125HR alignment in Eureka

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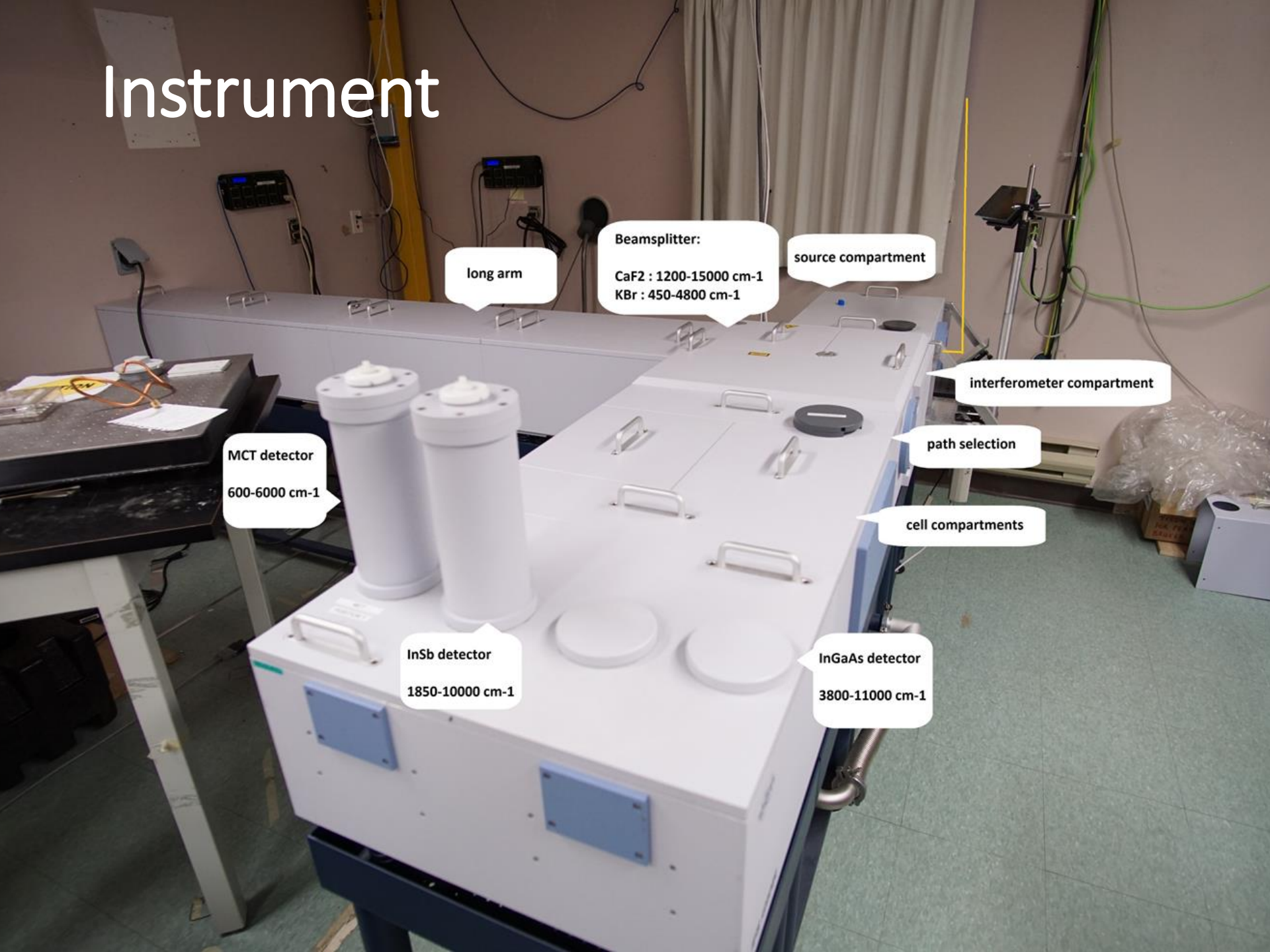
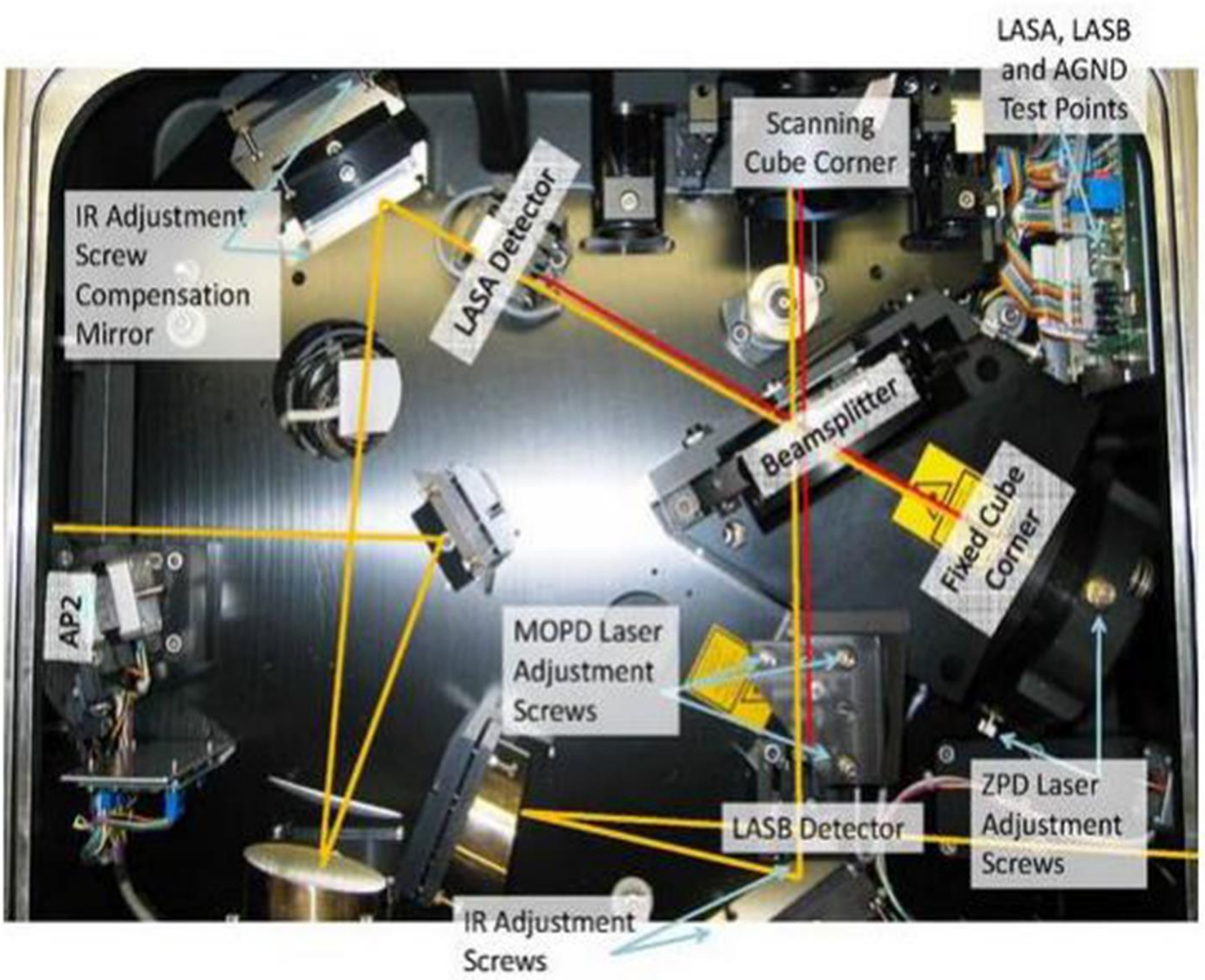
Instrument


long arm
Beamsplitter:
CaF2 : 1200-15000 cm-1
KBr : 450-4800 cm-1
source compartment
interferometer compartment
path selection
cell compartments
MCT detector
600-6000 cm-1
InSb detector
1850-10000 cm-1
InGaAs detector
3800-11000 cm-1


LASA, LASB
and AGND
Test Points
Scanning
Cube Corner
IR Adjustment
Screw
Compensation
Mirror
LASA Detector
Beamsplitter
Fixed Cube
Corner
AP2
MOPD Laser
Adjustment
Screws
ZPD Laser
Adjustment
Screws
LASB Detector
IR Adjustment
Screws

New

Existing aperture wheels did not have the center of different apertures at the same position

We installed new aperture wheels that should not have this problem

Installed new entrance window

Tyler !

Alignment

1 – Check of entrance aperture focus with the telescope in the long arm

2 - Setup a laser in place of the solar beam, pick off the beam from the interferometer compartment to view with the telescope and center entrance aperture on Haidinger fringes.

3 – Adjust the fixed corner cube to remove any apparent shift of the fringes through ZPD

4 – With the telescope back in the long arm, view the exit aperture, adjust the focus, co-align with the entrance aperture.

5 – Check the laser passes through the exit and entrance aperture and check laser signals

6 – Focus and center the image of the sources on the entrance aperture

7 – Peak detectors

8 – Cell tests

Step 1

- Focus telescope at infinity. Check the focus of the entrance aperture with the telescope installed in the long arm

- There was no adjustment to be made as the aperture appeared in focus

- Control the camera with a laptop while viewing image on a screen

Step 2

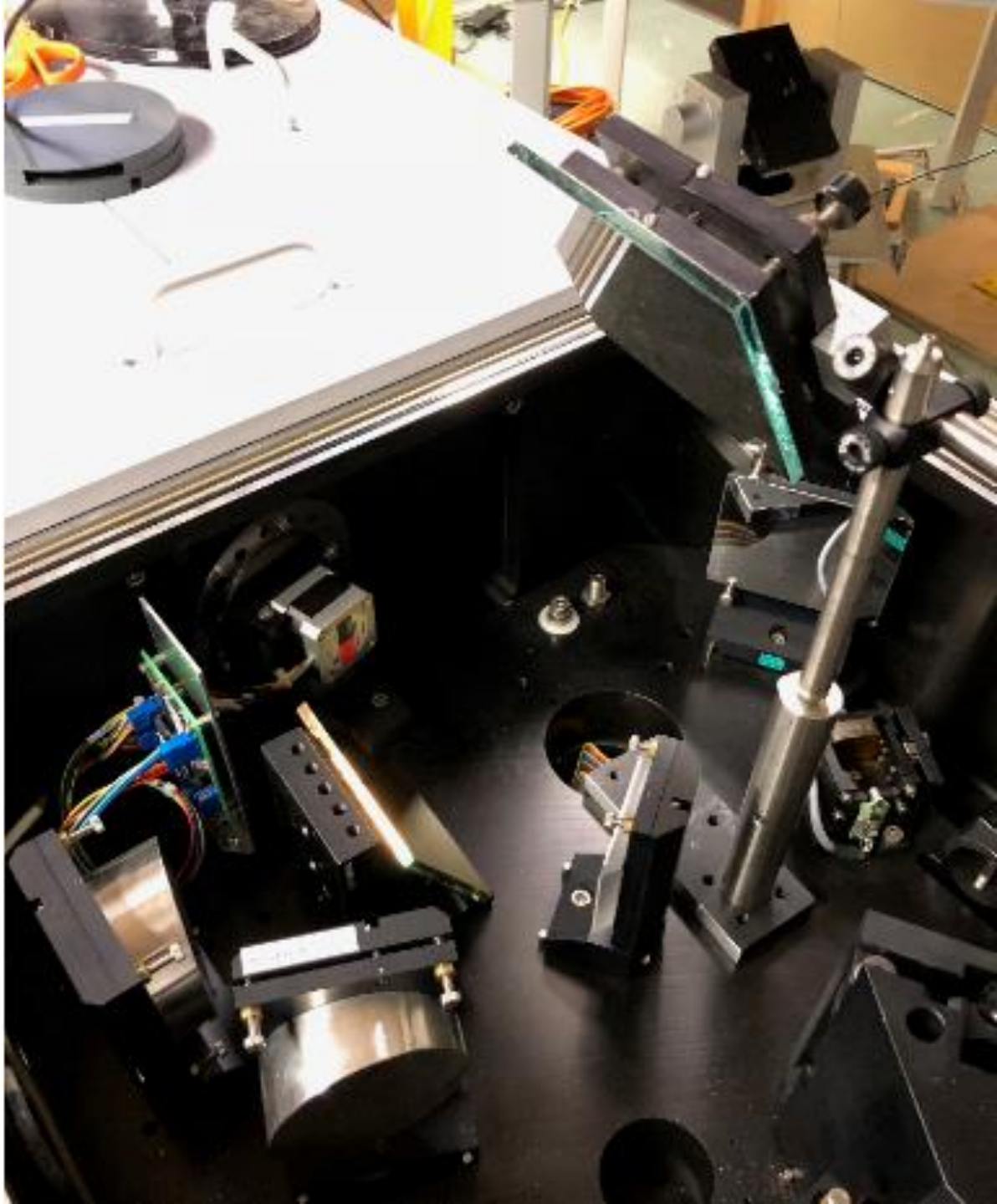
- Setup a HeNe laser in place of the solar beam
- Pick off the beam from the interferometer compartment
- Center the image of the entrance aperture on the fringe pattern.
- The mirror to adjust is circled in red

Laser setup

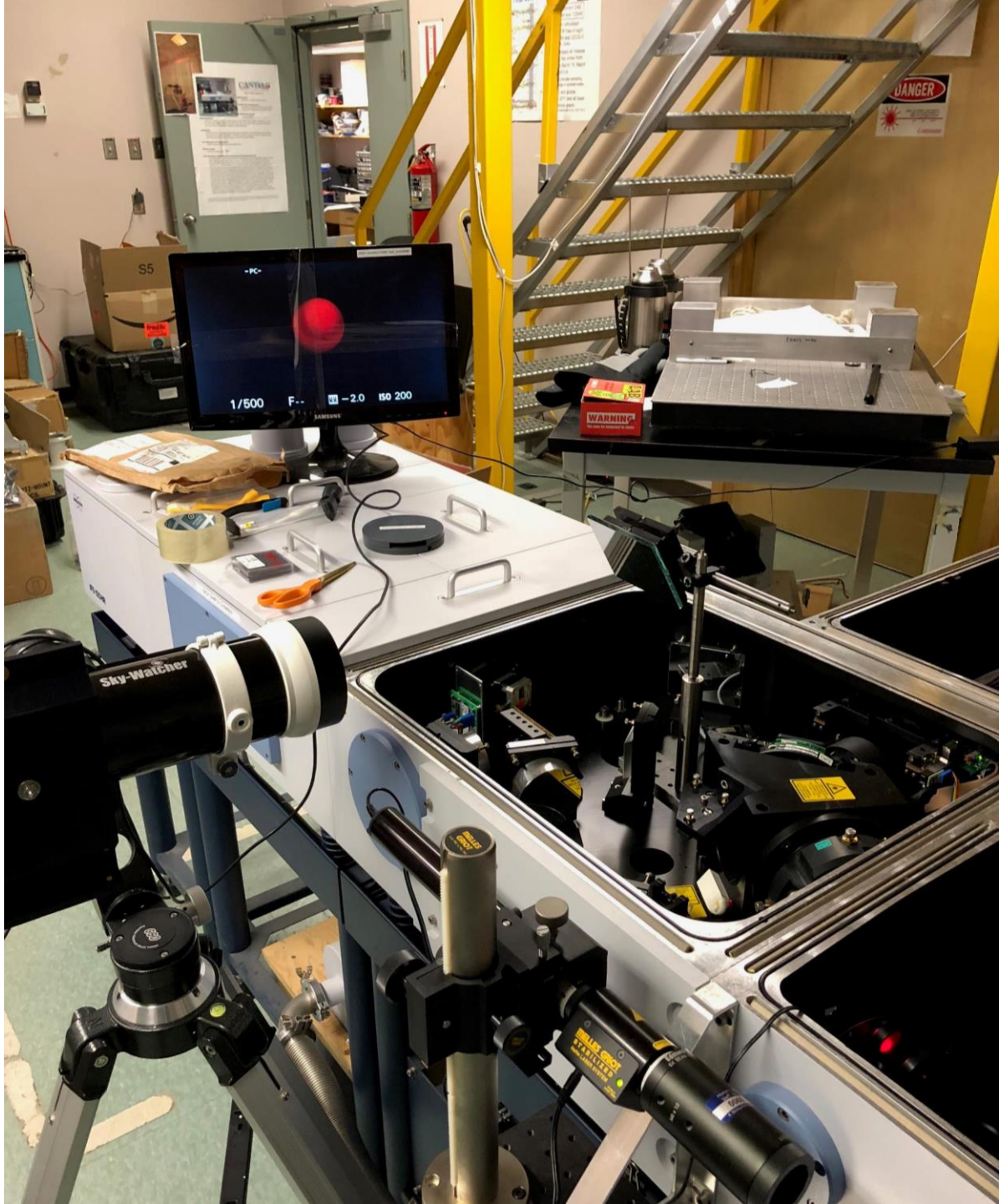
Speckle reducer and 1500 grit diffuser in front of the entrance aperture

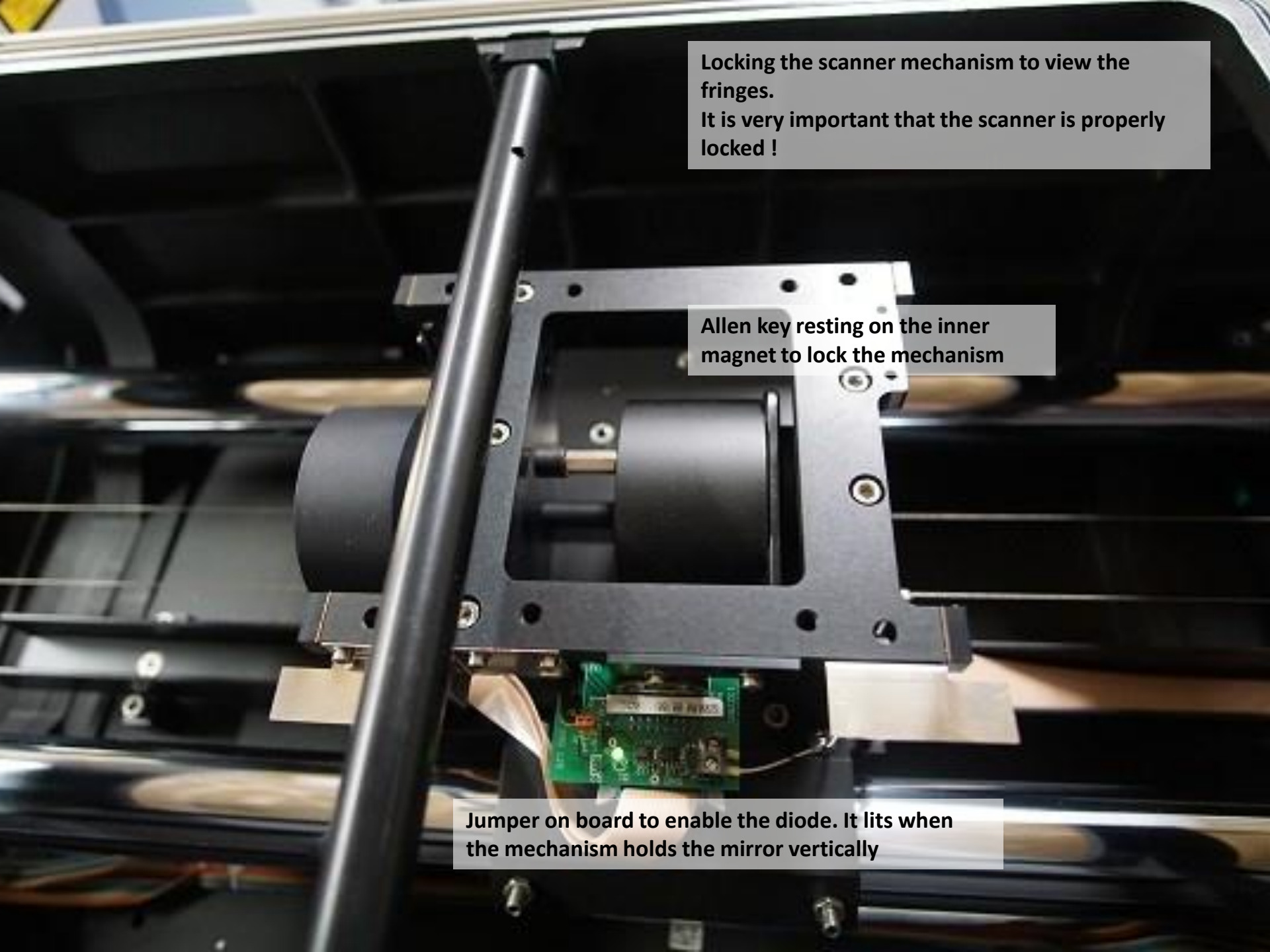
The ISO of the camera can also be adjusted to get better contrast of the fringe pattern

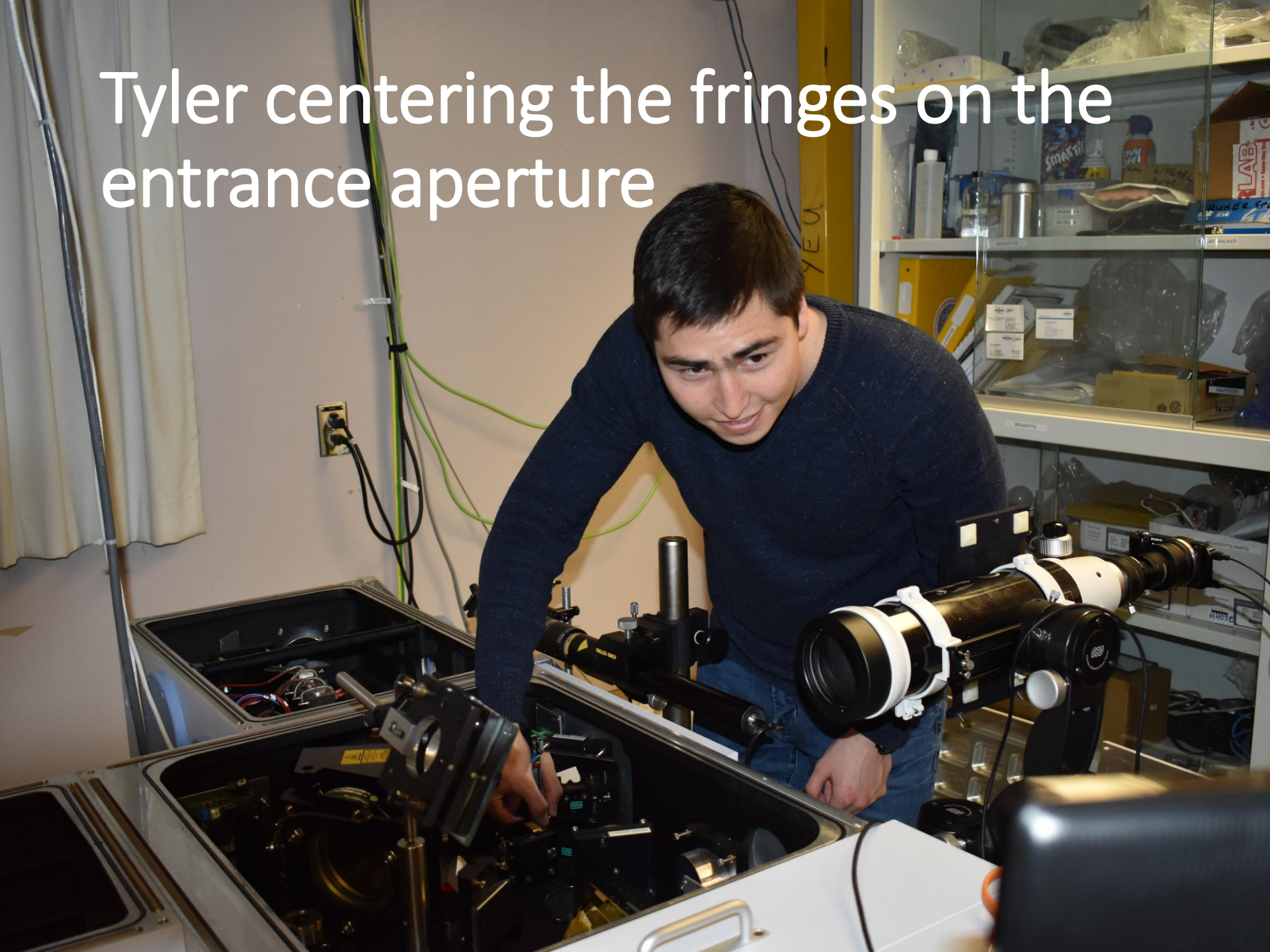
Periscope in the interferometer compartment to direct the collimated beam in the telescope



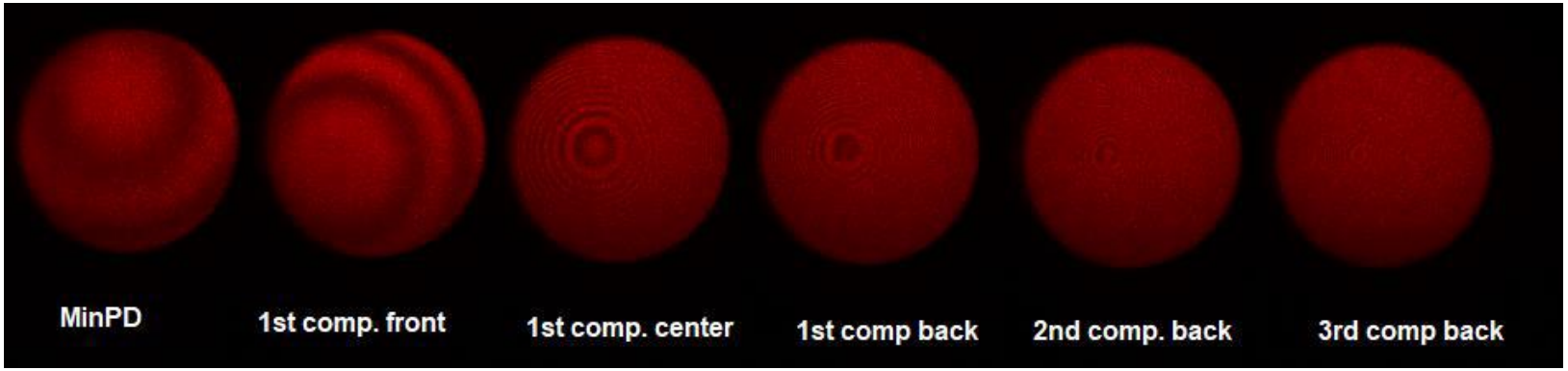
Overall setup to view the fringes

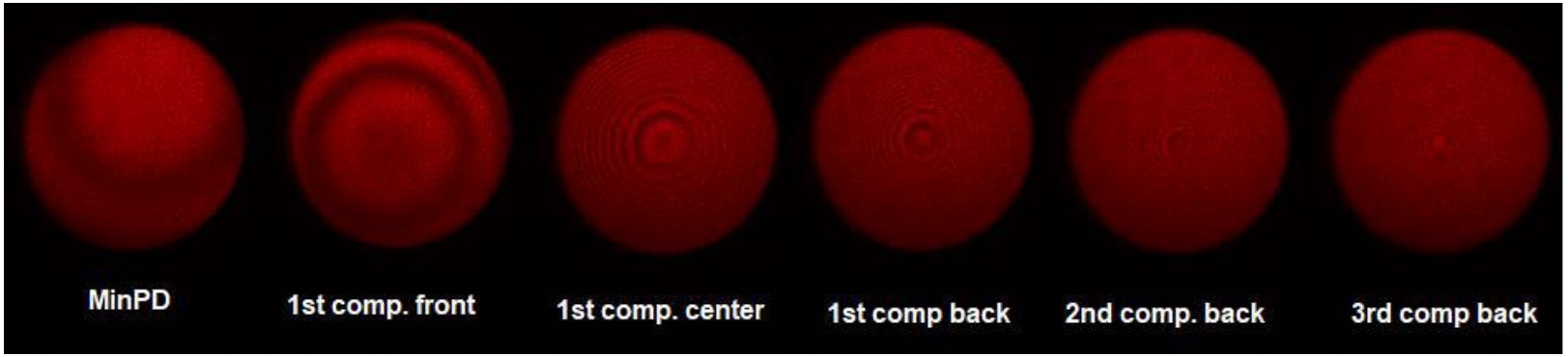



Locking the scanner mechanism to view the fringes.
It is very important that the scanner is properly locked !
Allen key resting on the inner magnet to lock the mechanism
Jumper on board to enable the diode. It lits when the mechanism holds the mirror vertically

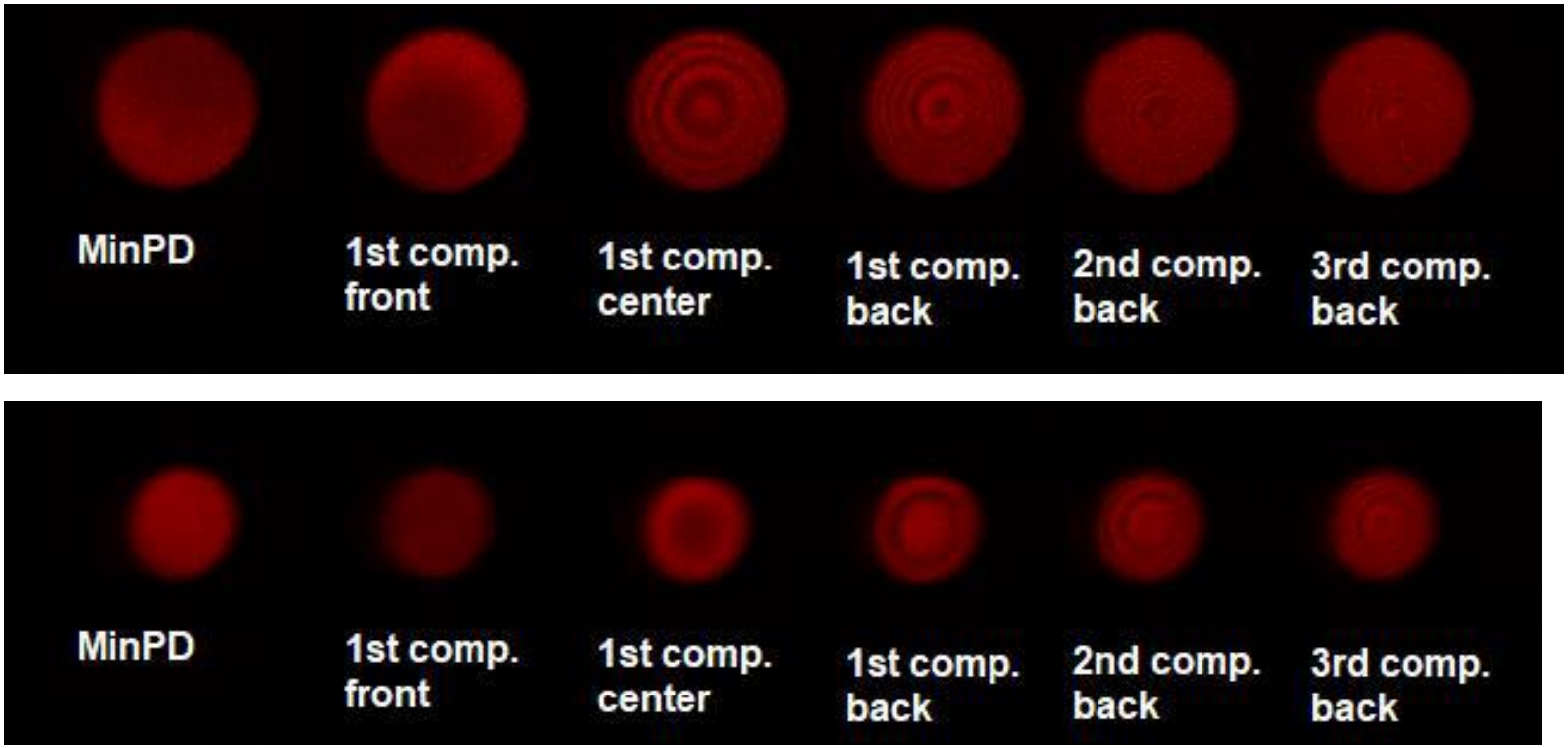

Tyler centering the fringes on the entrance aperture

Fringes after installing the new wheels and after 1st adjustment, 4 mm aperture





Fringes after the 2nd and 3rd adjustments, 2 mm and 1 mm apertures

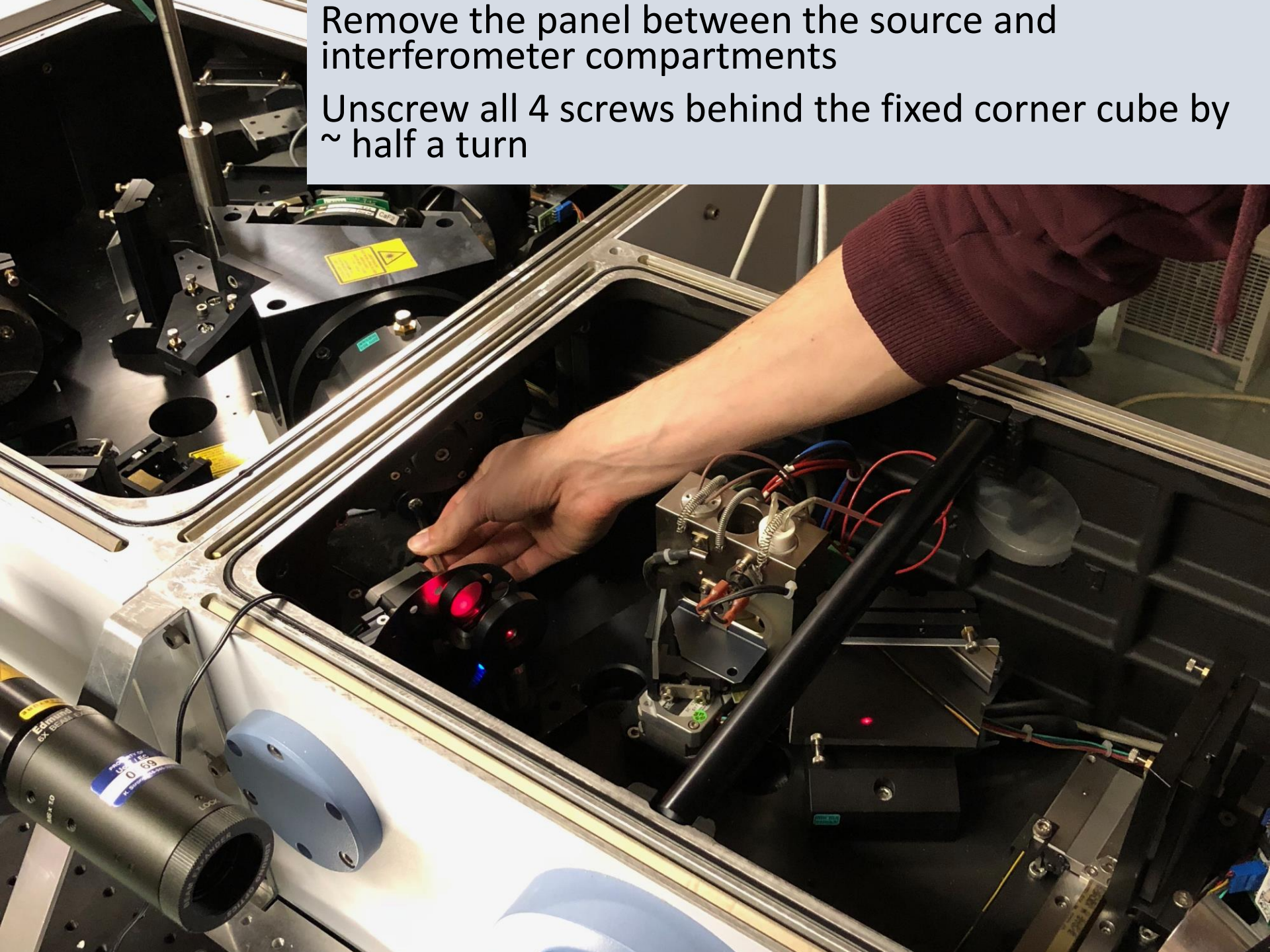


Step 3

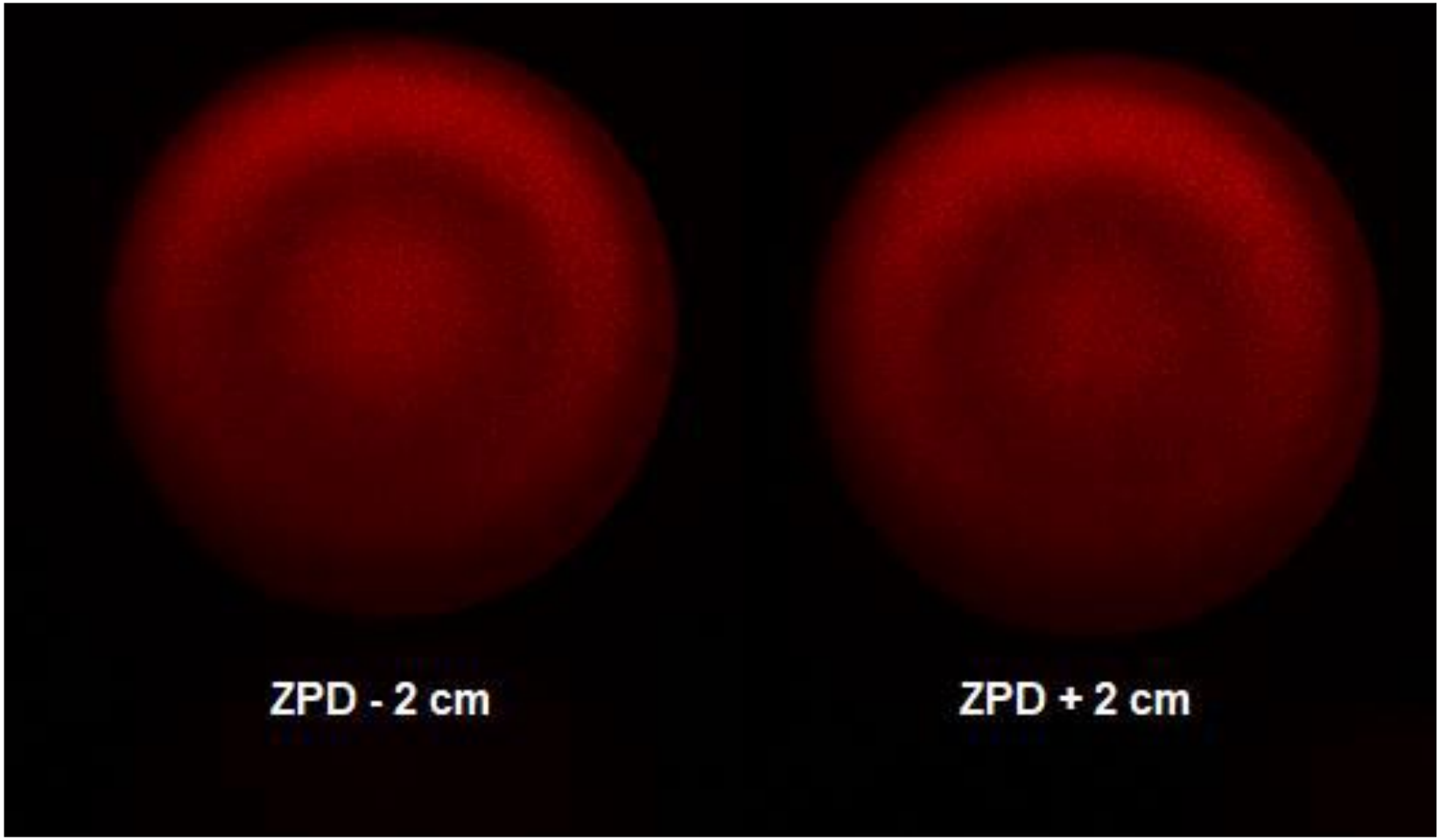
- Adjust the fixed corner cube to remove any apparent shift of the fringes through ZPD
- May need to iterate Step 2 and 3
- Use a large aperture to better see the shift through ZPD

Remove the panel between the source and interferometer compartments

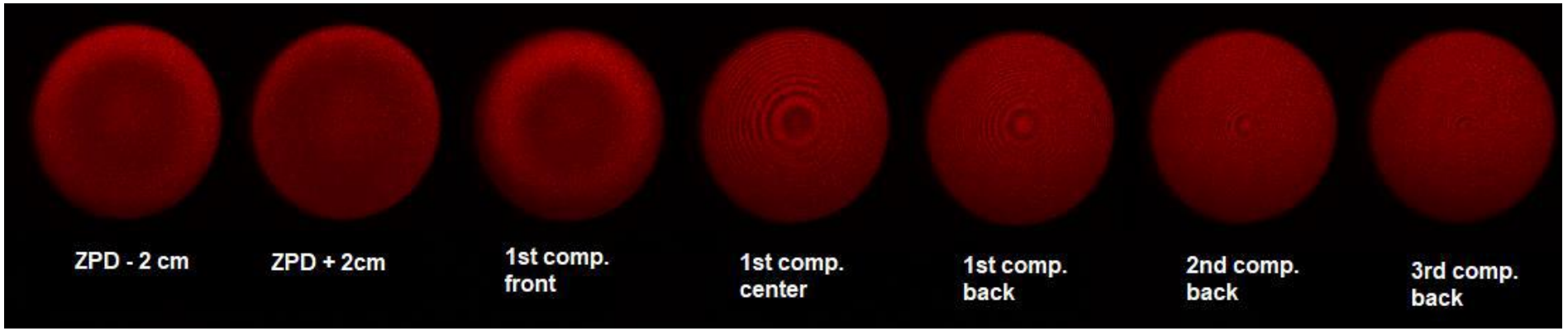
Unscrew all 4 screws behind the fixed corner cube by ~ half a turn



After the fixed corner cube adjustment

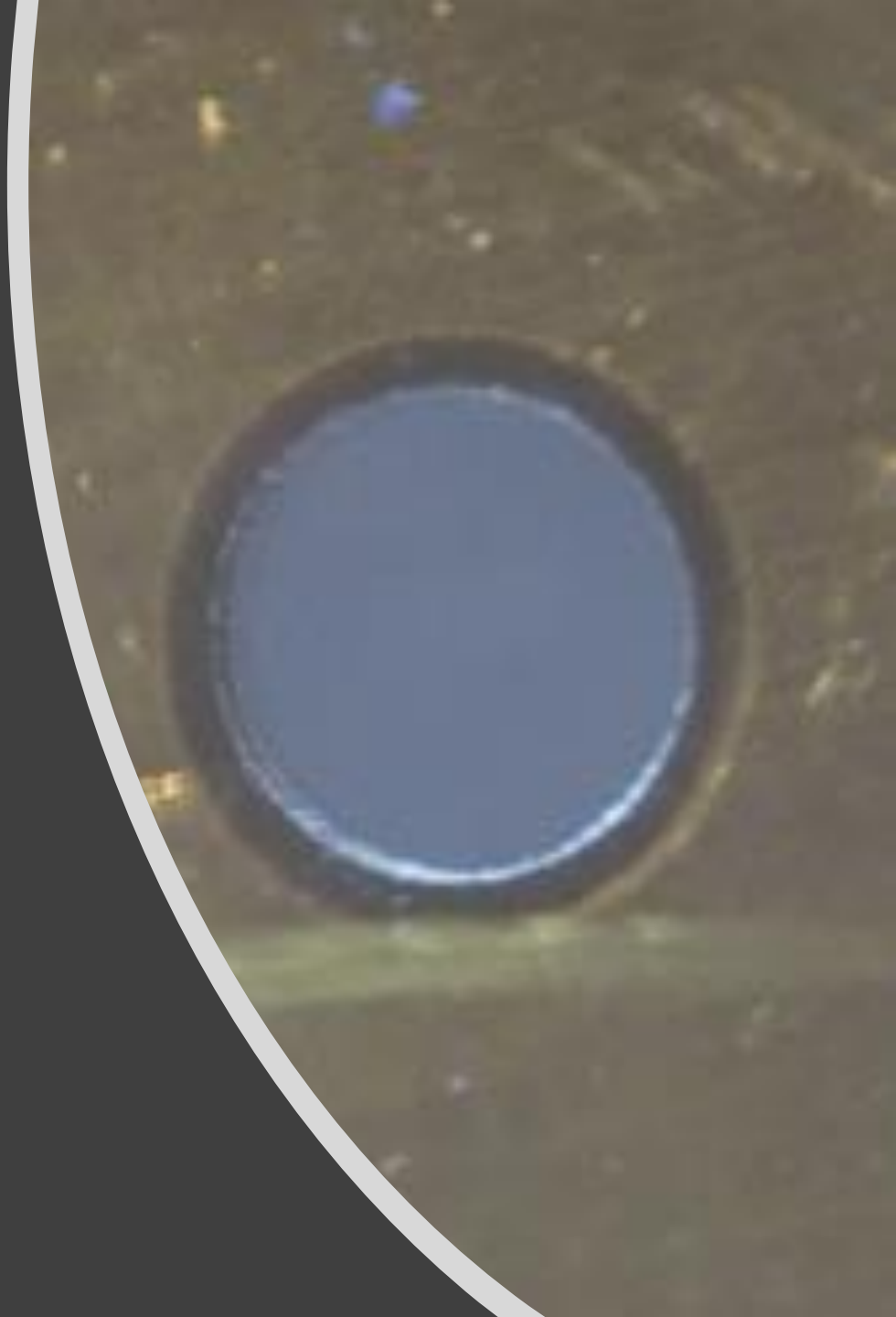


After 4th and 5th adjustment, 4 mm and 1 mm apertures



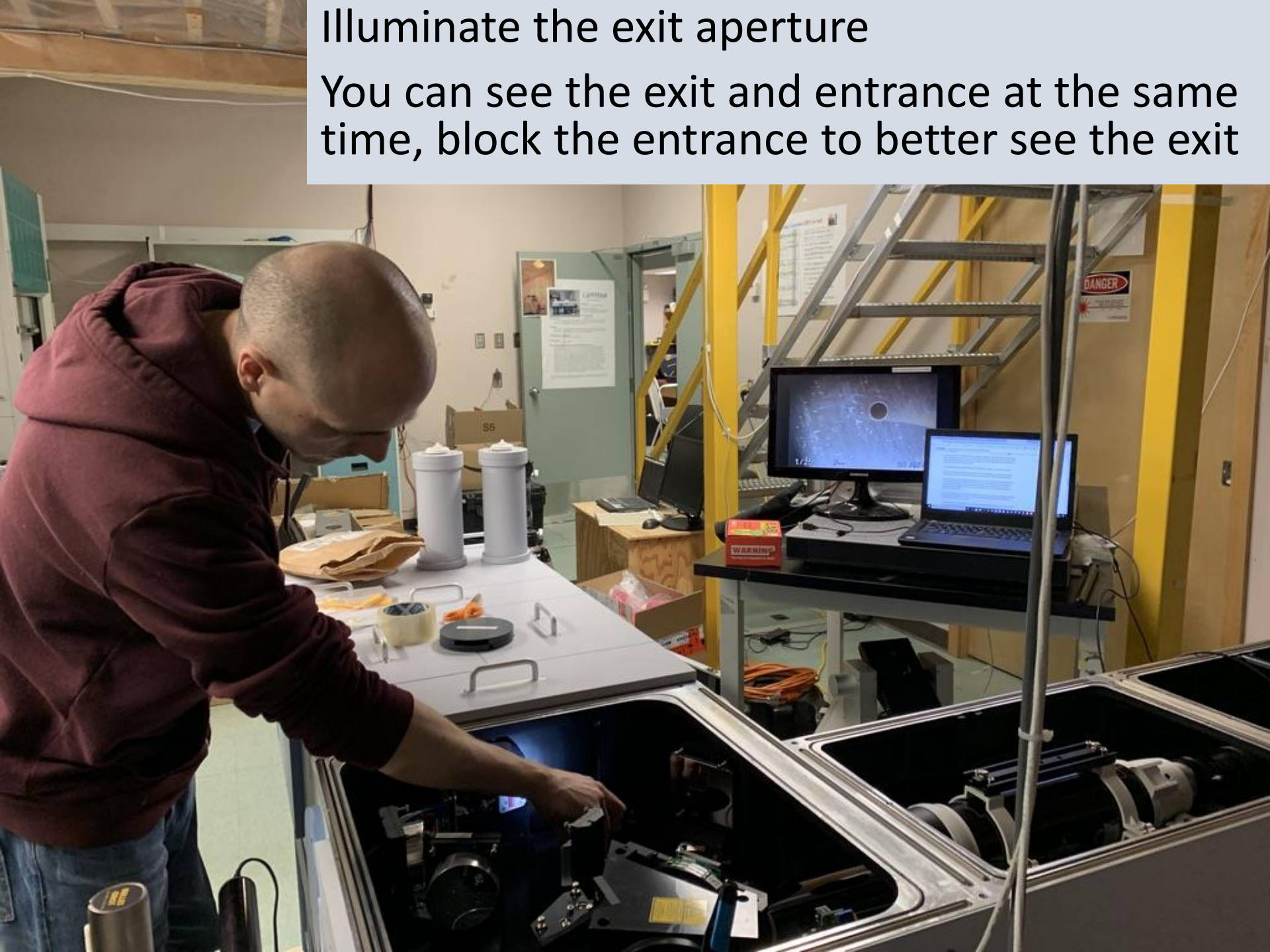
Step 4

- Place telescope in the long arm like in Step 1
- View the exit aperture and adjust focus if necessary
- Co-align the exit aperture



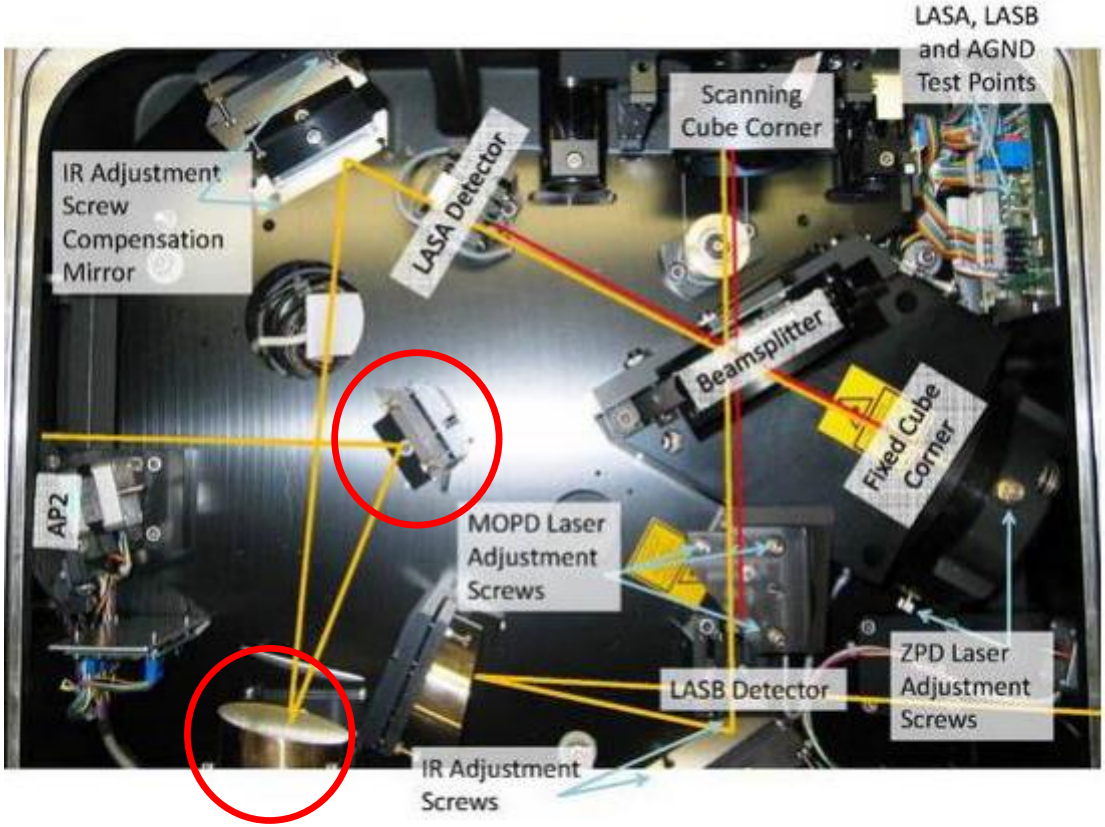
Illuminate the exit aperture

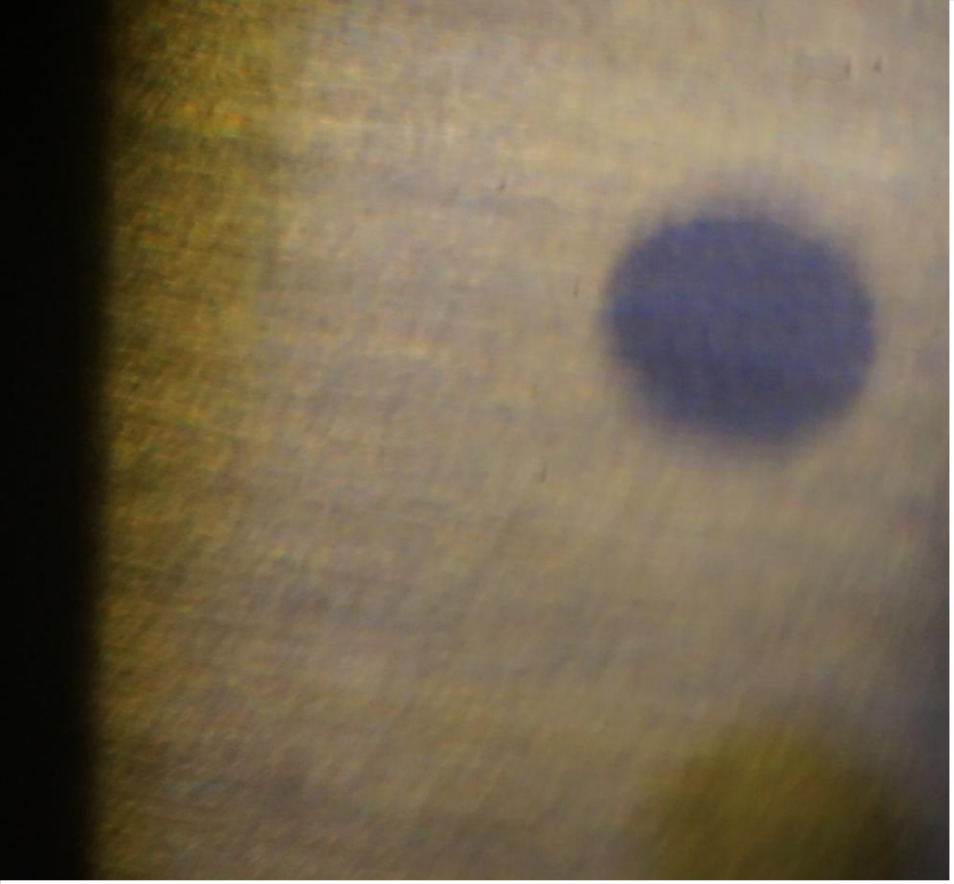
You can see the exit and entrance at the same time, block the entrance to better see the exit

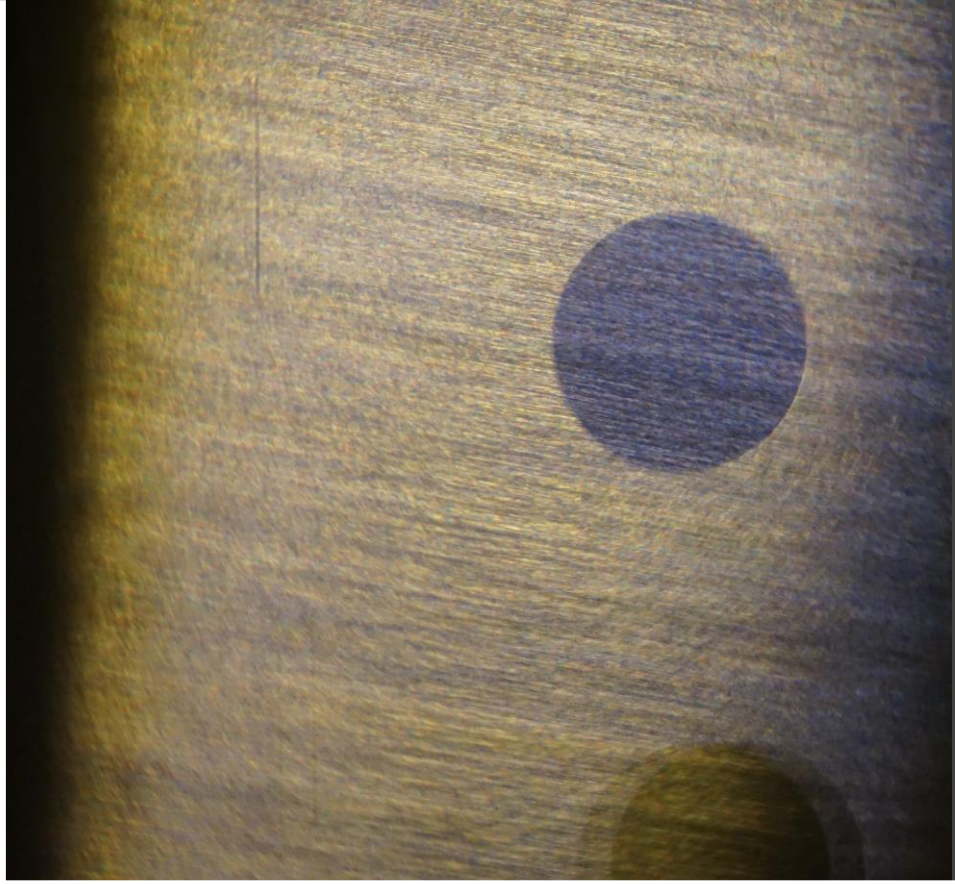


Focus adjustment

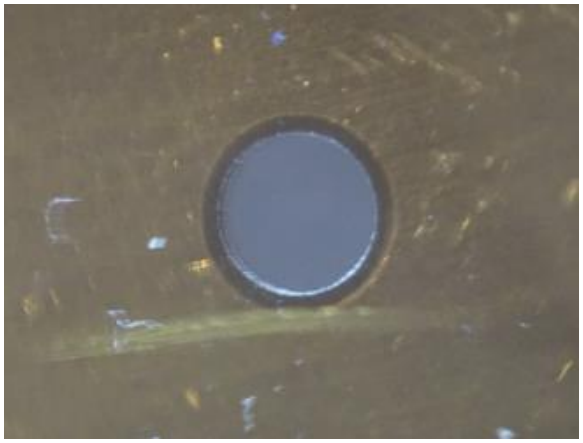
- The focus was ~5 mm in front of the exit aperture
- We adjusted the OAP and flat mirror (circled in red) to put the exit aperture in focus

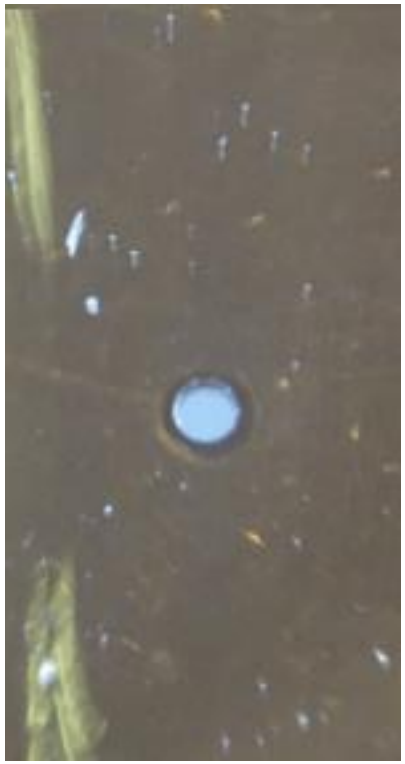


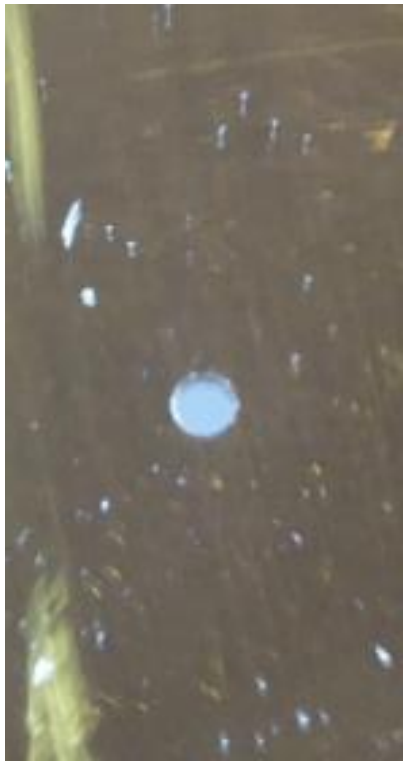




Exit aperture before and after the focus adjustment







After adjusting the flat mirror to co-align the exit with the entrance aperture

Left: 2 mm entrance aperture and 2.5 mm exit aperture
Center: 0.5 mm entrance and 0.7 mm exit aperture
Right: 0.5 mm entrance and 0.5 mm exit aperture

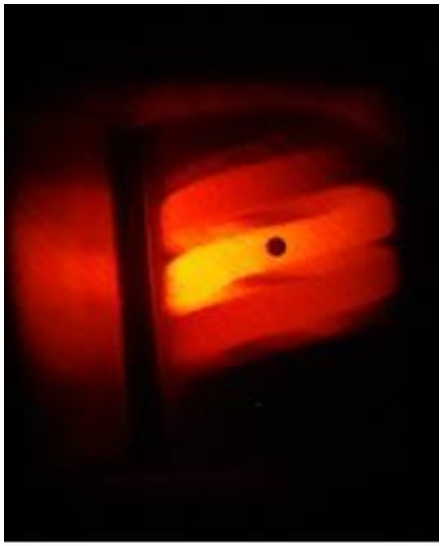
Step 5

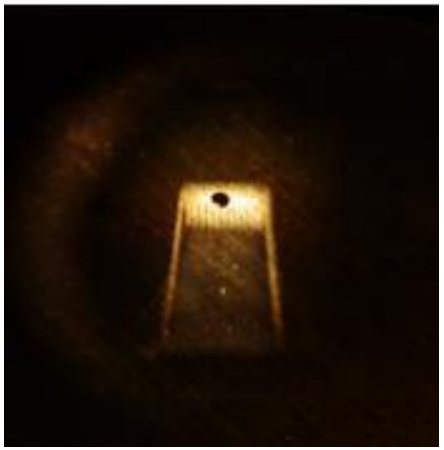
- Check the laser passes through the exit and entrance aperture
- Check laser signals

CaF2	**Zero (V)**	**Max (V)**		**Min (V)**		**ME**	
		ZPD	MPD	ZPD	MPD	MPD	ZPD
LASA	-9.250	-2.400	-2.900	-9.000	-8.700	0.841	0.930
LASB	-9.250	-3.700	-4.200	-9.200	-9.000	0.906	0.982
KBr	Zero (V)	Max (V)		Min (V)		ME	
		ZPD	MPD	ZPD	MPD	MPD	ZPD
LASA	-9.230	2.1	1.6	-7	-7.3	0.697	0.671
LASB	-9.240	-1.7	-2.1	-8.15	-7.9	0.684	0.747

Step 6

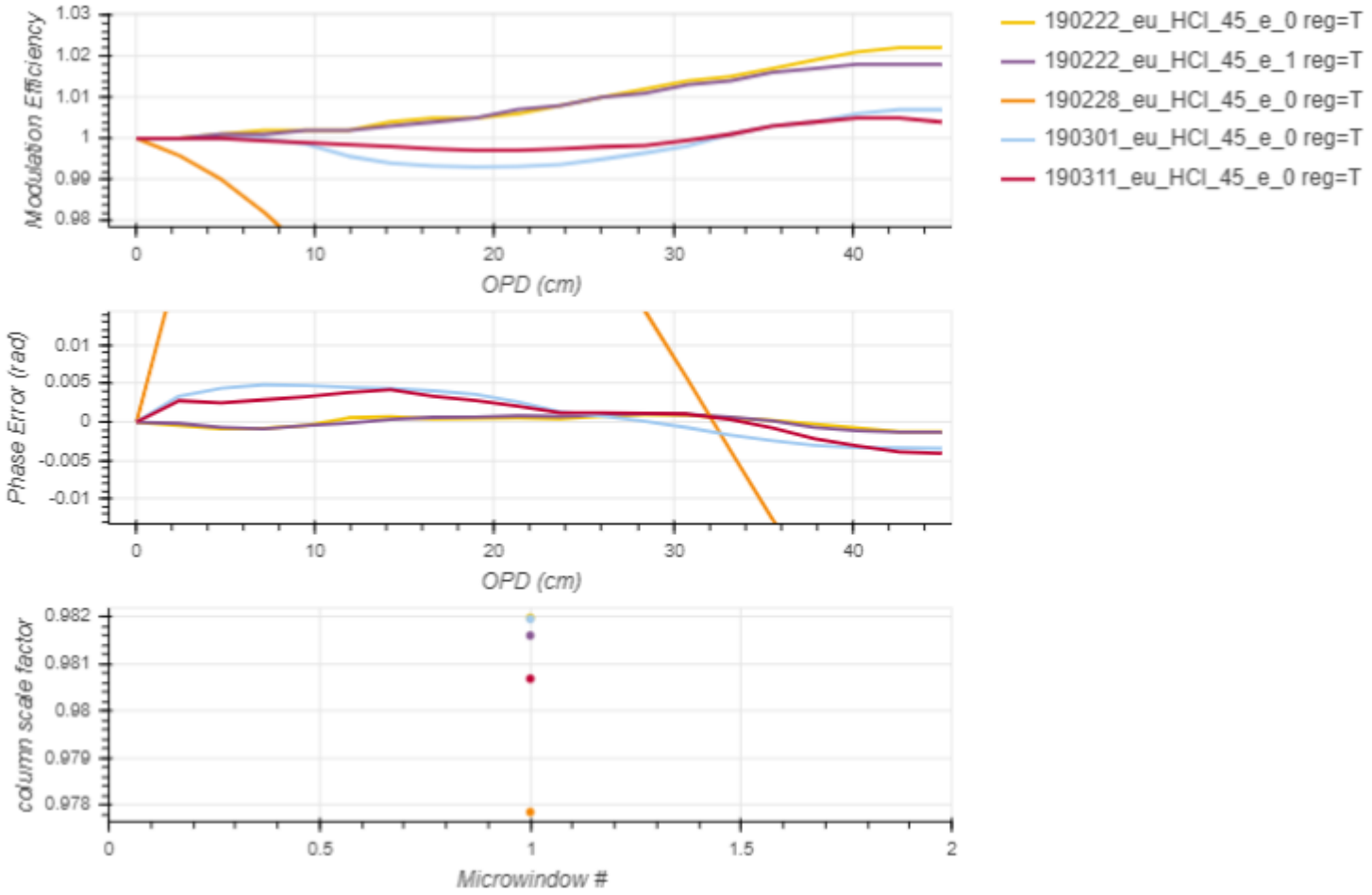
- Adjust the sliding spherical mirror in the source compartment to focus and center the image of the sources on the entrance aperture
- The MIR source looks like a spiral with the aperture center on an arm
- The NIR source looks like dark and bright stripes





HCl cell tests

Linefit 14.7
TCCON mode



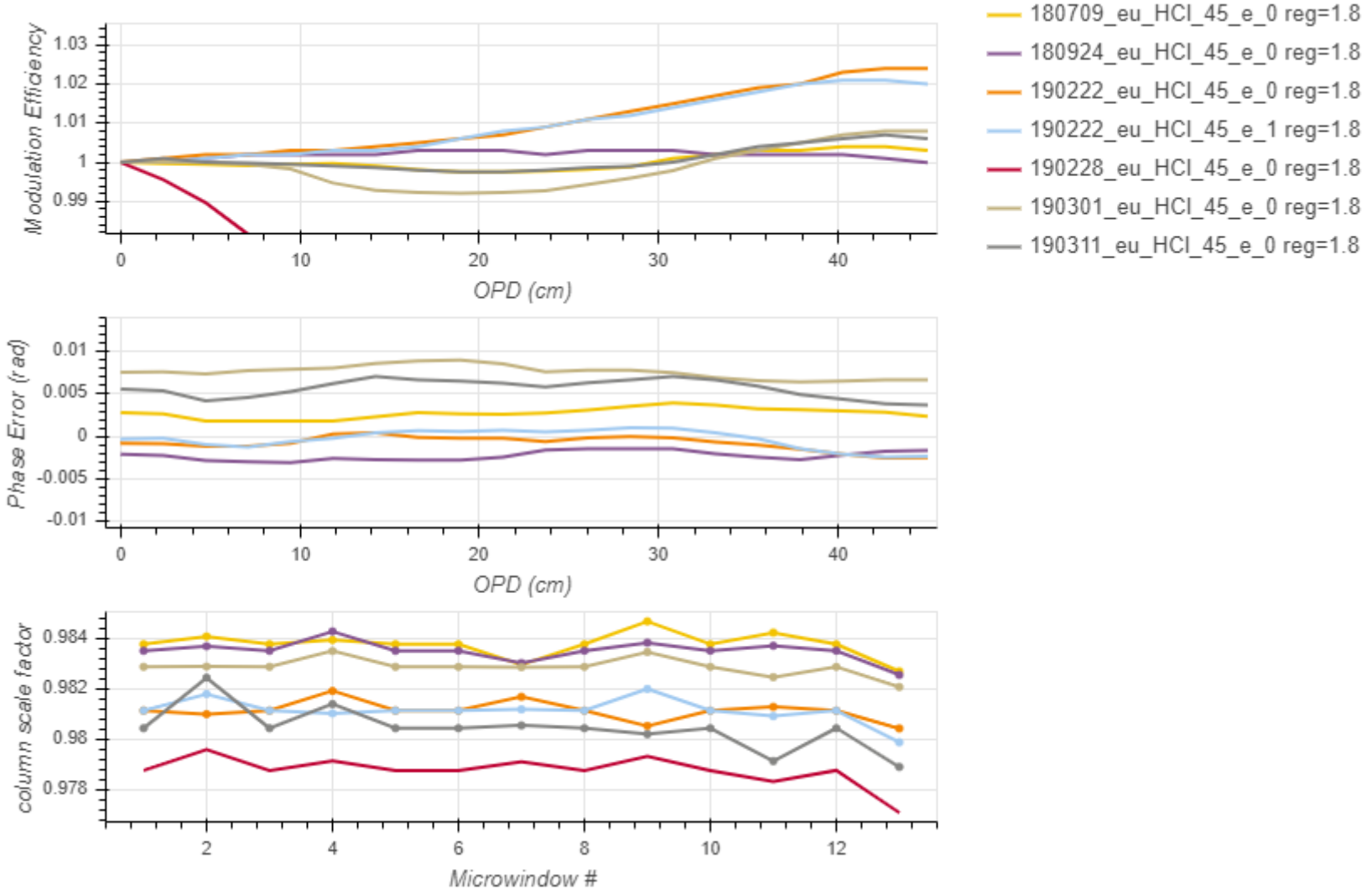
All with 1mm aperture

190228 : after installing the new wheels, gets down to 0.75 ME at MOPD

190301 : after the alignment

190311 : after the adjustment to the source mirror

HCl cell tests
Linefit 14.5



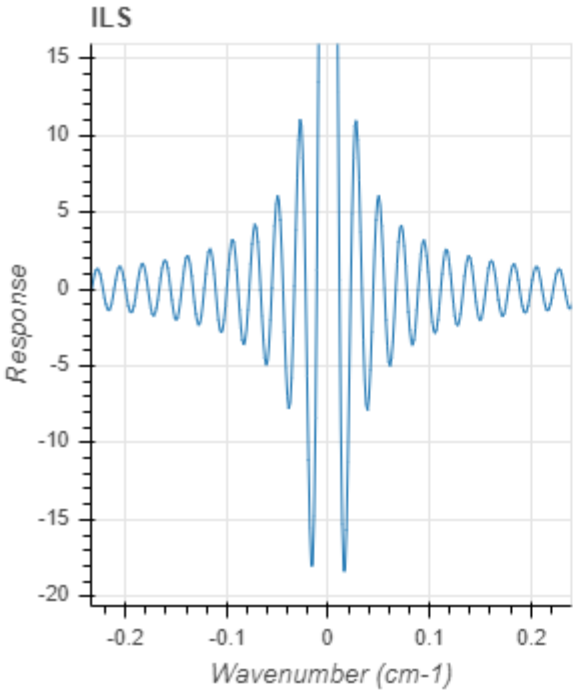
All with 1mm aperture

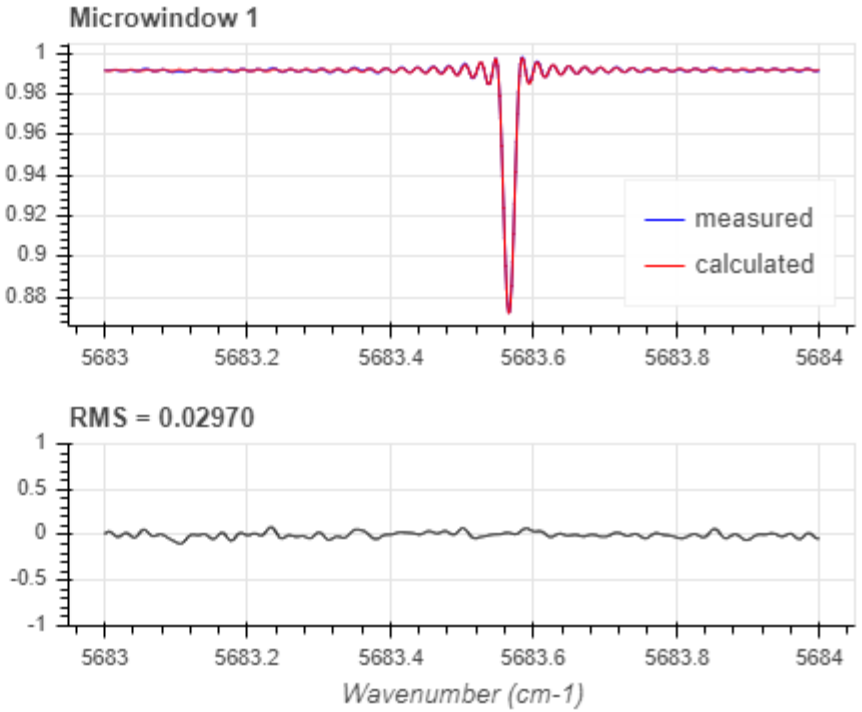
190228 : after installing the new wheels, gets down to 0.75 ME at MOPD

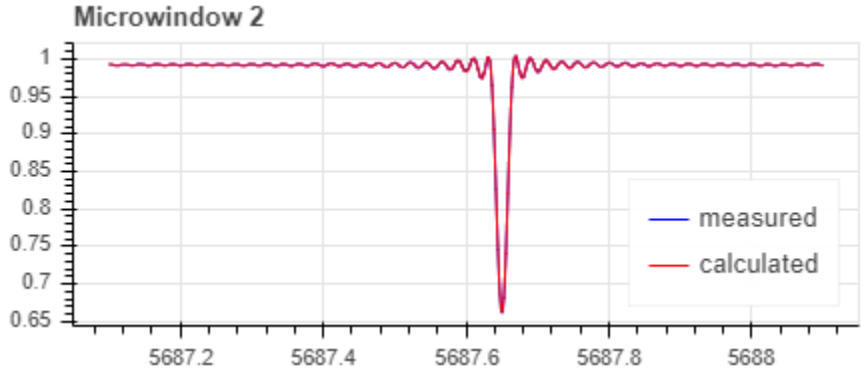
190301 : after the alignment

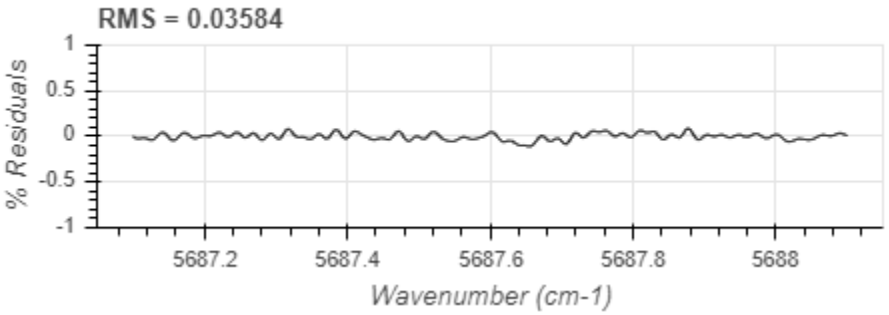
190311 : after the adjustment to the source mirror

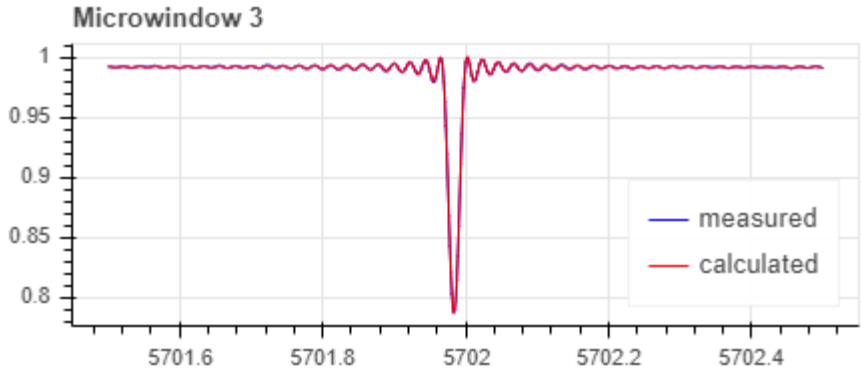
ILS and fits for the last HCl test

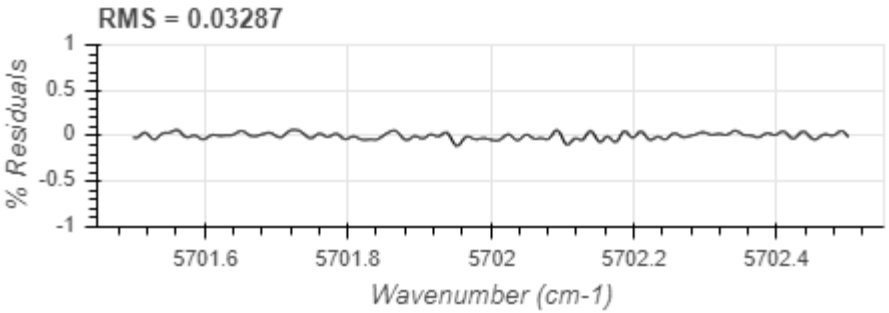


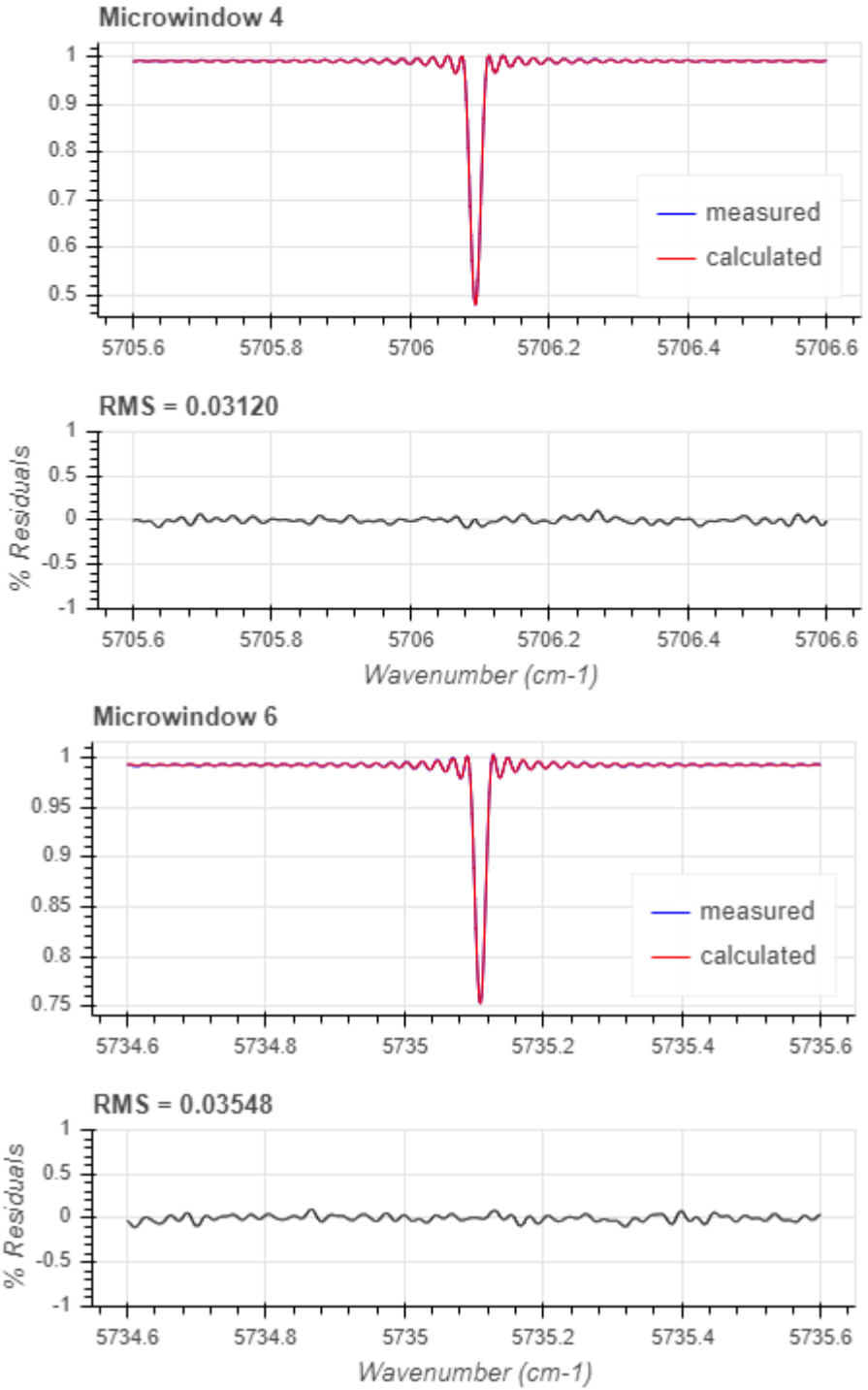


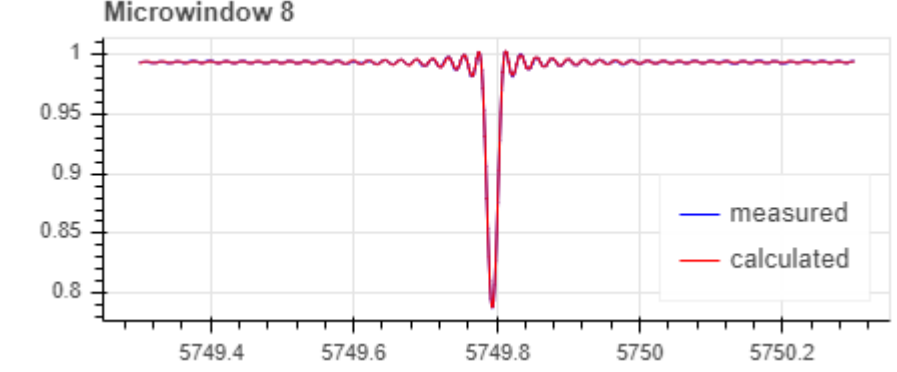


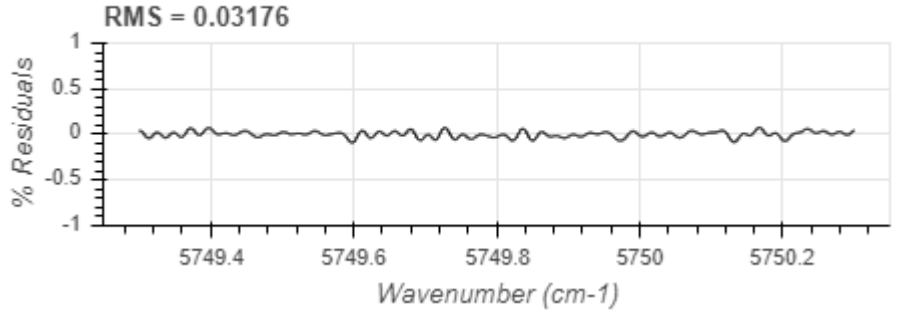


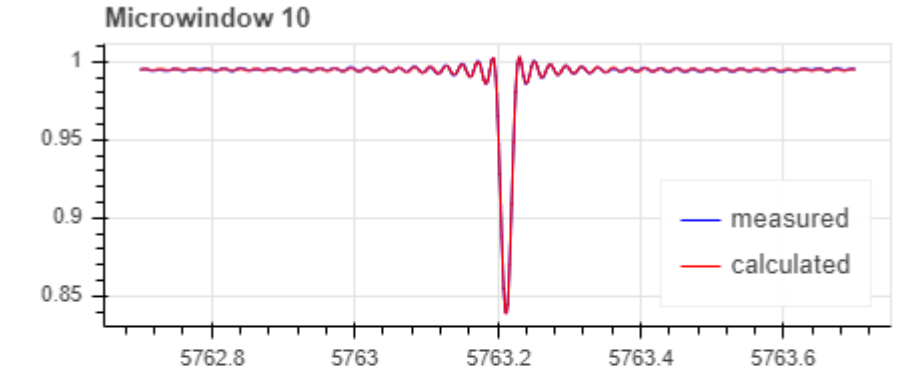


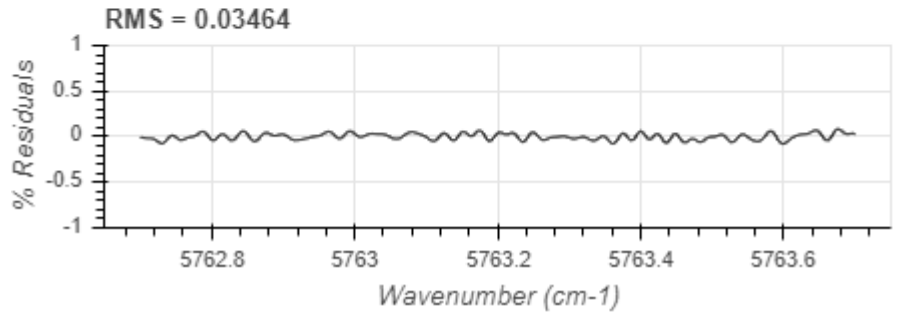



Microwindow 4
measured
calculated
RMS = 0.03120
% Residuals
Wavenumber (cm-1)
Microwindow 5
measured
calculated
RMS = 0.03084
% Residuals
Wavenumber (cm-1)
Microwindow 6
measured
calculated
RMS = 0.03548
% Residuals
Wavenumber (cm-1)
Microwindow 7
measured
calculated
RMS = 0.03432
% Residuals
Wavenumber (cm-1)

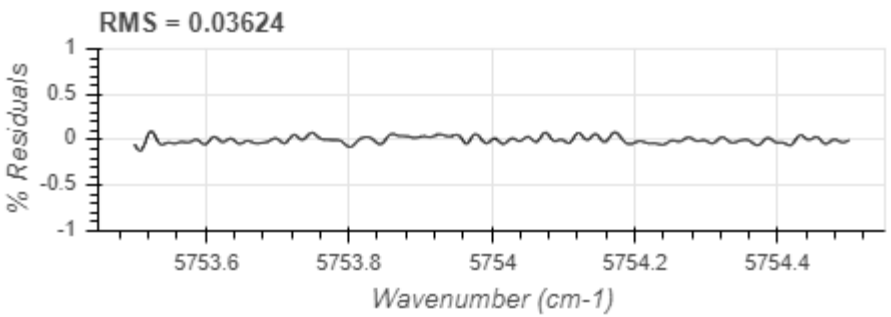

Microwindow 8
measured
calculated

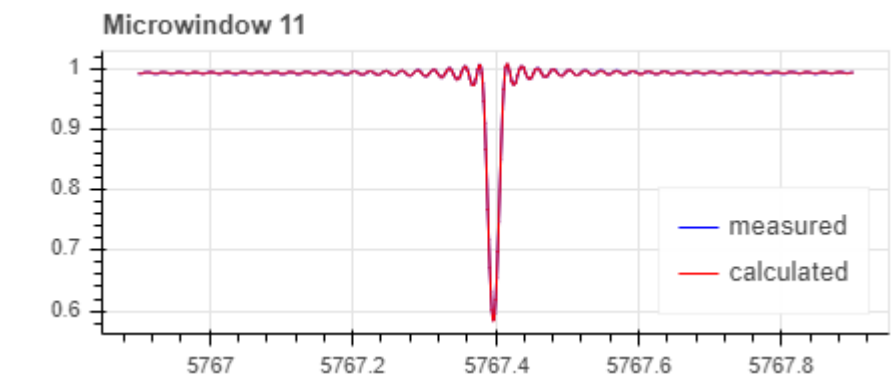

RMS = 0.03176
% Residuals

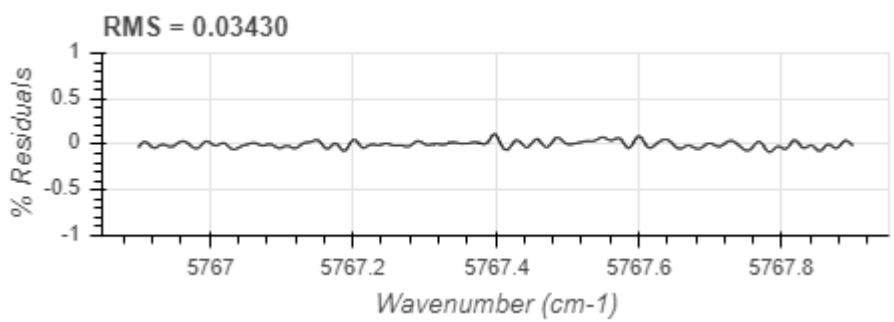

Microwindow 10
measured
calculated

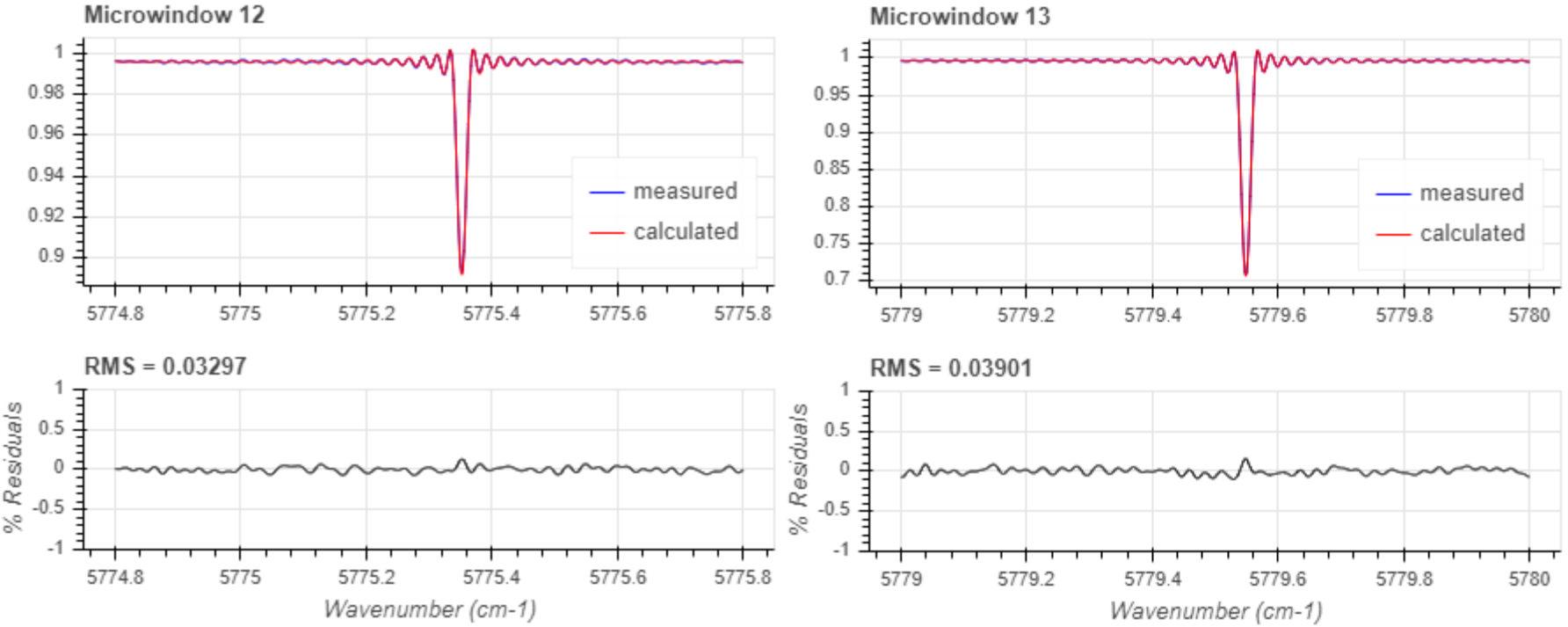

RMS = 0.03464
% Residuals
Wavenumber (cm-1)


Microwindow 9
measured
calculated

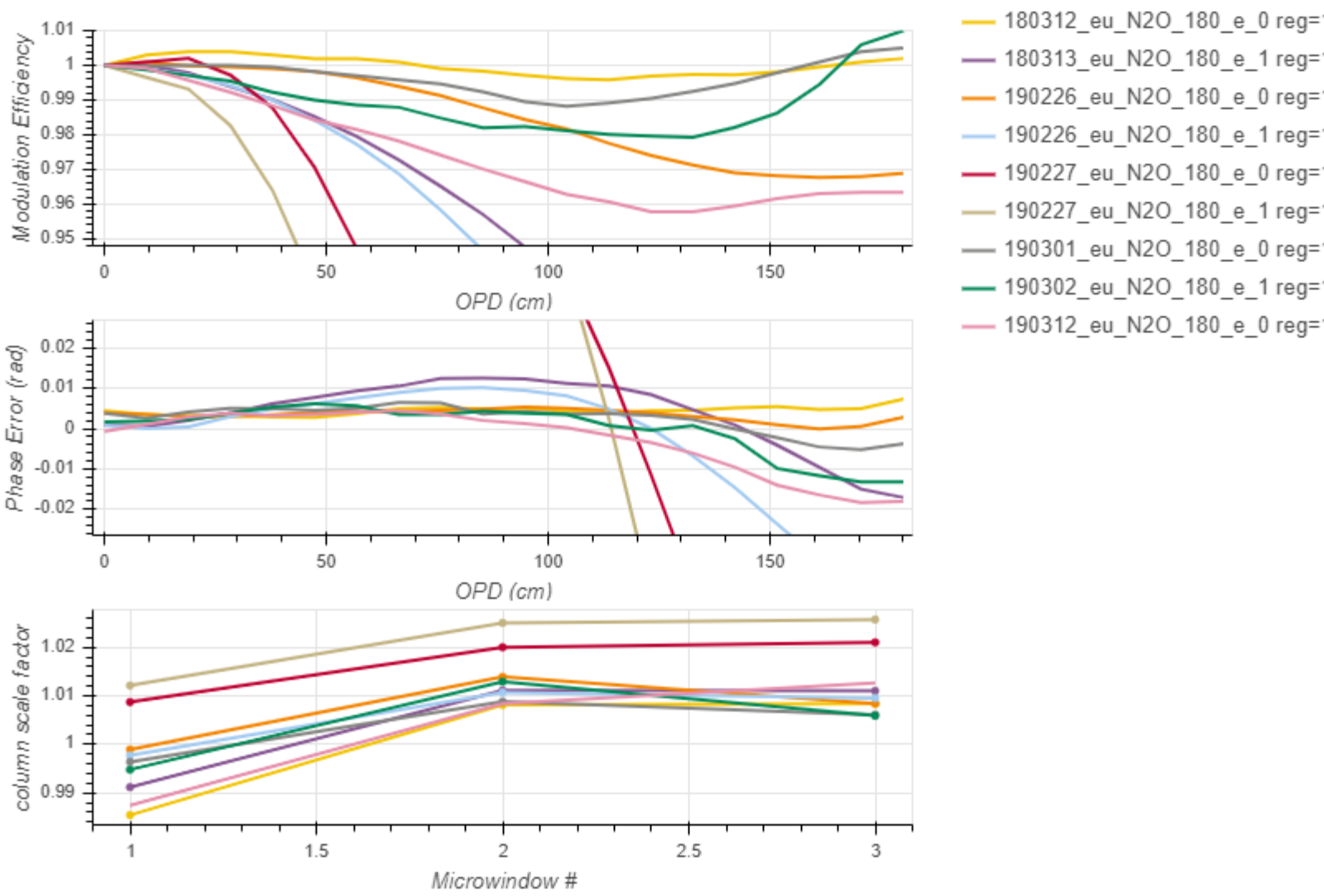

RMS = 0.03624
% Residuals
Wavenumber (cm-1)


Microwindow 11
measured
calculated


RMS = 0.03430
% Residuals
Wavenumber (cm-1)

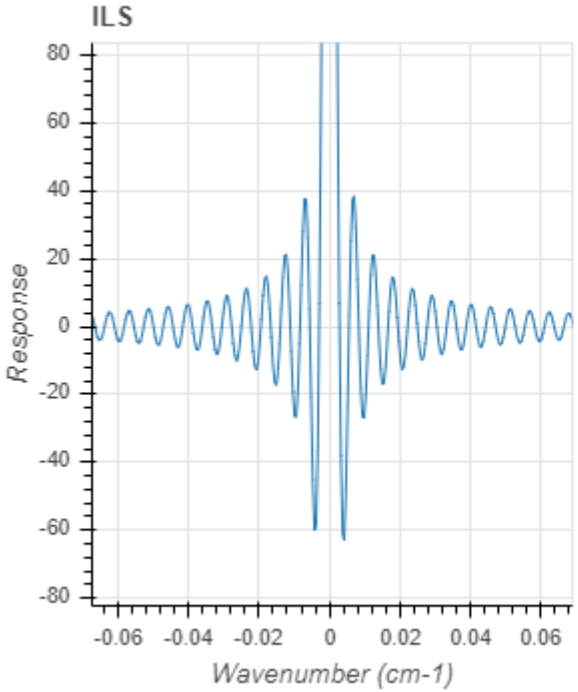

Microwindow 12
measured
calculated
RMS = 0.03297
% Residuals
Wavenumber (cm-1)
Microwindow 13
measured
calculated
RMS = 0.03901
% Residuals
Wavenumber (cm-1)

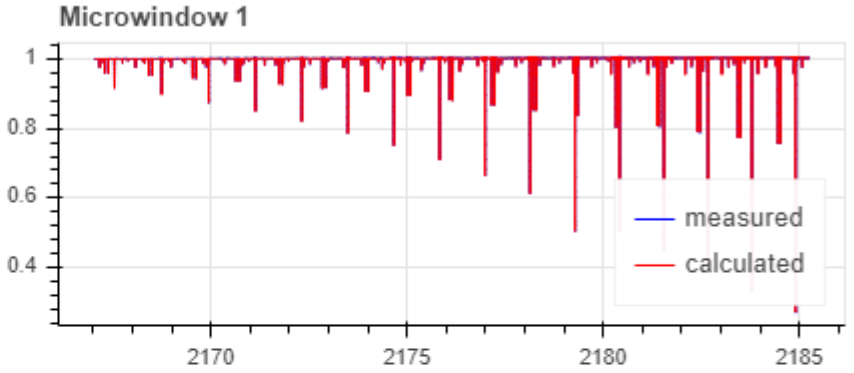
N_2O cell tests

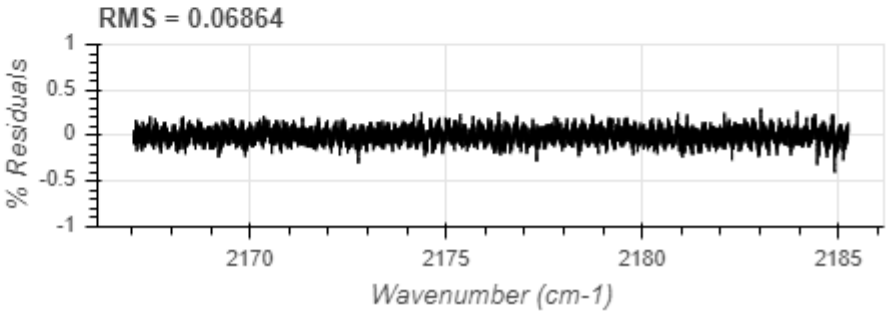


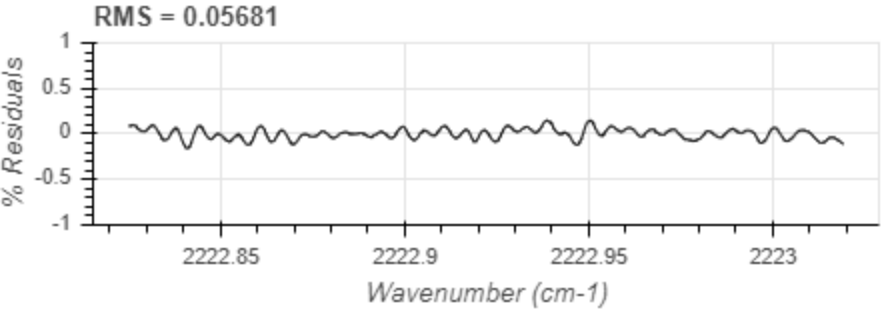
180312 and **190226** : 1 mm aperture and old wheels
180313 and **190226** : 1.15 mm aperture and old wheels, down to ~0.88 and ~0.83 respectively
190227 : 1mm aperture and new wheels, down to ~0.5 ME.
190227 : 1.15 mm aperture and new wheels., down to ~0.4 ME
190301 : 1.15 mm after the alignment, close to 1 ME
190302 : 1mm after the alignment, also close to 1.
190312 : 1 mm after the source mirror adjustment, ~0.96 ME at MOPD with better fits than previous tests.

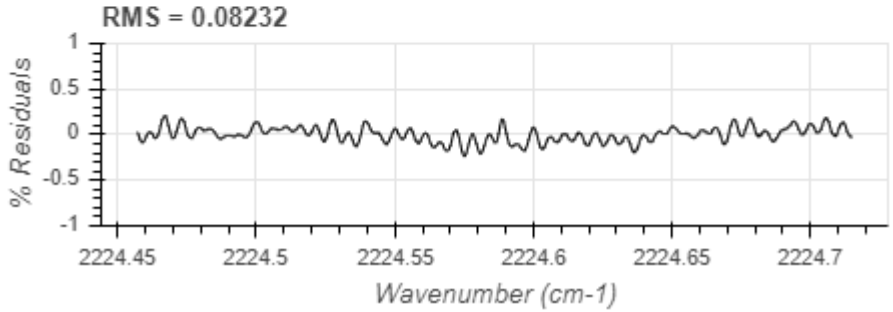
ILS and fits for the last N_2O test



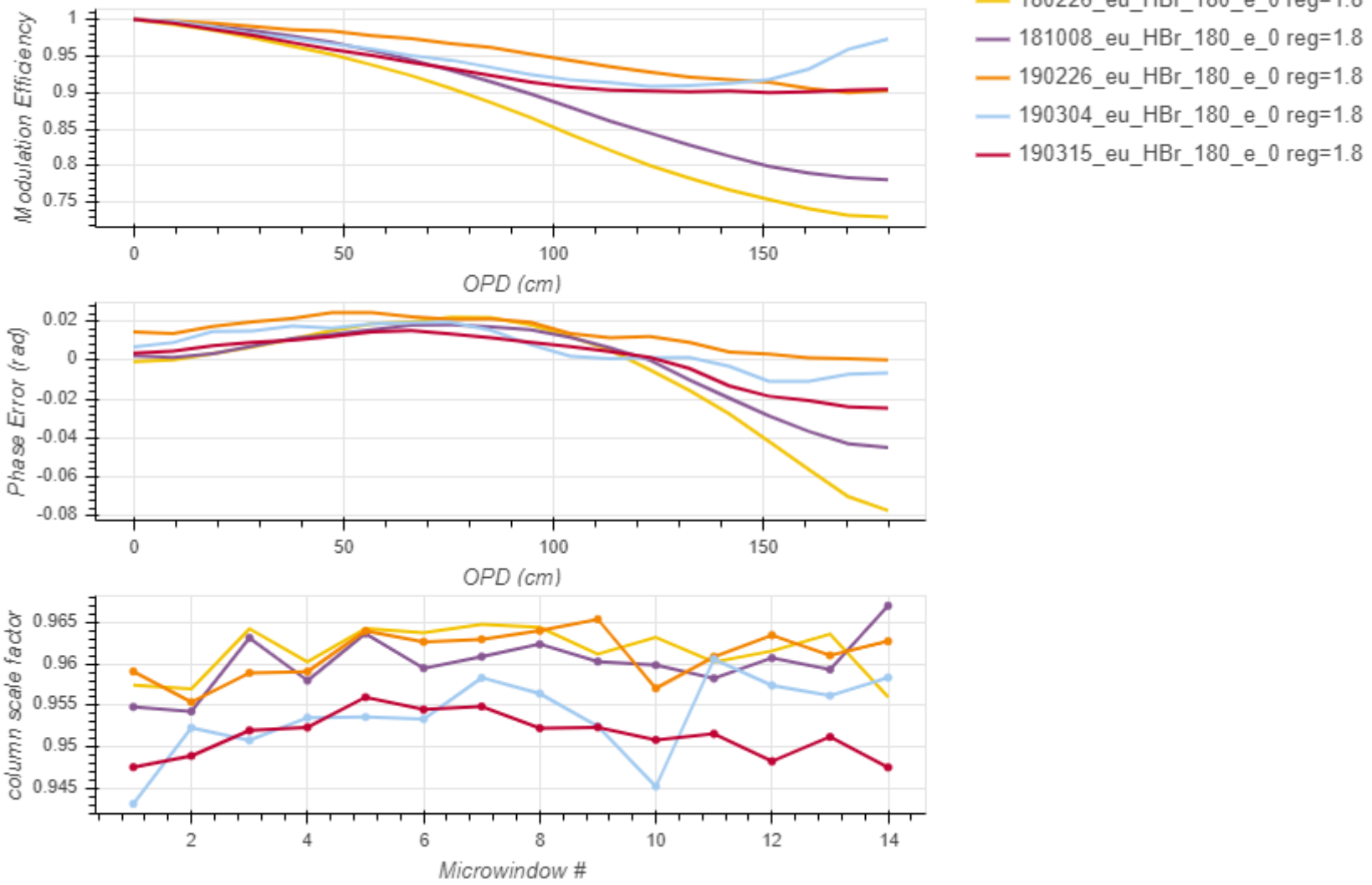








HBr cell tests



All with 1.15 mm aperture except **190226** with 1 mm aperture

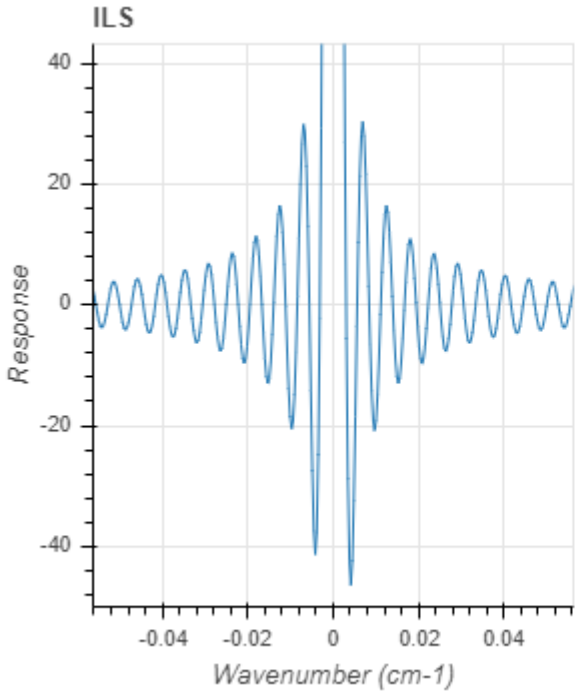
180226 and **181008**: old wheels

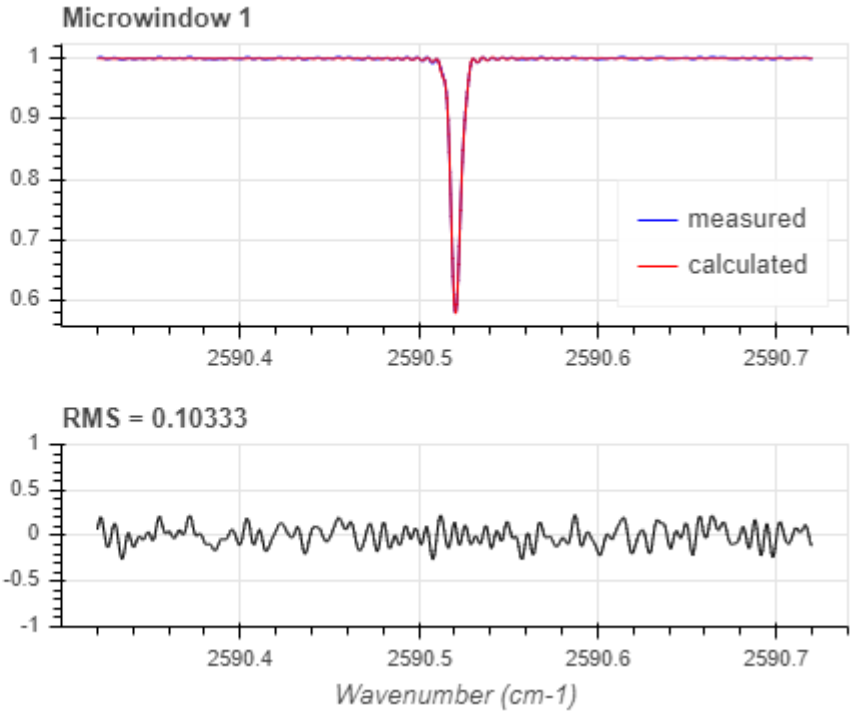
190226 : before the alignment and before installing the wheels

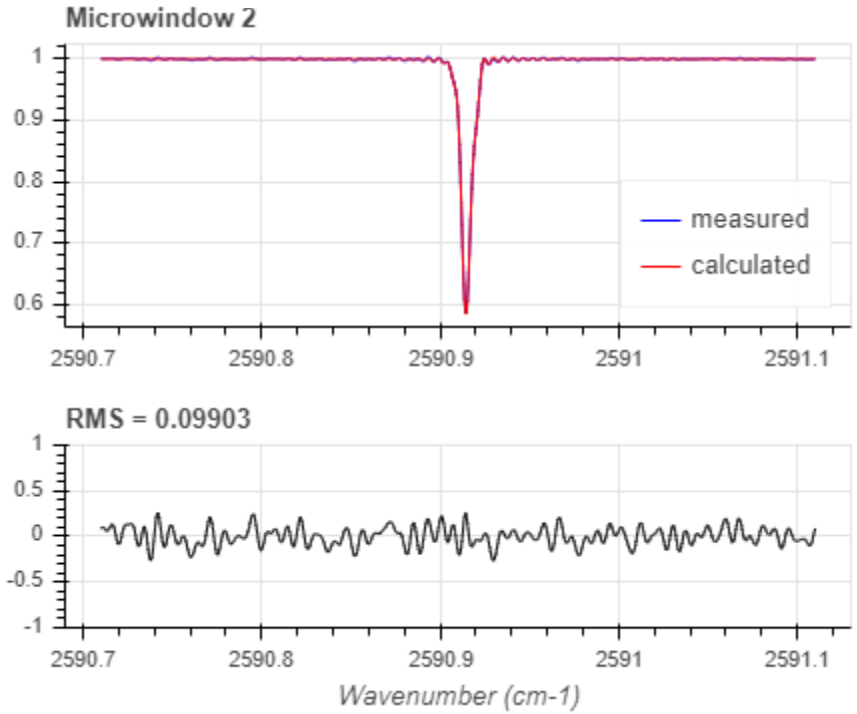
190304 : after the alignment

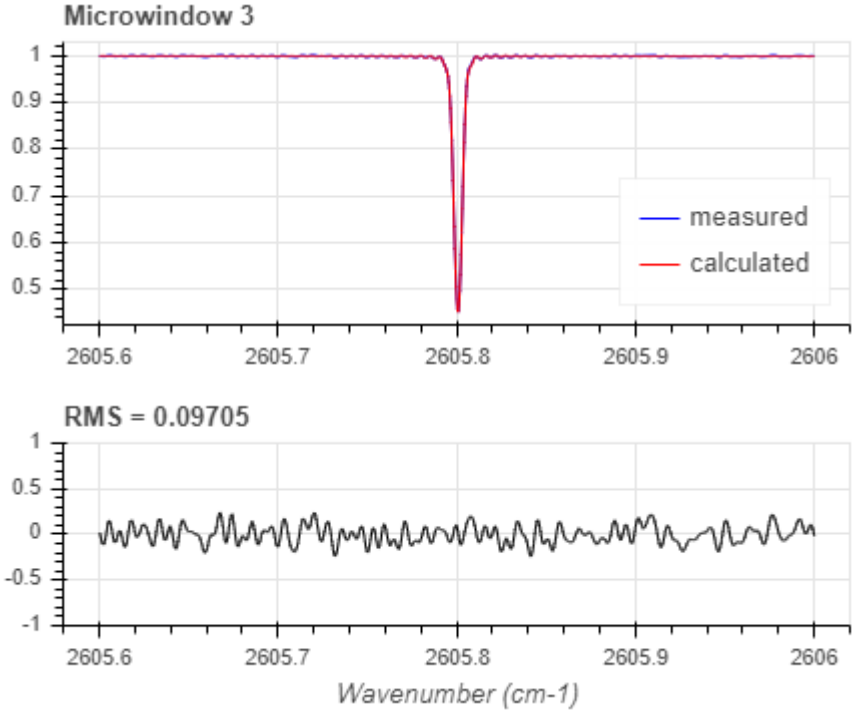
190315 : after the adjustment to the source mirror, fits are better than previous tests

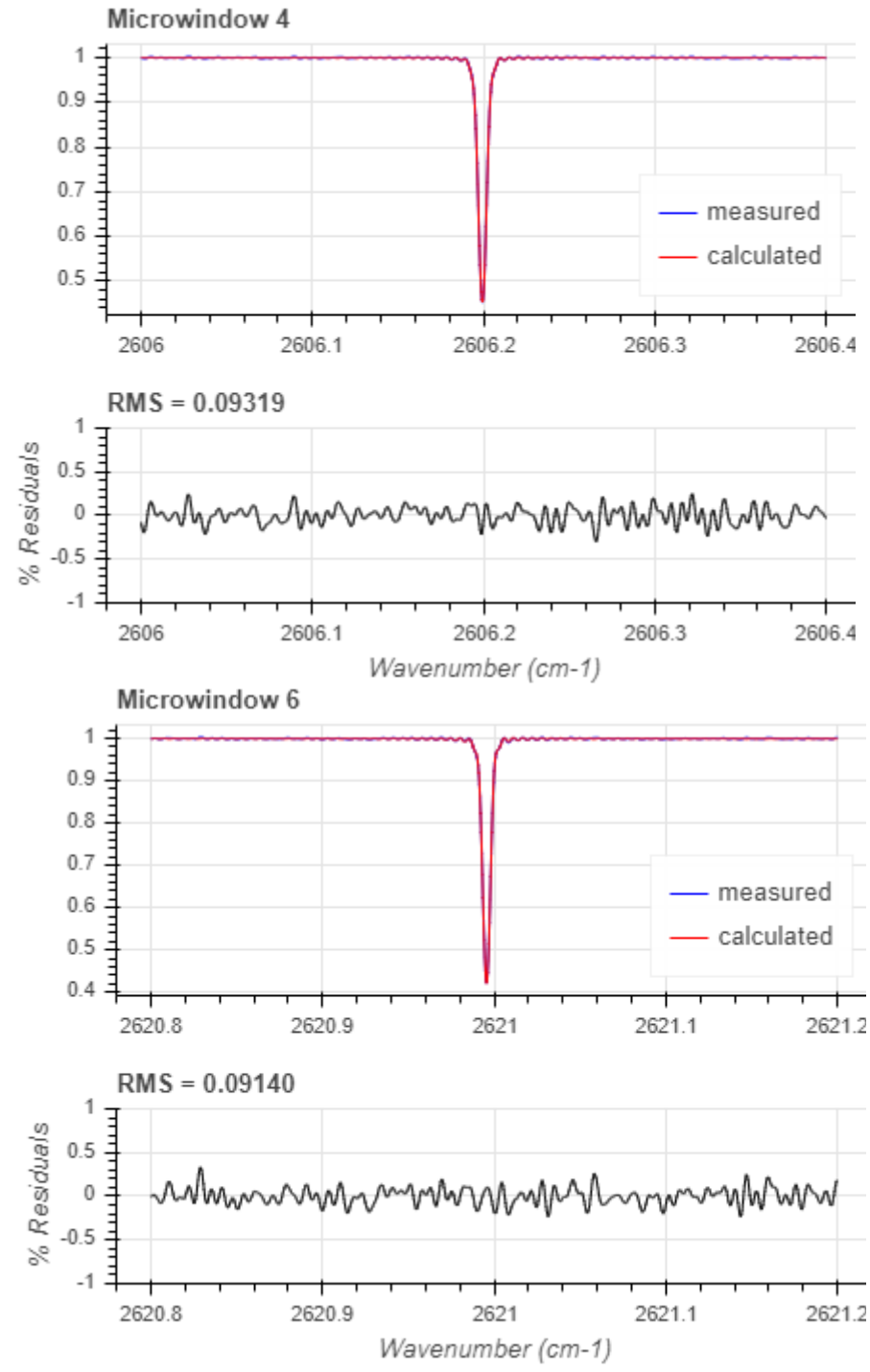
ILS and fits for the last HBr test

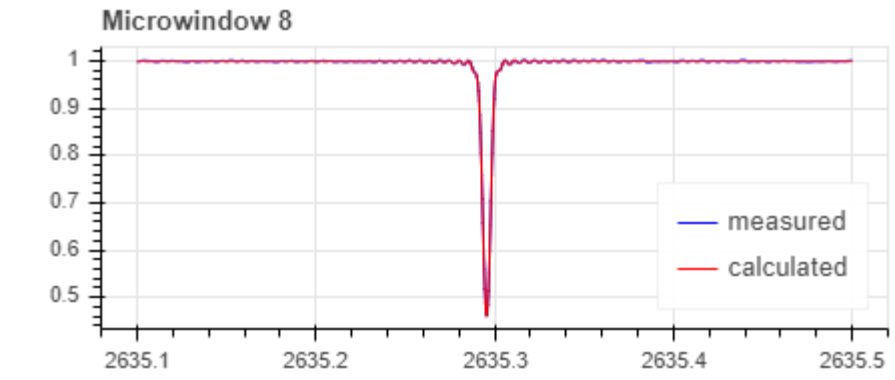


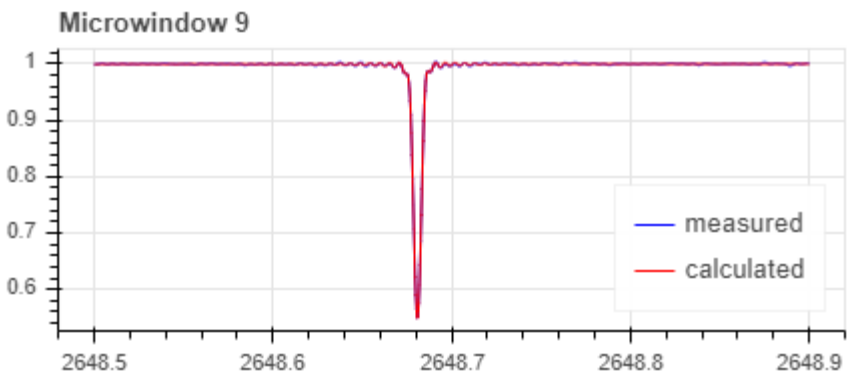


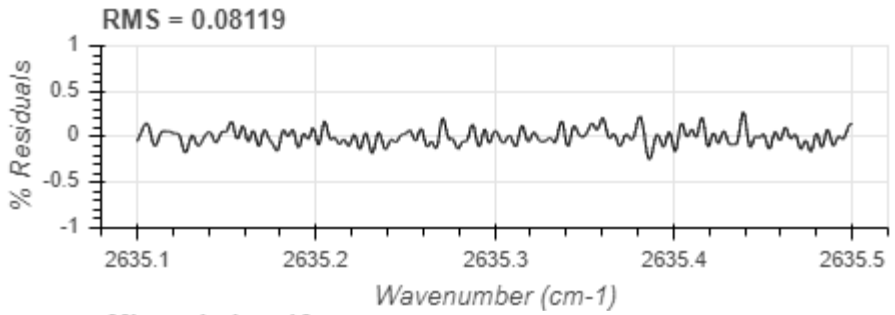


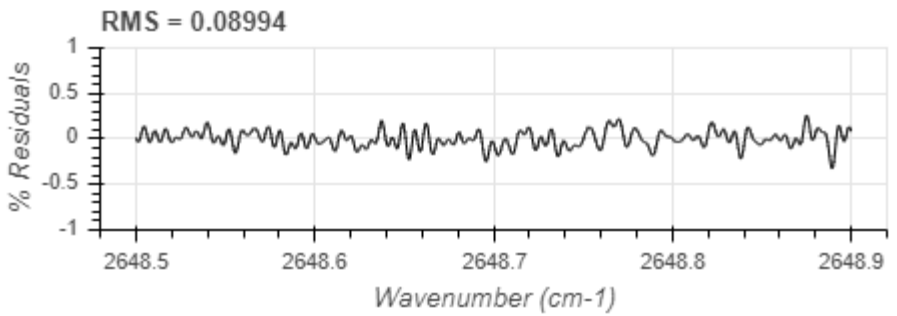


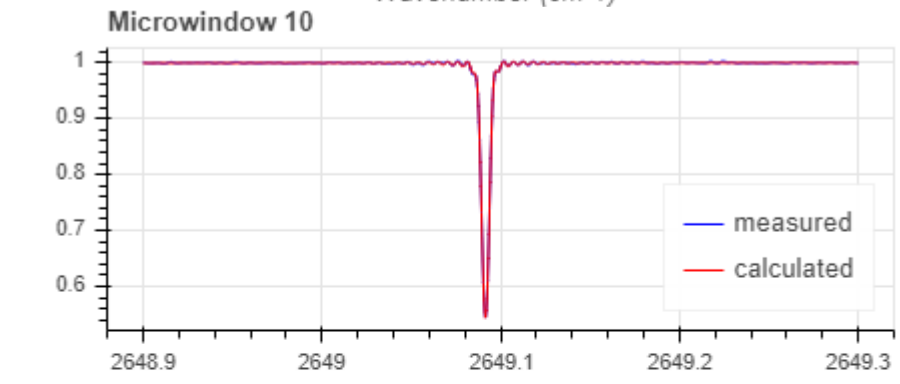

Microwindow 4
measured
calculated
RMS = 0.09319
% Residuals
Wavenumber (cm-1)
Microwindow 5
measured
calculated
RMS = 0.09281
% Residuals
Wavenumber (cm-1)
Microwindow 6
measured
calculated
RMS = 0.09140
% Residuals
Wavenumber (cm-1)
Microwindow 7
measured
calculated
RMS = 0.09068
% Residuals
Wavenumber (cm-1)

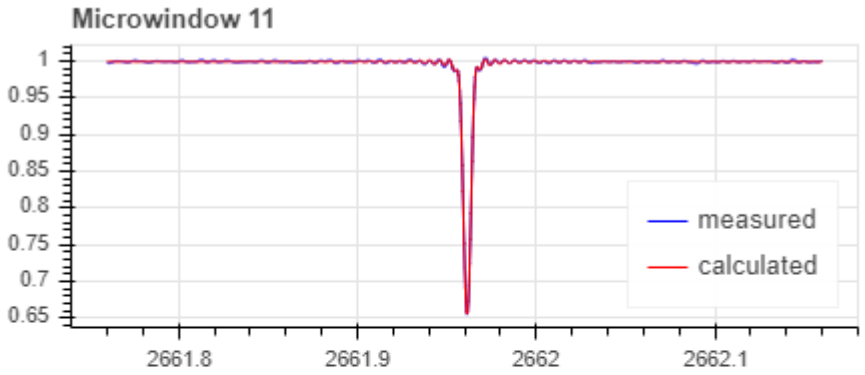

Microwindow 8
measured
calculated

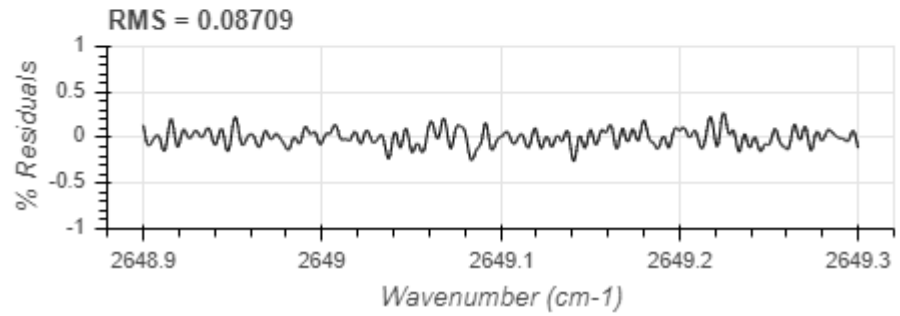

Microwindow 9
measured
calculated

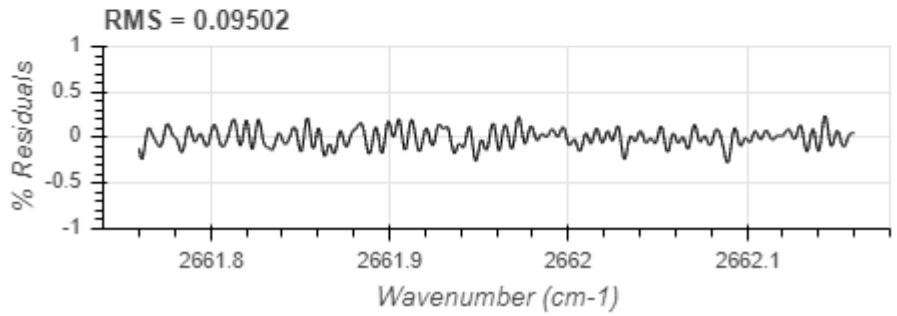

RMS = 0.08119
% Residuals
Wavenumber (cm-1)


RMS = 0.08994
% Residuals
Wavenumber (cm-1)

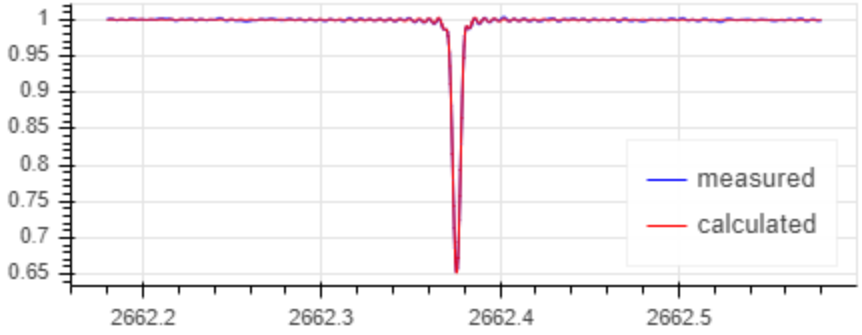

Microwindow 10
measured
calculated


Microwindow 11
measured
calculated

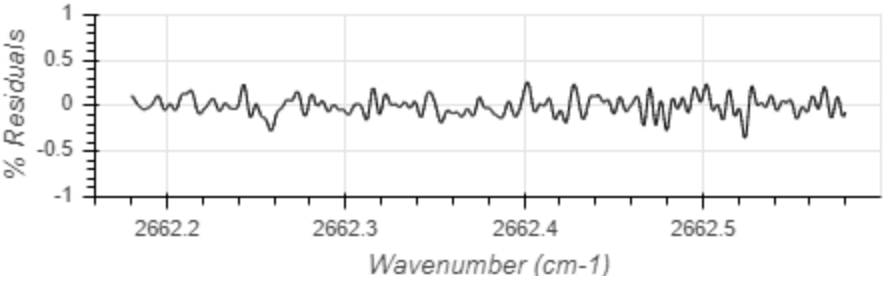

RMS = 0.08709
% Residuals
Wavenumber (cm-1)


RMS = 0.09502
% Residuals
Wavenumber (cm-1)

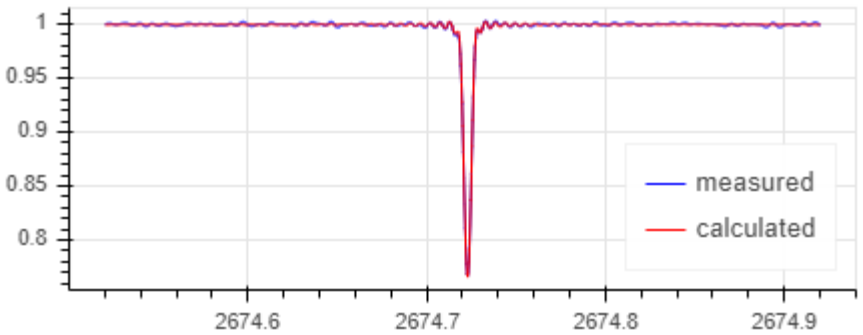
Microwindow 12



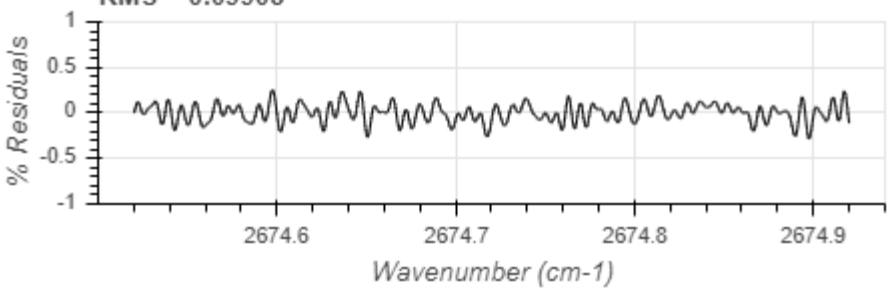
RMS = 0.09777



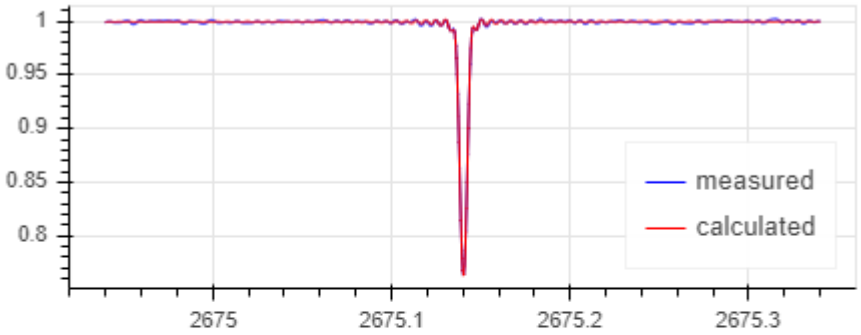
Microwindow 13



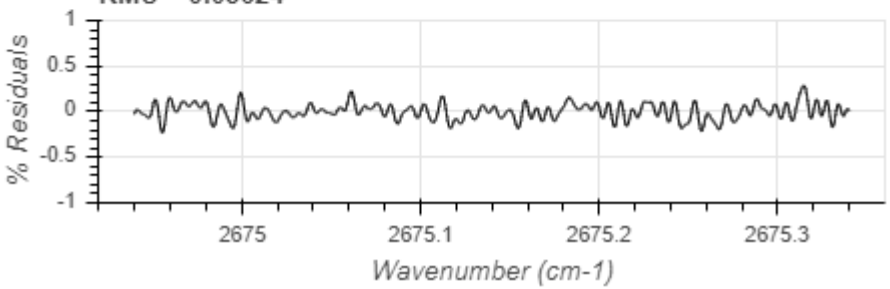
RMS = 0.09908



Microwindow 14



RMS = 0.08624



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(https://eureka.physics.utoronto.ca)

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