Preliminary Summary XP731
Non-solenoidal Ip Rampup with HHFW

C. Kessel, 5/28/07

- Goals
  - Examine sustaining Ip with HHFW via bootstrap current + HHFWCD
  - Provide long steady RF power input and H-mode regimes

- Run Plan Highlights
  - Deuterium, targeting H-mode
  - Low Ip at 250 kA
  - B_T = 5.5 kG for better heating efficiency at low $k_{||}$
  - Examine $k_{||}$ = 7, 10, 12 and 14 m^{-1} (90, 120, 150, 180^o phasing)
  - Examine power scan to ease into H-mode

Run Day - Tabulation

Once again we were not able to access Ip = 250 kA due to rtEFIT control settings - wasted 10 shots to discover this (123687-123697)

Set Ip = 300 kA and flattop out to 600 ms, tried 14 m^{-1} (180°) got lots of RF trips (123698-123704)

Switched to 7 m^{-1} (-90°), P_{HHFW} = 1.0-2.7 MW, **Te(0) = 0.9-1.55 keV** (123705-123721)

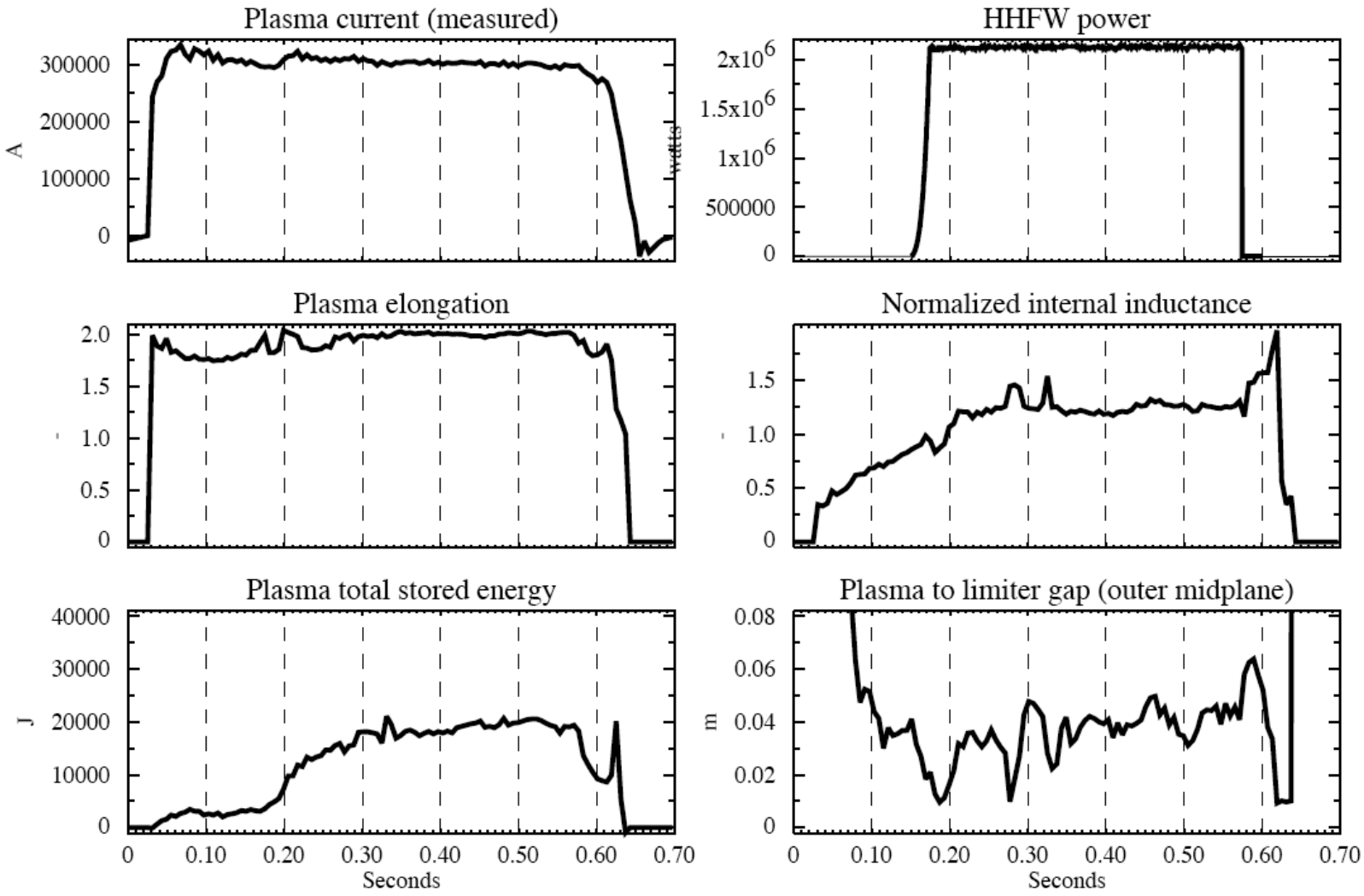
- Transient H-mode, but no sustainment
- Gap scan was inconclusive (other equilibrium factors like inner gap, level downward bias, etc.)

Switched to -120° phasing, P_{HHFW} = 1.0-2.3 MW, **Te(0) = 1.35-1.85 keV** (123722-123725)

Switched to -150-160° phasing, P_{HHFW} = 1.7-2.0 MW, **Te(0) = 2.0-2.7 keV** (123726-123733, Phil Ryan noted that phase flipped to -80° on some shots)

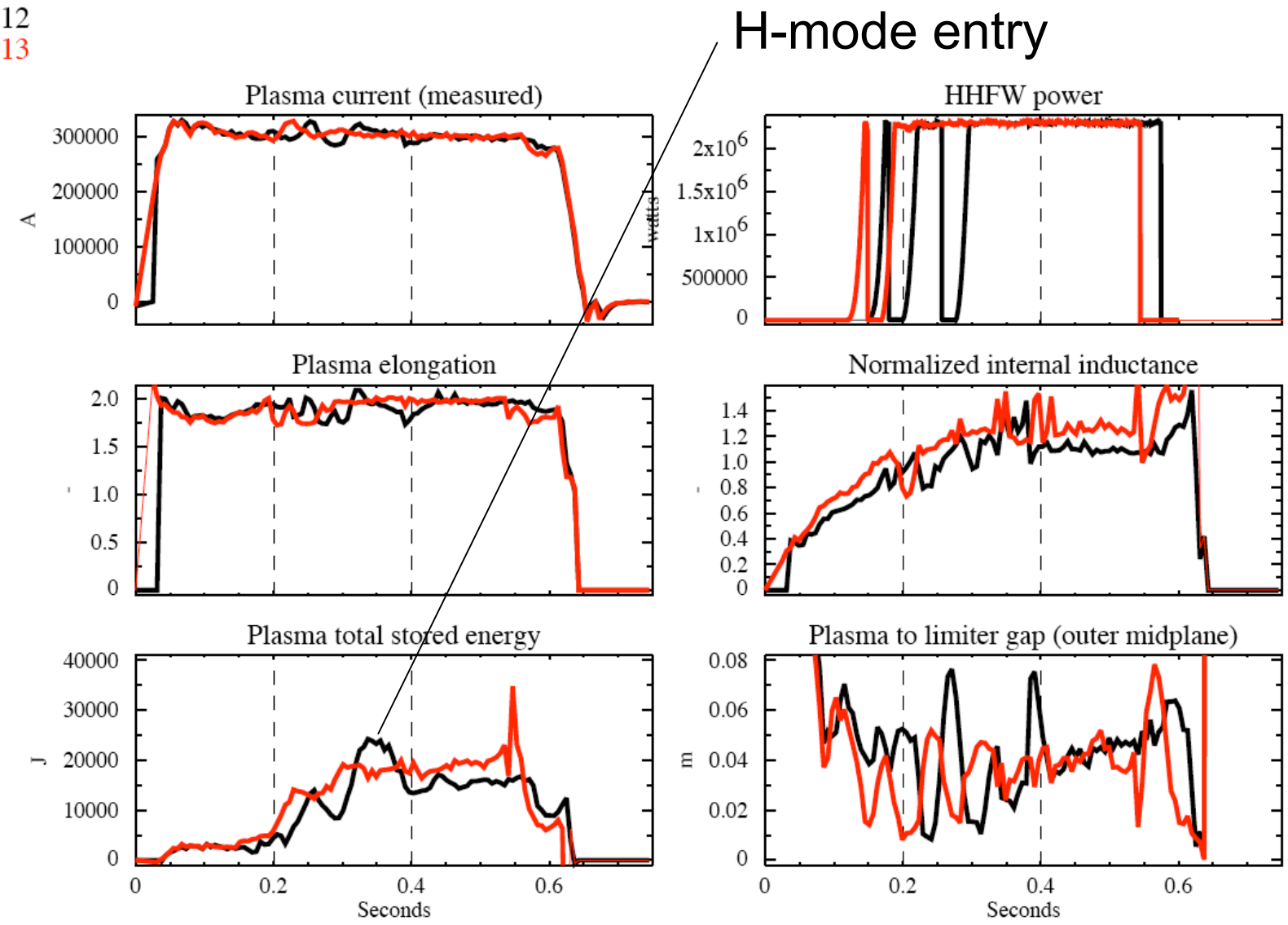
Basic Discharge Setup

Shots:
123710



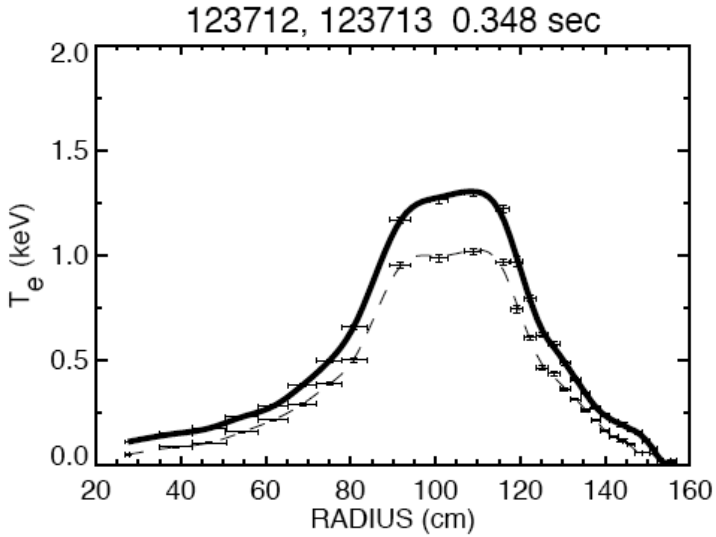
7 m^{-1} co-CD, Compare L-mode and H-mode

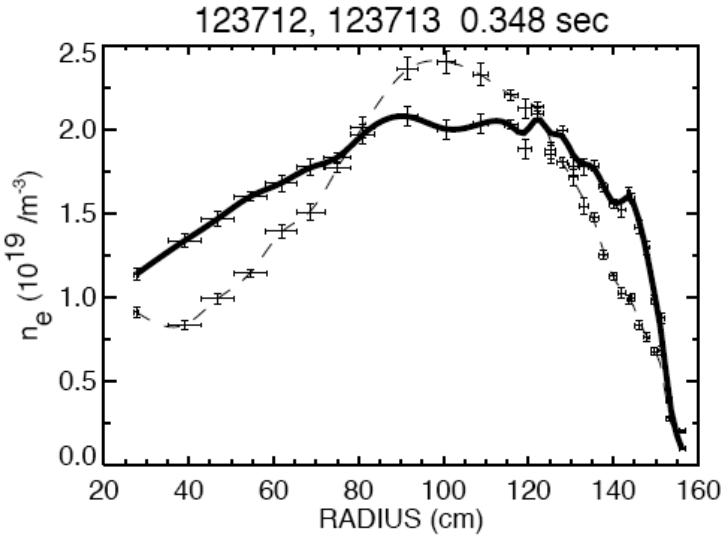
Shots:
123712
123713

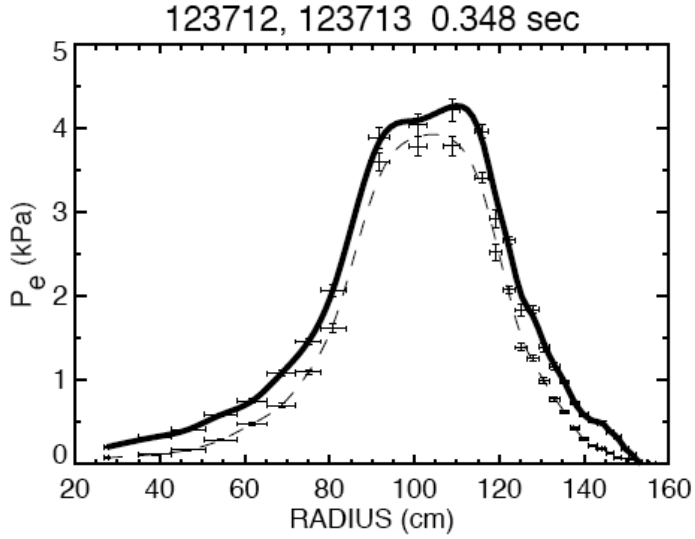


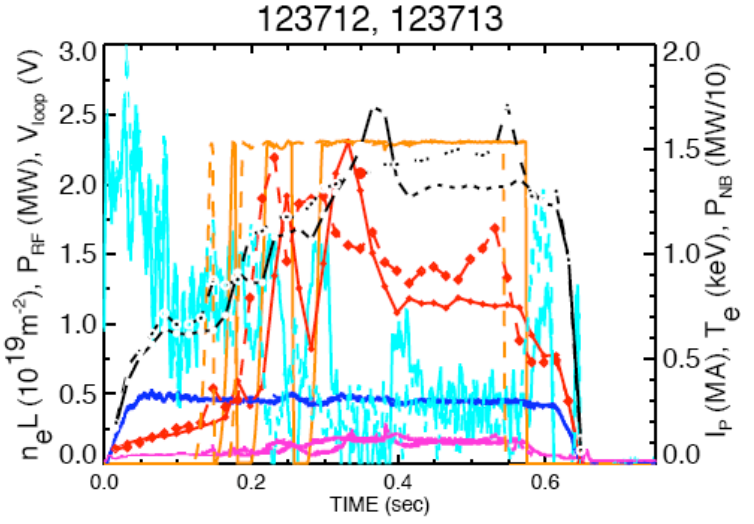
7 m^{-1} co-CD Compare L-mode with H-mode

H-mode entry creates T pedestal and broadens n





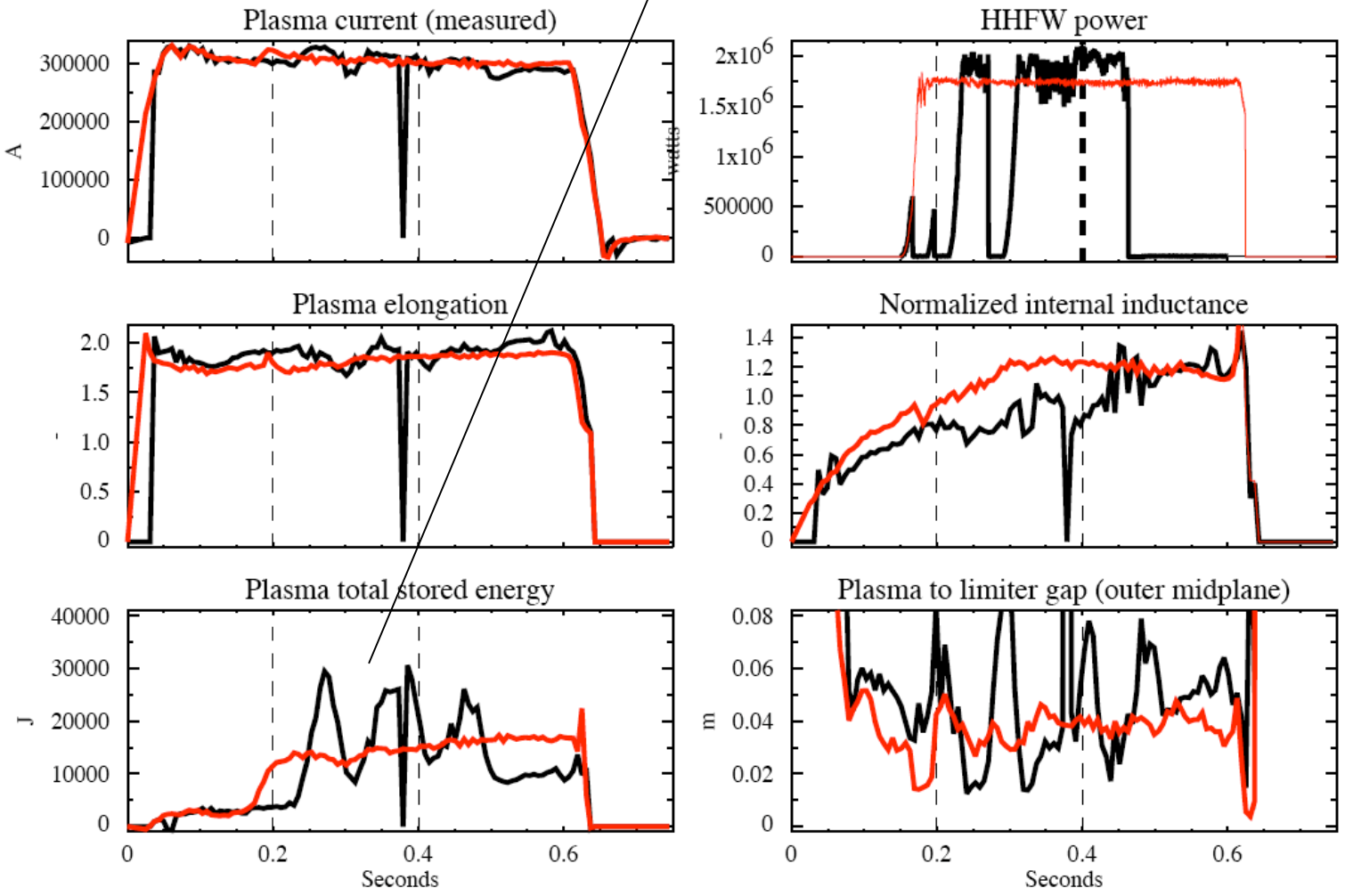




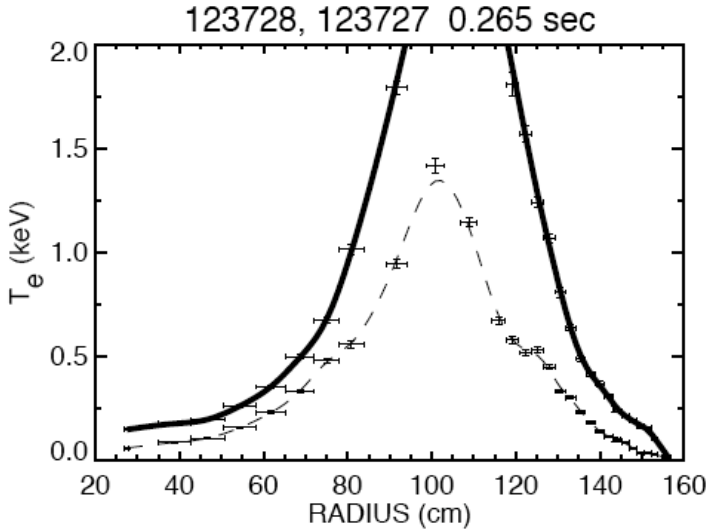
150 Deg Phasing, Compare L-mode and H-mode

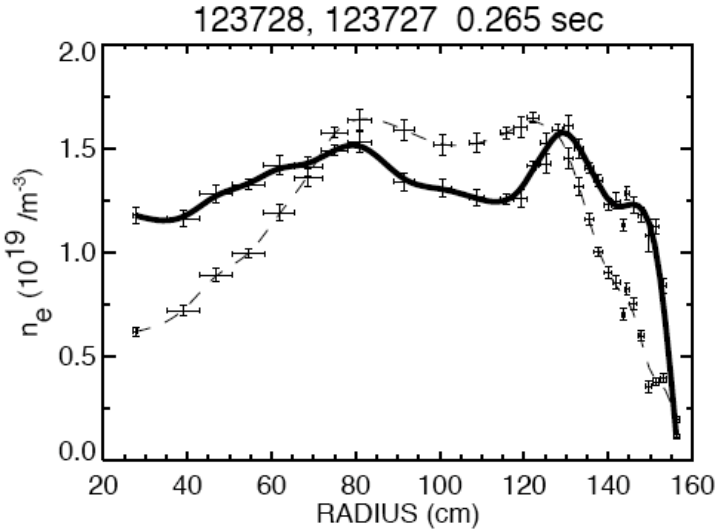
Shots:
123728
123727

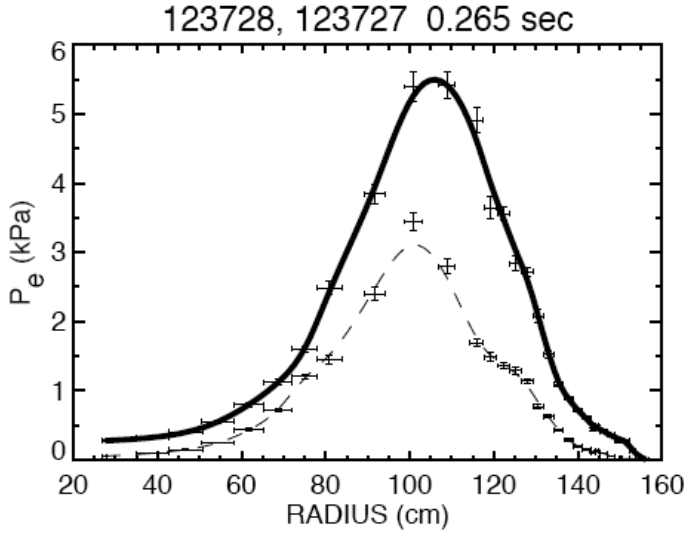
H-mode entries 1, 2, 3

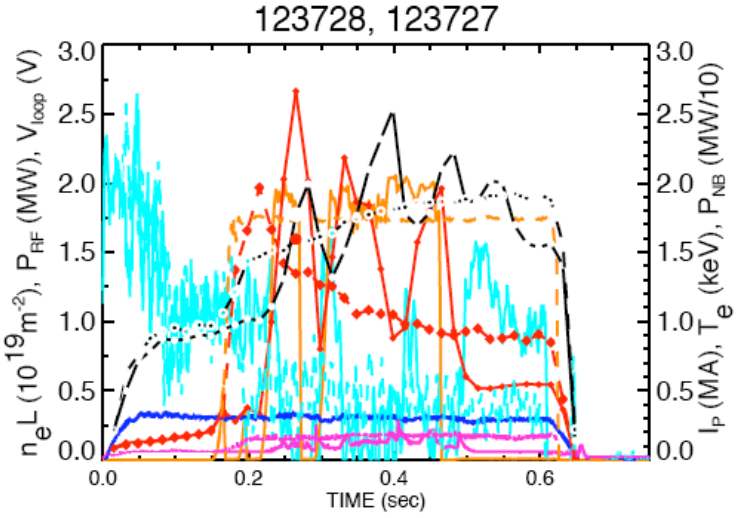


150 Deg Phasing, Compare L-mode and H-mode

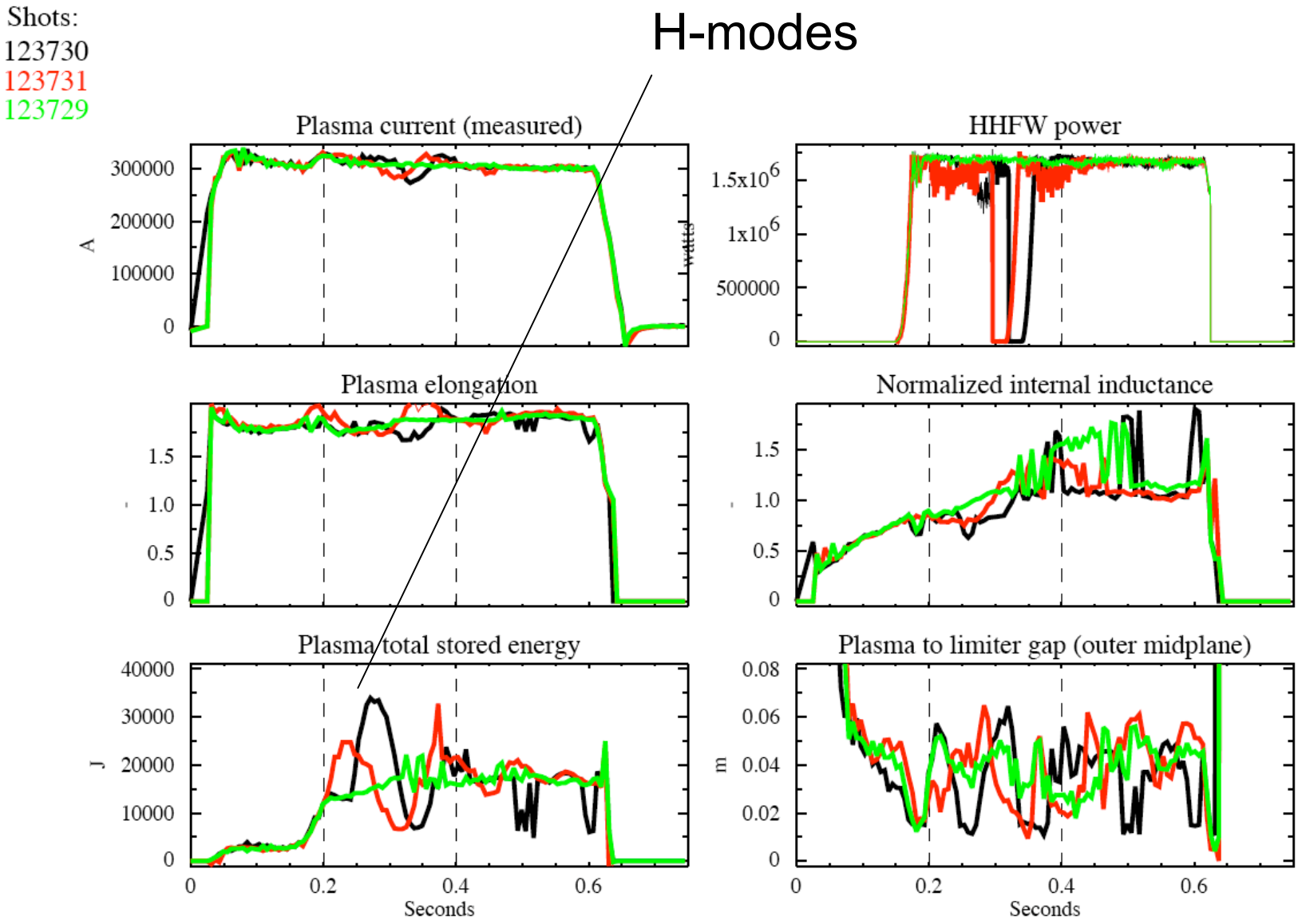




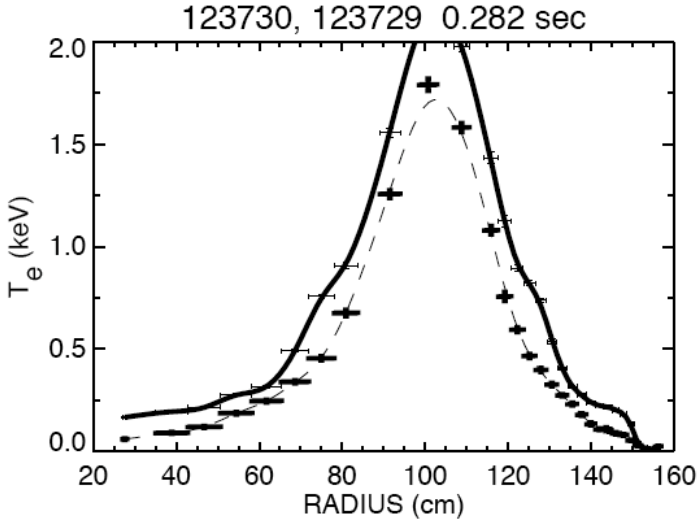


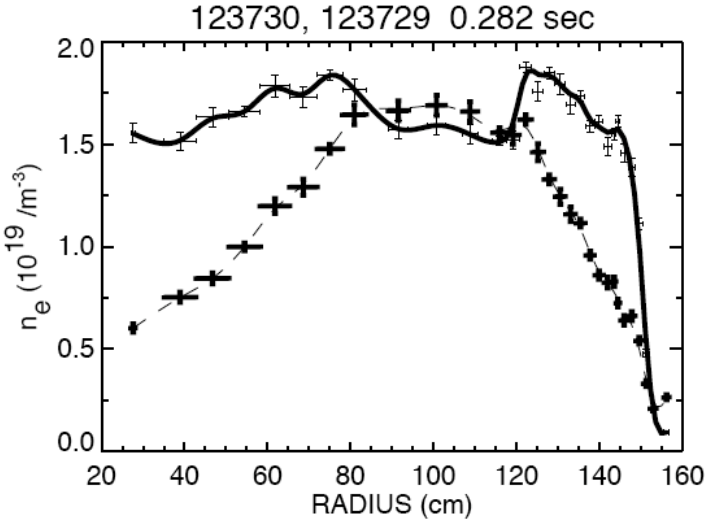


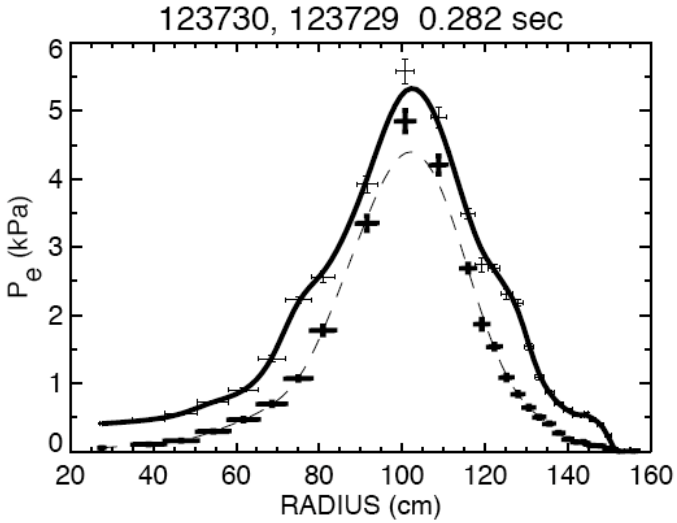
150 Deg Phasing, Changing to -80 Deg Phasing?? Compare L-mode and H-mode

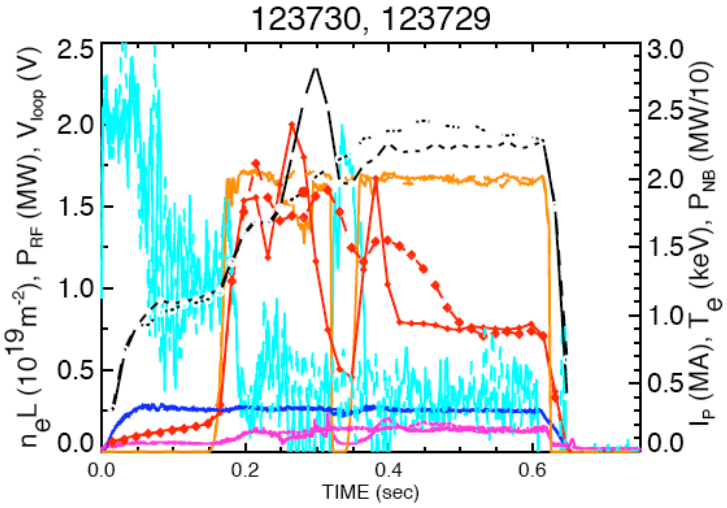


150 Deg Phasing, Compare L-mode and H-mode



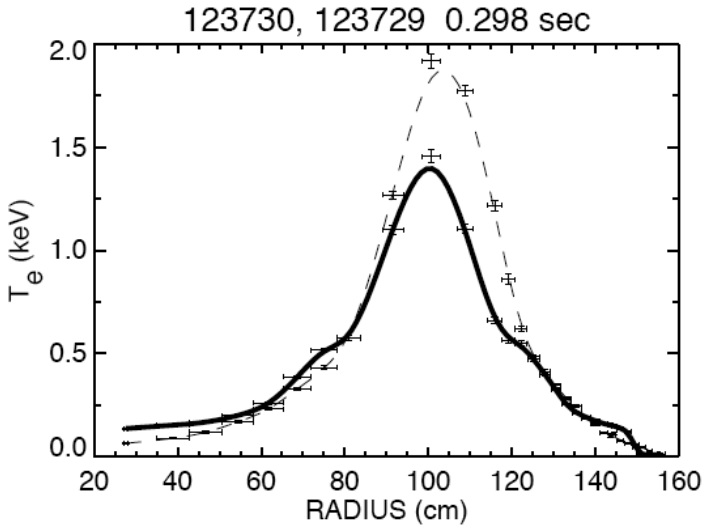


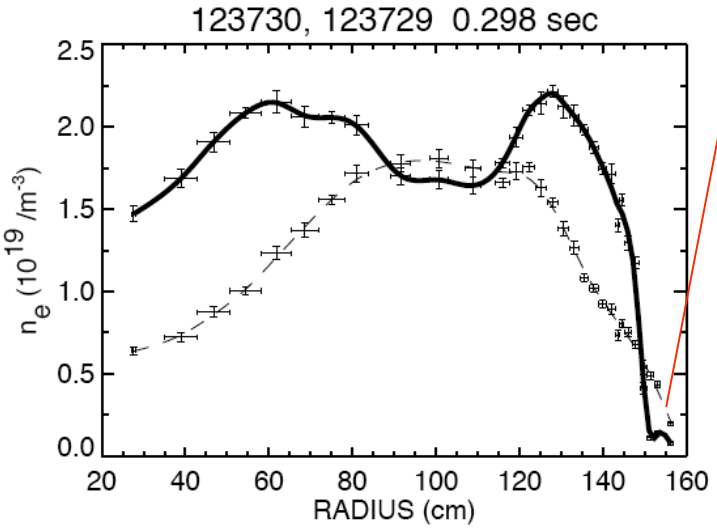


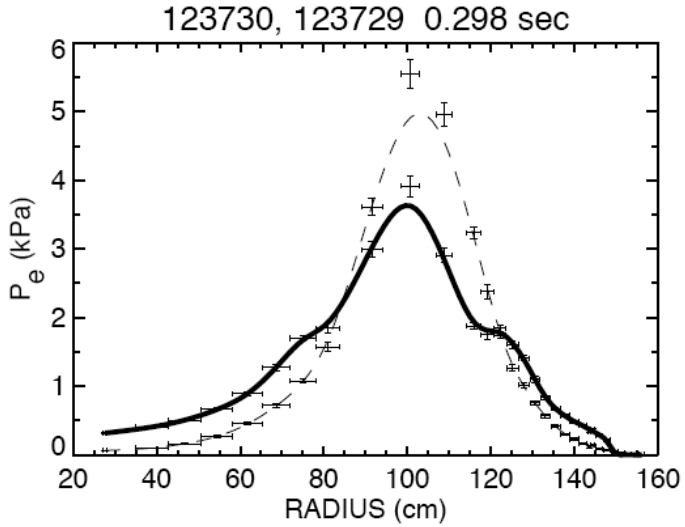


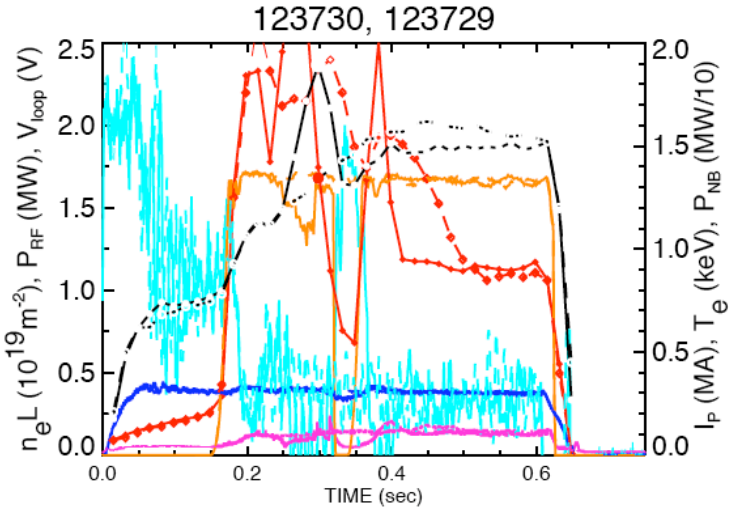
150 Deg Phasing, Compare L-mode and H-mode, 16 ms later

Larger gap with low density

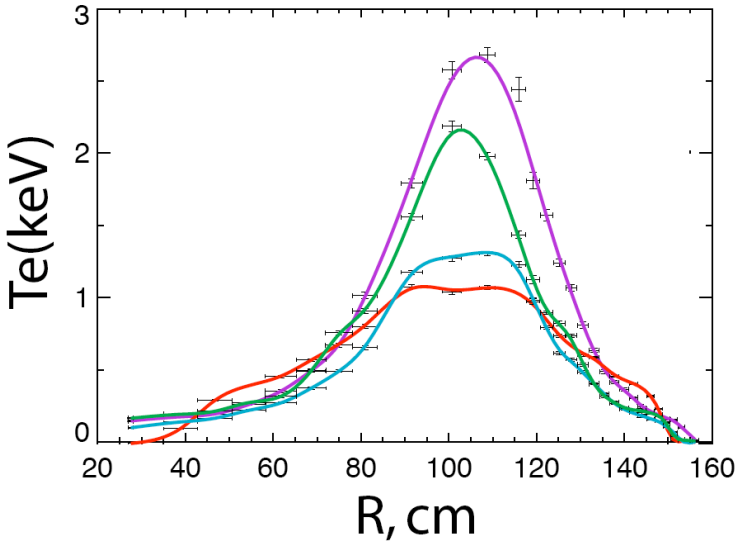








Compare H-mode Plasmas with 117605 from 2005



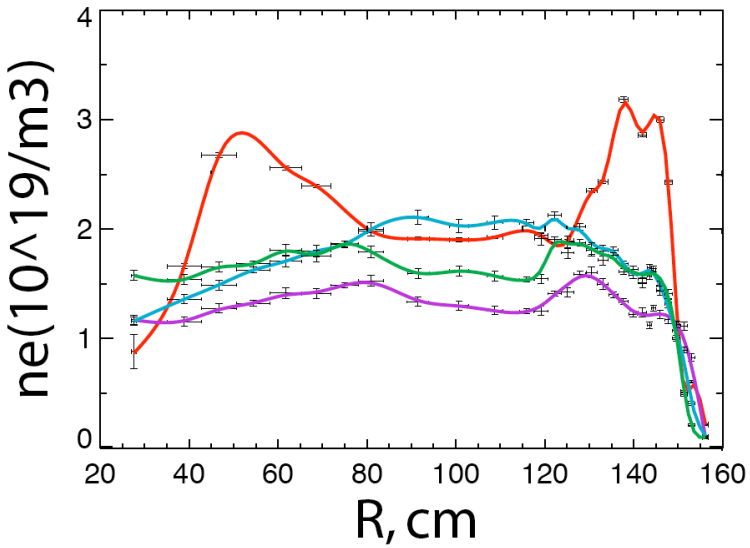
123712, -7 m^{-1} (-90°), 2.3 MW

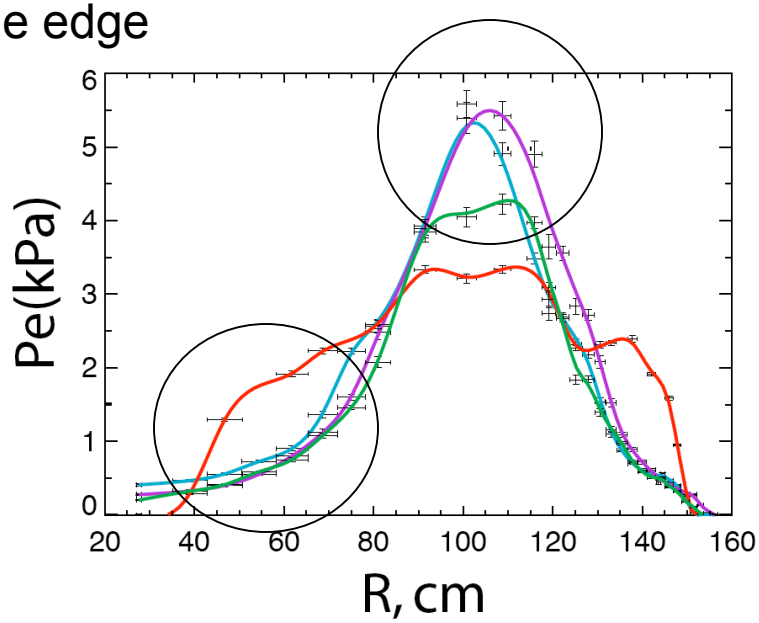
123728, (-160°), 2.0 MW

123730, (-150 --> -80°), 1.7 MW

117605, 14 m^{-1} (180°), 2.7 MW

Appears we are increasing W_{th} in core, not near the edge





Results

- It appears we will never access controlled Ip values below 300 kA ever again
- 7 m^{-1} co-CD at B_T = 5.5 kG does appears to provide higher Te(0) and broader n than we had at 4.5 kG, but we had very similar results of unsustainable H-mode attempts in 2005
- Intermediate phasings appear to provide a continuum of heating efficiency between 7 m^{-1} (least efficient) and 14 m^{-1} (most efficient) based on Te(0) comparison, but no better H-mode sustainment
- Line average density rise with entry to H-mode can be attributed to broadened (and even slightly hollow) density profiles
- Deuterium H-modes with HHFW heating (and possibly CD) are somewhat ellusive, difficulty recovering 2005 results
- Gap control and equilibrium reproducibility need a lot more attention, gap control with H-mode density edge needs to be much better