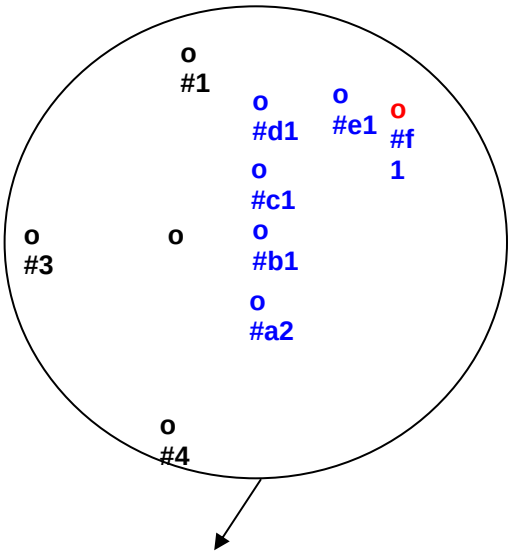
Absorption measurements on MMT4K04-1 before and after applying First Contact



Before

point #	Alpha [ppm]
1	1.05
2	0.983
3	0.9583
4	0.967

After

Point	Alpha
a2	1.00
b1	0.97
c1	0.97
d1	0.88
e1	0.84
f1	0.80

The **before** measurements were taken by Vlad, the **after** measurements were taken by Ashot.

9/20/06
Dear Helena,

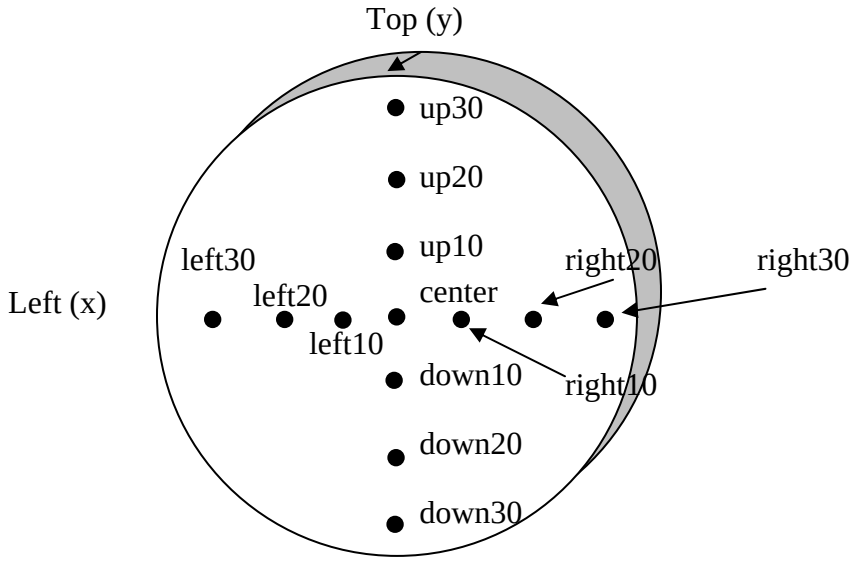
Please find attached the results on the MMT14K04-1 sample.
The average value, 1.15 ppm, turned out to be higher than the Vlad's one by about 15%. I guess this difference arises because of calibration.
I have some reasons to relay on my recent calibration rather than the Vlad's previous one. When you visit us, I will show you the reasons.
Tomorrow I am going to send back the sample.

Best,

Ashot.

MMT14K04-1

The "center" point is not a physical center. It is approximately coordinated in the (x,y)-plane with x and y = 35 mm both.
The "Top" has a an arrow mark. The arrow is directed to the coating.



Point #	(x,y) coordinates (mm) with respect to the center point	Point name	Alpha (ppm)
1	(0, 30)	Up 30	**1.19**
2	(0, 20)	Up 20	**1.18**
3	(0, 10)	Up 10	**1.24**
4	(0, 0)	Center (2 close points)	**1.22 (1.28)**
5	(0, -10)	Down 10	**1.23**
6	(0, -20)	Down 20	**1.26**
7	(0, -30)	Down 30	**1.22**
8	(-30, 0)	Right 30	**1.19**
9	(-20, 0)	Right 20	**1.13**
10	(-10, 0)	Right 10	**1.12**
11	(10, 0)	Left 10	**1.27**
12	(20, 0)	Left 20	**1.21**
13	(30, 0)	Left 30	**1.17**

The mirror was cover with First Contact for ~ 1 month and absorption was re-measured immediately after removing the film.

11/02/06
Hi, Helena.

The results of the measurements are attached.
After you left, the absorption started to increase rapidly and reached the previous value. Please look at the data. I am going to apply the "first contact" to the surface for a couple of weeks or 10 days and then record the time dependence.

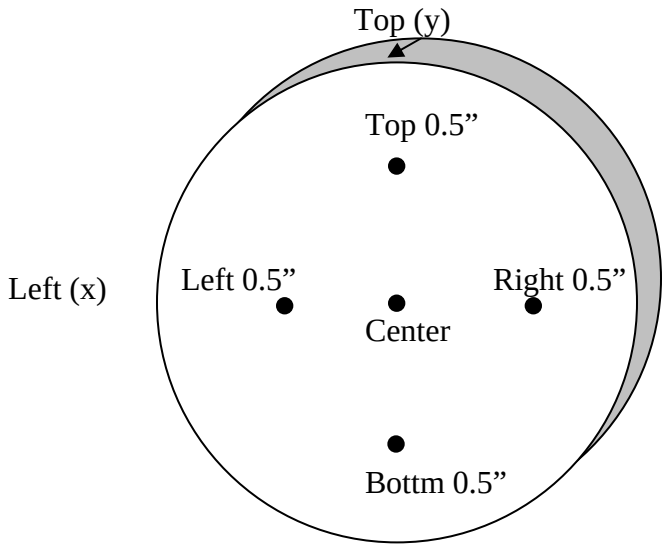
Ashot.

MMT14K04-1

The “center” point is not a physical center. It is coordinated approximately.
“Top” is marked by an arrow. The arrow is directed to the coating.

The absorption quickly increased after your departure, Helena, to the values I have measured a couple of months ago! Now, I am going, after your OK, to cover the optic by

a polymer film again, wait for a week or so, then record time-dependence of Alpha form one selected point immediately after opening.

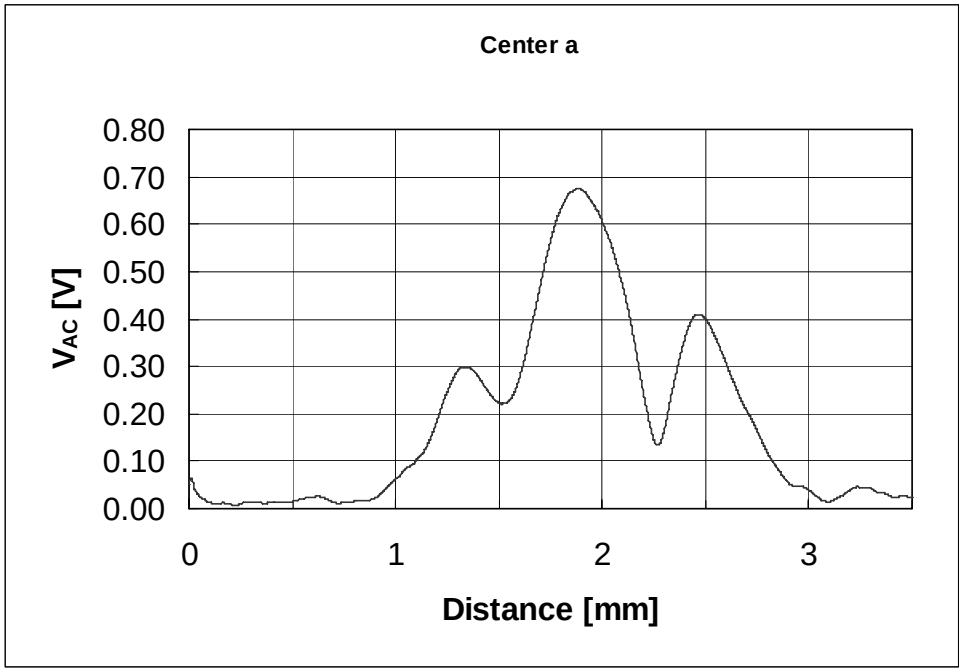


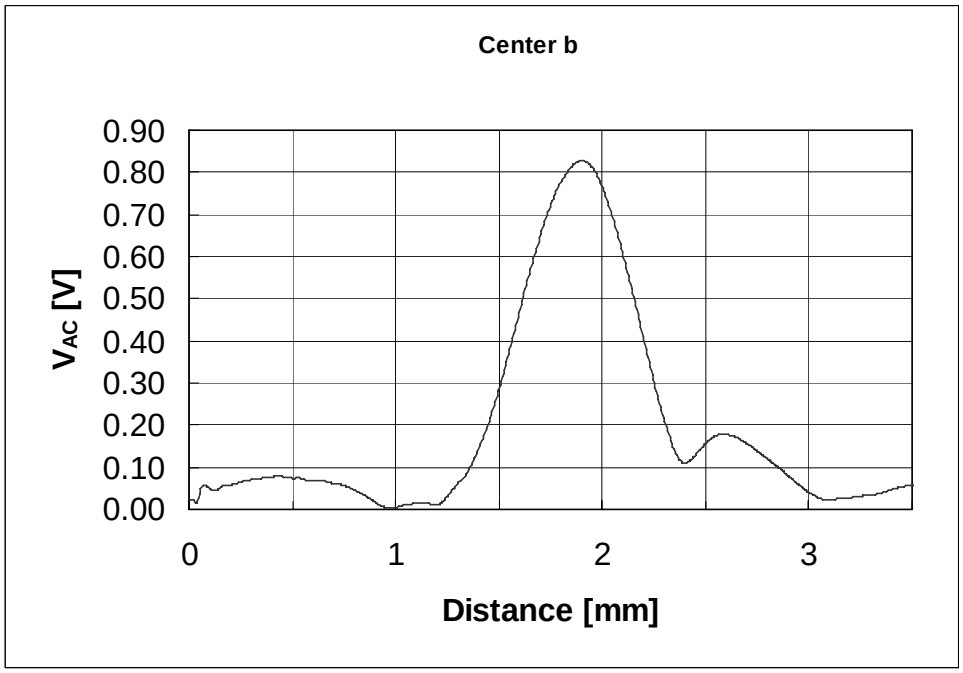
Point #	(x,y) coordinates (in) with respect to the center point	Point name	Alpha (ppm)
1	(0,0)	Center	**1.06**
2	(0, 0.5”)	Top	**1.16**
3	(0, -0.5”)	Bottom	**1.16**
4	(0.5”, 0)	Right	**1.19**
5	(-0.5”, 0)	Left	**1.16**

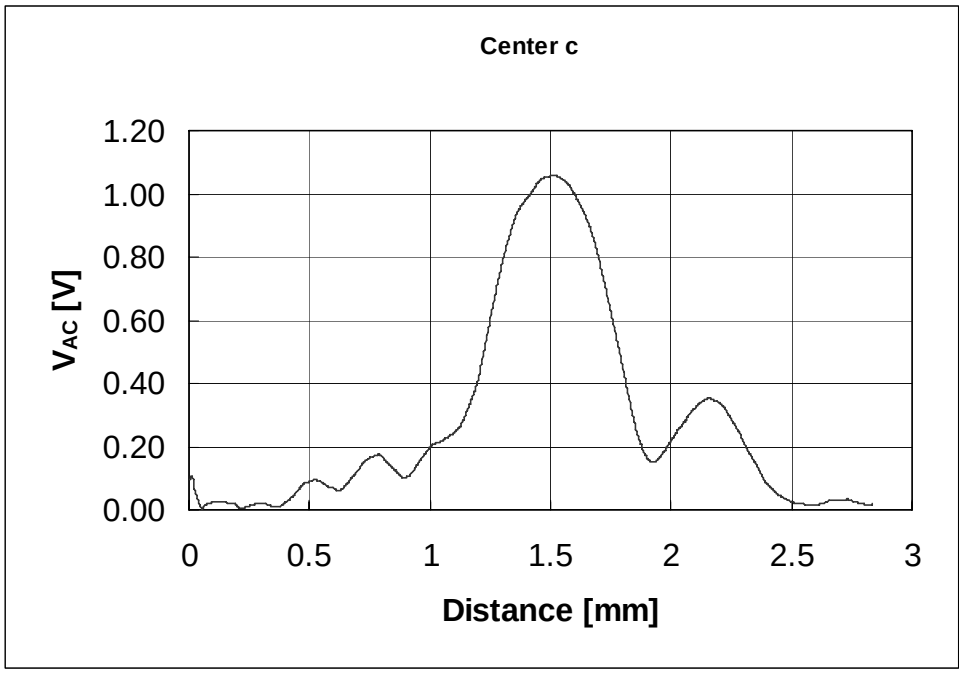
Progression of the point “Center”.

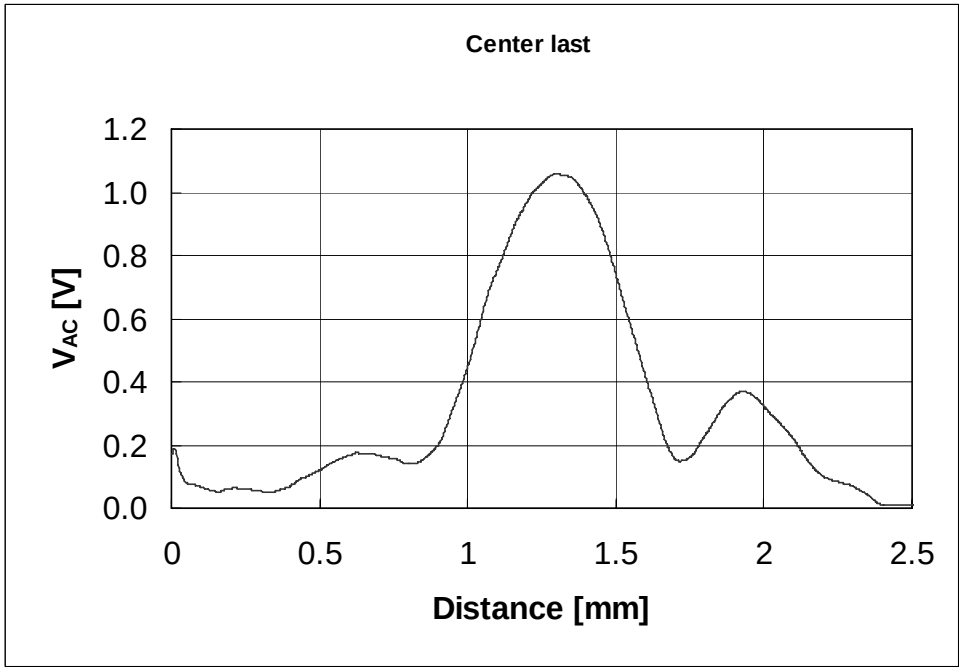
# of measurement	(Alpha (ppm)	
1	0.675	1st measurement
2	0.825	After 30 min
3	1.055	After 1 hour (points 1 to 3 differ ± 0.2 mm)
4	1.06	End of the day
5	1.165	Next day (#3 to 5 are from the same point)

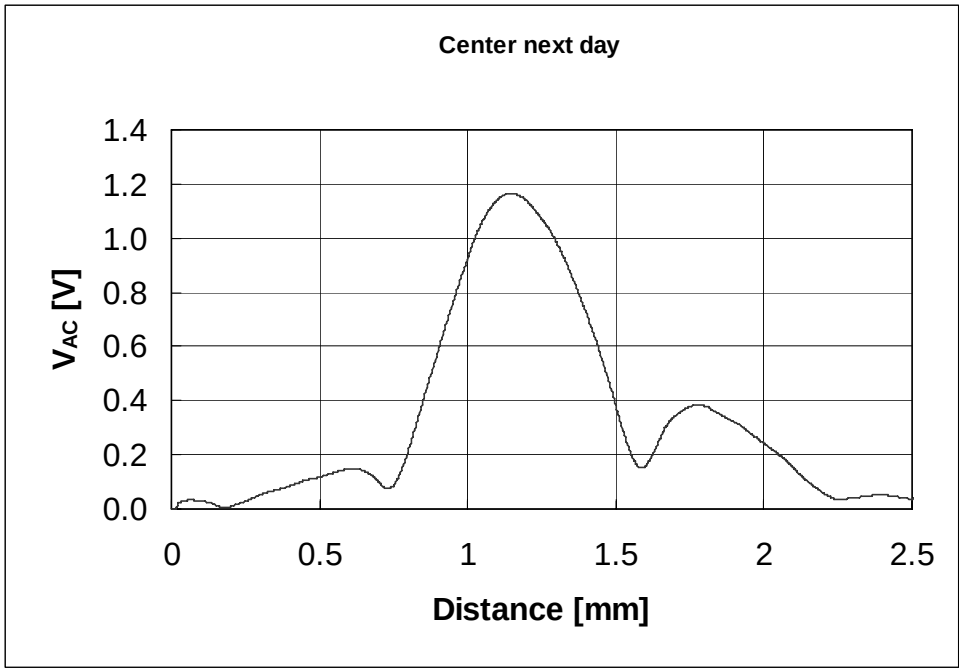
Plots

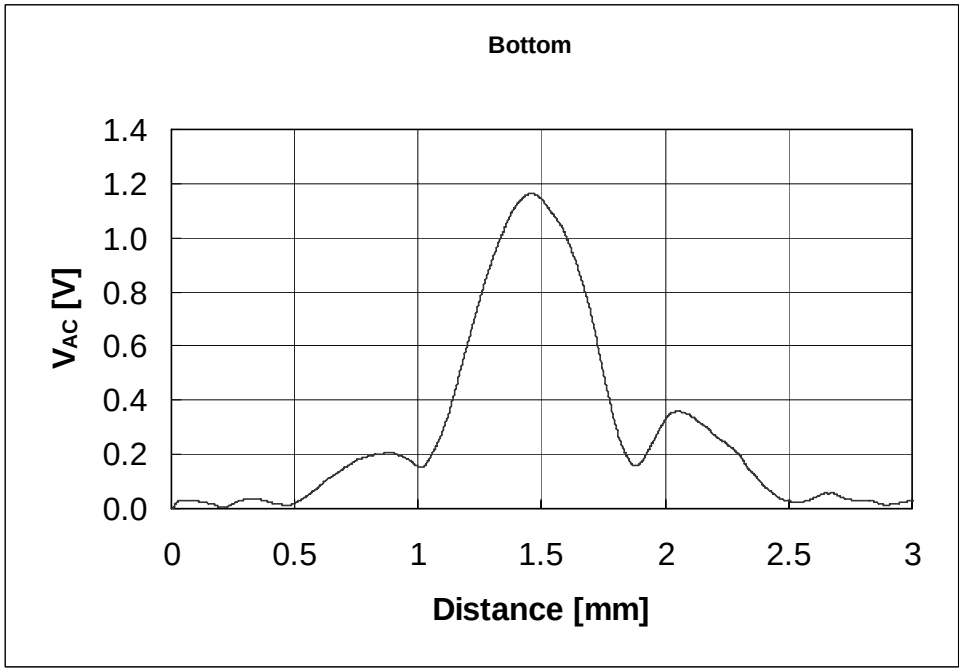

Center a
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
V_{AC} [V]
0
1
2
3
Distance [mm]

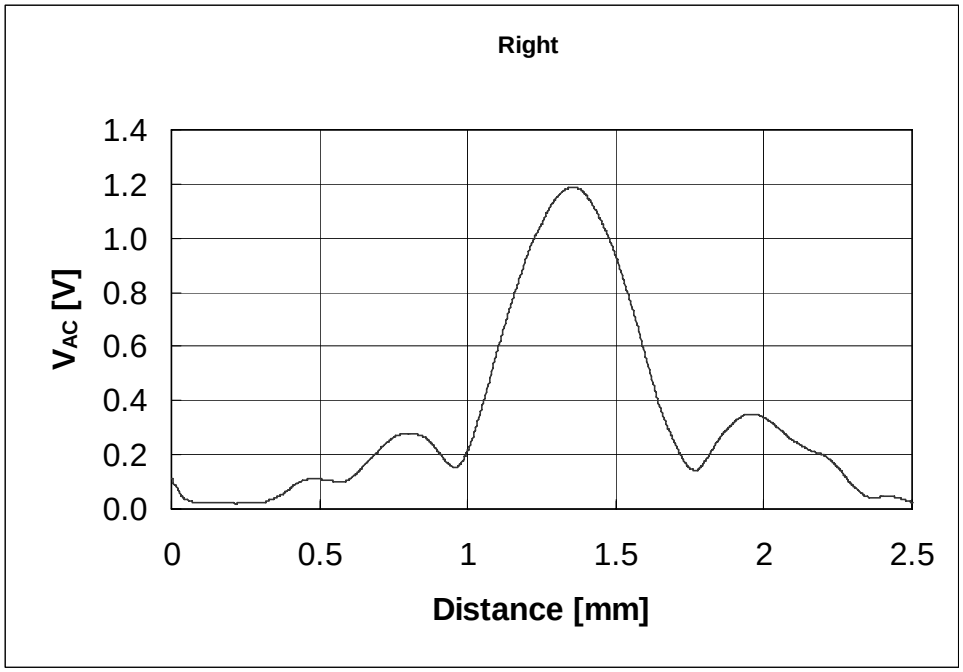

Center b
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
V_{AC} [V]
0
1
2
3
Distance [mm]

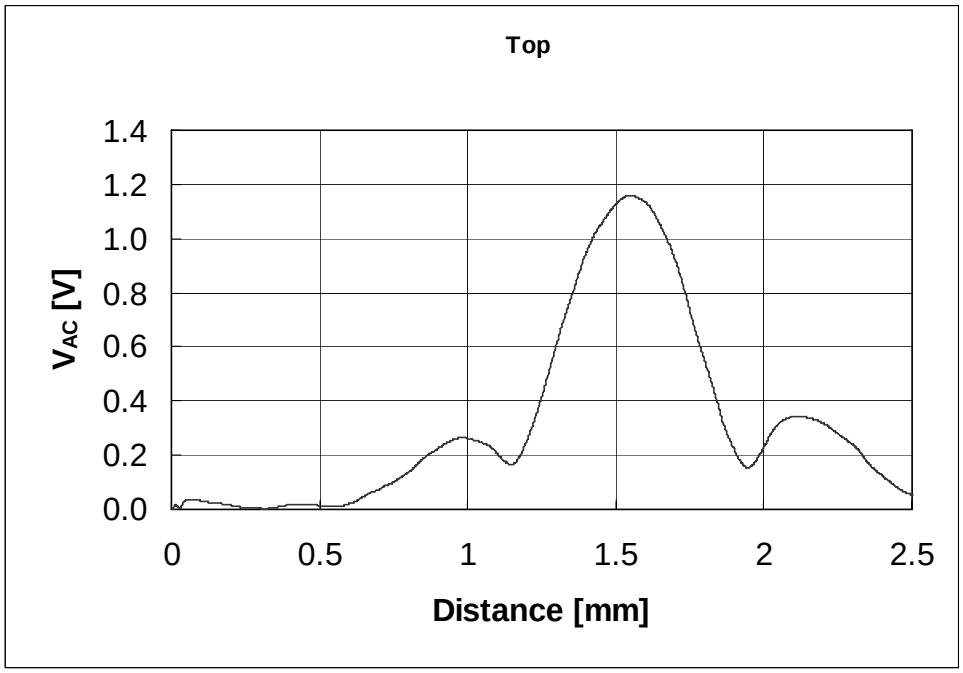

Center c
1.20
1.00
0.80
0.60
0.40
0.20
0.00
V_{AC} [V]
0
0.5
1
1.5
2
2.5
3
Distance [mm]

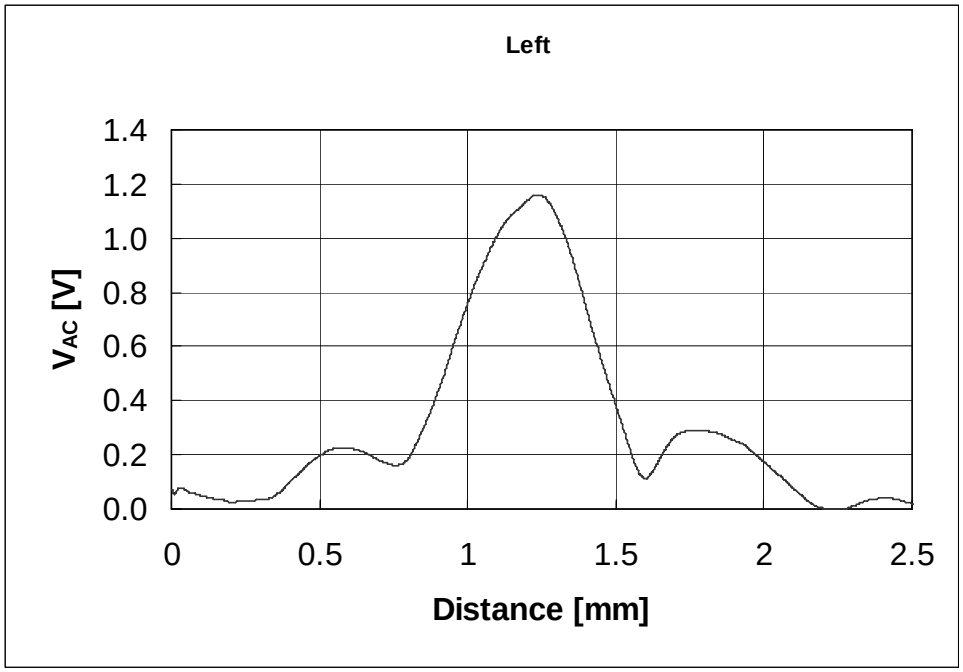

Center last
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V_{AC} [V]
0
0.5
1
1.5
2
2.5
Distance [mm]


Center next day
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V_{AC} [V]
0
0.5
1
1.5
2
2.5
Distance [mm]


Bottom
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V_{AC} [V]
0
0.5
1
1.5
2
2.5
3
Distance [mm]


Right
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V_{AC} [V]
0
0.5
1
1.5
2
2.5
Distance [mm]


Top
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
V_{AC} [V]
0
0.5
1
1.5
2
2.5
Distance [mm]



11/07/06

MMT14K04-1

Dear Helena,

I have measured other points on the sample. Some are close to the previous points. The new measurements give similar results as before, though a bit higher. I guess this is because the coating was not covered and remained in the sample holder, on air, for one whole day.

My previous data

Point #	(x,y) coordinates (mm) with respect to the center point	Alpha (ppm)
1	(0, 30)	**1.19**
2	(0, 20)	**1.18**
3	(0, 10)	**1.24**
4	(0, 0)	**1.22 (1.28)** 2 close points
5	(0, -10)	**1.23**
6	(0, -20)	**1.26**
7	(0, -30)	**1.22**
8	(-30, 0)	**1.19**
9	(-20, 0)	**1.13**
10	(-10, 0)	**1.12**
11	(10, 0)	**1.27**
12	(20, 0)	**1.21**
13	(30, 0)	**1.17**

The data right after your departure (center and ± 0.5”)

Point #	(x,y) coordinates (in) with respect to the center point	Point name	Alpha (ppm)
1	(0,0)	Center	**1.06**
2	(0, 0.5”)	Top	**1.16**
3	(0, -0.5”)	Bottom	**1.16**
4	(0.5”, 0)	Right	**1.19**
5	(-0.5”, 0)	Left	**1.16**

The next day data, the optic was not covered (center and ± 1.0”)

Point #	(x,y) coordinates (in) with respect to the center point	Point name	Alpha (ppm)
1	(0,0)	Center	**1.10**
2	(0, 1”)	Top	**1.40**
3	(0, -1”)	Bottom	**1.34**
4	(1”, 0)	Right	**1.51**
5	(-1”, 0)	Left	**1.43**

11/22/06

Hi Helena,
I have re-measured the MMT1404-1 disk. Surprisingly, there was no time dependence.

1) I have coated the optic by "First Contact" and left it coated for two weeks.
2) I removed the coating and mounted the sample in the set up, which was calibrated and aligned in advance.
3) The first z-scan started after about 3 min. Alpha = 1.1 ppm, which is as it must be.
4) Then I have centered on the maximum and started a 30 min t-scan. The value of alpha remained stable and constant.
5) I have scanned another point close to the first one. Aplha = 0.92, which is again within the frame of what we expected.
6) I have aligned the surface and made an x-scan (transversal with respect to the beam) moving the sample by hand very carefully. I thought this way I would be able to catch spikes and points that are far beyond the average value. During this scan, I was able to stop and wait for a while any time the value could be suspicious.
The total length of the scan was 20 mm. I was able to catch one small spike only, which may be a dust. The surface absorption is very even and no considerable change was detected.

Now I would rather assume that the value of 0.75 ppm we measured with you was simply by chance, because the set-up was not warmed up properly.

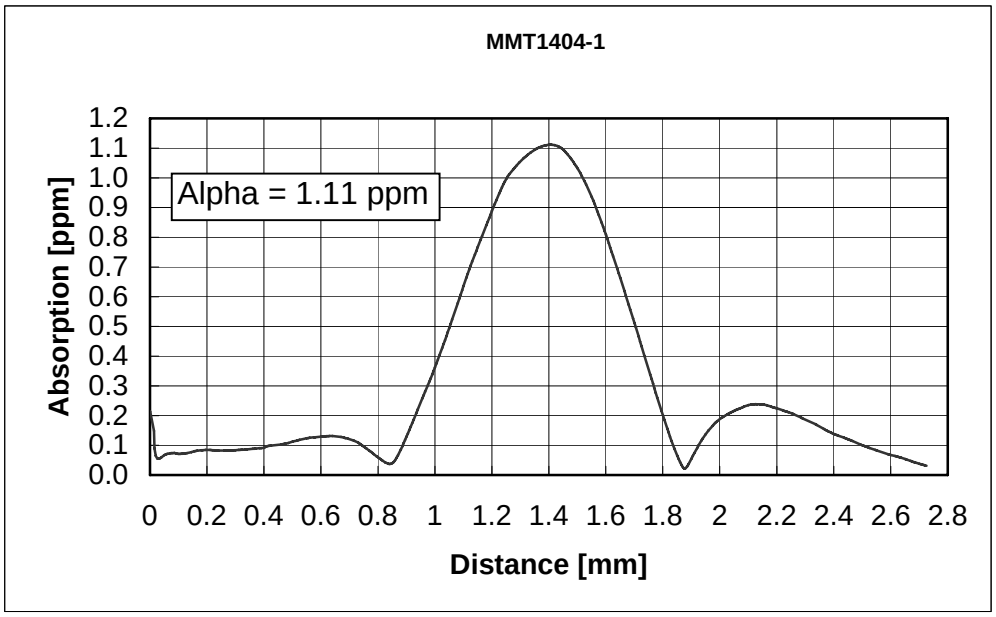
The conclusion is: Alpha = 1.1 in average and varies smoothly from 0.92 up to 1.25 depending on the position. No preference can be given to different parts of the surface. The absolute accuracy is +/- 2.5 % (i.e. +/- 0.025 ppm).

Actually, I do not mind to cover it again and try in a couple of weeks once more. However, I think now that the effect of coating is not that critical.

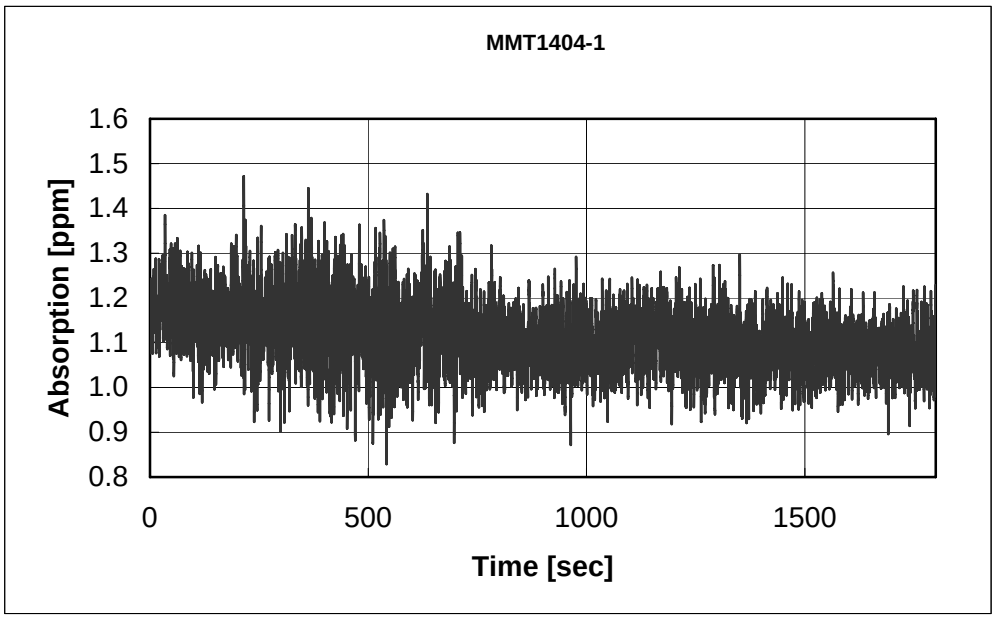
Ashot.

The results are given below.

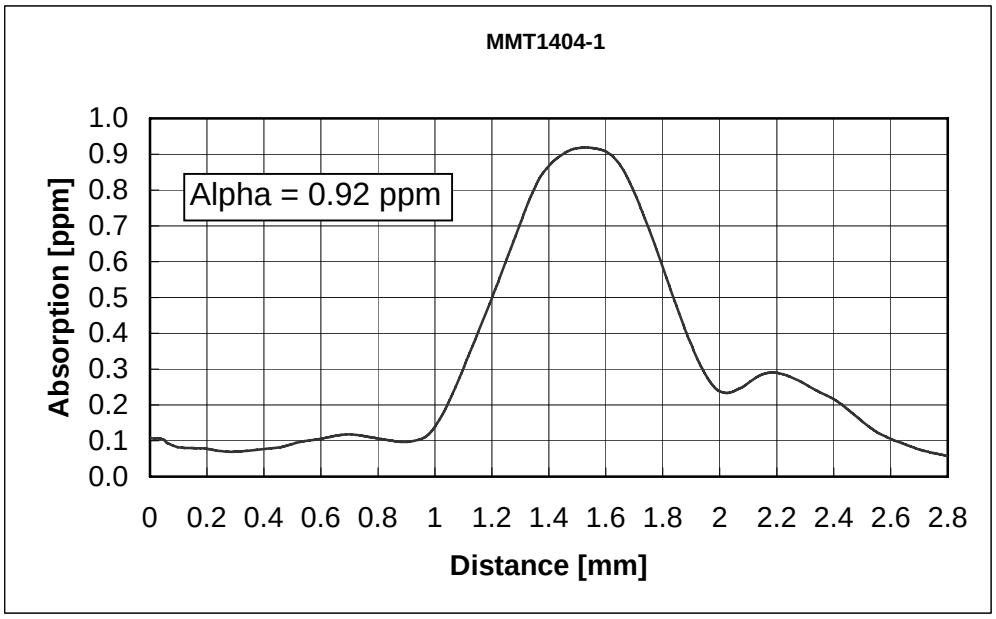
Central point (z-scan (longitudinal)



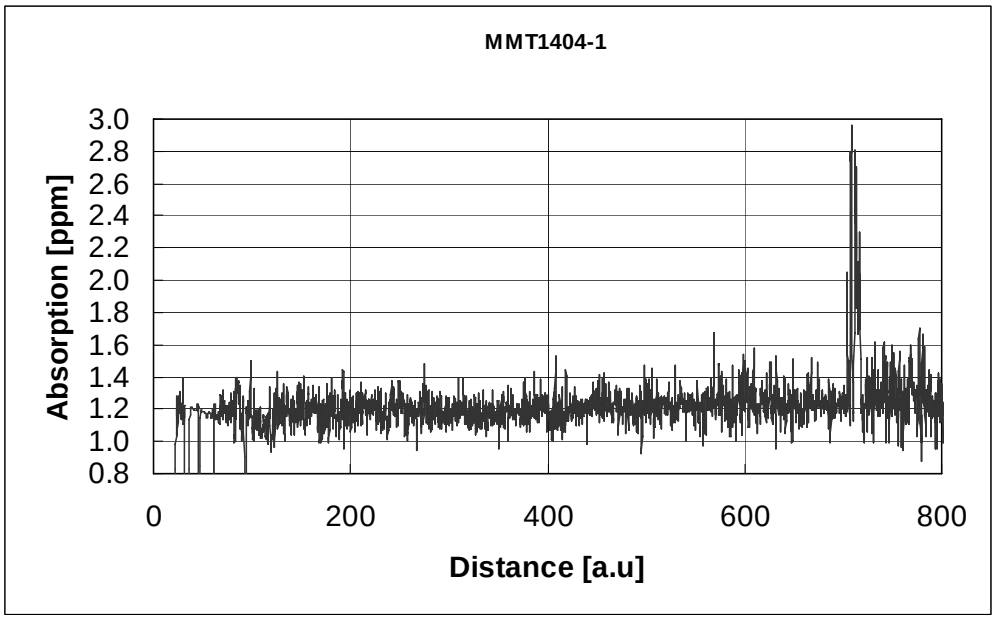
t-scan of the central point (Alpha ≈ 1.1 ppm).



10 mm left from center



Hand manipulated transversal x-scan (horizontal central line). The total length is 20 mm. Alpha slightly varies from 1.15 to 1.25. One "spike" was observed with Alpha = 2.9 ppm)



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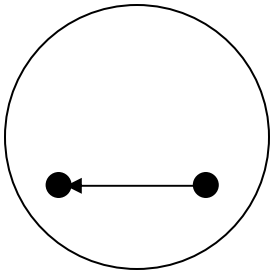
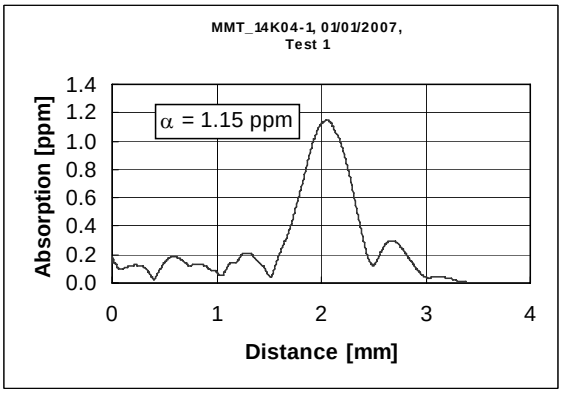


The line is located 1 cm below the central point and is 25 mm in length.

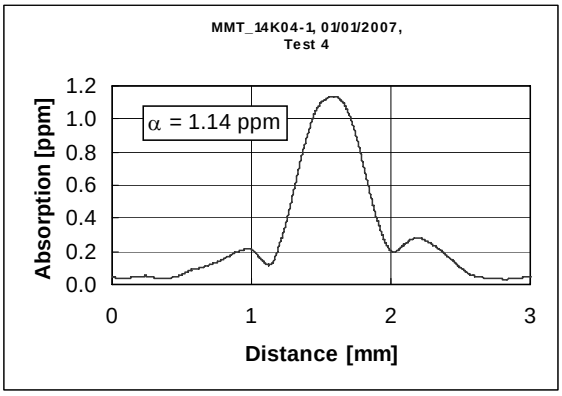
A) The average absorption value is about **1.1 ppm**. *It is not affected that much whether the sample is freshly cleaned or not,*

B) Also there is no time dependence of the absorption signal. At least for several days until the sample is really covered by dust.

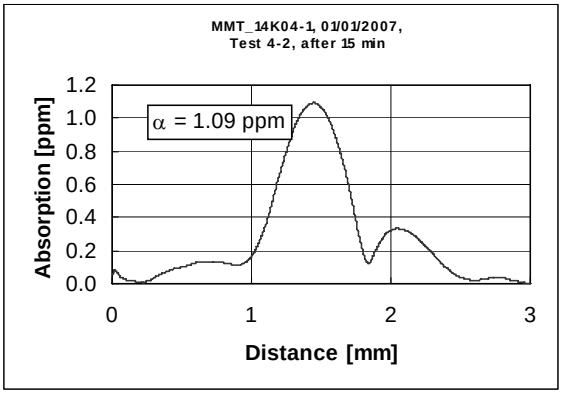
1) Start point as removed from the box.



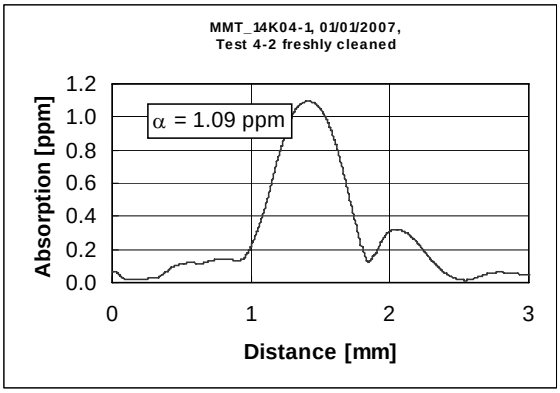
2) Start point repeated.



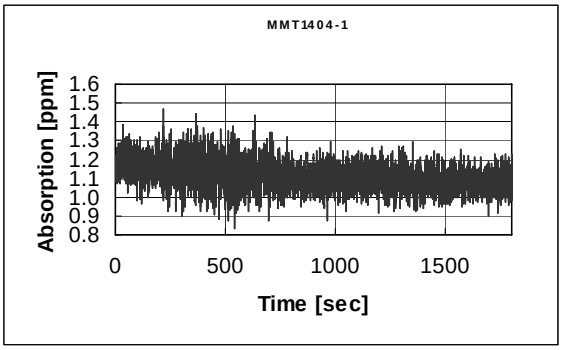
3) Start point repeated after 15 min.



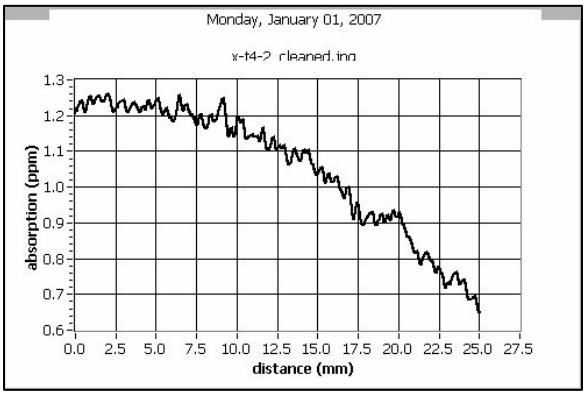
4) Start point freshly cleaned on site by methanol.



5) One sample time scan of a point close to the "start" point.



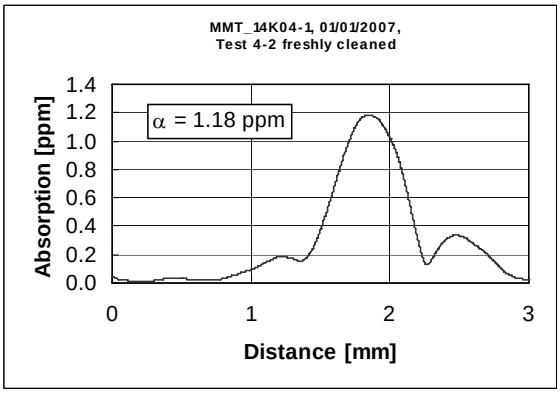
6) A continuous horizontal scan from “start” to “end” along the line shown on the sketch.



Because of a large diameter of the sample (∅ = 3”), it could not be aligned accurately perpendicular to the beam. Therefore the signal recorded was gradually “sliding off” the peak. The signal changes smoothly with no jumps, spikes etc.

In order to check the real value of the absorption at the end of the scan, it was measured at the “end” point.

7) End point just after the scan.



*C) As can be seen the absorption is **1.18 ppm.** So during the scan it varies from **1.22** to **1.18 ppm** smoothly. The distance dependence of the signal in Fig. 6 is, in fact, the deployed “shoulder of the distance dependence of signal in Fig.7.*

Notes

I) After the 25 mm *scan the shift from the maximum was about* 0.3 mm*. So the angular misalignment was* 0.68 degree.

II) During the scan the signal at the “start” point was recorded as 1.22*, not* 1.1 ppm*. This is because I have aligned the sample additionally before the scan: “touched it”! The absolute accuracy of the measurements is:*

$\Delta\alpha = \pm 10\%$

However the resolution is better the 0.1 ppm.