Study on stability of daily calibrations

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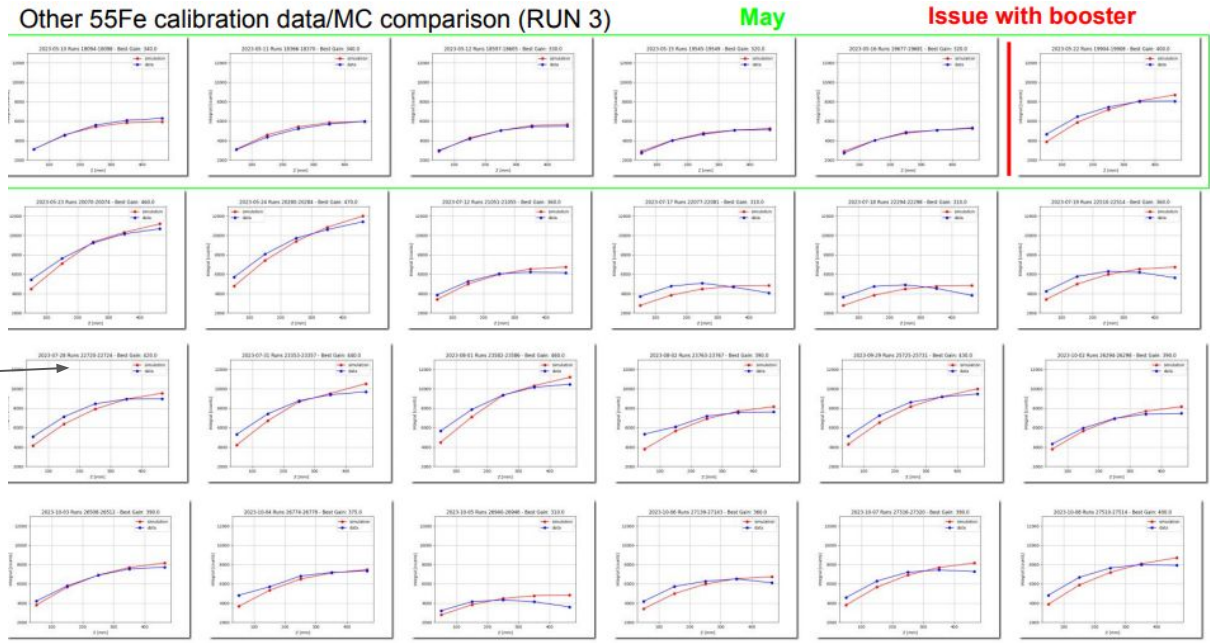
Intro

We know the simulation is not able to properly reproduce the attenuation of LIME underground date, probability due to different reabsorption in the drifting.

We widely discussed the topic at the Collaboration Meeting



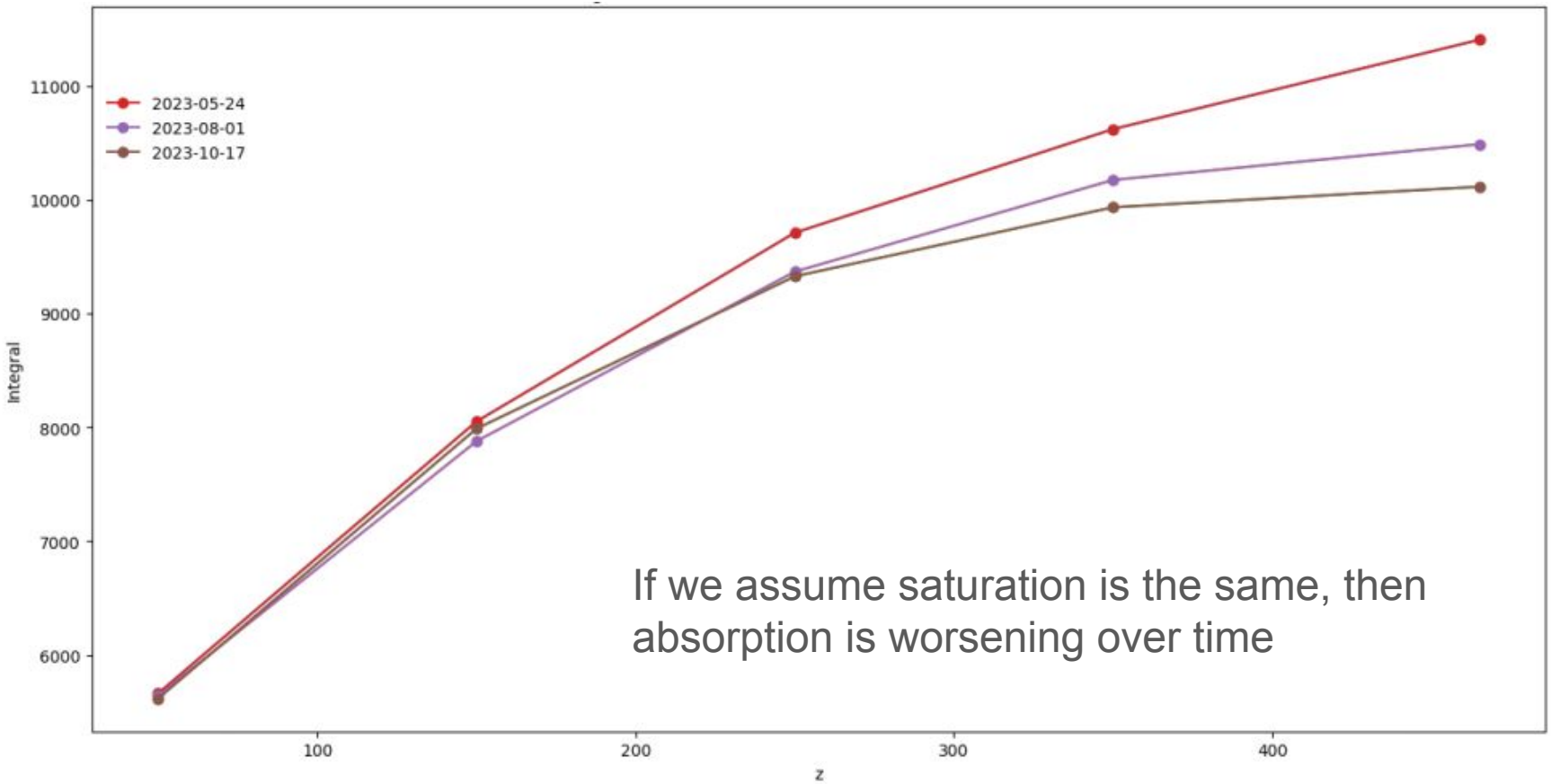
So we studied the reabsorption RUN 3 and RUN 4 calibrations, more in depth.

Looking at RUN 3

only before the removal of the collimator (November)

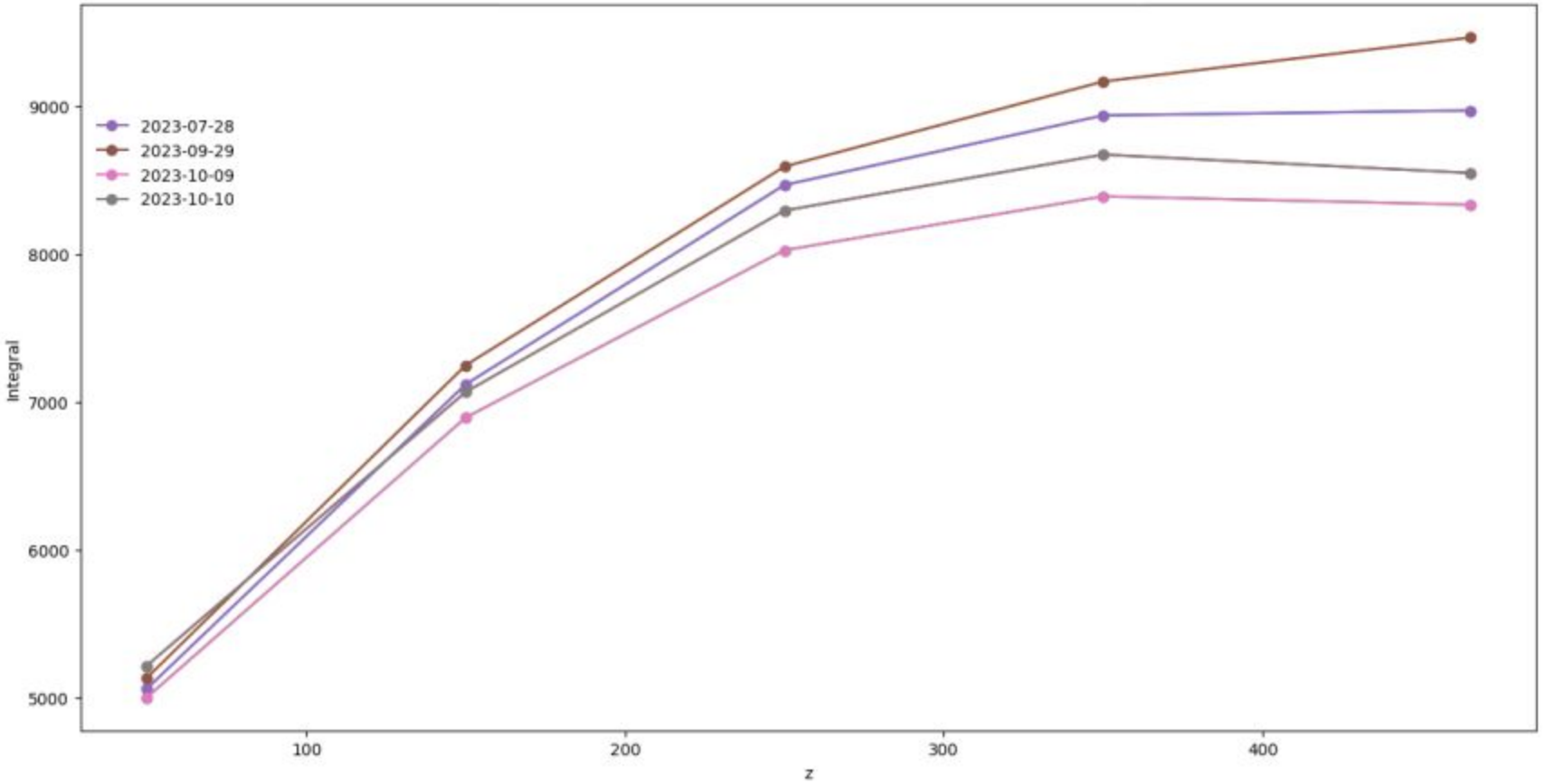
NOTE: I am using new reconstructed data (and also applying the iron map to correct for x-y non-uniformity)

Comparing calibrations with similar integral in step 1 (DATA)



If we assume saturation is the same, then absorption is worsening over time

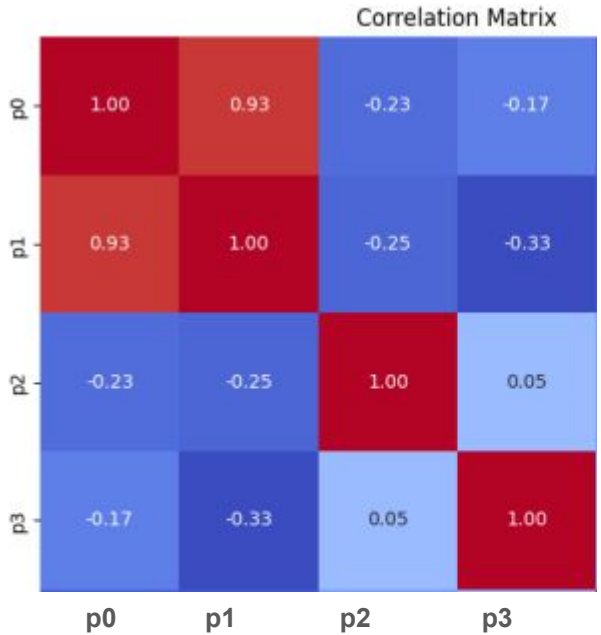
Data

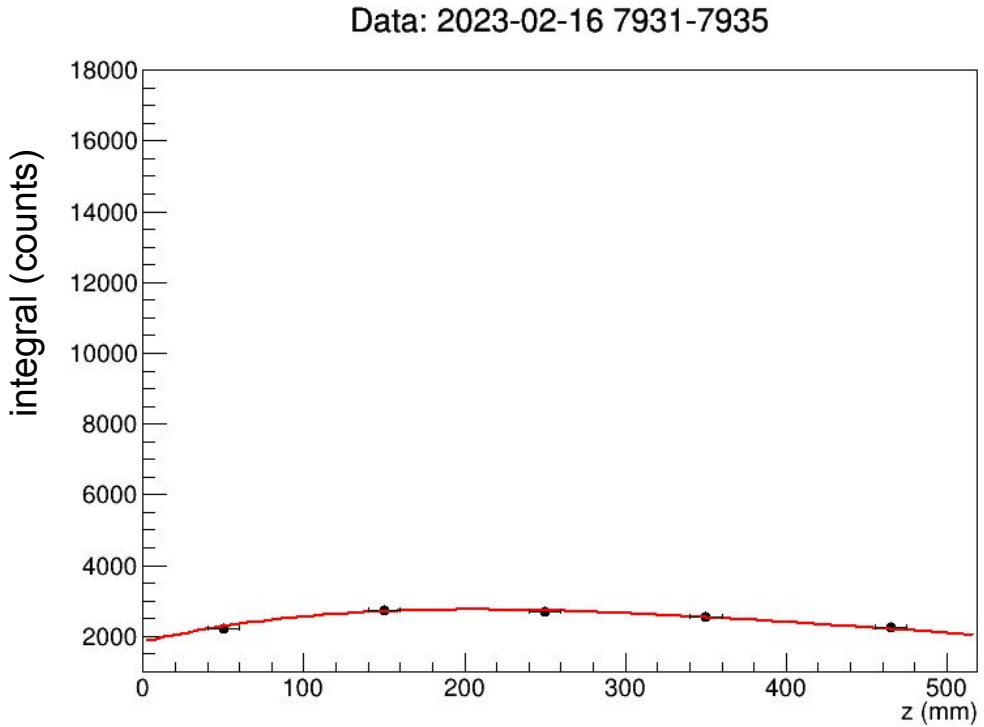

2023-07-28
2023-09-29
2023-10-09
2023-10-10
Integral
z
9000
8000
7000
6000
5000
100
200
300
400

Phenomenological fit

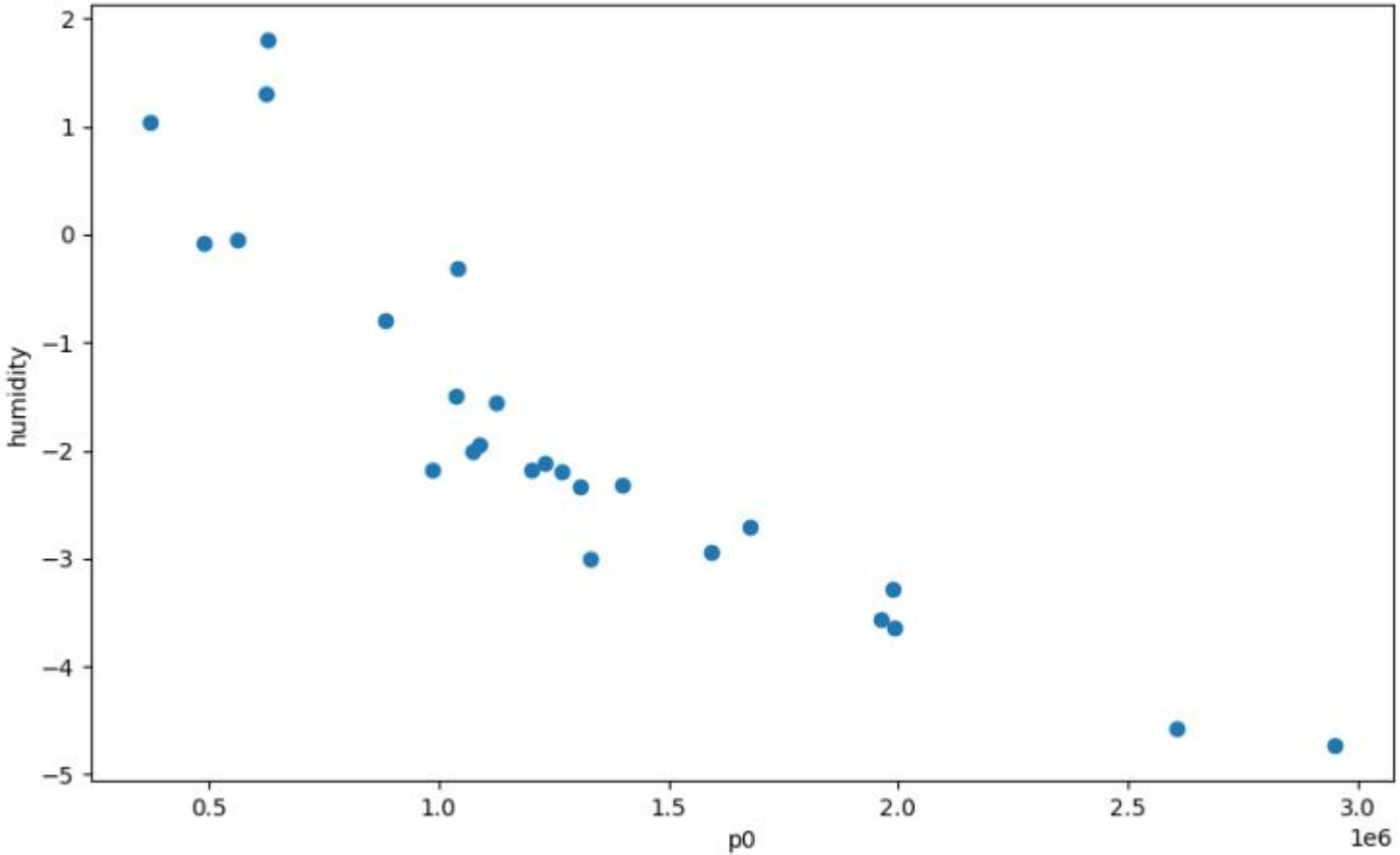
$$y = p0 * (1-\exp(-(x-p3)/p1)) * \exp(-x/p2)$$

p0 -> LY(plateau value if no saturation and reabsorption)
p1 -> saturation
p2 -> reabsorption in drifting
p3 -> position when we have zero counts
(p3 has no physical meaning)

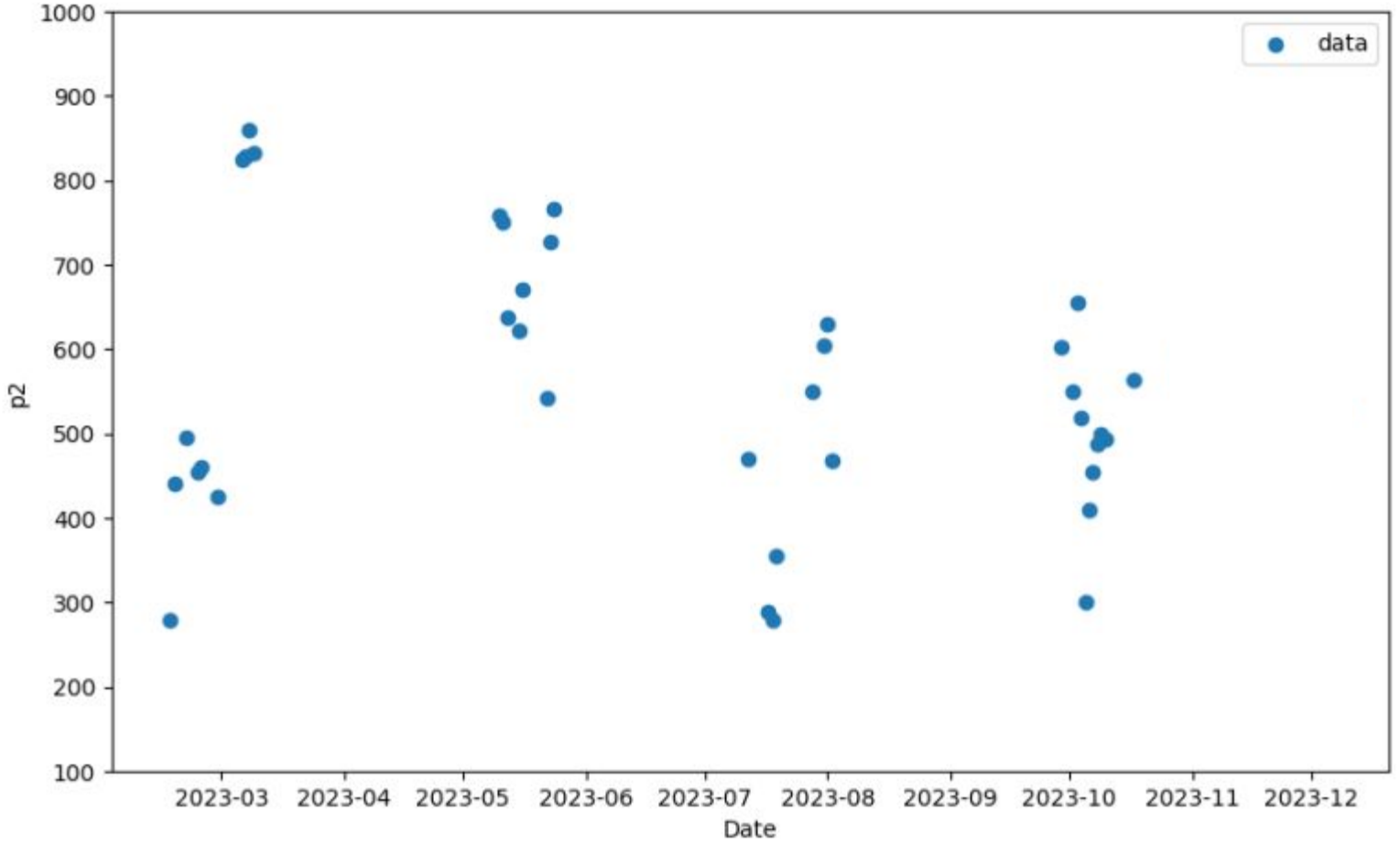




Expected correlation between p0 and humidity

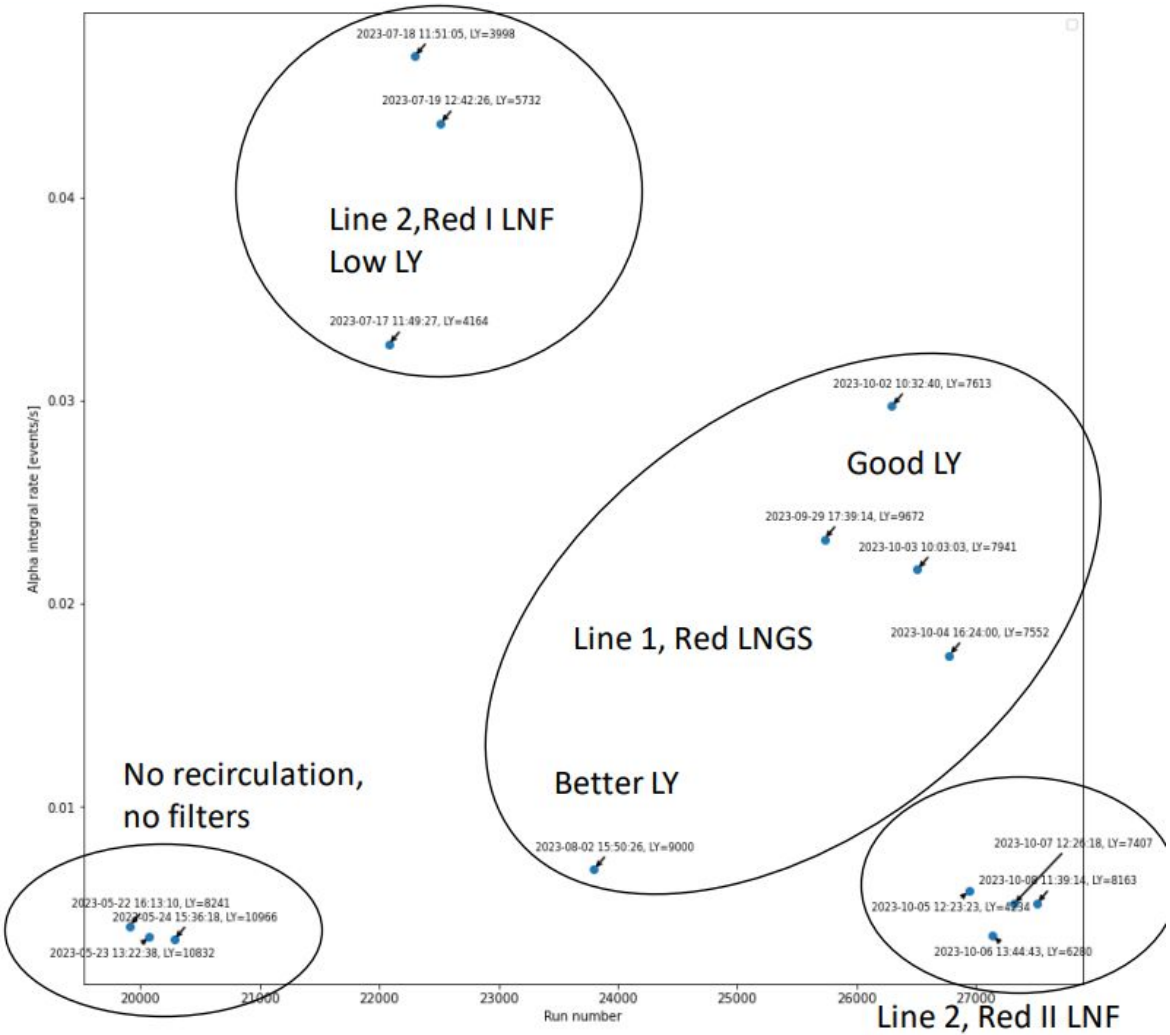


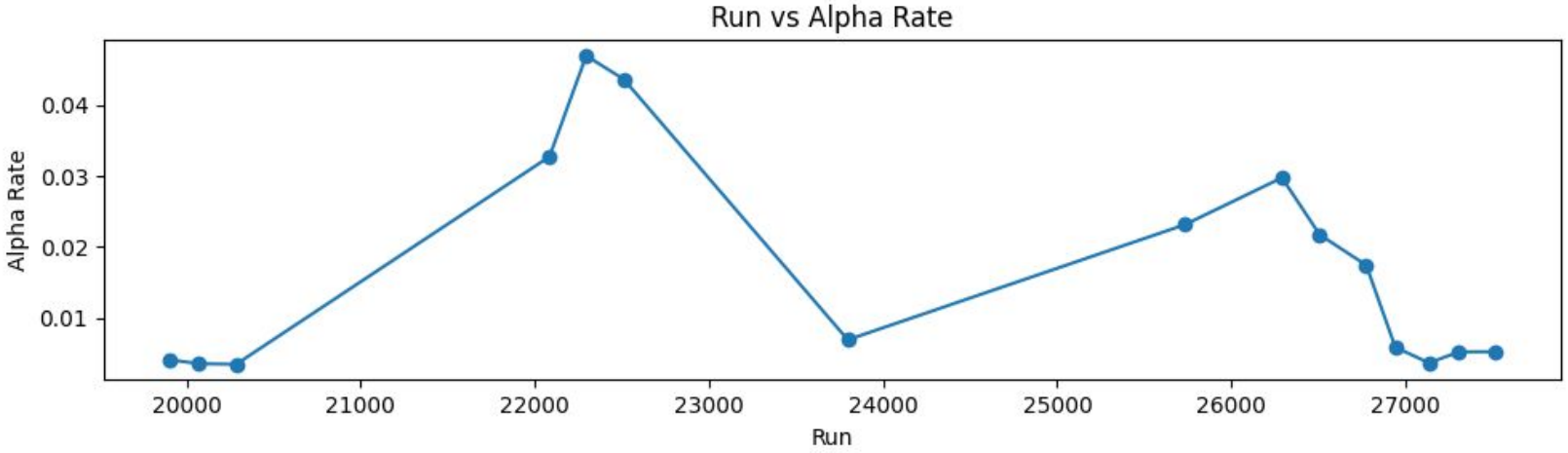
p2 (representing the reabsorption) should be correlated to the attenuation length in the gas)

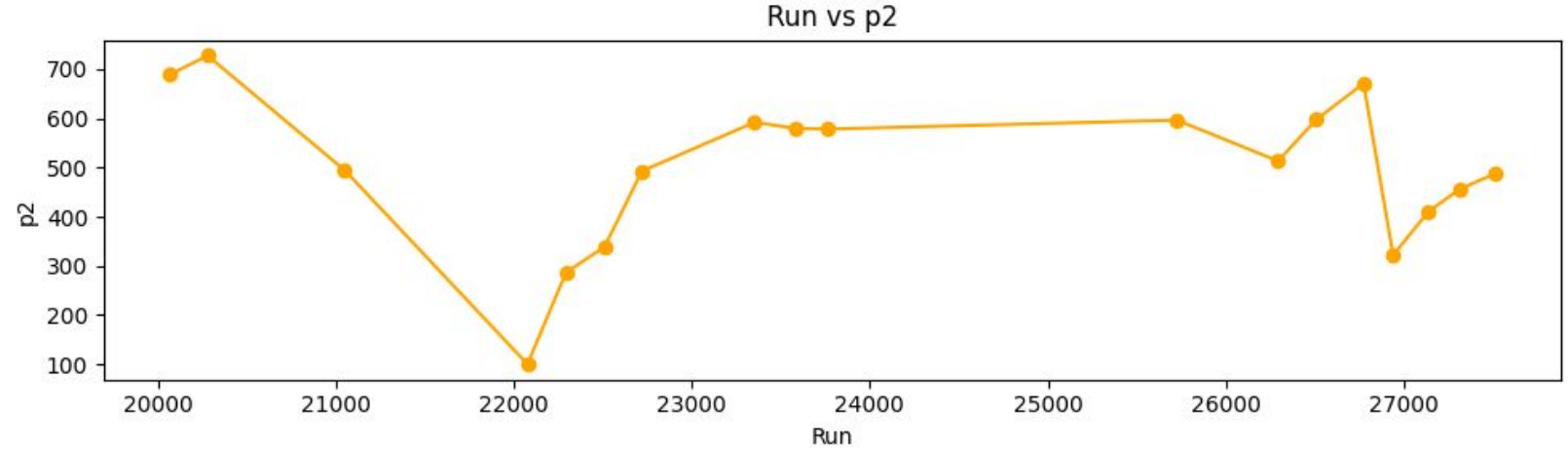


We already know the alpha rate is varying a lot. [Flaminia]

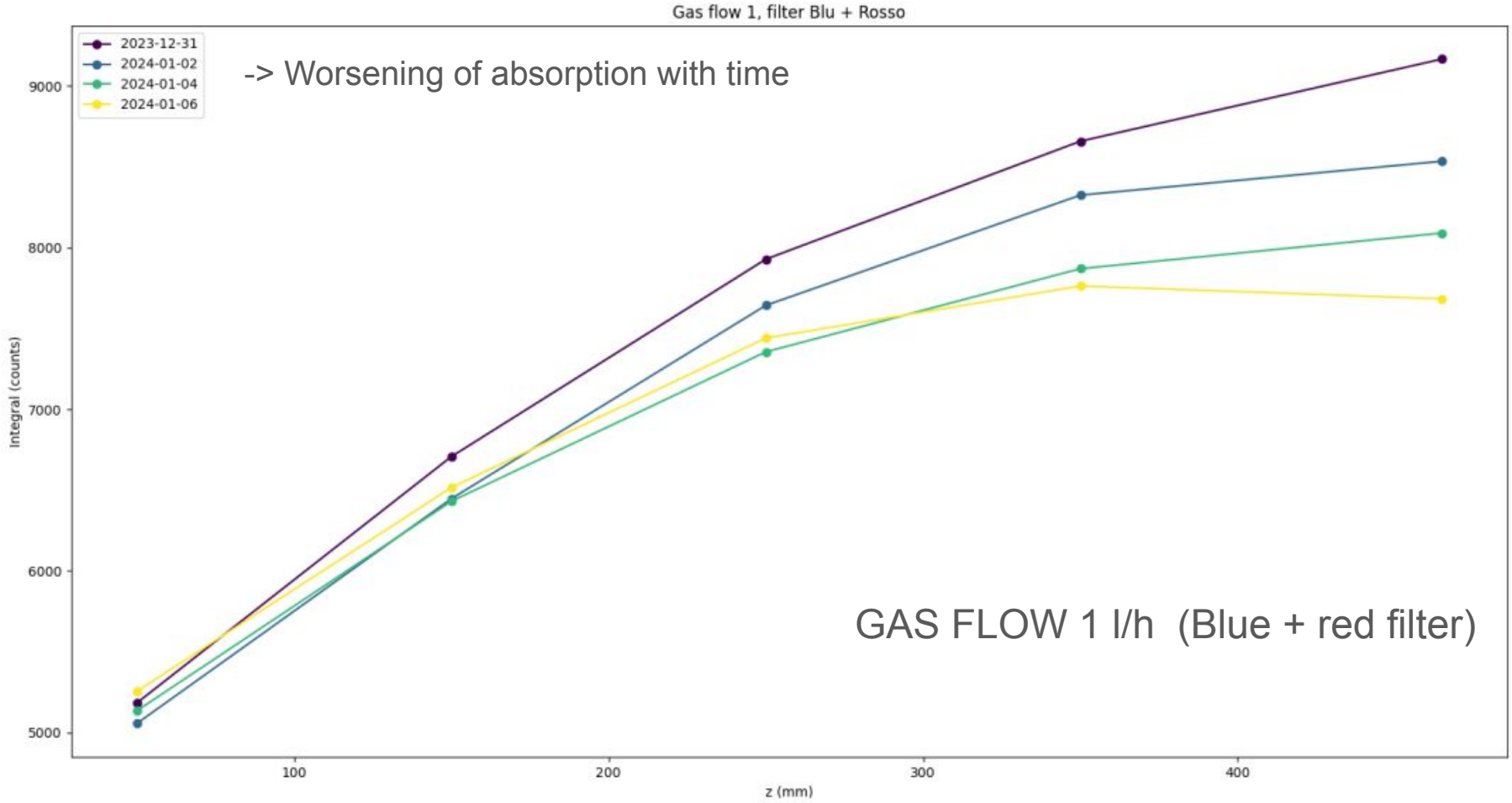
As suggested, we looked at a possible correlation between alpha rate and reabsorption (p2 parameter).

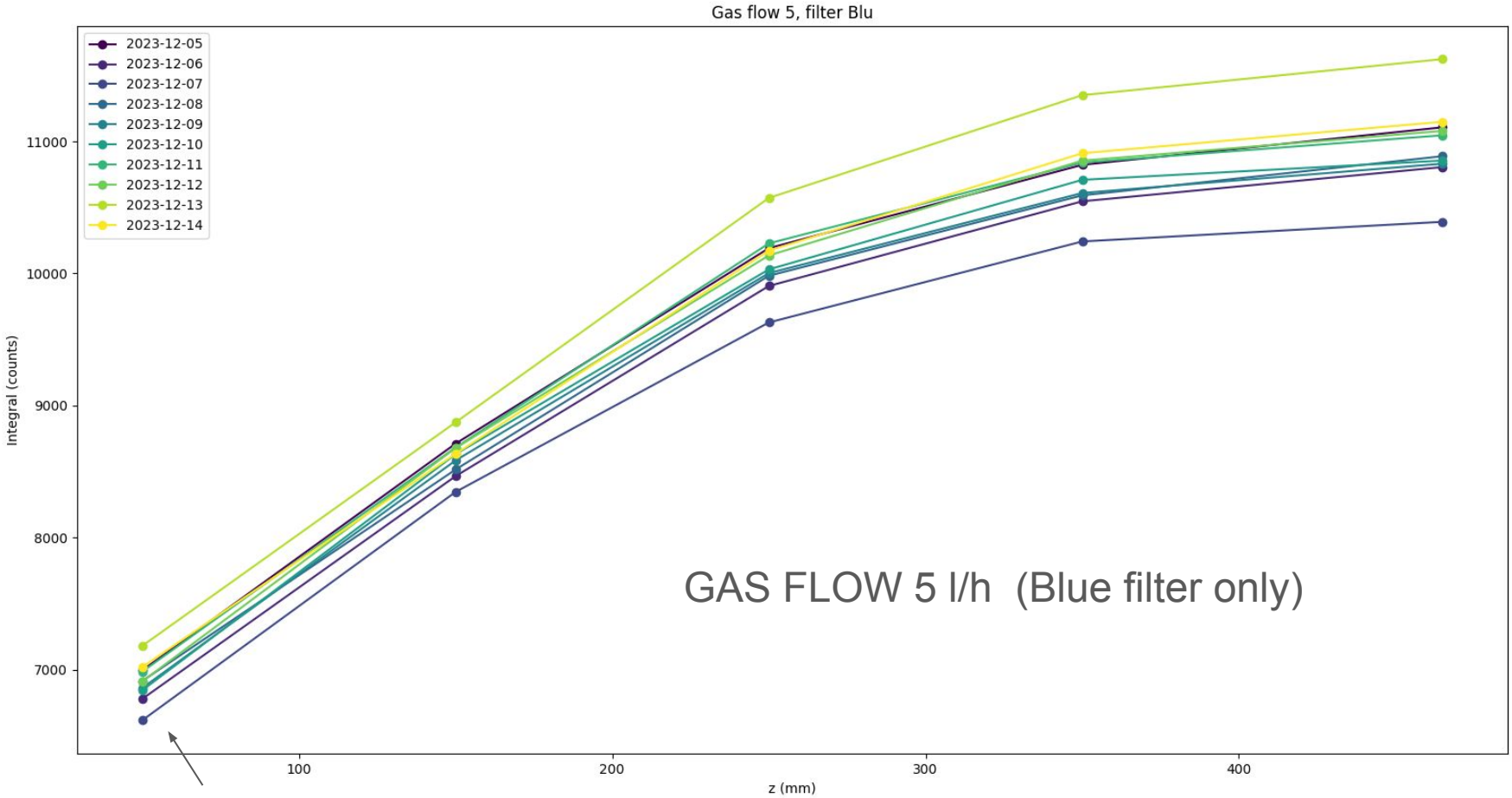



Run vs Alpha Rate
Alpha Rate
0.04
0.03
0.02
0.01
20000
21000
22000
23000
24000
25000
26000
27000
Run

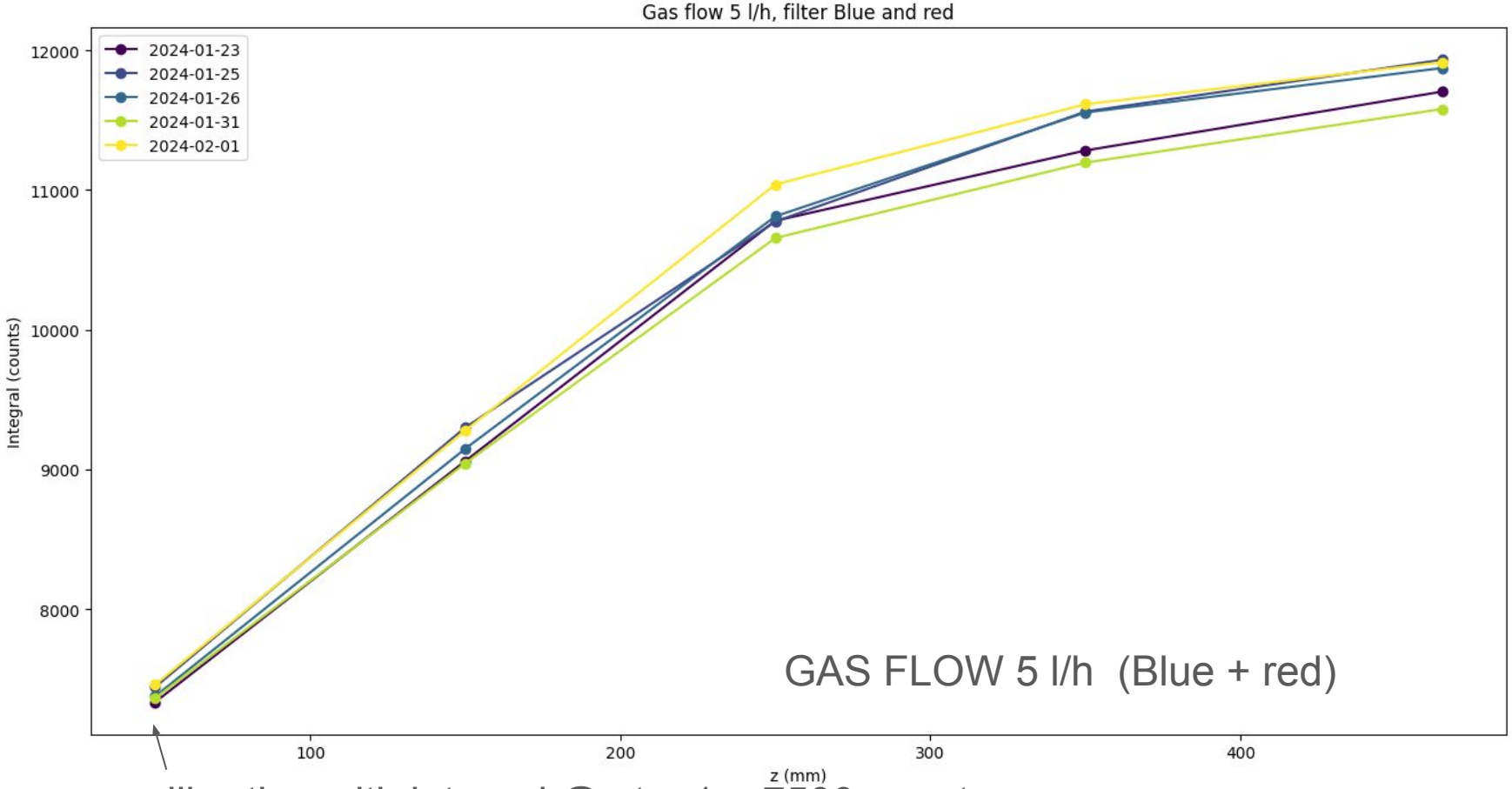

Run vs p2
p2
700
600
500
400
300
200
100
20000
21000
22000
23000
24000
25000
26000
27000
Run

Looking at RUN 4….

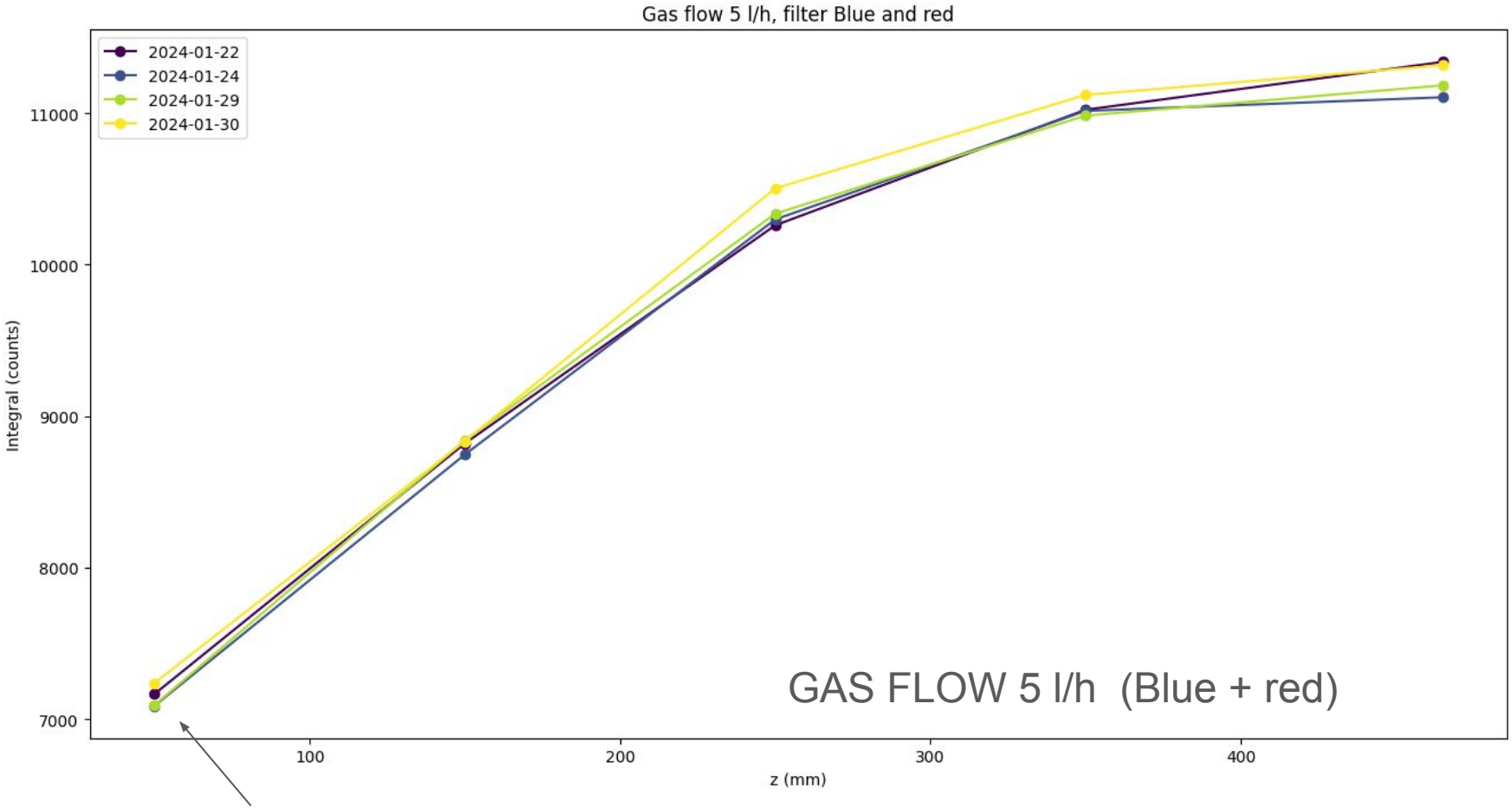

Gas flow 1, filter Blu + Rosso
2023-12-31
2024-01-02
2024-01-04
2024-01-06
-> Worsening of absorption with time
GAS FLOW 1 l/h (Blue + red filter)
Integral (counts)
z (mm)
9000
8000
7000
6000
5000
100
200
300
400



calibration with integral @ step1 around ~7000 counts (December 2023)



calibration with integral @ step1 ~ 7500 counts



calibration with integral @ step1 ~ 7000 counts

Conclusions

- The correlation observed between the alpha rate and the p2 parameter (attenuation in drift) suggests that we are introducing not only alpha but also other contaminants.
- RUN 4 daily calibrations show how we can reduce the variability in attenuation using a higher gas flow (5 l/h).
- It would be interesting to compare alpha rate and attenuation (p2) also for RUN 4 calibrations.
- We think the phenomenological fit should be implemented in grafana to monitor the behavior of reabsorption and saturation.