Update on RICH activities

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The 2017 run MAPMT status

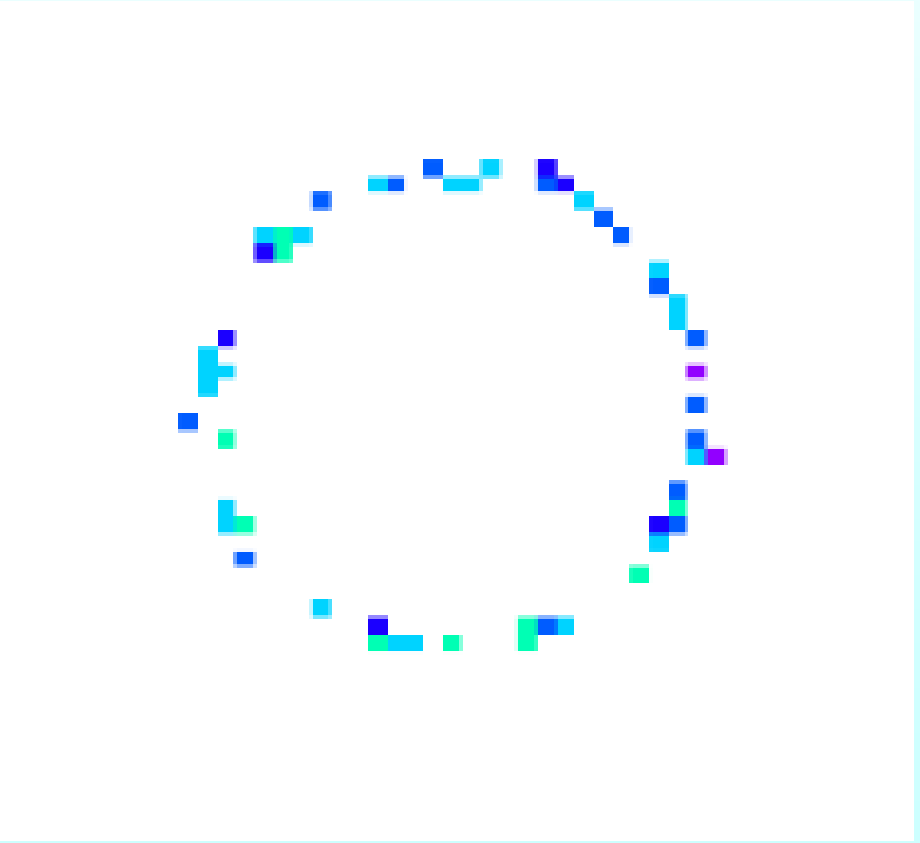
The RICH-1 gas radiator status

The HYBRID PDs status

The gaschromatography

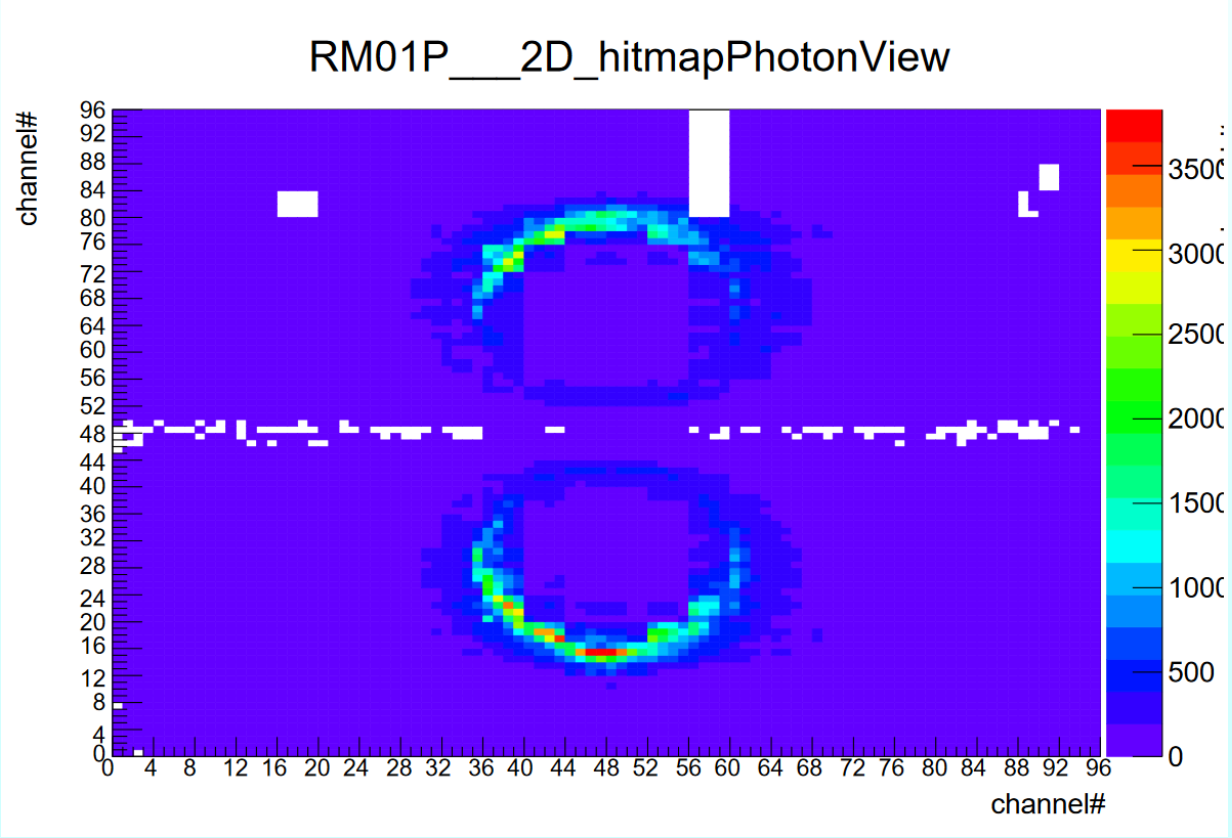
Preliminary analysis of our gas

Next steps



MAPMTs status at last TB

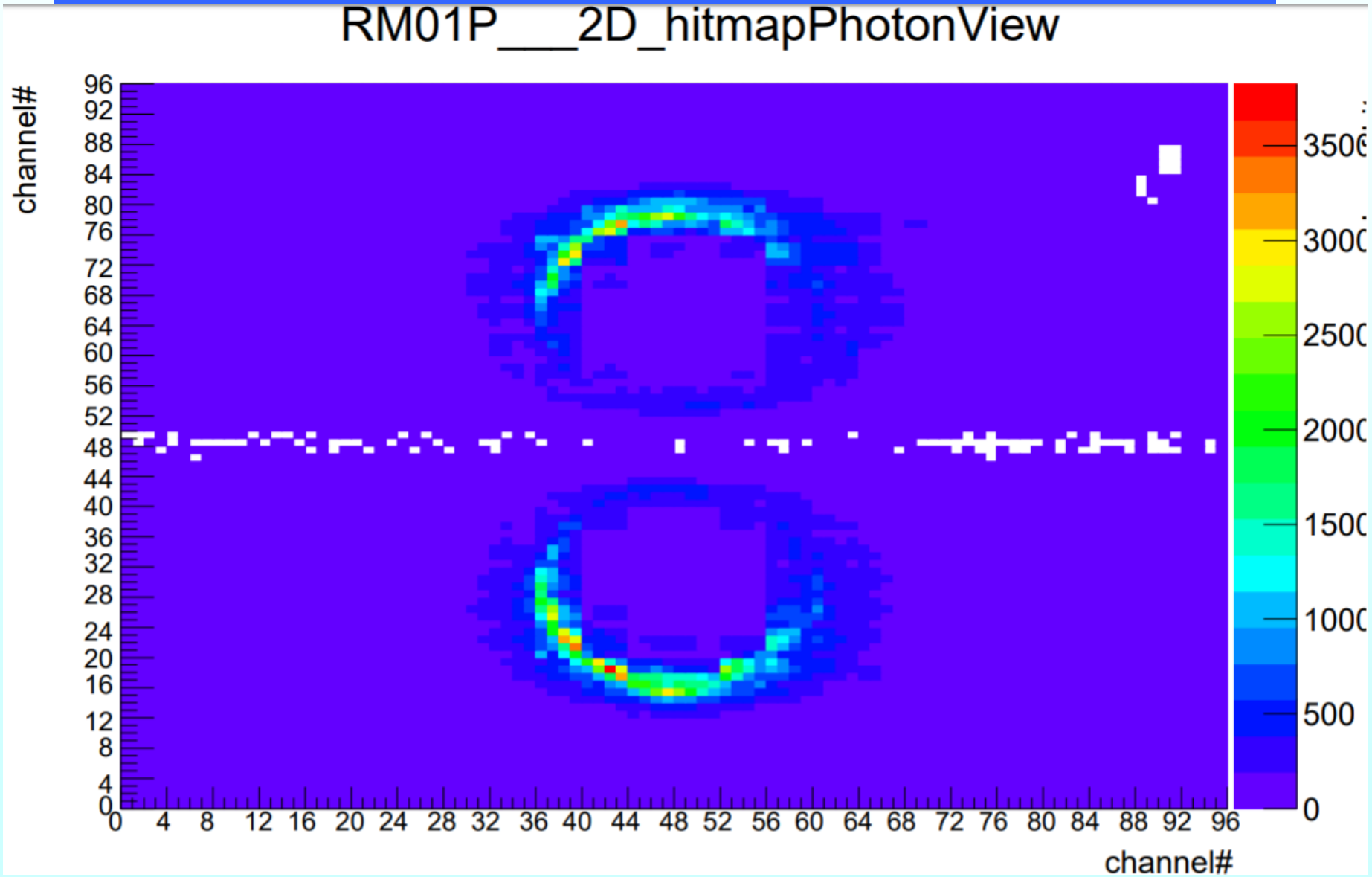
At the beginning of the run all MAPMTs and all DREISAMs were checked to be o.k.
presently 1 DREISAM sends no data (roof problem?) and 1 MAPMT is missing



SLIDE FROM LAST TB

1% of the active surface is off.
To fix it access in front of the RICH is needed. We are ready to do it.

MAPMTs status now

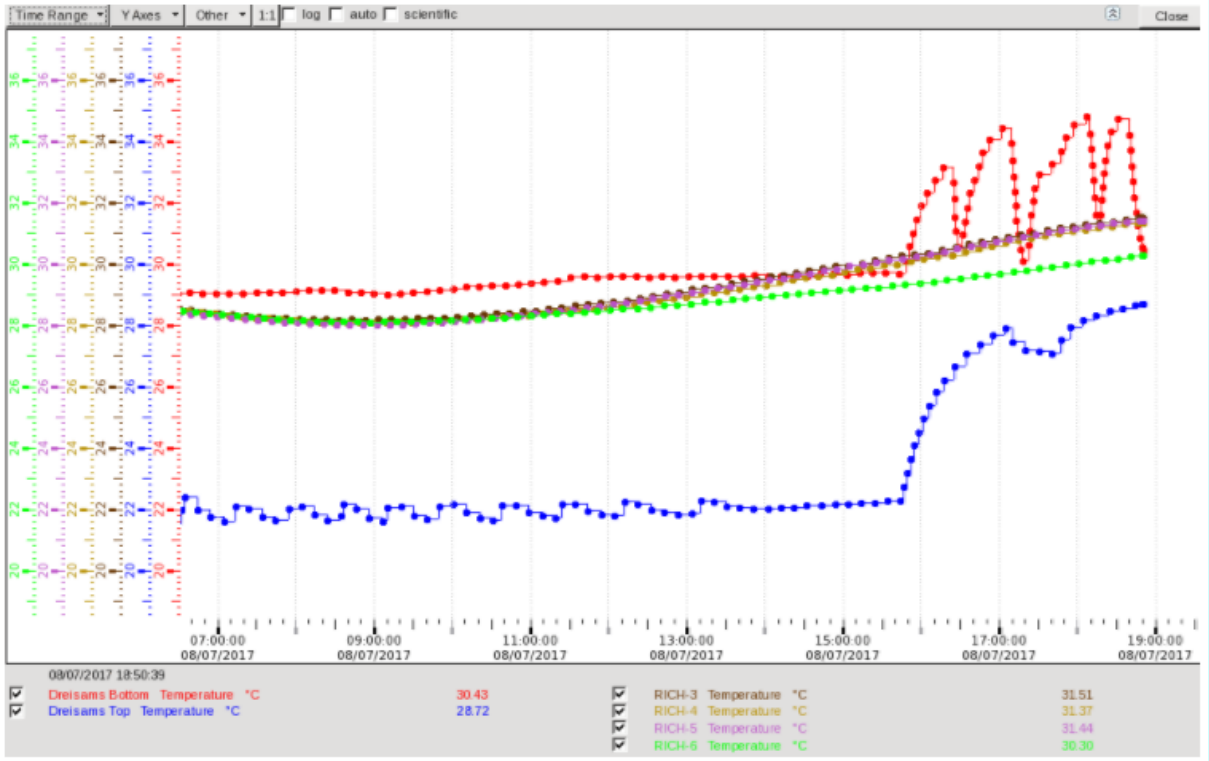


LV failure (temperature) issue

Every year we faced some LV failure on the hottest data taking period

57627	F. Tessarotto	Sat 08 July 2017, 18:51

The power supply for LV MAPMT Digital Bottom Jura failed twice (at 16
this comment.
It seems that starting from 15:45 a temperature issue appeared



This year we have a new, more powerful water cooling system for the FE

The last time a problem appeared, for the LV only, was July 8th: new fan units were installed and no further problems were experienced

Purification of C4F10

for 2017 run we foresaw adding C4F10 to the gas recovered from 2016 run.

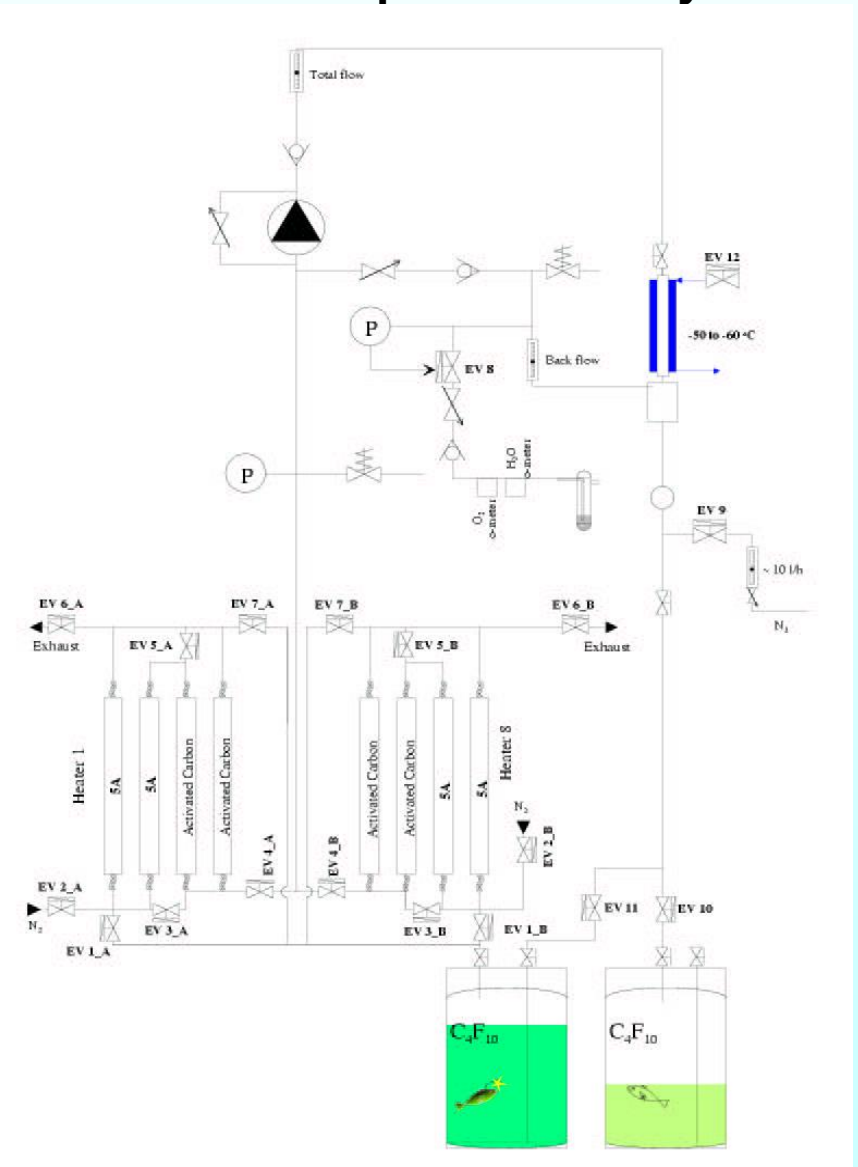
a bottle with ~ 450 kg was purchased (last possibility to purchase C4F10), no other C4F10 is available in these quantities on the market worldwide.

We always need to purify the new gas in view of our extreme purity requirements

The purification process is slow, delicate and requires experts

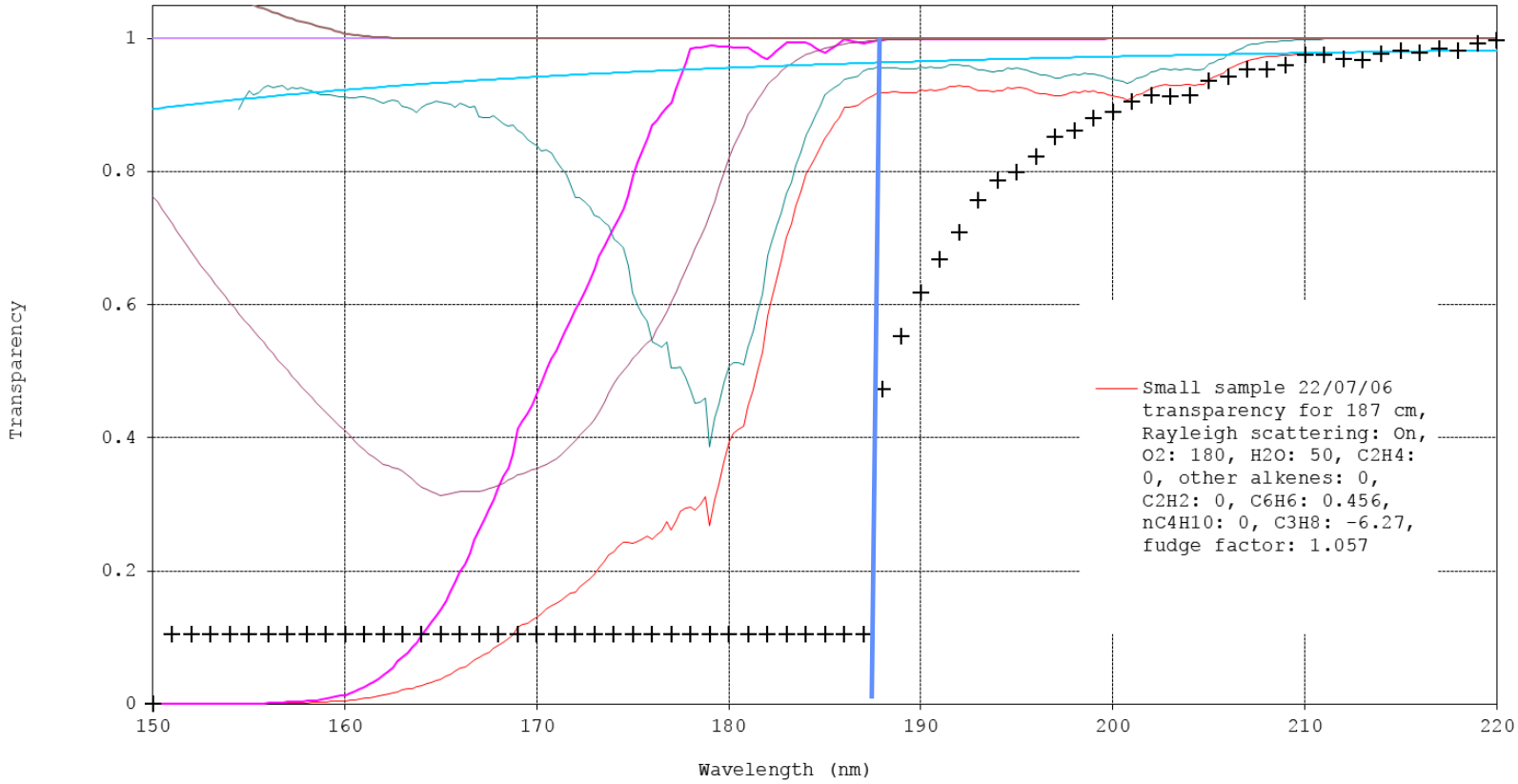
The purification process was performed on part of the new gas

Scheme of the purification system



Purification of C4F10

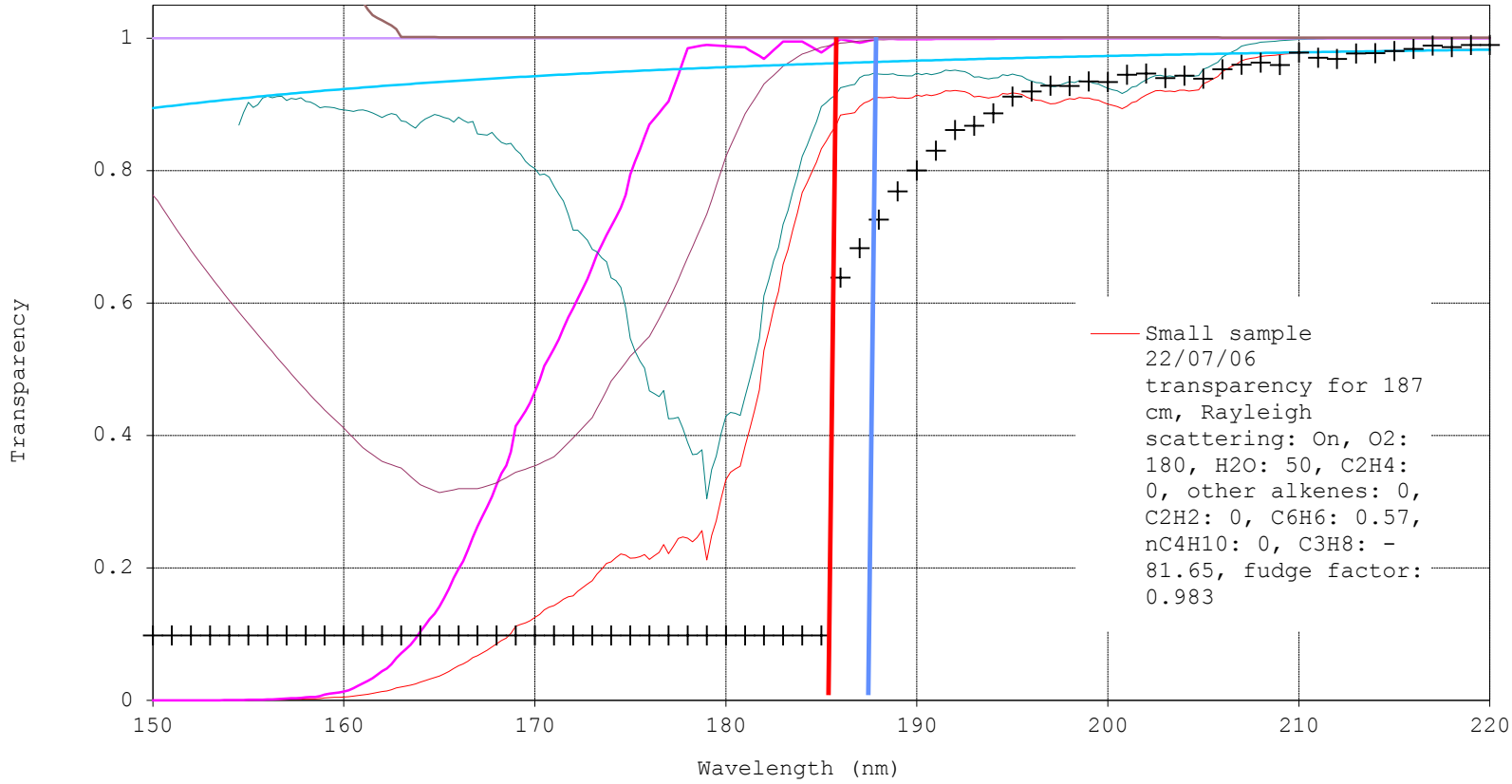
The transparency of the C_4F_{10} from the new bottle is really bad



before applying the purification process

Purification of C4F10

Surprisingly, the transparency of the C_4F_{10} remains bad

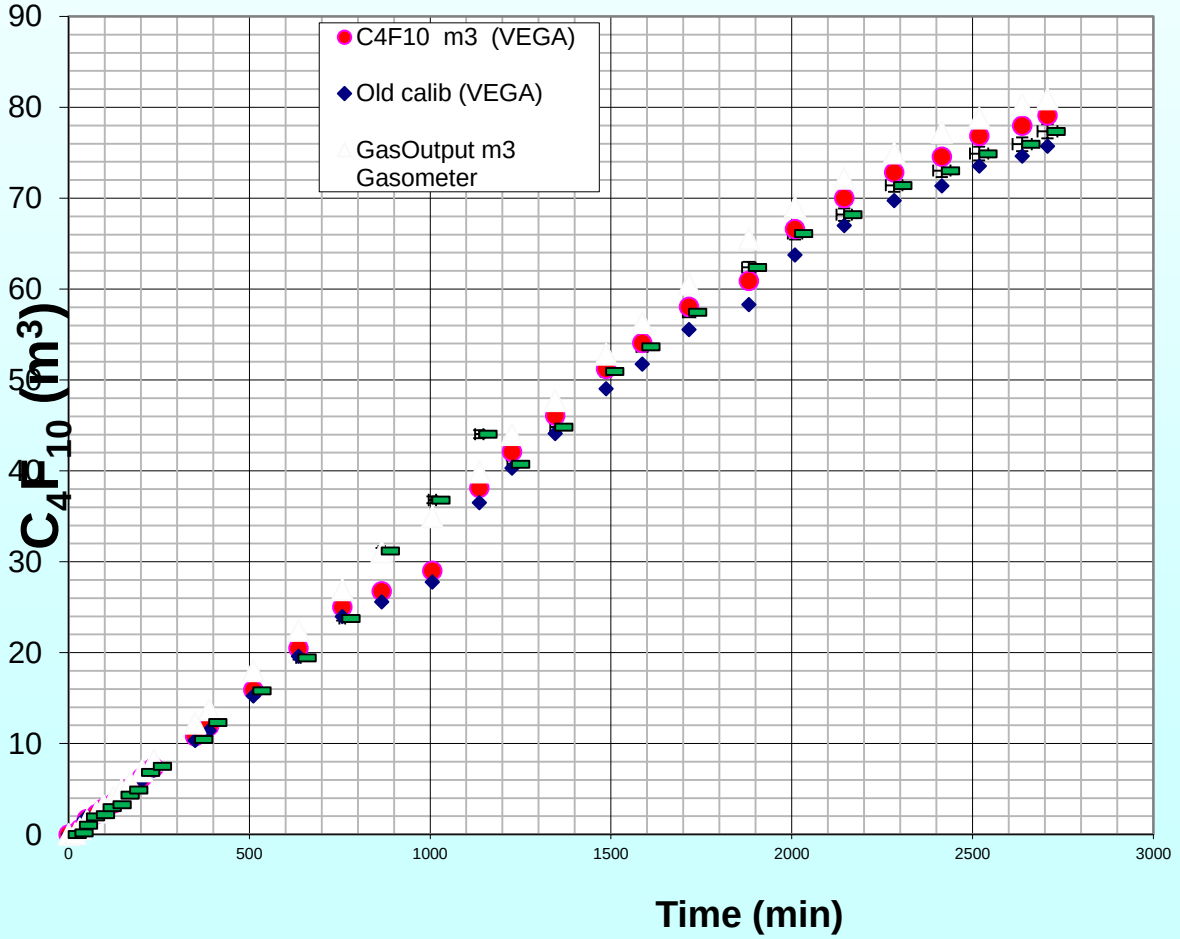


after applying the purification process. Many tests were done to make sure that the purification system works fine: it does.

RICH-1 filling gas

The filling was performed using the gas in the reservoir: we decided to stop it when 90% of C4F10 in the RICH was reached (instead of the 95 -97 %).

Having a bit of C4F10 in liquid form is essential for the RICH "breathing"



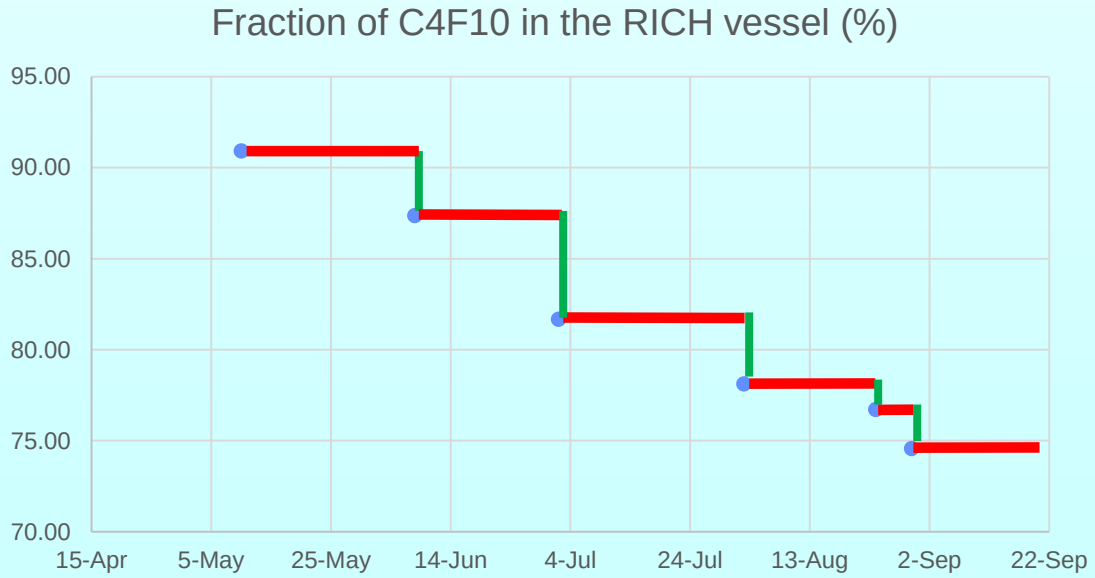
at the beginning of COMPASS physics data taking we secured the RICH operation by adding 2 m^3 of N_2 in the vessel because there was no liquid any more in the reservoir. (2.5% decrease of C_4F_{10} fraction)

With the present leak (~6 l/h) we will need extra gas (either C_4F_{10} or N_2 within two weeks)

We will need further filling in the near future: the operation of MAPMTs is almost unaffected, not so the gas-based PDs

Nitrogen in RICH-1

date	N2 (m^3)	N2 corr. (m^3)	N2 fraction (%)	C4F10 (%)
10-May	8	8	9.09	90.91
8-Jun	2.5	3.125	3.55	87.36
2-Jul	4	5	5.68	81.68
2-Aug	2.5	3.125	3.55	78.13
24-Aug	1	1.25	1.42	76.70
30-Aug	1.5	1.875	2.13	74.57
tot:	0	22.375	25.43	74.57



After the C_4F_{10} filling, nitrogen has been added 5 times (see table), for a total of about 16 m^3 so far.

The fraction of C_4F_{10} in the radiator gas versus time is represented by the red lines in the graph: it went from ~91% down to ~75%

With the present leak (~6 l/h) we will need extra nitrogen filling and will reduce the C_4F_{10} fraction by ~5% per month of data taking, unless we succeed in cleaning new C_4F_{10} in the meantime

Fast circulation

During the commissioning phase the fast circulation compressor could not be started.

An intervention from HAUG technician took place on June, Wednesday 21st

The problem was identified: a loss of reference parameters in the PLC control system. The correct parameters were recharged (after a long struggle).

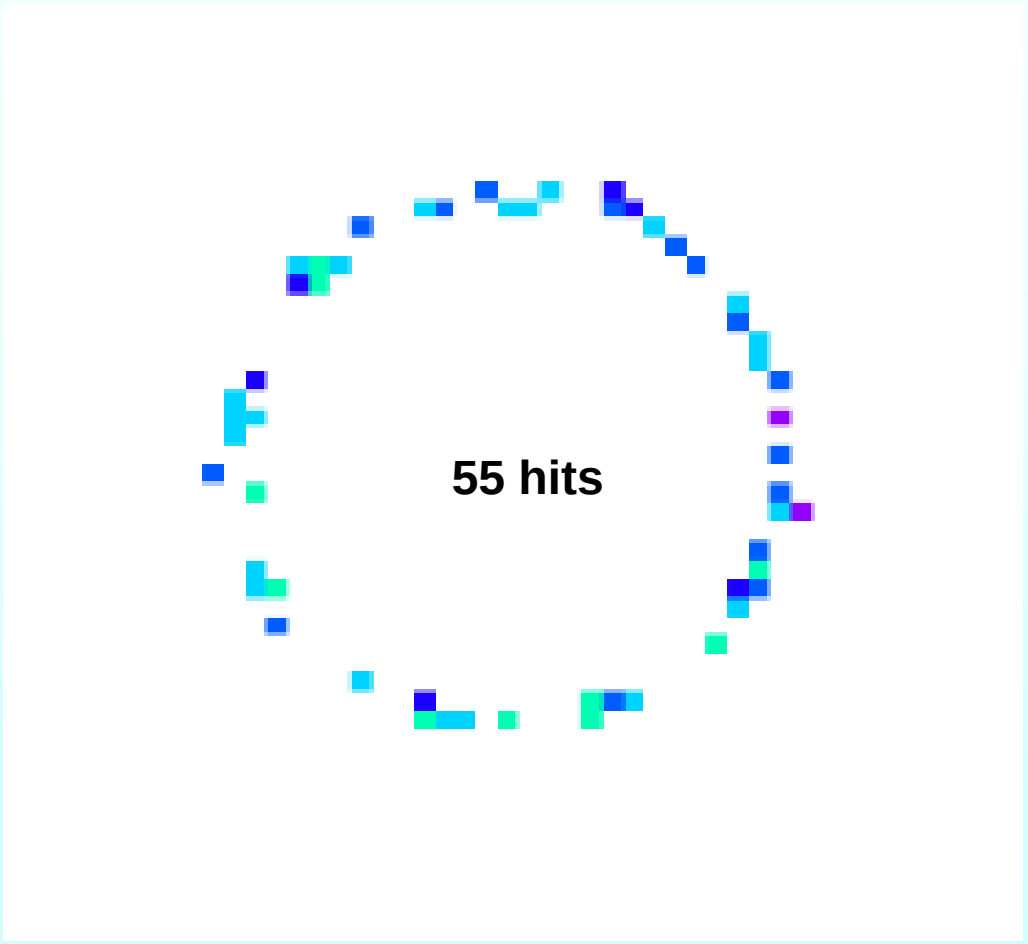
Since then we are circulating the radiator gas at ~90% of the maximum flow (which is 20 m^3/h)

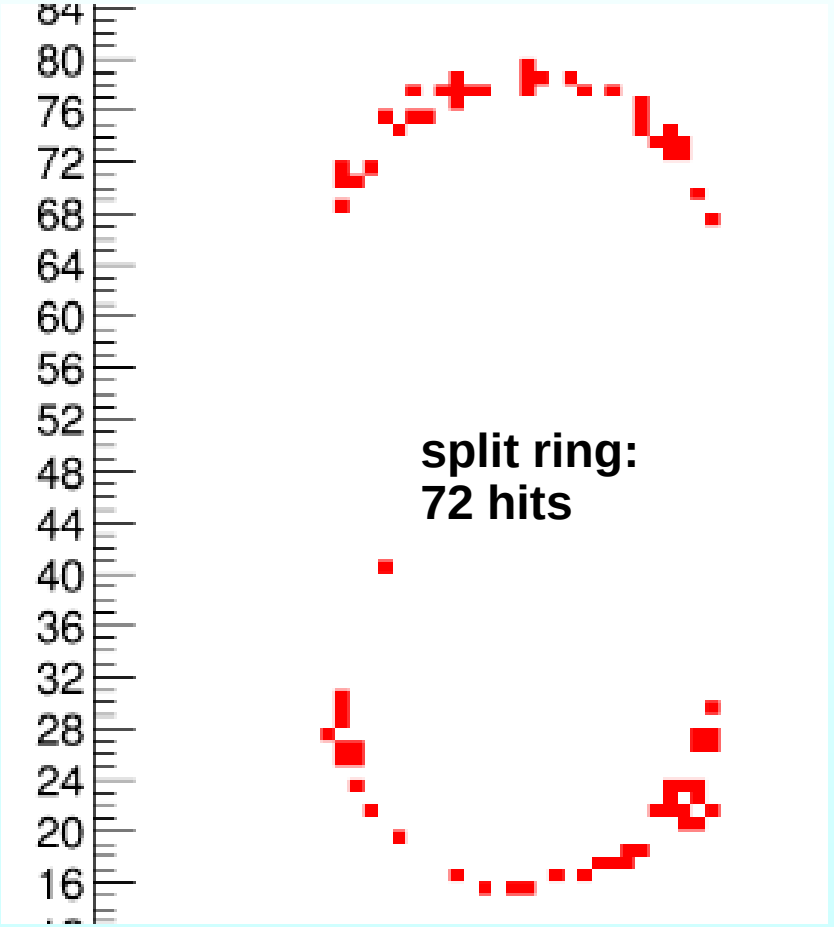
The fast circulation is really important because of the reduced C_4F_{10} percentage.

We had no interruption of the fast circulation so far.

Number of photons

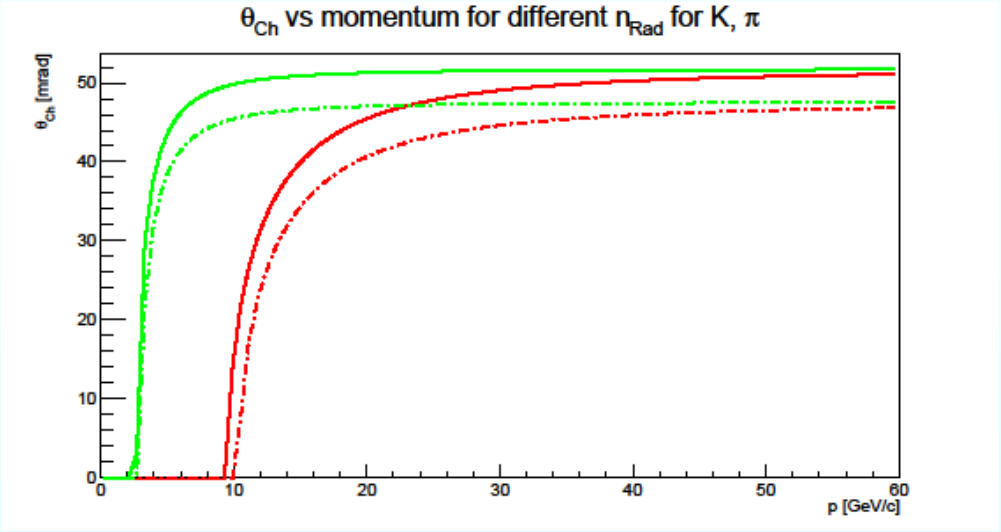
Typical (randomly chosen) rings (from Friday 01/09/2017)

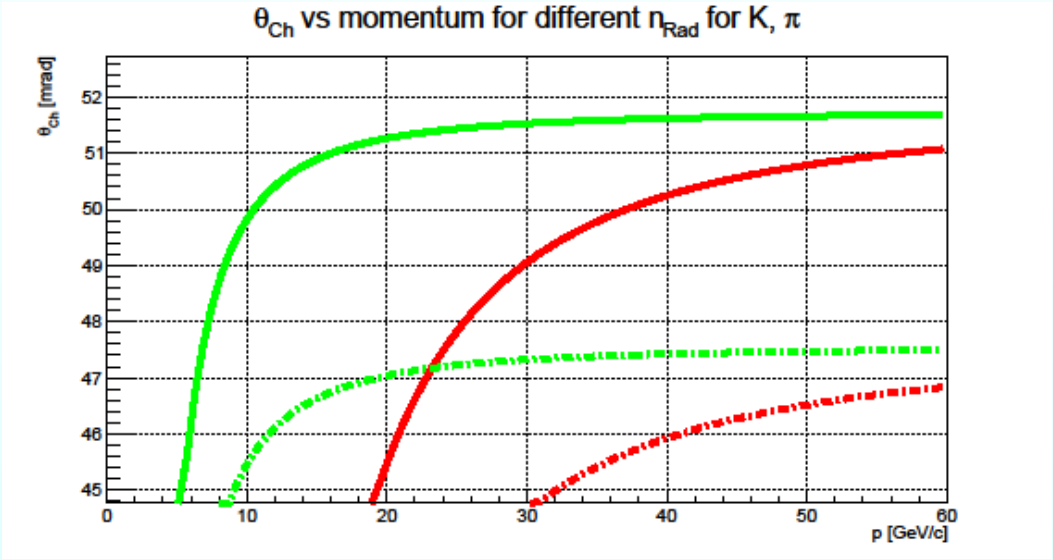


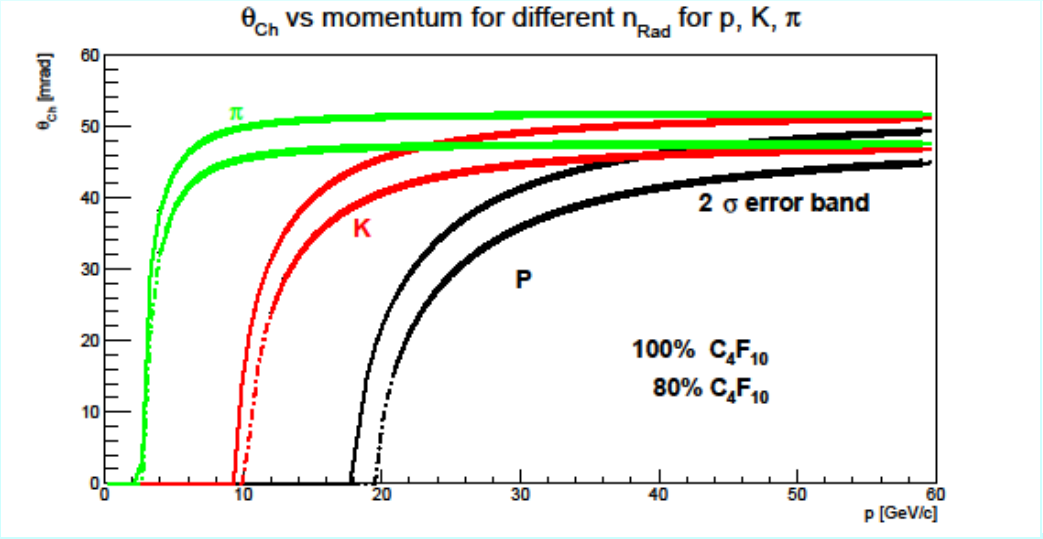


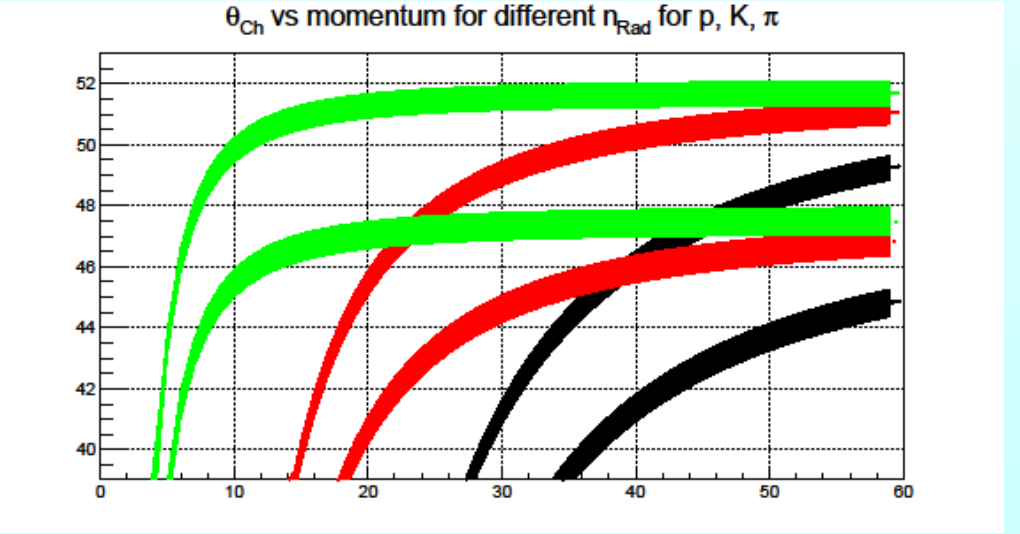
The expected effect of 15-20% reduction in the number of detected photons is being investigated. On-line images suggest there is no major impact.

Cherenkov angle vs p



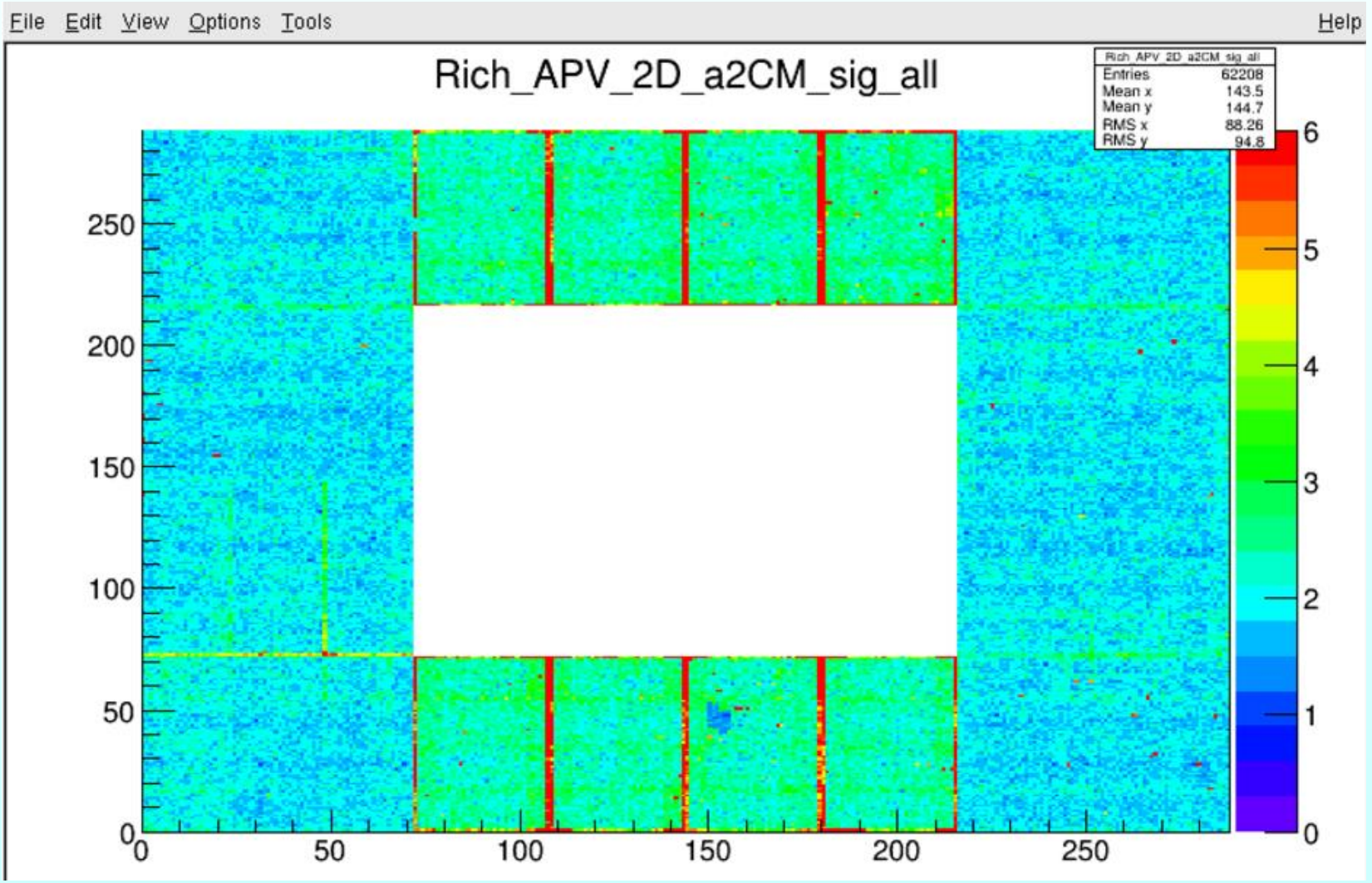




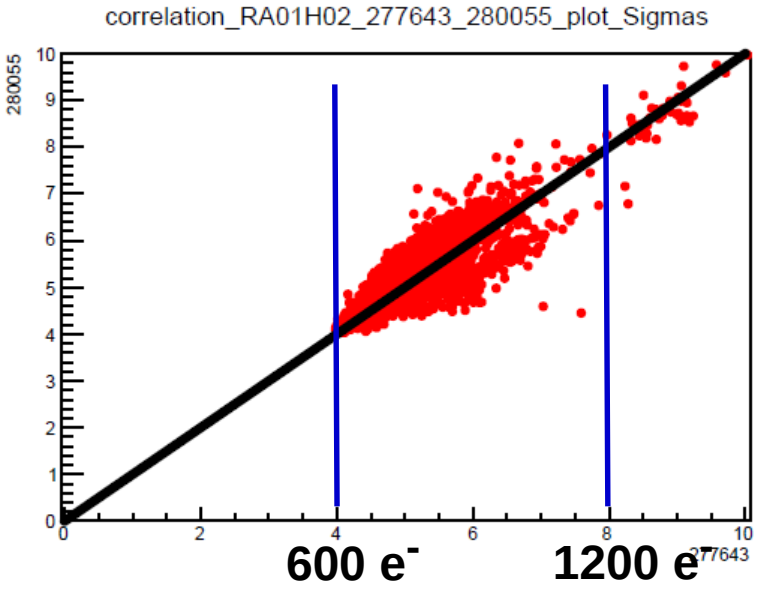


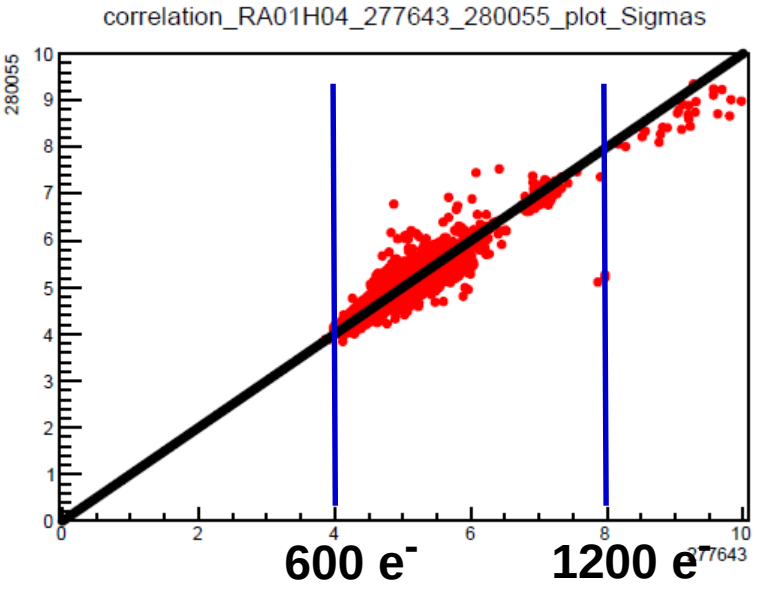
Noise figure from last MD ped. runs

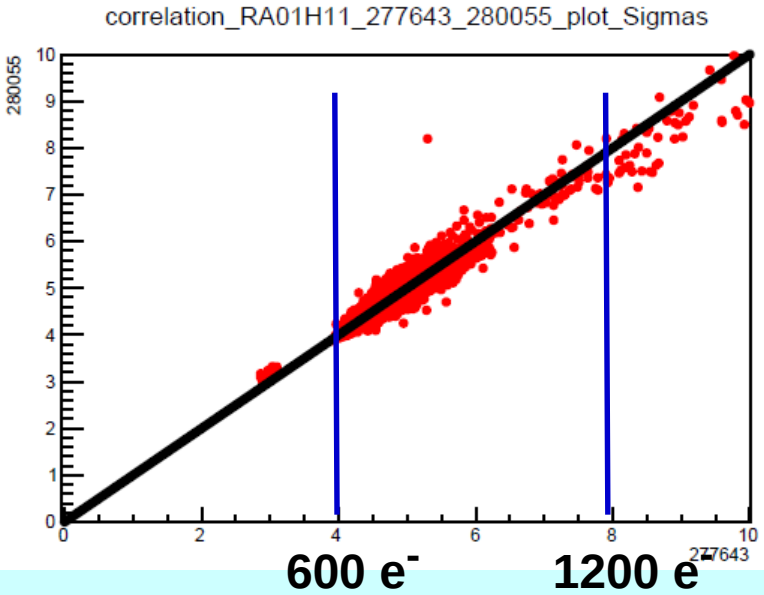
MWPCs **Hybrids** **MWPCs**

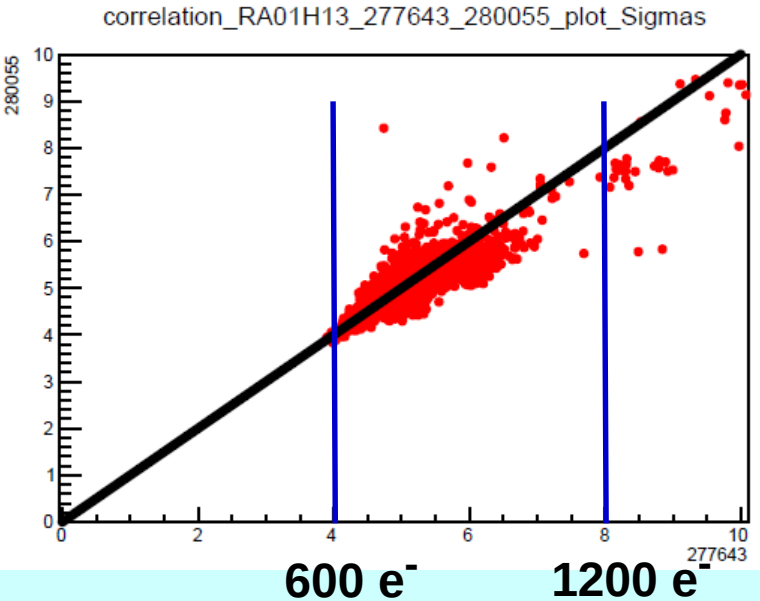


New vs previous pedestal sigmas



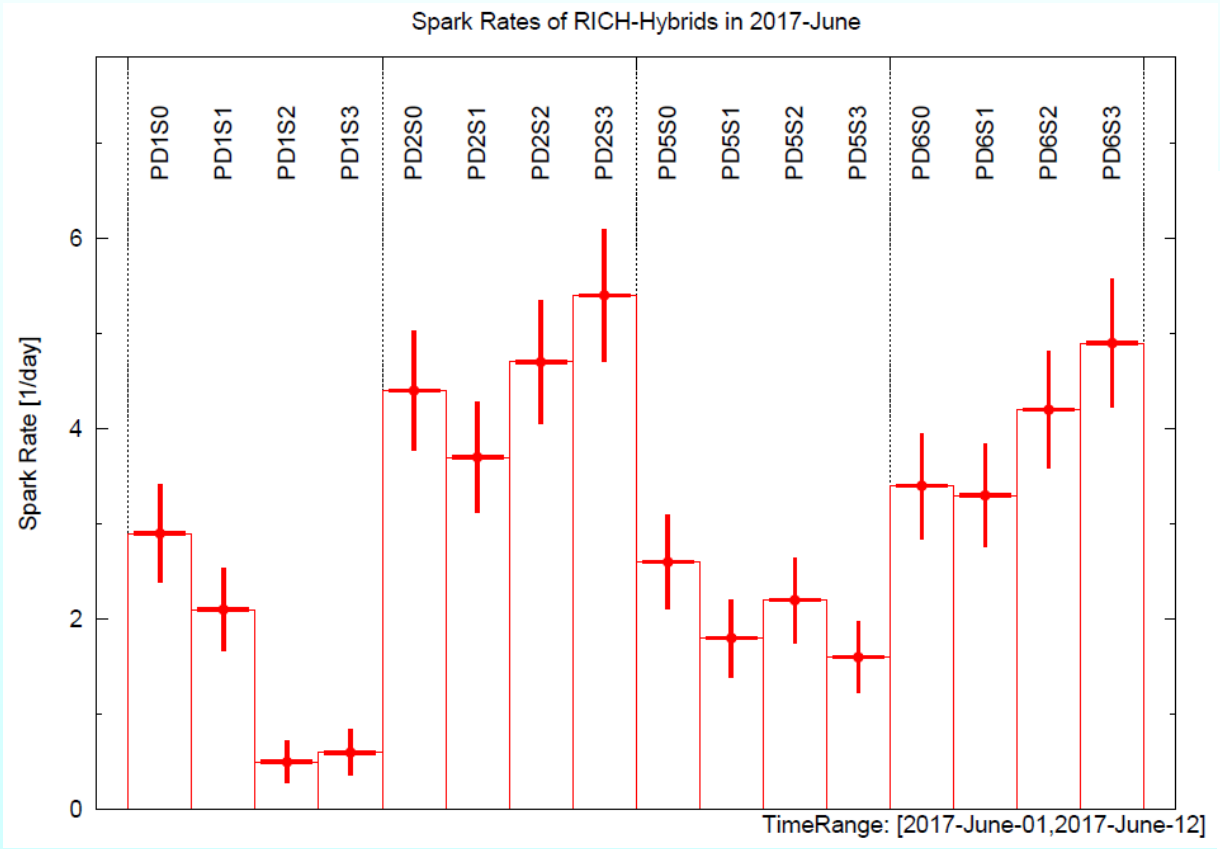




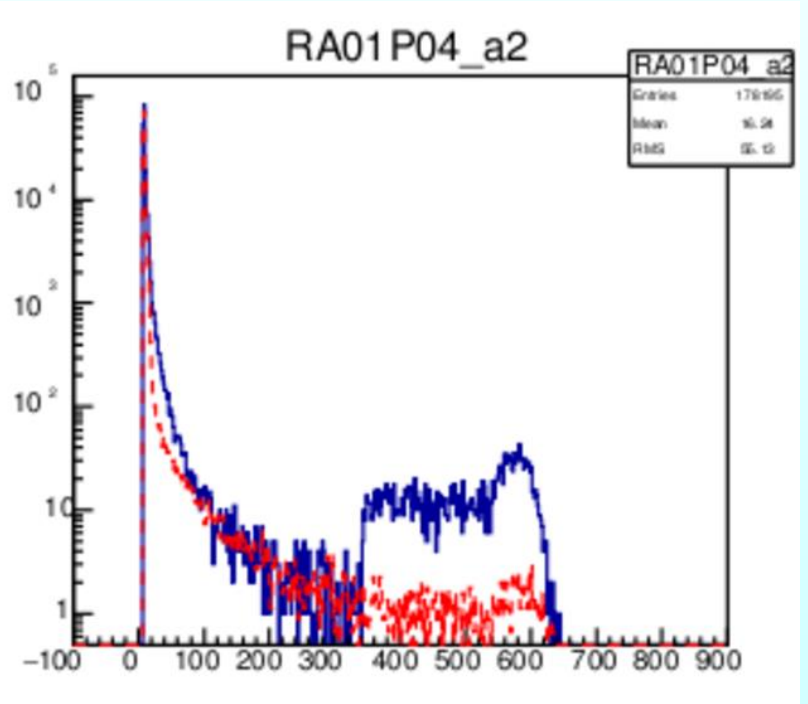


Rate of discharges in Hybrid PDs

We have on average about 3 discharges/day per sector



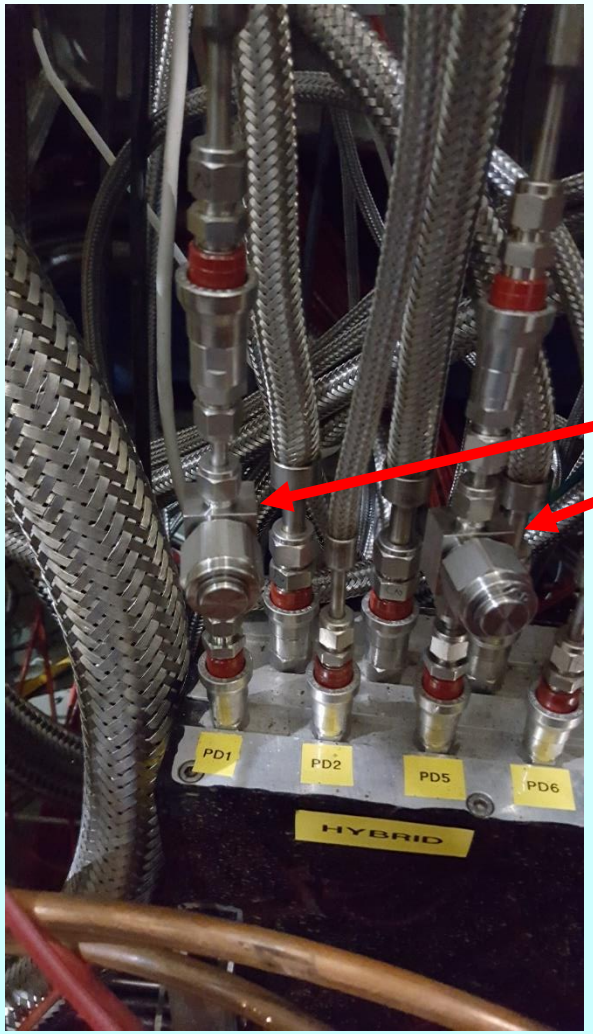
APV error rate:
SrcID 547: 8-10/day
SrcID 549: 4-5/day
SrcID 550: 4-5/day



The OFFSPILL LOAD procedure does work.
failue rate: ~ once-twice per month

New (7 µm pores) filters installed

We have 20 shorted pads (in 12000) in the Micromegas: to avoid micro-dust particulate contamination from the input gas, new filters have been installed



Swagelok 316 stainless steel particulate filter 7 µm pore size

No new shorts have developed in the last month

55 hits

Our bad C_4F_{10} is good for LHCb

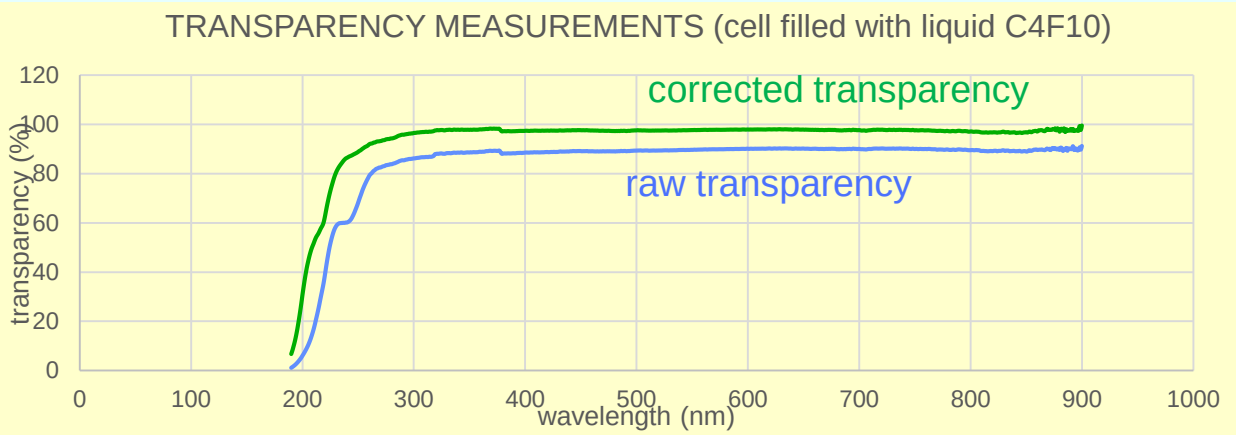
The only owner of significant amount of C_4F_{10} apart from COMPASS is LHCb

They use it as radiator for LHCb RICH1 (4 m^3 volume) which operates in the visible range (Hybrid vacuum–Si)PMs.

We explored the possibility to exchange our bad gas with better one from them.

We provided evidence to LHCb that our gas is fully transparent in the visible region.

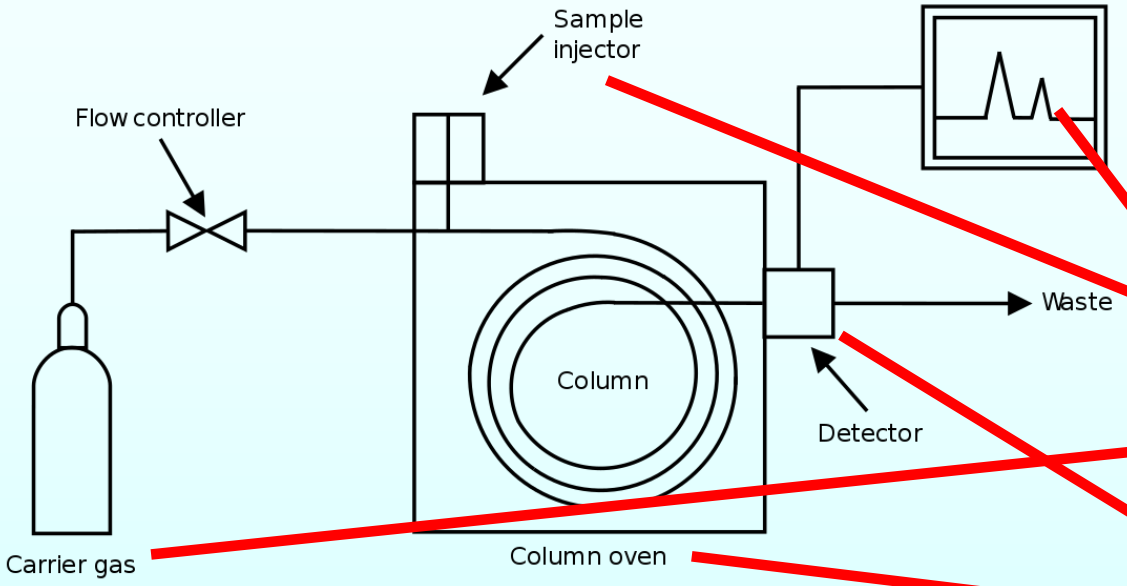
Cell for the transparency measurement of liquid C_4F_{10} in the visibile range

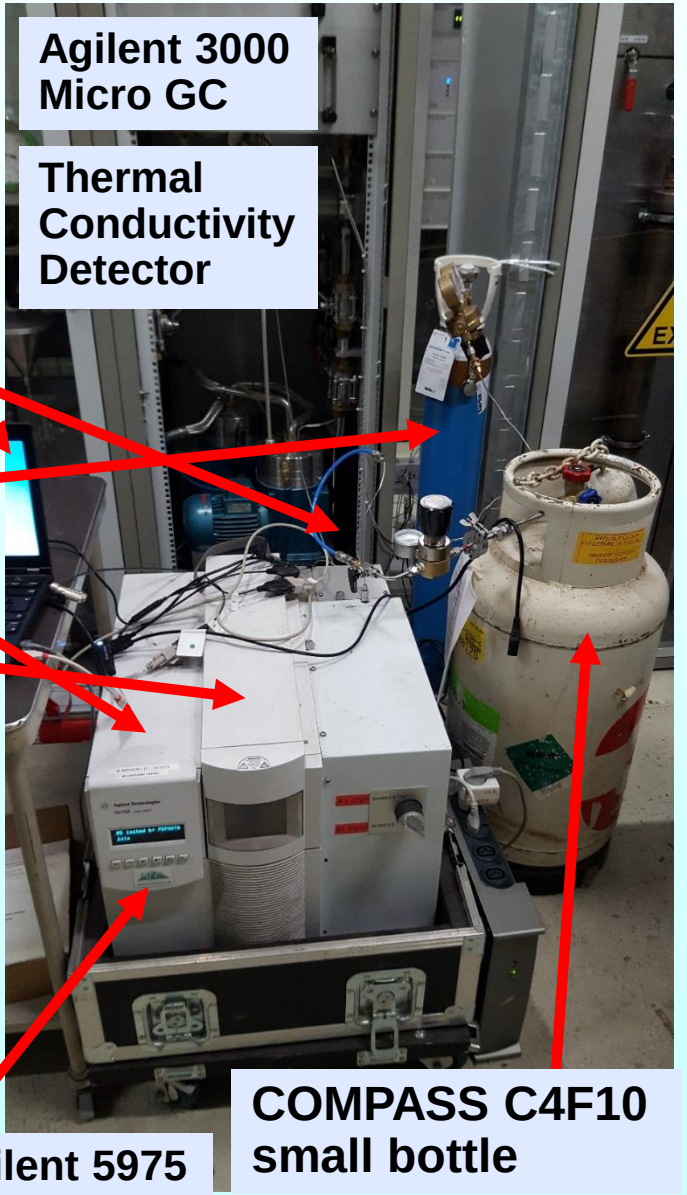


We received a small bottle from LHCb: the transparency of this gas, after passing through our active carbon and molecular sieve is unfortunately very similar to our bad gas.

New sample from a different production lot will be provided and a new transparency measurement is foreseen soon.

Gaschromatography





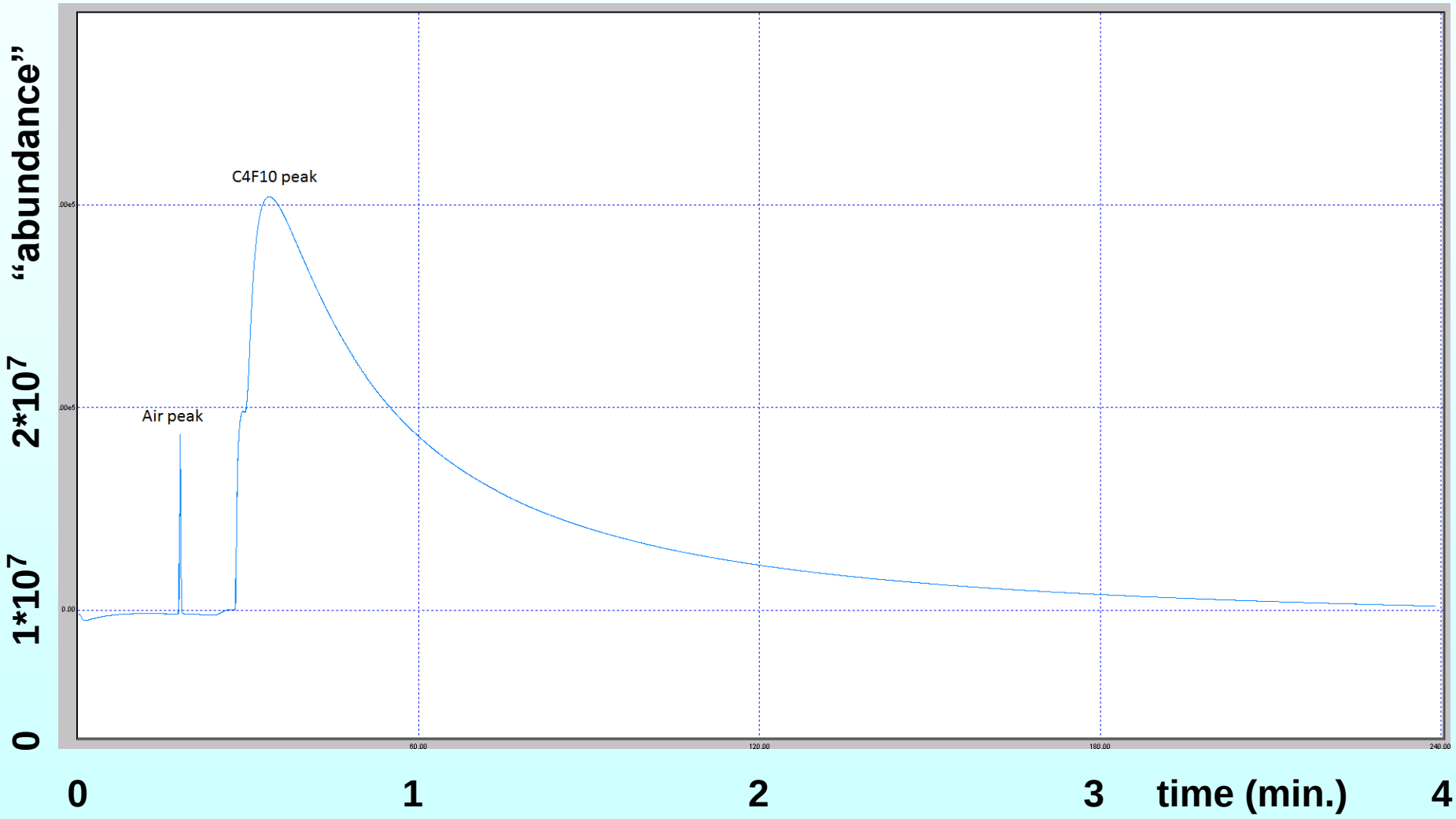
He carrier "mobile phase" in 8 m long capillary column, coated with a special "stationary phase" material.

Gaseous compounds elute at different times because the "retention time" of each compound is different (Van der Waals bonds with the stationary phase coating)

Thermal conductivity versus time is measured.

Different measurements with different temperature and He flow

C_4F_{10} gaschromatography spectrum



Preliminary analysis performed by Roberto Guida, Beatrice Mandelli and Giulio Candreva

Old LHCb C_4F_{10} gaschromatography

EDMS 1434322

PH Department
Detector technologies

EDMS Id 1434322	Created: 12/11/2014 Last modified: 12/11/2014	Nb. Of pages: 7 Version: 1

LHCb RICH1 Detector:
Gas chromatographic analysis of C_4F_{10} containers

https://edms.cern.ch/document/1434322

Roberto GUIDA
Beatrice MANDELLI
PH-DT-DI

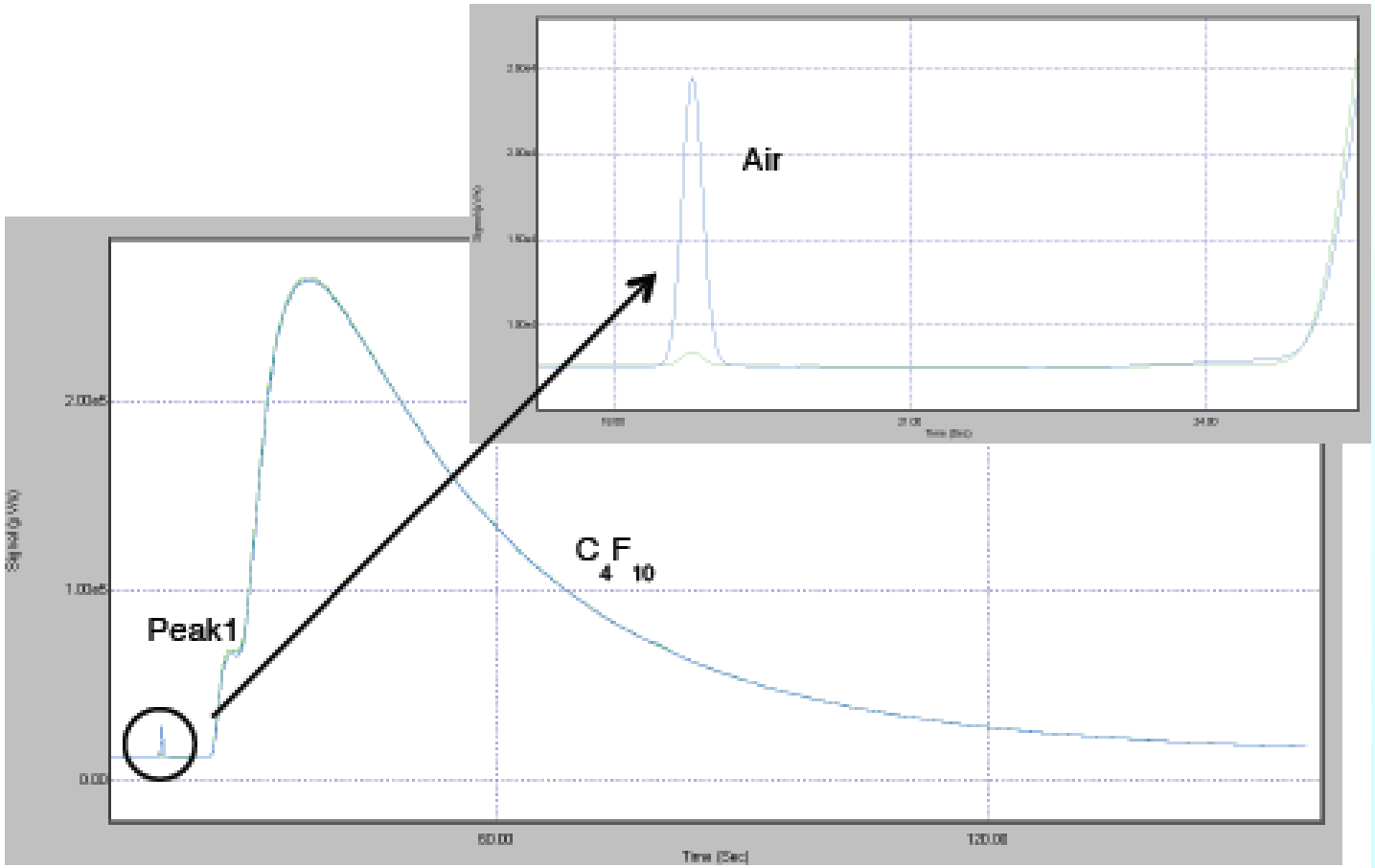
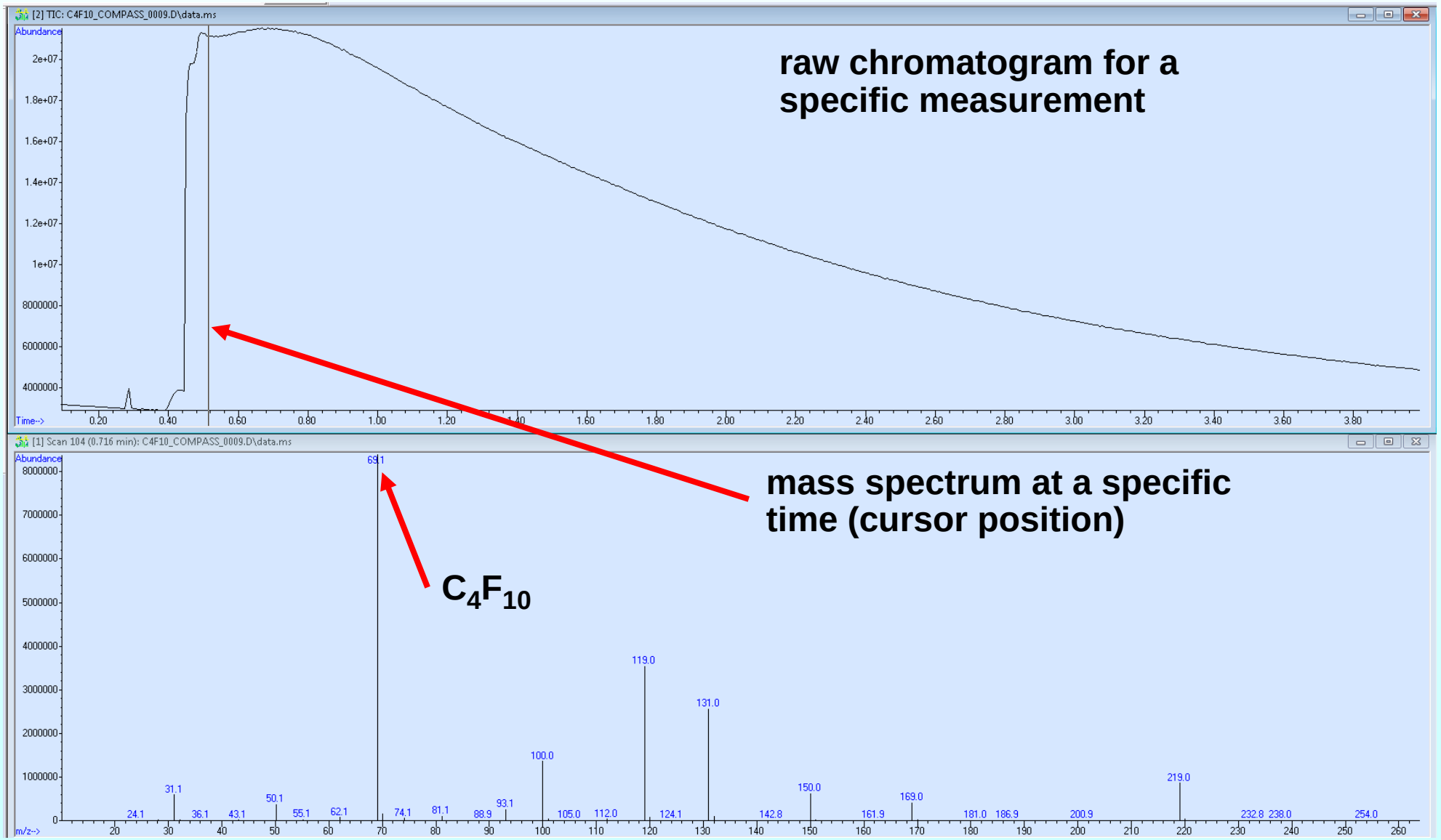
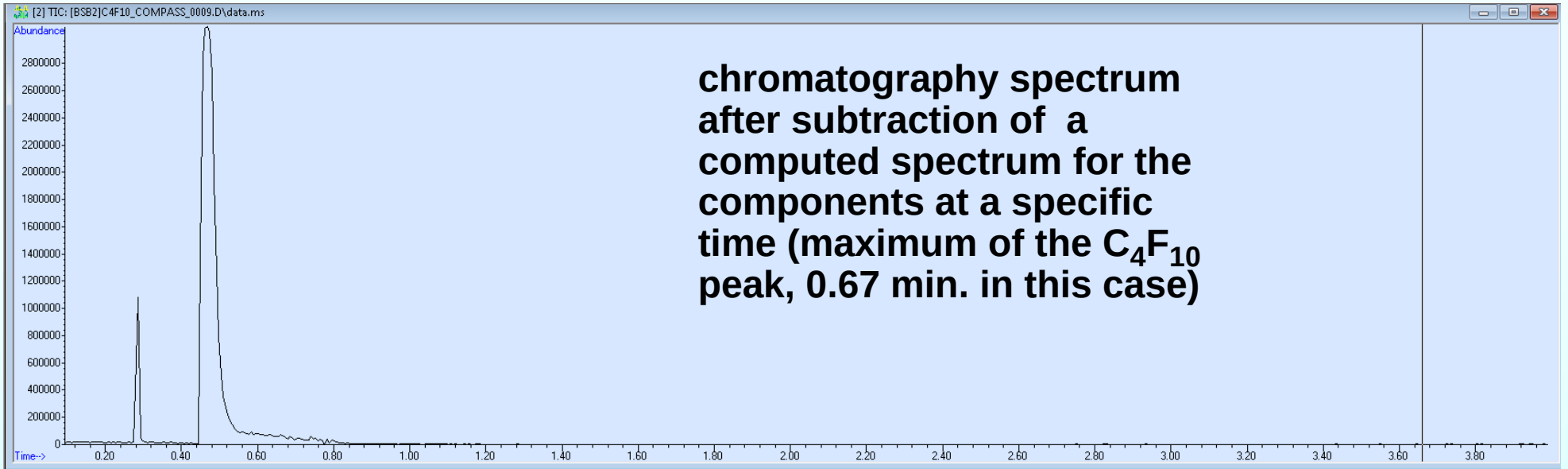


Fig. 2 Comparison of two chromatograms. The blue line is the vapour chromatogram while the green line is the liquid phase chromatogram. The circle shows the Air peak while the unknown peak is named "Peak1" in the chromatogram. In the zoomed window the Air peak is shown: in the vapour phase it could be also 20 times higher than in the liquid phase.

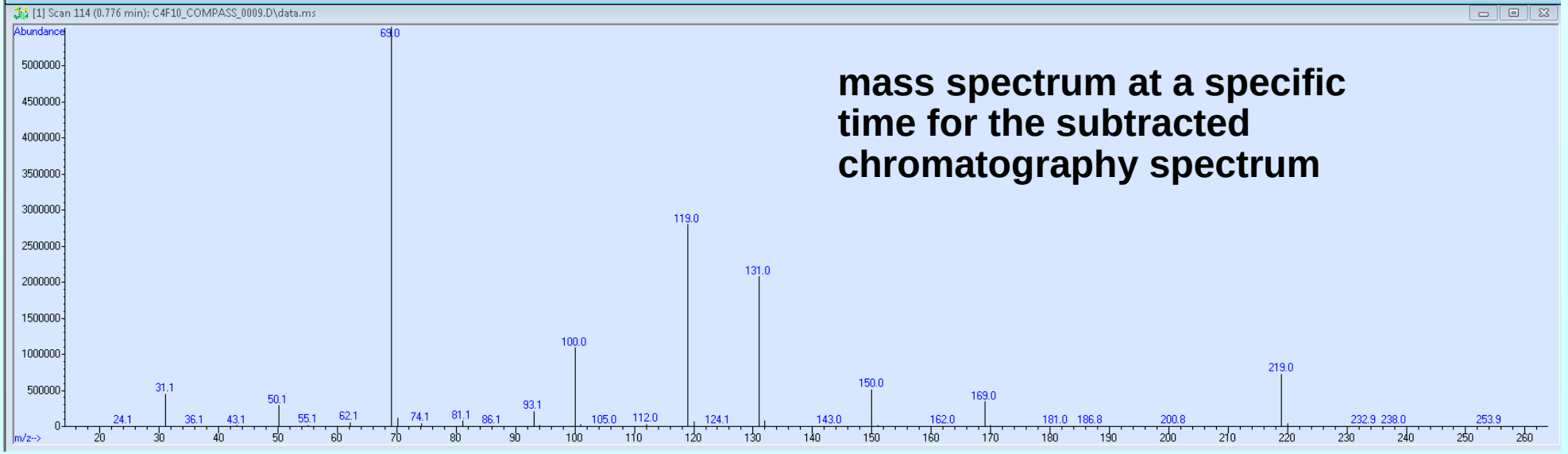
Mass spectrum at given time



Preliminary analysis: step 2

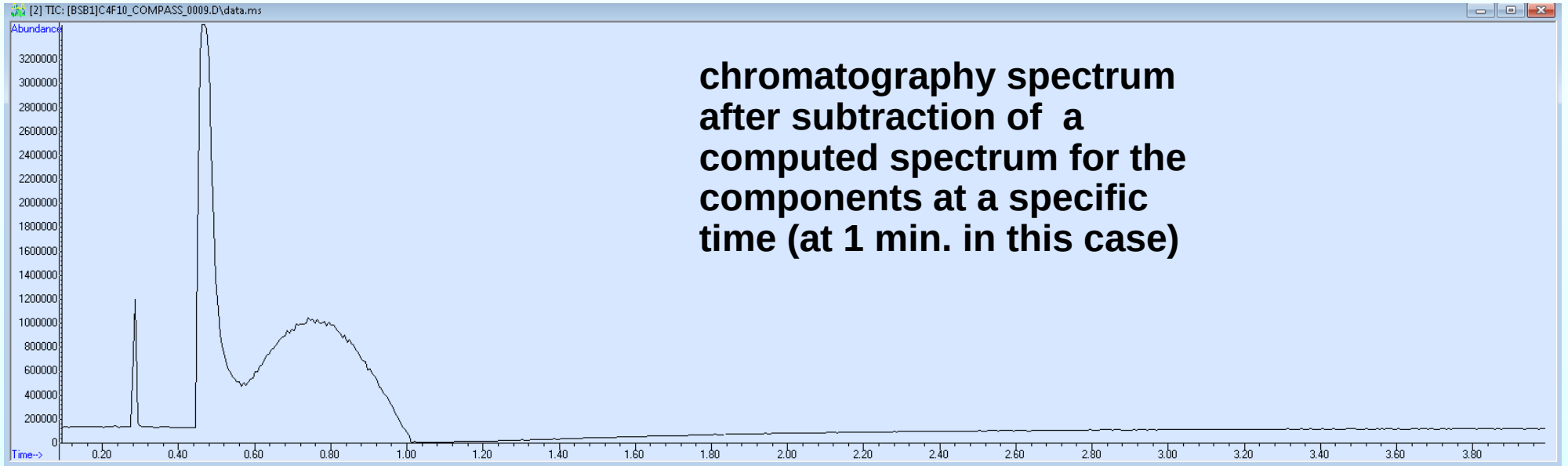


chromatography spectrum after subtraction of a computed spectrum for the components at a specific time (maximum of the C_4F_{10} peak, 0.67 min. in this case)

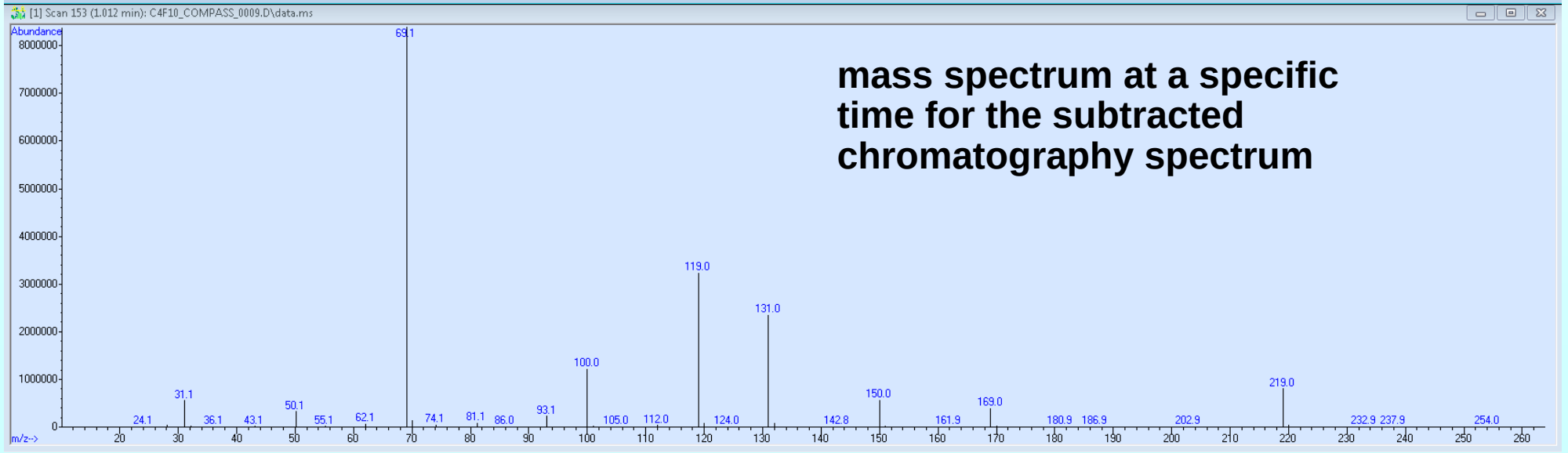


mass spectrum at a specific time for the subtracted chromatography spectrum

Preliminary analysis: step 2

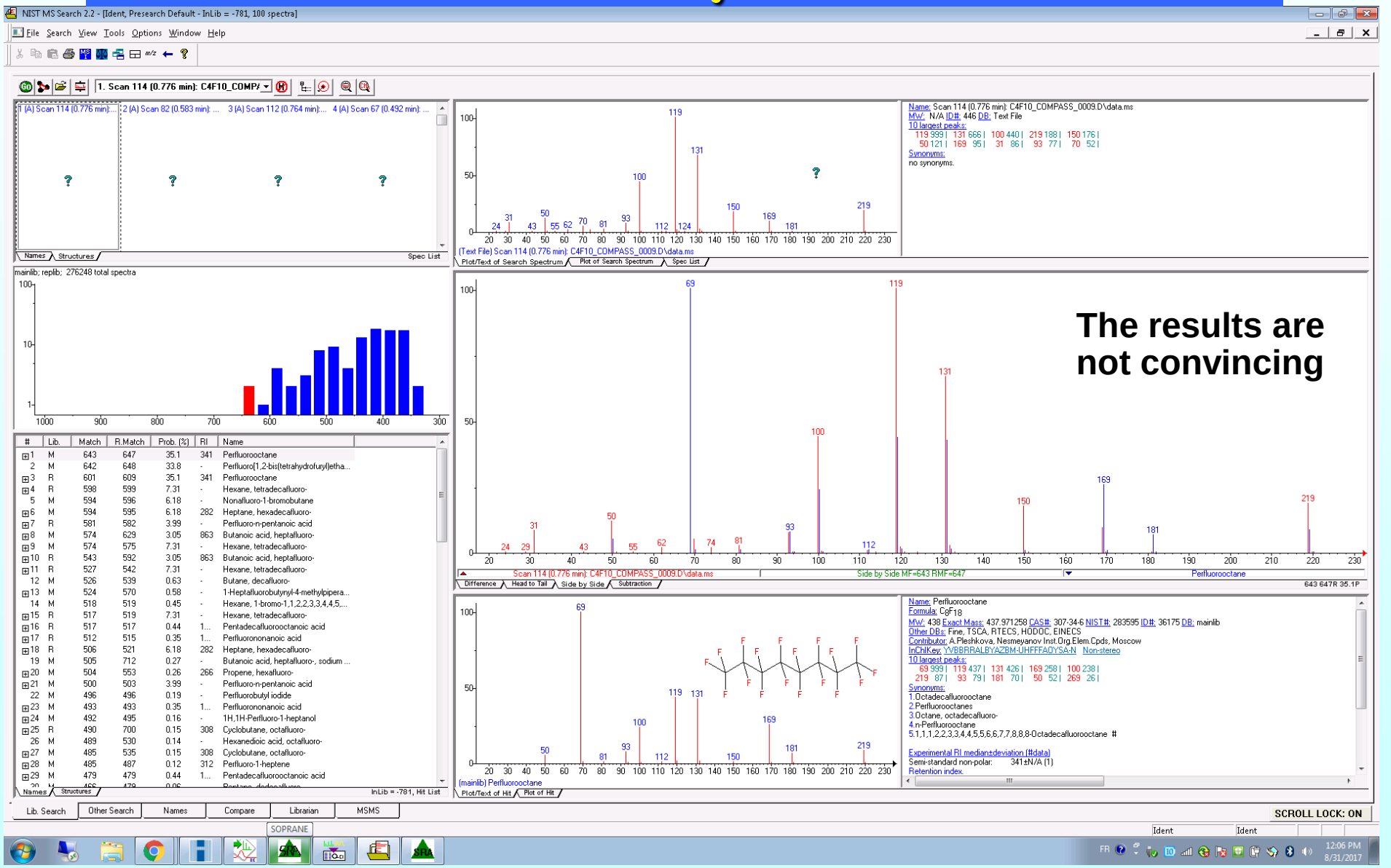


chromatography spectrum after subtraction of a computed spectrum for the components at a specific time (at 1 min. in this case)

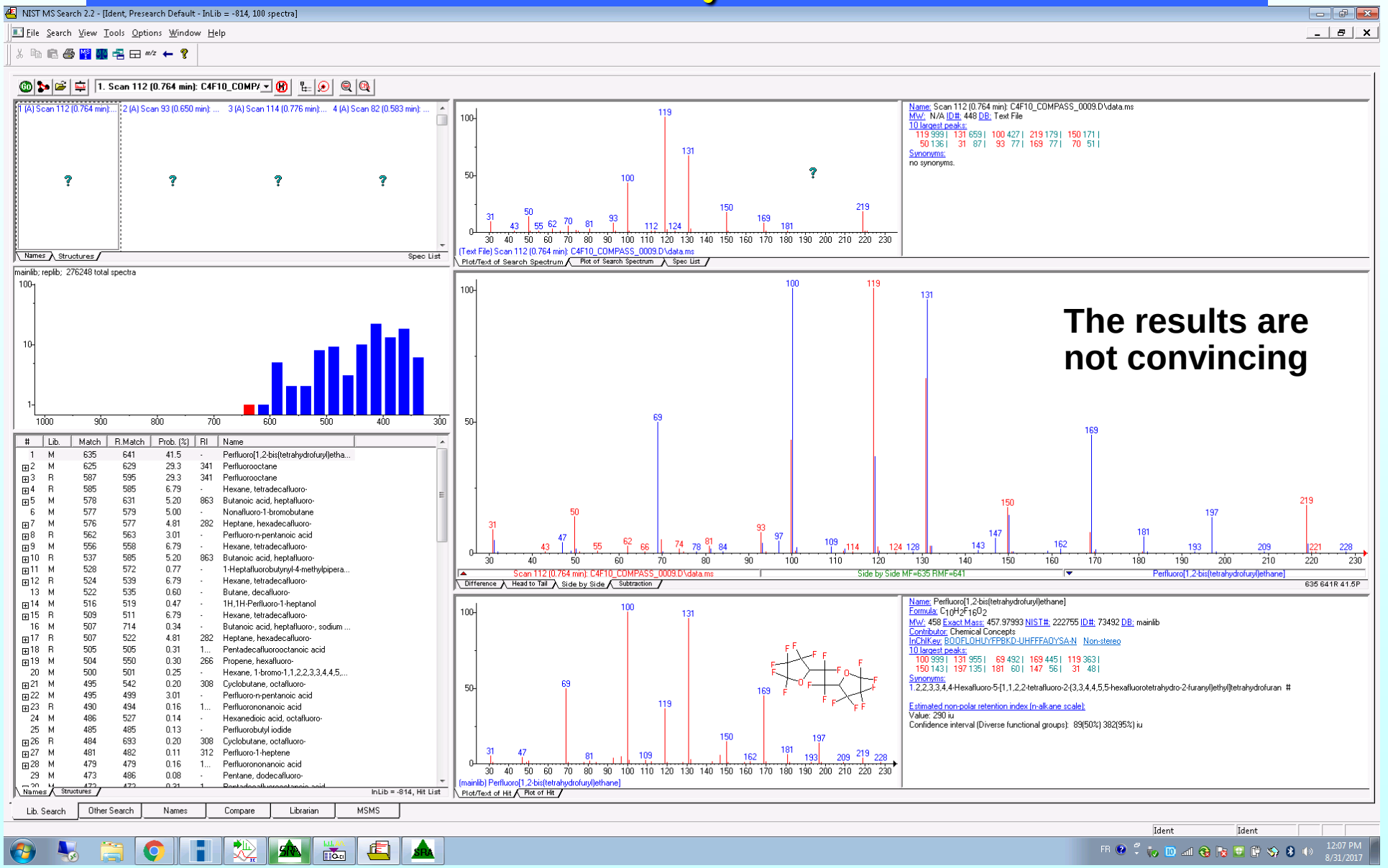


mass spectrum at a specific time for the subtracted chromatography spectrum

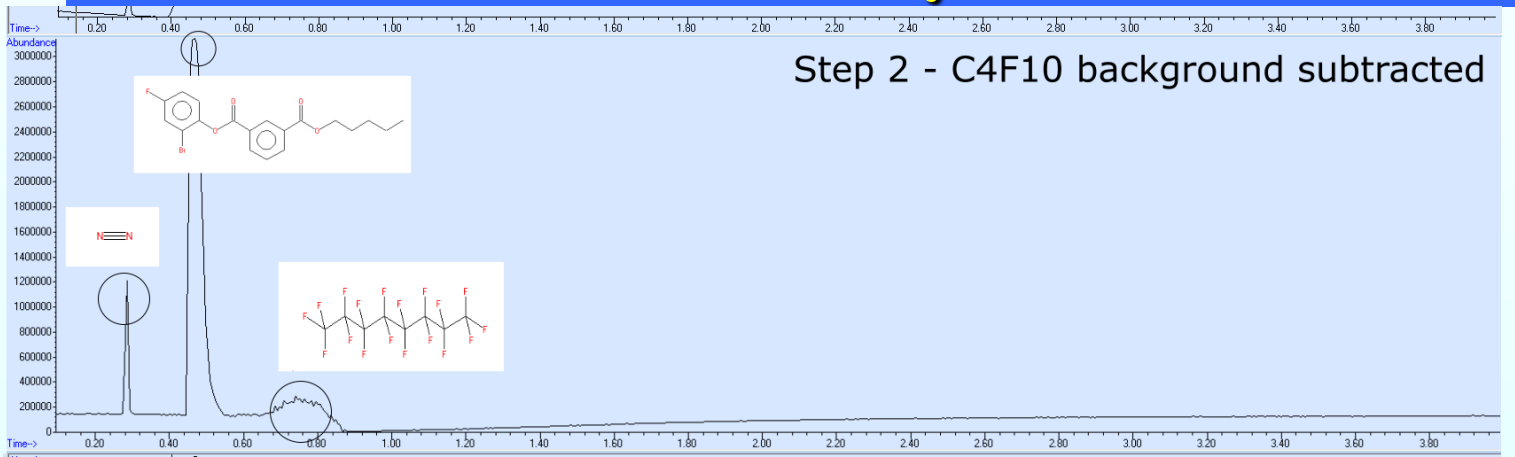
Preliminary results

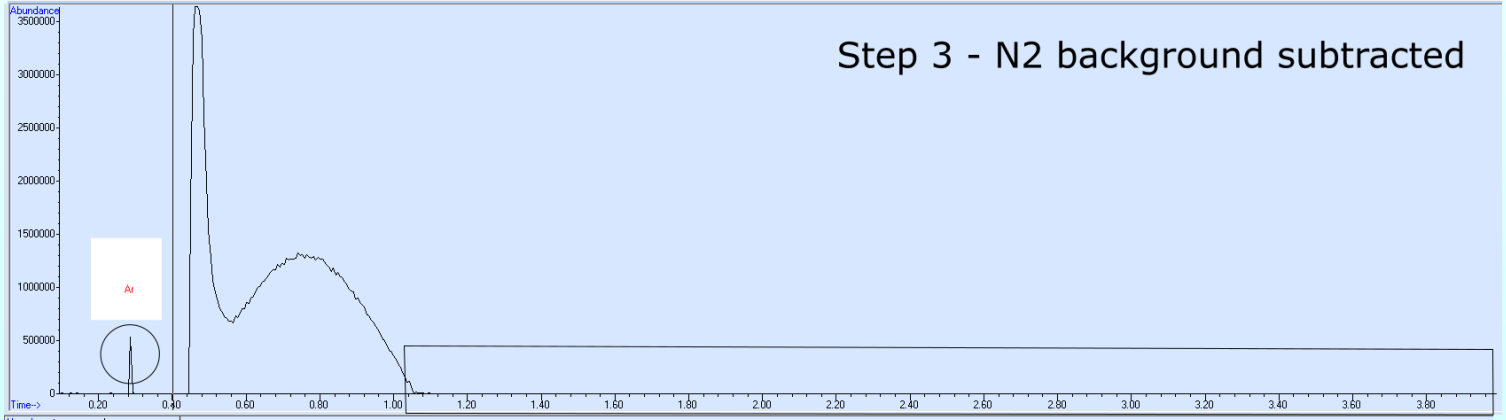


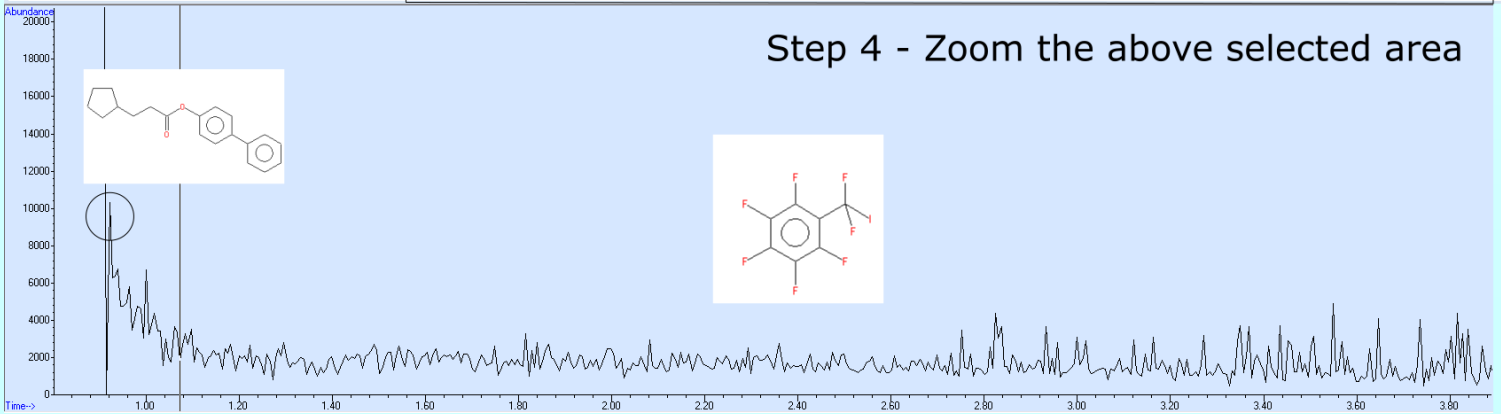
Preliminary results



Preliminary results

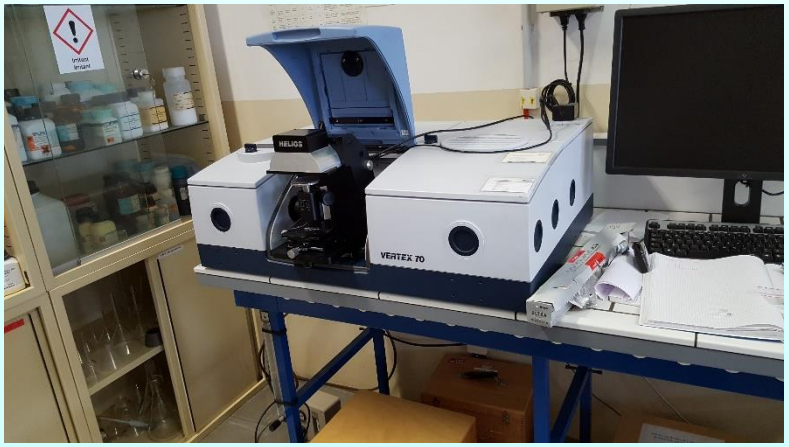


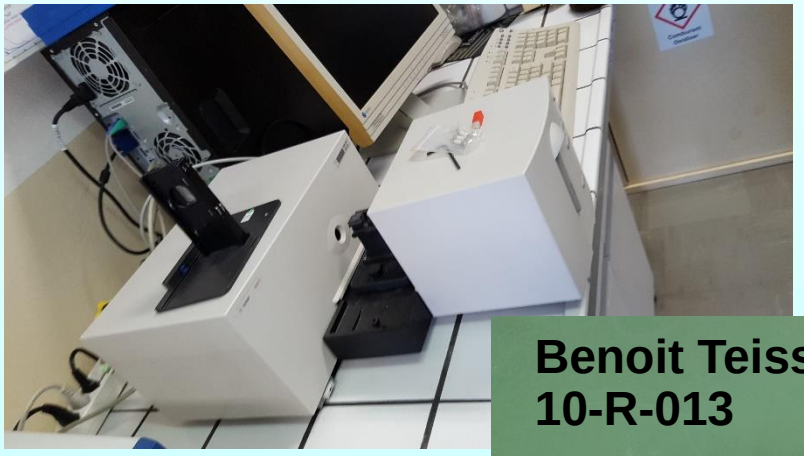




The results are not convincing but they hint at the presence of longer chains and do not exclude the presence of aromatic rings

Next step: further analysis





The CERN VSC (Vacuum Surface and Coating) Group has a chemical laboratory equipped with analysis instruments: Gas-chromatograph (60 m long column) with Mass Spectroscopy,
IR and UV gas spectroscopy - UV transparency analyzer.
We agreed on a first measurement of our gas in September