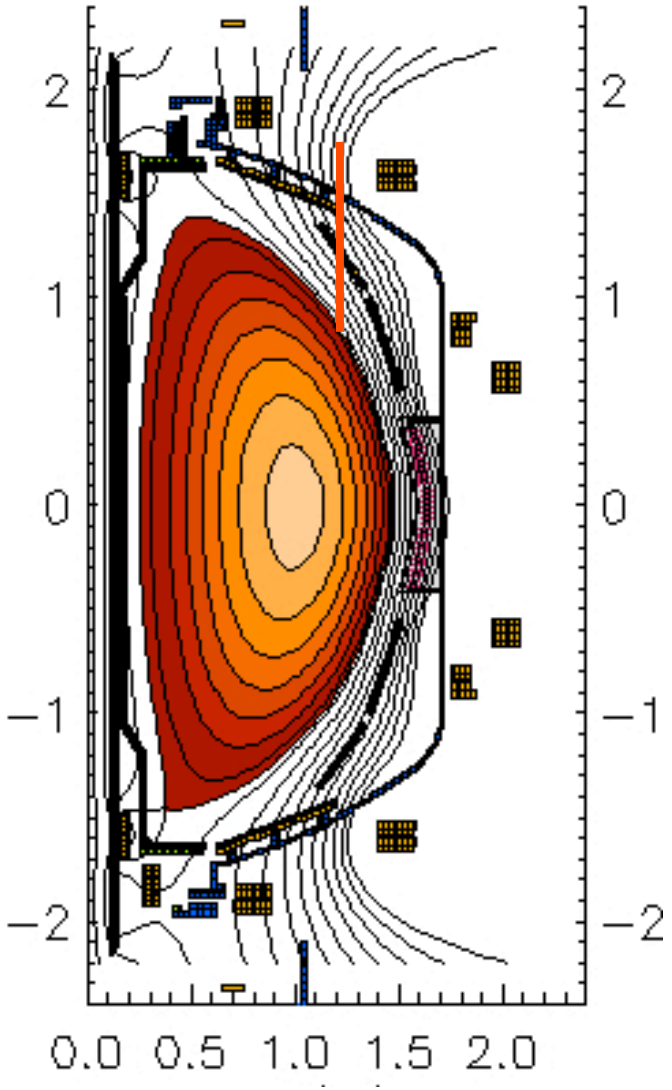
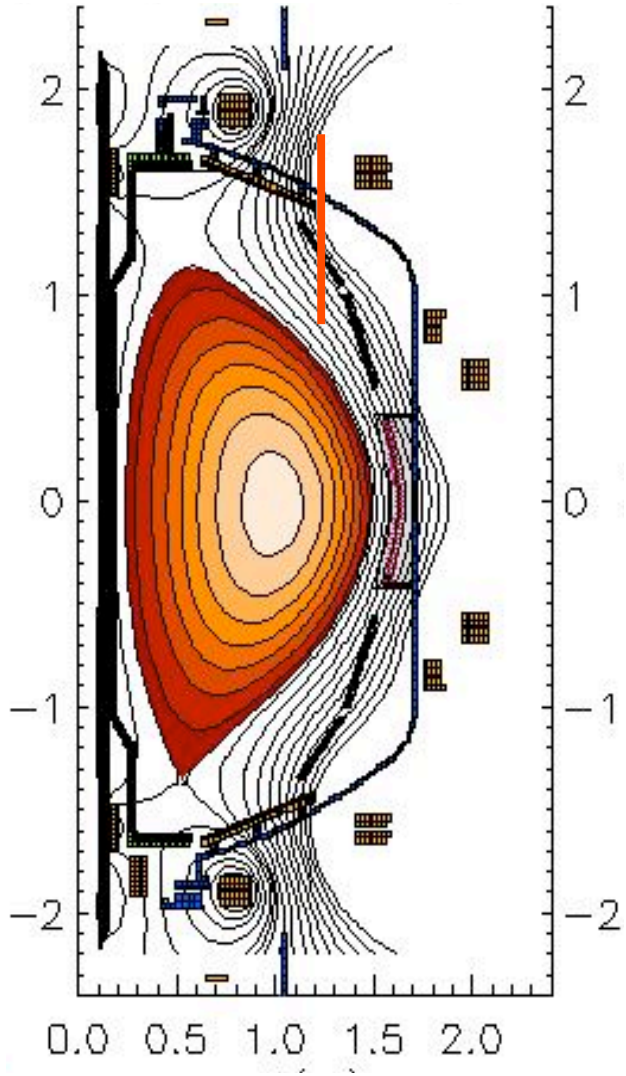
Standard Fiducial

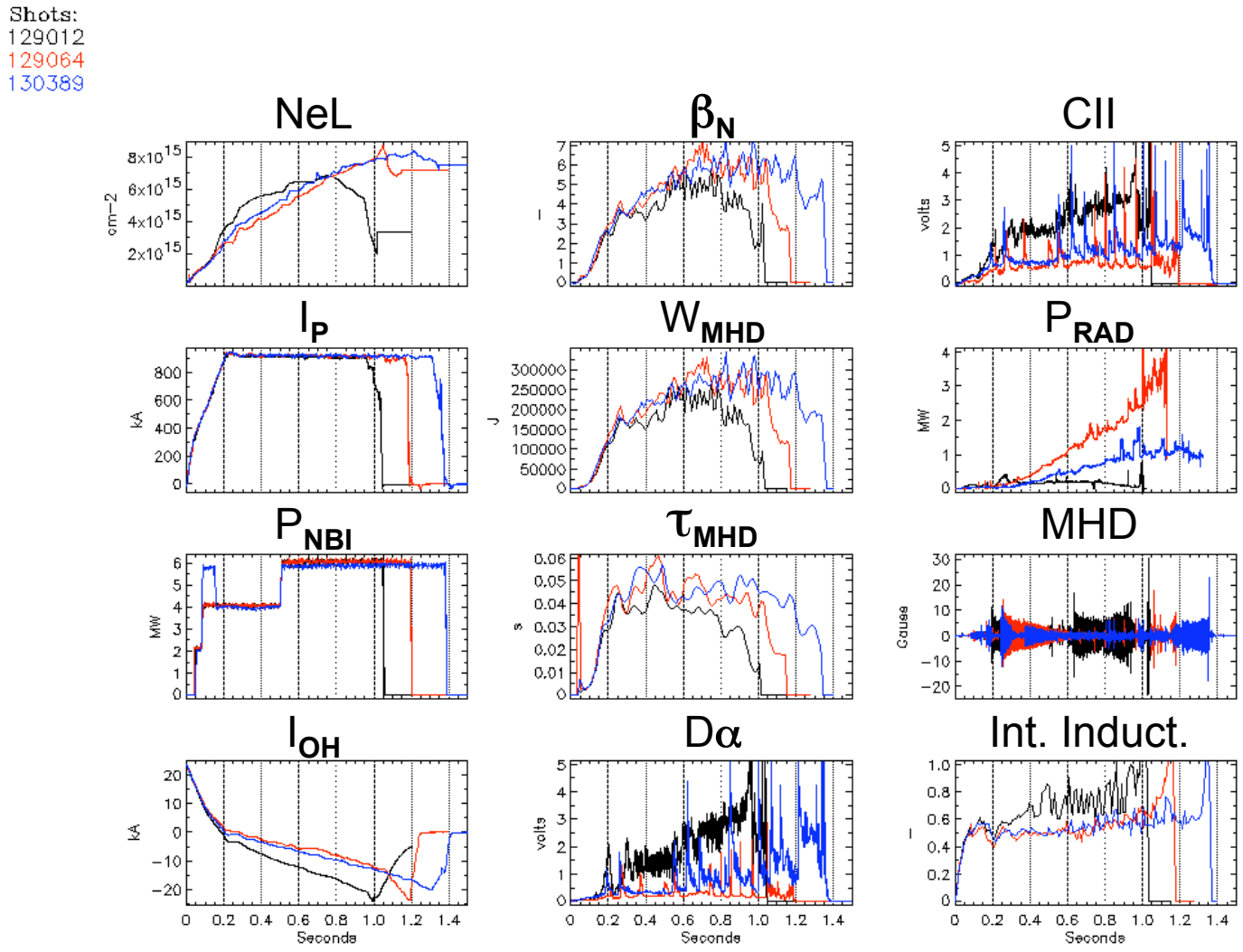


ELMs / LLD



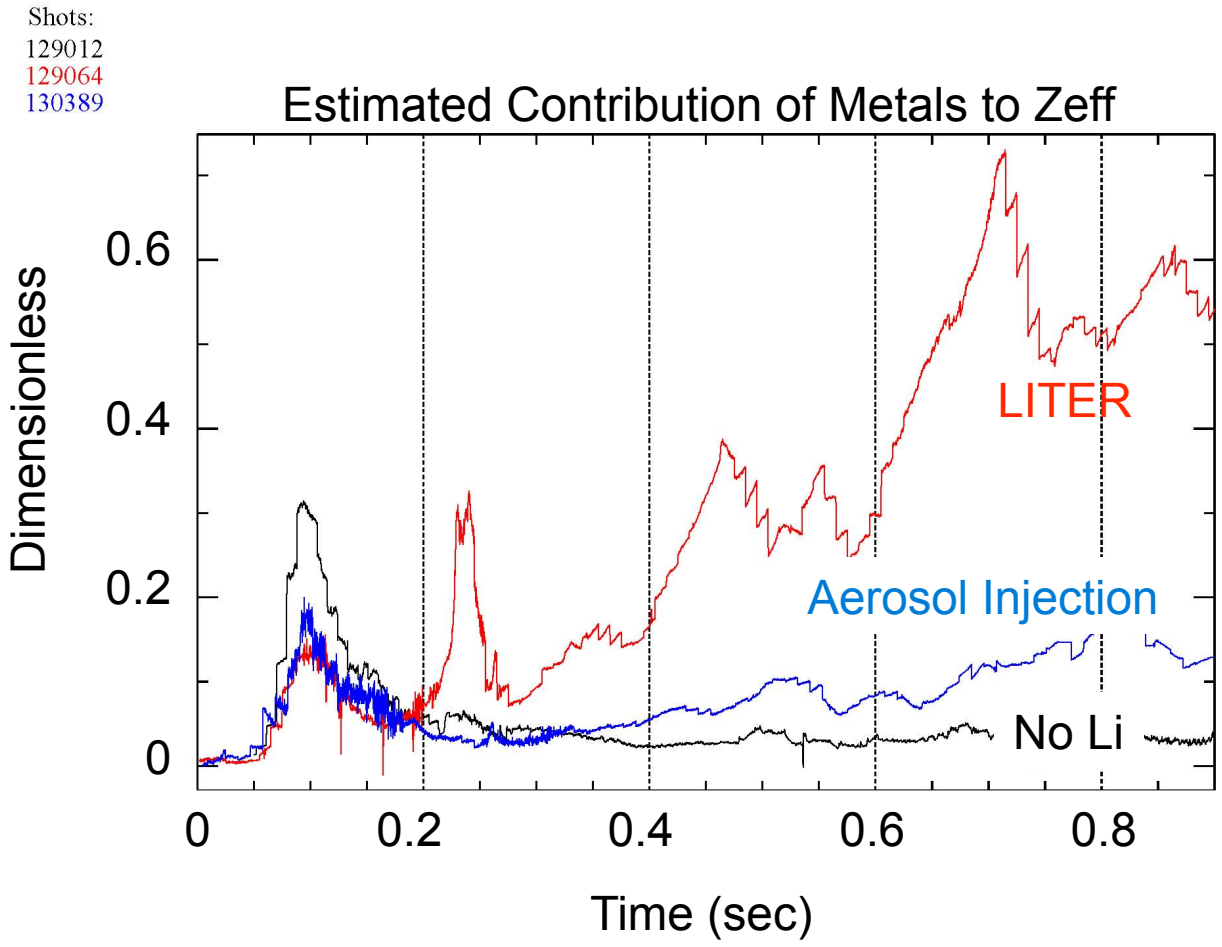
Comparison: LITER, Aerosol and No Lithium Shots

No Li **700 mg LITER** **7 mg Early Li Aerosol**

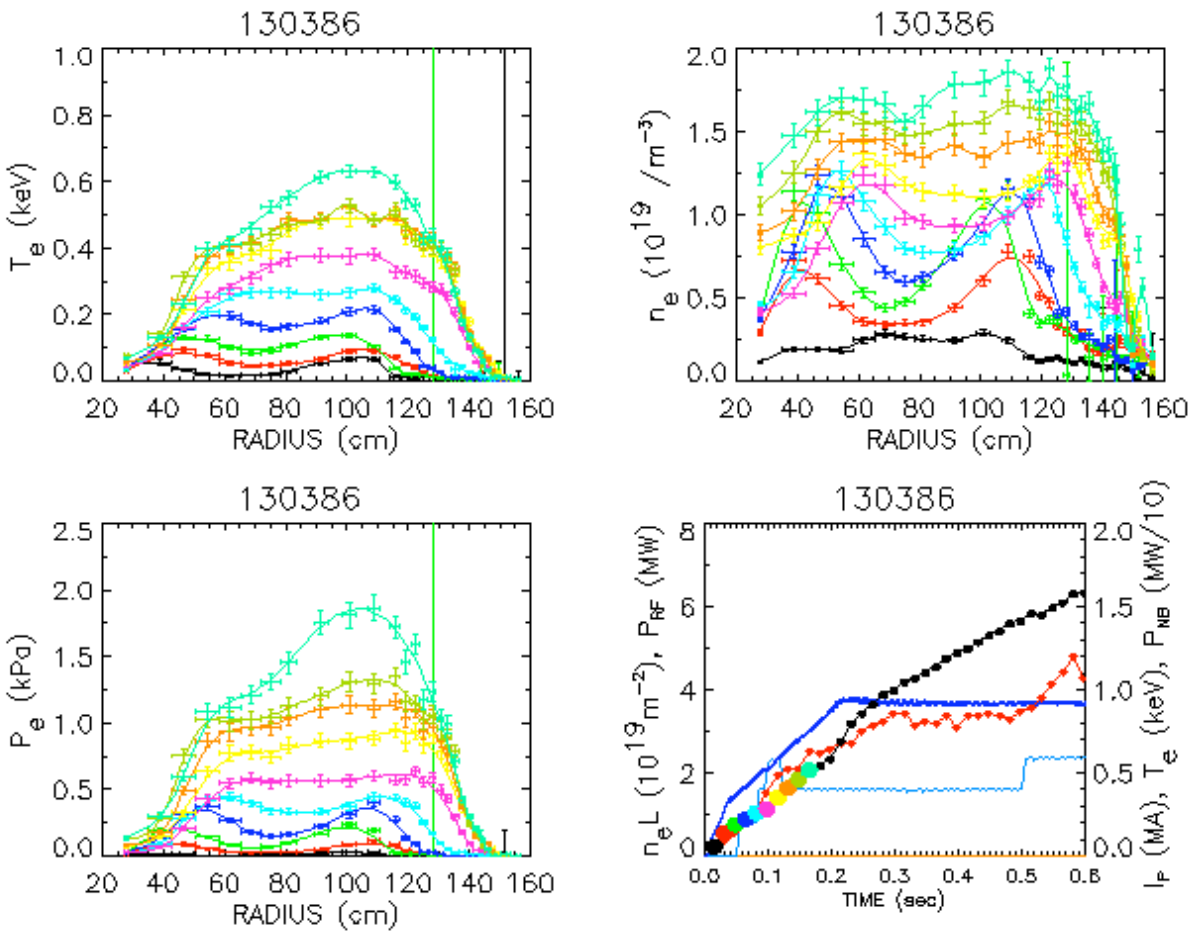


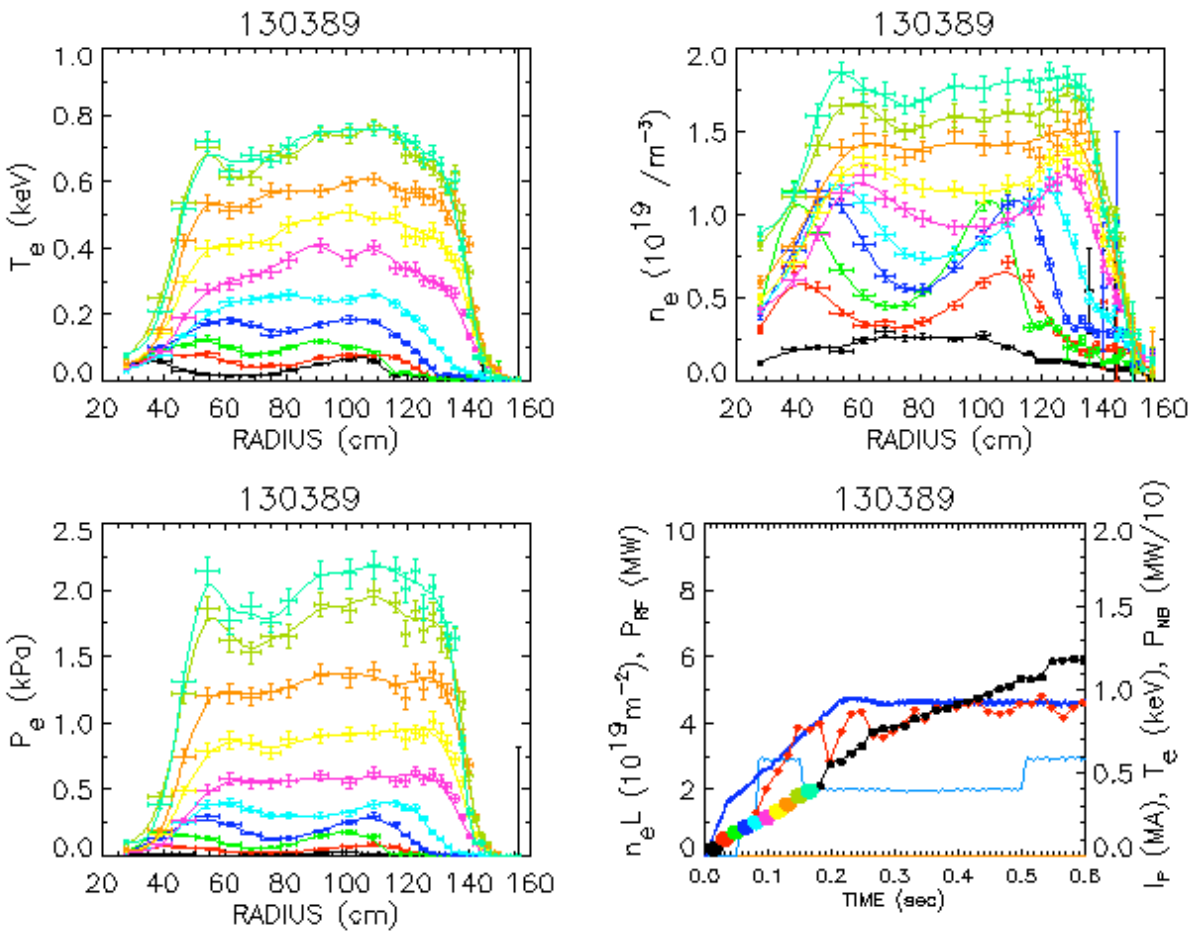
Comparison: Zeff(0) from Metals

No Li 700 mg LITER 7mg Early Li Aerosol



S. Paul


130386
T_e (keV)
RADIUS (cm)
130386
n_e (10^{19} /m^{-3})
RADIUS (cm)
130386
P_e (kPa)
RADIUS (cm)
130386
$n_e L$ ($10^{19} m^{-2}$), P_{RF} (MW)
I_P (MA), T_e (keV), P_{NB} (MW/10)
TIME (sec)


130389
T_e (keV)
RADIUS (cm)
130389
n_e (10^{19} /m^{-3})
RADIUS (cm)
130389
P_e (kPa)
RADIUS (cm)
130389
$n_e L$ ($10^{19} m^{-2}$), P_{RF} (MW)
I_P (MA), T_e (keV), P_{NB} (MW/10)
TIME (sec)

Goal(s) of the XP

1. Establish whether or not the 1st aerosol experiment was a fluke.

   Fiducials: H mode by early NBI overdrive - no CS gas

   Early aerosol injection – before L-to-H transition
   10 mg/s and higher – probe the limit of Li aerosol mass flux

   Push plasma performance
   If problems try OH shot or two

---------- If time permits ----------

2. Investigate effects on ELMs.
   Can aerosol trigger small ELMs at higher flux rates (>35mg/s)?

3. Investigate whether more Li atoms can be injected than D2 atoms.
   LLD loading - need relevant discharge

4. Investigate Li efficacy with double null discharges

Shot 130388: Early Injection of Li Powder

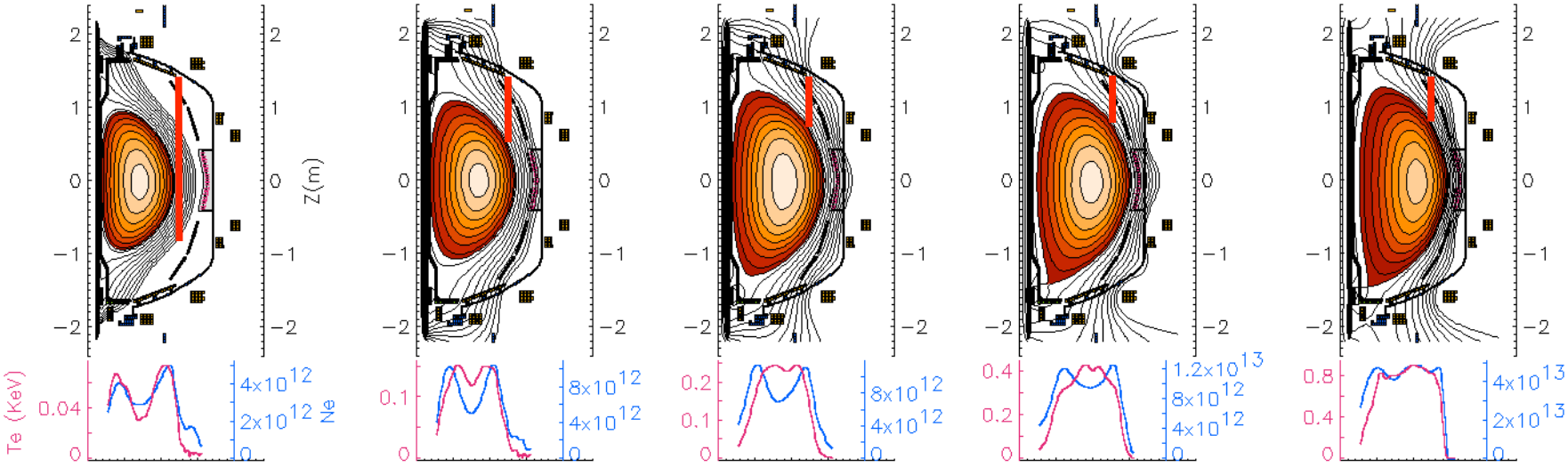
- Nominal aerosol trajectories shown by red vertical lines

Plasma Encounters Aerosol Particles

Li^{+1} Rings Observed (Fig 12)

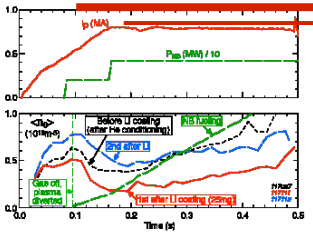
X-Point Established (H-mode @ 180 ms)

Stored Energy Steady State

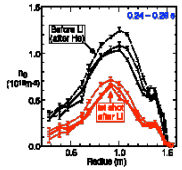


25 ms 58 ms 80 ms 102 ms 509 ms

2005 First LSN NBI D Shot After 25 mg of Li Pellet Injection Exhibited Factor ~50% Decrease in Density

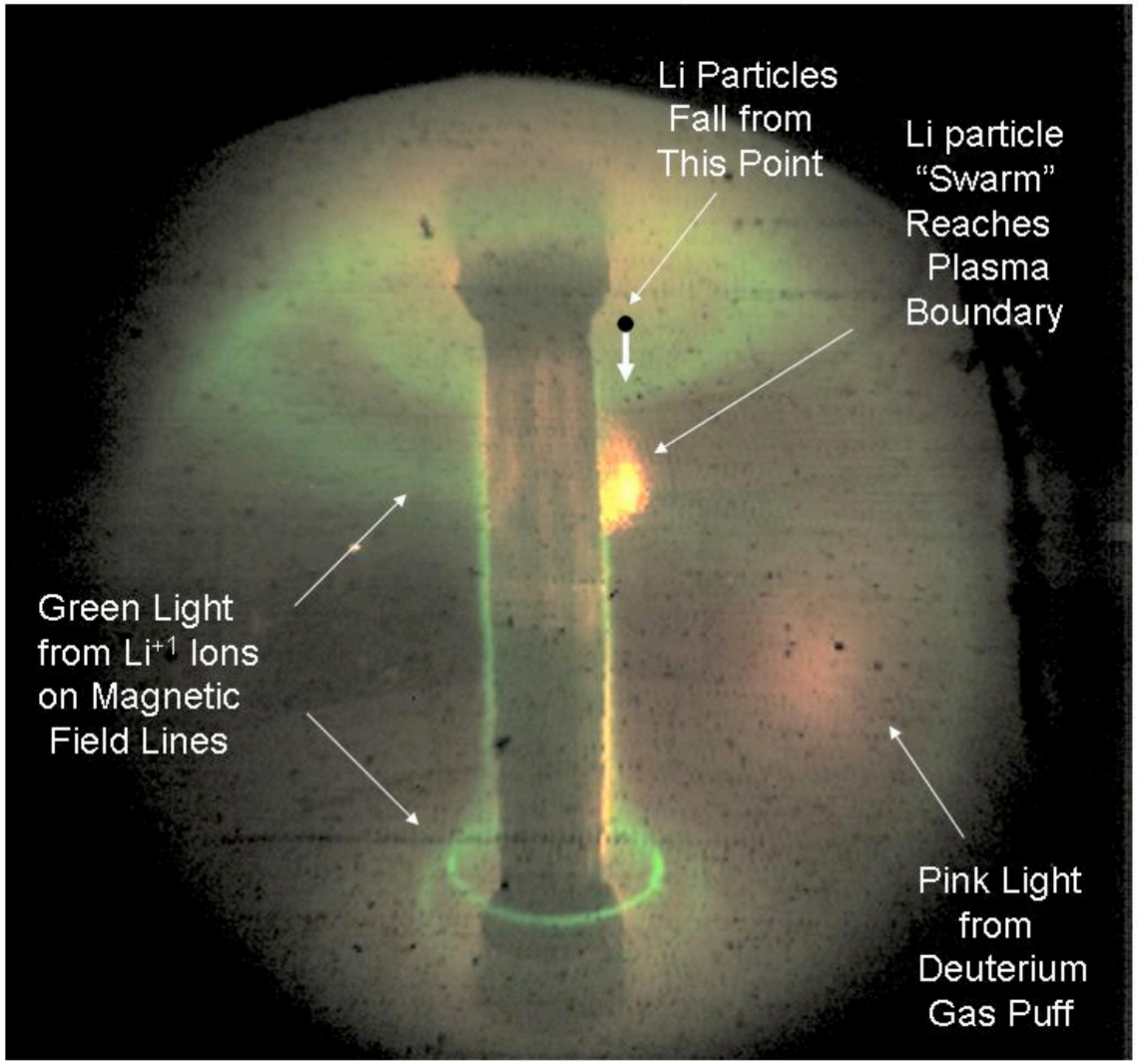


Lower single-null divertor discharges, 0.45T, D_2 gas fueling 3.5mg



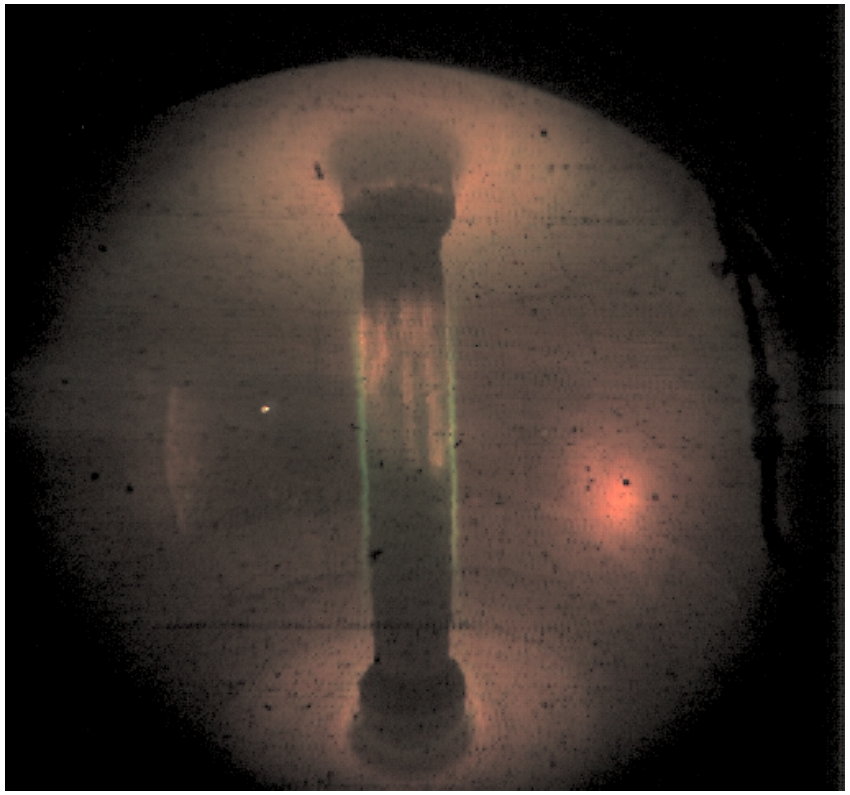
- **25 mg of Li pumping of edge density saturated after the 3 similar D discharges and returned to pre-Li wall conditions, as expected if most injected gas reacts with the deposited Li.**
- ***Rate of density rise is below NBI fueling rate.***

Camera View of Early Li Aerosol Injection Taken at t ~ 60 ms

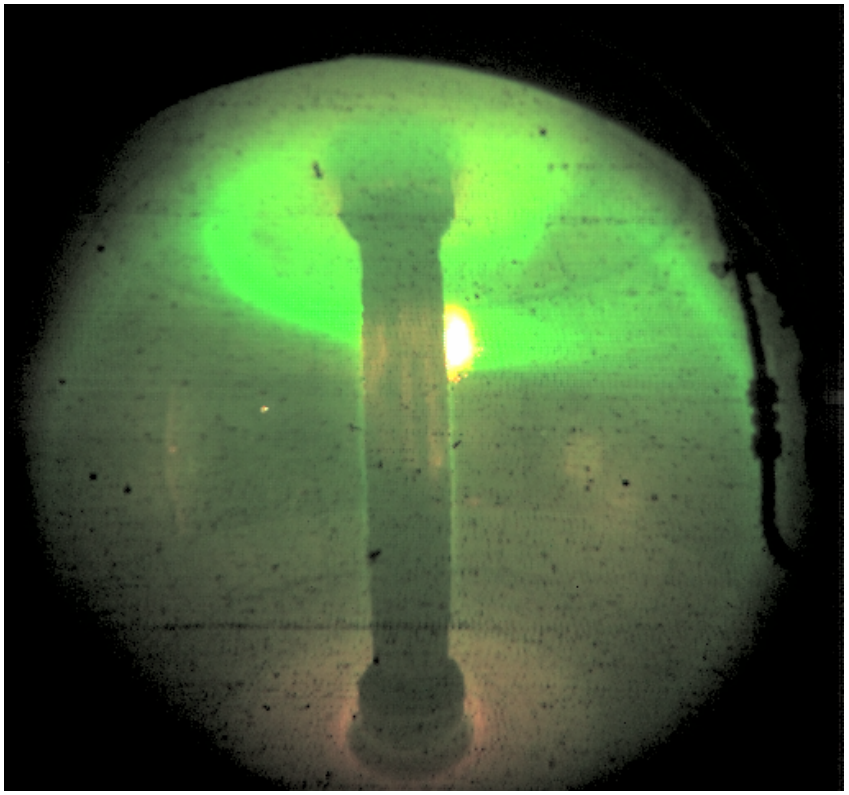


The Subtle Difference Between 130386 and 130389

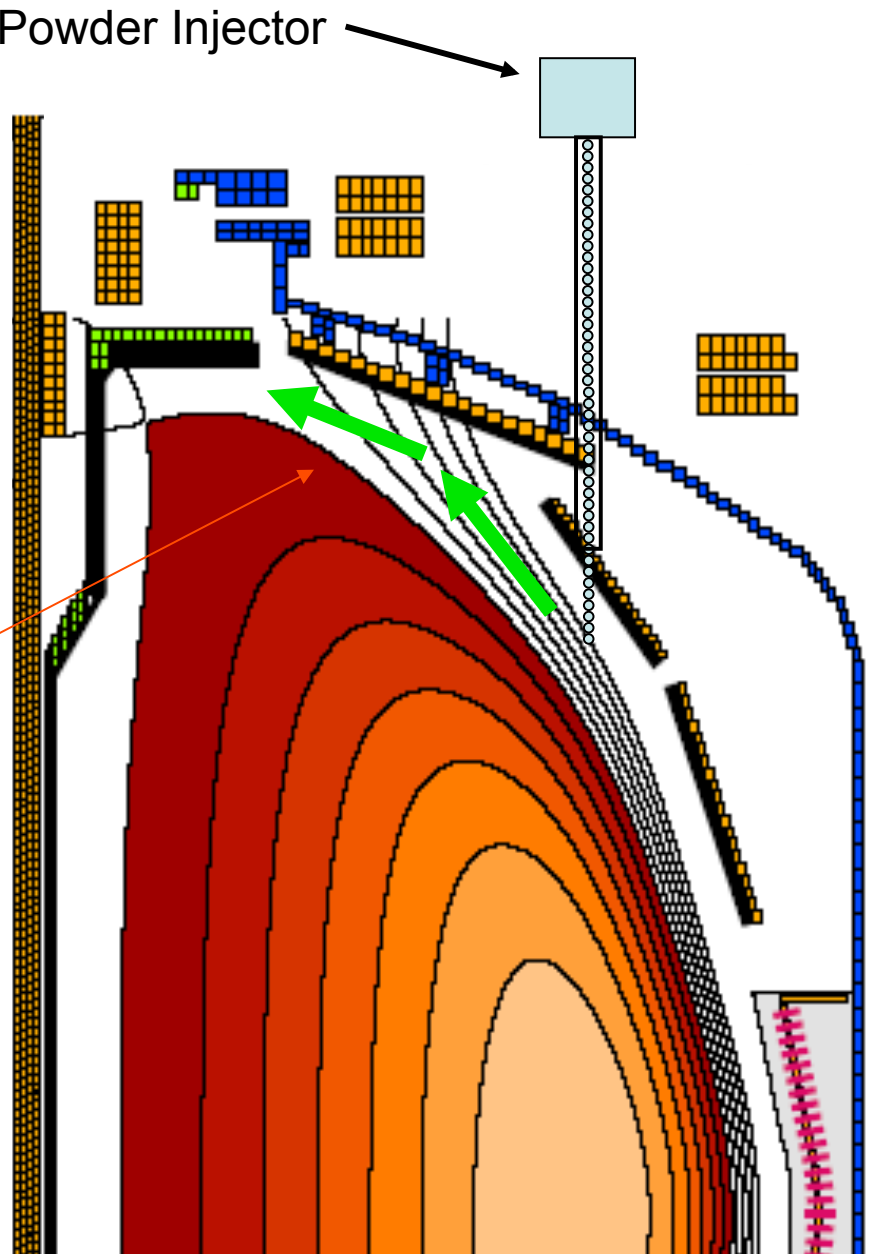
130386 @ 85 ms No Li



130389 @85 ms Early Powder

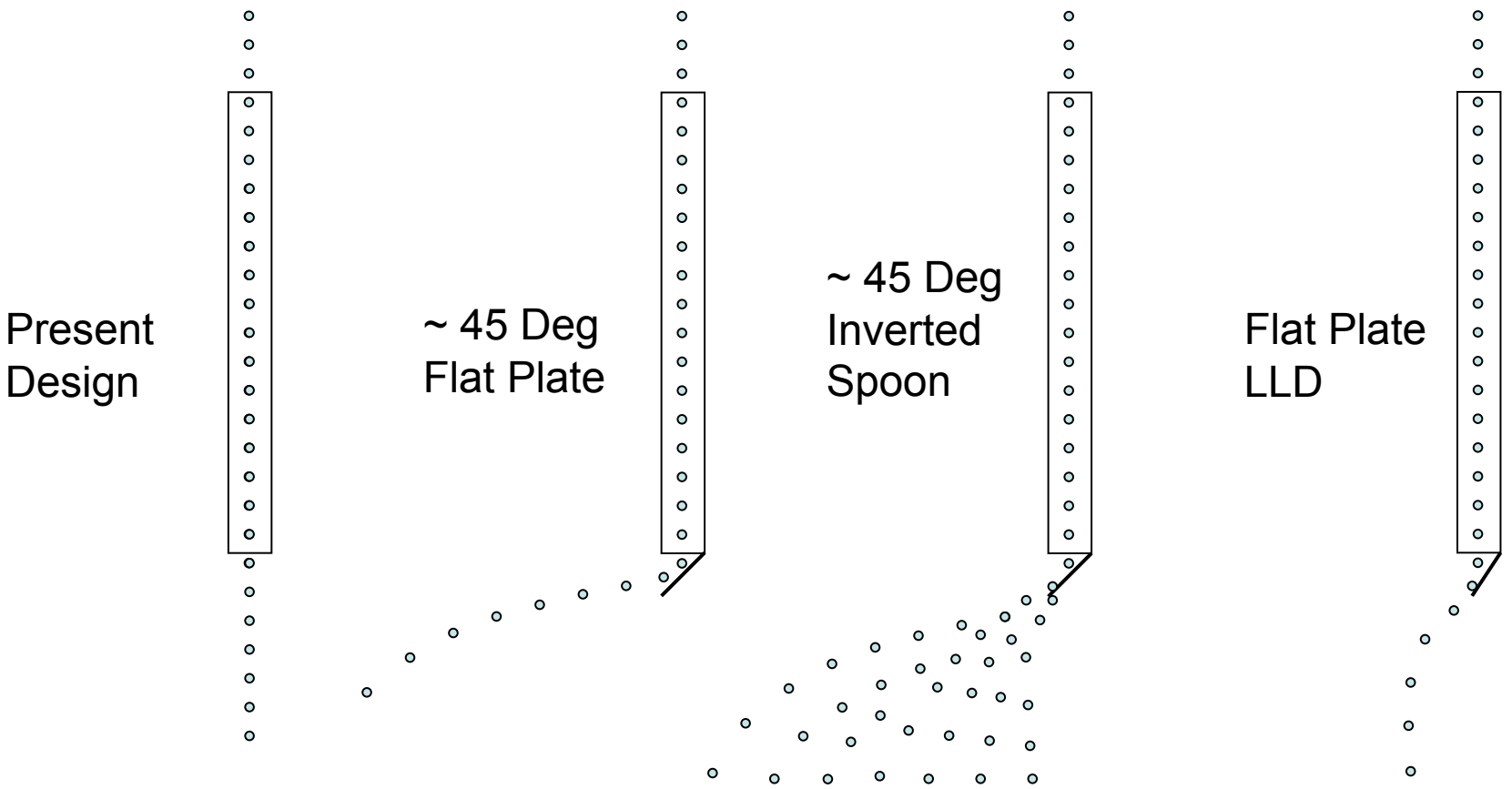


Why a Double Null Discharge Would be Interesting

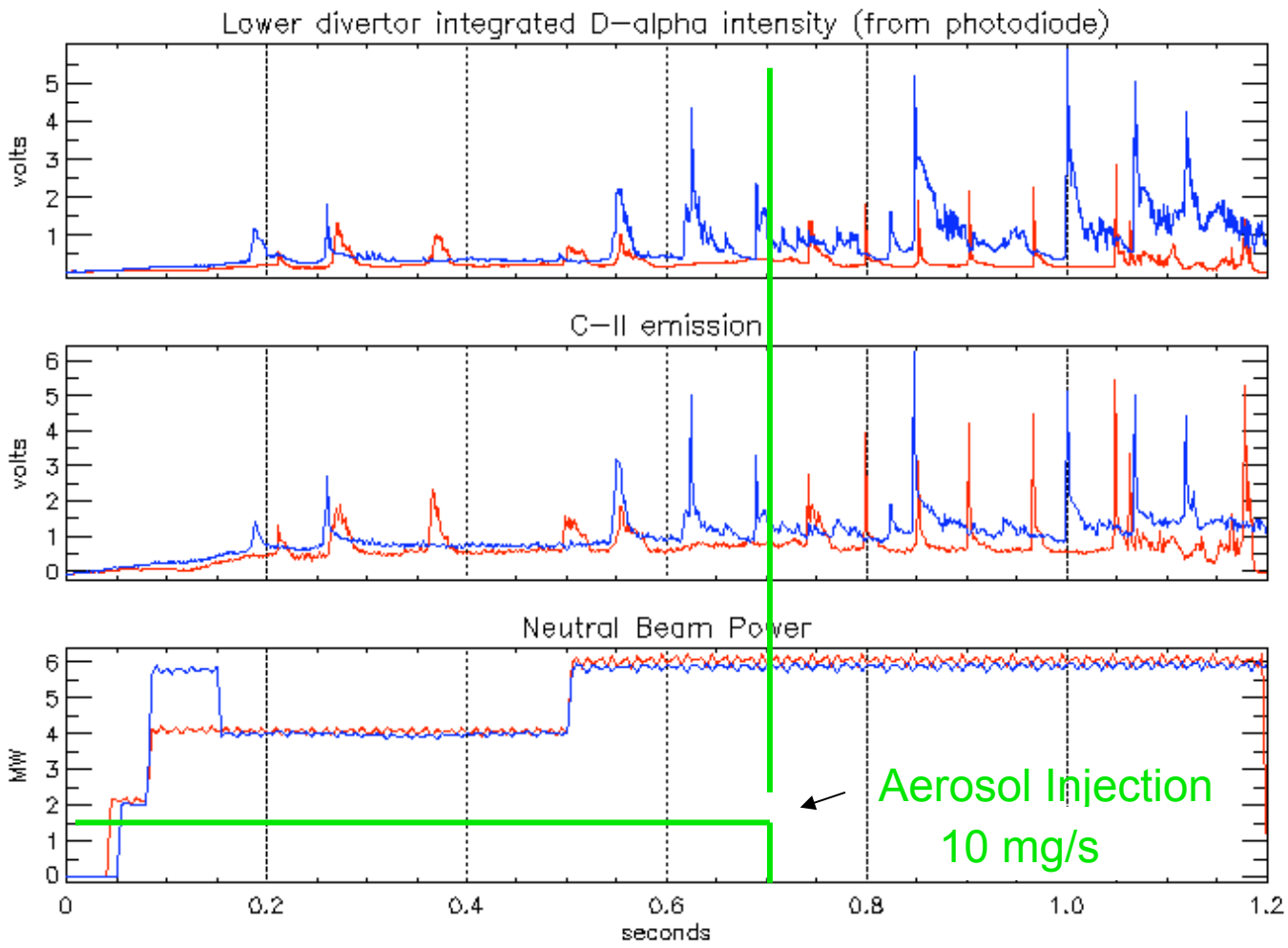


Li Ions Head Preferentially for Upper Strike Points

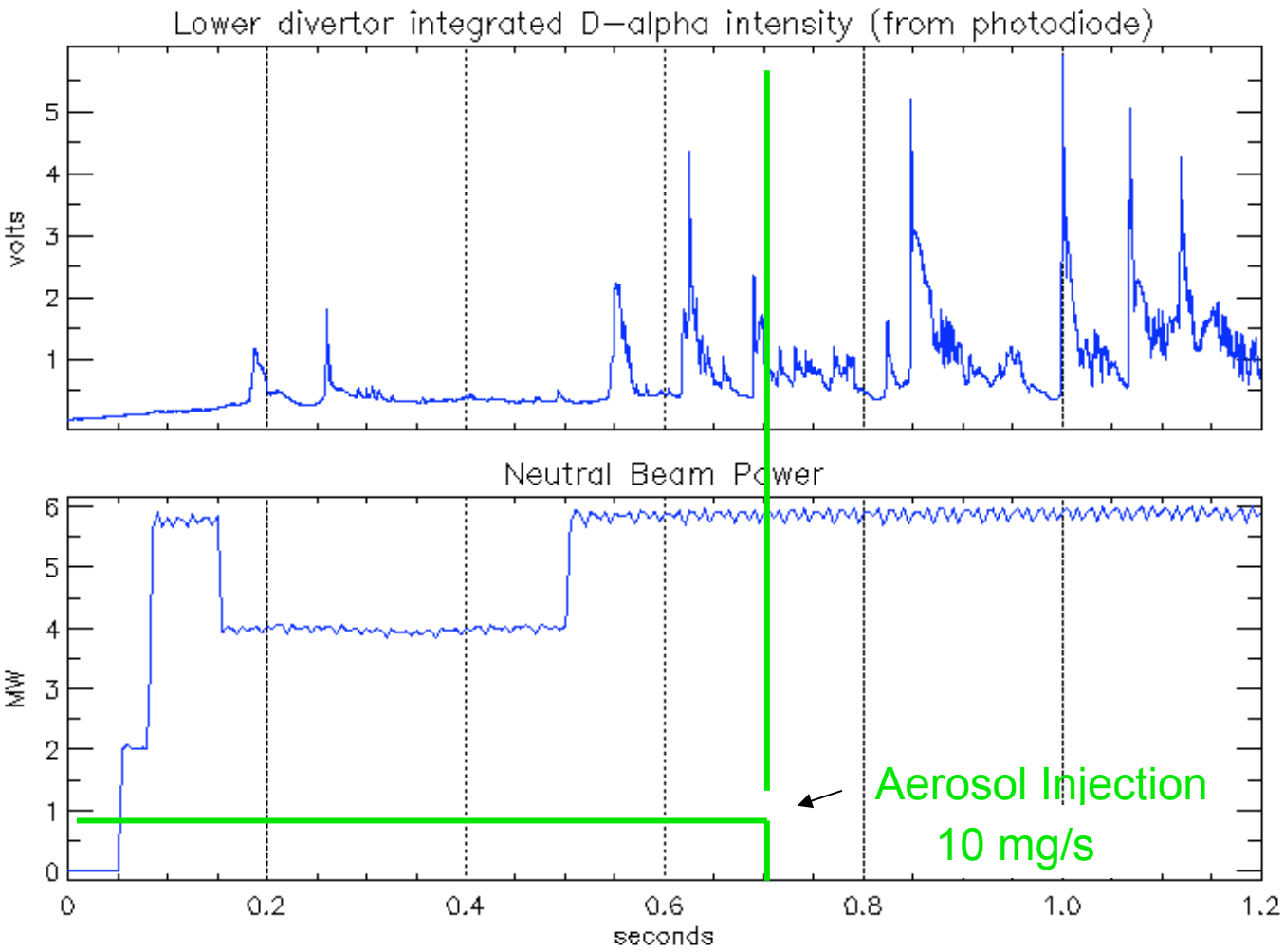
Getting Toward the Center Stack (or LLD) - Early (Using a "Splash Plate")

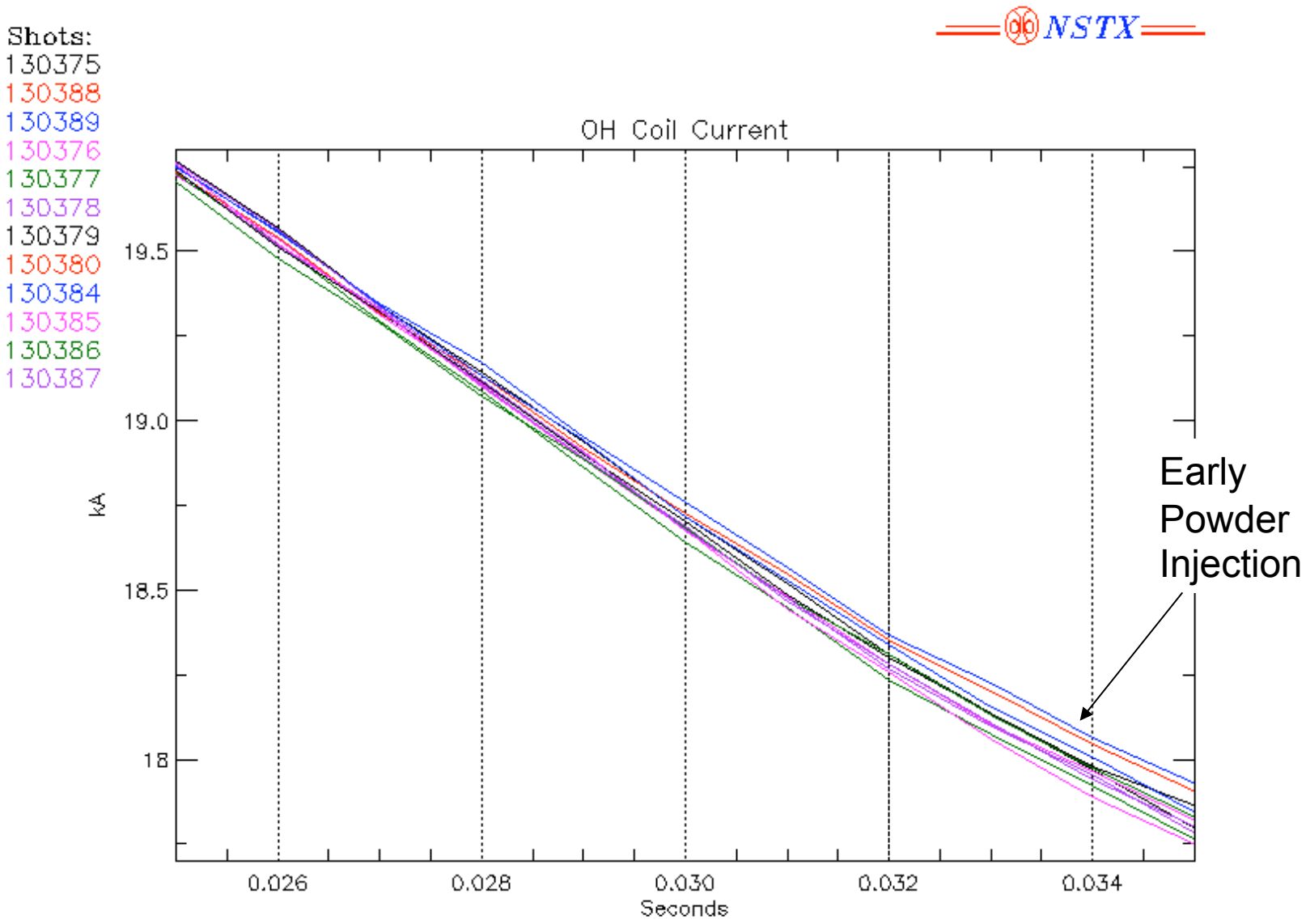


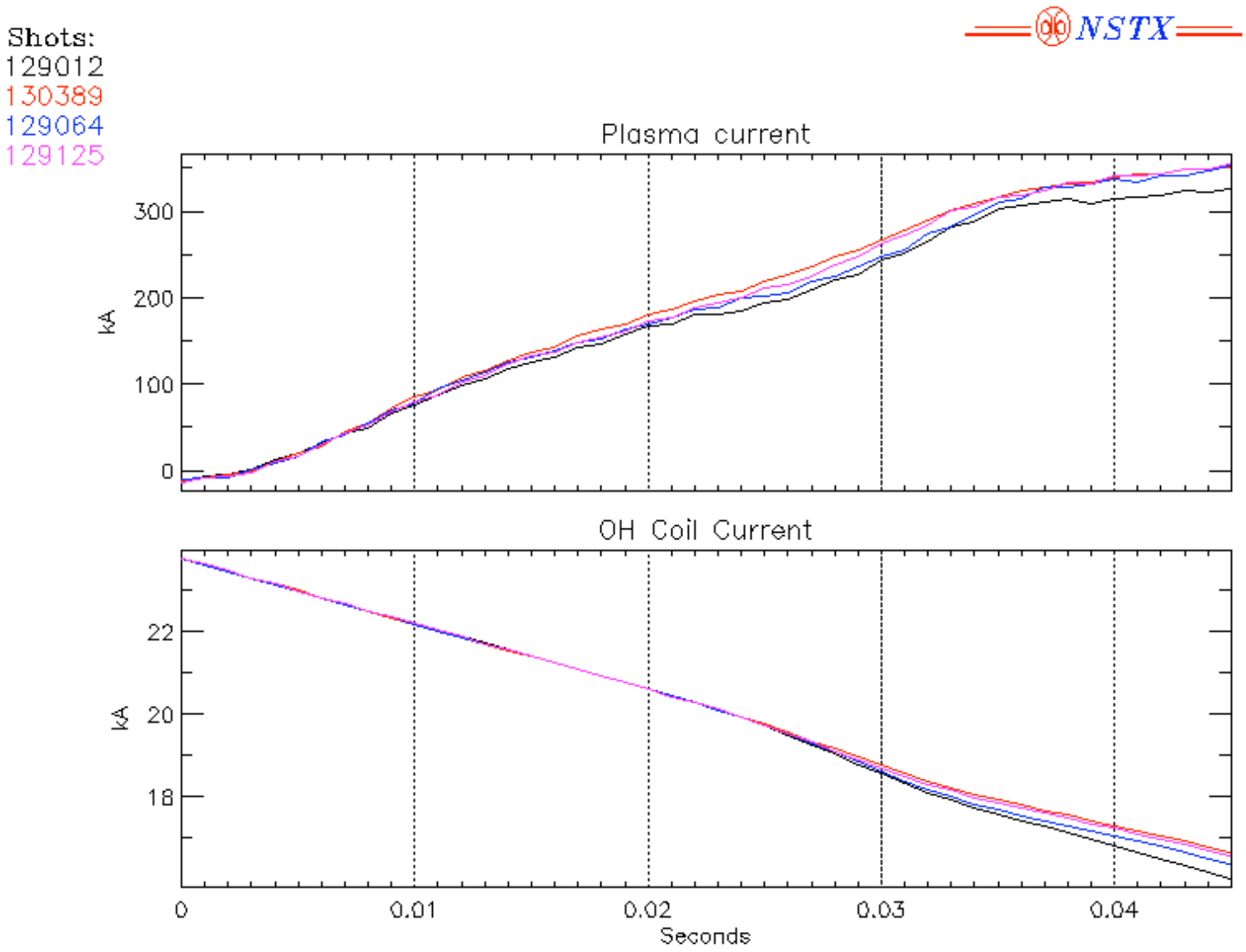
Shots:
129064
129064
130389

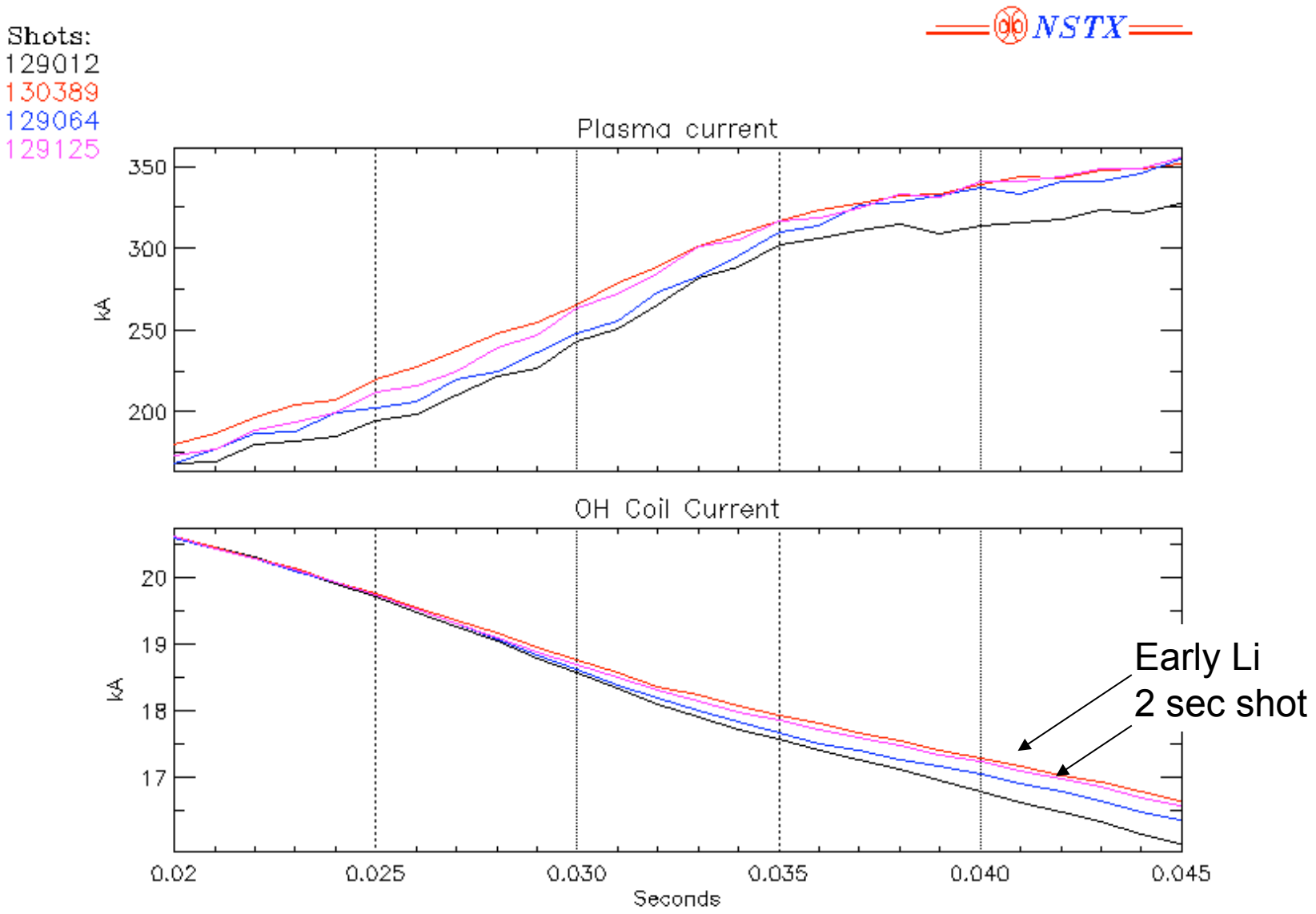


Shots:
130389
130389
130389




Shots:
130375
130388
130389
130376
130377
130378
130379
130380
130384
130385
130386
130387
NSTX
OH Coil Current
19.5
19.0
18.5
18
kA
0.026
0.028
0.030
0.032
0.034
Seconds
Early
Powder
Injection


Shots:
129012
130389
129064
129125
NSTX
Plasma current
300
200
100
0
kA
OH Coil Current
22
20
18
kA
0
0.01
0.02
0.03
0.04
Seconds


Shots:
129012
130389
129064
129125
NSTX
Plasma current
350
300
250
200
kA
OH Coil Current
20
19
18
17
kA
0.02
0.025
0.030
0.035
0.040
0.045
Seconds
Early Li
2 sec shot

Li Has Unique Energy Structure – Easy to Create Li^{+1}

Can We Exploit This to Save Early Volt Secs ?

Ionization Energy (eV)

	H	He	Li	Be	B	C	N	O
+1	13.6	24.6	5.39	9.32	8.30	11.3	14.5	13.6
+2		54.4	76.6	18.2	25.1	24.4	29.6	35.1
+3			123	154	37.9	47.9	47.4	54.9