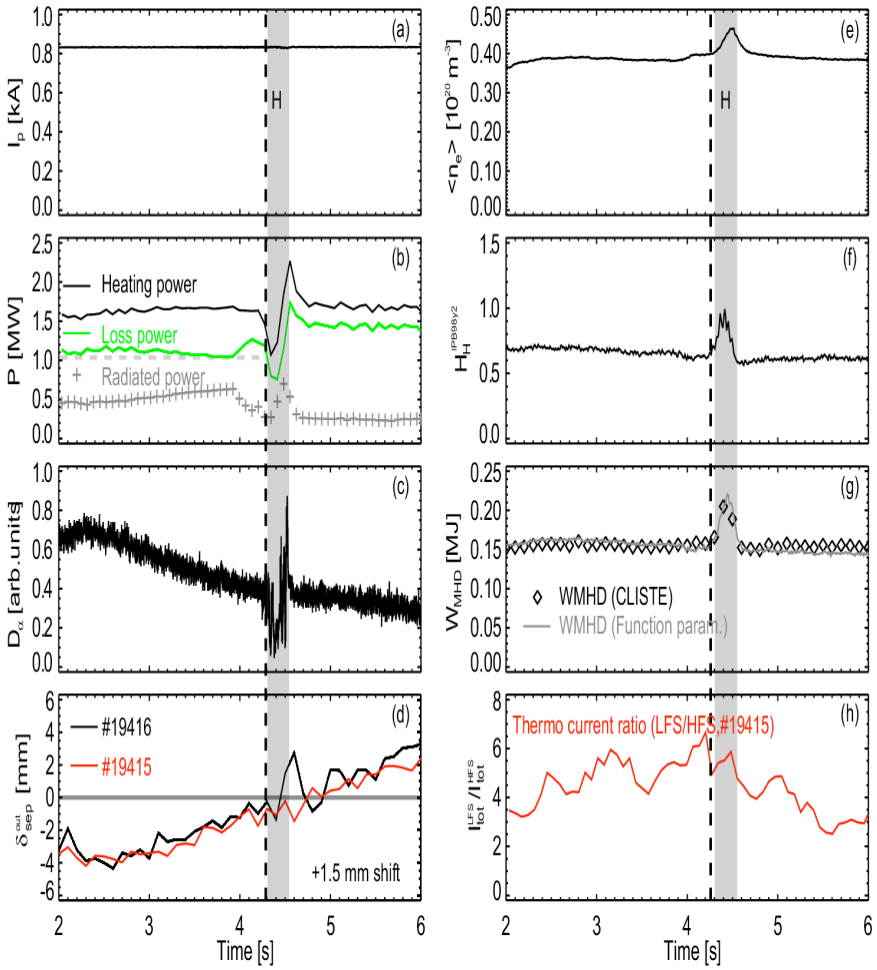
APS invited talk summary - H. Meyer (by R. Maingi)

Possible titles:

- The effect of the magnetic configuration on edge transport barrier formation in tokamaks (mix of MAST, NSTX, ASDEX-Upgrade)
  - This was title of APS 2006 nomination which was almost accepted
  - Meyer has written two papers on this, so maybe different focus better?

- The dependence of the power threshold on drsep, X-point height, and RF vs. NBI heating in spherical tokamaks (mostly NSTX, with some MAST)

Improved H-mode access in DN in MAST

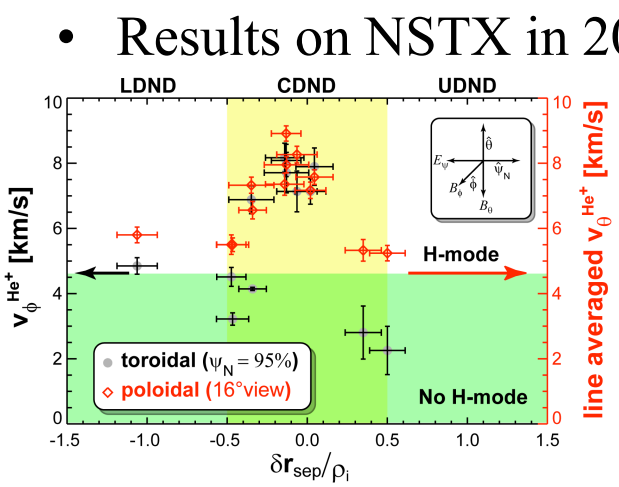


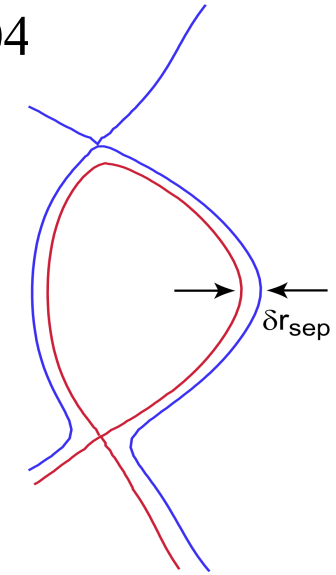
[1] Meyer et.al., PPCF **47** p843 (2005)

[2] Meyer et.al., NF (2006)

Motivation:

- P_{thr} reduced by factor 2 in C-DN on MAST (NSTX similarity shape).
- 20 % of P_{thr} reduction in C-DN on AUG.
- Results on NSTX in 2004





Goals and Results of XP in NSTX

- ✓ Measure P_{thr} in DN, L-SN, and U-SN with NBI heating (Ion Grad-B toward low X-point)
  - P_{thr} lowest in DN, then LSN, then USN with NBI
- ✓ Compare P_{thr} with RF and NBI heating
  - P_{thr} decreased with drsep with RF heating
  - P_{thr} comparable between NBI and RF
- ✓ Measure P_{thr} with different heights of X-point in L-SN
  - Ohmic H-mode in both LSN and DN with reduced X-point heights/larger elongation

Edge/SOL data under analysis

- Profile analysis of 30 pt Thomson data in progress (are gradients different near P_{LH}?)
- Analysis of v_p, v_t , E_r and T_i in the edge and SOL of the plasma from ERD in progress
- Edge fluctuation measurements made with gas puff imaging (GPI) need to be examined
- Need analysis of reflectometer measurements of fluctuations and correlation lengths
- Simulation of neoclassical ion loss vs. geometry with XGC-0 may yield insight

Lowest P_{thr} in DN and highest in U-SN

NBI heated: I_p= 0.6 MA, B_t = 0.45 T

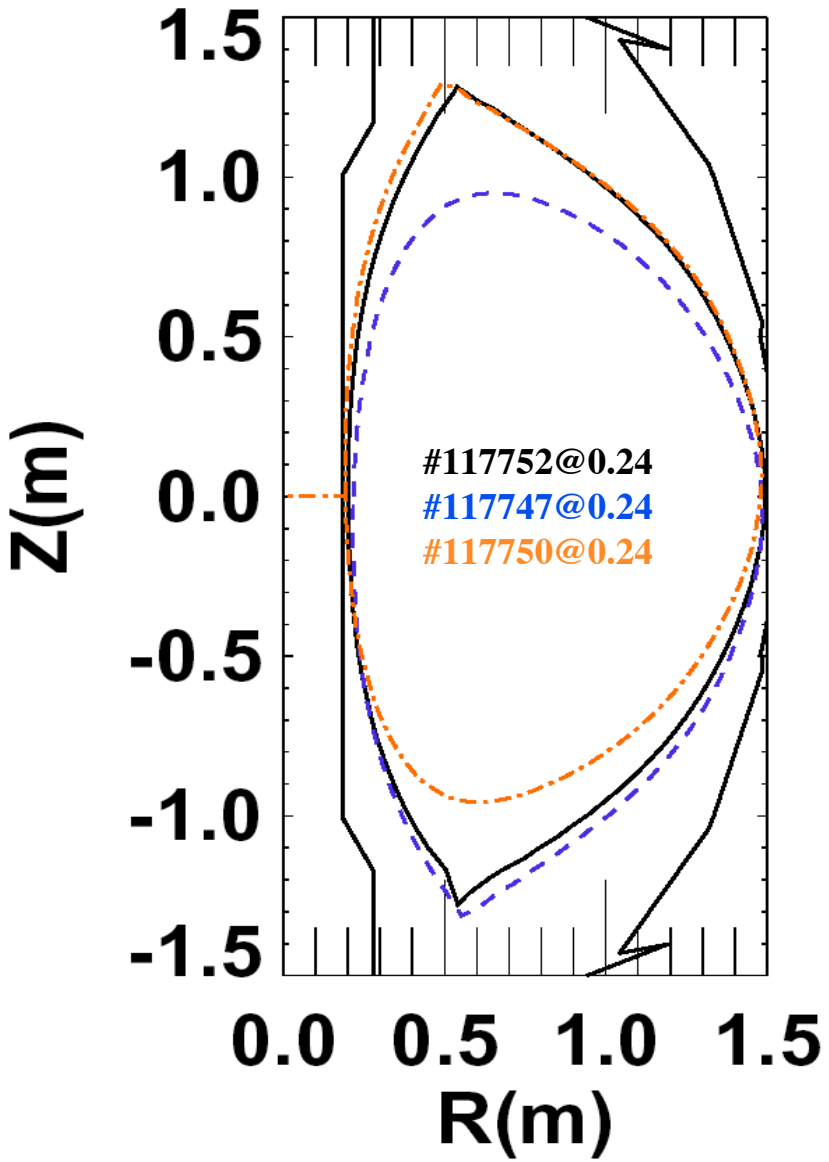
Pulse	Conf.	dr_{sep} [mm]	κ	δ_u	δ_l	P_{NBI} [MW]
117752	DN	0	2.0	0.49	0.47	0.6
117747	L-SN	-20	1.76	0.35	0.52	1.1
117750	U-SN	14	1.72	0.55	0.35	4.0

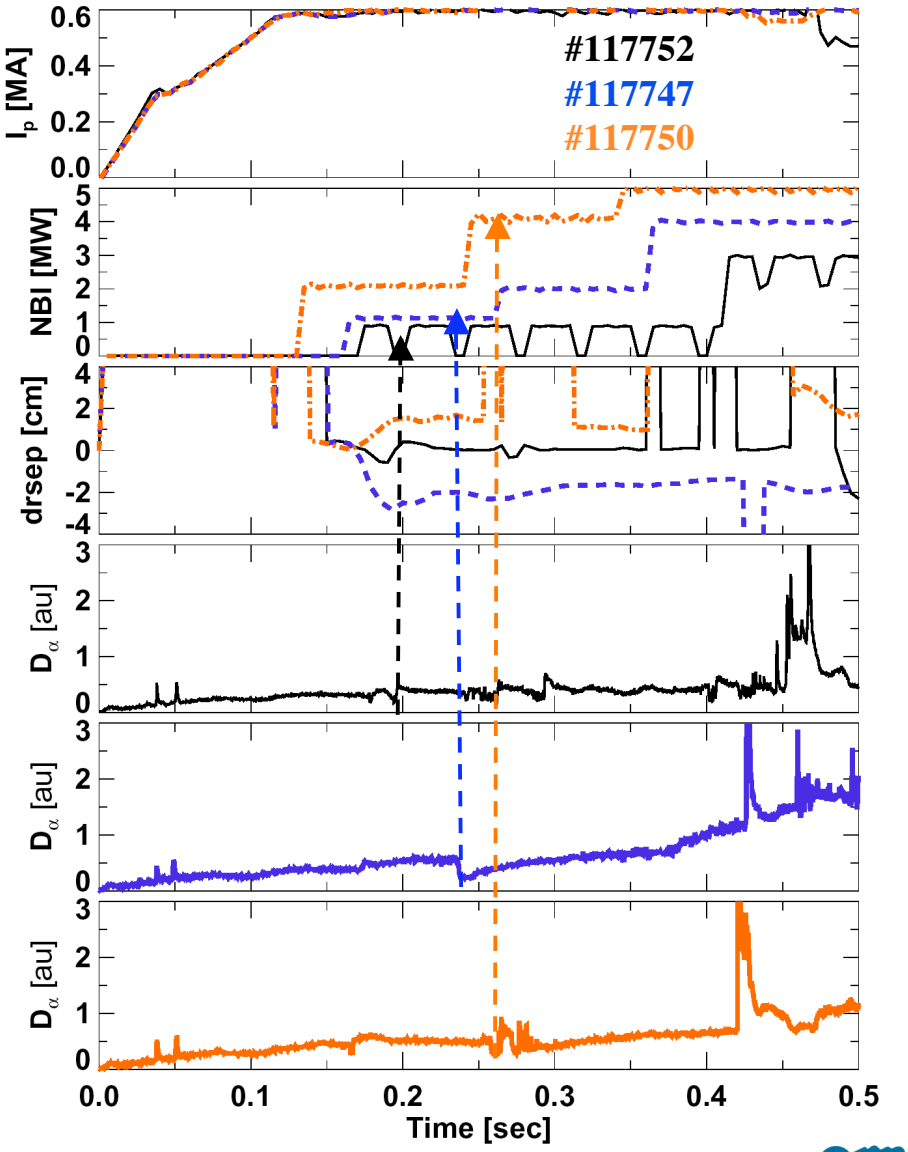
RF heated: I_p = 0.6 MA, B_t = 0.45 T

Pulse	Conf.	dr_{sep} [mm]	κ	δ_u	δ_l	P_{RF} [MW]
117767	DN	0	1.98	0.49	0.48	0.6
117776	DN	0	1.97	0.50	0.47	1.1
117777	L-SN	-5	1.89	0.36	0.45	1.7 – 2.2
117782	L-SN	-17	1.86	0.27	0.45	2.7

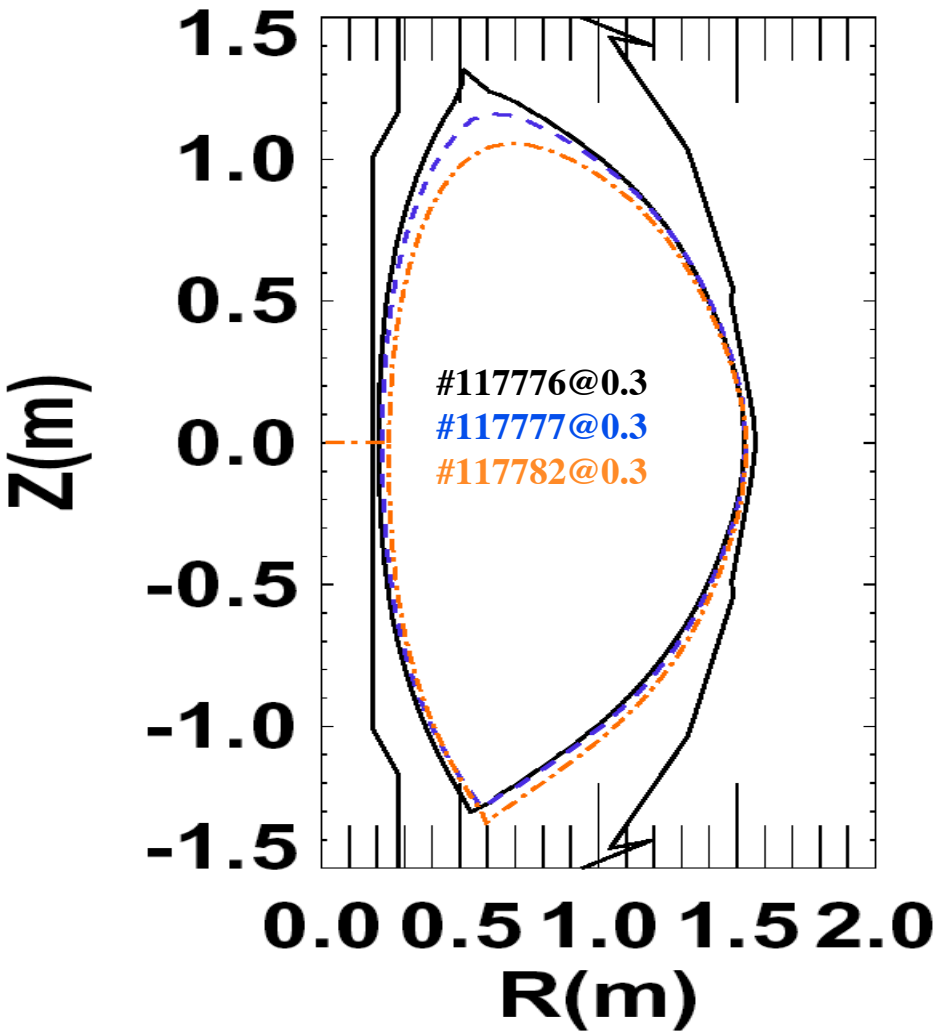
Ohmic: I_p = 0.9 MA, B_t = 0.45 T, -24 mm < dr_{sep} < 0 (117754, 117756)

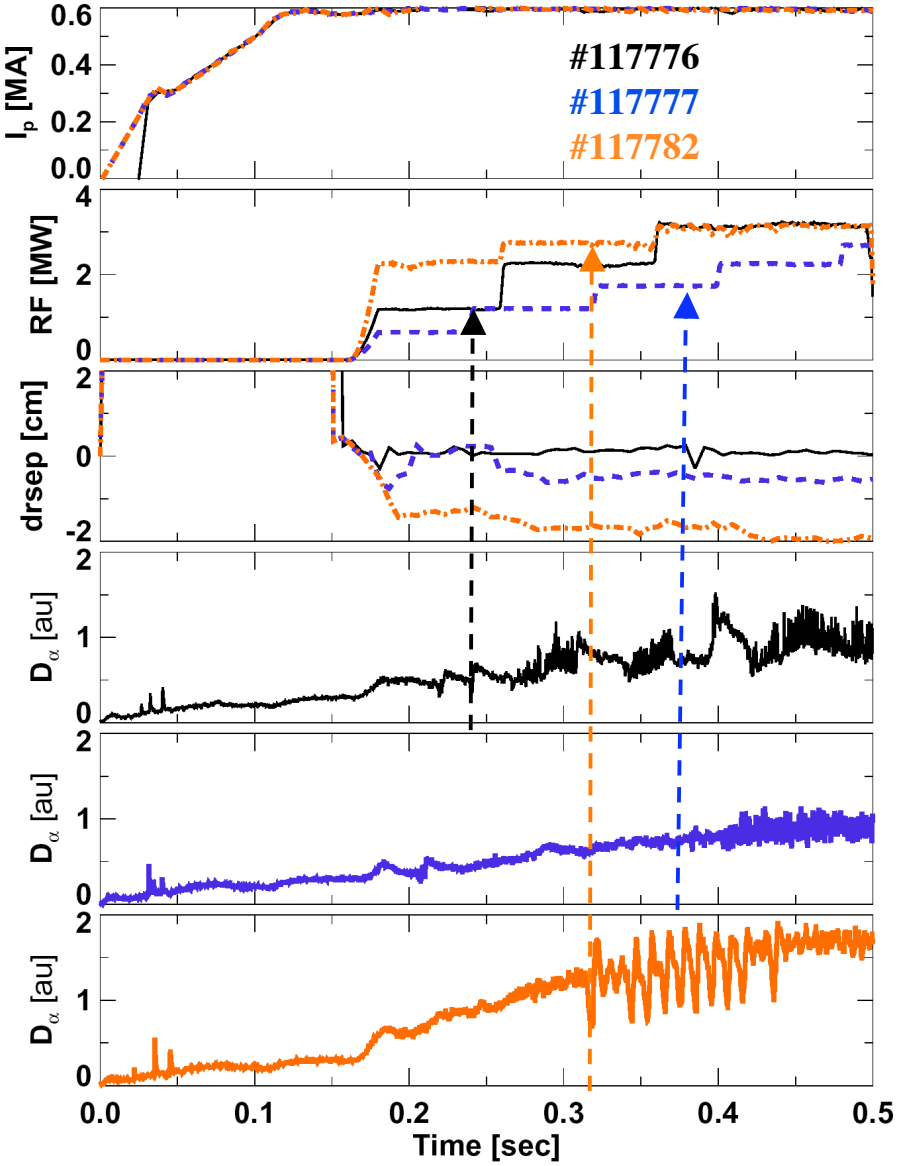
P_{LH} lowest in balanced DN with dr_{sep}~0 w/NBI heating



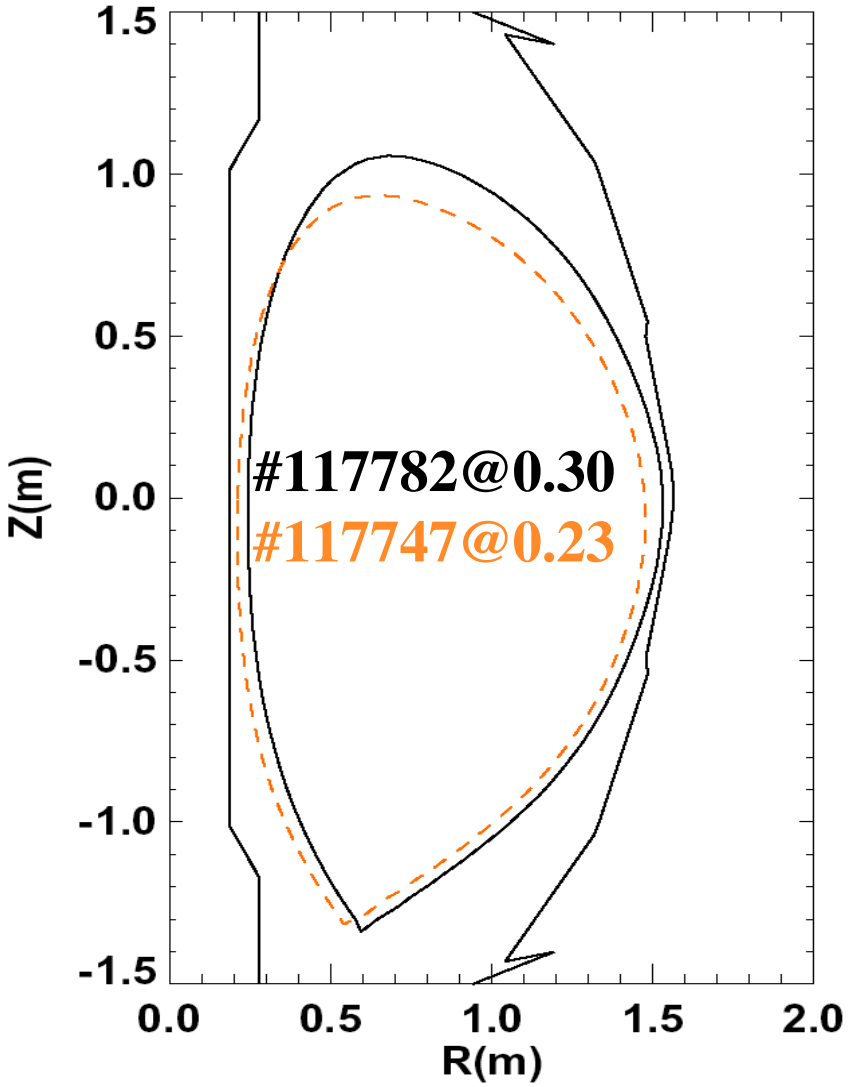


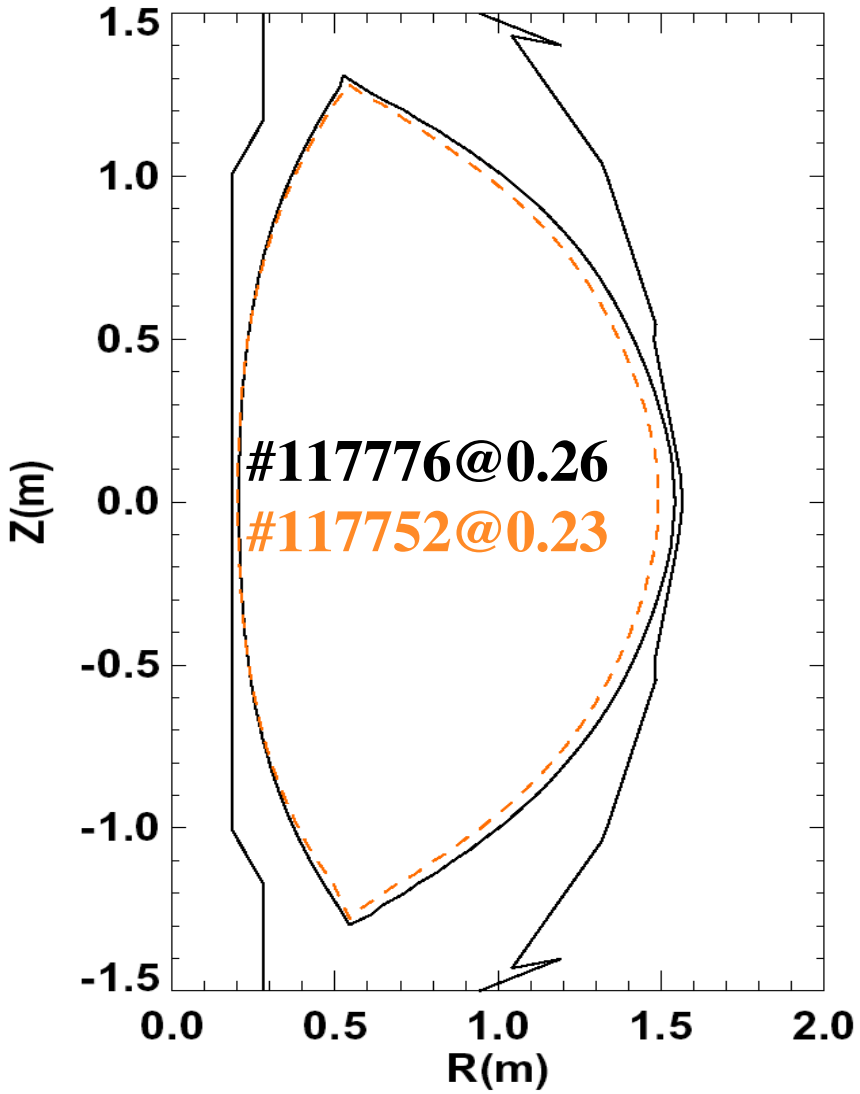
P_{LH} increased with decreasing dr_{sep} with RF heating





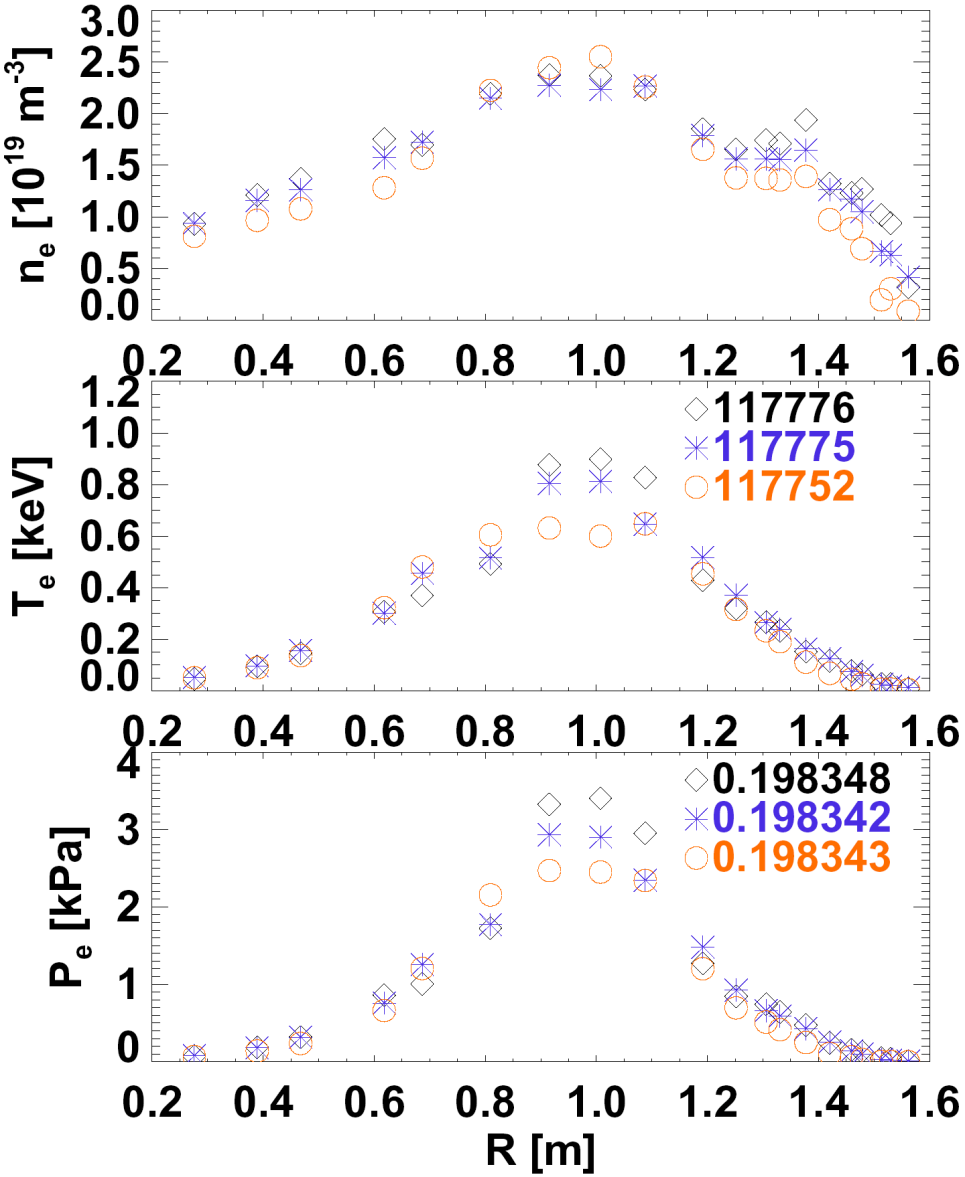
Similar shapes achieved in NBI and RF power threshold experiments at time of L-H dithers





- P_{thr} similar as well: P_{aux} ~ 500-700 kW

L-mode: Edge profiles similar from Thomson data

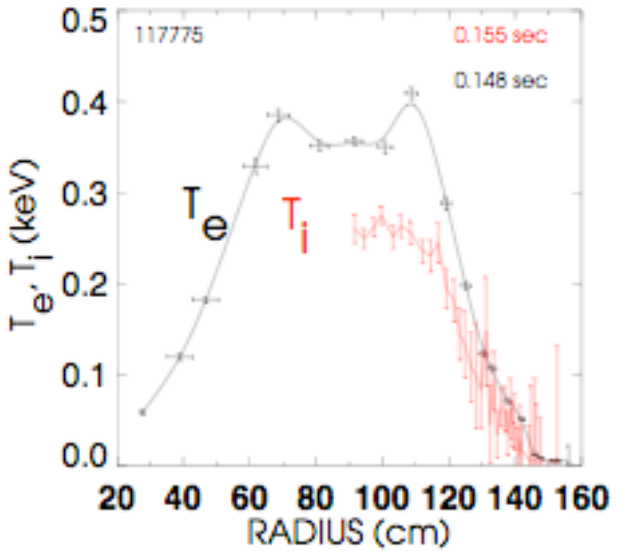


- At this time, all discharges are in L-mode.
- Note: 117752 is shifted inward to avoid prompt scrape-off loss of charge exchange neutrals from NBI.
- T_e profile shows HHFW heating in core plasma, but edge plasmas similar.
- 117775 shown for comparison, since no T_i data in 117776

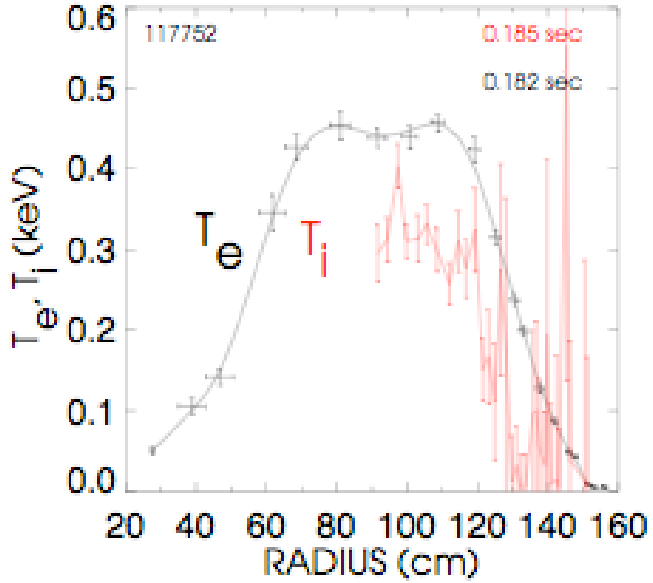
L-mode: Core T_i is lower than core T_e

NSTX

HHFW



NBI



- Note different scales.
- T_i data in HHFW case from 10 ms NBI "blips" at 100 ms intervals, hence differing time slices for pre L-H transition comparison.

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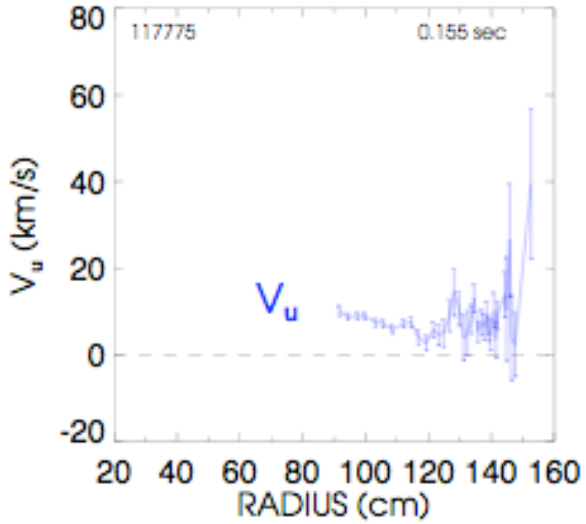
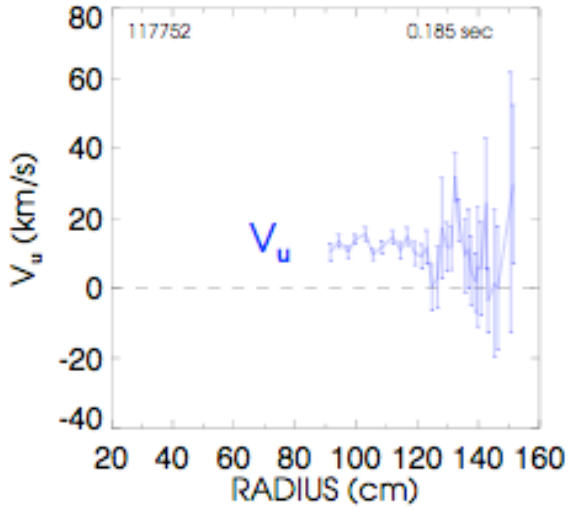
L-mode: Rotation profiles similar with RF or NBI

HHFW



NBI



- NBI has been on for 10 ms in 117752
- L-H transition occurs around 200 ms in both cases.

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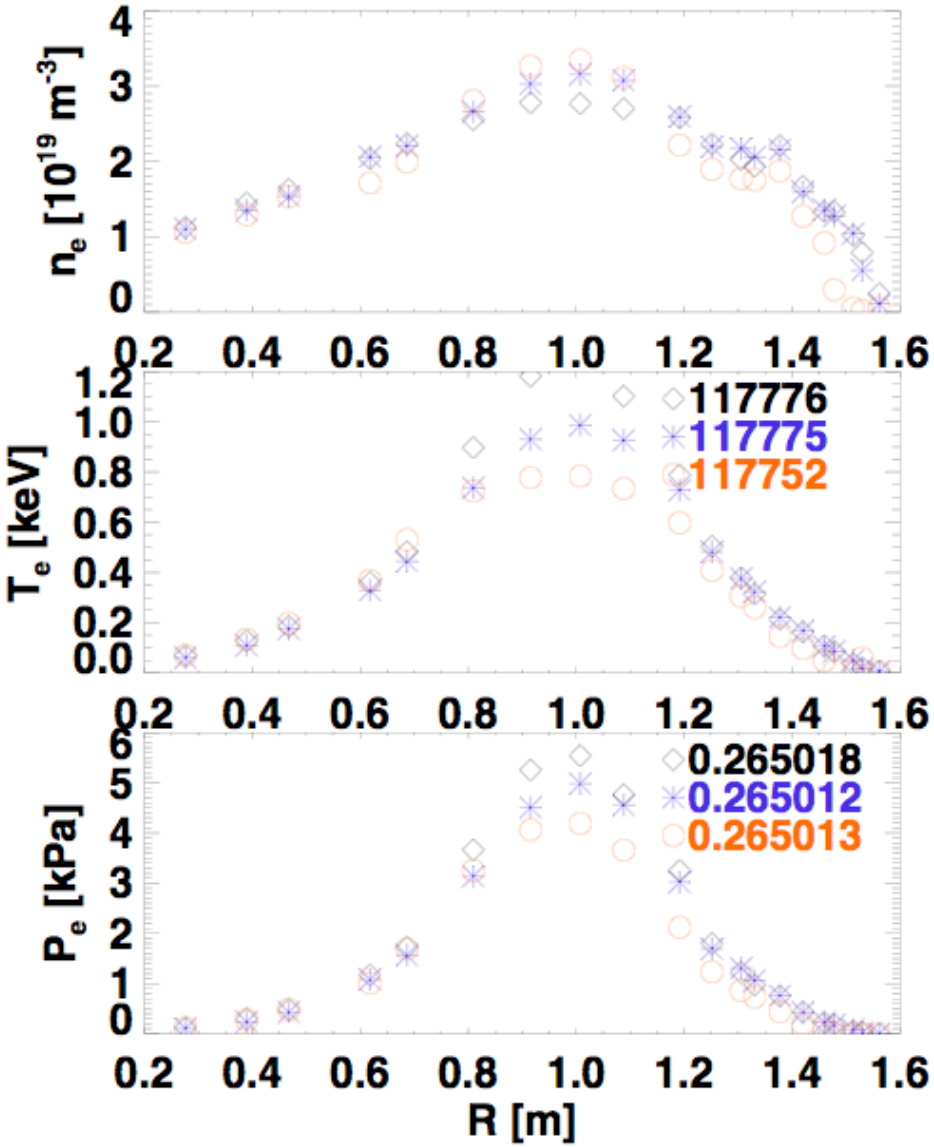
H-mode: Edge profiles similar from TS data



- By this time, all discharges are in H-mode.
- Note: 117752 is shifted inward to avoid prompt scrape-off loss of charge exchange neutrals from NBI.
- Te profile shows HHFW heating in core plasma, but edge plasmas similar.
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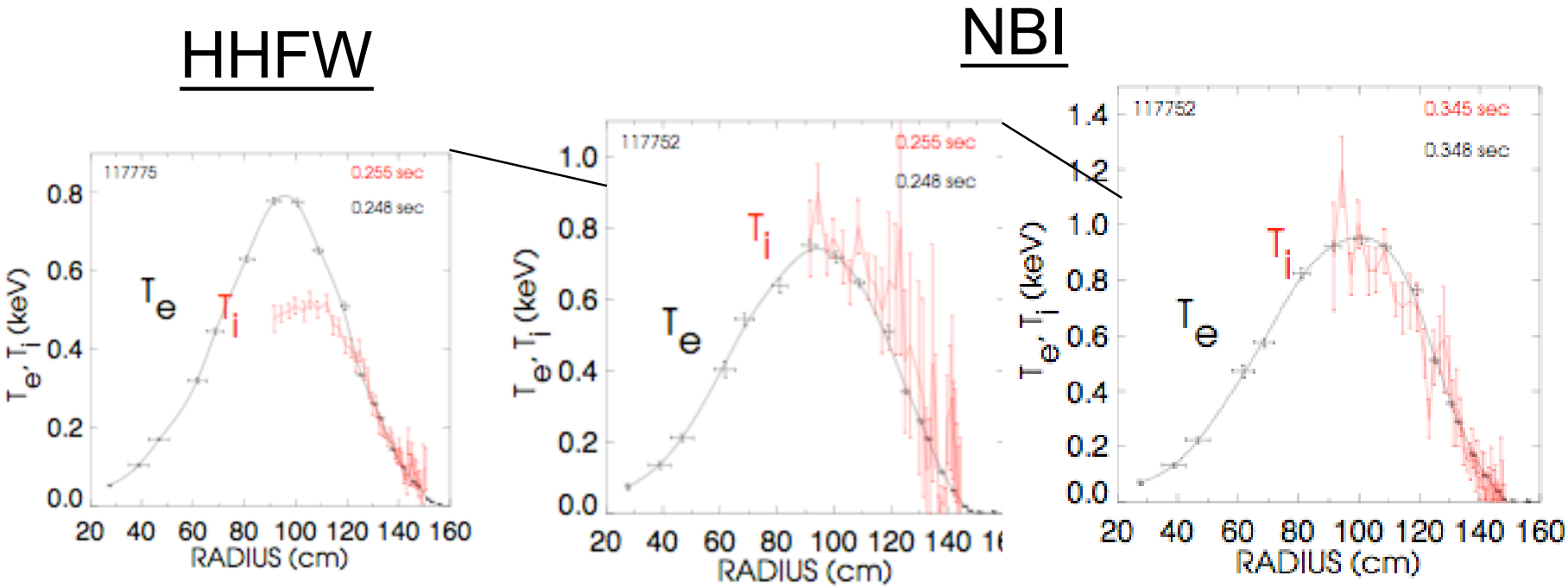
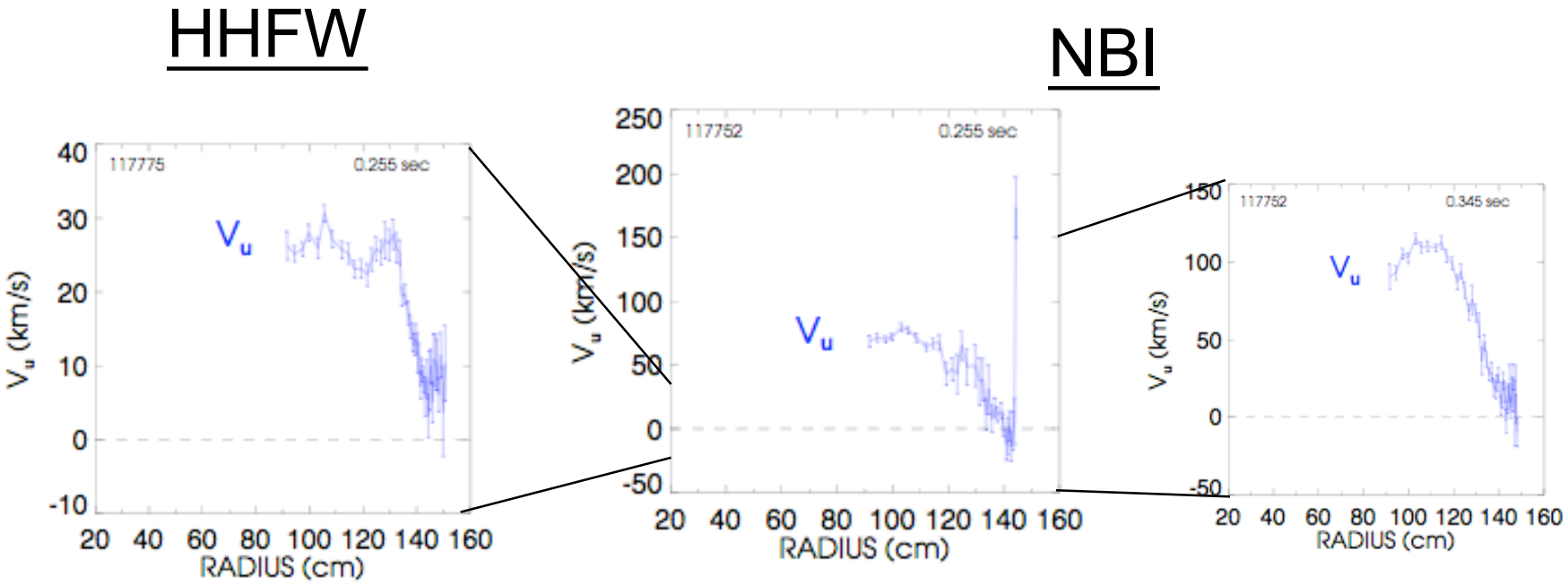
H-mode: Ions clearly heated in NBI



- Ions are hotter in the NBI case, while electrons are similar in RF and NBI
- T_i and T_e continue to increase during H-mode with NBI
- 117775 drops out of H-mode, but H-mode and T_e are maintained for longer duration in 117776

H-mode: Rotation spins up in NBI, not in RF



- Toroidal rotation doubles in H-mode (from 15 to 30 km/s) for HHFW, then is steady.
- Toroidal rotation quadruples in H-mode (from 15 to 60 km/s) for NBI, and continues to increase.