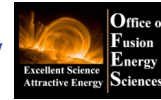


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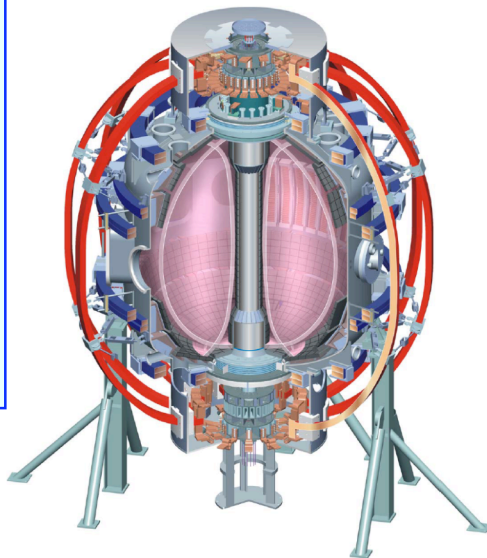
# XP601: Effect of Evaporated Lithium PFC Coatings in NSTX on Density Control

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**NSTX Results Review**  
July 26-27, 2006, PPPL

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# XP601: Outline



- 2 versions of lithium evaporator (LITER-1) installed in succession on upper port aimed 22° downward toward of lower CS and divertor graphite tiles.
- LITER-1 temperatures (450–680°C) produced evaporation rates of 0.08 to 35 mg/min with a Gaussian-like angular distribution with a 1/e full width of about 22°.
- 12 separate depositions (1.6 mg to 4.8 g) of lithium were performed (9 g total). Lower Single-Null L-mode and H-mode, and Double-Null Reversed-Shear plasmas were studied.
- After lithium coating, reference ratio of oxygen to carbon emission lower than achieved with boronization.
- Other effects observed under some conditions:  
**5-29% decreases in  $n_e$  and increases up to 15% in  $T_e$ , 20% in  $T_i$ , 20% in  $n$ /sec, reductions in H-mode ELM frequency, increased long pulse fueling, improved reverse shear....**

# Experimental Sequence

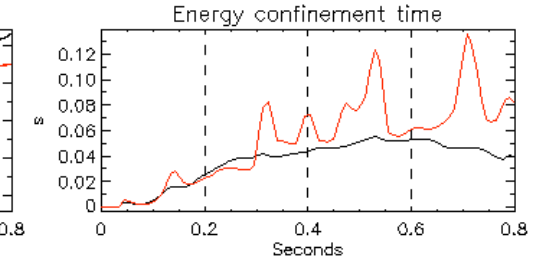
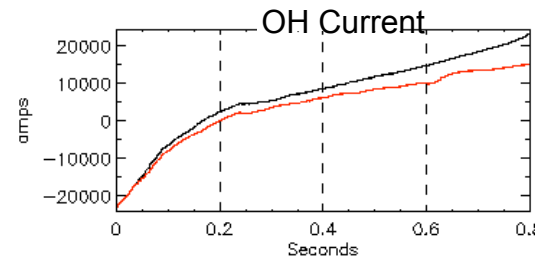
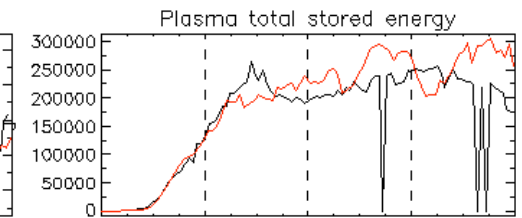
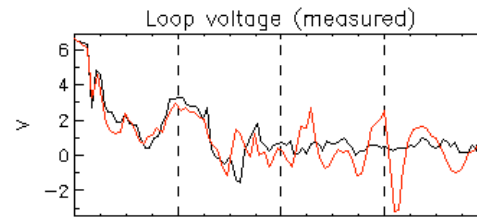
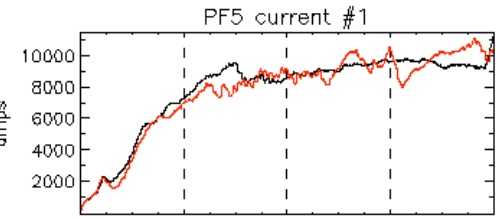
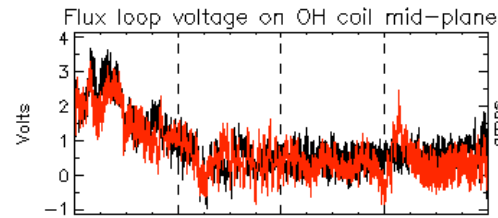
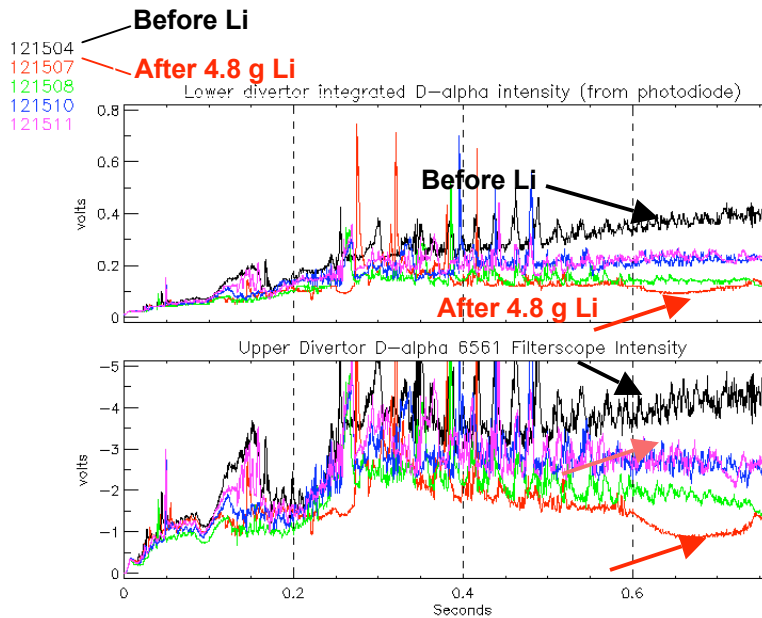


Evaporation Number	mg	Evaporation Duration	Time to 1st Shot	He Discharge Conditioning	Type	Ref Shot	Compare Shot	Comments
E-1, 4/07/06	1.6	11 min		none	L	none		no change
E-2, 4/11/06	14.3	245 min	151 min	7 He, 4/10/0	L	119872	119854	no change
E-3, 4/11/06	77.0	128 min	11 min	none	L	119875	119854	no change
E-4, 4/12/06	215	128 min	167 min	none	L	119879	117087	no change
E-5, 4/12/06	0					none		
E-6, 4/13/06	643	369 min	85 min	none	L	119894	119887	no change
<b>E-7, 5/04/06</b>	<b>378</b>	<b>63 min</b>	<b>23 min</b>	<b>6 He, 5/04/06</b>	<b>L</b>	<b>120474</b>	<b>120464</b>	<b>first noteworthy changes</b>
E-8, 5/05/06	0					none		
<b>E-9, 6/09/06</b>	<b>440<sup>c)</sup></b>	<b>76 min</b>	<b>75 min</b>	<b>none</b>	<b>H</b>	<b>121323</b>	<b>121270</b>	<b>similar changes</b>
<b>E-10, 6/09/06</b>	<b>203<sup>a)</sup></b>	<b>50 min</b>	<b>17 min</b>	<b>none</b>	<b>H</b>	<b>121334</b>	<b>121270</b>	<b>no change</b>
<b>E-11, 6/09/06</b>	<b>295<sup>b)</sup></b>	<b>36 min</b>	<b>25 min</b>	<b>none</b>	<b>H</b>	<b>121336</b>	<b>121270</b>	<b>marginal increase</b>
<b>E-12, 6/22/06</b>	<b>4780</b>	<b>12.3 hrs</b>	<b>160 min</b>	<b>none</b>	<b>H</b>	<b>121507</b>	<b>121504</b>	<b>similar changes</b>
<b>E-13, 6/22/06</b>	<b>1046</b>	<b>66 min</b>	<b>24 min</b>	<b>none</b>	<b>H</b>	<b>121512</b>	<b>121504</b>	<b>similar changes</b>
<b>E-14, 6/22/06</b>	<b>1008</b>	<b>28 min</b>	<b>8 min</b>	<b>none</b>	<b>H</b>	<b>121521</b>	<b>121504</b>	<b>similar changes</b>

# Lithium Reduced $D\alpha$ Luminosity, Loop Voltage and Flux Consumption



Shots:  
121504  
121521



- $D\alpha$  reduced after Li

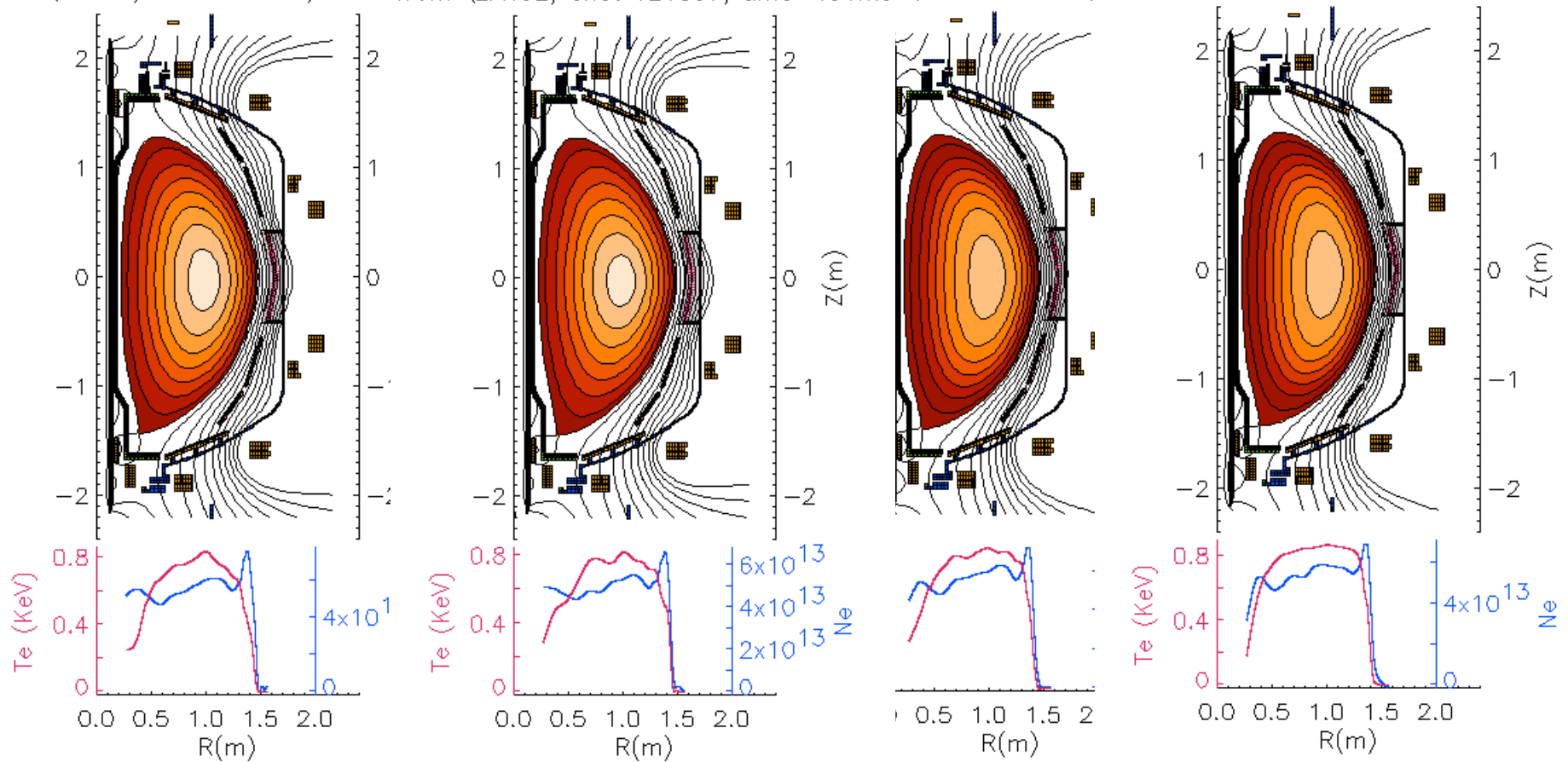
• 121504 before Li

• 121521 after an additional 1.1g Li between discharges (2nd evaporation after 4.8g)

# Lithium on PFCs May Be Broadening Profiles



from \EFIT02, Shot 121504, time=401ms, from \EFIT02, Shot 121507, time=401ms, from \EFIT02, Shot 121512, time=403ms, from \EFIT02, Shot 121521, time=403ms



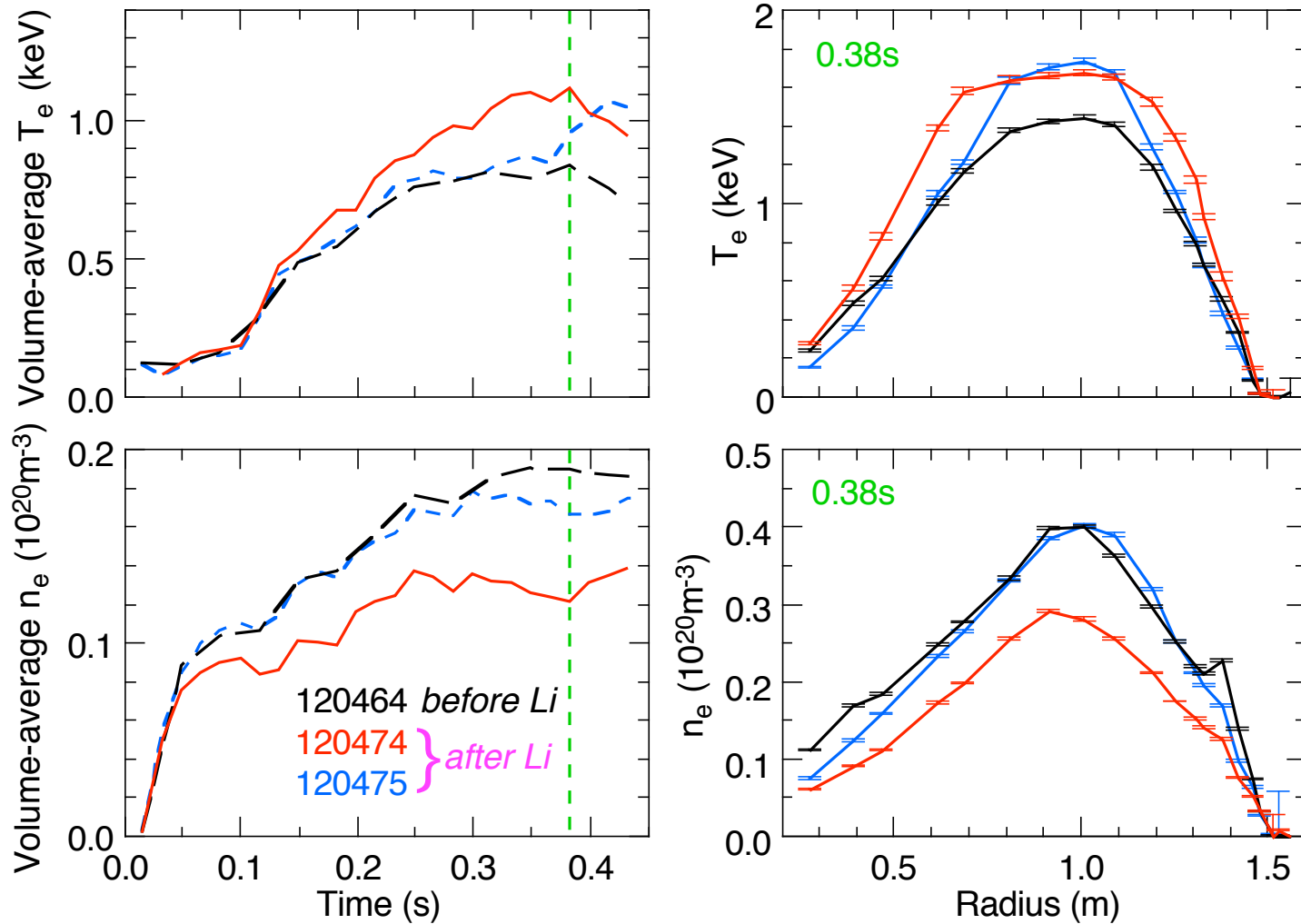
Before Li

After 4.8g Li

After +1.1g Li

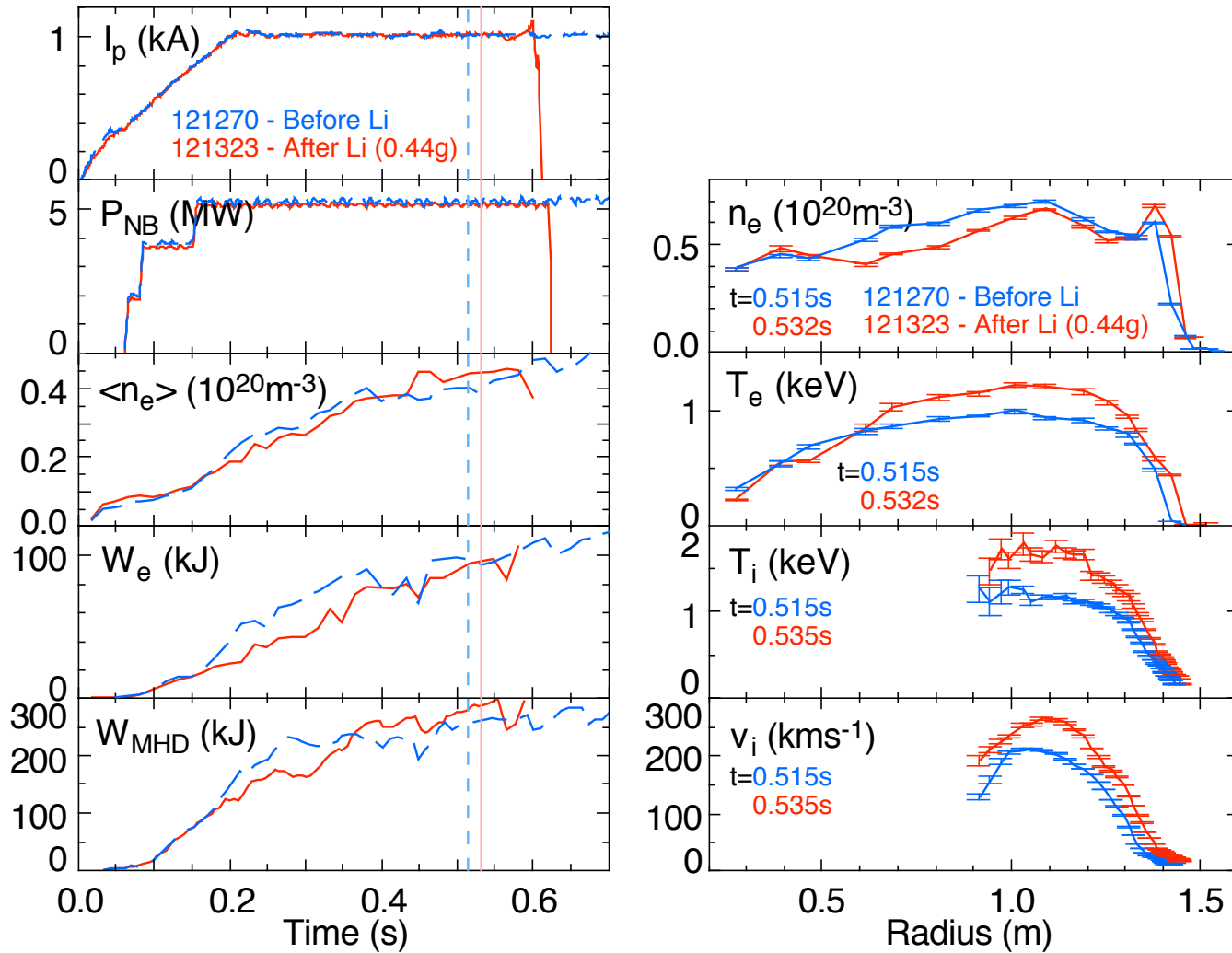
After +1.1g Li

# LSN L-mode Exhibited Changes After 0.38g Lithium PFC Coating



M. Bell

# H-mode Exhibited Changes After 0.44g Lithium Coating without pre Helium Discharge Conditioning



M. Bell

# Summary and Conclusions



- Effect on density for XP601 persists for one shot after application of lithium
- Other plasma effects persist longer
- For present geometry, performance improvements appear not dependent on quantity of lithium deposited beyond certain threshold
  - Thereafter small depositions between shots appear to recover conditions
  - Indications of possible long-term improvements
- The initial results suggest upgrade of present capability for
  - Faster between-shot evaporation
  - Broader coverage on lower divertor target region