Quantitative Gas Analysis

Determination of the concentration of gas species as a part of the hole gas mixture.

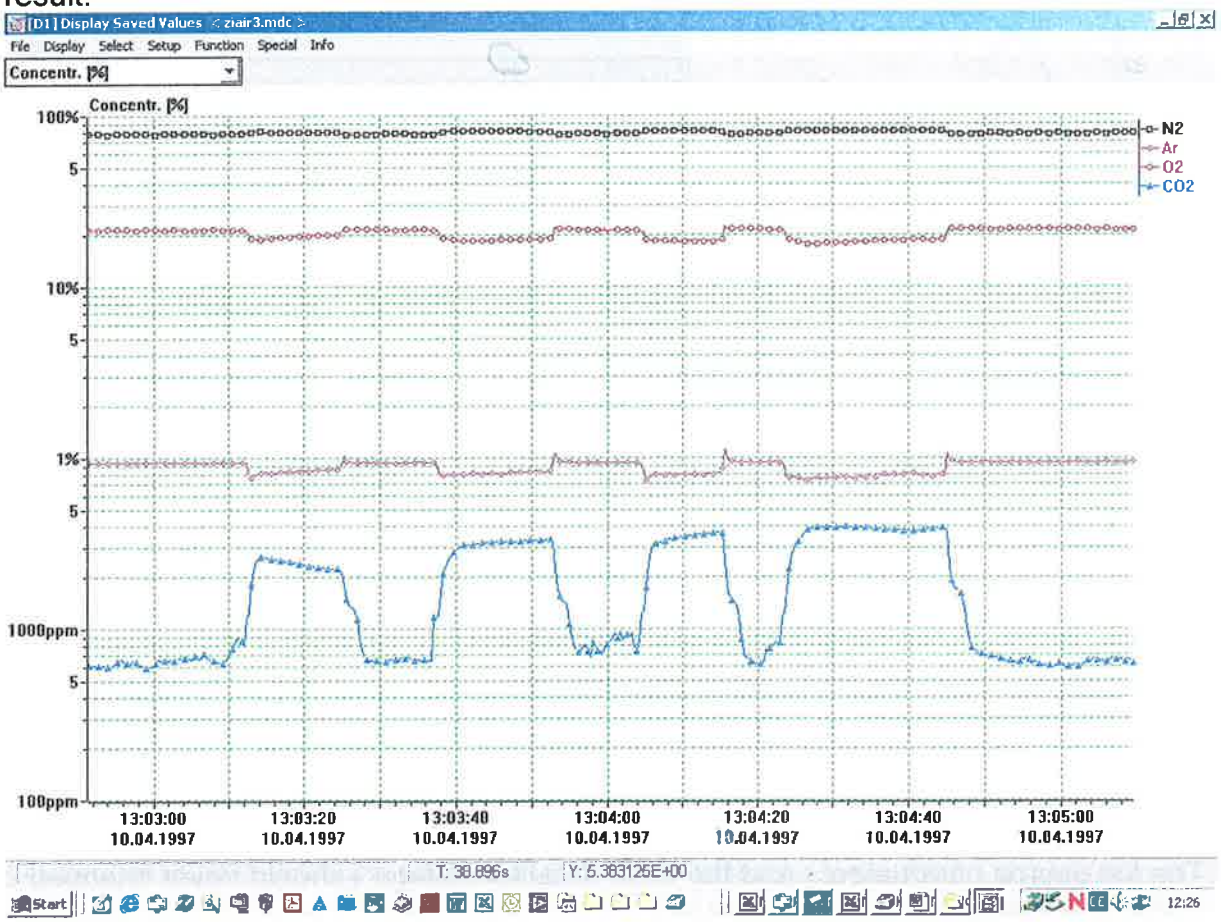
predictions:

- QMS with QuadStar software (QAM-module)
- calibration gases

procedure with the QuadStar software:

- tuning of the ion source parameters (" tune up ")
- offset calibration
- mass scale adjust
- zero gas measurement (background determination)
- gas specific calibration with calibration gases with known concentration
- measurement of the unknown gas mixture

result:



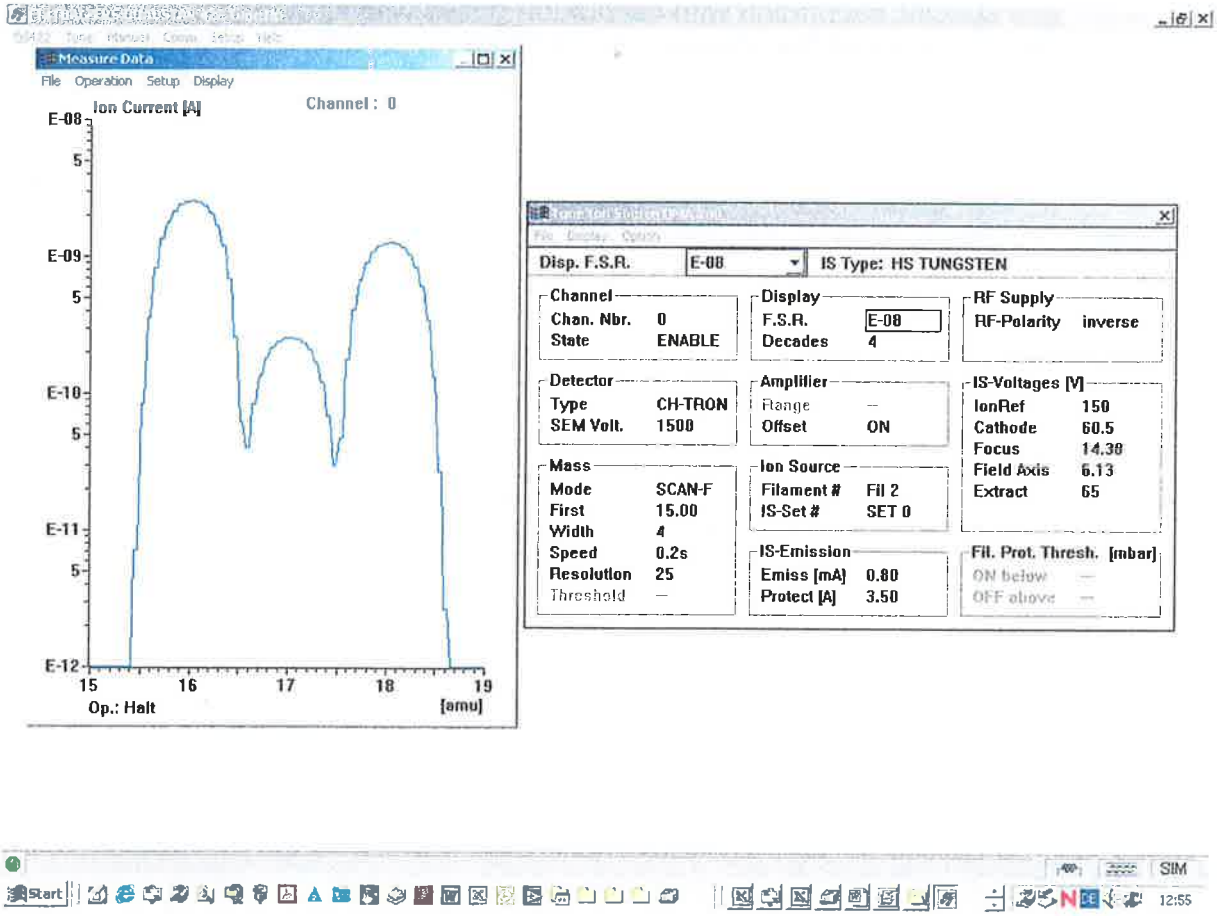
Tuning of the ion source parameter

prediction: sample gas inlet

"Tuneup" menue , ➔ "Ion source ...."
optimation of the ion source parameters regarding of:

- maximum of intensity
- best resolution for the interesting masses
- peak shape
- stability

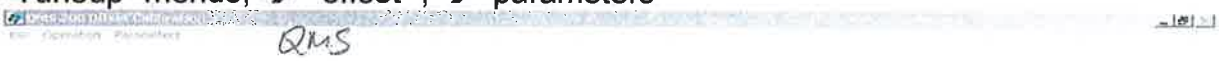
result:



Remark:
The ion source parameters (and the SEM detector voltage) should never changed during the following measurements !!!

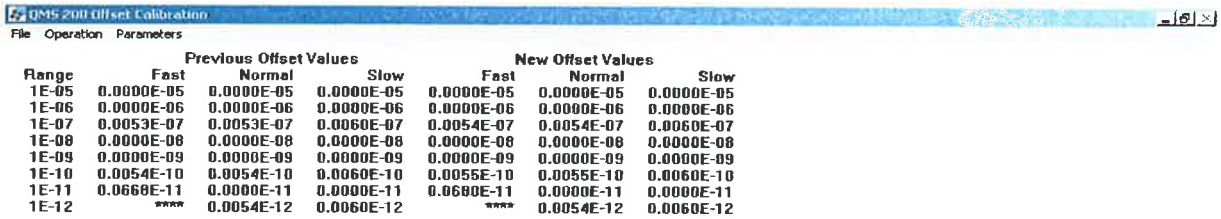
Offset calibration

Determination of the offset of the electrometer preamplifier in each range.
(without gas inlet or with emission off)
"Tuneup" menue, ➔ " offset ", ➔ "parameters"



- select mass 5,5 amu for QMA 400/430/410 and 50,5 amu for PRISMA
- Set detector type to Faraday and resolution to 1 (Prisma)

result:



QMS 200 Offset Calibration

File Operation Parameters

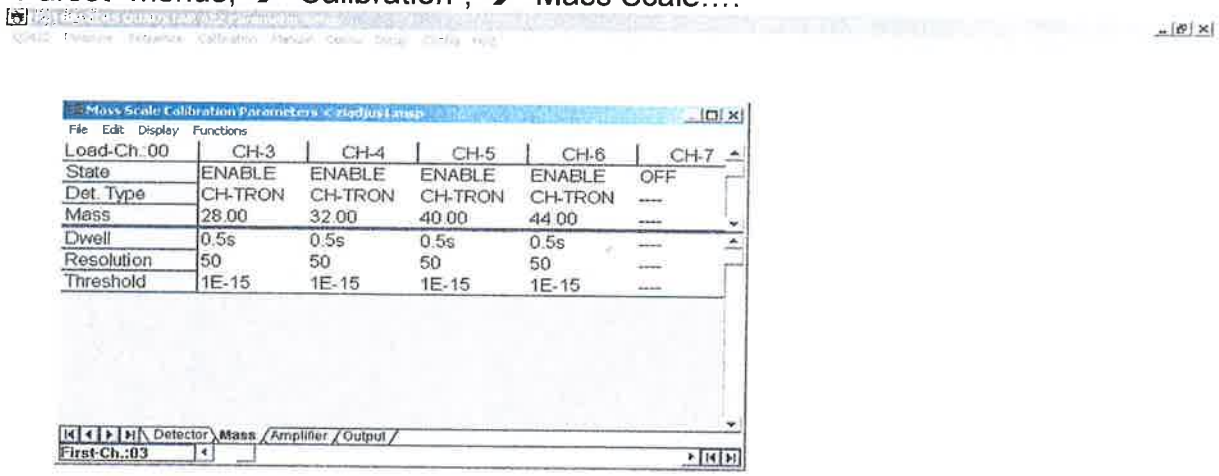
	Previous Offset Values			New Offset Values		
Range	Fast	Normal	Slow	Fast	Normal	Slow
1E-05	0.0000E-05	0.0000E-05	0.0000E-05	0.0000E-05	0.0000E-05	0.0000E-05
1E-06	0.0000E-06	0.0000E-06	0.0000E-06	0.0000E-06	0.0000E-06	0.0000E-06
1E-07	0.0053E-07	0.0053E-07	0.0060E-07	0.0054E-07	0.0054E-07	0.0060E-07
1E-08	0.0000E-08	0.0000E-08	0.0000E-08	0.0000E-08	0.0000E-08	0.0000E-08
1E-09	0.0000E-09	0.0000E-09	0.0000E-09	0.0000E-09	0.0000E-09	0.0000E-09
1E-10	0.0054E-10	0.0054E-10	0.0060E-10	0.0055E-10	0.0055E-10	0.0060E-10
1E-11	0.0668E-11	0.0000E-11	0.0000E-11	0.0680E-11	0.0000E-11	0.0000E-11
1E-12	****	0.0054E-12	0.0060E-12	****	0.0054E-12	0.0060E-12

Mass scale adjust

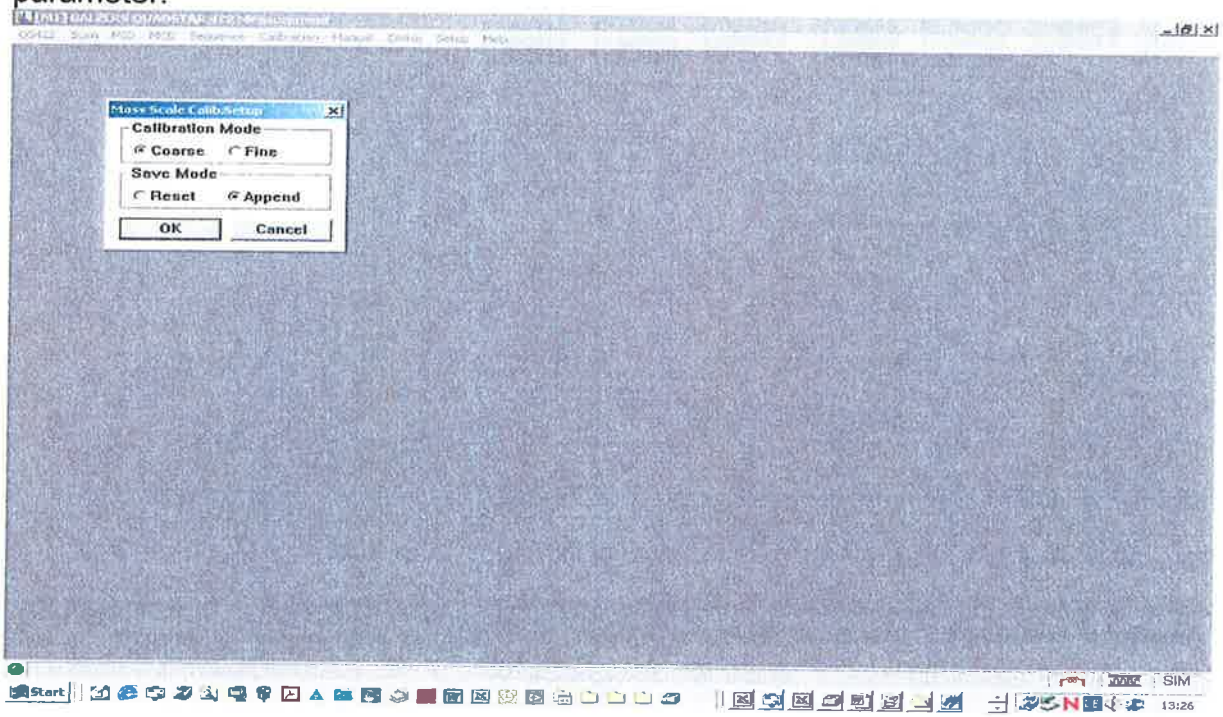
Adjust of the peak maximum of each mass number of interest.

predictions: - gas inlet of the sample gas (or calibration gases)

parameter:
"Parset" menue, ➔ "Calibration", ➔ "Mass Scale...."



"Measure" menue, ➔ "Calibration", ➔ "Mass Scale Adjust"
parameter:

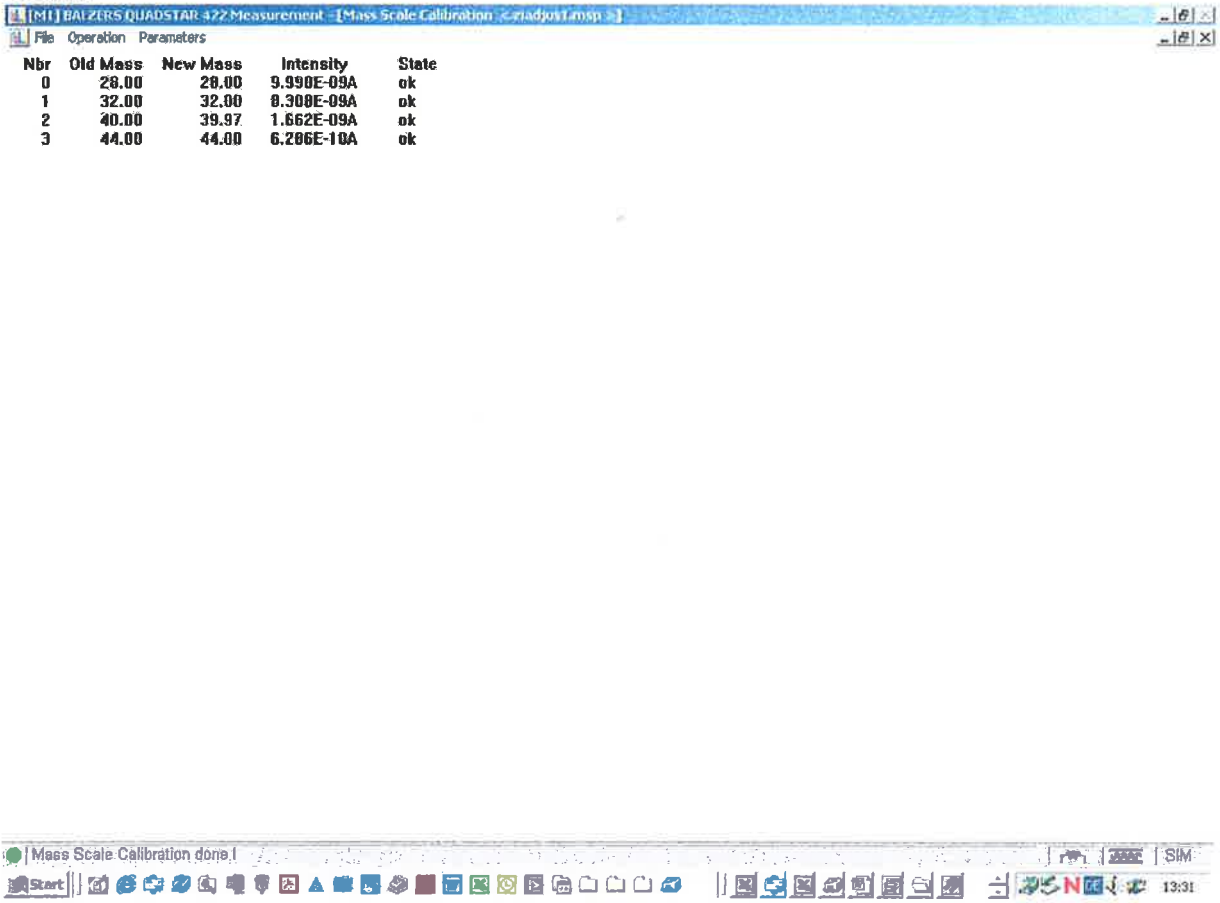


Erstelldatum 13.11.2000 12:04:0020:54

Remarks:

- "coarse" ➔ "fine"
- in the "append" mode, new mass numbers will be append, existing mass numbers will be overwritten

result:



Remark:

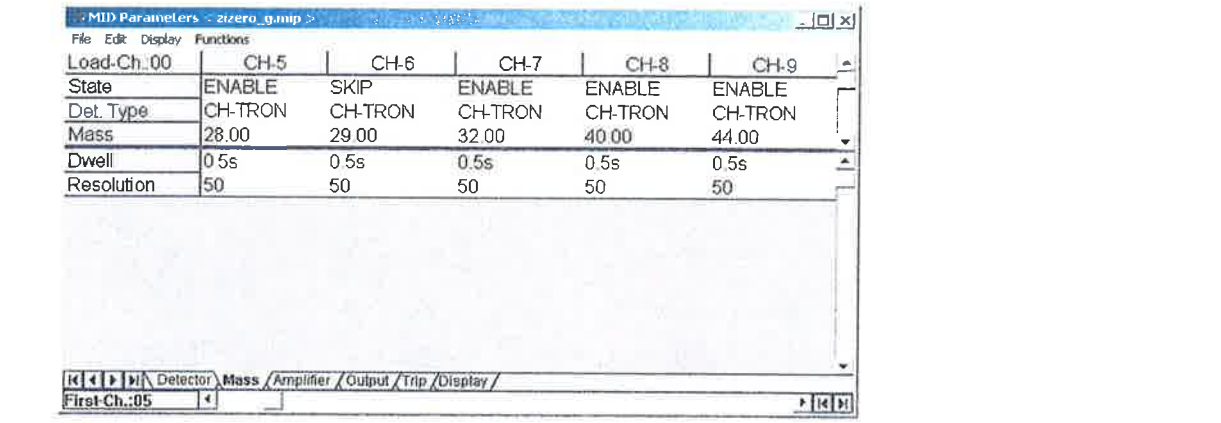
- all existing parameter files (MID and MCD) will be corrected with the actual mass scale correction

Zero Gas Measurement

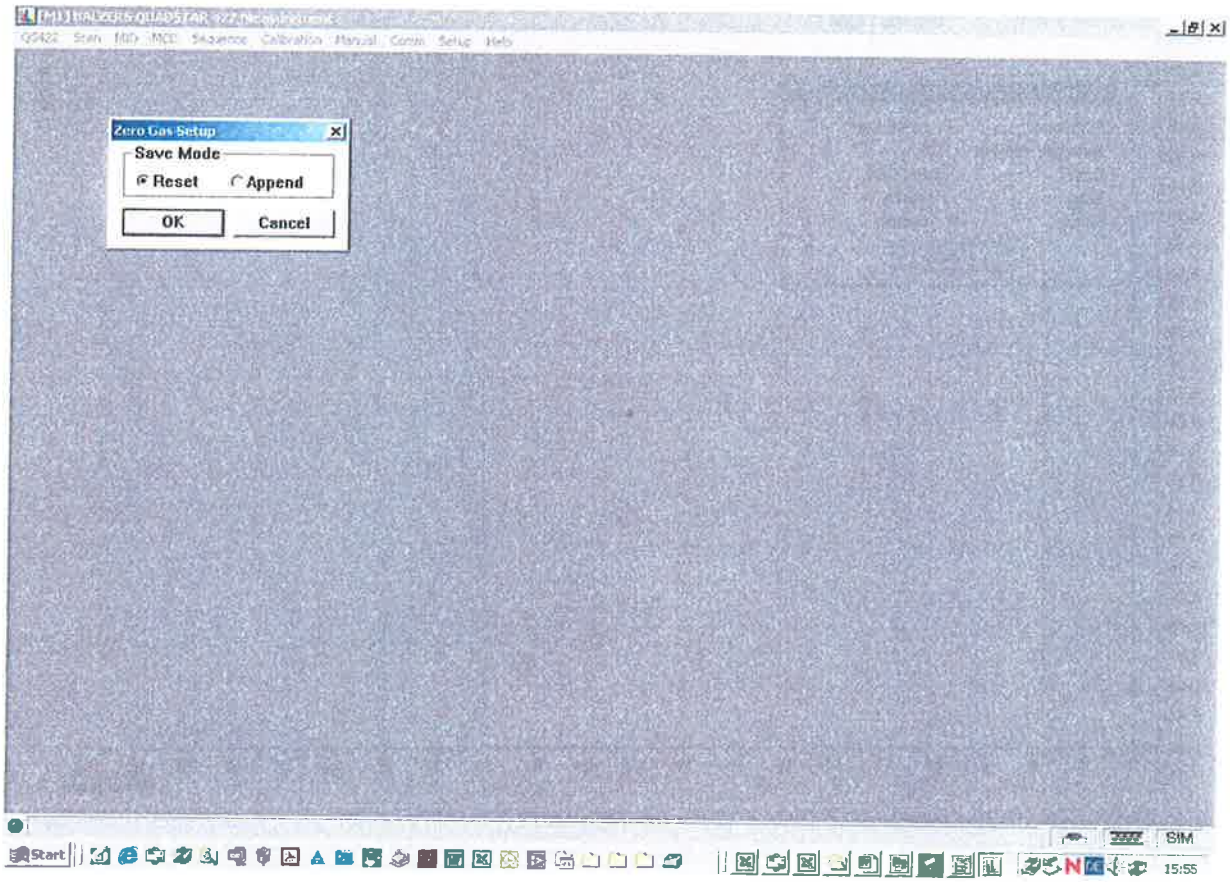
Determination of the intensity at the interesting mass numbers caused by the "backround" of the analyze chamber or by a "zero gas" inlet.
➔ $I_{res.}$ (m/e= ?)
predictions:

- inlet of the zero gas (very pure gas)
- or closed gas inlet, determination of the residual gas components

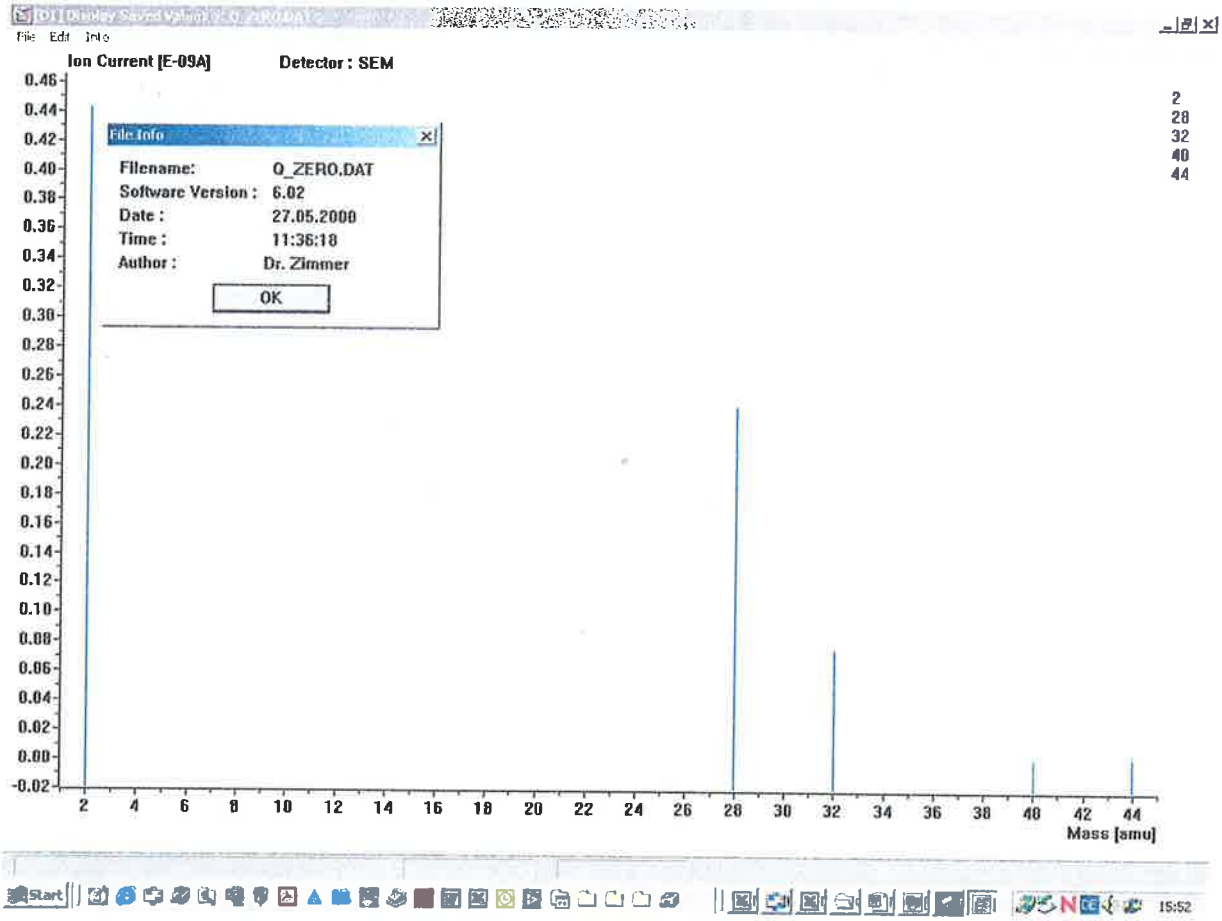
parameter:
"Parset" menue, ➔ "MID",



"Measure" menue, ➔ "Calibration", ➔ "Zero Gas…."



result: in file “Q_zero.dat”



Remarks:

- you can detemind the background at more mass numbers than you need (in the example m/e= 2)
- in the “append” mode, new mass numbers will be append, existing mass numbers will be overwritten

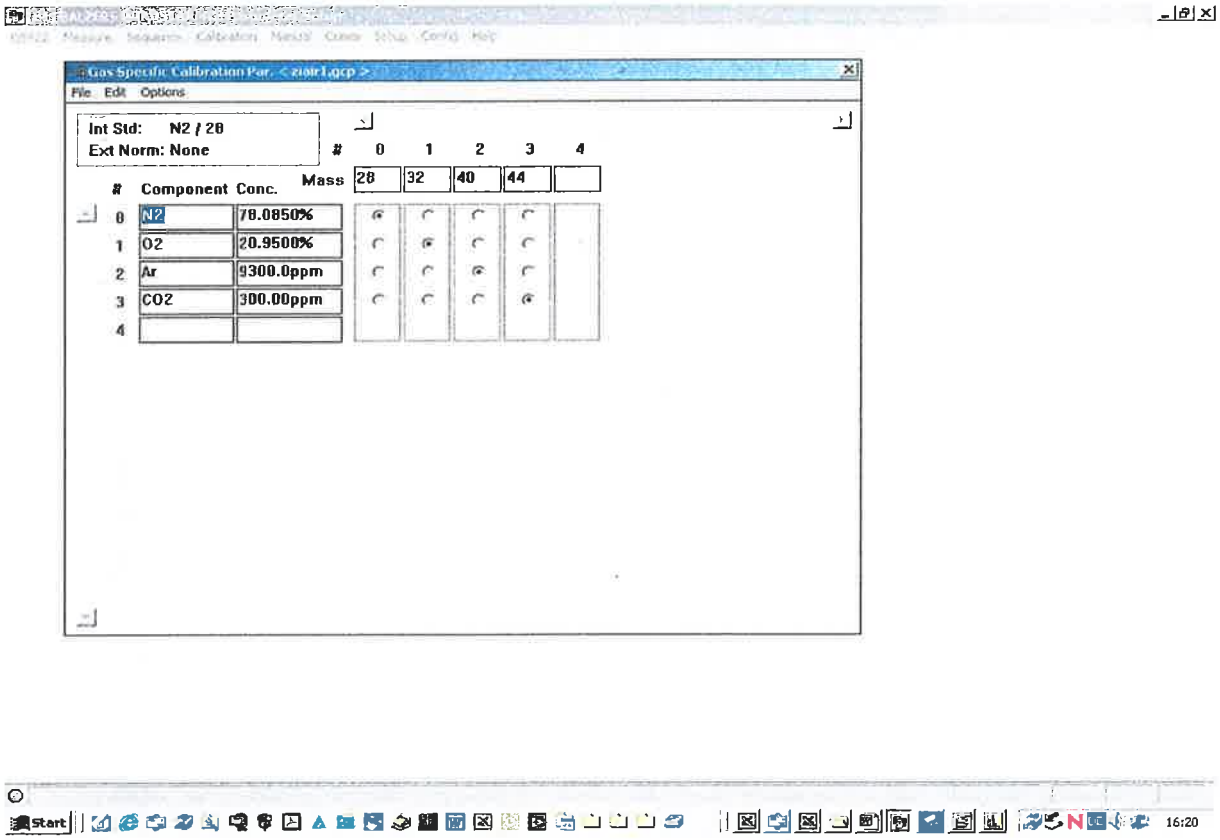
Gas Specific Calibration

Determination of the calibration factors (matrix) for each mass number and gas species.
➔ $K(C_x) = I_{cal}(x) / c_x$, with $I_{cal}(x) = I_{tot}(x) - I_{res}(x)$

predictions:

- calibration gas mixtures with non overlapped fractal pattern
- calibration gas inlet open

parameter:
"Parset" menue, ➔ "Calibration", ➔ "Gas Specific Sensity"



Remarks:

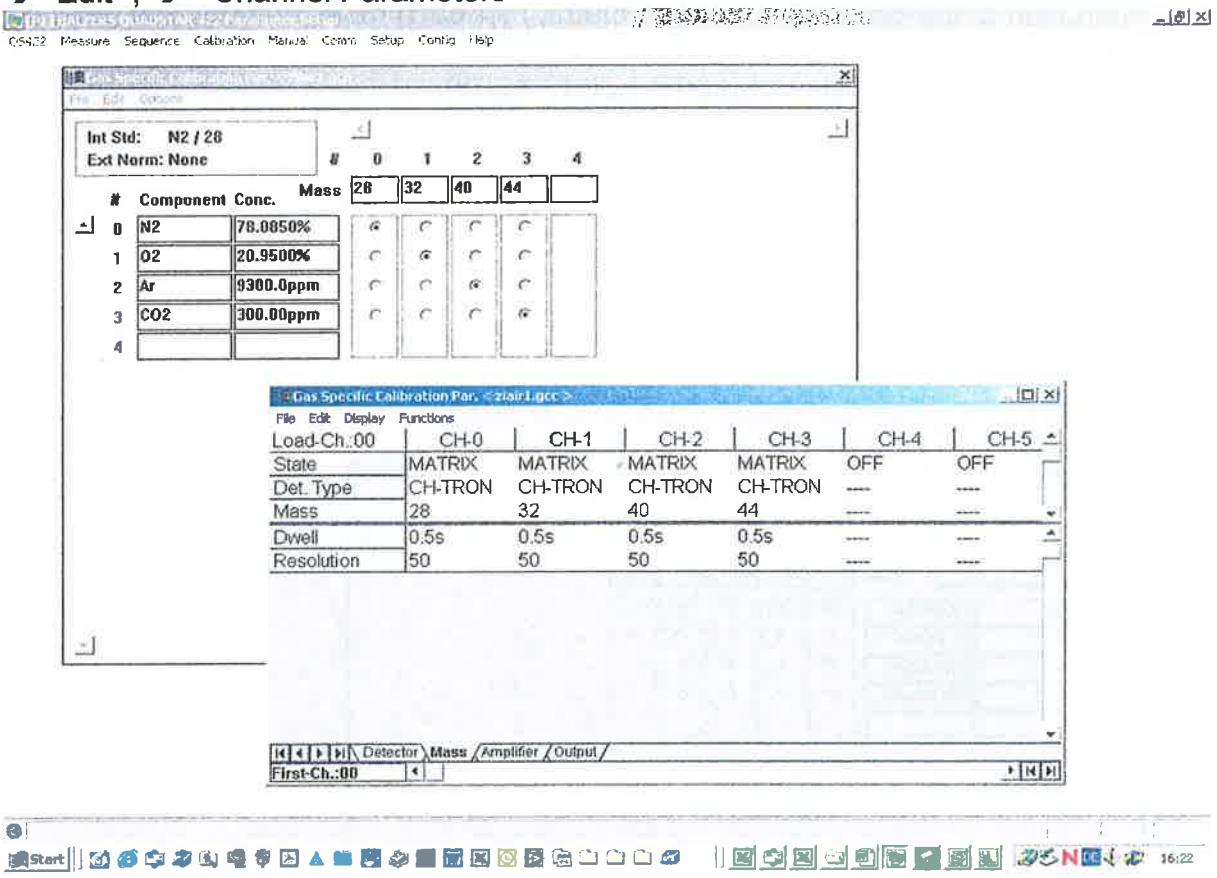
"Internal Standard" means not only, that the calibration factor is equal "1", it means also that the component which is defined as "internal standard" change not the (former determind) calibration factor.

Example:
Now we have for the same measurement task 3 calibration gas mixtures.

a) Ar / CO_2
b) N_2 / O_2
c) Ar / O_2

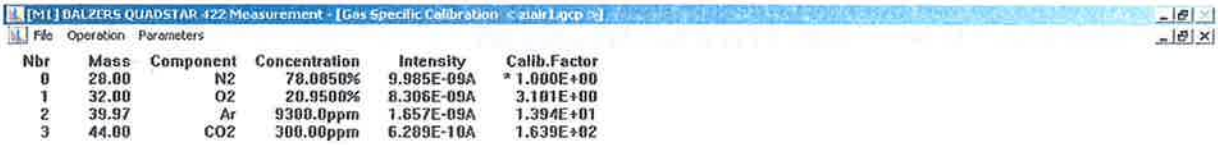
possible calibration procedure:
1. Ar / O_2 , internal standard : Ar
2. N_2 / O_2 , internal standard : $\underline{O_2}$
3. Ar / CO_2 , internal standard : $\underline{Ar}$

➔ "Edit" , ➔ "Channel Parameters"



"Measure" menue, ➔"Calibration", ➔ "Gas Specific Sensity"

result:



Nbr	Mass	Component	Concentration	Intensity	Calib.Factor
0	28.00	N2	78.0850%	9.985E-09A	* 1.000E+00
1	32.00	O2	20.9500%	8.306E-09A	3.101E+00
2	39.97	Ar	9300.0ppm	1.657E-09A	1.394E+01
3	44.00	CO2	300.00ppm	6.289E-10A	1.639E+02

Remarks:

- " * " shows the internal Standard (in the example N_2 at 28)

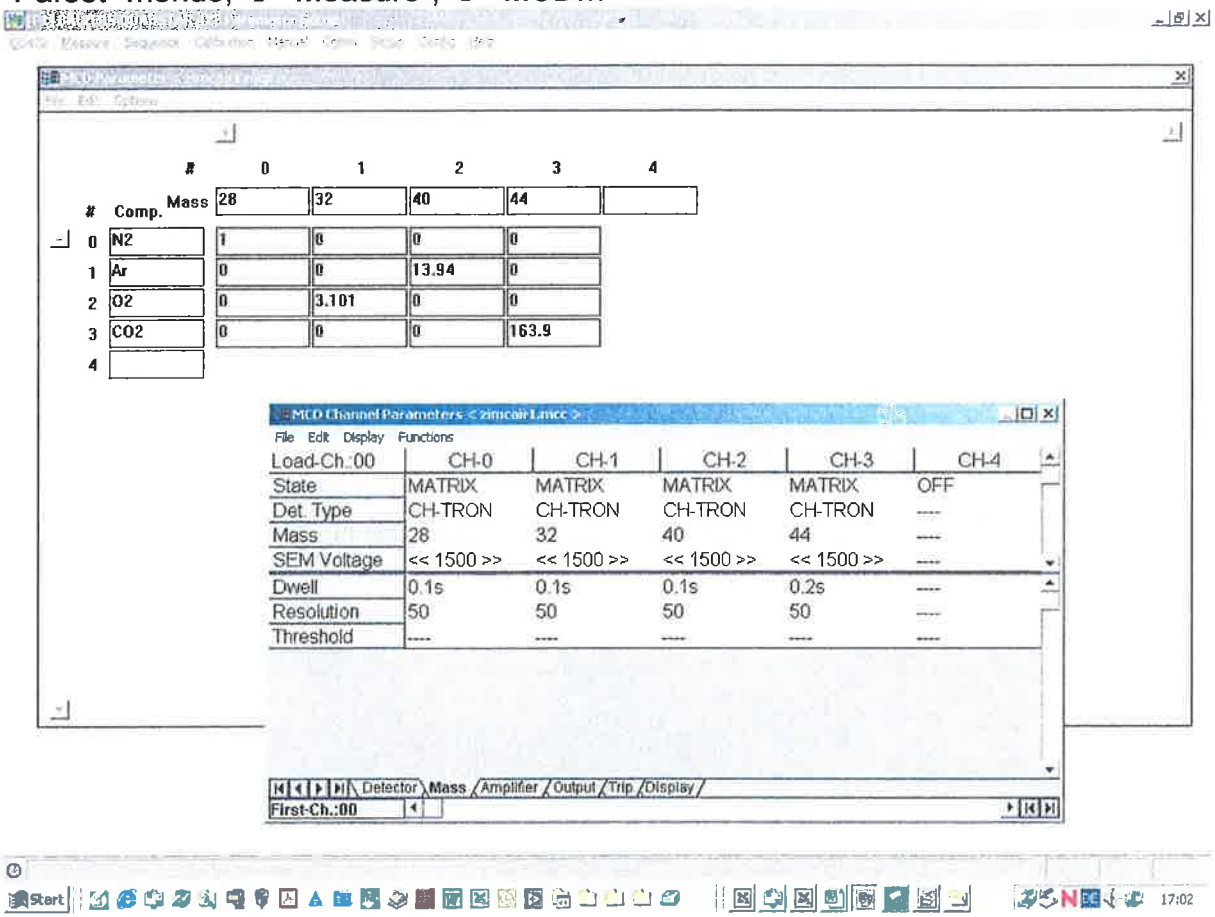
MCD measurement

Determination of the concentration of gas species in a unkwown gas mixture.
➔ C (x) = I (x) / K (x) with I (x) = I_{total} (x) – I_{res} (x)

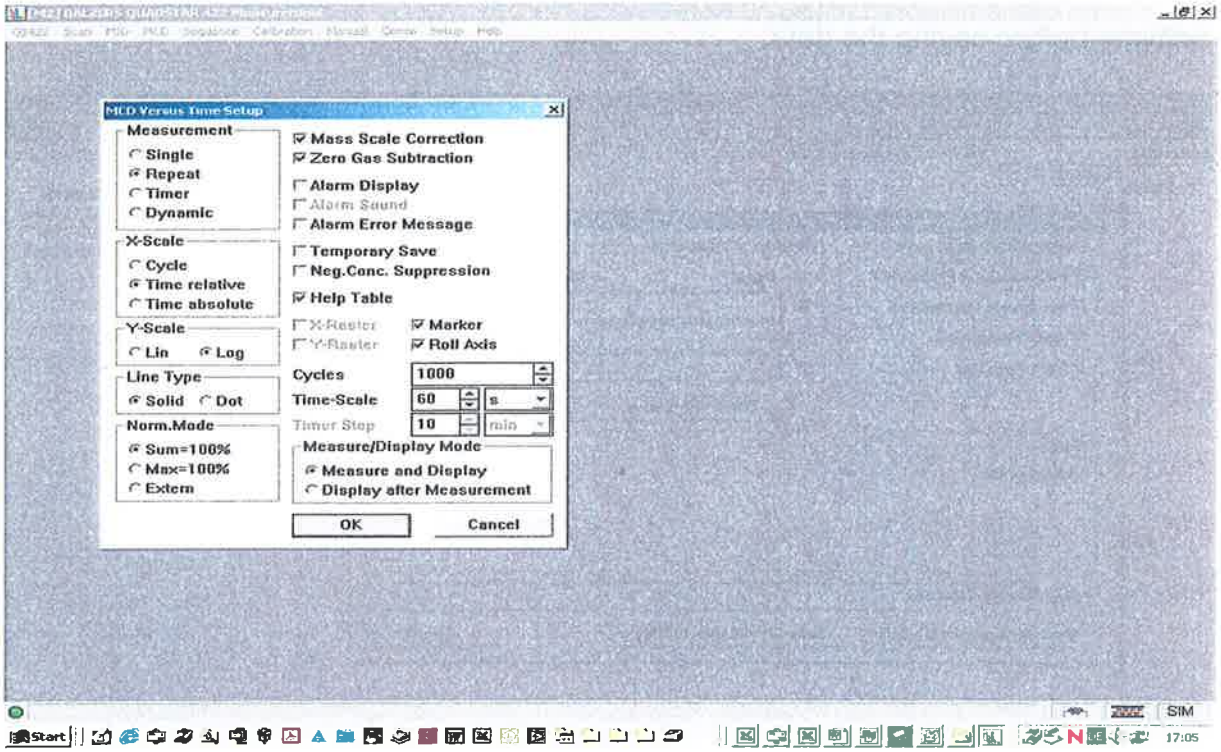
predictions:

- all calibration procedures done
- no change in the ion source parameters, same detector, same SEM voltage (use the feature “common voltage”), same resolution parameter
- sample gas inlet open

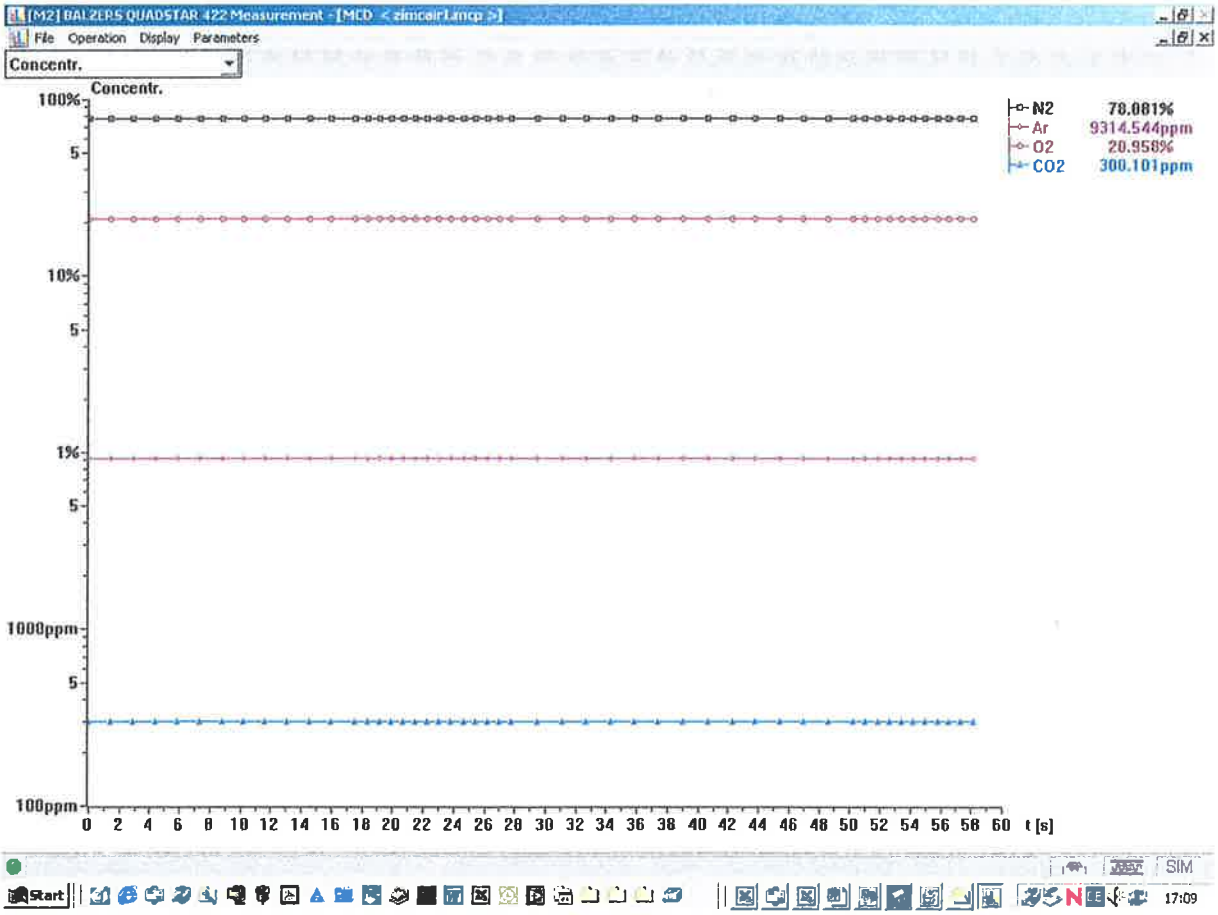
parameter:
“Parset” menue, ➔ “Measure”, ➔ “MCD…”



"Measure" menue, ➔ "MCD", ➔ "Setup", ➔ "Versius Time "

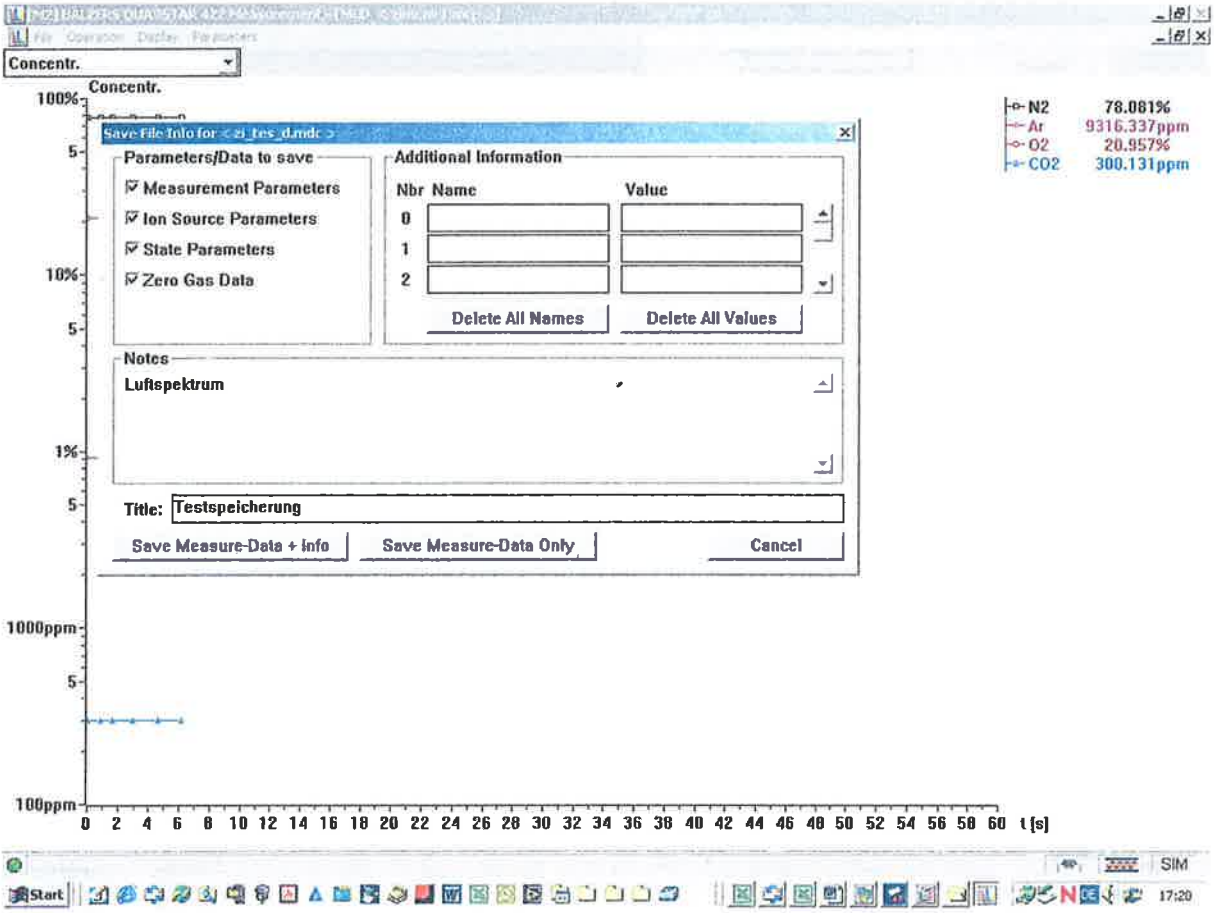


"Measure" menue, ➔ "MCD", ➔ "Versius Time"
result:



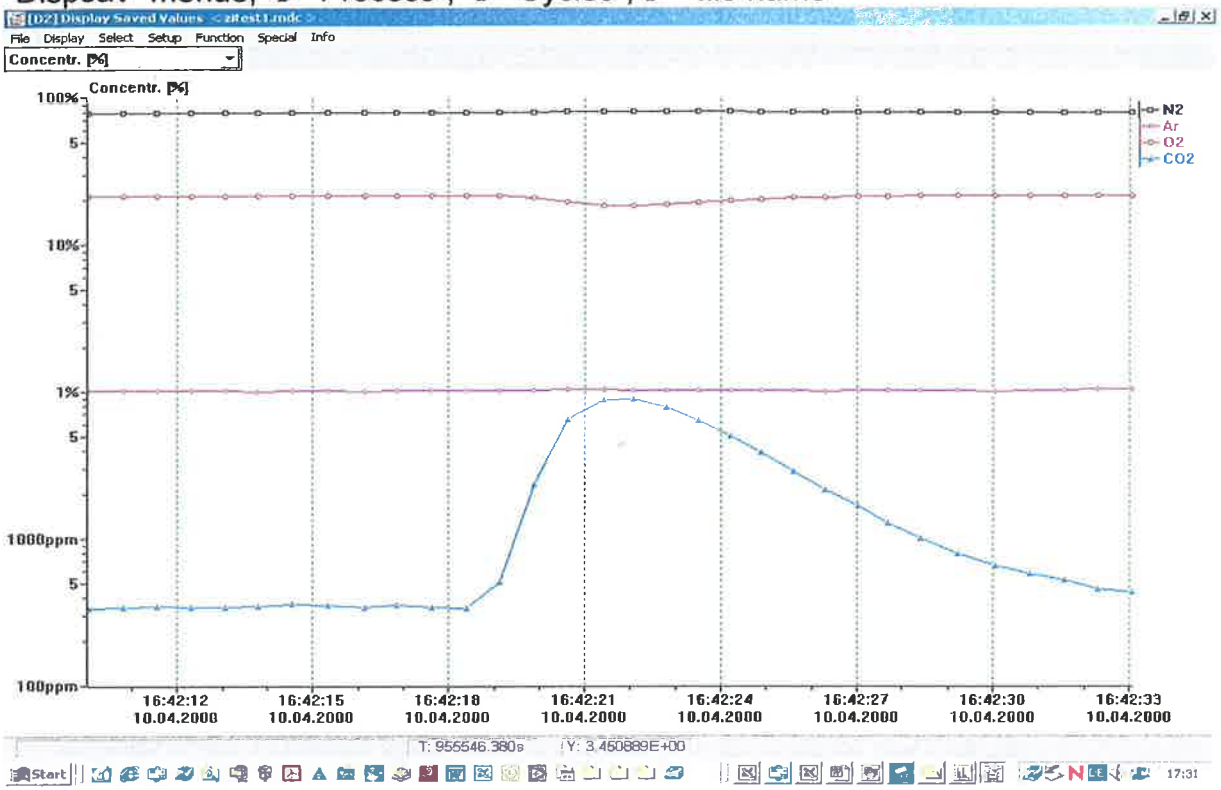
Display Saved Values

activate before saving the data:



Display Saved Values

"Dispsav" menue, ➔ "Process", ➔ "Cycles",➔ "file name"



➔ "Info"

Work with the Process Control Module (Sequencer)