# NSTX EXPERIMENTAL PROPOSAL XP 304

Controlling density rise through helium conditioning

C. H. Skinner, D Mueller, H Kugel, R Maingi…..

## 1. Overview of planned experiment

One run day:

• Goal 1: Assess role of divertor temperature in density rise and impurity generation by strike point jog.

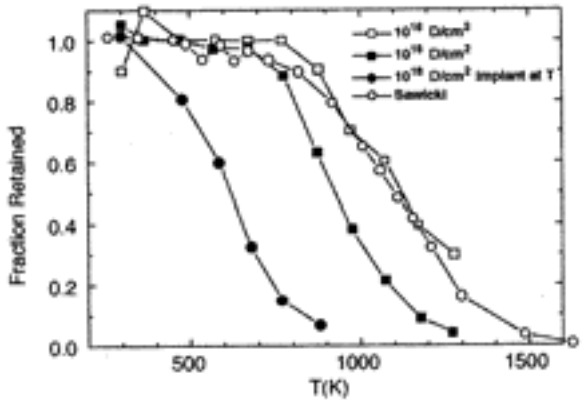
• Goal 2: Reduce density rise by depleting D in divertor with He conditioning with NBI.

• Goal 3: (time permitting) Compare conditioned LSN fiducial to same discharge but USN run on un He-conditioned upper divertor.

*run Wednesday January 29th...*

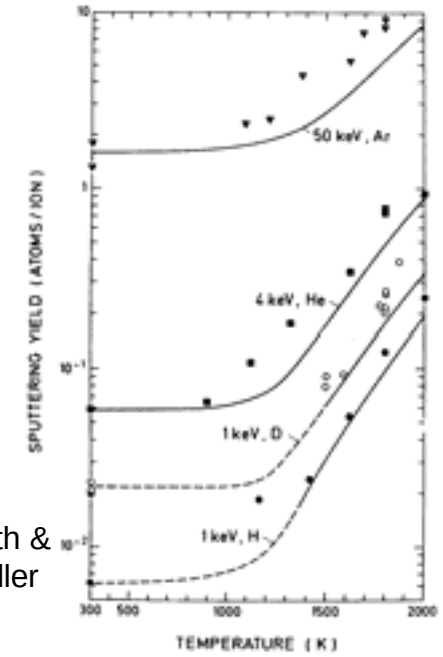
# Temperature effects:

## D release



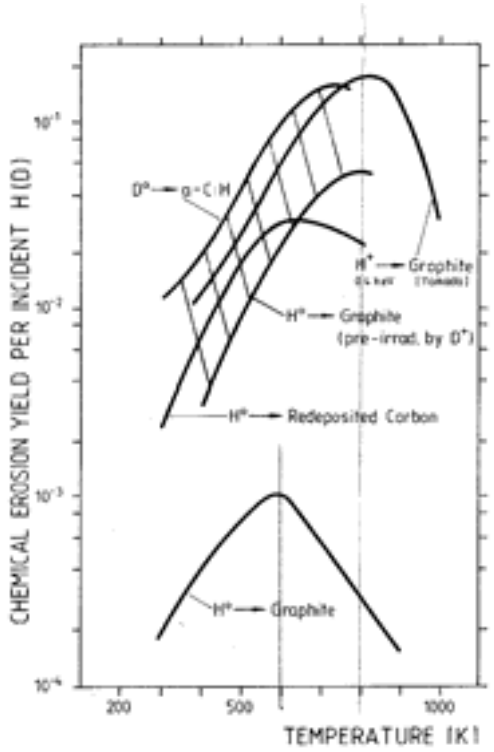

Doyle et al.,

## Radiation Enhanced Sublimation (RES) as temp. rises

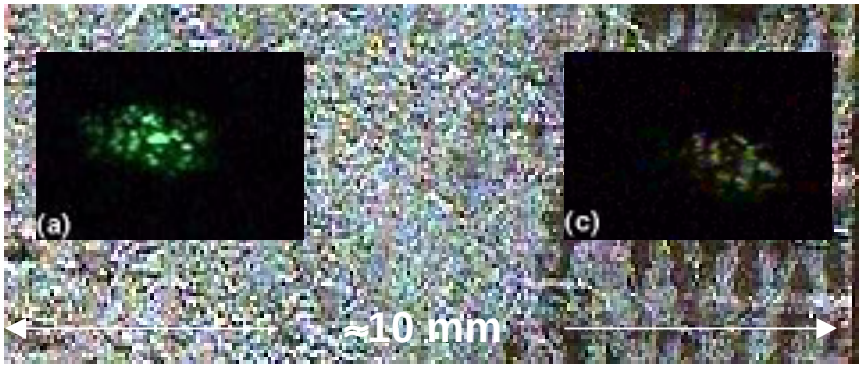



Roth & Moller

## Chemical Sputtering




Vietzke & Haasz.




Skinner et al.,

*Temp: 1841 °C left, 1181 °C right*

*Same heat flux (from laser spot)*

*Microhotspots - surface temperature not single value (varies x2)*

# Overview of run day:

*Problems:*

- *machine control software (2.25 h)*
- *CA to fix Mirnov (0.75 hr)*
- *Software loads wrong TF - CA to check rectifier (2.25 hr)*

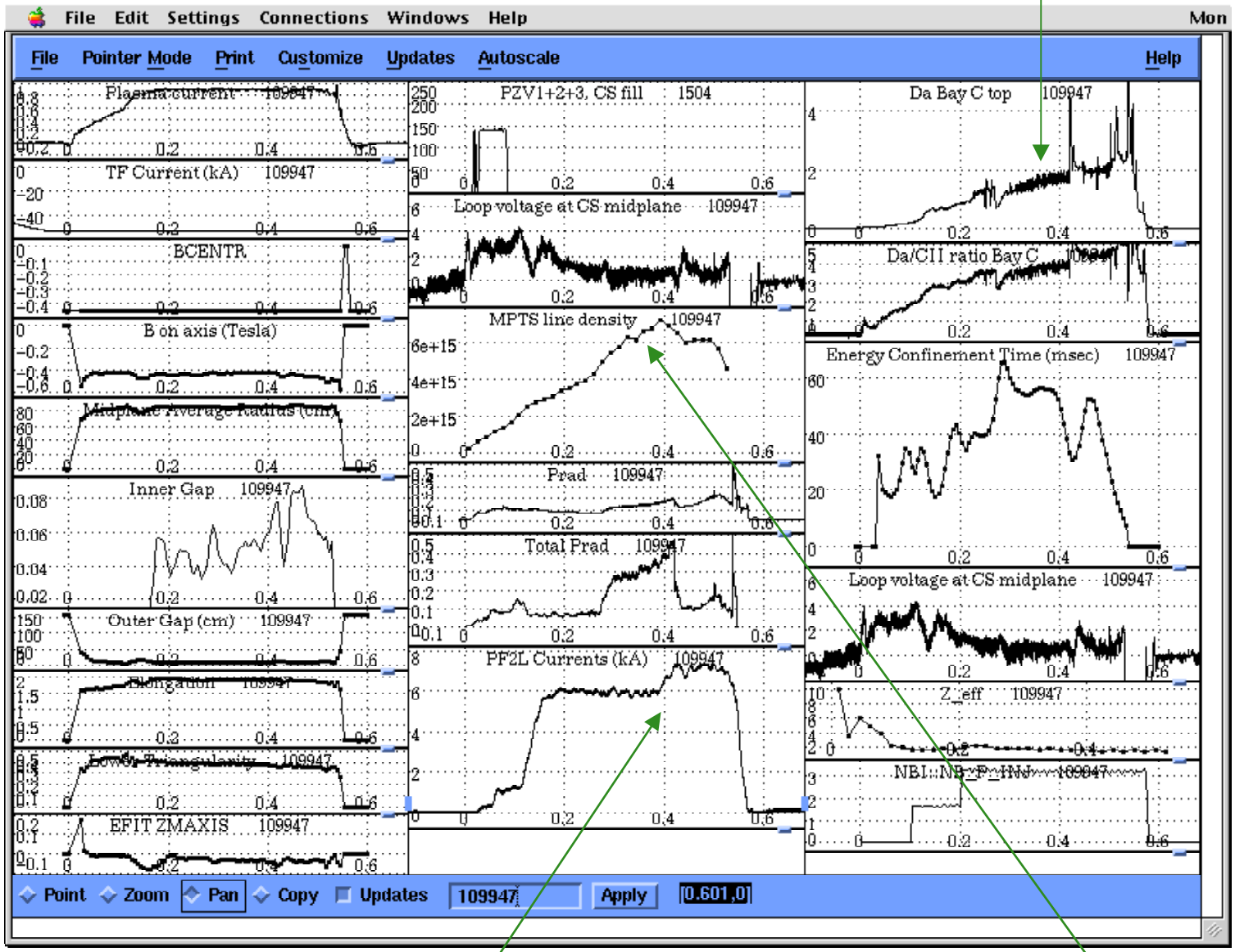
- *TF trip gives 26% Beta toroidal (#109941)*

*XP time (3.75 hr)*

- *insufficient time for He conditioning, focus on strike point jog*
- *develop discharge with 220ms long, reasonably quiescent H-mode by adjusting CS gas feed*
- *jog strike point with PF2 (PF1 ineffective)*
- *2.5 jog/no jog comparisons show roll over in density before loss of H-mode (caveat emptor)*
-

*Jog shot 109947:*

*H-mode from 267 - 418 ms*




*109947 had PF2L increase from -7 to -8.5 from 380 to 415 ms, hold until 530 ms then ramp back down to -7*

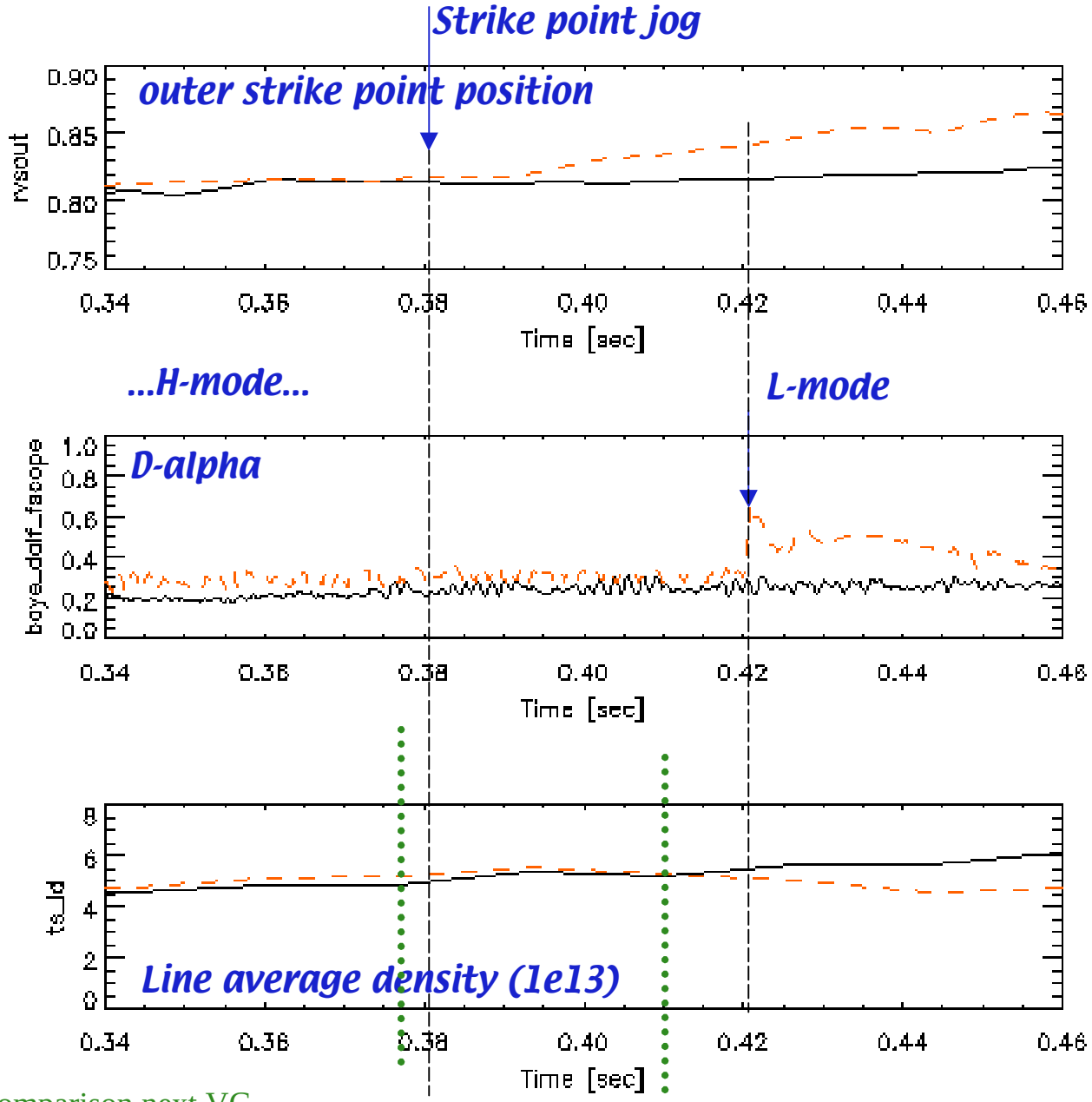
*effect on density rise ?*

# *Indication of density rollover after strike point jog, before L-mode, but…*

***109946*** ——————

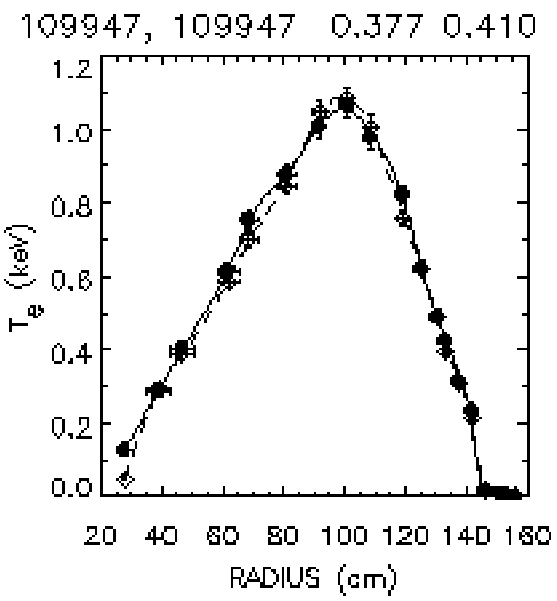
***109947*** - - - - - - - - - - - - - - -

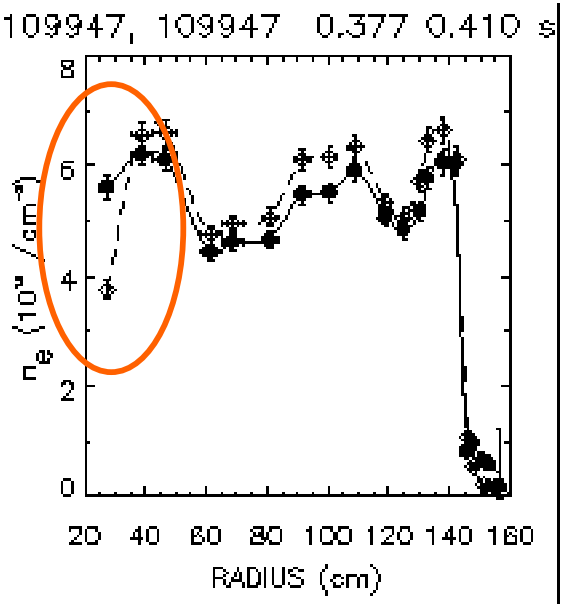
109947 had PF2L increase from -7 to -8.5 from 380 to 415 ms, hold until 530 ms then ramp back down to -7

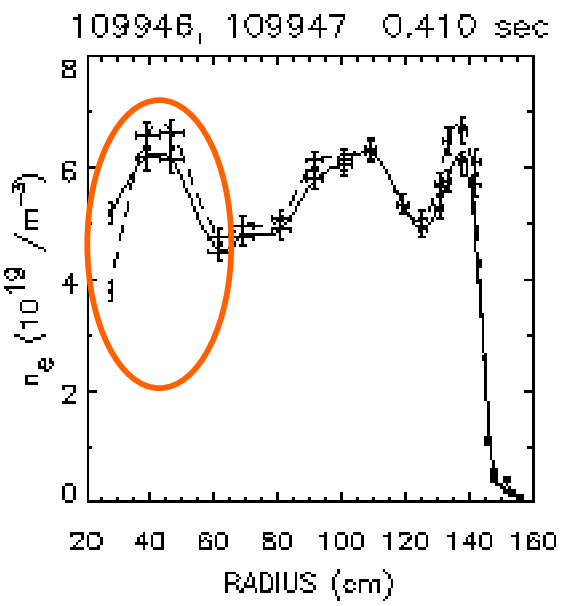


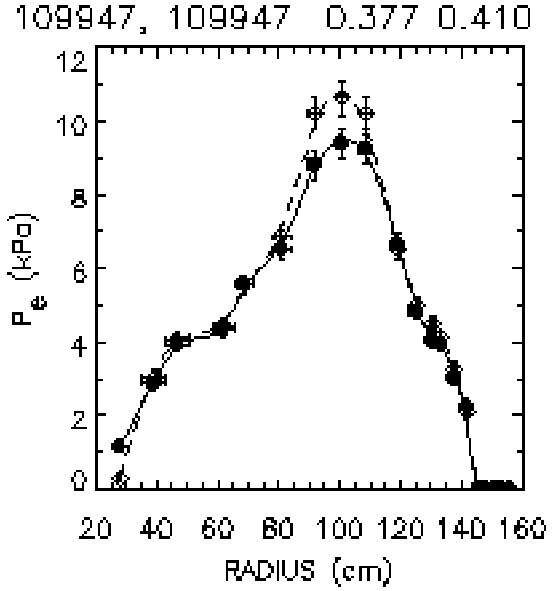

MPTS comparison next VG

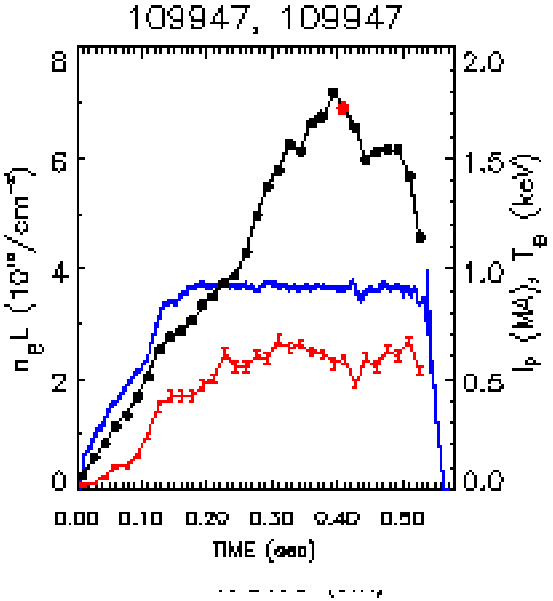
## ... but motion away from CS causes major part of density reduction.

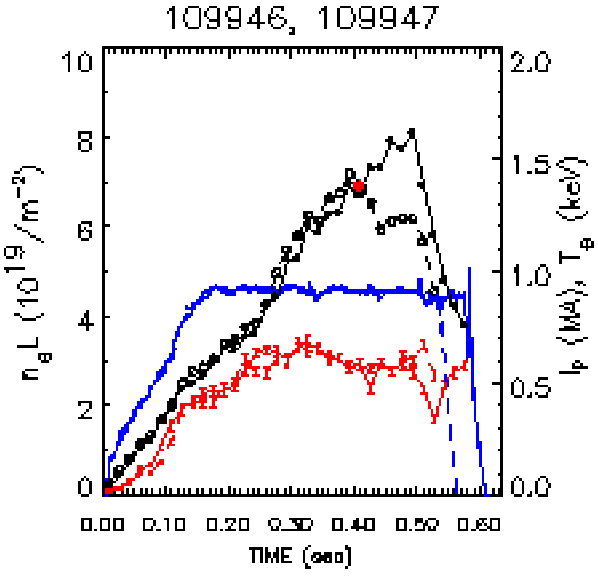


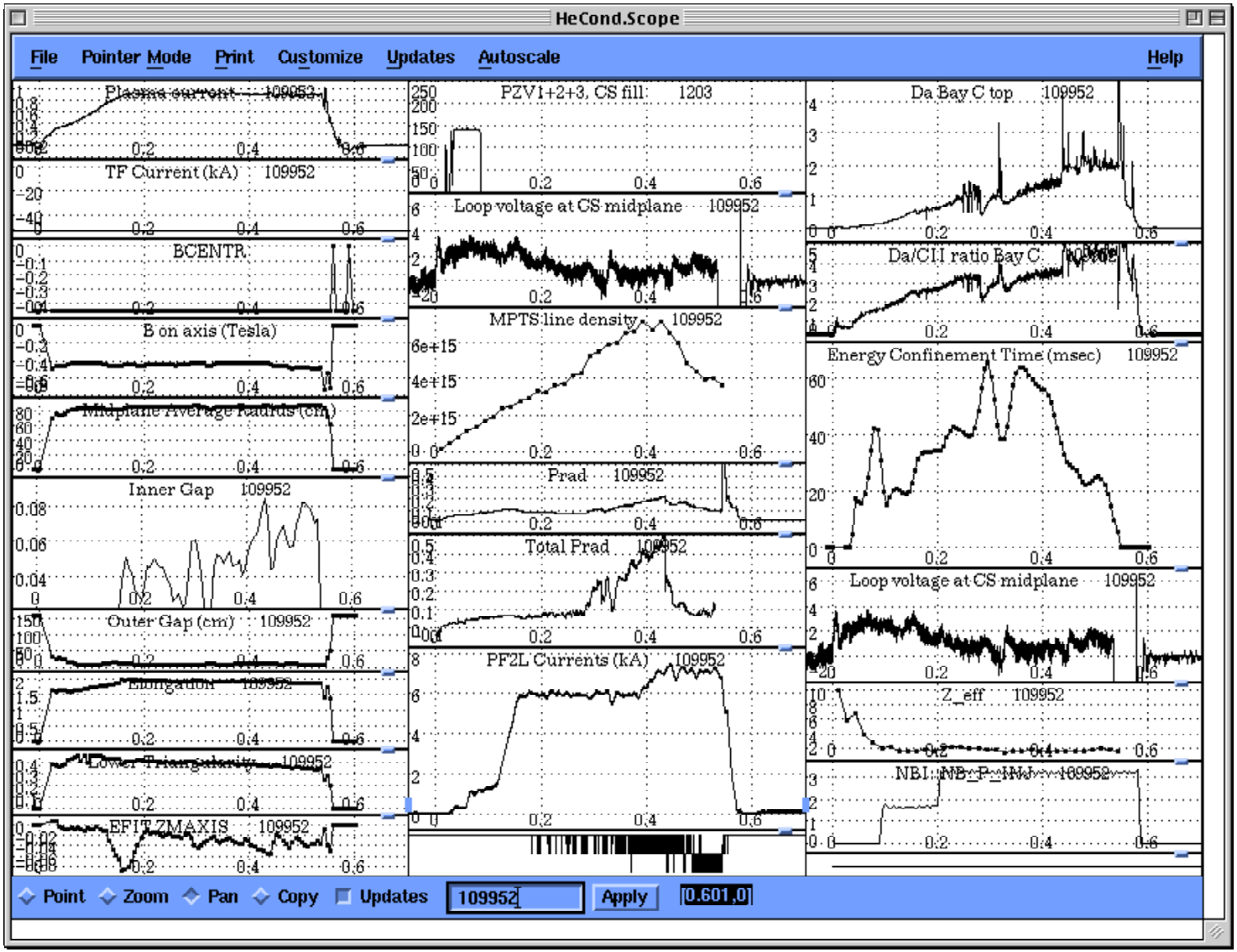




HeCond.Scope
File
Pointer Mode
Print
Customize
Updates
Autoscale
Help
Plasma current 109952
TF Current (kA) 109952
BCENTR
B on axis (Tesla)
Midplane Average Radius (cm)
Inner Gap 109952
Outer Gap (cm) 109952
Elongation 109952
Lower Triangularity 109952
EFIT ZMAXIS 109952
PZV1+2+3, CS fill 1203
Loop voltage at CS midplane 109952
MPTS line density 109952
Prad 109952
Total Prad 109952
PF2L Currents (kA) 109952
Da Bay C top 109952
Da/CII ratio Bay C
Energy Confinement Time (msec) 109952
Loop voltage at CS midplane 109952
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NBI NB_P_NW 109952
Point
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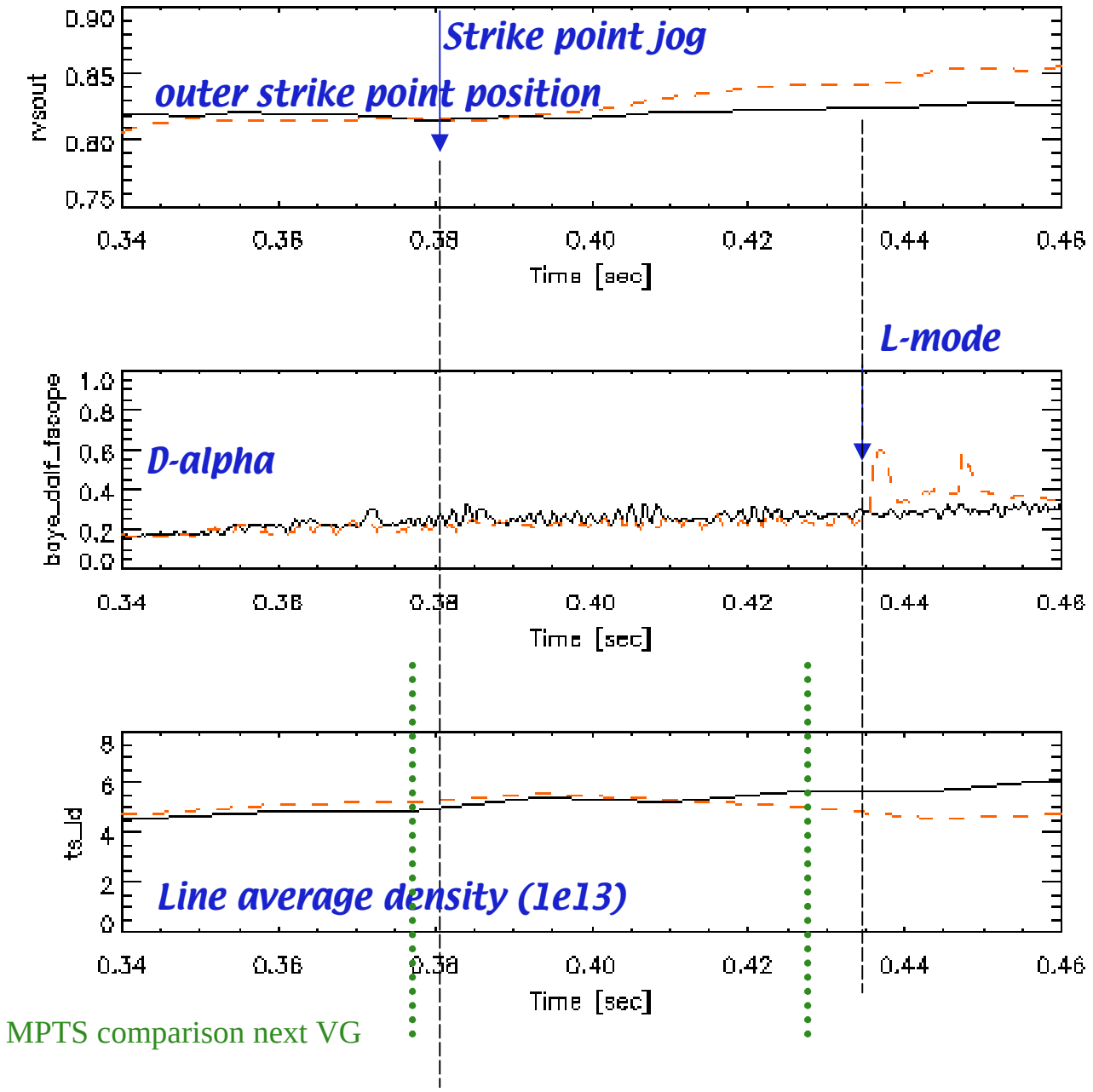
# *Indication of density rollover after strike point jog, before L-mode, but…*

***109950*** ——————

***109952*** - - - - - - - - - - - - - - -

109952 had PF2L increase from -7 to -8.5 from 380 to 420 ms,




MPTS comparison next VG

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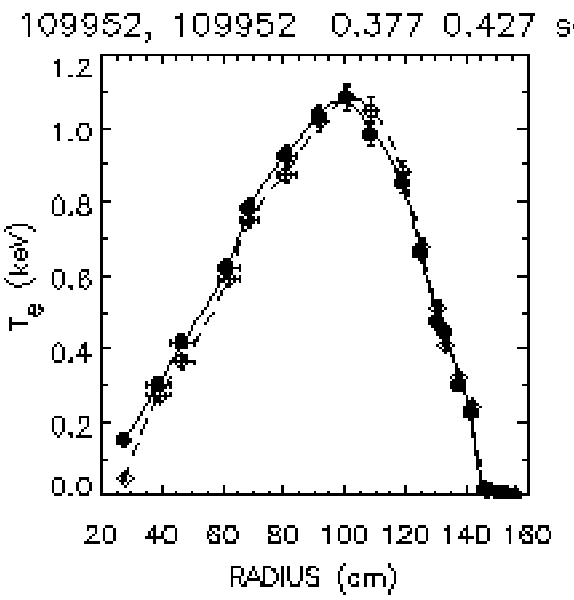
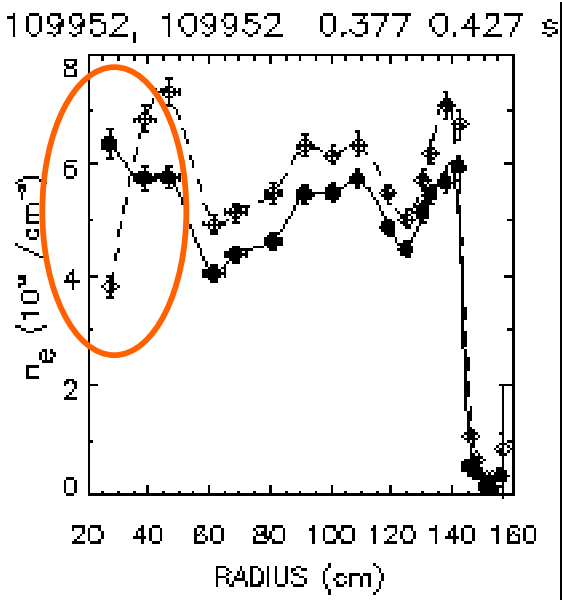
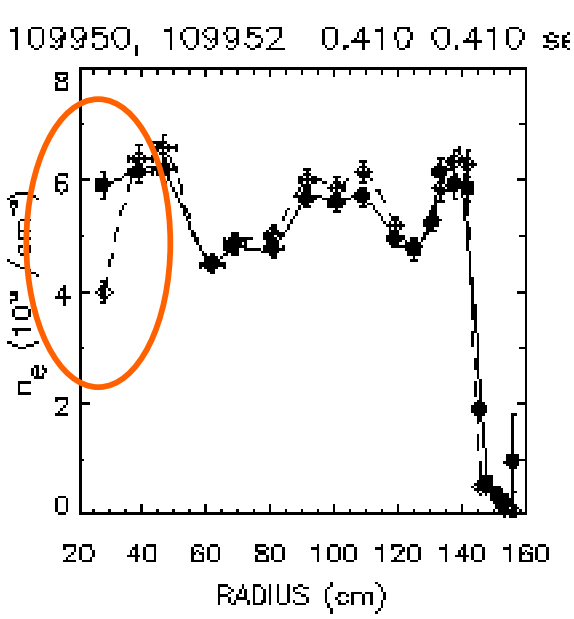
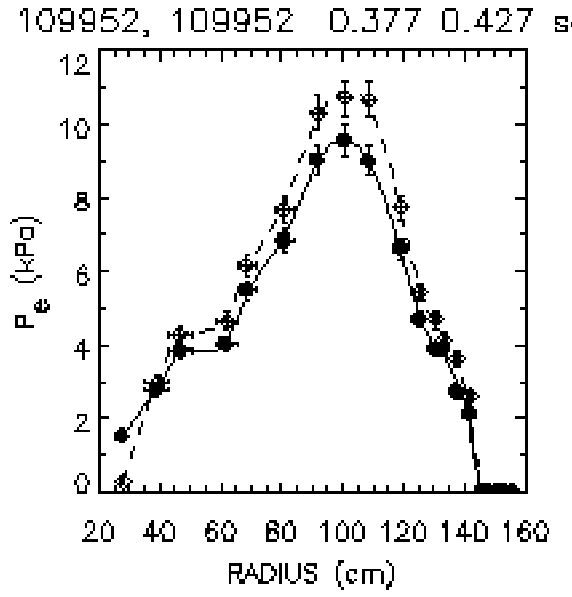
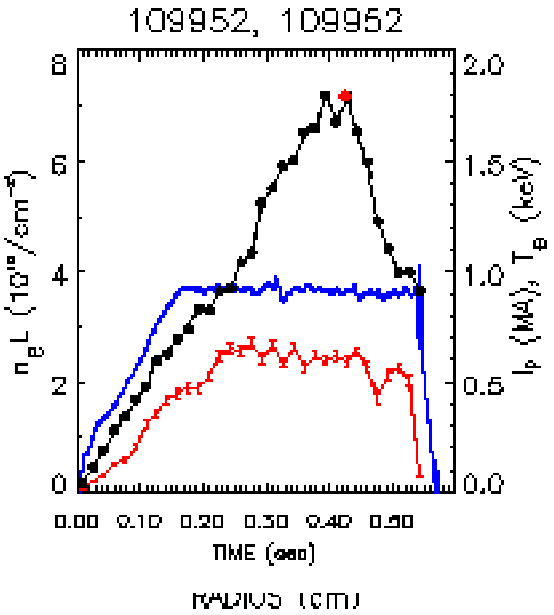
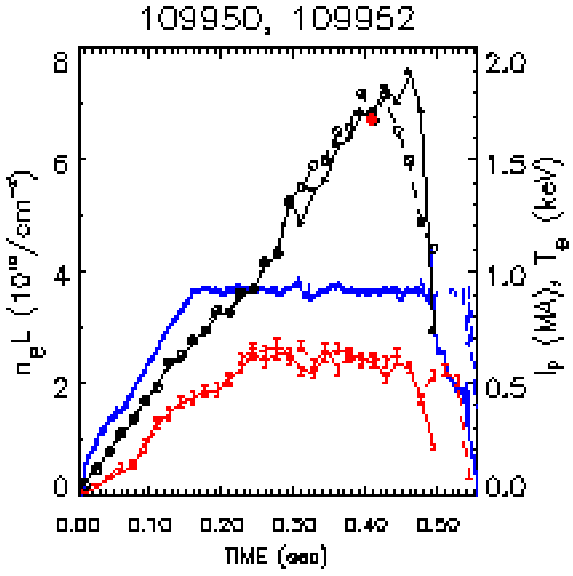


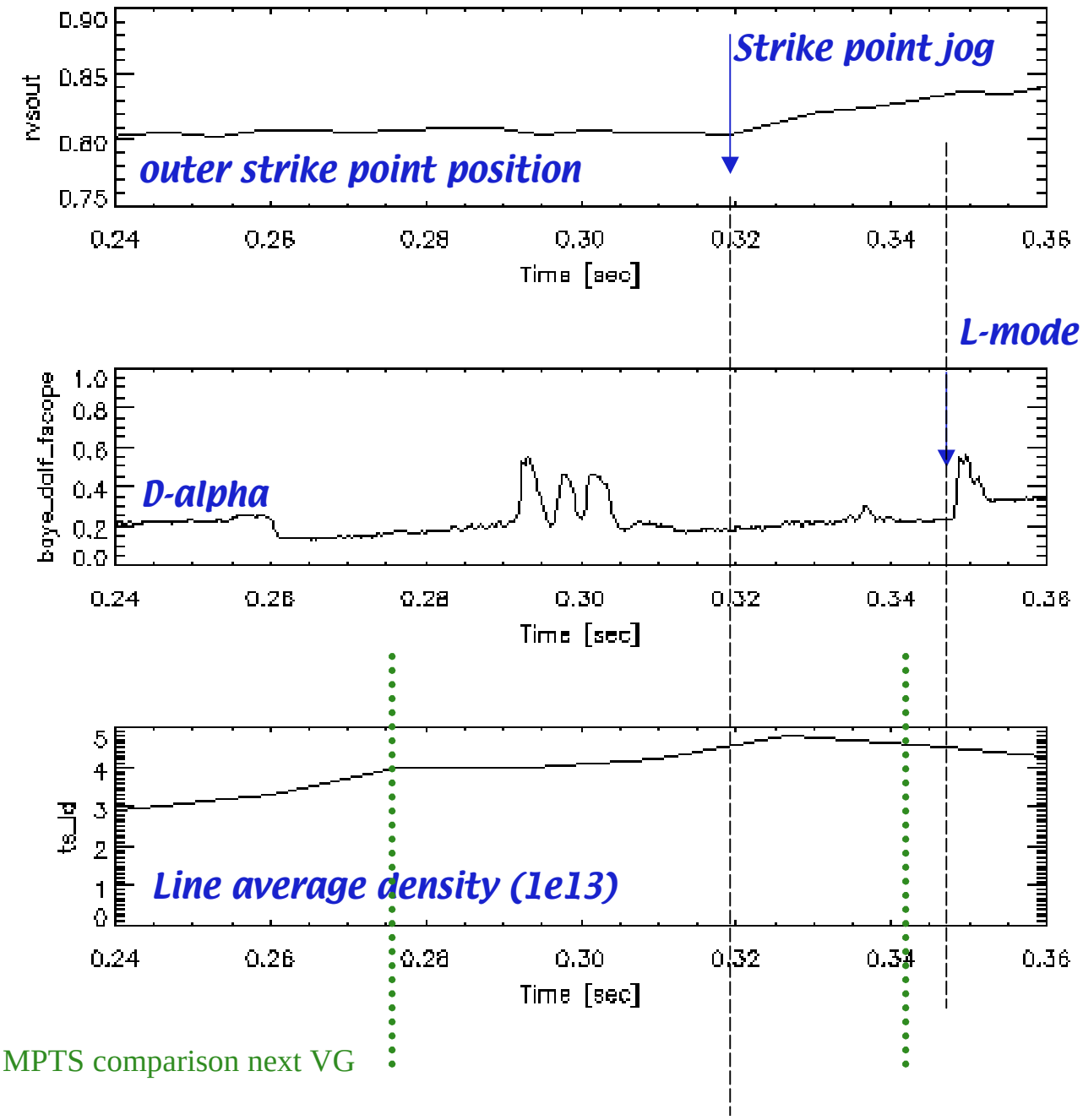



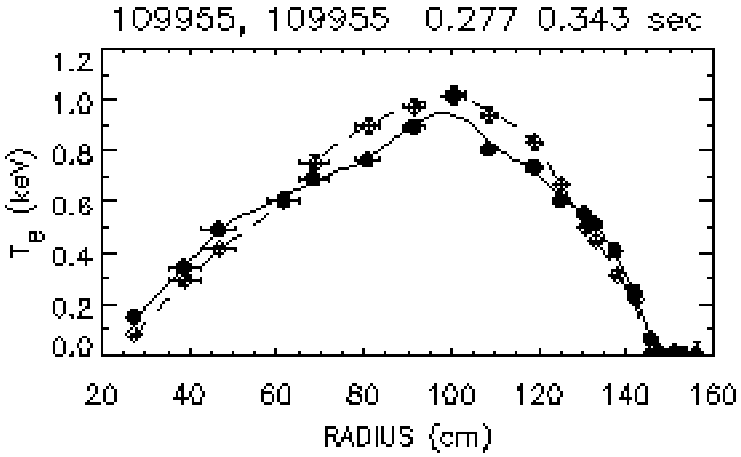
# *Indication of density rollover after strike point jog, before L-mode, but…*

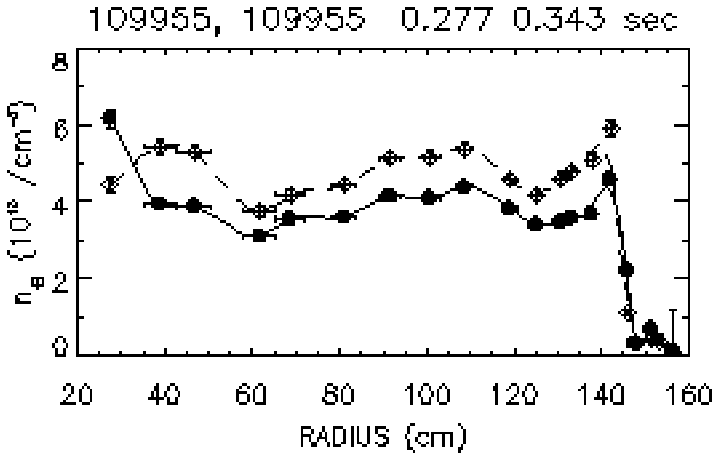
***109955***
***no time for no jog shot***

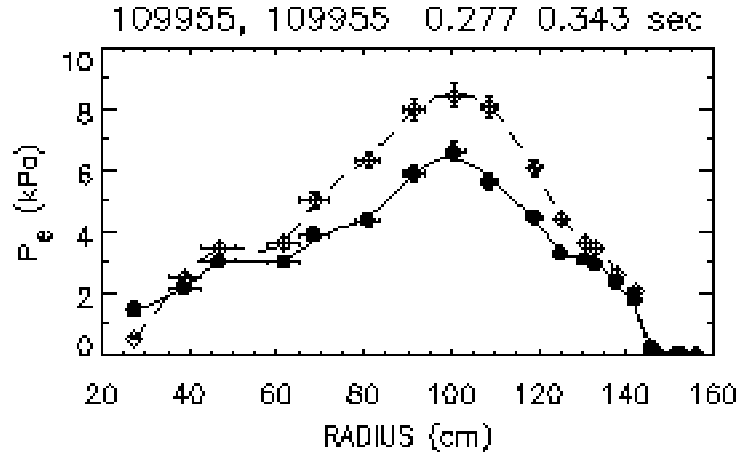
109955 had PF2L increase from from 320 ms,

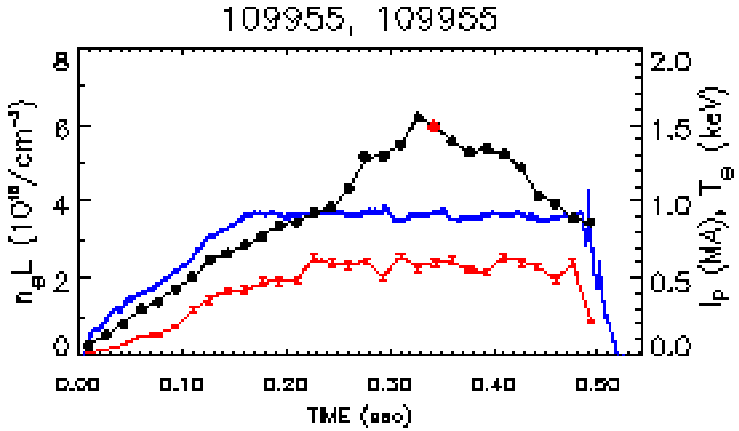



MPTS comparison next VG


109955, 109955 0.277 0.343 sec
$T_e$ (keV)
RADIUS (cm)


109955, 109955 0.277 0.343 sec
$n_e$ ($10^{13}$ /cm$^3$)
RADIUS (cm)


109955, 109955 0.277 0.343 sec
$P_e$ (kPa)
RADIUS (cm)


109955, 109955
$n_e L$ ($10^{18}$/cm$^2$)
$I_p$ (MA), $T_e$ (keV)
TIME (sec)

# Summary:

- Density rollover observed after strike point jog, but causality complicated due to change in plasma shape.

  - jog duration before loss of H-mode too short for IR camera (33 ms frame time)

  - H-alpha camera data .... ?

- Some data gained on high Beta and H-mode behavior vs plasma shape

- Need more discharge development time to stay in H-mode longer and control inner gap ( RTEFIT ?) for definitive experiment on effect of jog on density rise.

- Still need to run helium conditioning part of XP to address access to discharges > 1 s without exceeding density limit.