# Underground LIME: Run 2

## $^{55}$Fe calibration runs


Rita Roque| CYGNO Reconstruction & Analysis Meeting | 25/05/2023

The speaker acknowledges the FCT PhD studentship (ref. SFRH/BD/143355/2019).

# Introduction

## Data Information

Scan in z with the $^{55}Fe$ source in the following days:

**-FEBRUARY-**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | | | | |

**-MARCH-**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

The data was taken with a drift field of 996 kV/cm and:

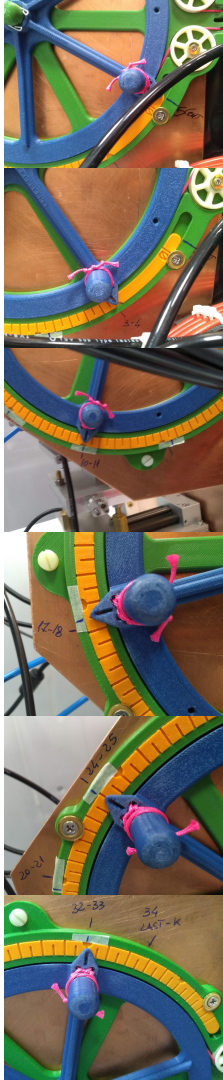
- VGEM=440 V for days 9/3, 8/3, 7/3, 6/3, 20/2
- VGEM=420 V for days 28/2, 24/2, 23/2, 21/2

The data of days 16/2 and 17/2 was taken with different drift fields. -> discarded

## Goals

Study the light yield behaviour with:

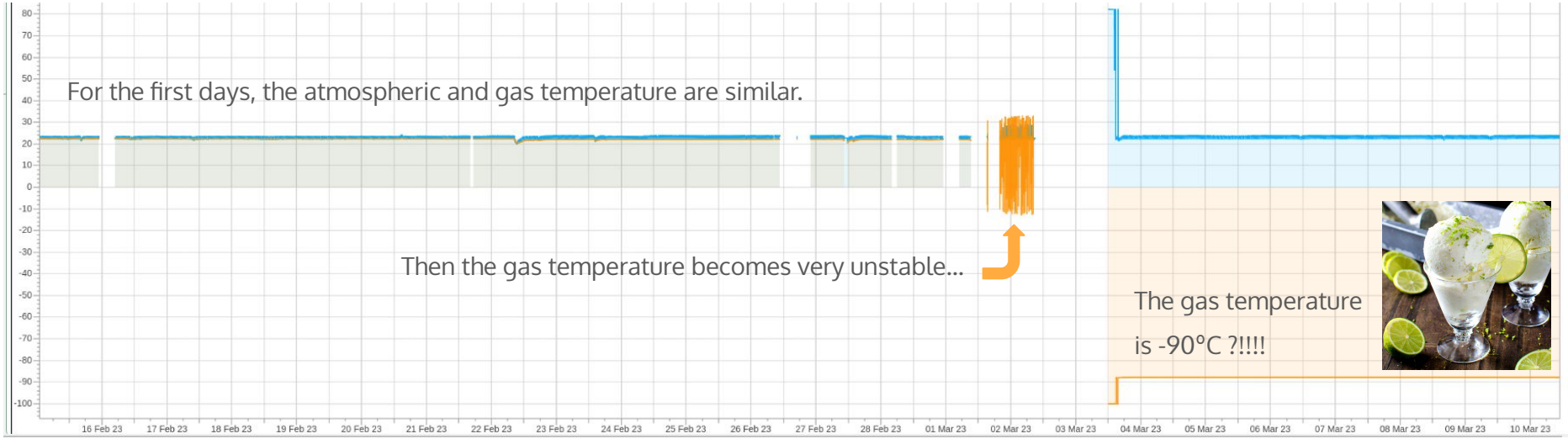
- ❑ VGEM
- ❑ Time
- ❑ Temperature
- ❑ Pressure
- ❑ Source position (Z)



# Ambient data – gas temperature

The gas temperature recording is strange for some days...

Spike in atmospheric temperature up to 80°C ?!!!!



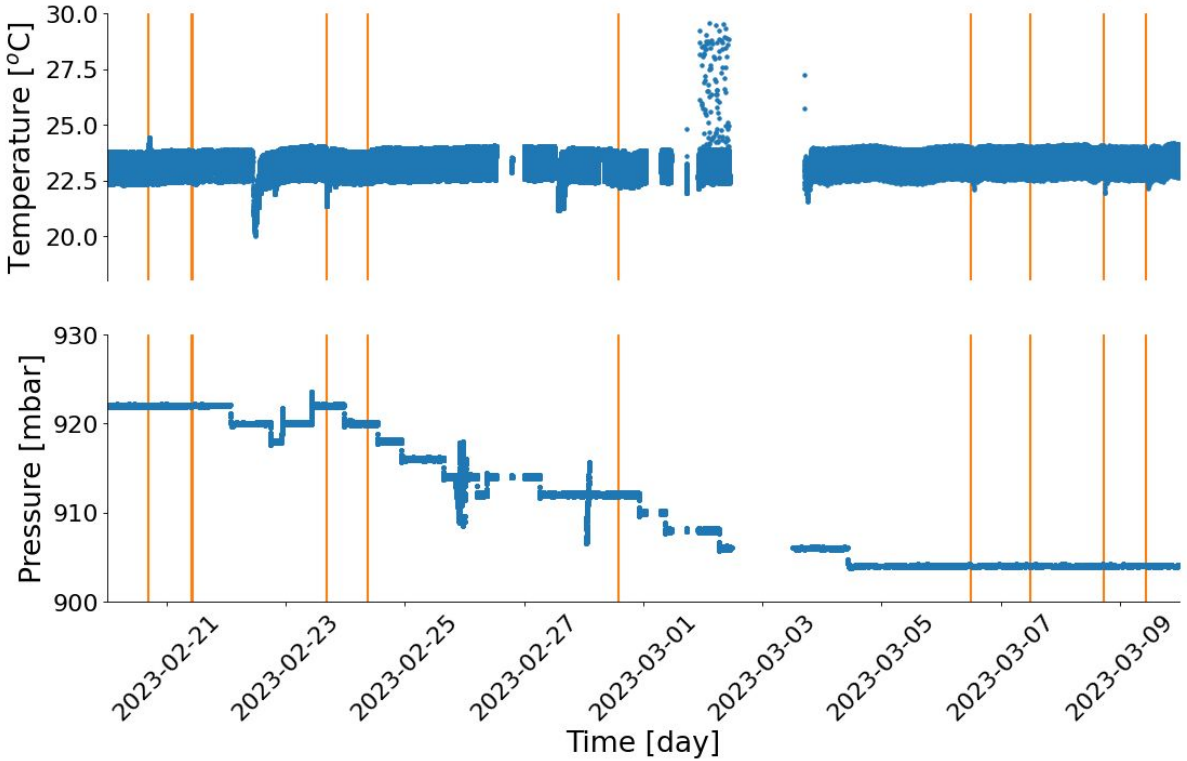



## Conclusion

There were probably issues with the gas temperature sensor, so I used the atmospheric temperature data, which seems reliable.

# Ambient data – gas temperature and pressure

The gas pressure and atmospheric pressure were taken from MIDAS (thanks Stefano).



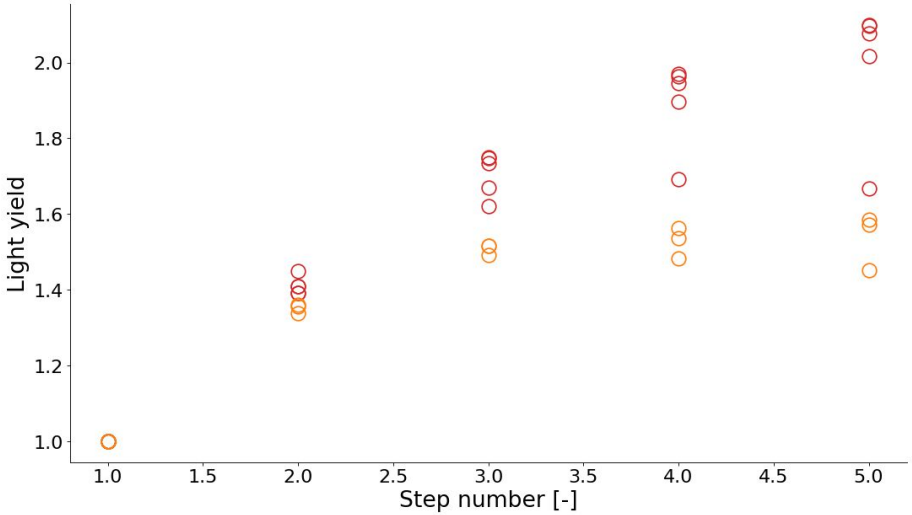

The calibration procedures are presented in orange.

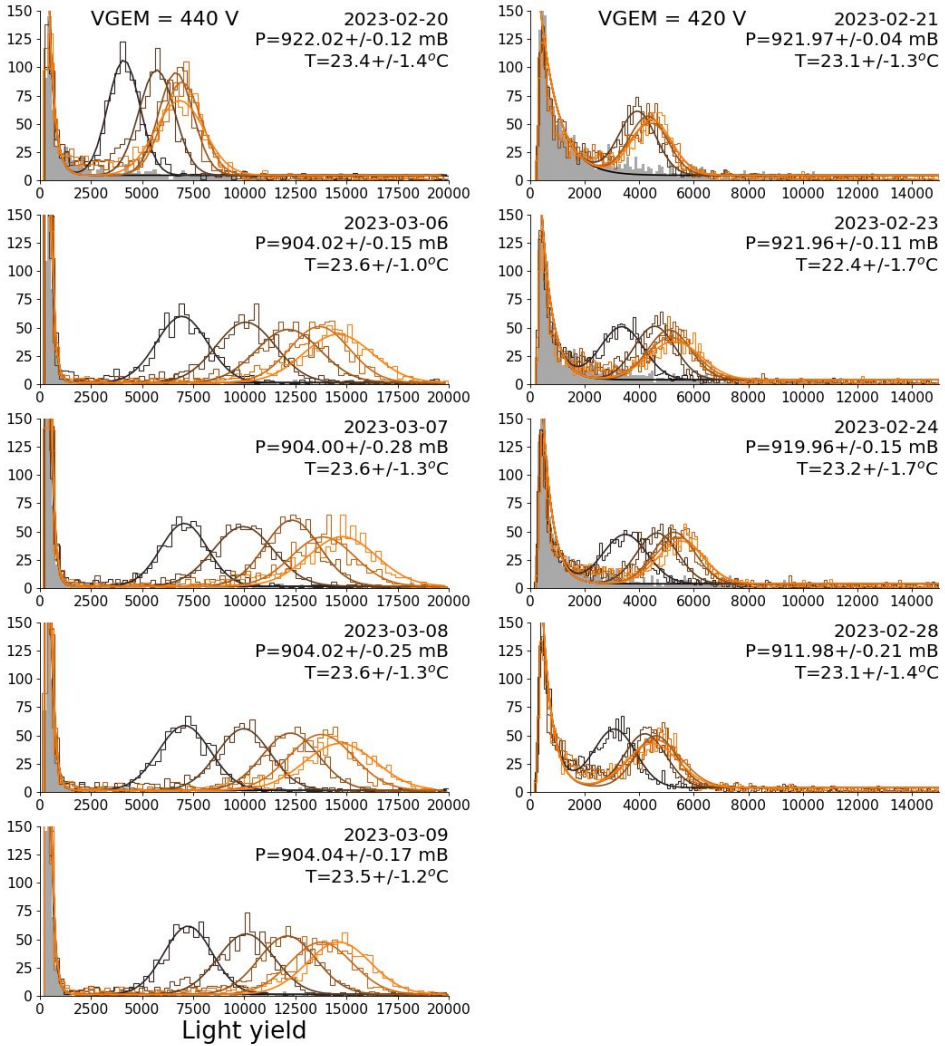
Each supercluster data was linked to the closest pressure and temperature recording using the start time of the acquisition.

# Light yield spectra

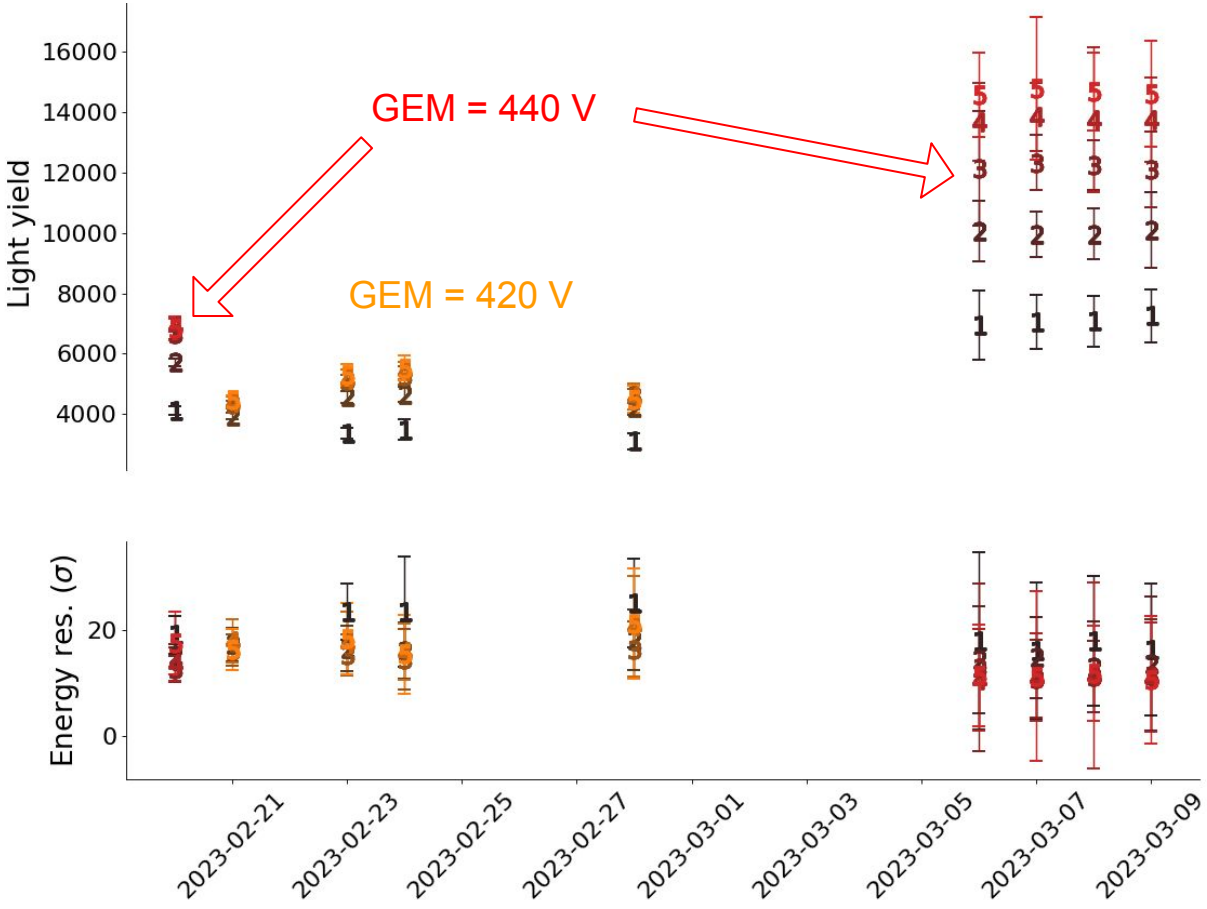
The background (parking runs) was fitted to an exponential function.

The light yield spectra were then fitted to a gaussian summed to the background exponential profile.



# Light yield over time



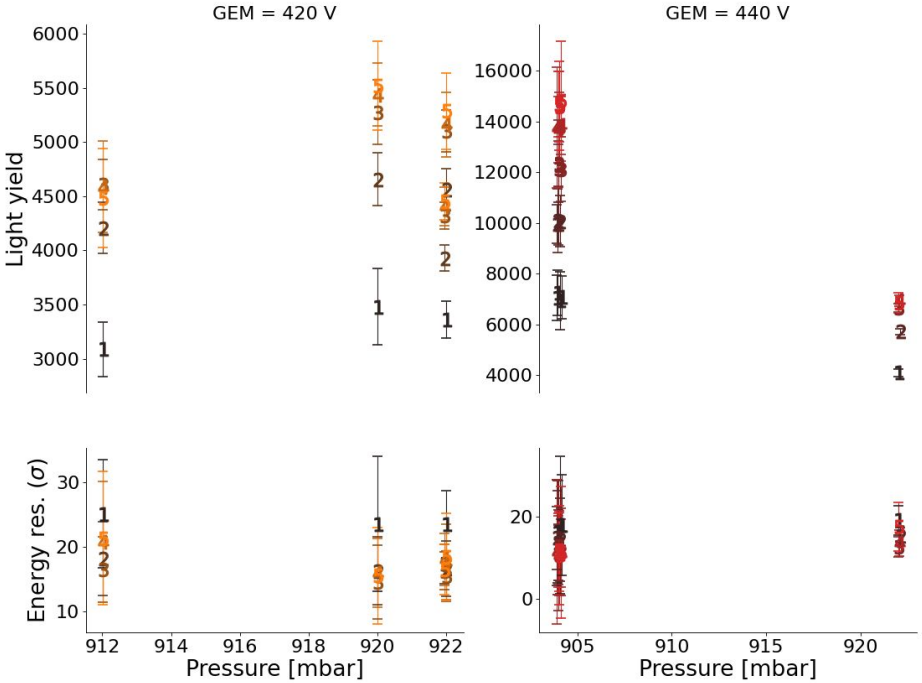

Even for the same detector conditions, the light yield slightly fluctuates over time:

| Step ➡ | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 440V | LY | 1.6 | 0.6 | 0.7 | 0.5 | 0.6 |
| | σ | 5.3 | 5.2 | 6.9 | 2.6 | 3.9 |
| 420 V | LY | 5.1 | 6.8 | 8.1 | 8.8 | 9.9 |
| | σ | 3.3 | 4.5 | 5.0 | 9.8 | 12.8 |

$$\text{Fluctuation} = \frac{\sigma}{\mu} \times 100\%$$

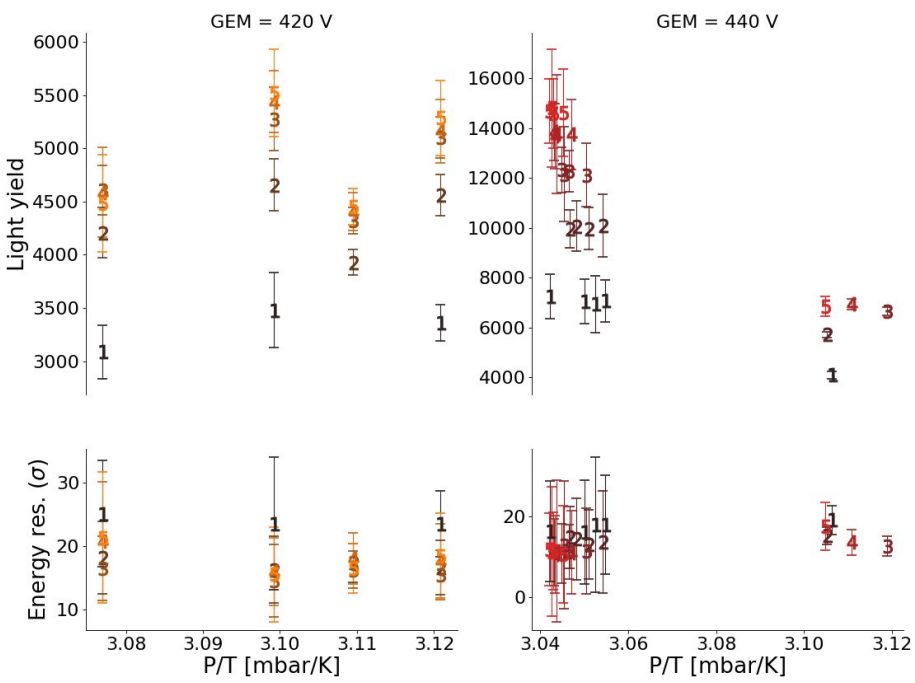
# Light yield and ambient conditions

## Light yield vs pressure




- For 420 V the LY seems independent of pressure
- For 440 V the LY seems to decrease with pressure

## Light yield vs P/T




- For 420 V the LY seems independent of P/T
- For 440 V the LY seems to decrease with P/T

# Conclusions

- **The light yield changes over time for the same detector conditions**

  The light yield fluctuates between 0.5% and 9.9%, and the energy resolution between 2.6% and 12.8%.

- **The fluctuations in the light yield are not correlated to ambient conditions**

  This means that we cannot correct the LY using the ambient conditions. Maybe with more data?

**The daily calibration procedure is fundamental!**