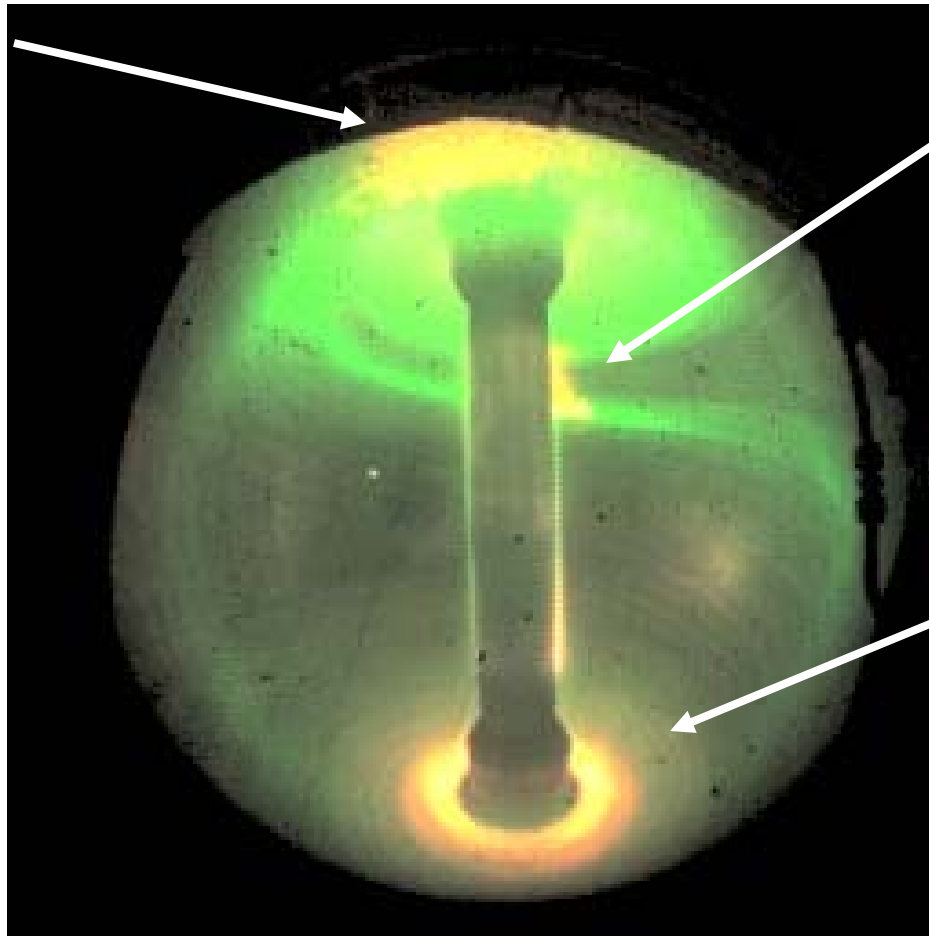


Three Sources of Li from Droppers

Bay C
Li Particles

Shot 135063 @ 79 ms



Bay I
Li Particles

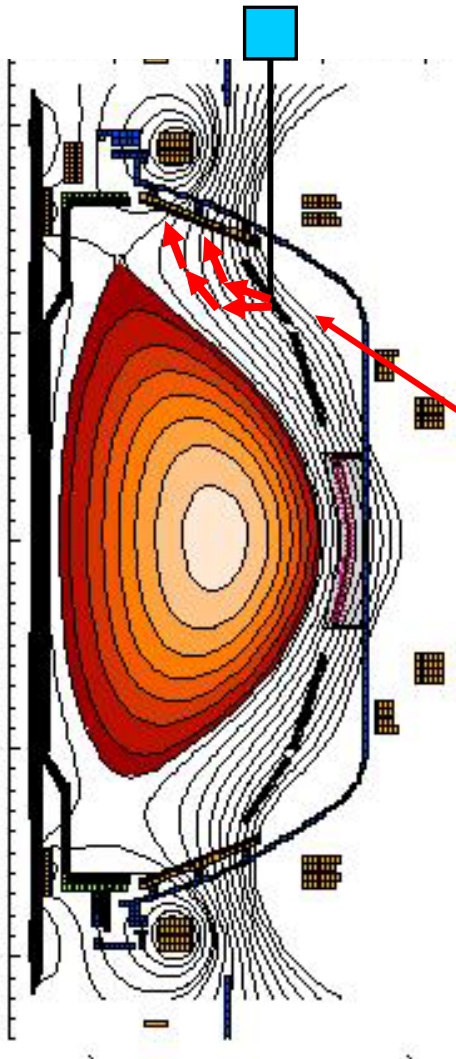
Pre-Positioned
Li Particles

A Few Musings About the Dropper

- Li Enhanced I-Mode
- Can/Should ELMs be Eliminated Slowly?
 - LITER & Dropper Synergy
 - Light on LITER, Heavy on Dropper
 - Eliminate ELMs in Real Time with Dropper
 - Induce Very Few ELMs with External Fields (ala Canik) and Dropper
- Reduce Impurity Accumulation by Changing Shape with Dropper On.
- Pre-Post Conditioning of CS
- Can ELMs be Beaten to Death by Blunt Trauma?

ELM-Free ~ H-Mode with Reduced Impurities (Lithium Enhanced I-Mode)

Requires ion grad-B drift point away from divertor
(i.e. need upper single null)



Li travels
directly to outer
strike point

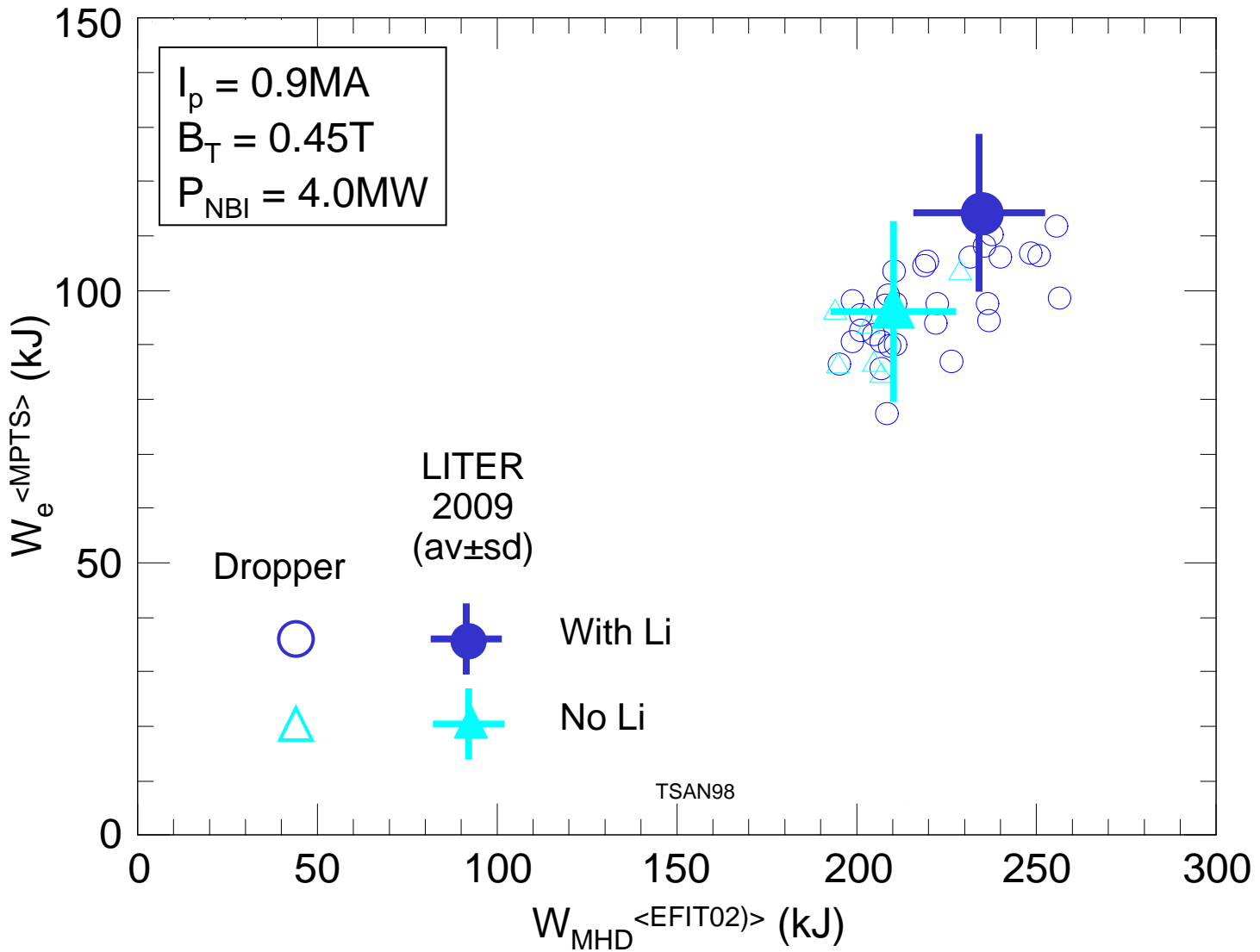
I-Mode Advantages:

- No Elms
- No Impurity Accumulation
- Reasonably High Confinement
 $H_{98} \sim 1$
- Need not involve LLD

Possibility:

- Li injected from dropper could increase performance / confinement while reducing Zeff

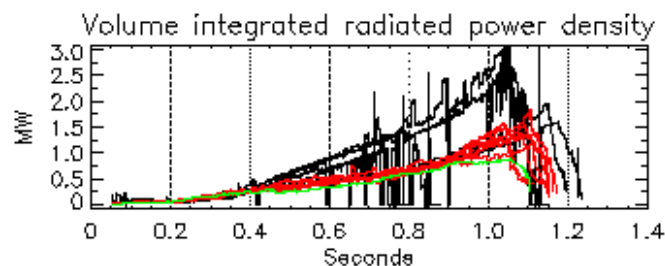
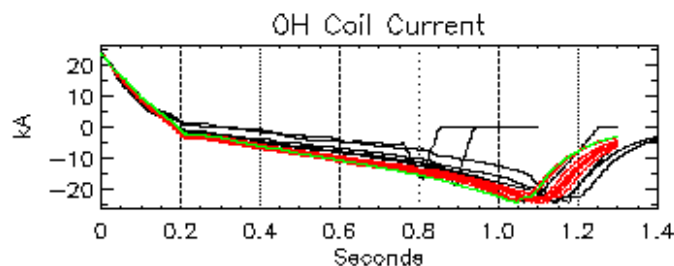
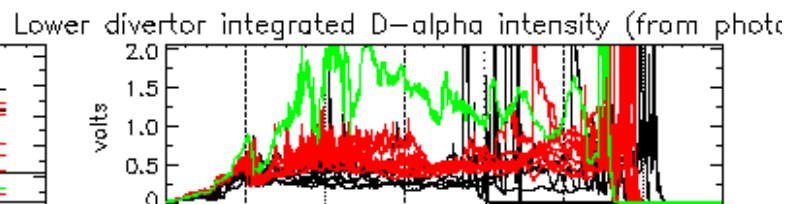
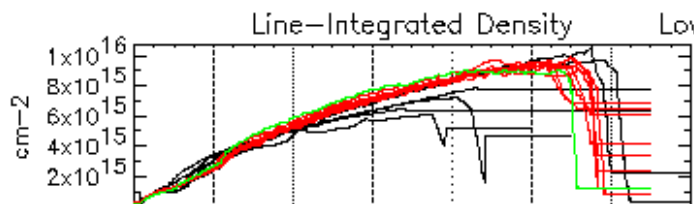
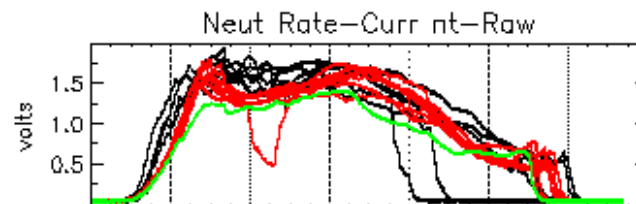
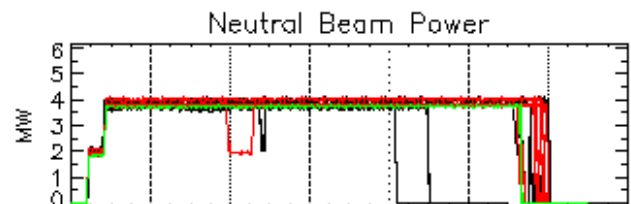
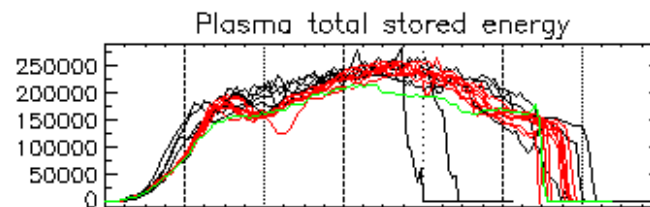
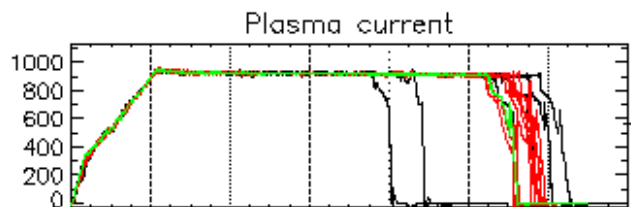
2009 XP-913 Results



Can/Should Elms be Eliminated Slowly?

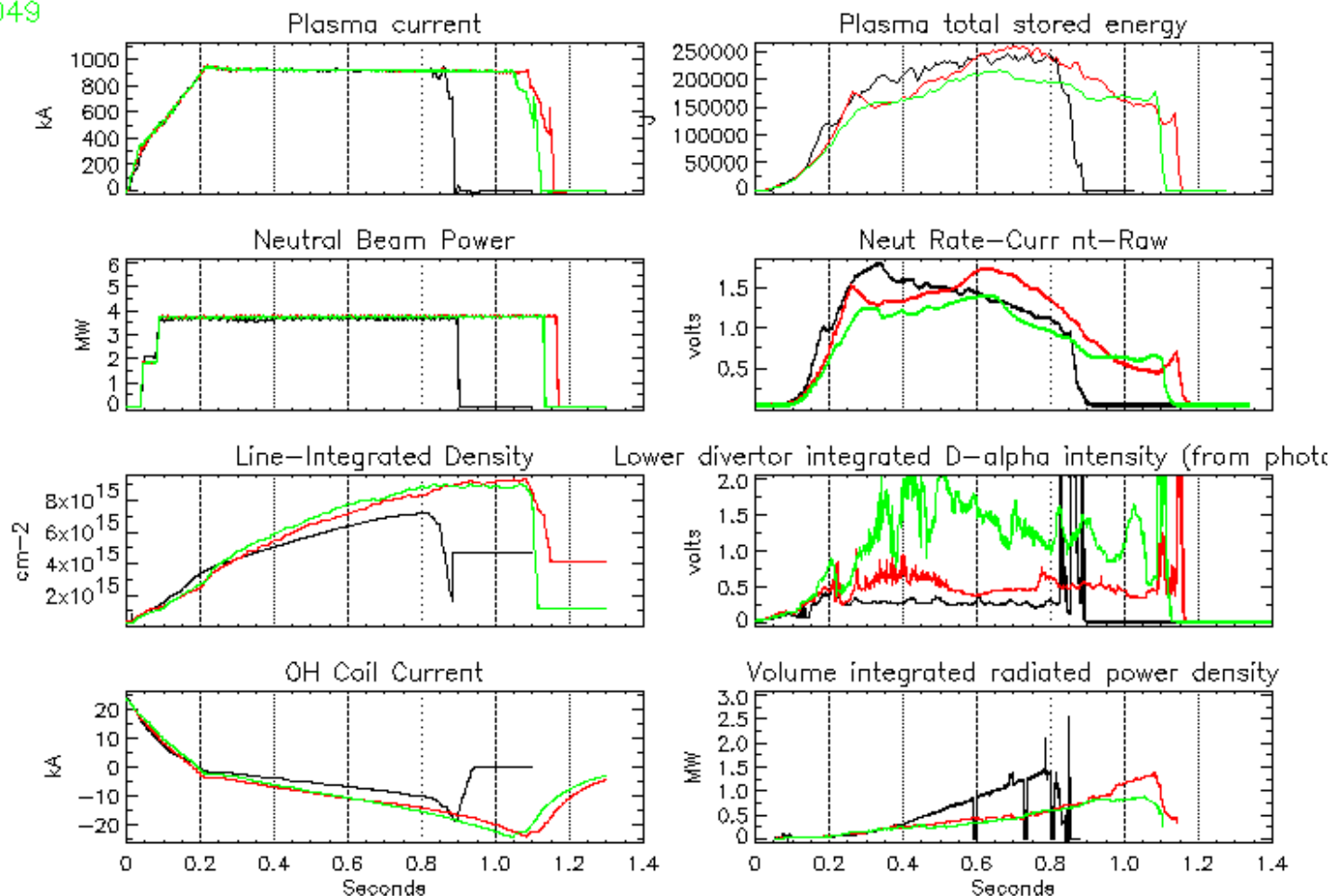
Shots:

- 134084
- 129946
- 129245
- 129263
- 134085
- 129269
- 135063
- 135056
- 135064
- 135059
- 135058
- 135361
- 135360
- 135069
- 135049



Can/Should ELMs be Eliminated Slowly?

Shots:
129263
135063
135049

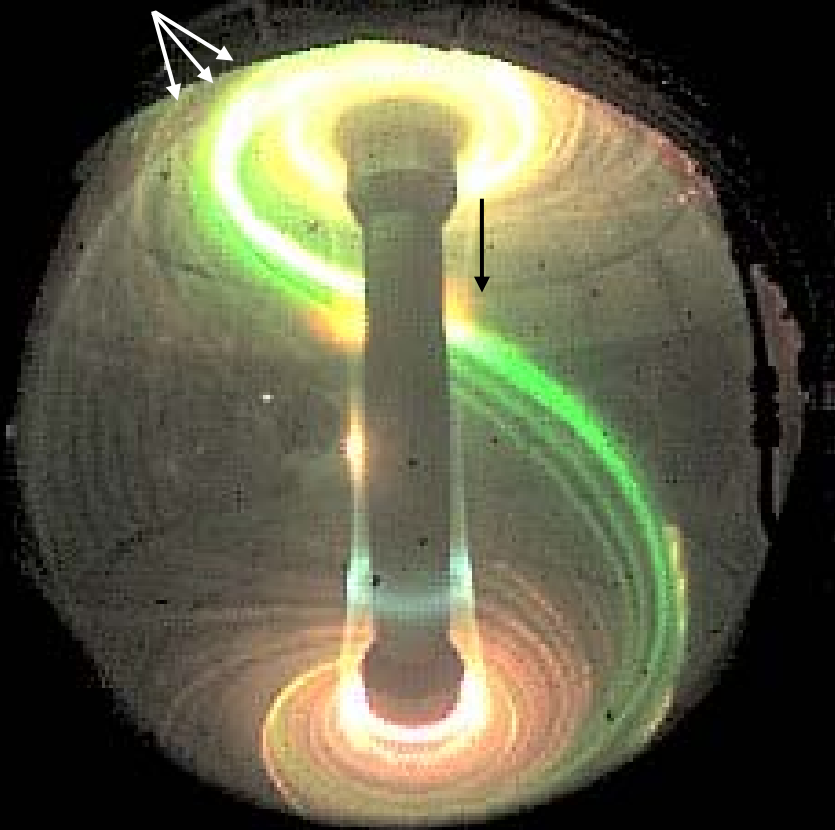


Shot 135063: Enhanced Confinement, No Elms, Low P_{rad}

- A Few Small Elms Early Seems to Purge the Core Sufficiently
- Drop in Carbon Radiation from Center Stack – Transition?

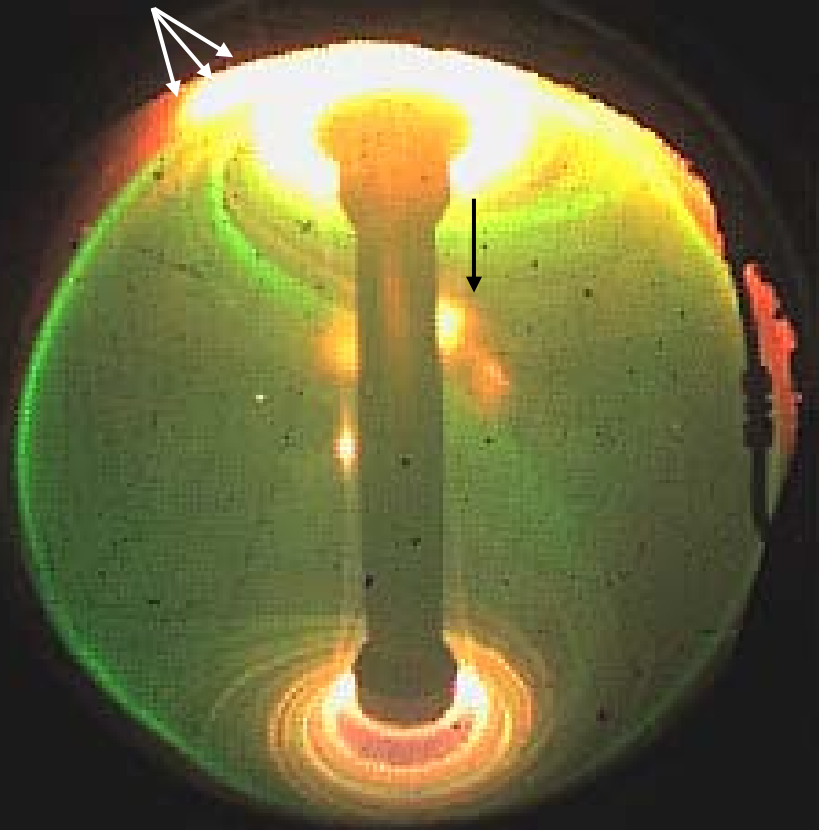
Shot 135063 $t = 369$ ms

(Above Camera) Bay C Bay I (Behind CS)



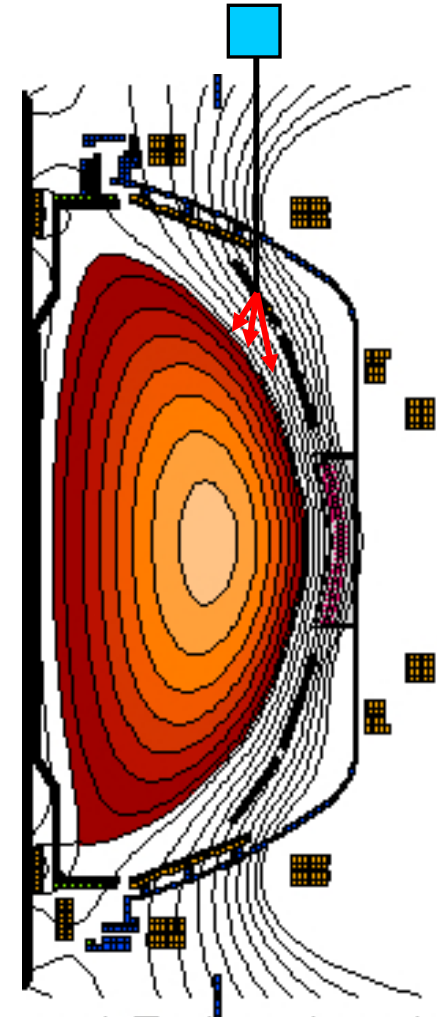
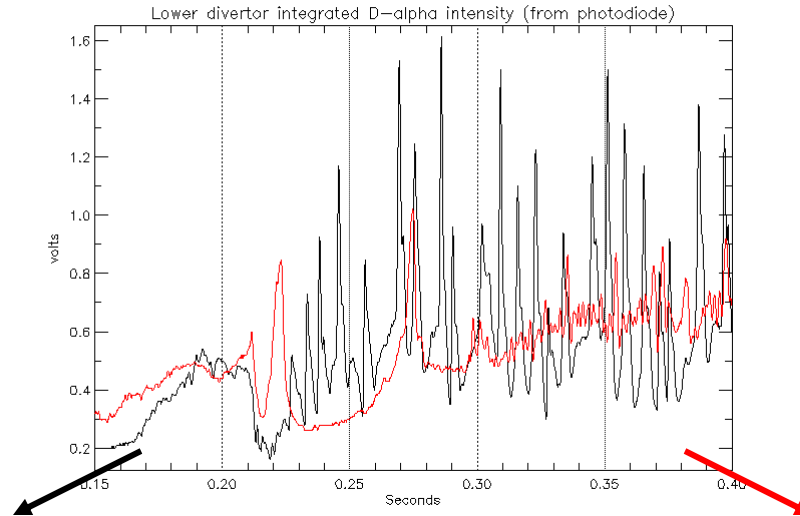
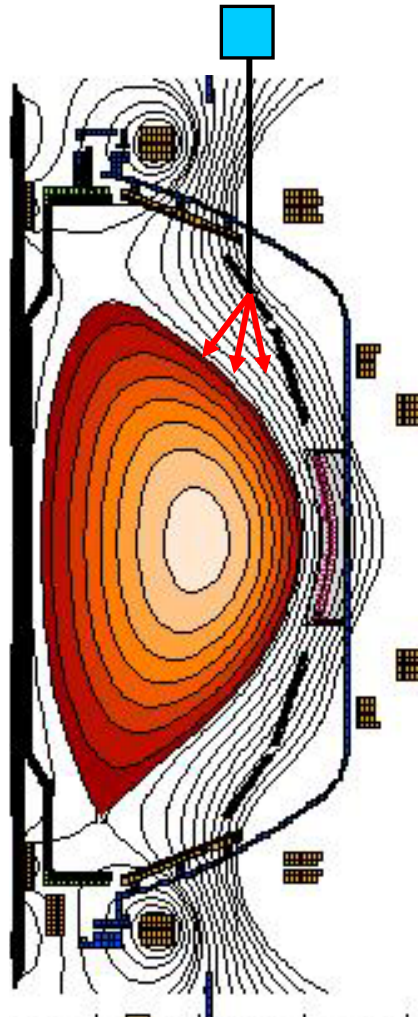
Shot 135063 $t = 655$ ms

(Above Camera) Bay C Bay I (Behind CS)



Can We Flush Impurities from the Core by Allowing Early Elms with Shaping and Eliminating Later Elms with Dropper ?

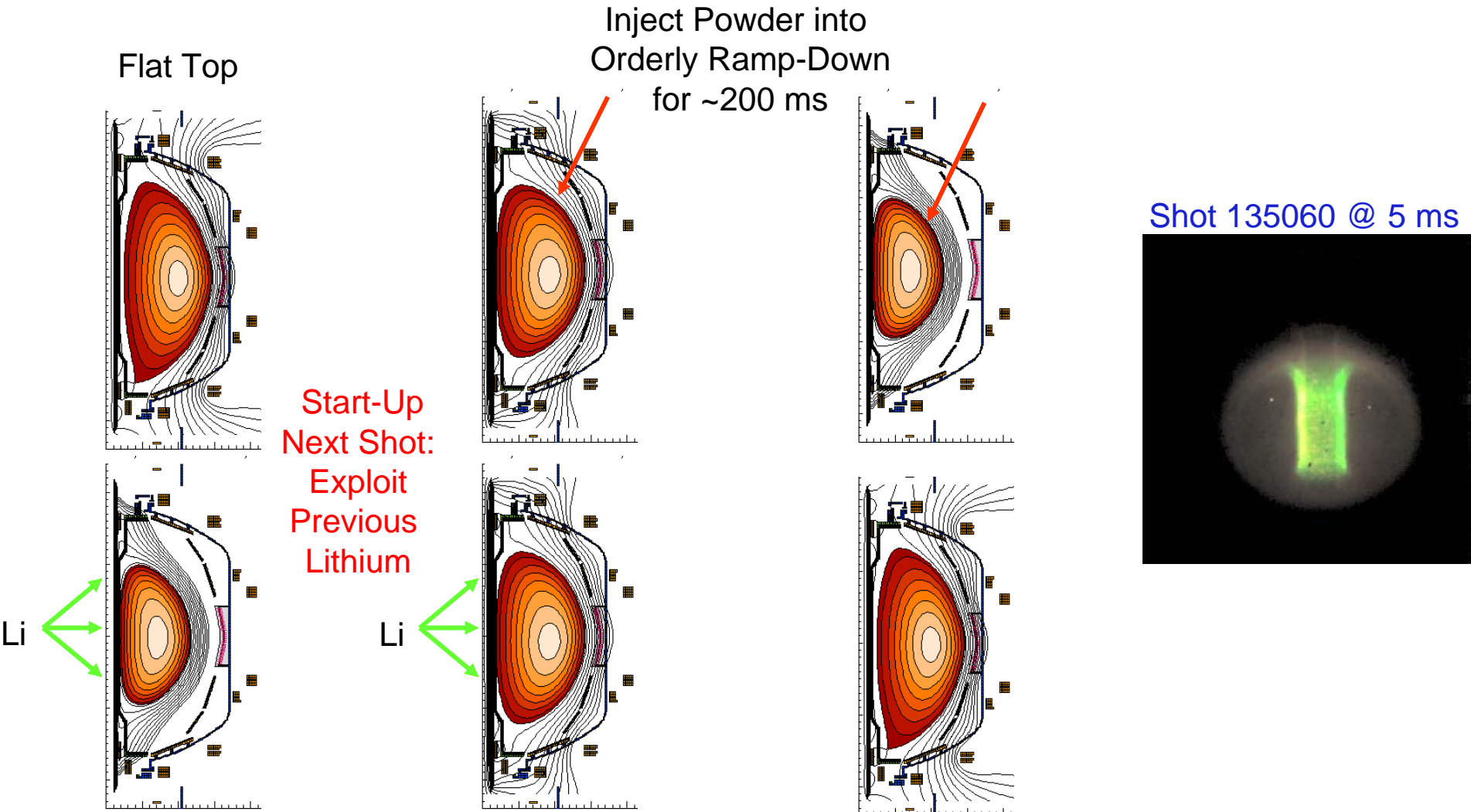
Shots:
129019
135063



Idea: Switch from Low δ to Higher δ During Discharge with Dropper on
- Impurities Flushed from H-Mode Plasma Early – Elms then shut off and Plasma Remains Clean

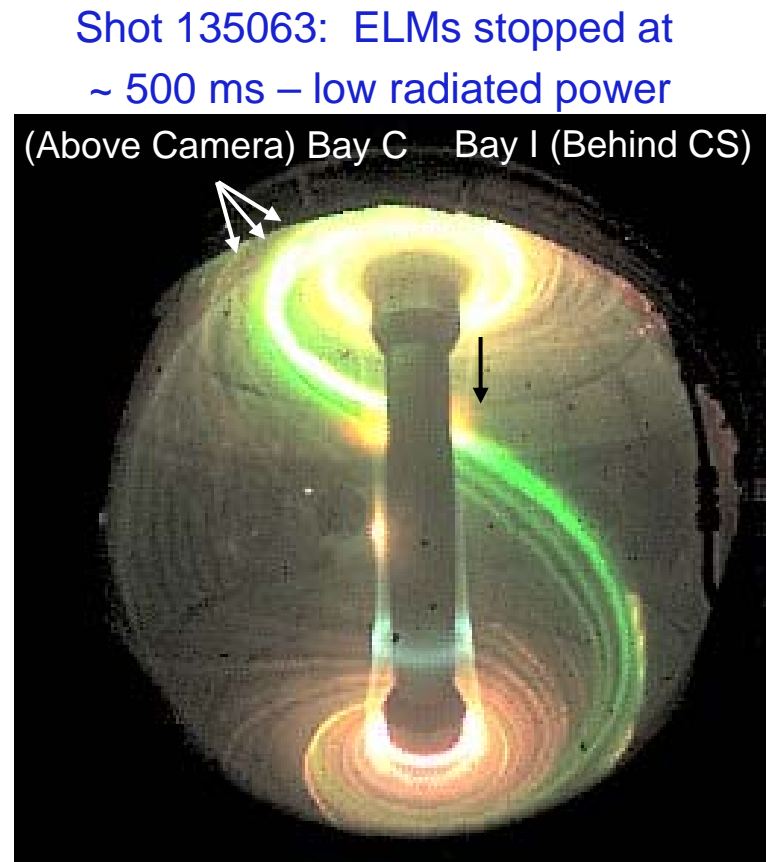
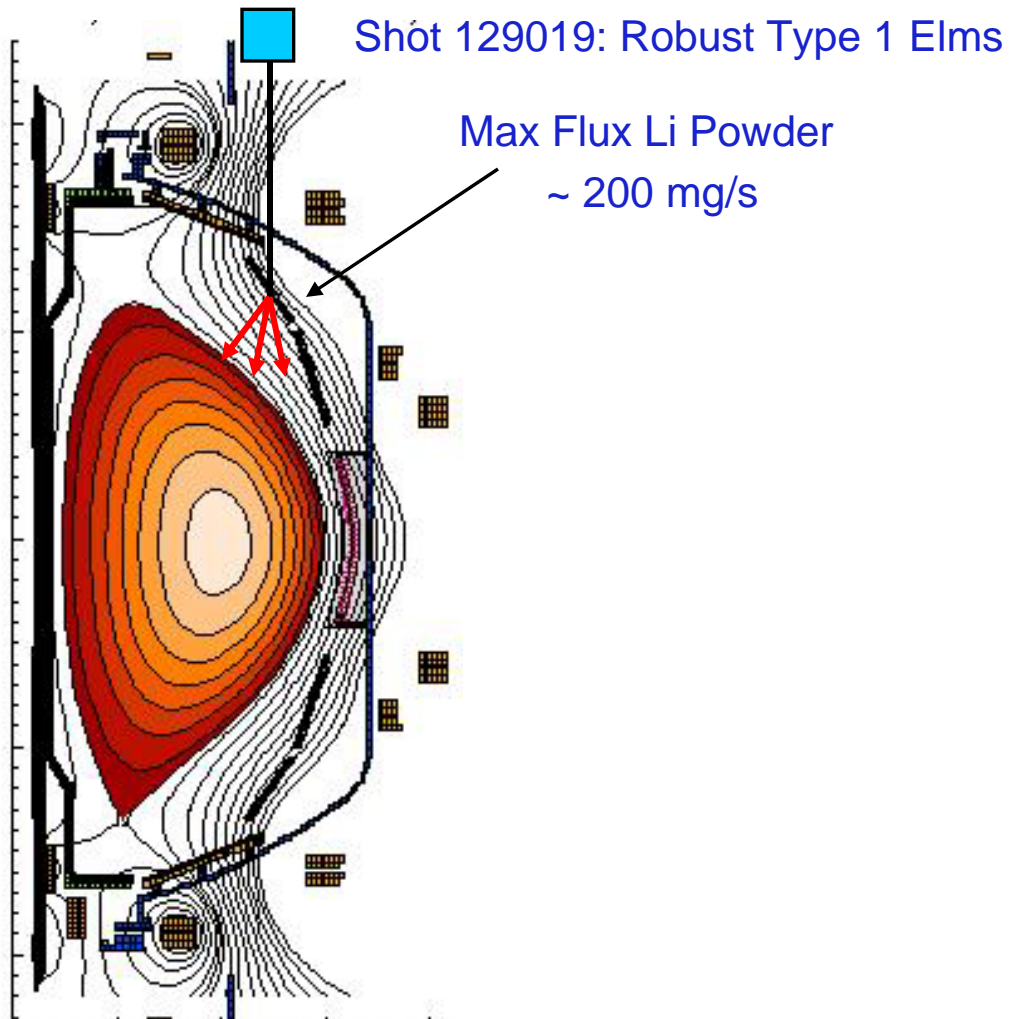
Post / Pre Conditioning of the CS with Lithium to Reduce Early OH Consumption

- End discharges with an orderly injection of Li onto the CS instead of disruption



Can ELMs be Beaten to Death by Blunt Trauma?

- Can Li Aerosol in SOL Buffer PFCs From ELMs & and Lower Zeff?



EXTRA SLIDES

Li Dropper Locations and Trajectories on NSTX

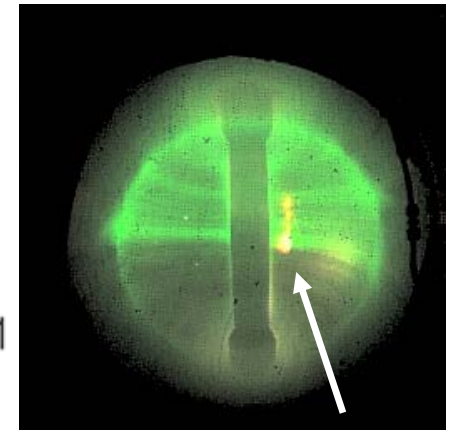
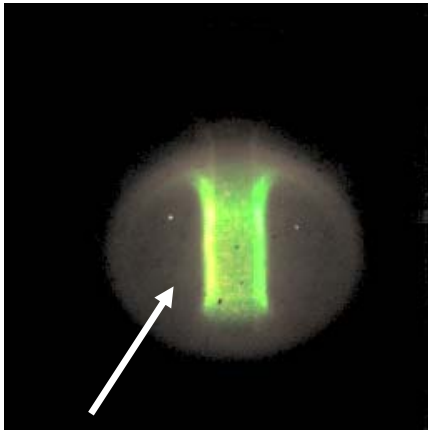
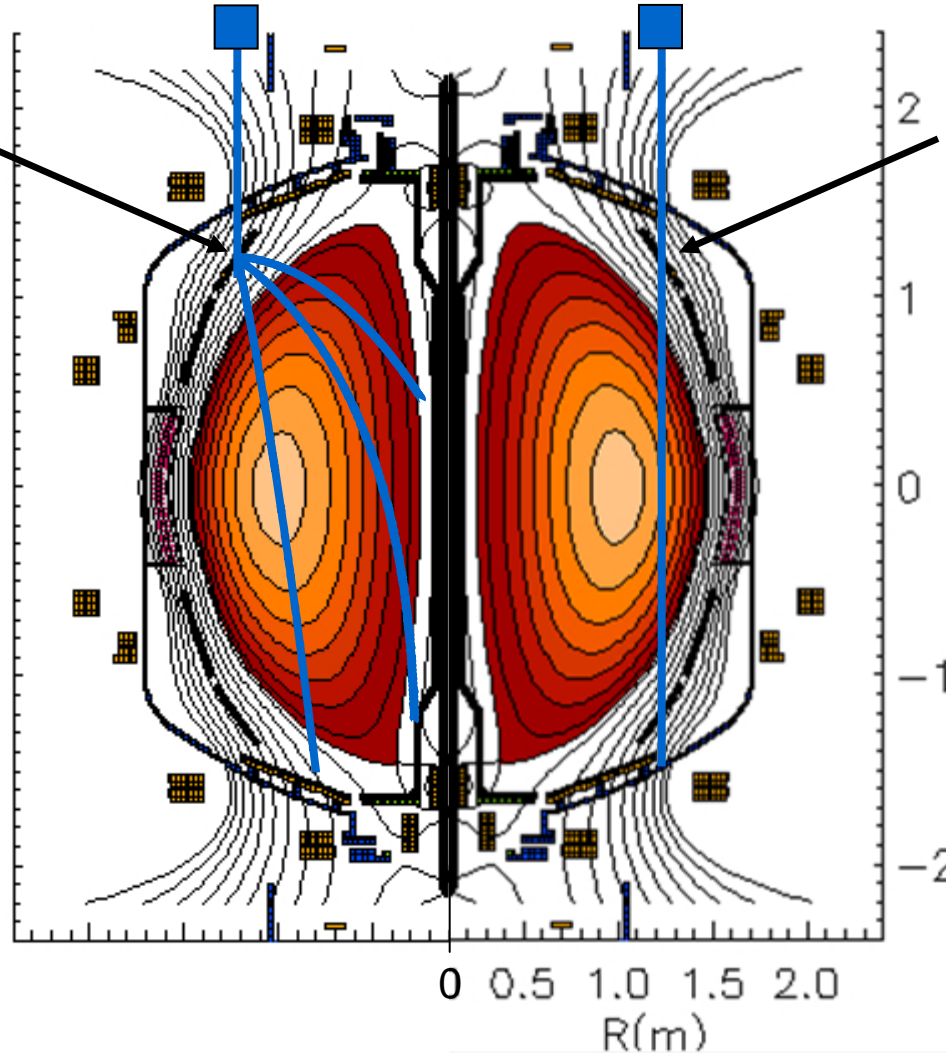
Allow a Variety of Injection Scenarios

Bay C Dropper

Bay I Dropper

Particles Scatter
off Splash Plate
(45 degree)

Particles Drop
Straight Down
Into SOL

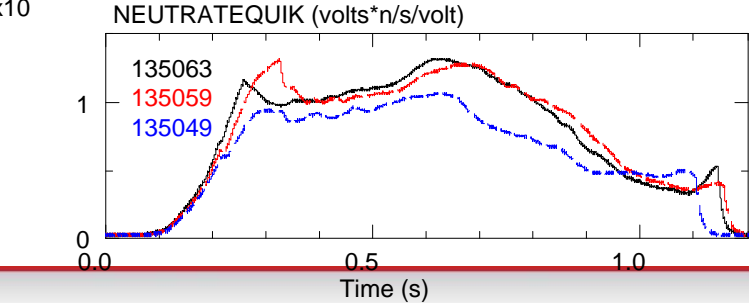
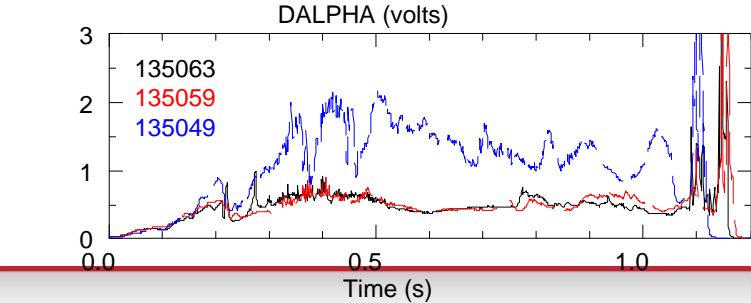
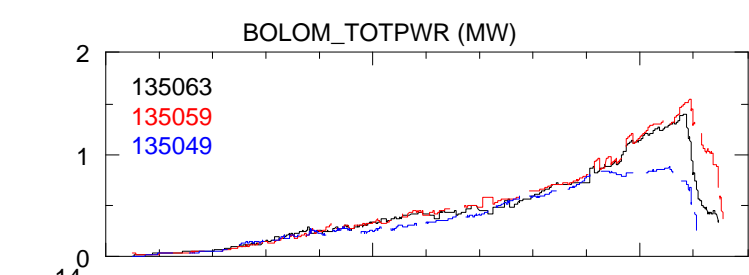
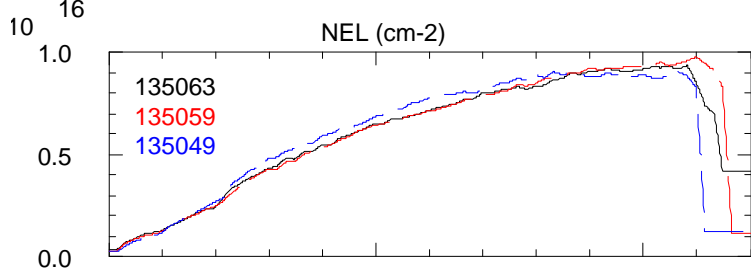
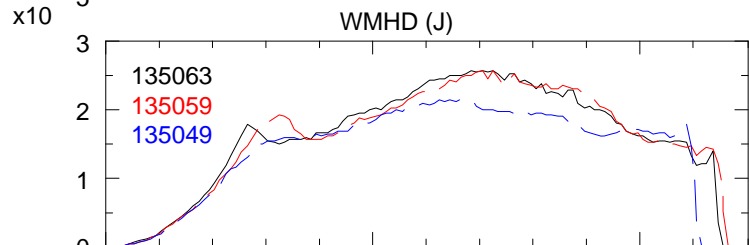
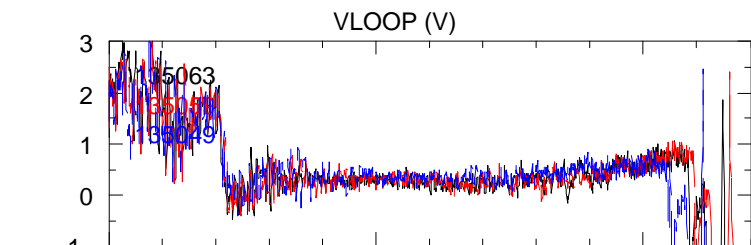
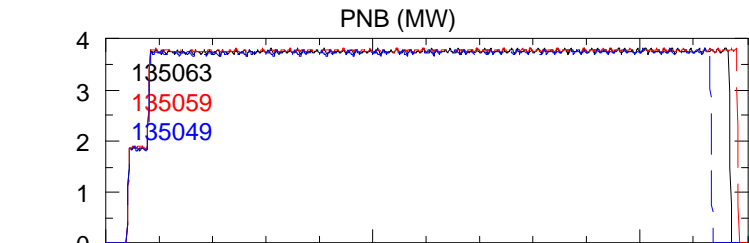
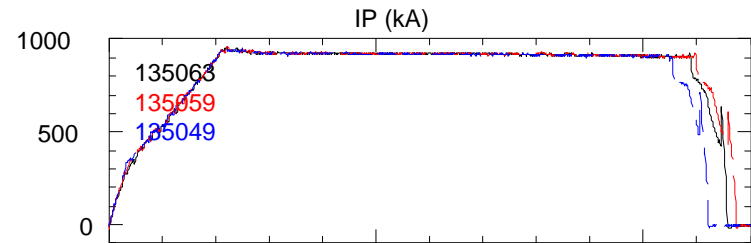


Li Droplets on
NSTX Center Stack
at Breakdown
Using Bay C Unit

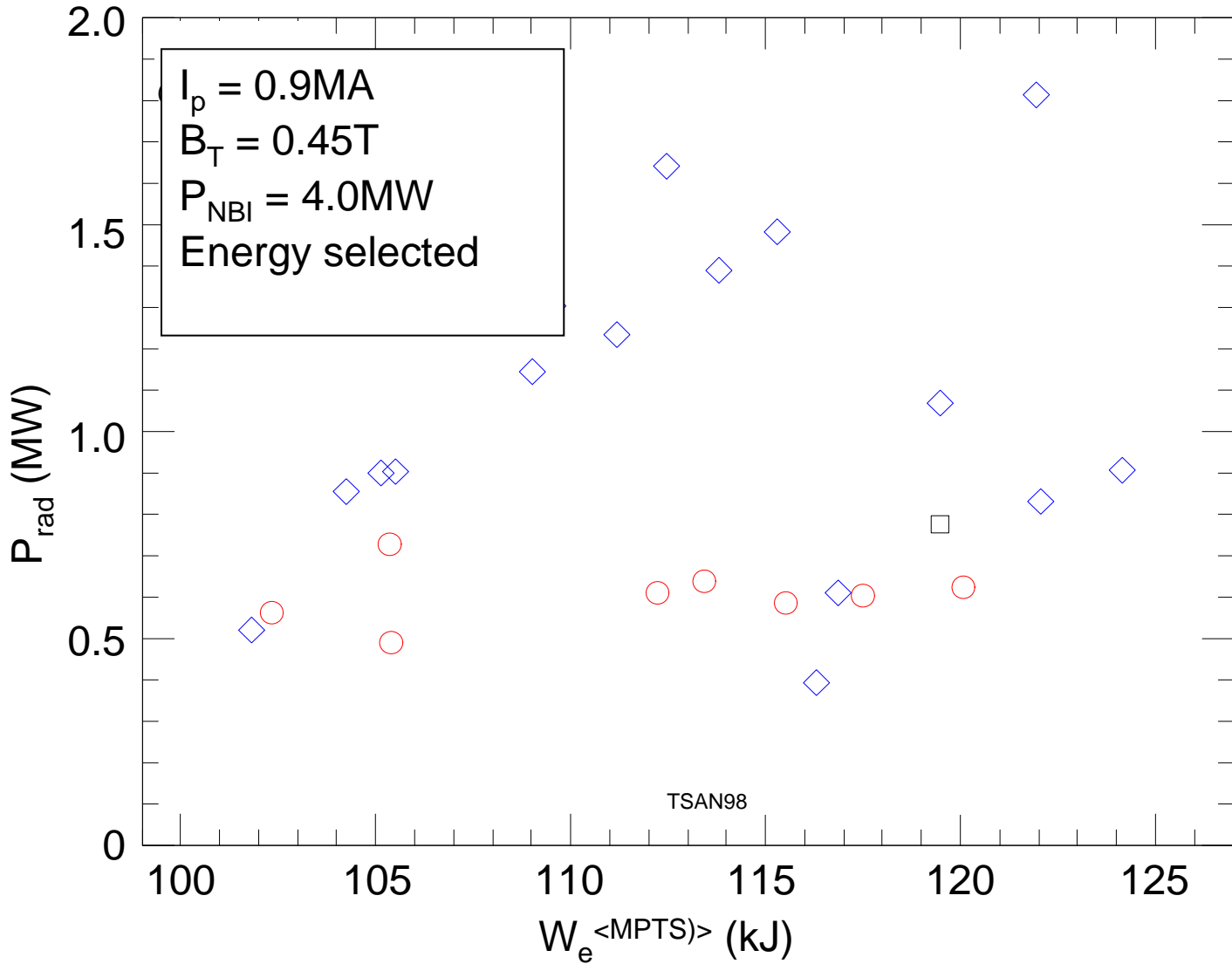
Li Droplets Into
Plasma SOL
at $t = 25$ ms
Using Bay I Unit

Lithium Powder Produced Effects Similar to Evaporated Lithium in Neighboring XPs

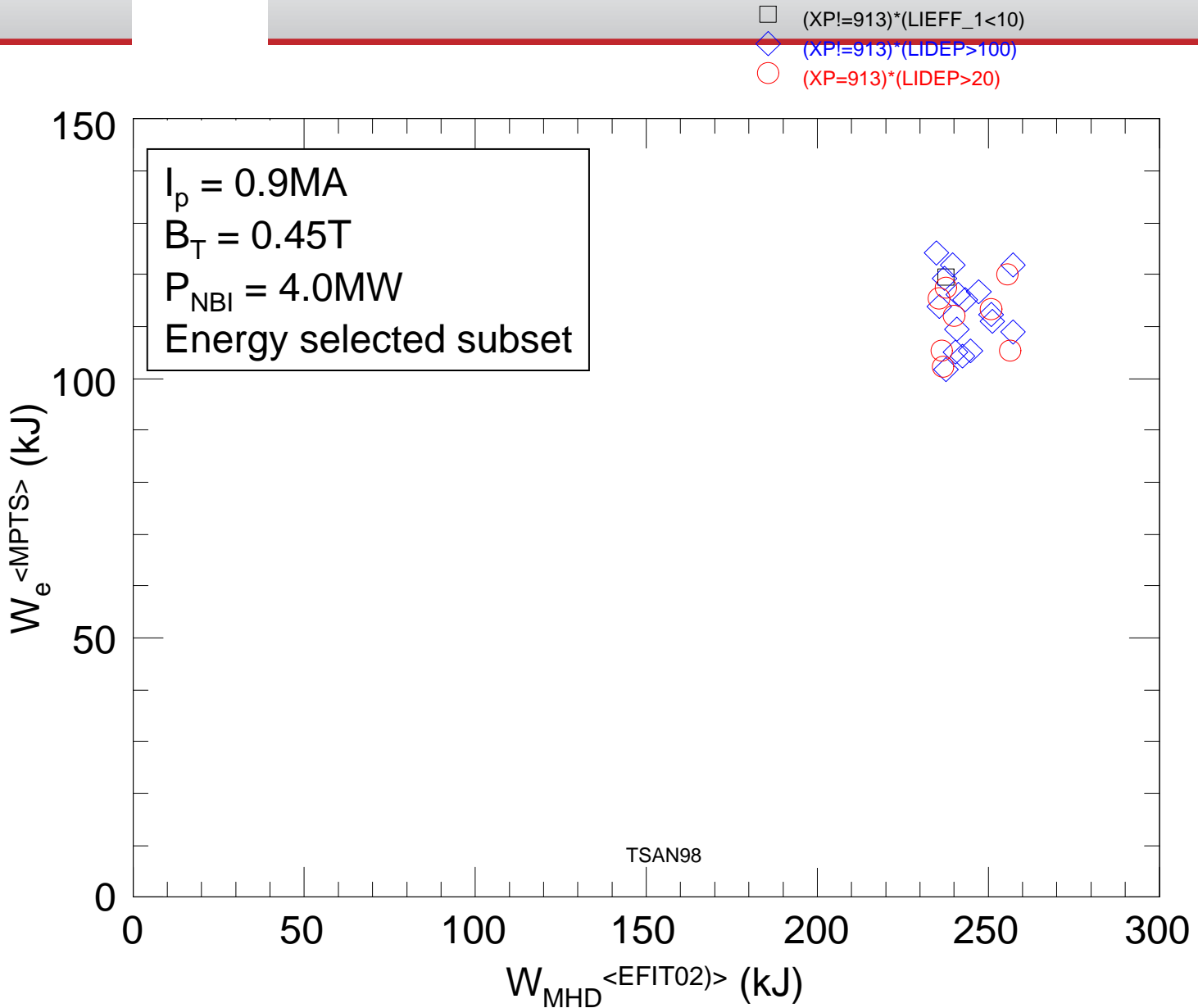
135049: No Li; 135059: 74mg Li; 135065: 68mg Li

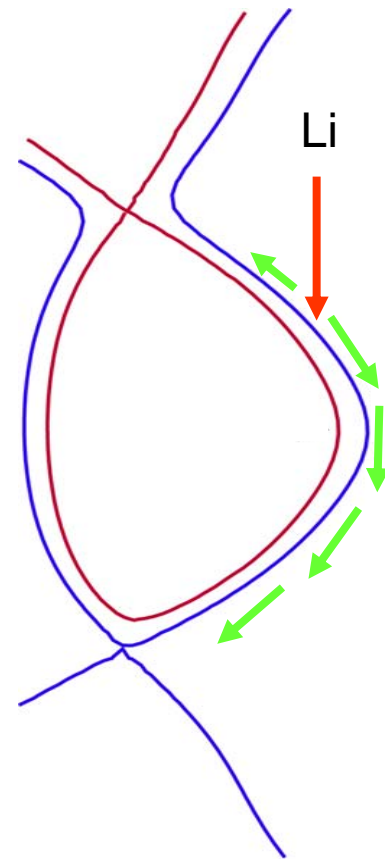
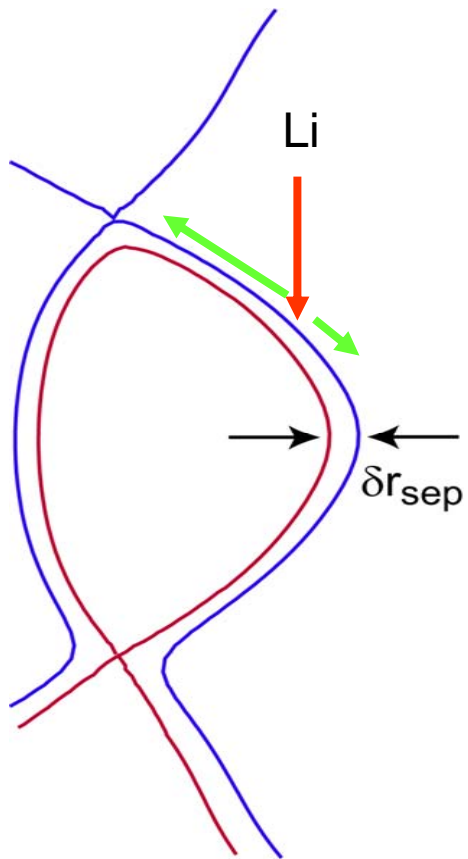


- (XP!=913)*(LIEFF_1<10)
- ◇ (XP!=913)*(LIDEP>100)
- (XP=913)*(LIDEP>20)

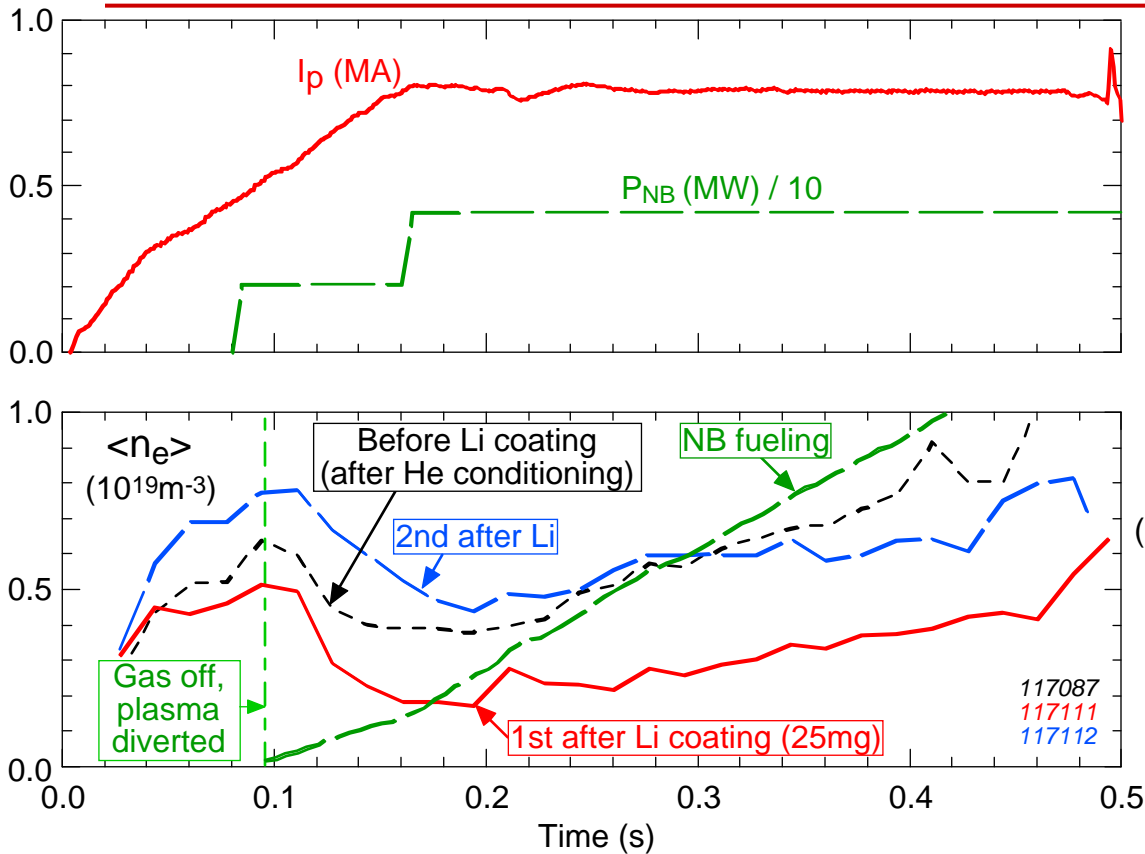


2009 XP-913 Results

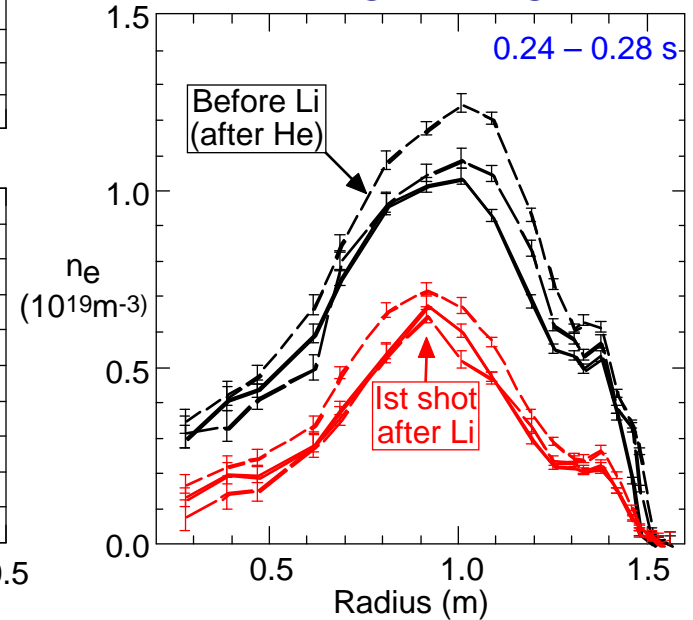




2005 First LSN NBI D Shot After 25 mg of Li Pellet Injection Exhibited Factor ~50% Decrease in Density

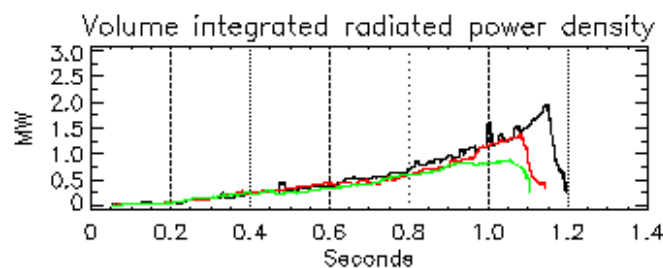
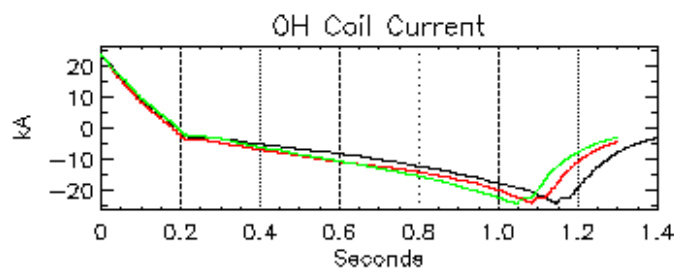
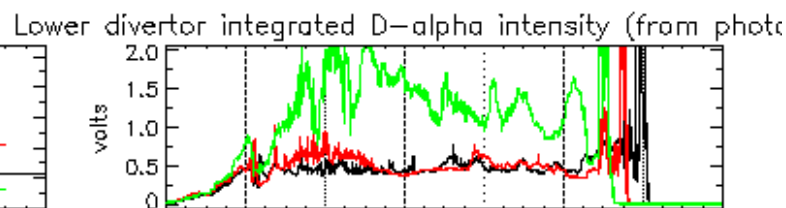
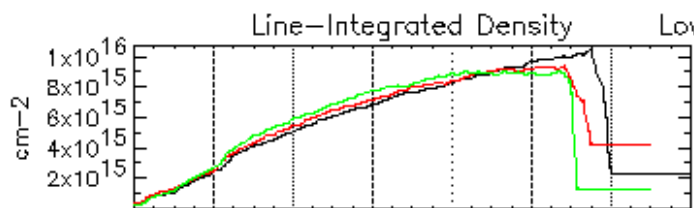
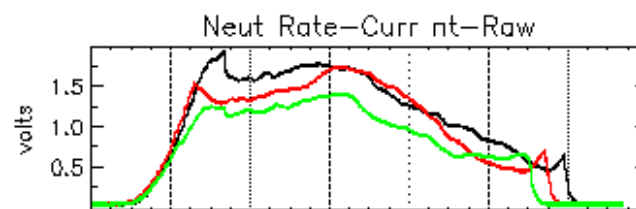
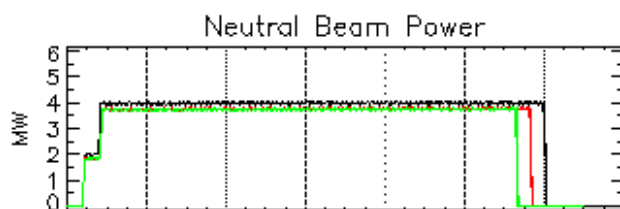
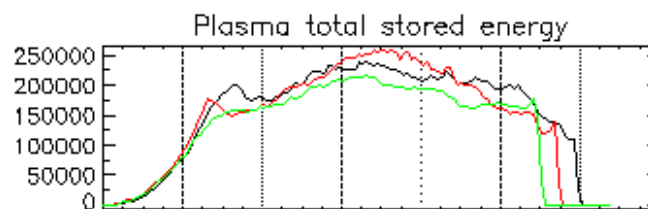
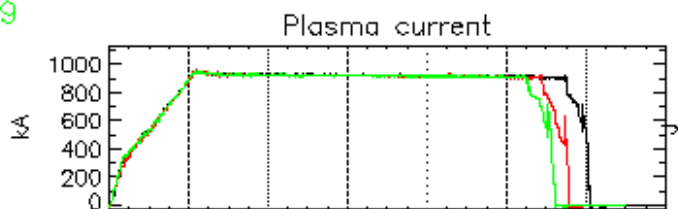


Lower single-null divertor discharges, 0.45T, D₂ gas fueling 3.5mg



- 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.*

Shots:
134084
135063
135049



Shots:
134085
135063
135049

