O2/N2 measurements in the ICOS network

Markus Eritt, Richard Kneißl, Lars Borchardt, Martin Strube, Philippa Vestner

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- O2/N2 measurements at the ICOS CAL FCL
- flask sampling with T-connection
- humidity and mass spec O2/N2 measurements

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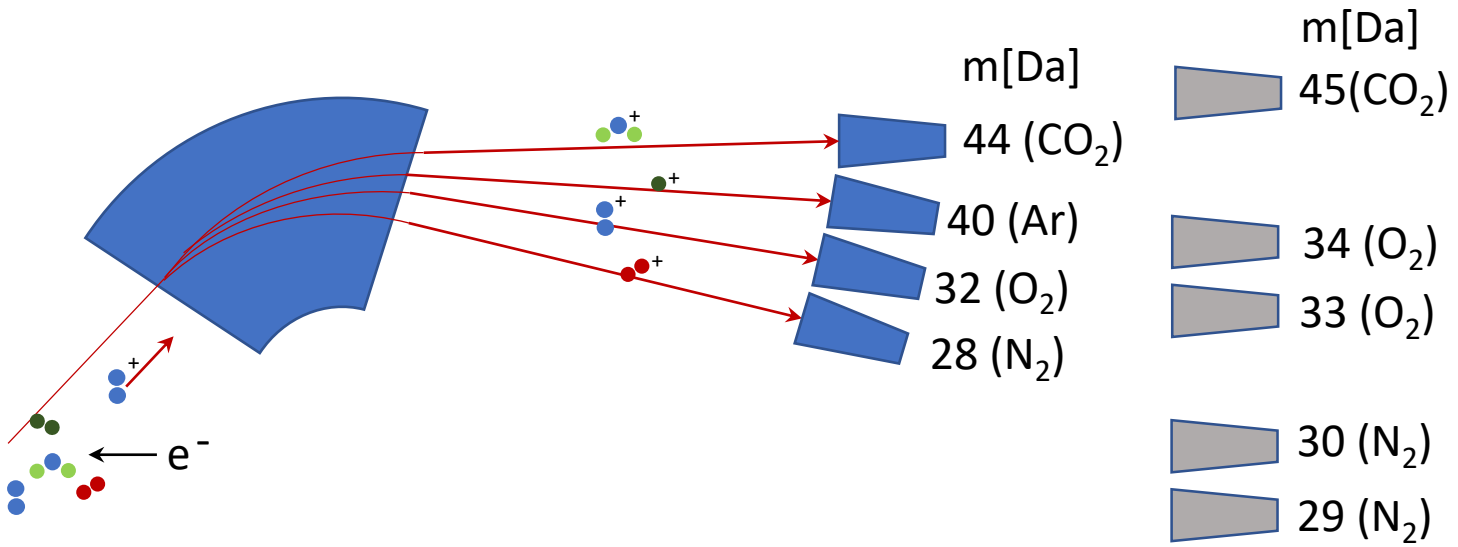
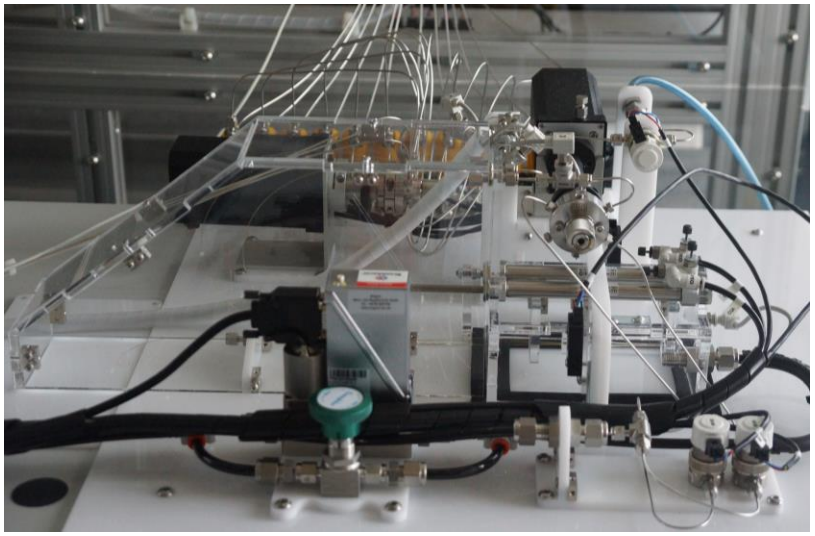
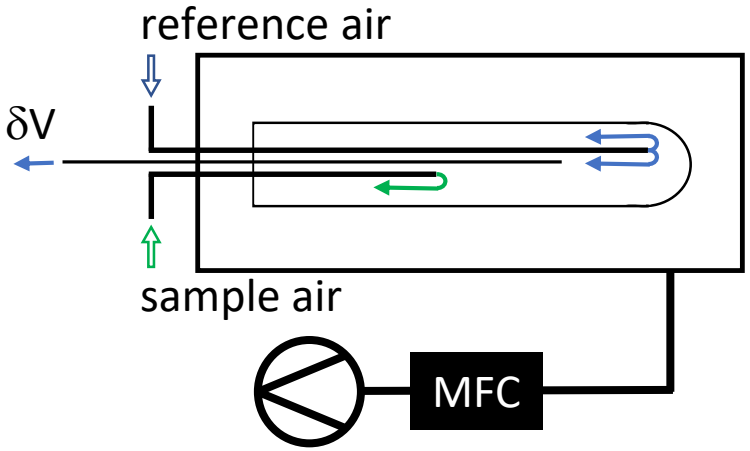
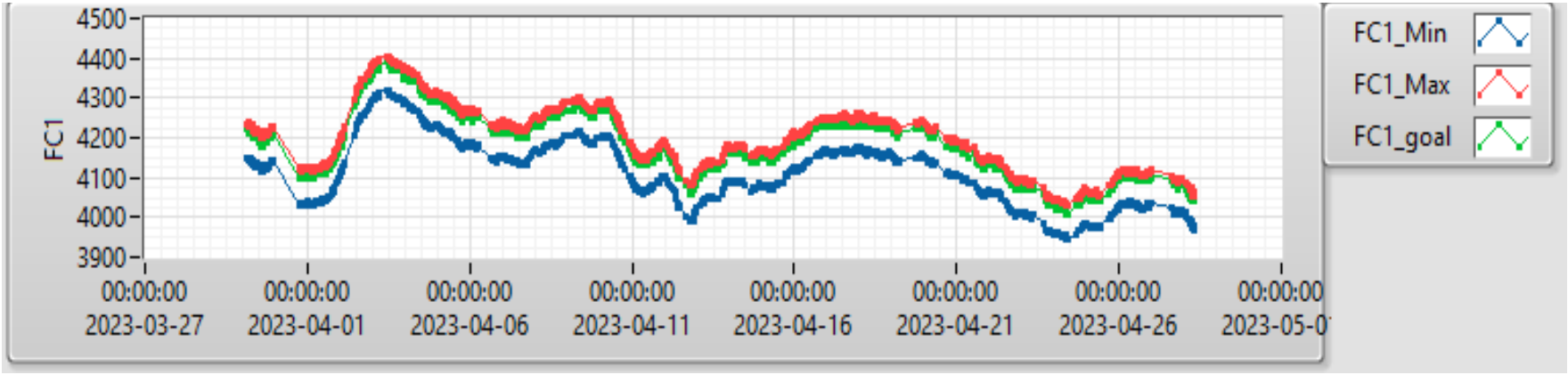
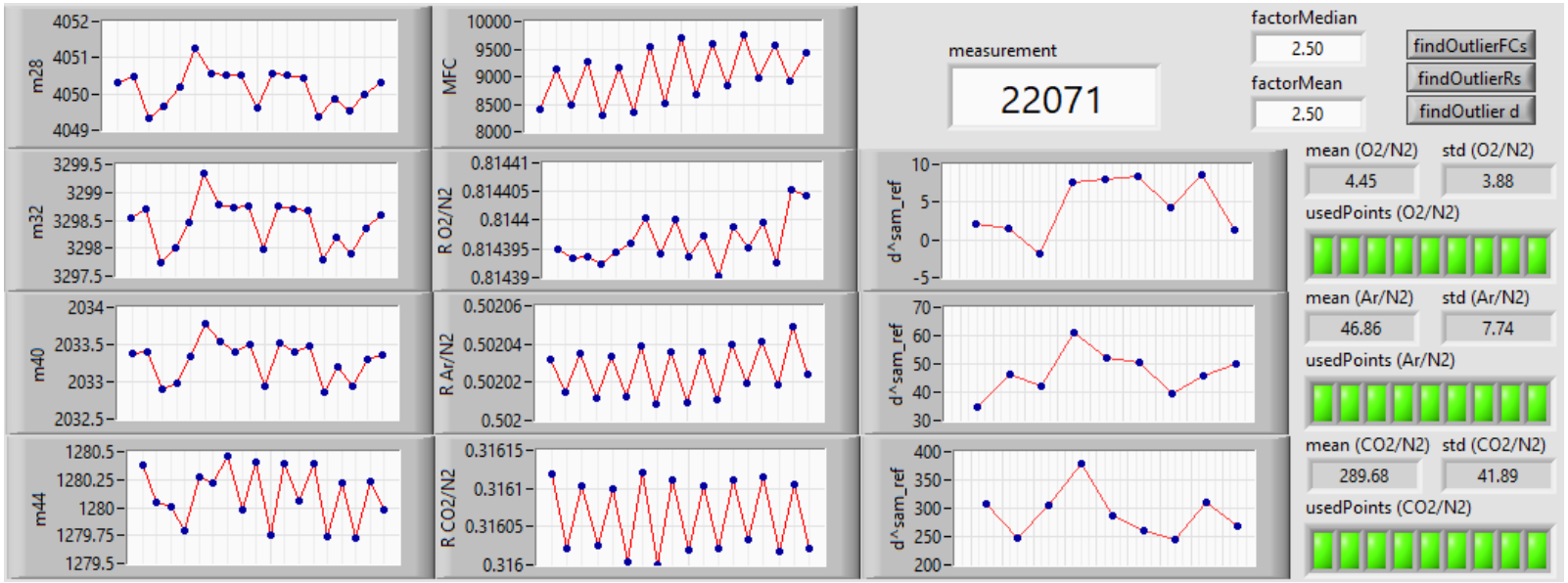
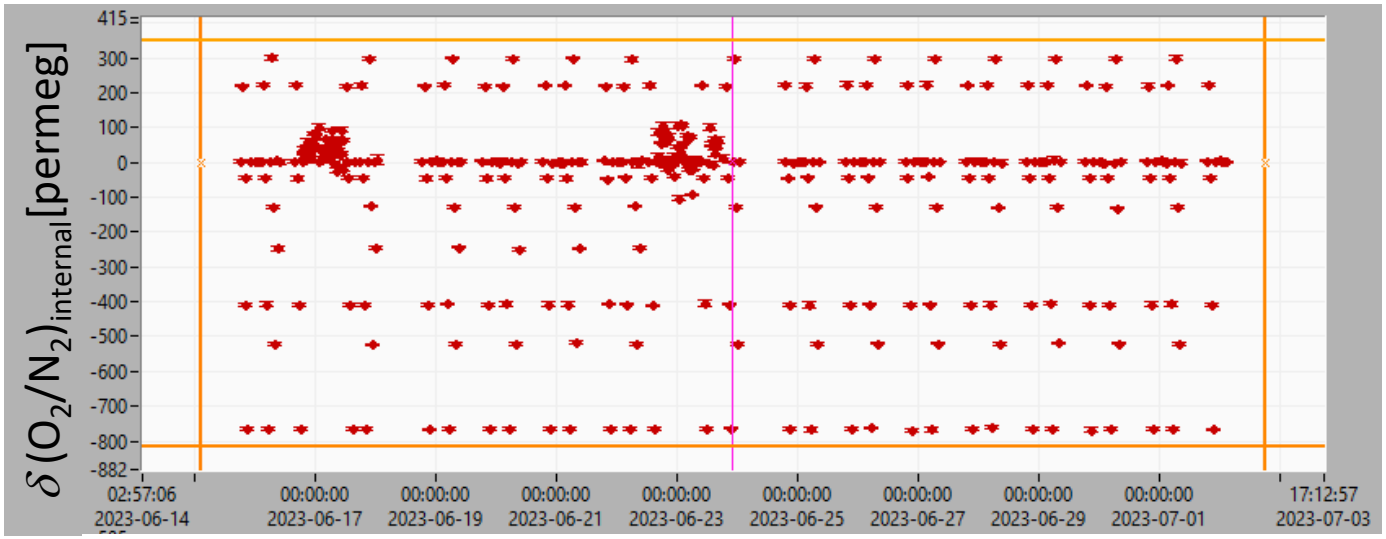

m[Da]
44 (CO_2)
40 (Ar)
32 (O_2)
28 (N_2)
e -
m[Da]
45(CO_2)
34 (O_2)
33 (O_2)
30 (N_2)
29 (N_2)

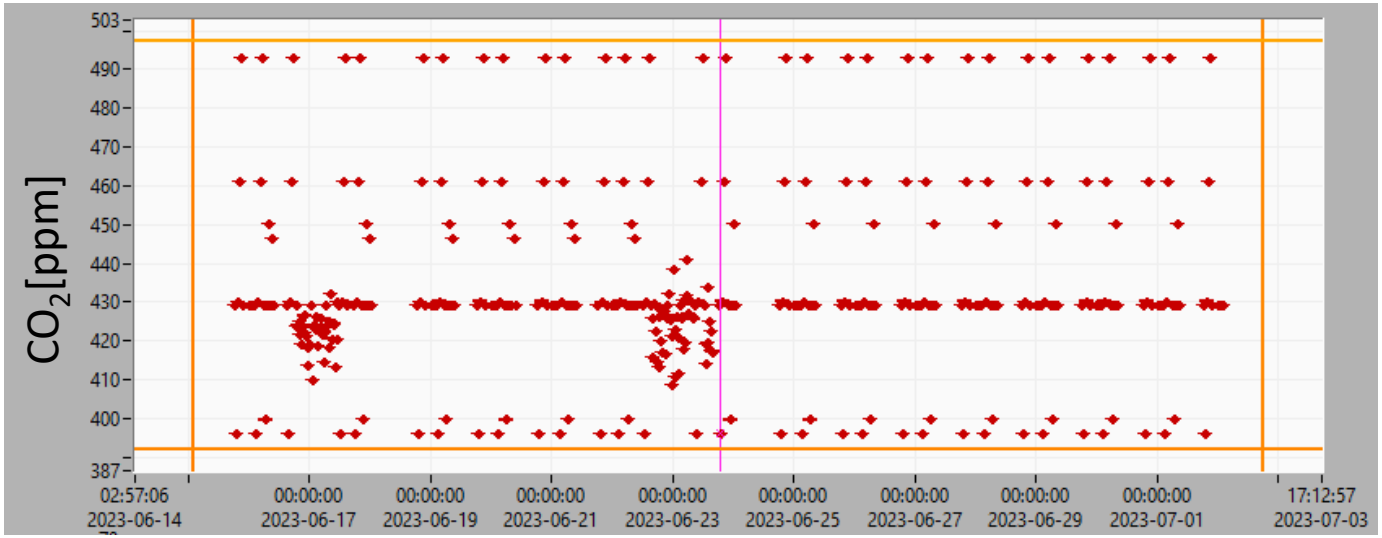



reference air
δV
sample air
MFC

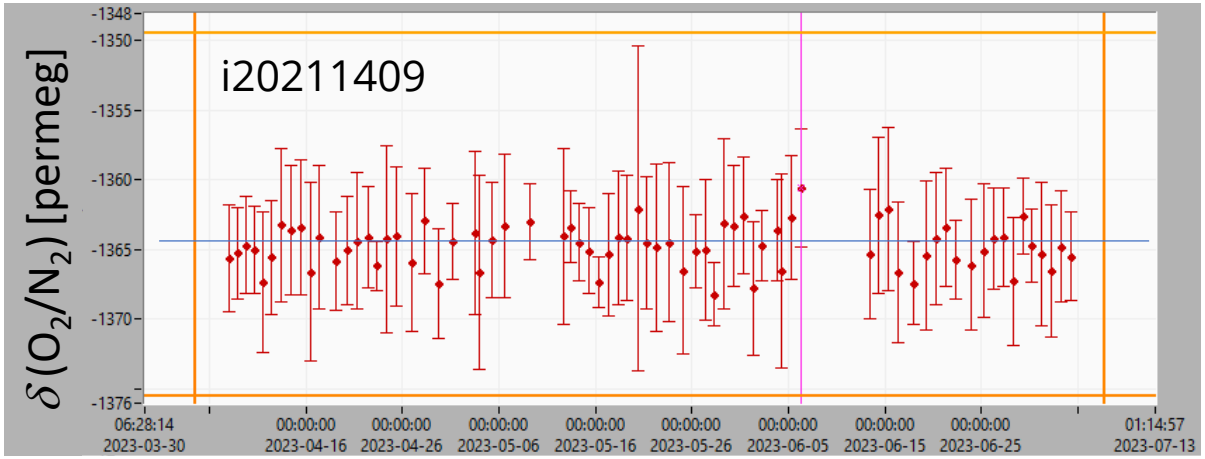

FC1
4500
4400
4300
4200
4100
4000
3900
00:00:00
2023-03-27
2023-04-01
2023-04-06
2023-04-11
2023-04-16
2023-04-21
2023-04-26
FC1_Min
FC1_Max
FC1_goal


m28
m32
m40
m44
MFC
R O2/N2
R Ar/N2
R CO2/N2
d^sam_ref
measurement
22071
factorMedian
2.50
factorMean
2.50
findOutlierFCs
findOutlierRs
findOutlier d
mean (O2/N2)
4.45
std (O2/N2)
3.88
usedPoints (O2/N2)
mean (Ar/N2)
46.86
std (Ar/N2)
7.74
usedPoints (Ar/N2)
mean (CO2/N2)
289.68
std (CO2/N2)
41.89
usedPoints (CO2/N2)


$\delta(O_2/N_2)_{internal}$[permeg]
415
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-882
02:57:06
2023-06-14
00:00:00
2023-06-17
00:00:00
2023-06-19
00:00:00
2023-06-21
00:00:00
2023-06-23
00:00:00
2023-06-25
00:00:00
2023-06-27
00:00:00
2023-06-29
00:00:00
2023-07-01
17:12:57
2023-07-03


CO_2[ppm]
503
490
480
470
460
450
440
430
420
410
400
387
02:57:06
2023-06-14
00:00:00
2023-06-17
00:00:00
2023-06-19
00:00:00
2023-06-21
00:00:00
2023-06-23
00:00:00
2023-06-25
00:00:00
2023-06-27
00:00:00
2023-06-29
00:00:00
2023-07-01
17:12:57
2023-07-03

internal reproducibility



3 SCRIPPS assigned cylinders:

76 measurements (03/2023 -> 07/2023)

		O_2/N_2	Ar/N_2	CO_2
i20211438	D753839	-561.60 ± 1.59	-209. 94 ± 3.44	399.77 ± 0.01
i20211413	D752840	-980.32 ± 1.89	-209.47 ± 3.28	429.33 ± 0.01
i20211409	D753841	-1364.76 ± 1.53	-624.19 ± 3.49	450.44 ± 0.01

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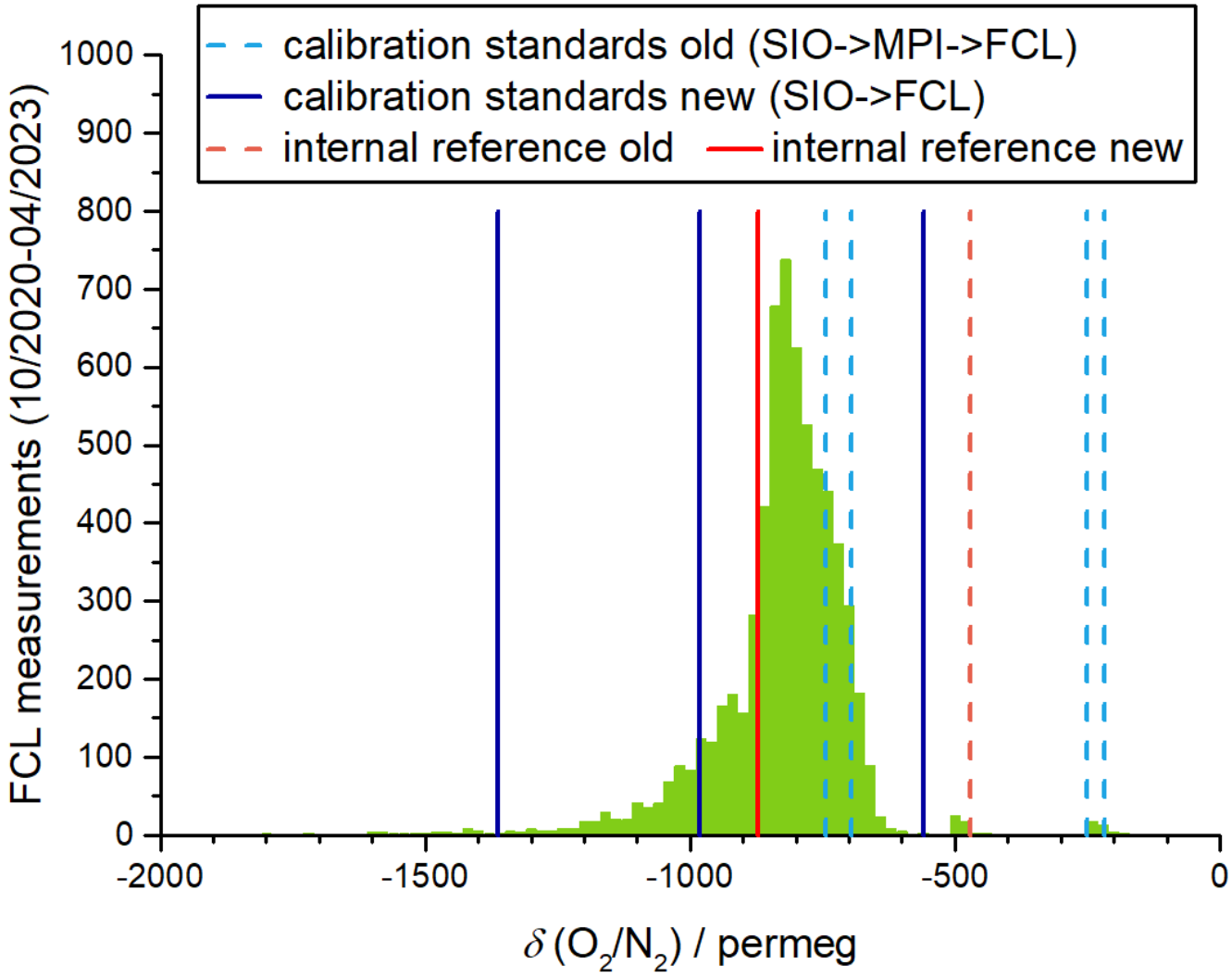
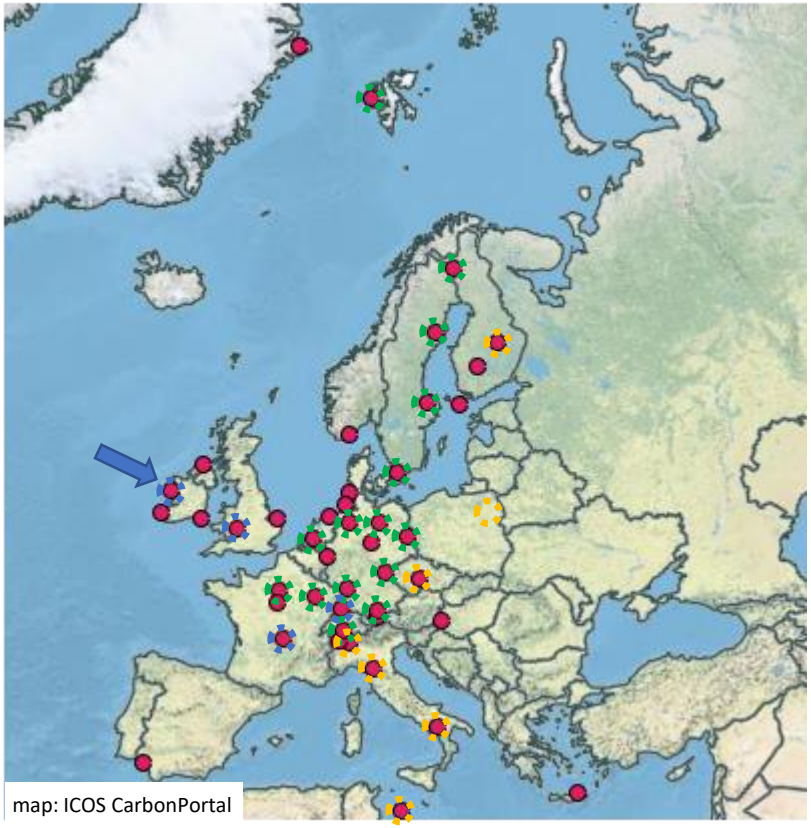
flask measurements

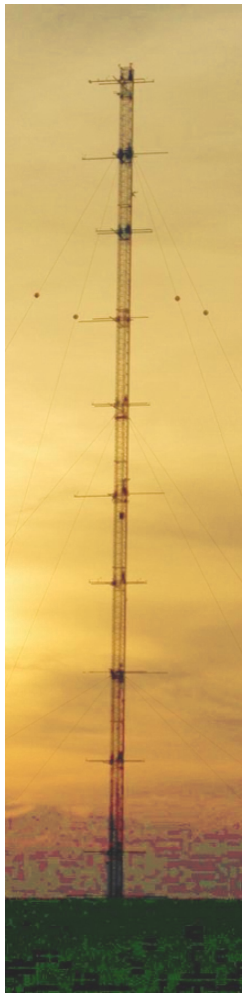


- O2/N2 measurements at the ICOS CAL FCL
- **flask sampling with T-connection**
- humidity and mass spec O2/N2 measurements



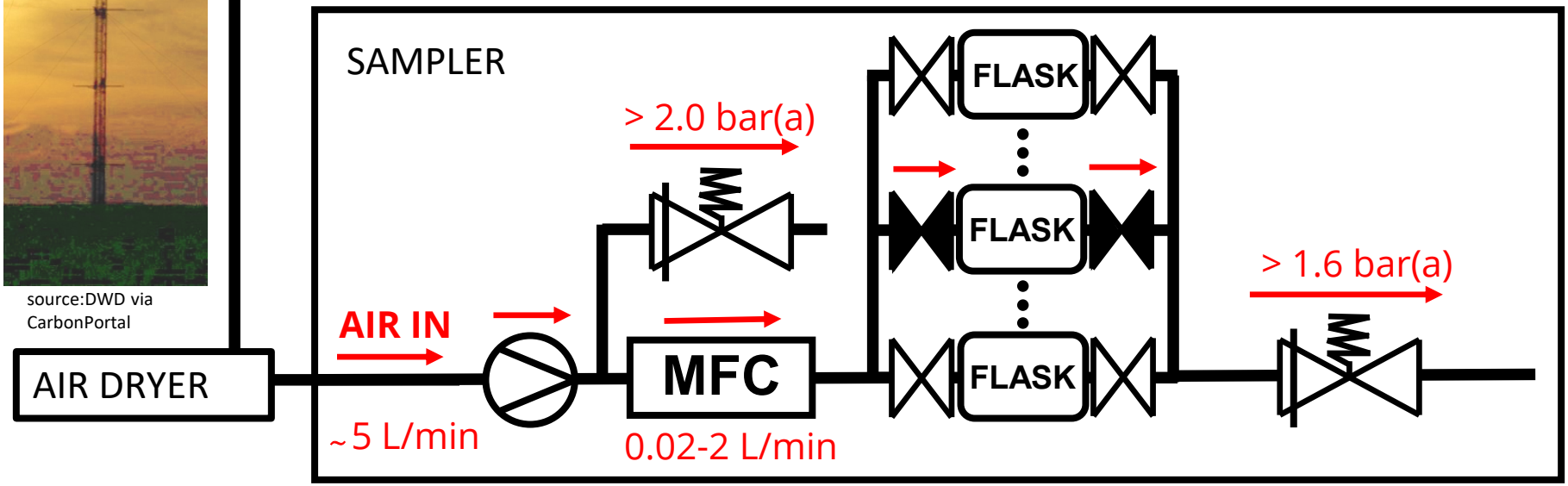
map: ICOS CarbonPortal

- ICOS Atmosphere Stations
- Flasksampler taking samples
- Flasksampler to be installed
- Flasksampler in production



source:DWD via CarbonPortal

plot shows flasksampling with constant weight over one hour



Measurement setup without flask sampler

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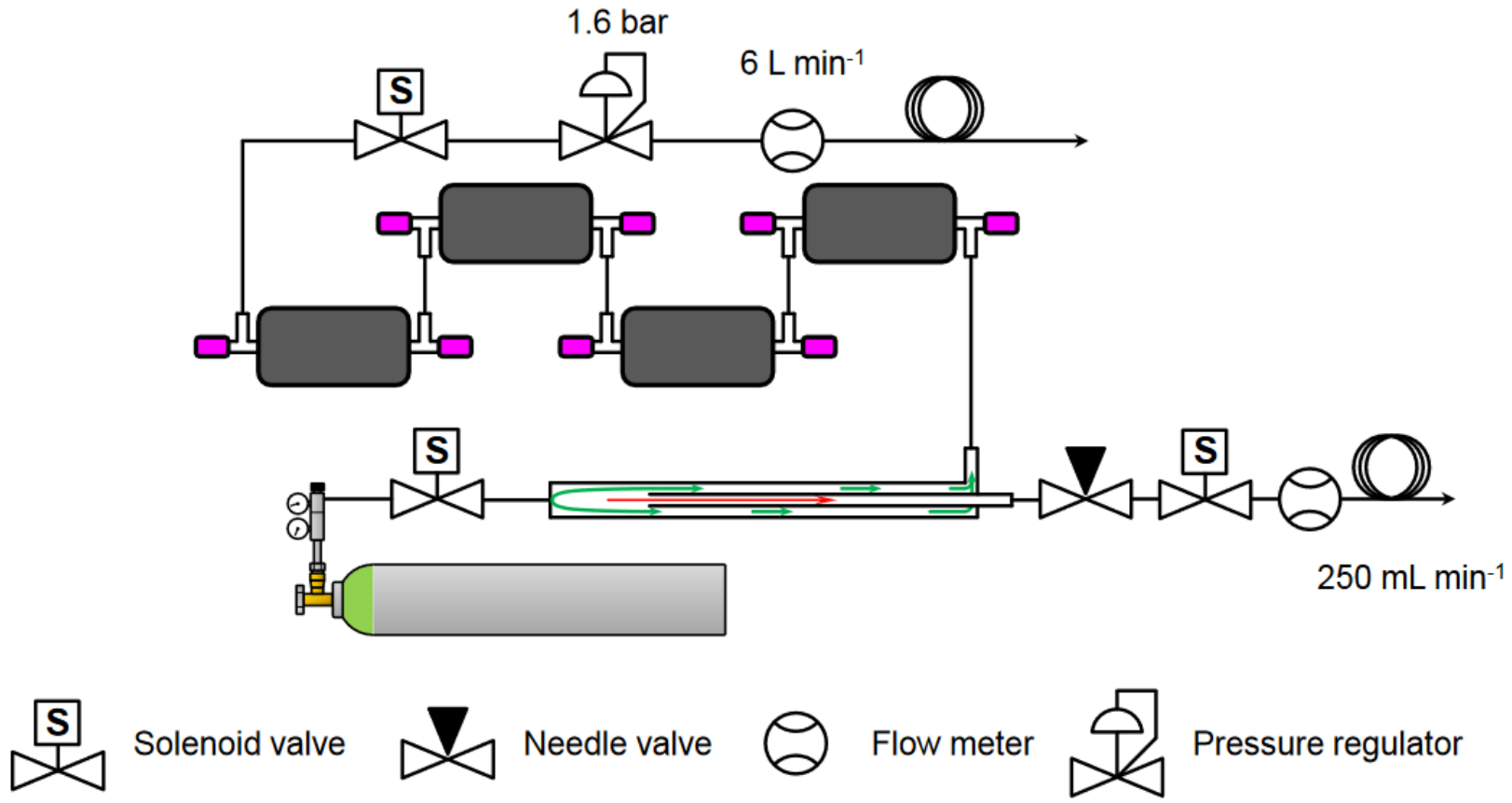

slide presented by Michael Schibig et. al at ICOS MSA 2019-11-19 Bologna/Italy

Measurement setup with flask sampler

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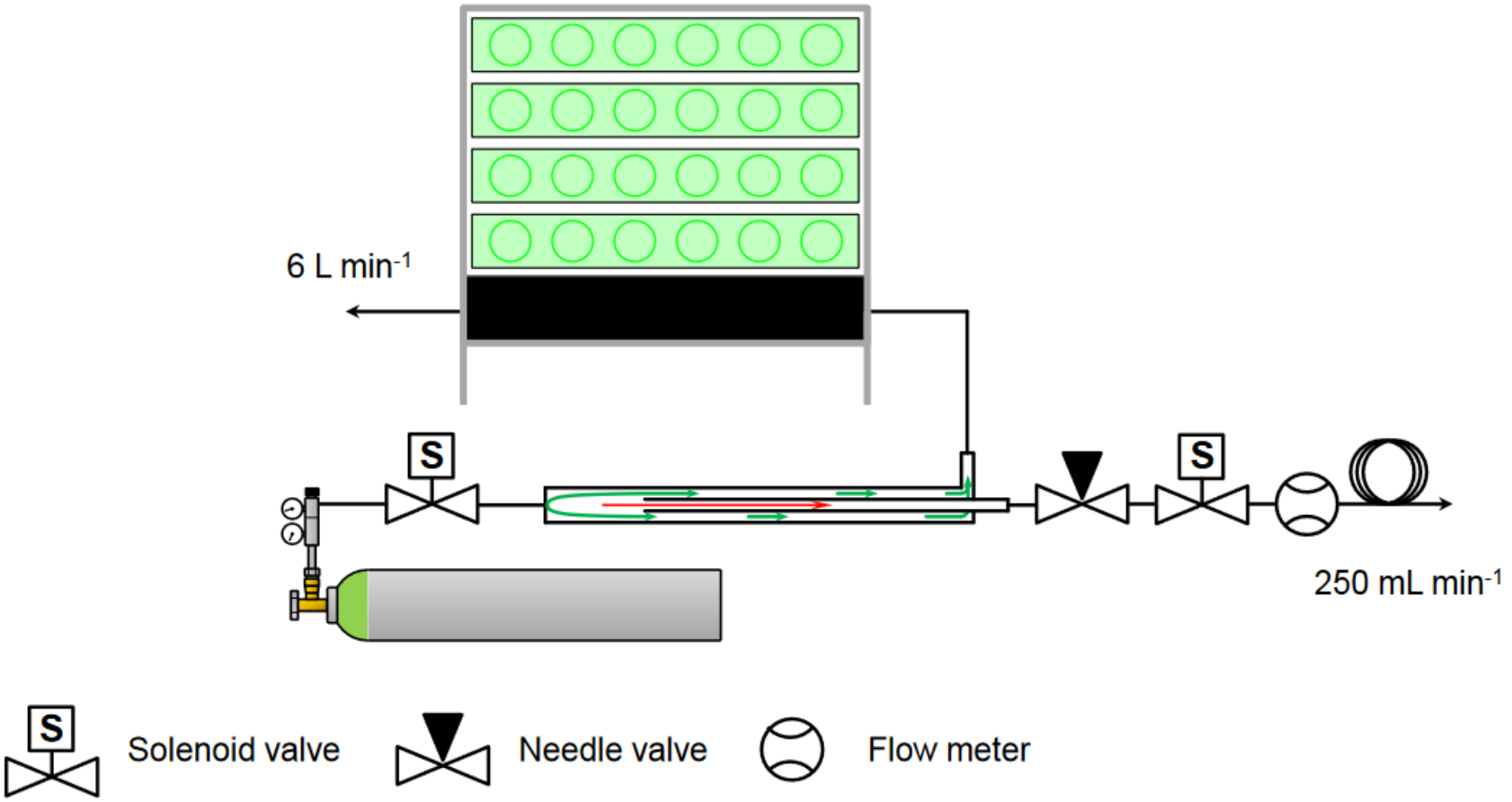

Summary

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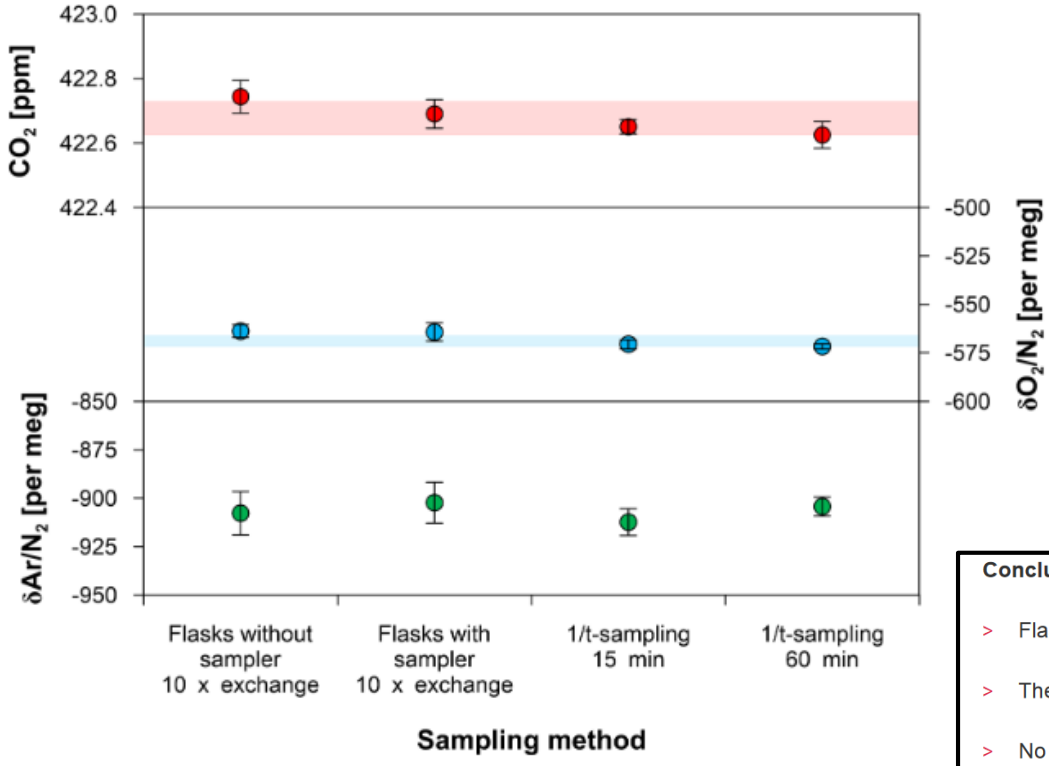

	CO_2 [ppm]	O_2/N_2 [per meg]	Ar/N_2 [per meg]
Flasks without sampler (10 x exchange)	422.74 ± 0.05	-563.8. ± 3.2	-907.8 ± 11.1
Flasks with sampler (10 x exchange)	422.69 ± 0.04	-564.3 ± 4.8	-902.3 ± 10.5
Flasks with sampler 1/t 15 min	422.65 ± 0.02	-570.7 ± 2.4	-912.4 ± 6.9
Flasks with sampler 1/t 60 min	422.63 ± 0.04	-571.8 ± 1.3	-904.3 ± 4.9

Conclusions

- Flask sampler seems to perform well in Bern
- The 24 sampling ports yield similar results
- No obvious fractionations of CO_2, O_2 or Ar with either of the sampling methods were observed
- Only one single gas was used for tests

slide presented by Michael Schibig et. al at ICOS MSA 2019-11-19 Bologna/Italy

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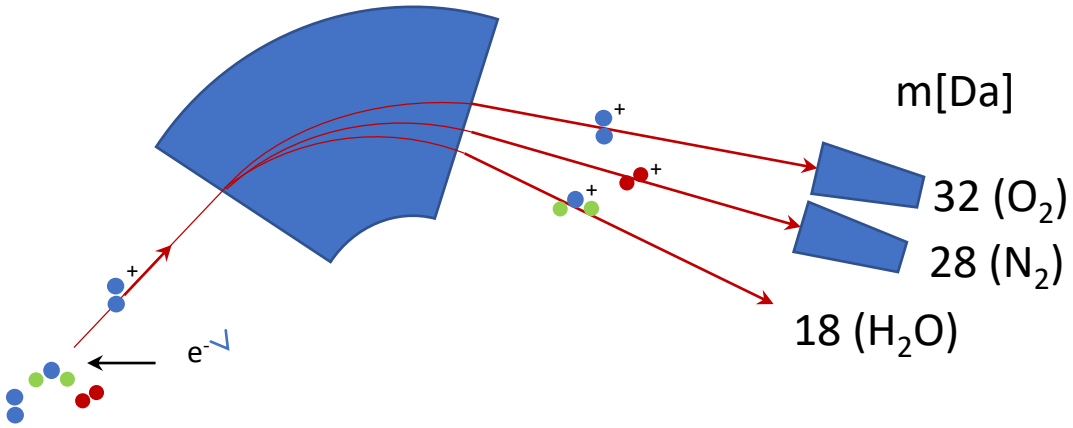
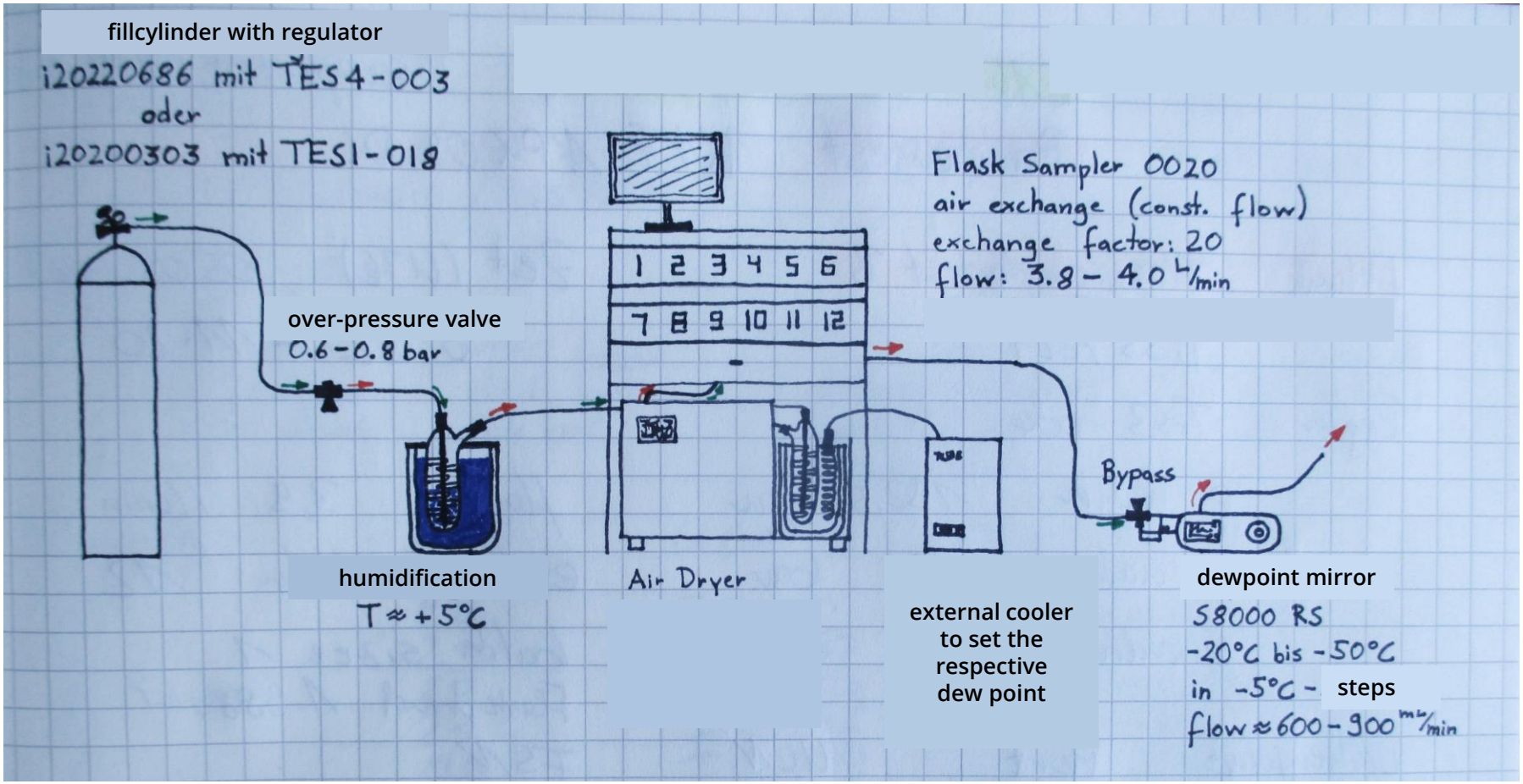
what is the influence?



schematic setup



drawing: Philippa Vestner

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Thank you