He:CF4 Gas Mixture Ratio Stability Analysis

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Summary and main idea

- Useful Values
- Density Fluctuation
- Ratio Fluctuation
- Pressure Normalisation
- Conclusions

Density Fluctuation → **Mixture Ratio Fluctuation** → **Gain Fluctuation**

Some useful values to remember

What are we dealing with

In principle @ p ≃ 1000 mbar and T = 0 °C:

- He:CF_4 (60:40)
- $\rho_{HeCF_4} = 1.68$ mg/cm³

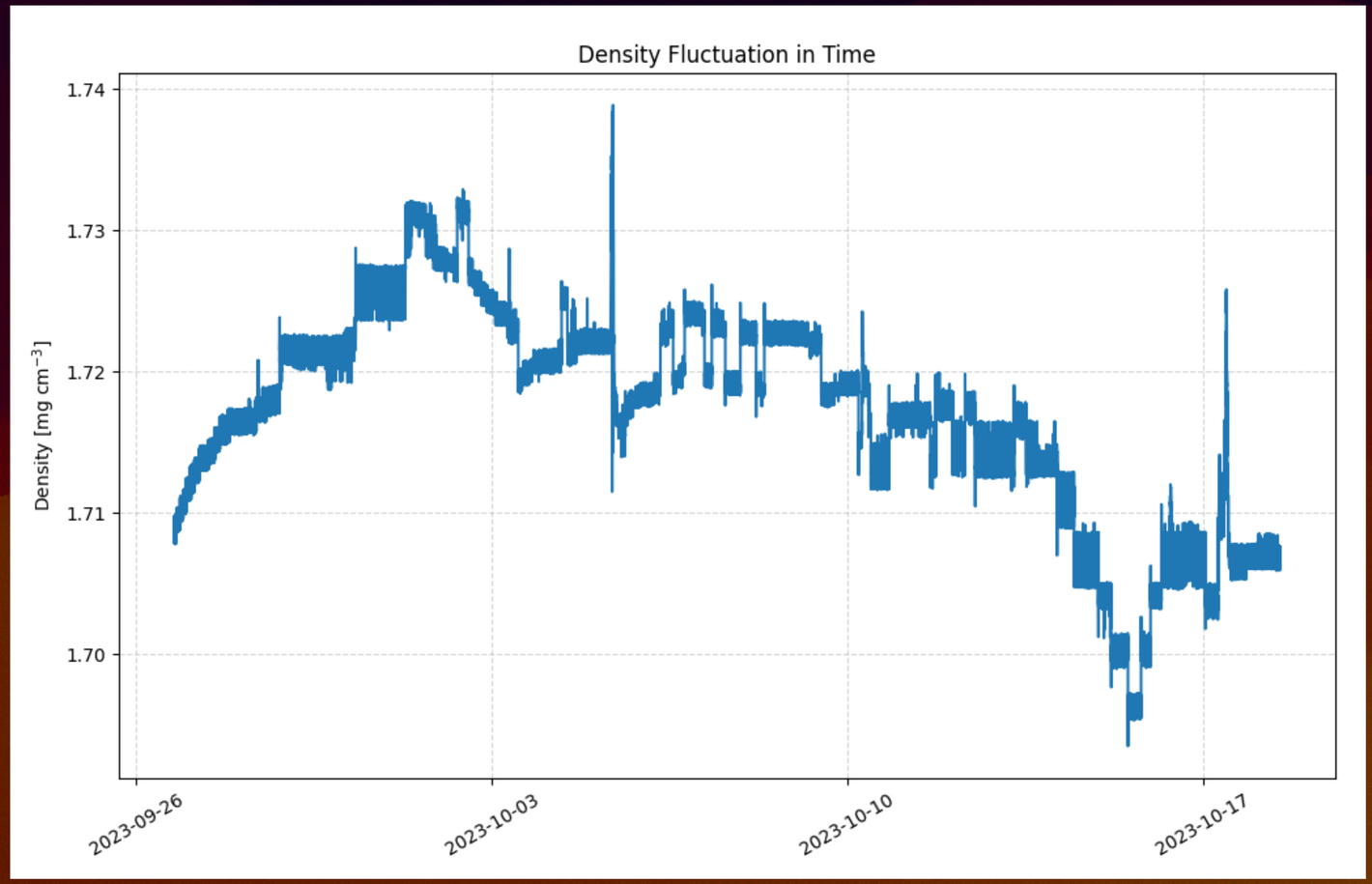
Underground we have p ≃ 900 mbar, so we expect:

- **Still** He:CF_4 (60:40)
- $\rho^{LNGS}_{HeCF_4} = 1.49$ mg/cm³

Note: here we are assuming that the ideal gas law still holds for CF_4 @ T = 0 °C.

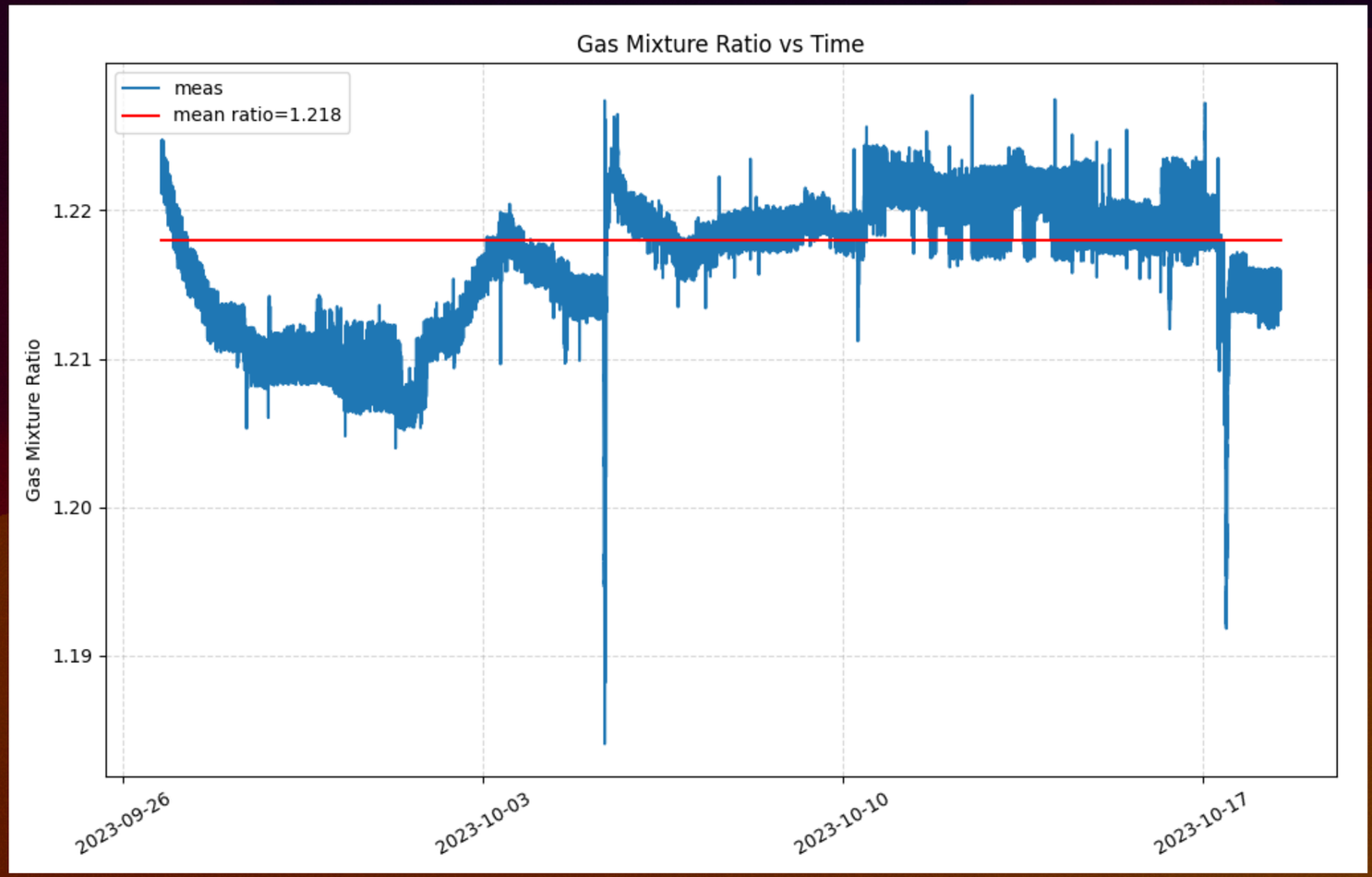
Density Fluctuation

- Density measured at LNGS seems not to resemble the expected one.
- It fluctuates around a slightly higher value with respect to the expected one.



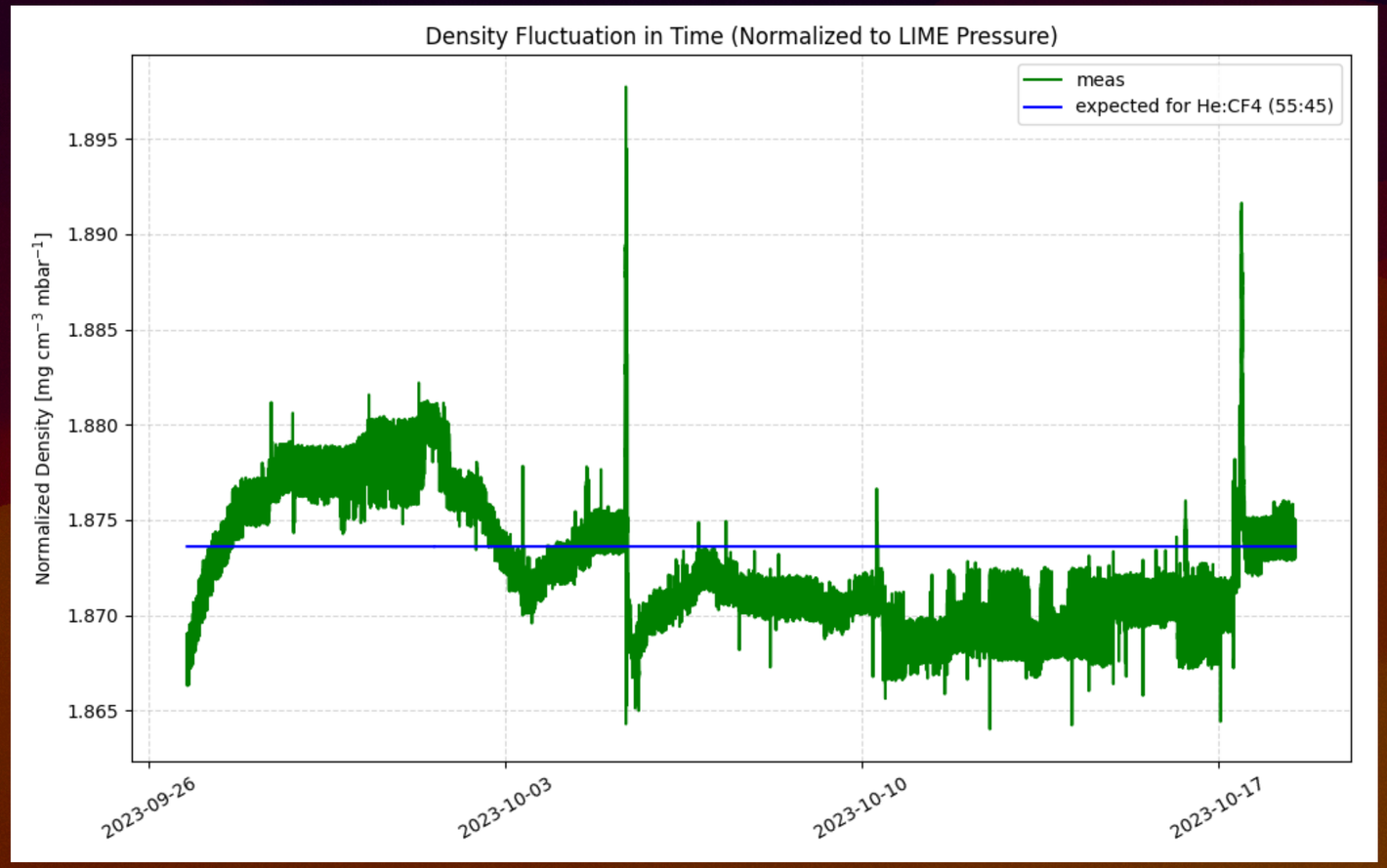
Gas Mixture Ratio Fluctuation

- More analytically we can invert the ideal gas law to extract the $HeCF_4$ mix ratio fluctuation in time.
- We can clearly see that the mixture ratio, between 29th September and 18th October has always been the expected value, fluctuating around 1.218.



Density Fluctuation - pressure normalisation

- When normalising the fluctuation to the LIME pressure, we see that the trend is compatible with the one expected for a 55:45 gas mixture.



Conclusions

1. If there are no errors in this analysis, we can conclude that for some (at the moment unknown) reason **the gas mixture ratio is not the one expected**.
2. In principle **this ratio fluctuation should produce a fluctuation in the overall gain.**
3. The idea is now to quantify this gain variation and the entity of the consequences produced by this.

Thank you for your attention!

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