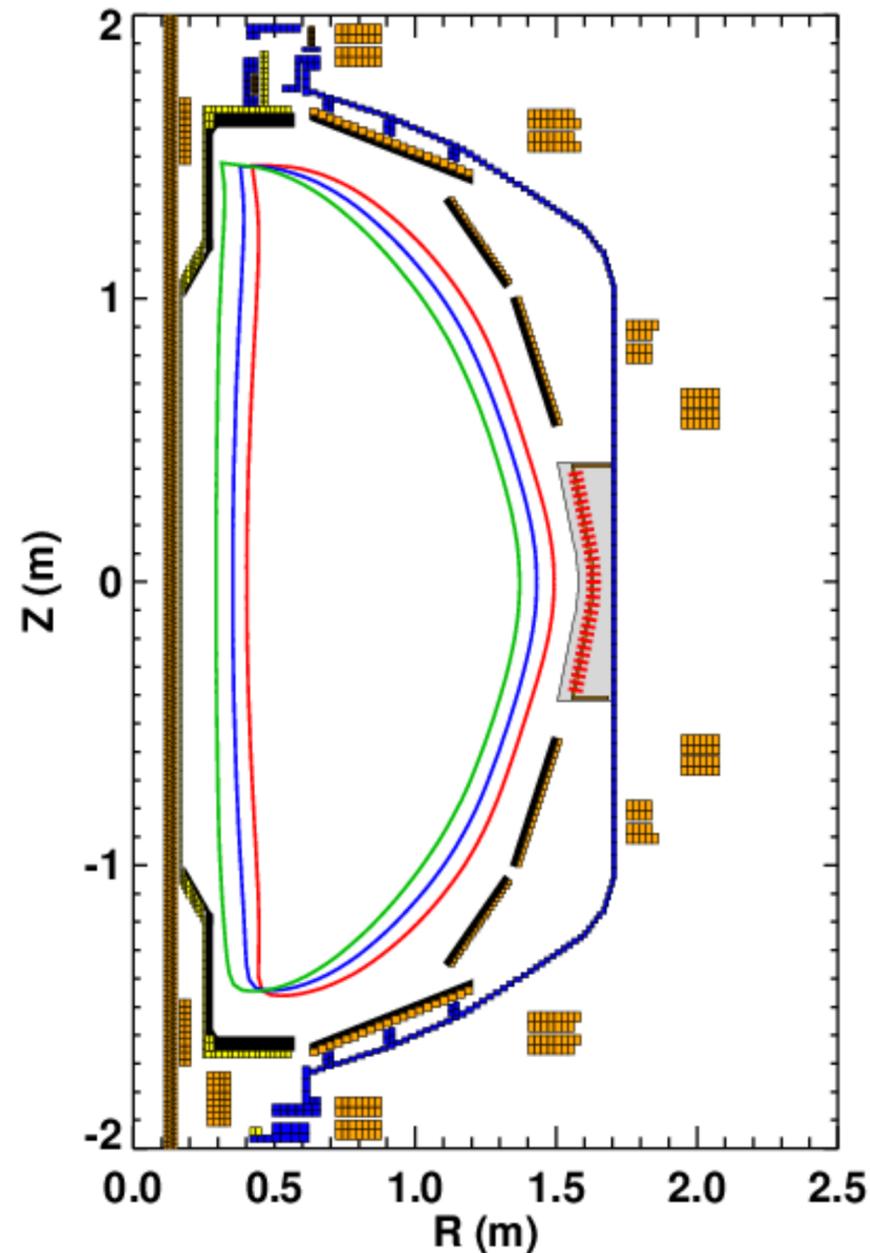
NSTX
MAST
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- Little variation across machine with matching shape suggests that aspect ratio has little effects.
– $A \sim 2.85$ & 1.42
- Contrasting ELITE calculations showing strong changes in aspect ratio led to variation in pedestal pressure at low triangularity.
- Attempt a scan in NSTX over a narrow range of aspect ratio with enhanced MPTS system.

Document/Revisit the Aspect Ratio Effects on the Pedestal Structure at Fixed Elongation with Enhanced MPTS system

- Aspect ratio scan at fixed κ .
- Inner and outer gaps change at fixed plasma height



- Pedestal height increase with triangularity motivates scan of the aspect ratio.
- Target a small scan on NSTX! important test of theory with minimal changes in other parameters.
- Enhanced MPTS system and scenario capability.
- Scan A = 1.54 -1.74 with $I_p \sim 700\text{kA}$
- Dial down the lithium to insure ELMy discharges
- Request 0.5 day but aim to get enough data during scenario development from SPG's XP.