XP 529: Dependence of the H-mode Pedestal Structure on Aspect Ratio
NSTX/MAST/DIII-D ITPA Joint Experiment

R. Maingi, T.Osborne@, A. Kirk*

Oak Ridge National Laboratory

@ General Atomics

* UKAEA, Culham

XP Review

July 28, 2005

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 T_e width
- 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)

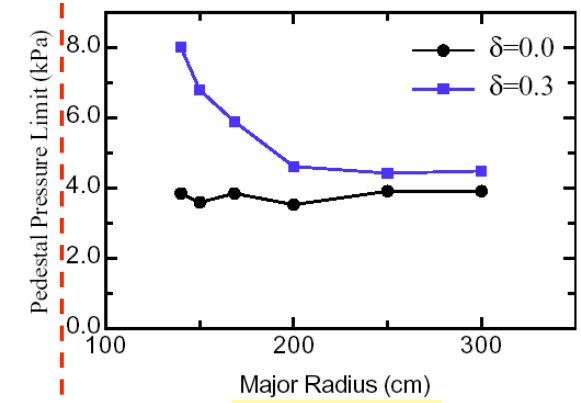
  $\Rightarrow$ What is the aspect ratio dependence of pedestal?

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

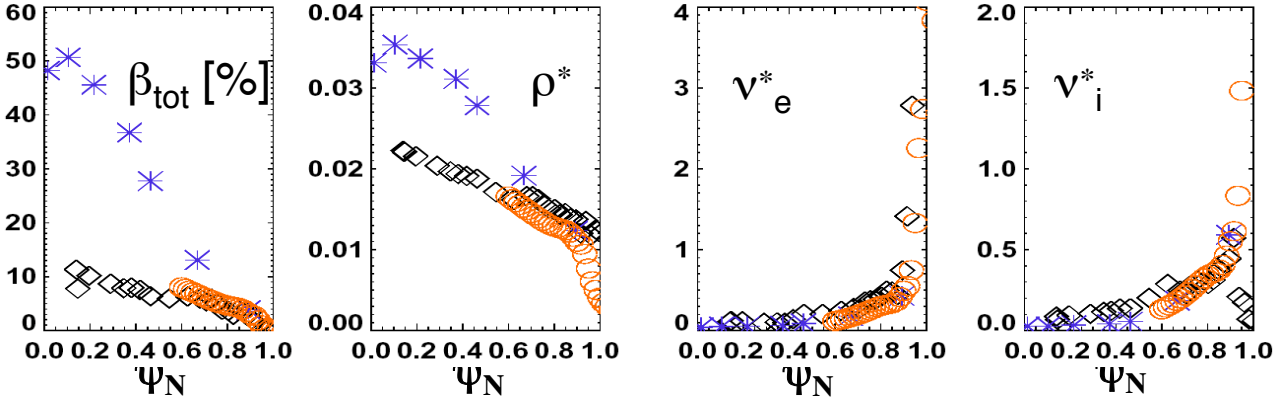
  $\Rightarrow$ ideal aspect ratio scan candidates
- *Experiment run in DIII-D and scheduled in MAST*

Multi-Device Experiments Used to Investigate Effect of Aspect Ratio on Pedestal Stability

- Pedestal peeling-ballooning stability indicative of ELM onset criteria (critical issue for ITER)
- Stability codes predict higher edge pedestal pressure limit in certain shapes at low R/a
- NSTX/DIII-D/MAST ITPA pedestal similarity experiment in progress to test this: DIII-D part finished, MAST to match shape and finish experiment in fall '05.



P. Snyder, PPCF 2004



DIII-D #121504@1175 (I_p=0.6 MA, B_t=0.5 T)

NSTX Typical (different shape)

MAST Typical (different shape: A. Kirk, PPCF 2004)

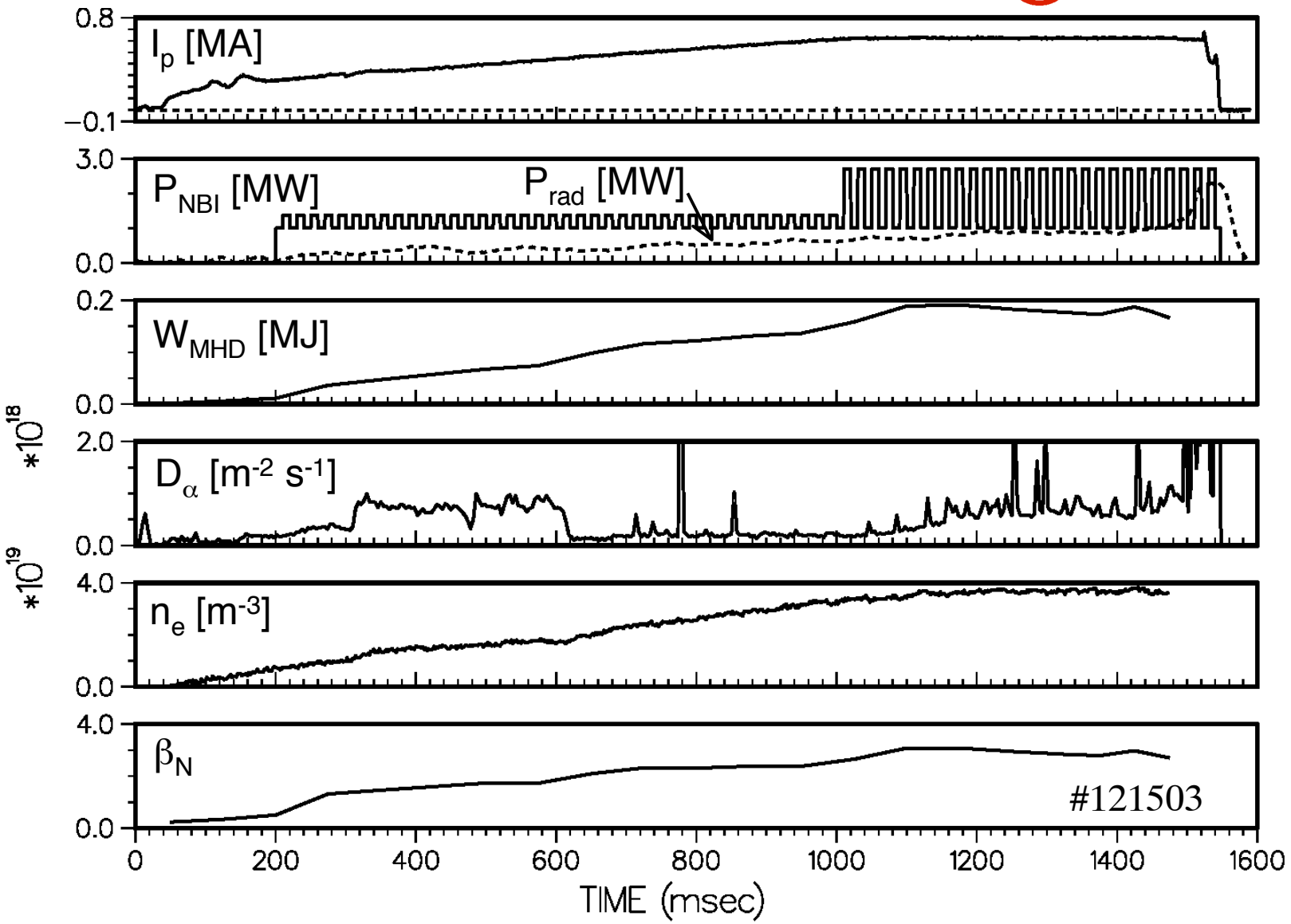
Goals and Execution of Experiments

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

Execution (1 day):

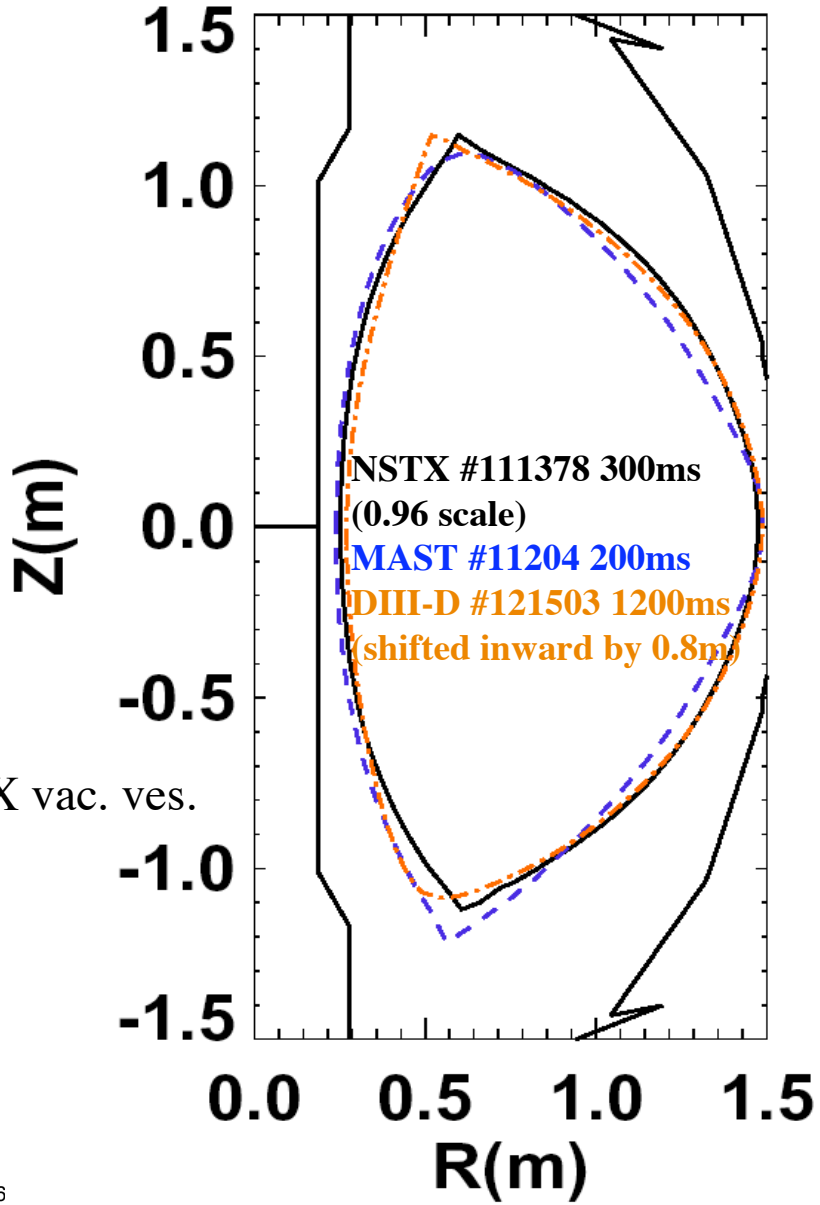
- Reproduce the "higher" squareness shape from D3D shot #121504, with NSTX parameters I_p=800 kA, B_t=0.45 T, P_{NBI} = 2-4 MW (whatever needed for H-mode access), under rtEFIT control. The outer gap must be adjusted to ~ 9-10 cm to provide optimal Thomson profile resolution. A good starting point may be NSTX #111378, except with early NBI changed so that src. B starts at 80ms and src. A at 200 ms. (5-10 shots)
- Vary the NBI heating power from 2-6 MW to match the edge ρ^* at the top of the pedestal ~ 0.011, and as much as possible, vary the HFS fueling rate to match the edge ν^* at the top of the pedestal from 0.4-1. (5-10 shots)
- Increase NBI power to determine the pedestal β limit. May have to change I_p to match ρ^* and vary density slightly to match ν^*. (5-10 shots)
- Time permitting: repeat steps I-III with lower squareness shape (D3D #121516), which is a better match to the MAST shape. (5-10 shots)

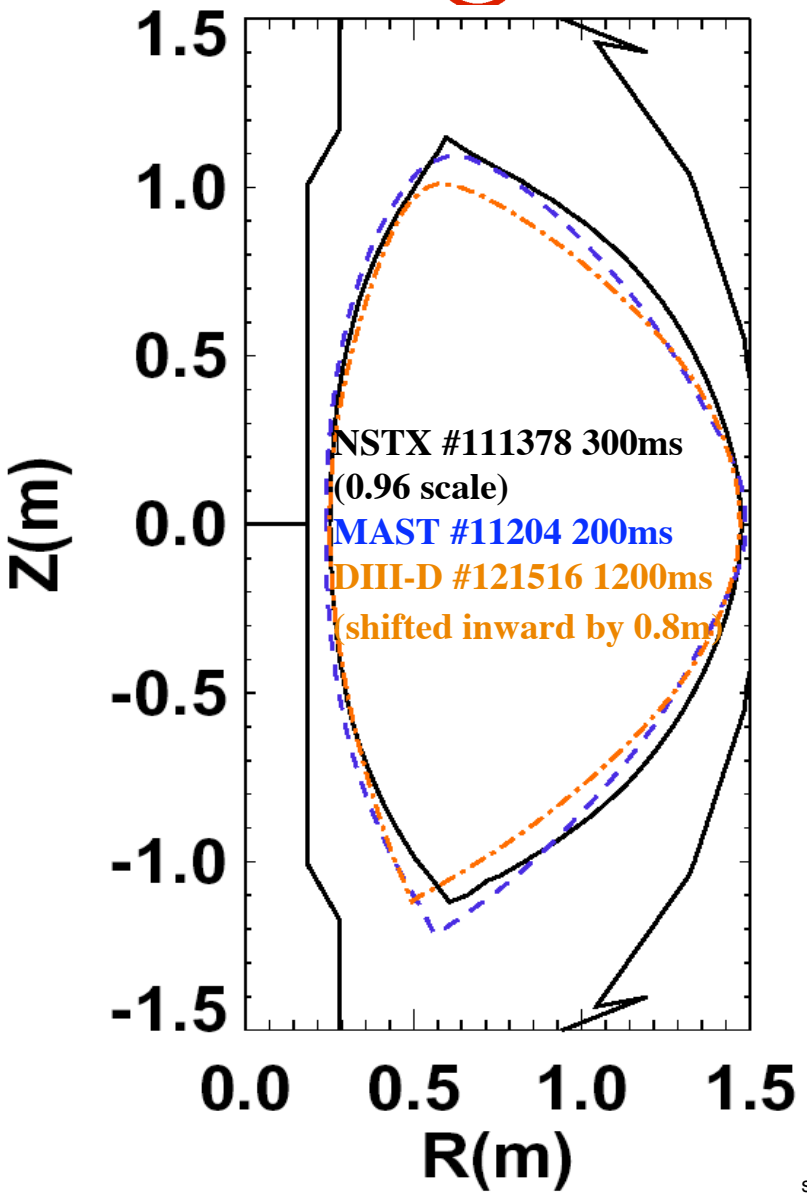
NSTX shape in DIII-D at B_t^0=0.5 T achieved sufficient flat-top for profile analysis



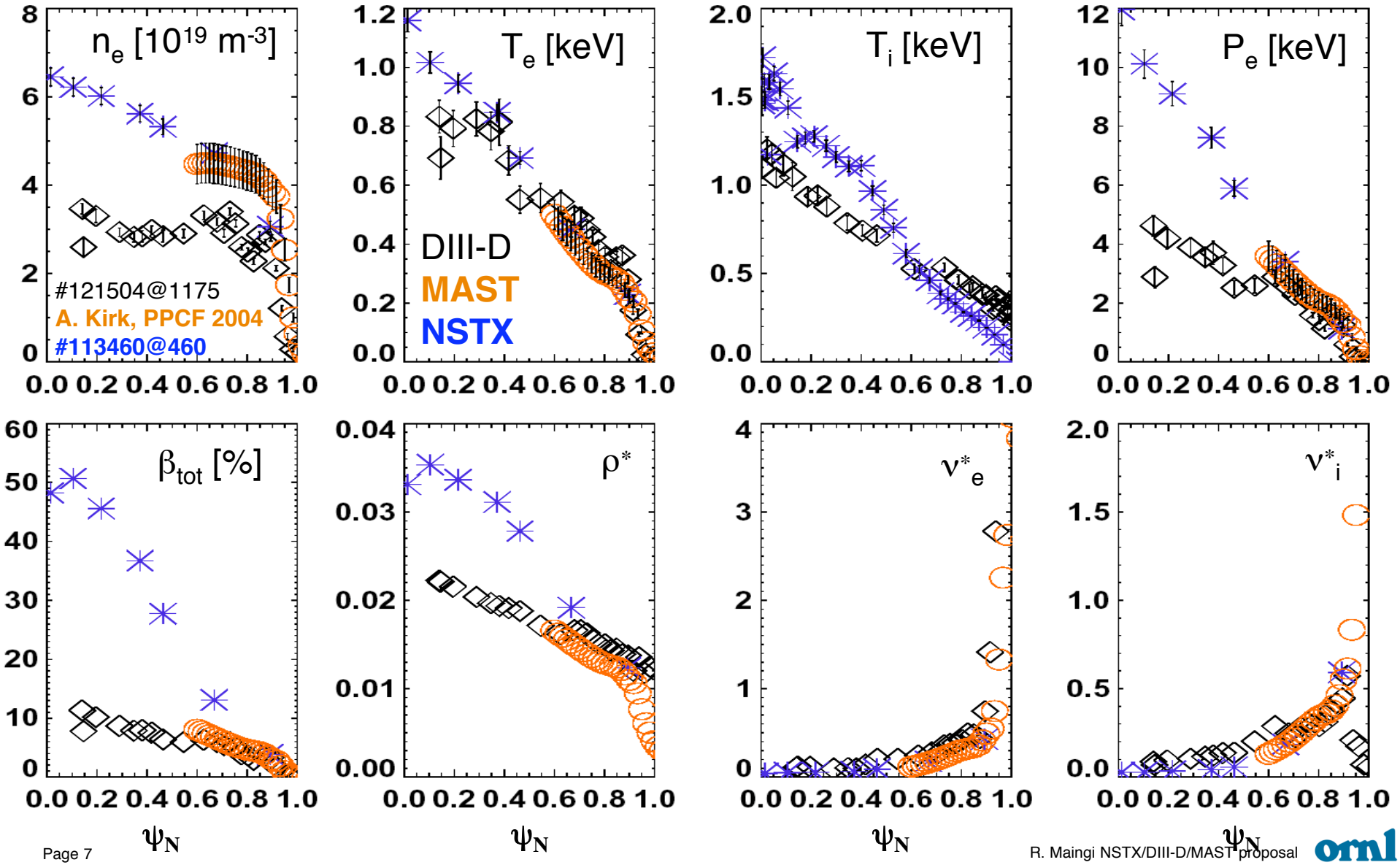
DIII-D shape flexibility used to match both high (NSTX) and low (MAST) squareness in DN shape

NSTX vac. ves.

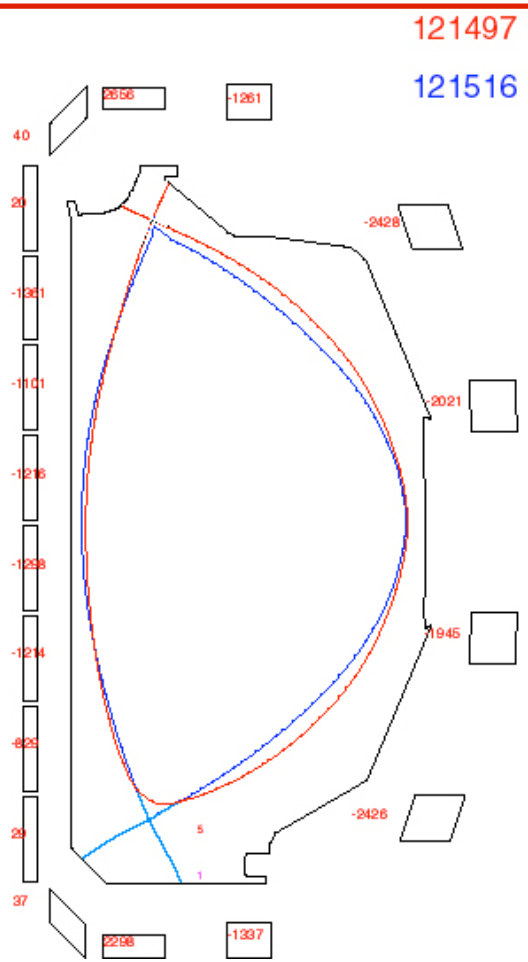


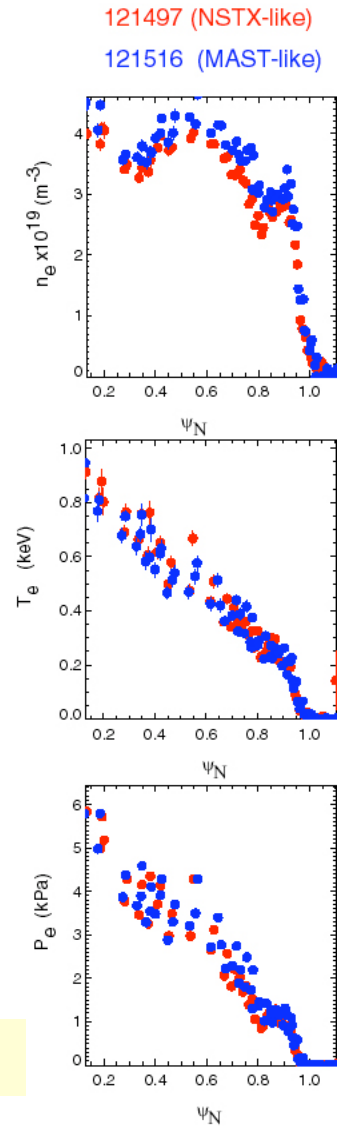


Target Dimensionless Profiles Achieved in DIII-D comparable with MAST (w/T_i=T_e), NSTX Sample Profiles



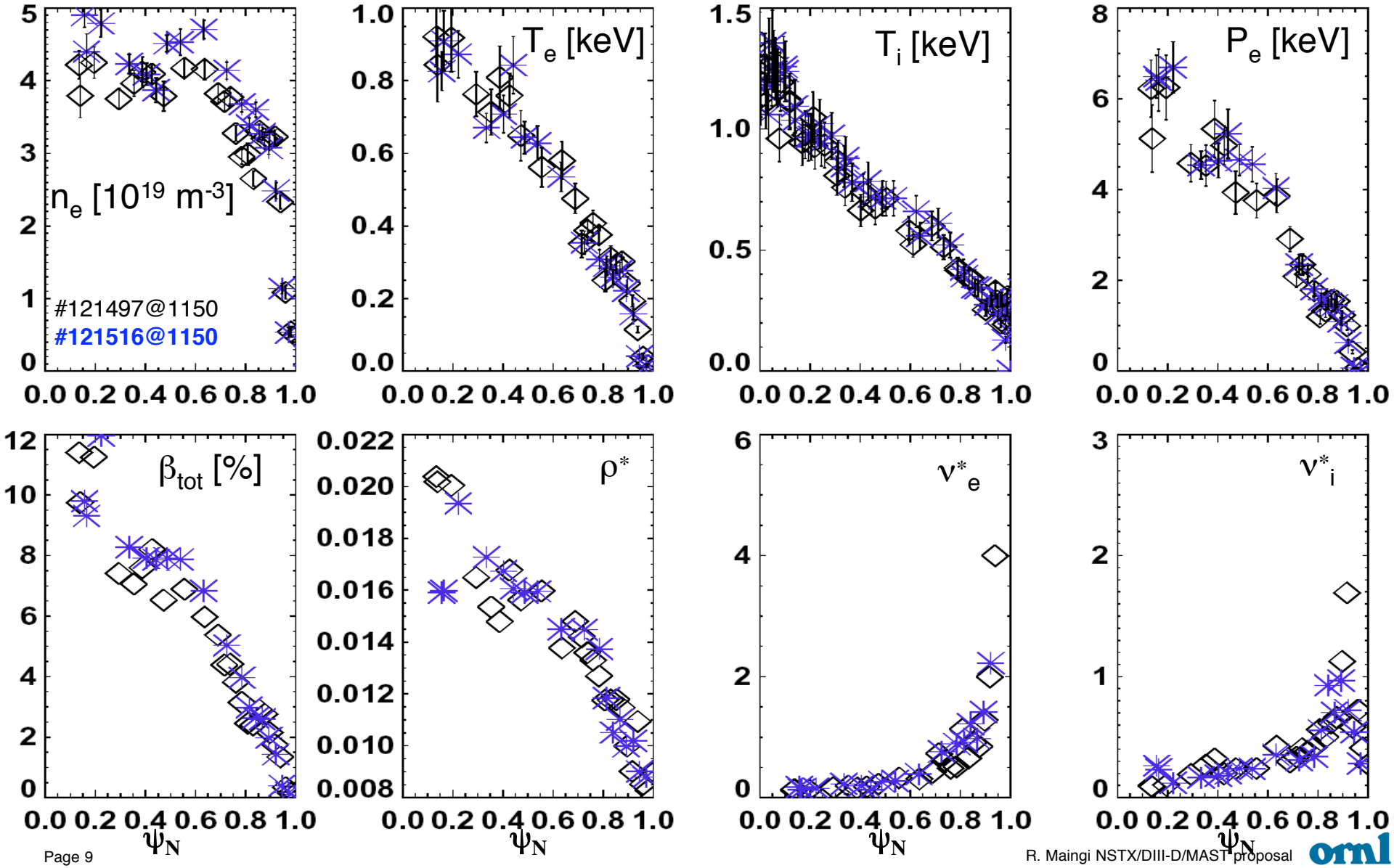
Pedestal Parameters Independent of Squareness





For these collisionalities, squareness has little effect on Pedestal

Plasma Profiles Comparable in DIII-D Shapes with Different Squareness



Backup