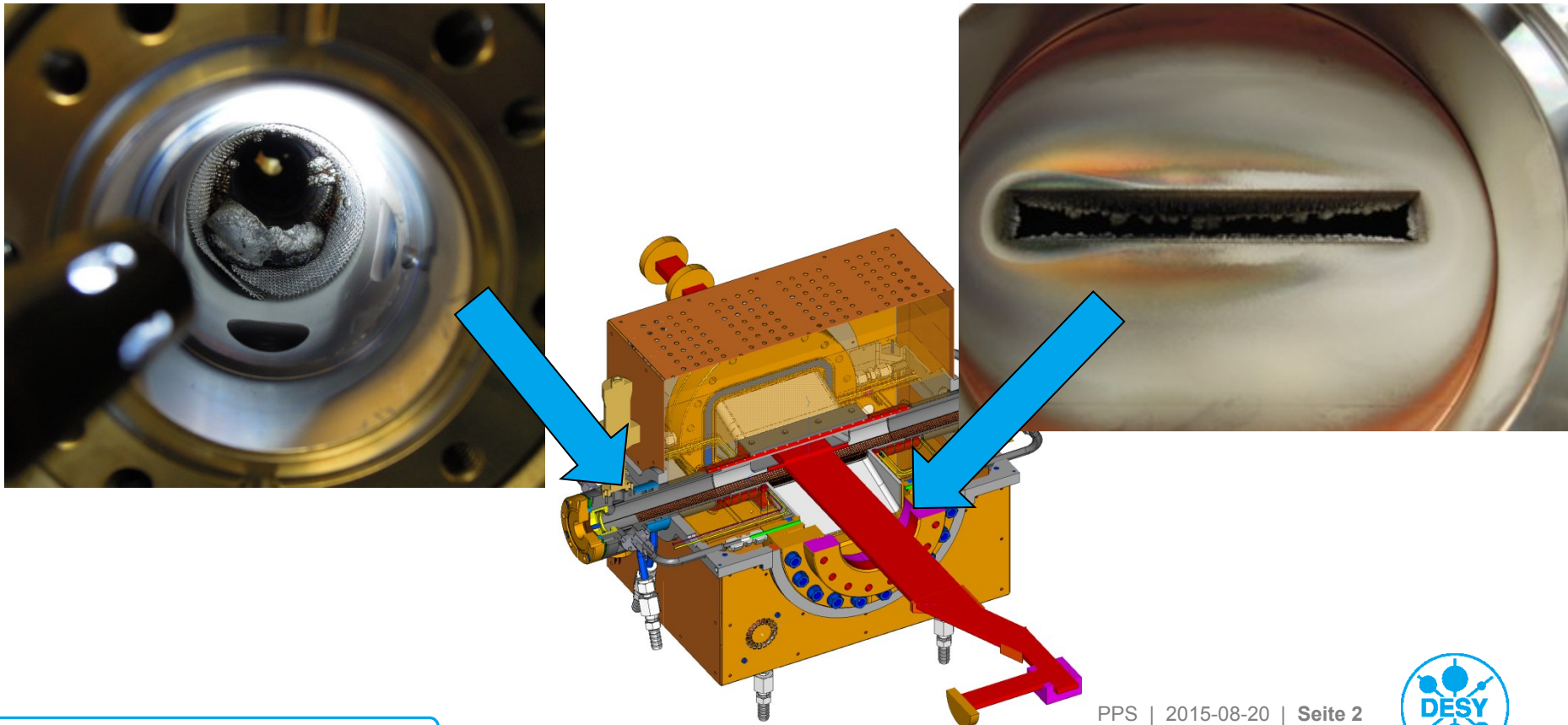


# Results from gas density measurement for plasma cell

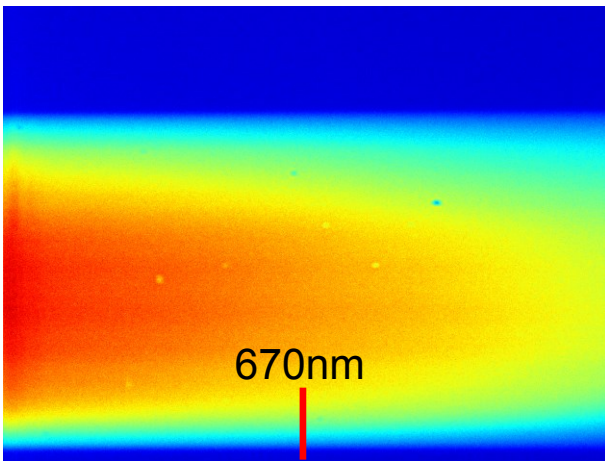
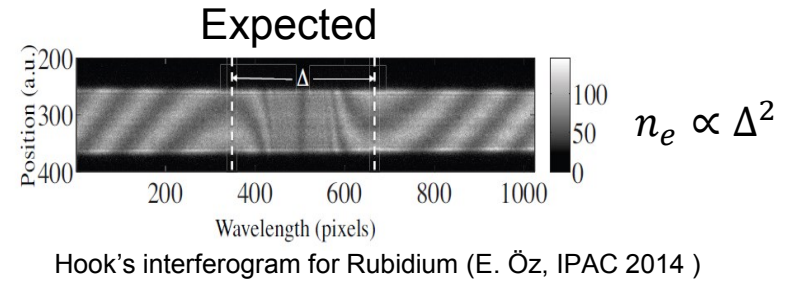
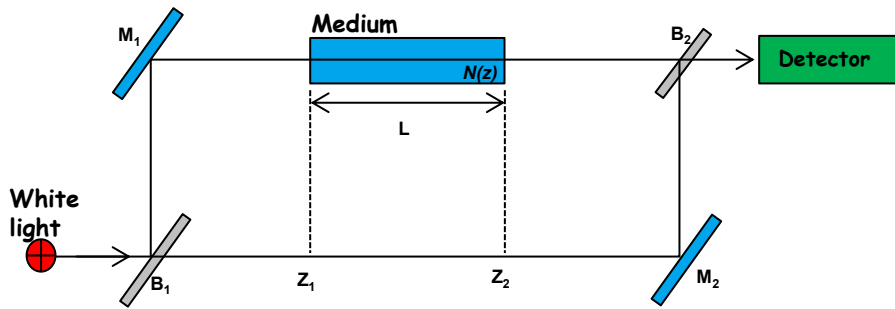
G. Pathak  
20/08/2015

# Plasma cell status after extraction from the tunnel

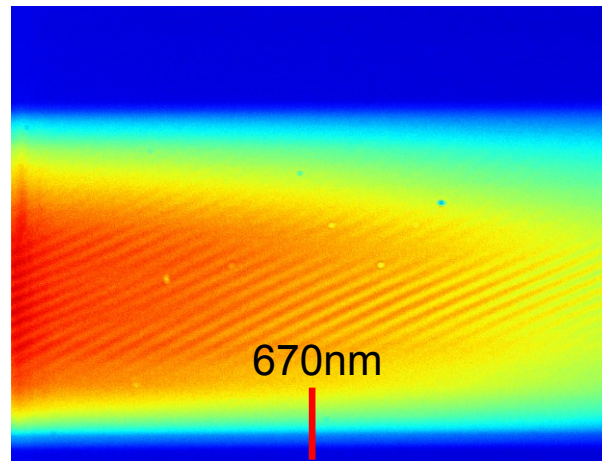
- When we did experiment in the tunnel
  - The amount of Li inside was 25g
  - Buffer gas pressure was 0.27 mbar
- Big amount of Li was deposited on cold regions of the plasma cell



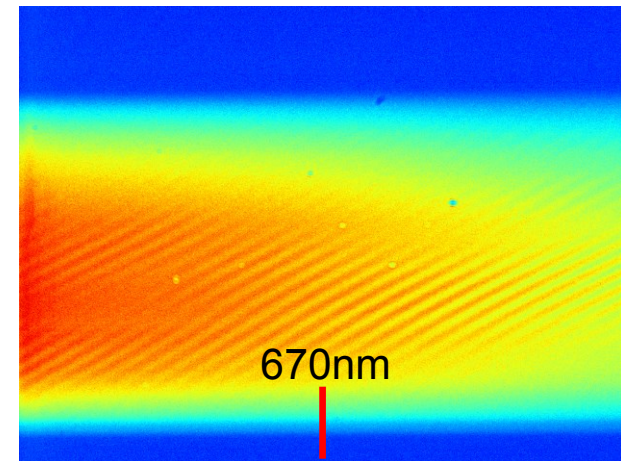
# Hook method results before the pressure and Li amount was increased in the plasma cell



One arm of interferometer is closed



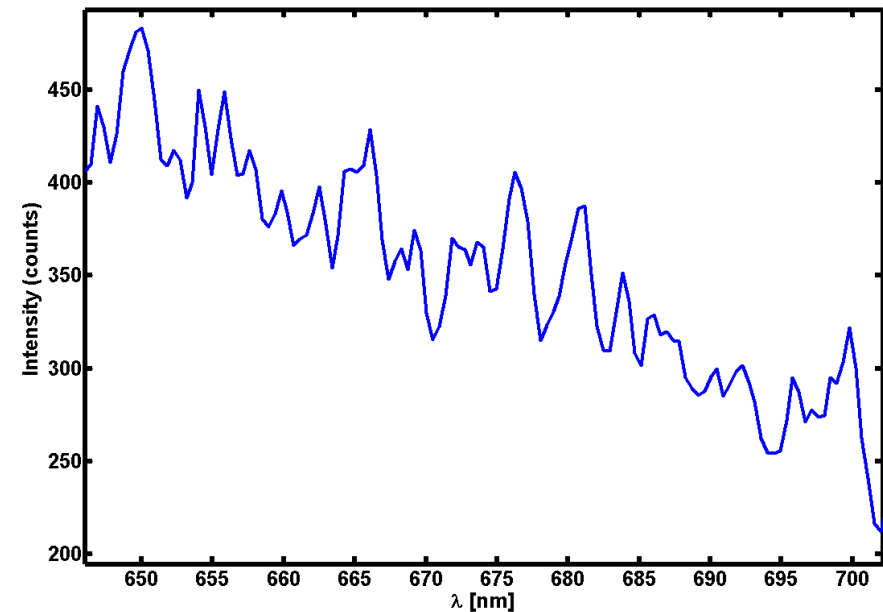
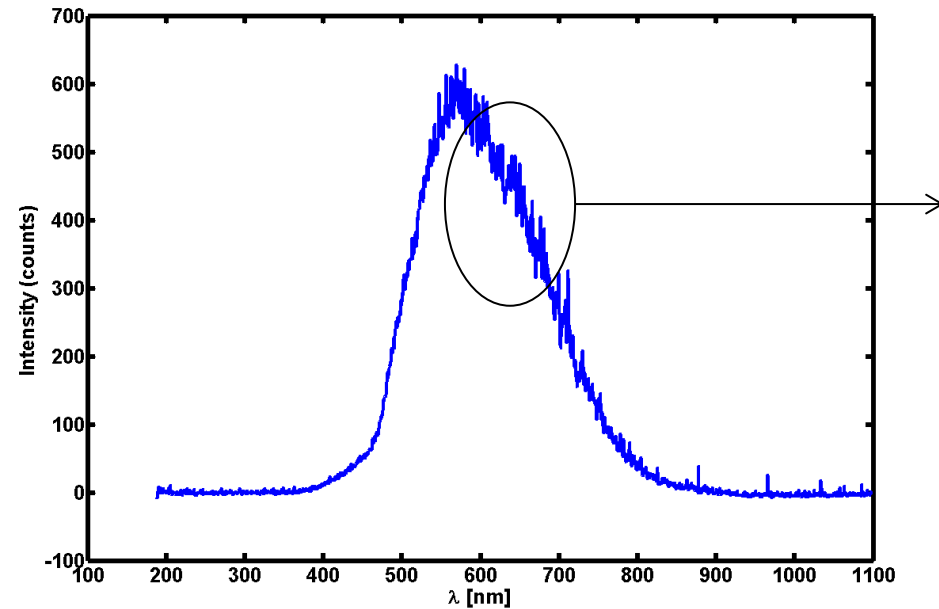
@350 °C



@650 °C

# Spectrum after the plasma cell

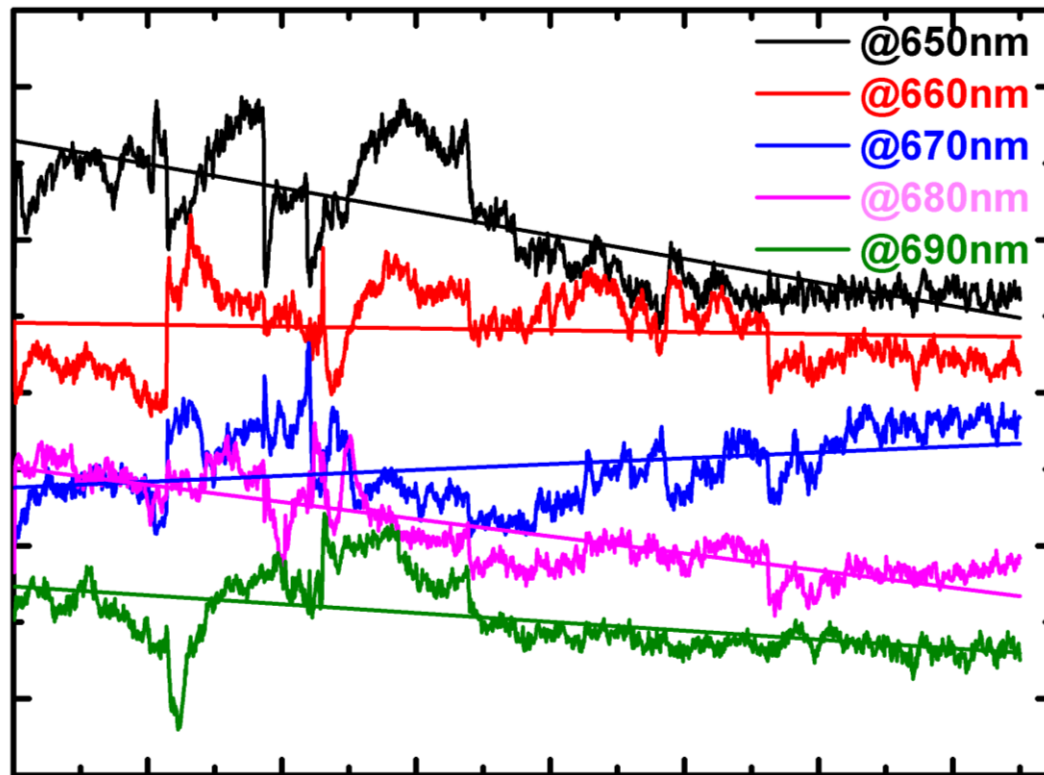
The amount of Li inside was 25g  
Buffer gas pressure was 0.27 mbar



Spectrum @ 680 °C

- The signal @~670.7 **should disappear** during the plasma cell **cooling** while the other signals should remain there.

# Change in the intensity of the signal



Cooling direction  $\longrightarrow$

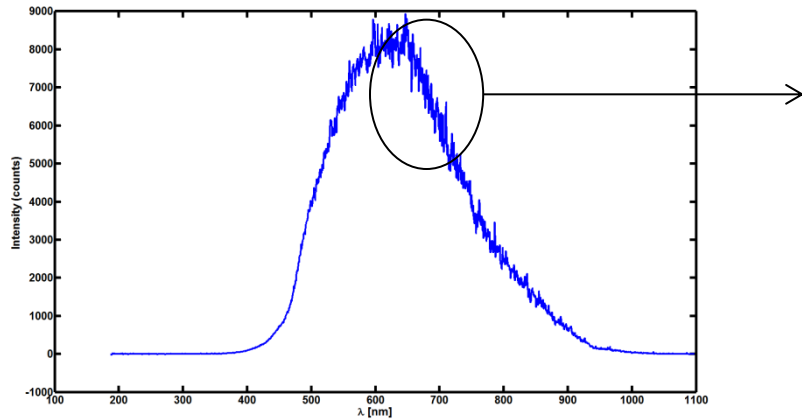
@650nm	Intercept	432.44805
	Slope	-0.03867
@660nm	Intercept	372.87052
	Slope	-0.00306
@670nm	Intercept	319.00226
	Slope	0.00958
@680nm	Intercept	325.49477
	Slope	-0.02801
@690nm	Intercept	286.6892
	Slope	-0.01447

- > Rough calculation shows gas density  $\sim 9 \times 10^{14} \text{ cm}^{-3}$ , which strongly depends on the length of the Li gas column.
- > Absorption spectrum @ 670.7 nm is almost undetectable – reason for why I didn't observed the hooks

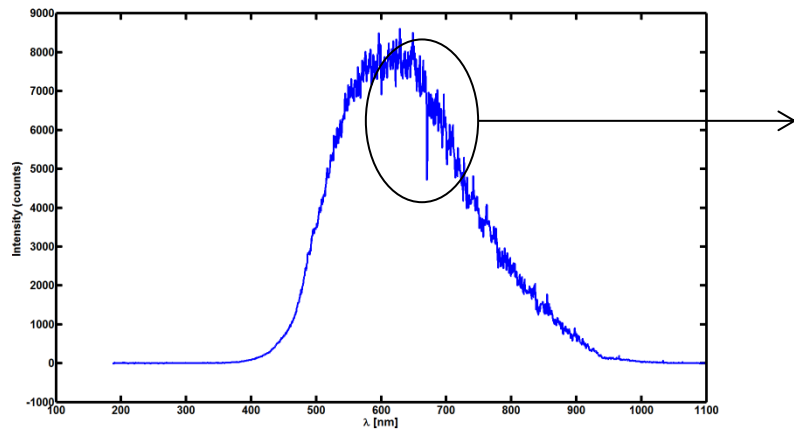
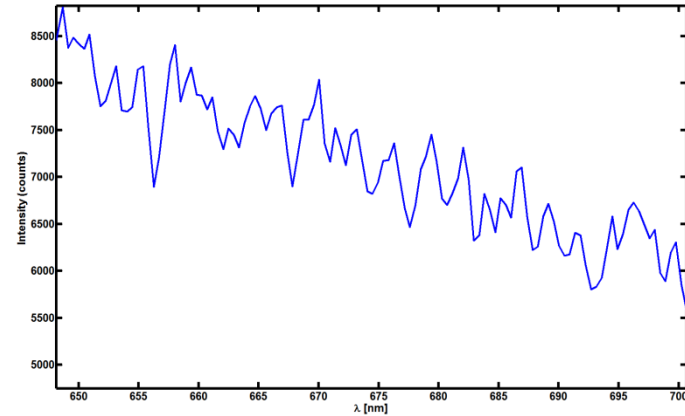
**How to increase the density?**

# Solution

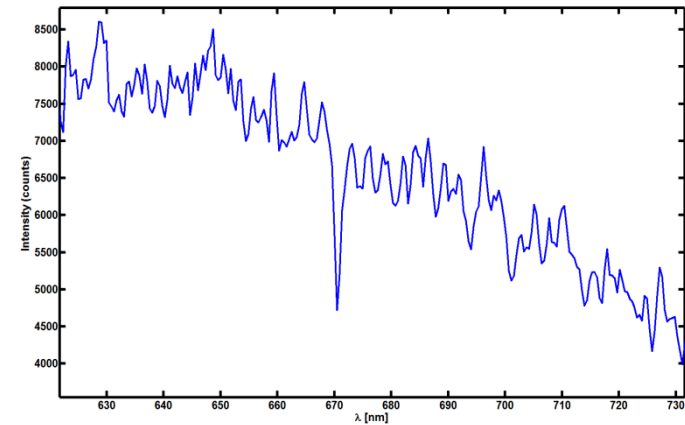
- 6.5 g of additional Li was loaded on Monday (initial amount was 25 g)
- Buffer gas pressure was increased from 0.27 to 0.67 mbar



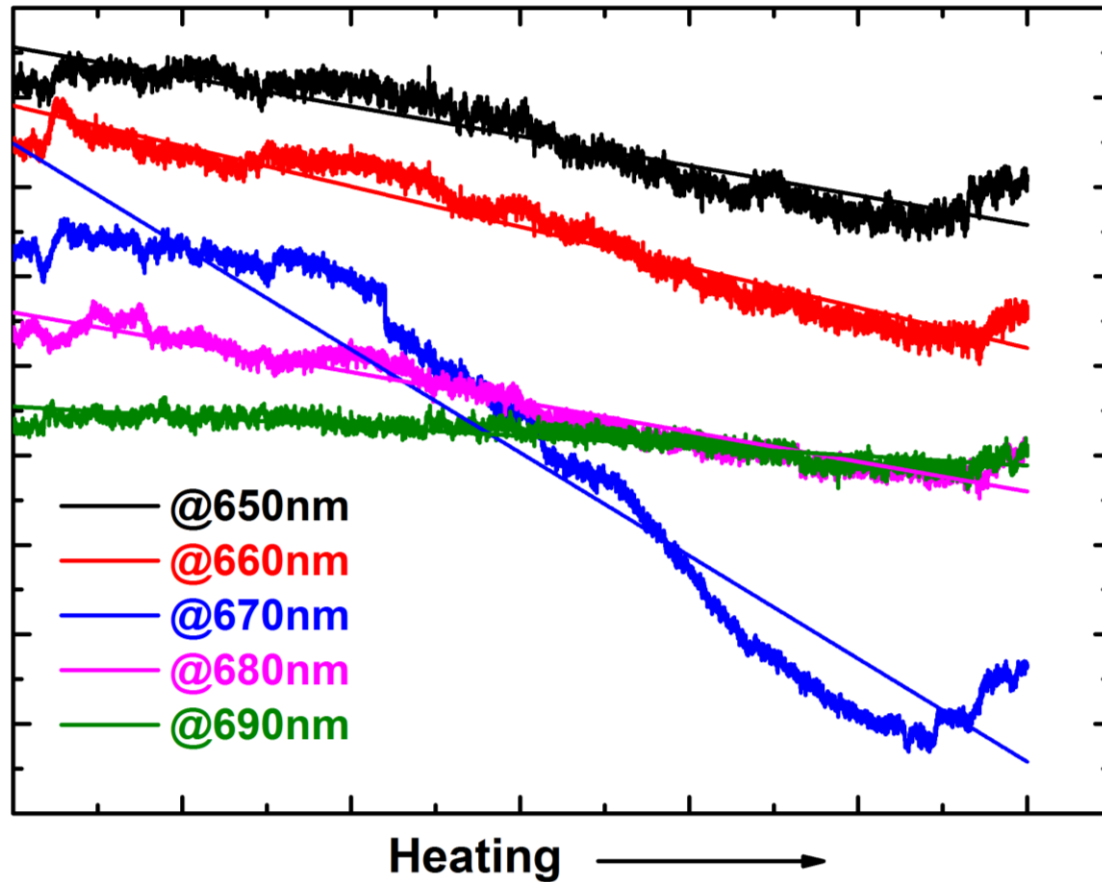
Spectrum @ 555 °C



Spectrum @ 680 °C



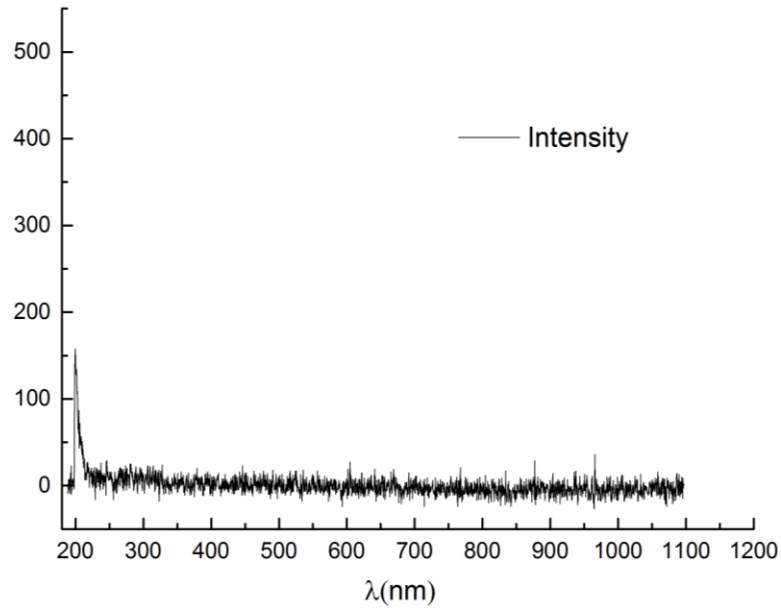
# Change in the intensity of the signal



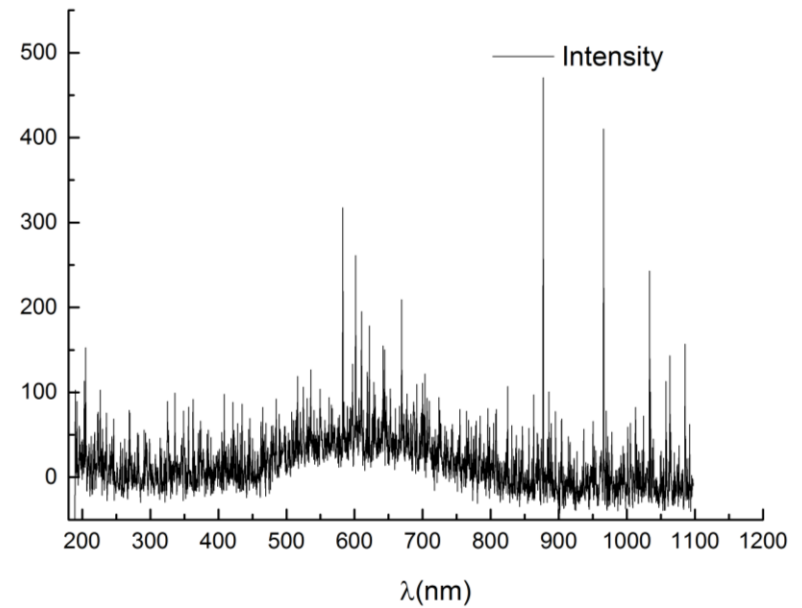
@650nm	Intercept	8281.16236	2.63
	Slope	-0.1655	7.59568
@660nm	Intercept	7954.3376	2.37
	Slope	-0.22555	6.85375
@670nm	Intercept	7743.42129	6.73
	Slope	-0.5757	0.00
@680nm	Intercept	6799.51929	1.83
	Slope	-0.1668	5.28277
@690nm	Intercept	6273.46526	1.22
	Slope	-0.05495	3.54512

- > Rough calculation shows gas density  $\sim 2 \times 10^{15} \text{ cm}^{-3}$ , which strongly depends on the length of the Li gas column.
- > Expecting the density measurement by hook's method

# Evidence of plasma



Before plasma cell (ArF laser)

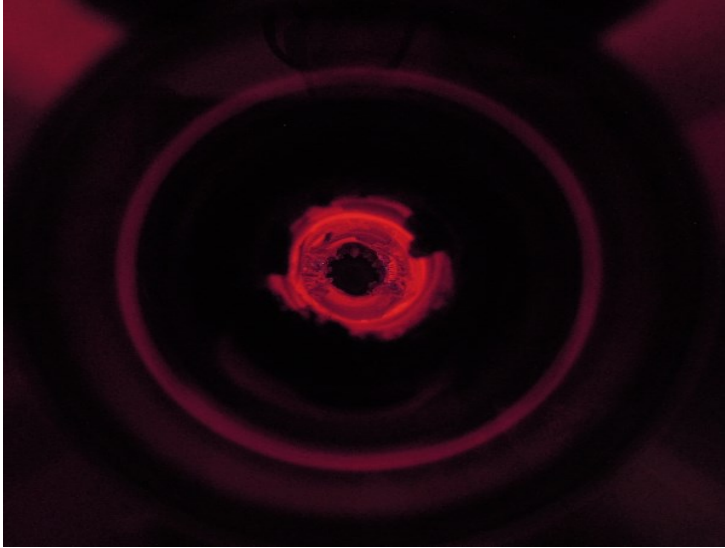


After plasma cell

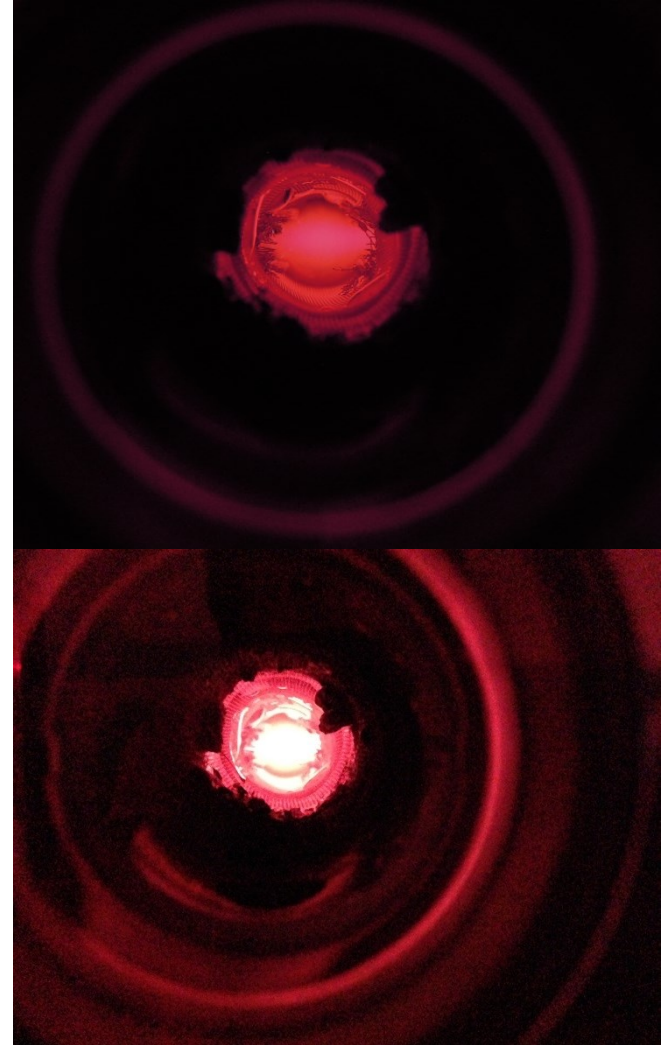


# Plasma generation in 1L18

Laser off

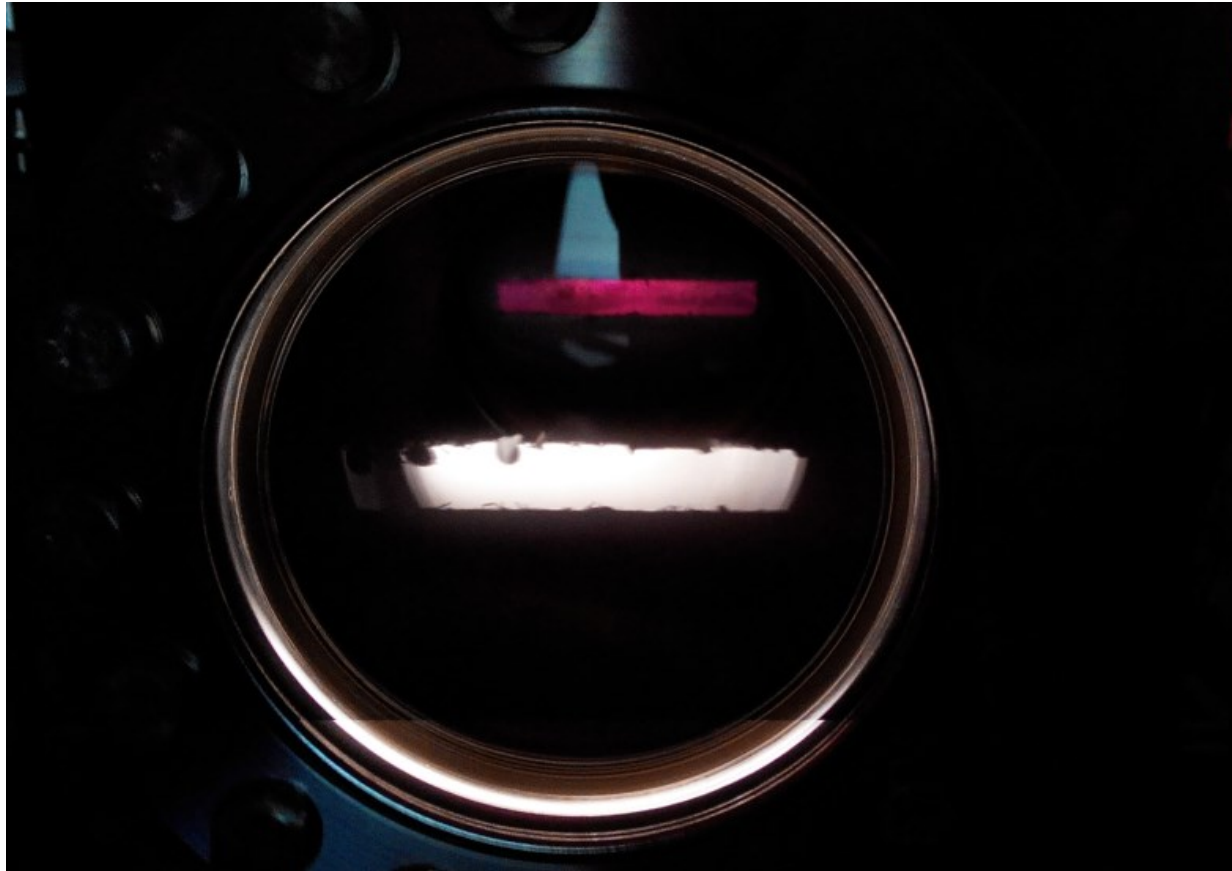


Laser on



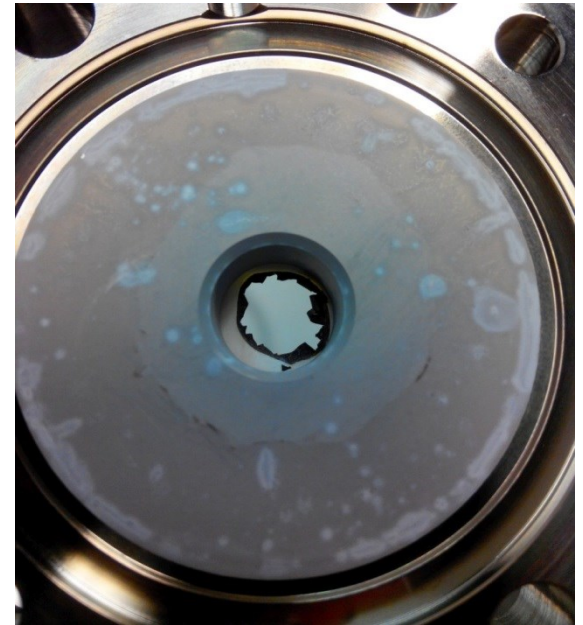
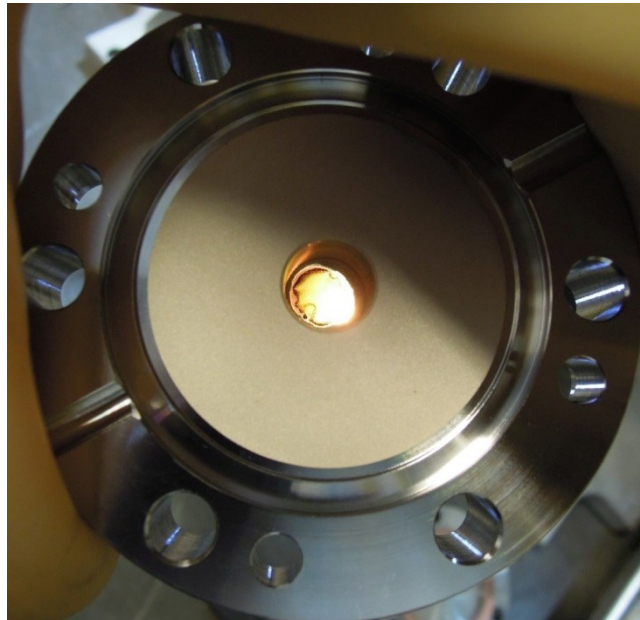
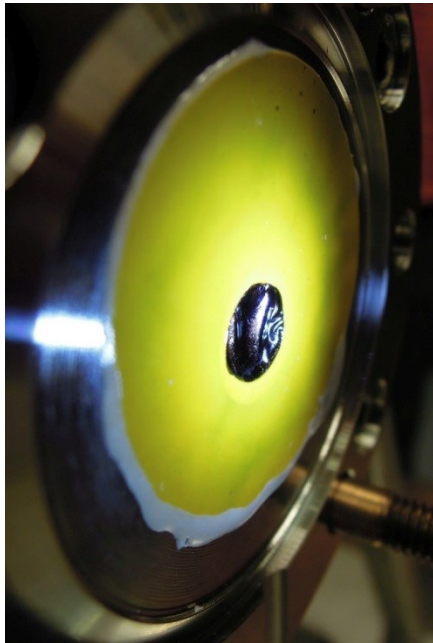
# Plasma generation in 1L18

- > We still have one normal glass window on the opposite to the laser side, so it is impossible to measure laser absorption at the moment



# Kapton windows are destroyed after dismounting

- Possible reason is the reaction of thin Li layer deposited on the foil with air



- New Kapton windows are in preparation

# Schedule for KW34-35

## > KW34:

- Monday: load additional Lithium, install the MgF2 window, heat up to 400 °C for the virtual leak fixing
- Tuesday: pump out the VL, adjust buffer gas pressure, transfer the cell to 1L18, heat to nominal operational temperature, record Li absorption line while heating
- Wednesday: generate plasma with the ArF laser
- Thursday/Friday: Li vapor density measurement. Try to record the plasma spectrum. Monitor Li absorption line over time (over weekend?) to see if Li vapor density is constant or not

## > KW35:

- install Kapton windows and the second MgF2 window
- optional: load more Lithium (depends on the absorption line behavior and visual inspection of condensed Li on the walls)
- install the plasma cell in the tunnel (latest on Wednesday)
- do laser absorption measurement for cooled and heated state of the cell

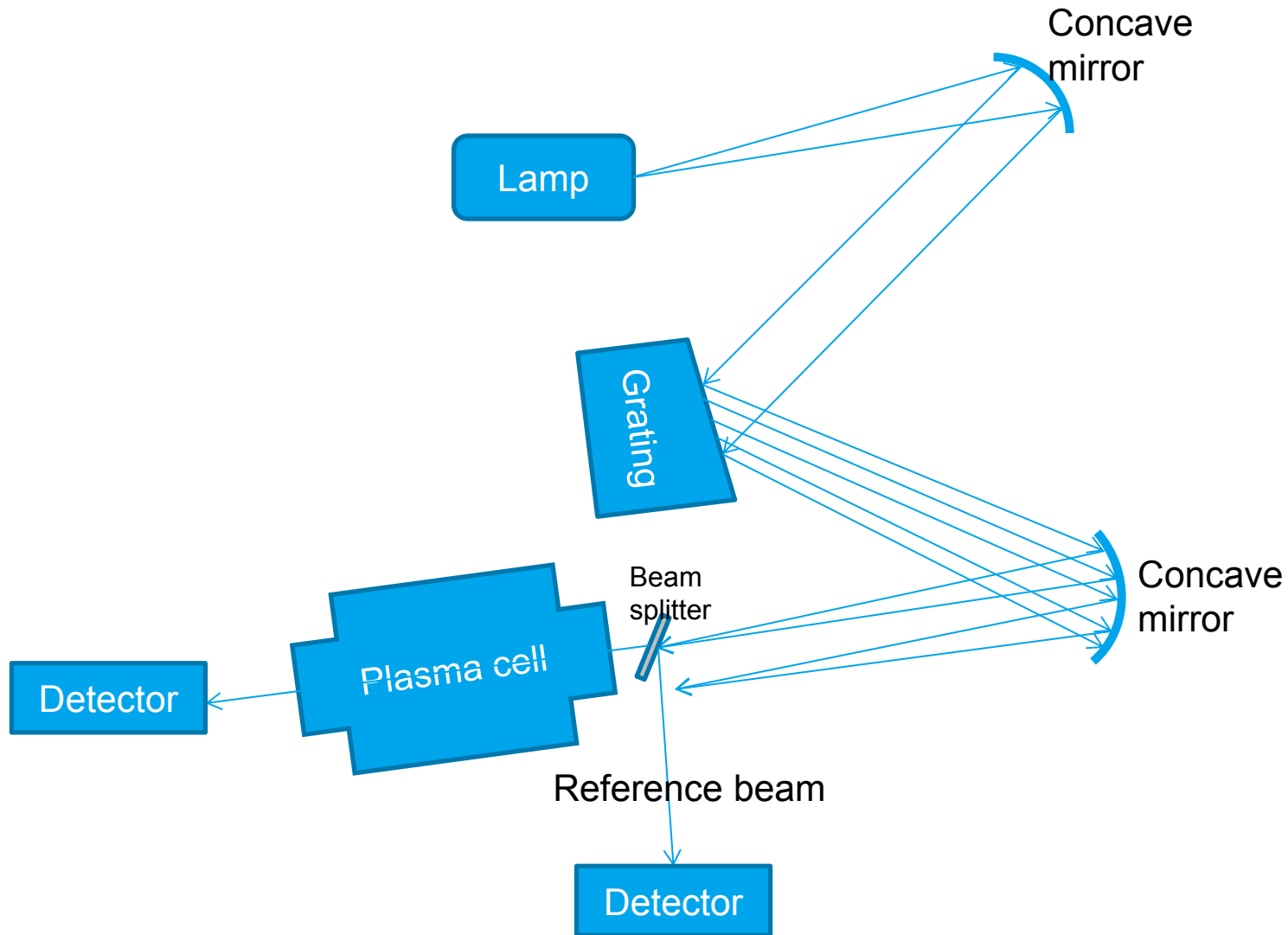


# THANK YOU

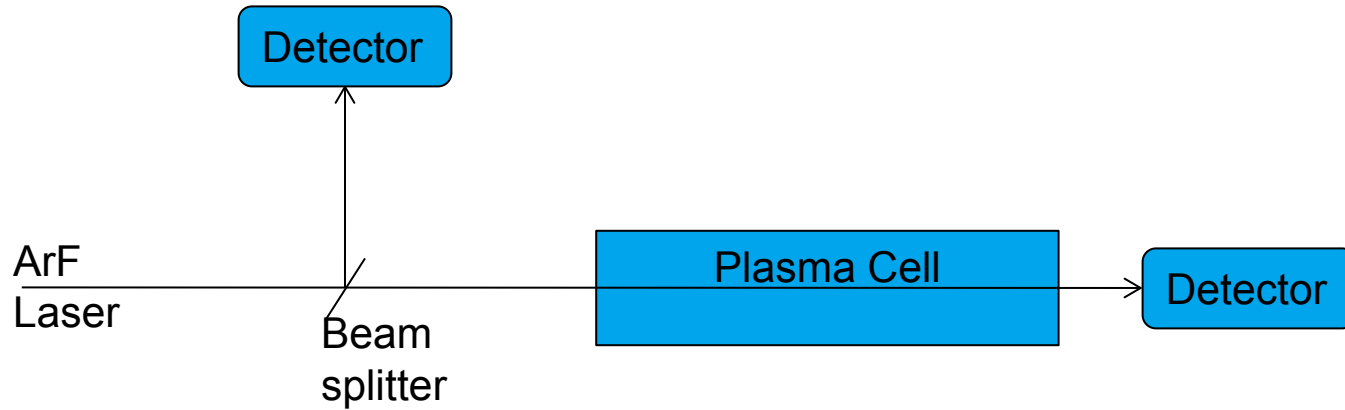
Special thanks to  
Gregor, James, Johannes, Mark, Osip



# Monochromator design for white light absorption for gas density measurement



# Absorption



$$n_0 L = -\frac{1}{\sigma} \ln \left( \frac{E_{\text{transmitted}}}{E_{\text{incident}}} \right)$$