Studies of the response stability as a function of the time and gas humidity, density and pressure

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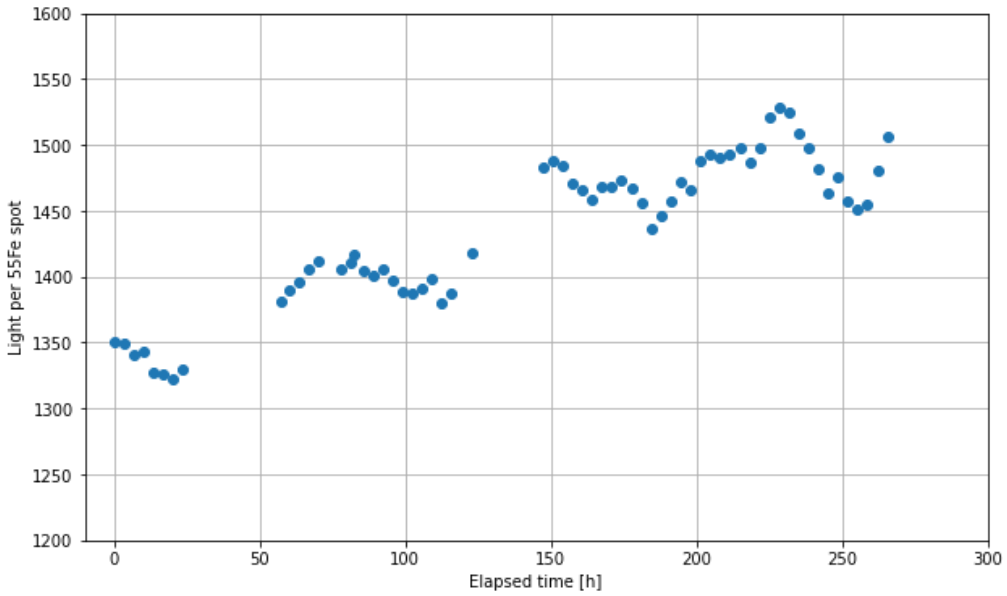
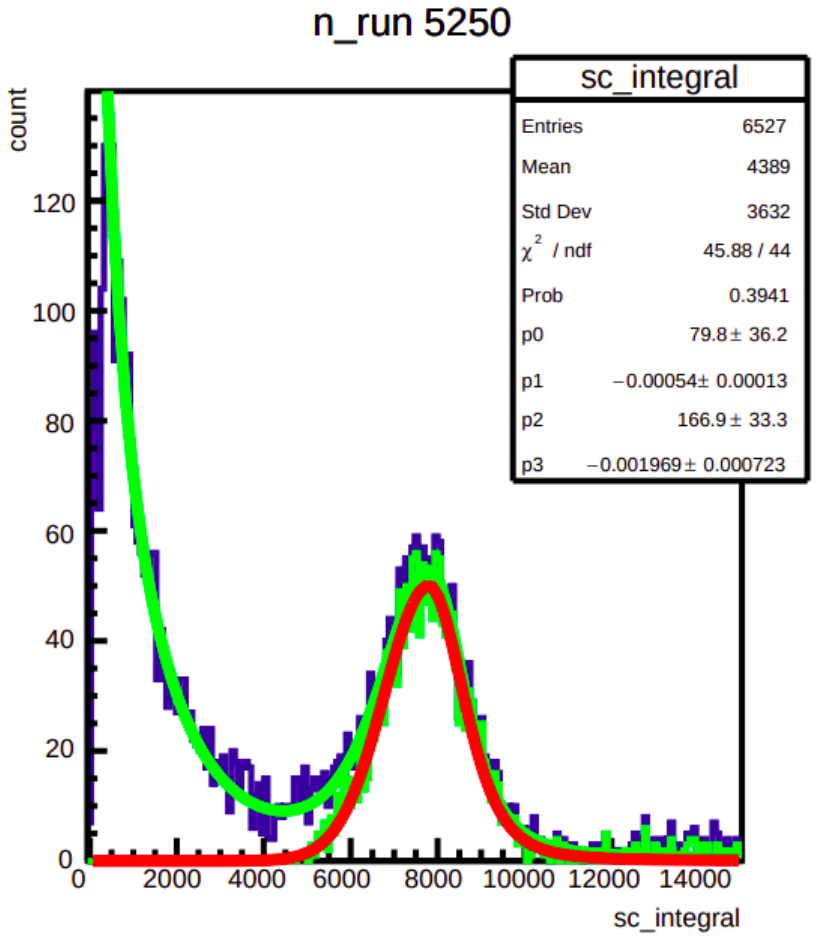
Outline

- Studies of the response stability with data taken at
  - LNF as function of :
    - Time;
    - Pressure;
  - LNGS;
    - Run1 as function of:
      - Pressure;
      - Gas flow;
    - Run3 as function:
      - Pressure;
      - Humidity

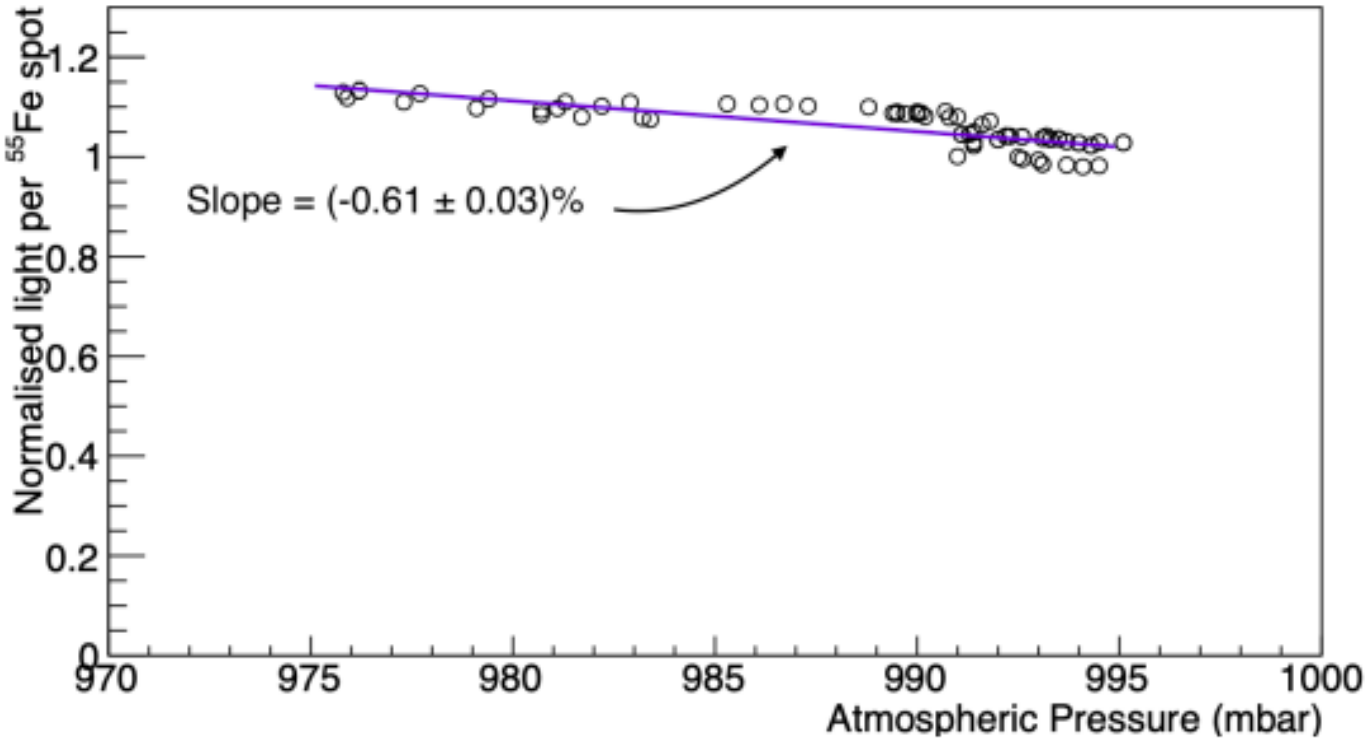
LNF

- Data are reconstructed using DBSCAN
- The ^{55}Fe peak in the integral distribution is fitted with exp + exp + Cruijff function and the mean defines the iron peak





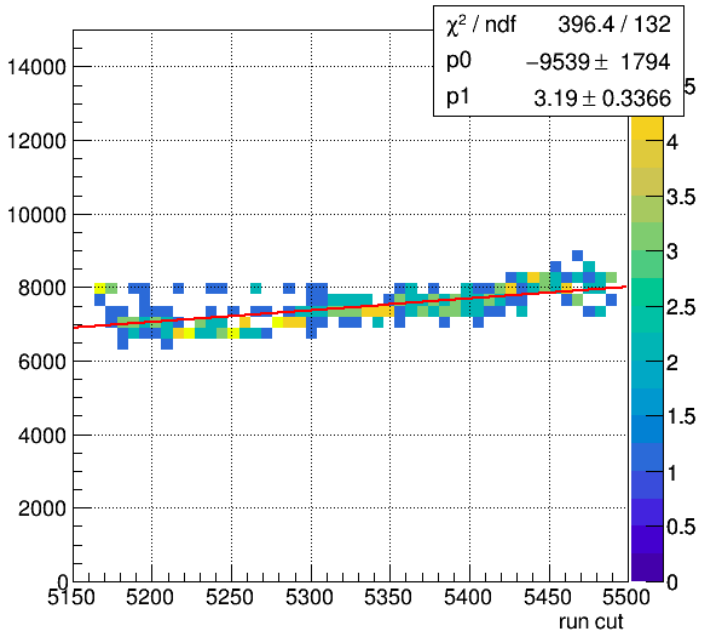
- The ^{55}Fe peak of each run are normalized to the first run
- The normalised ^{55}Fe peak is plotted in function of the pressure and a linear fit is performed
- The light yield decreases of about 0.6% per millibar

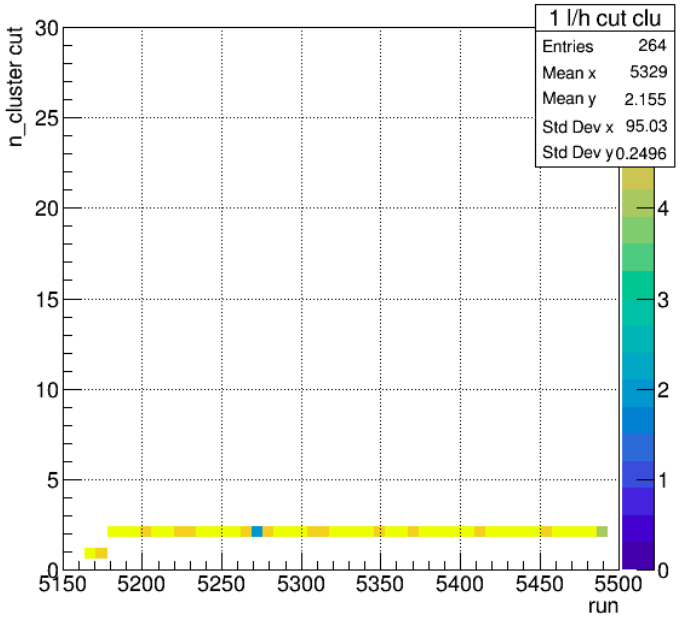


LNGS - Run1

- The ^{55}Fe source is placed 25cm far from the GEMs
- HV = 420 V
- Expoure Time = 0.3 s
- Cut suggested by Emanuele are apllied:
  - sc_integral > 1500
  - 0.15*sc_length< 50
  - sc_rms > 6
  - sc_tgausssigma/sc_lgausssigma > 0.6
  - sc_tgausssigma/sc_lgausssigma < 1.1
  - R< 900
- The integral distribution is fitted with the Cruijff function
- The data are taken with different gas flows:
  - 1 l/h
  - 3 l/h
  - 10 l/h
  - 20 l/h

1 l/h

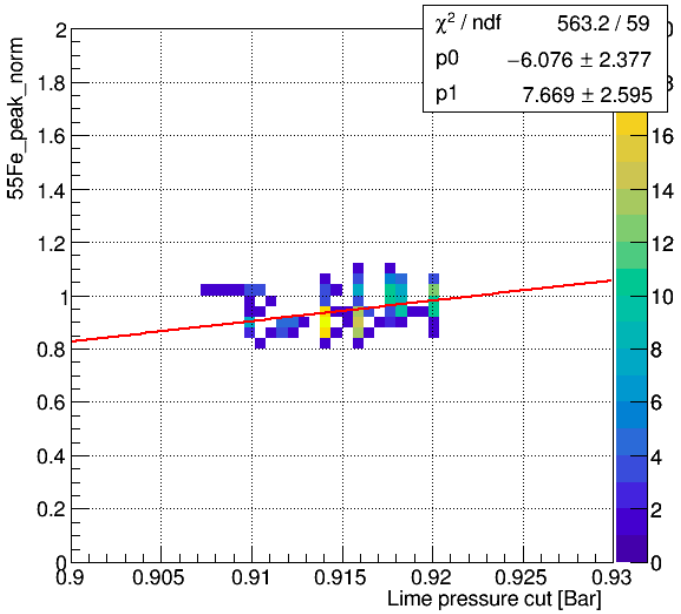




$$\frac{dG}{G} \propto - \frac{d\rho}{\rho}$$

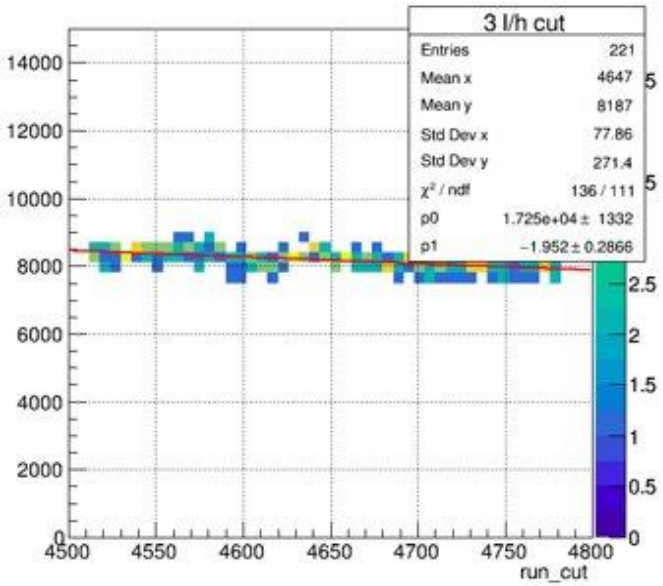
$$\rho \propto 1/T$$

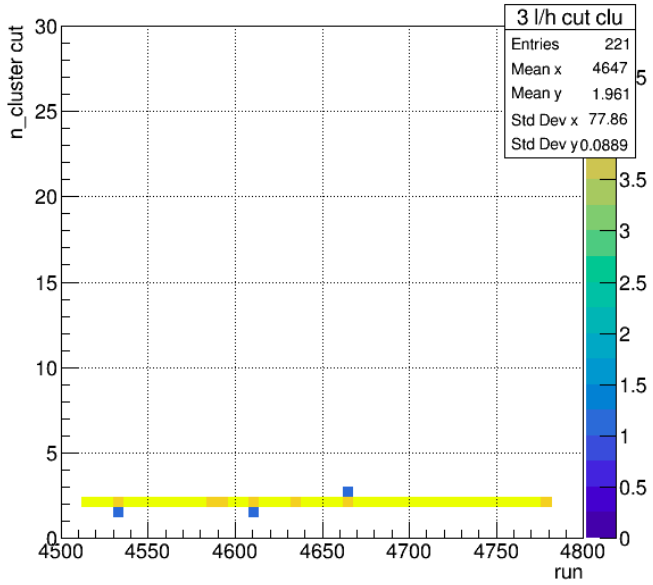
$$\rho \propto P$$

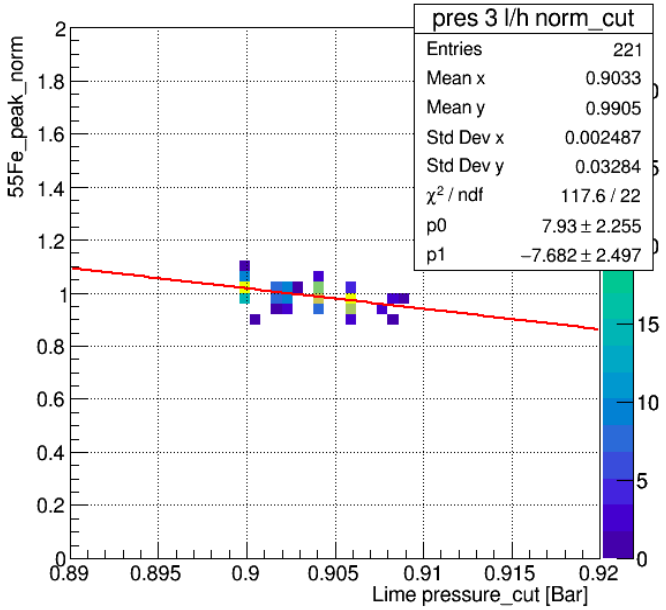


- The LY increases increasing the pressure
- The low gas flow could not "clean" the gas
- The number of ^{55}Fe cluster is costant

3 l/h

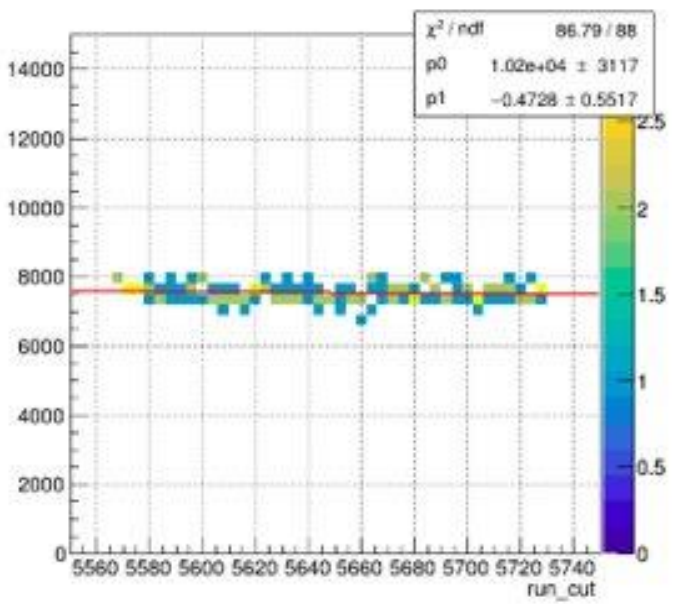


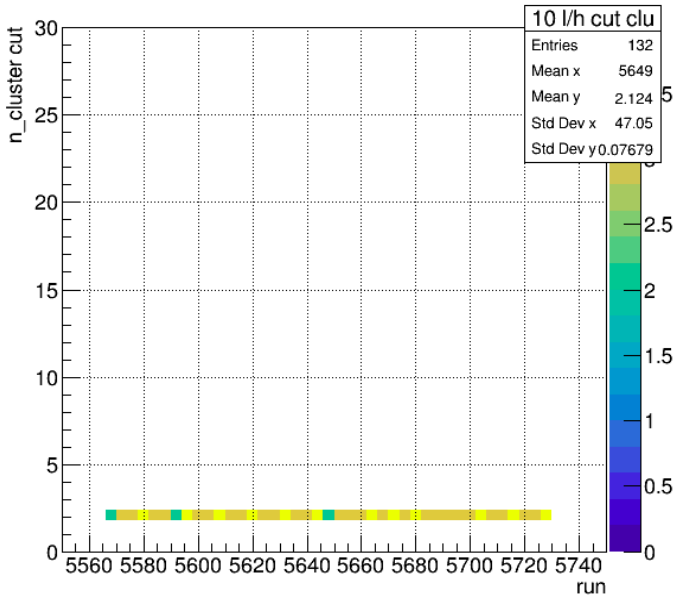


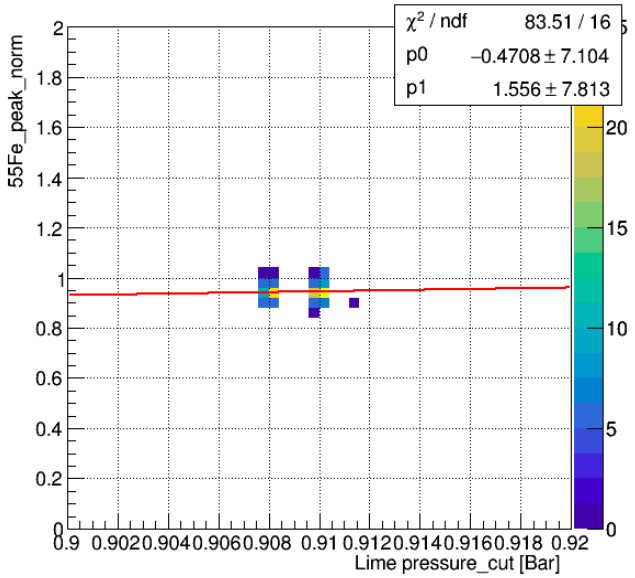


- The LY decreases increasing the pressure
- The number of ^{55}Fe cluster is costant
- light yield decrease of about 0.7% per millibar

10 l/h



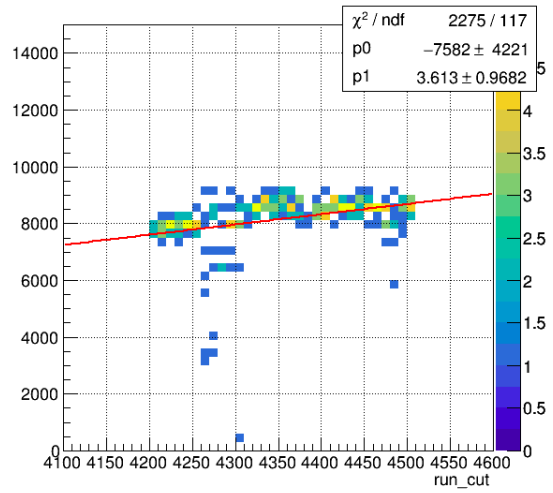


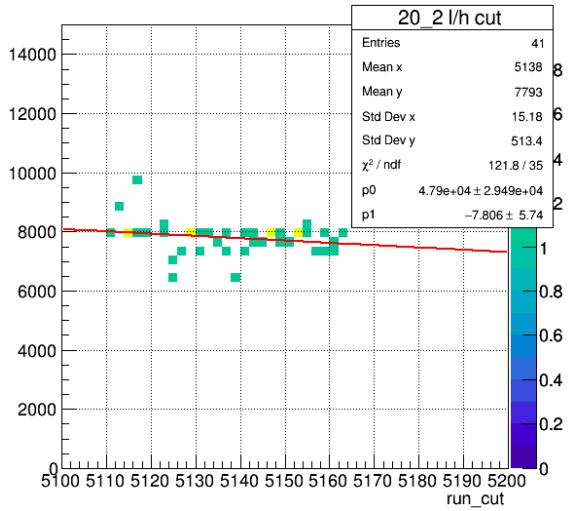


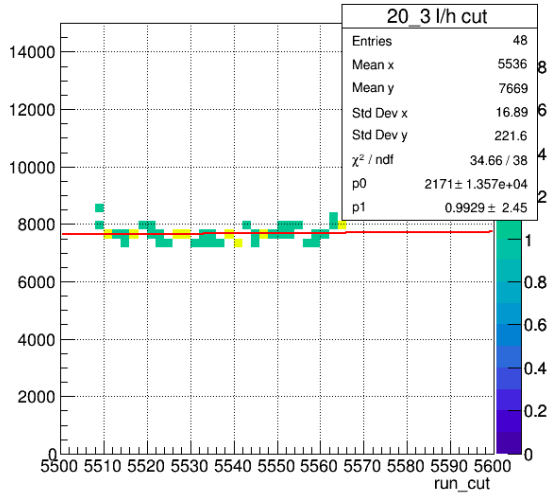
- The pressure is costant -> the LY is costant
- The number of ^{55}Fe cluster is costant

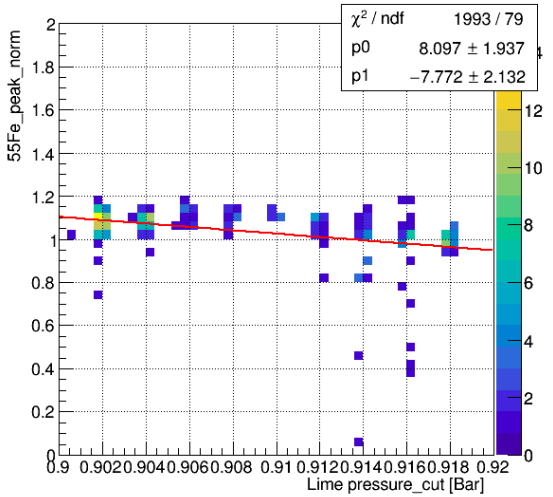
20 l/h

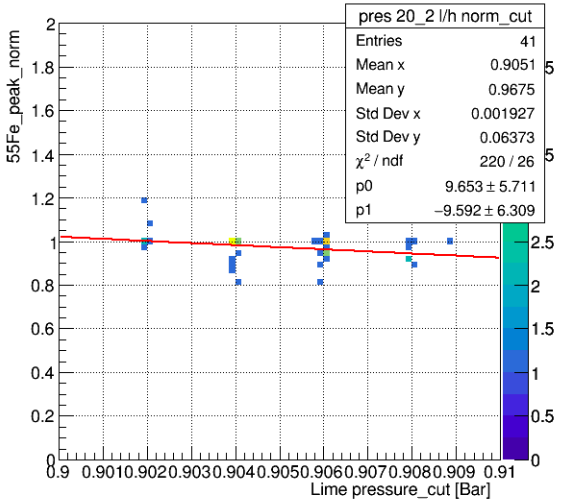
There are three different region with gas flow 20 l/h

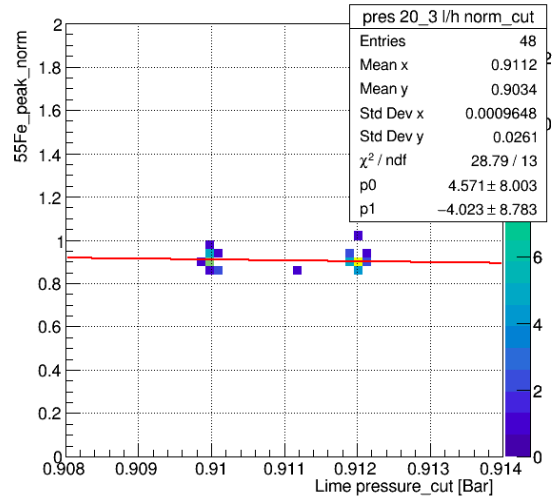


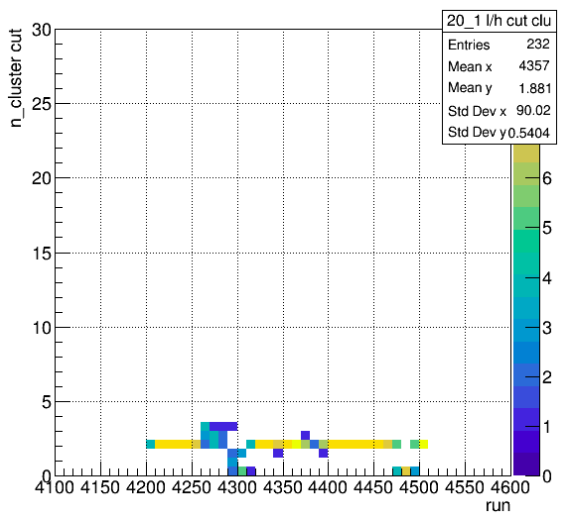


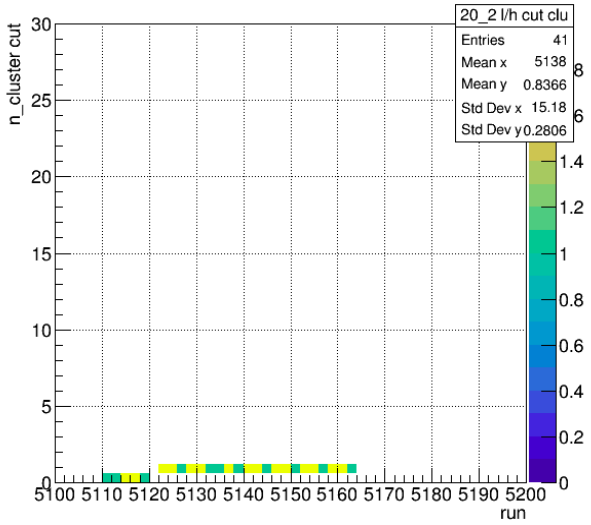


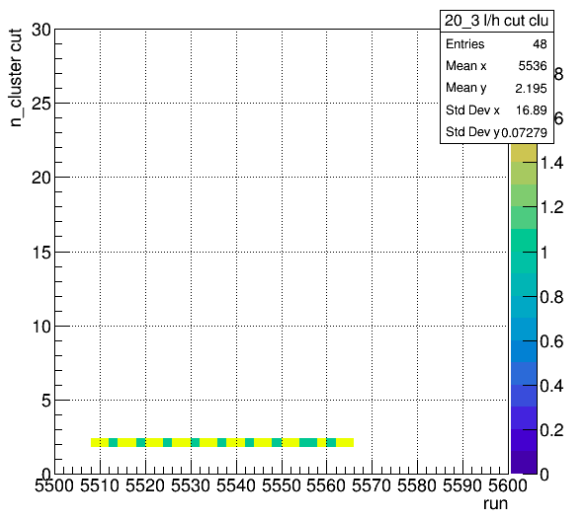












- The LY decreases increasing the pressure
- The number of ^{55}Fe cluster is costant
- light yield decrease of about 0.7%, 0.9% and 0.4% per millibar

LNGS - Run3

- Runs taken in exam: [17400 - 20415]
- Period: [05 May 2023 – 25 May 2023]
- HV = 440 V
- Exposure time = 0.3 s

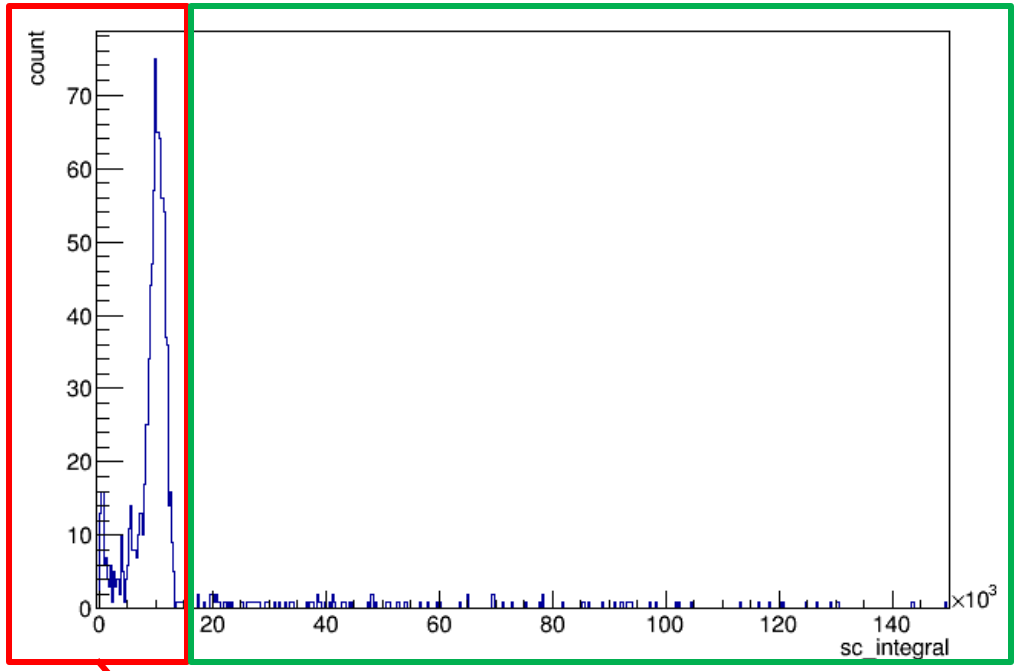
The daily calibration data with the ^{55}Fe source are skiped (where the source is placed every time at different distance from the GEMs)

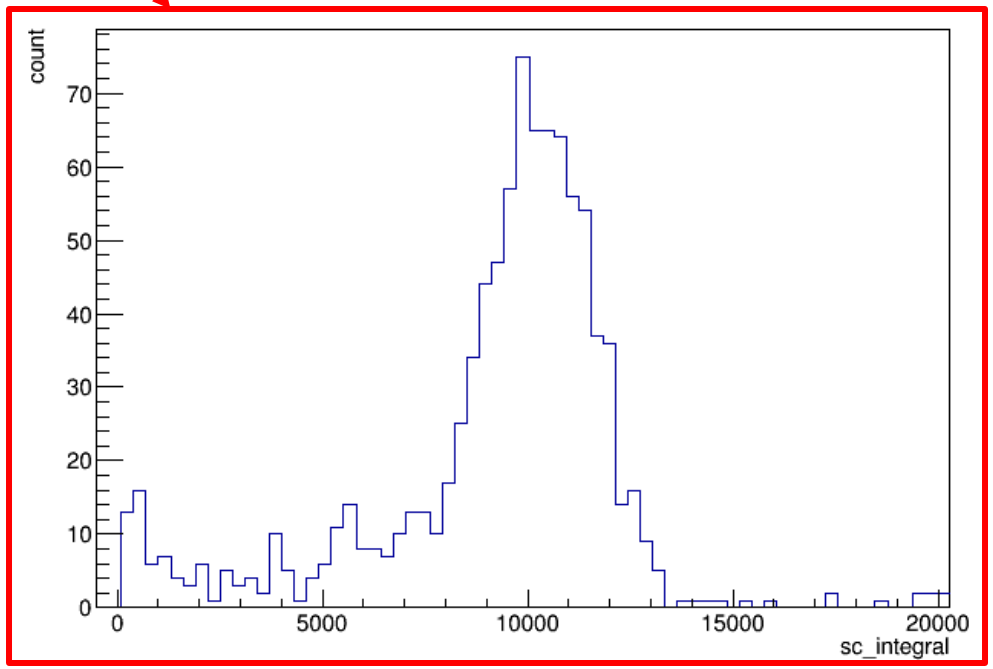
In some of the runs the ^{55}Fe source is placed 25 cm far from the GEMs and the peak is fitted

The **green region** is defined after the signal of the ^{55}Fe source in order to check a "safe" region

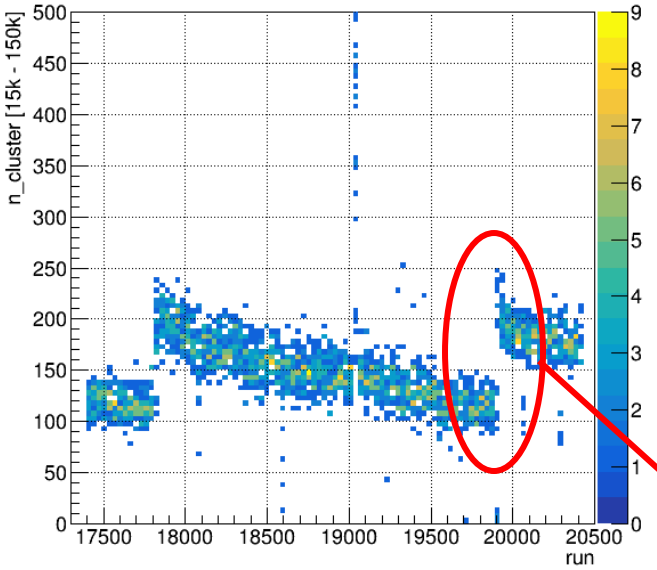
In the **green region** I defined:

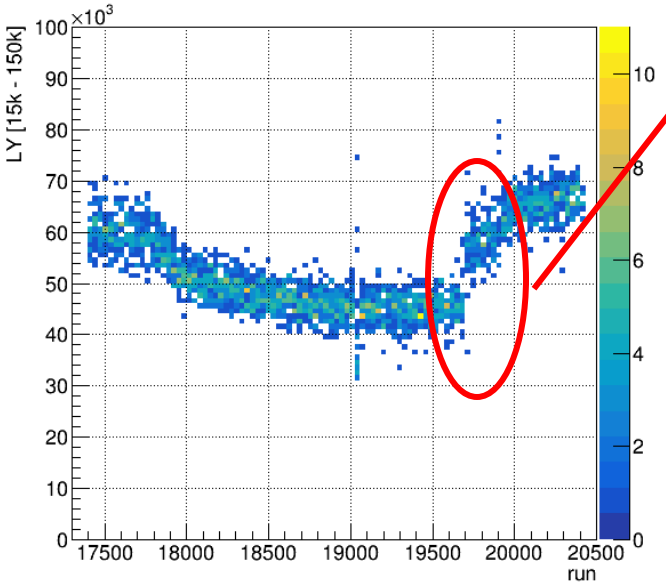
- LY -> the average between 15k and 150 k
- Sc_int_post -> the number of cluster with intenity between 15k and 150k





Number of cluster and LY vs run number

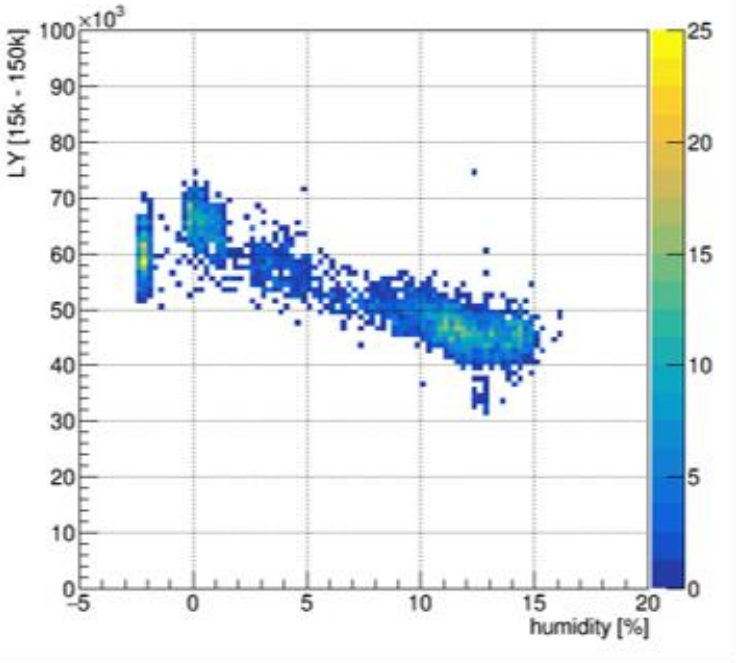


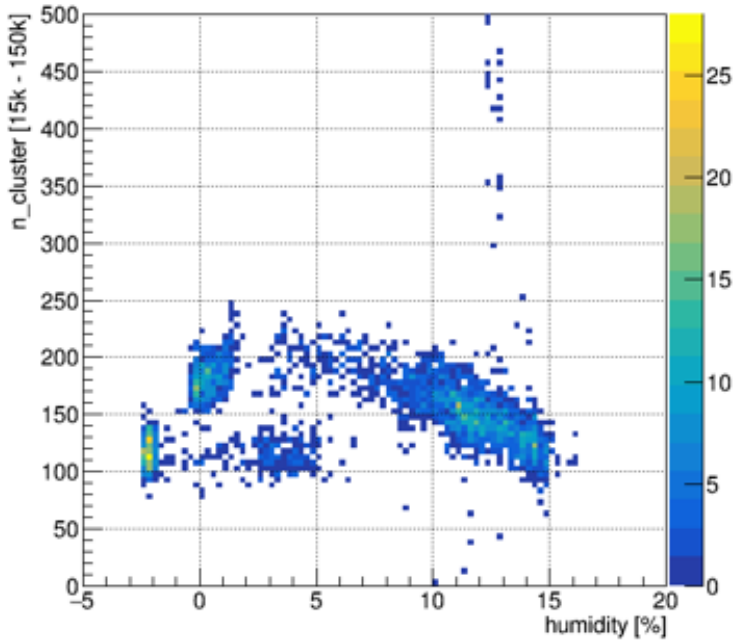


Human intervantion

The number of cluster and the LY is not costant

Number of cluster and LY vs humidity



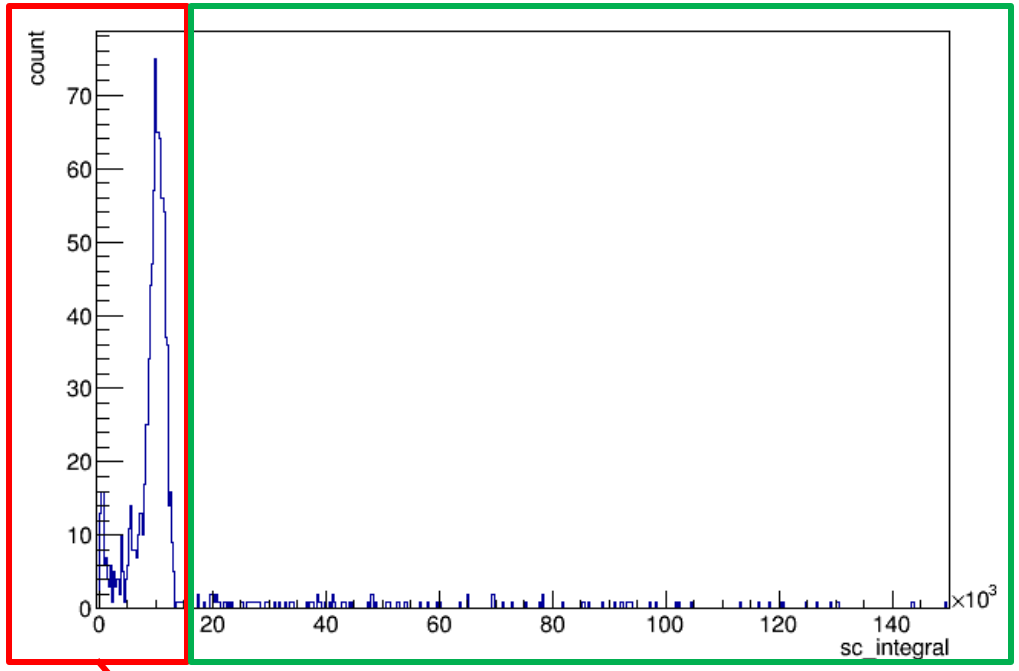


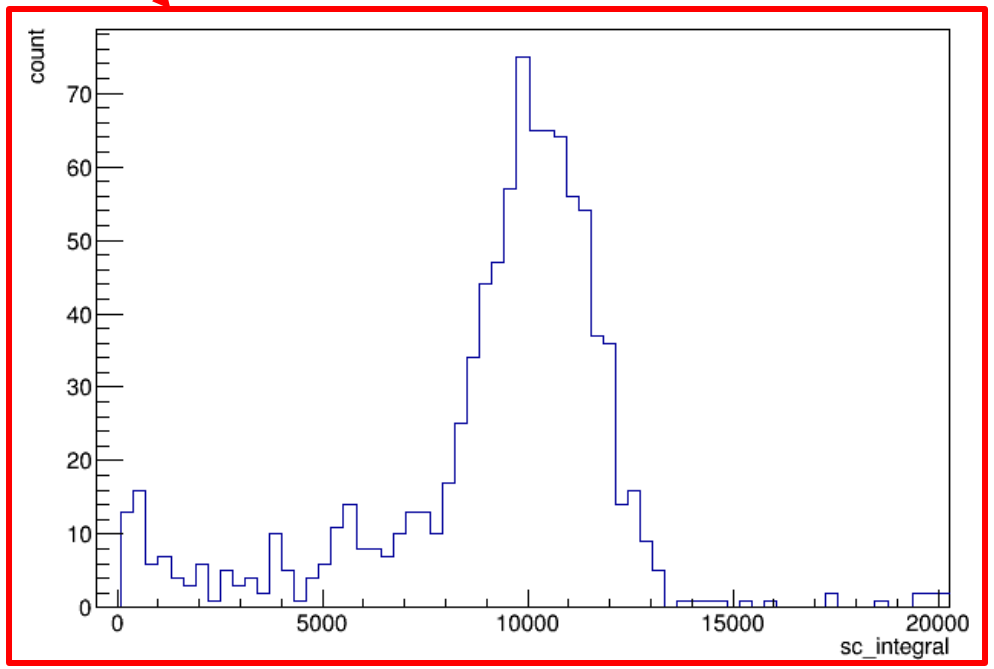
Increasing the humidity -> the LY and the number of cluster decreases

The **red region** is defined where there is the signal of the ^{55}Fe source

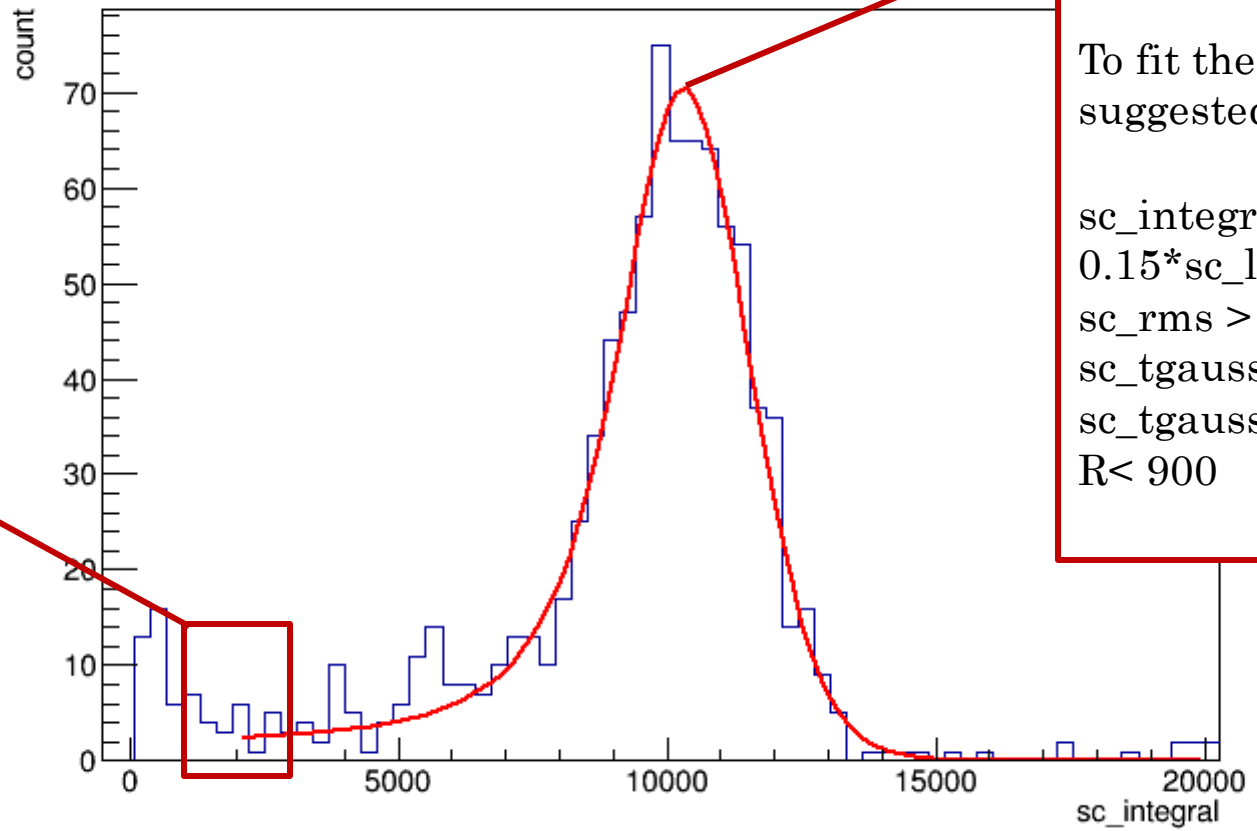
In the **red region** I defined:

- Sc_int -> the number of cluster before the ^{55}Fe peak between 1k - 3k in order to check the background stability
- ^{55}Fe peak -> the mean of the Cruijff function fit





Sc_int = number of cluster

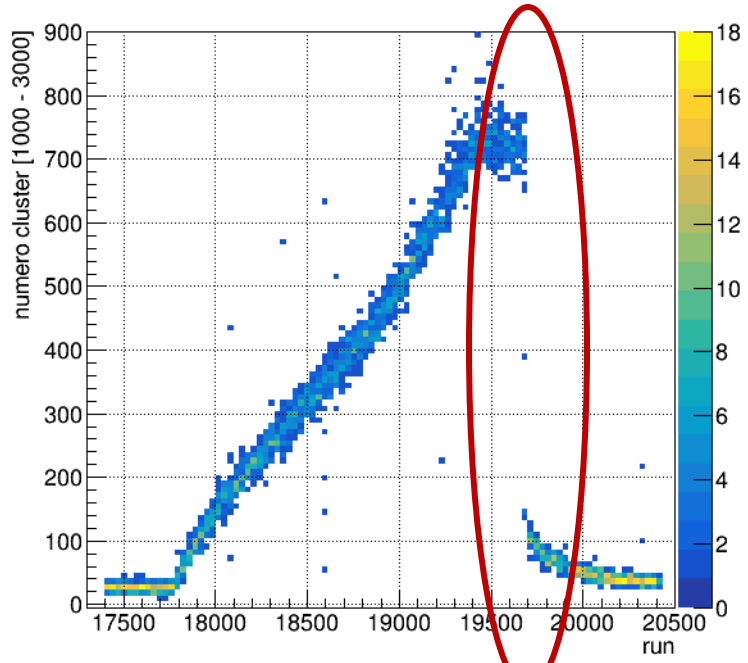


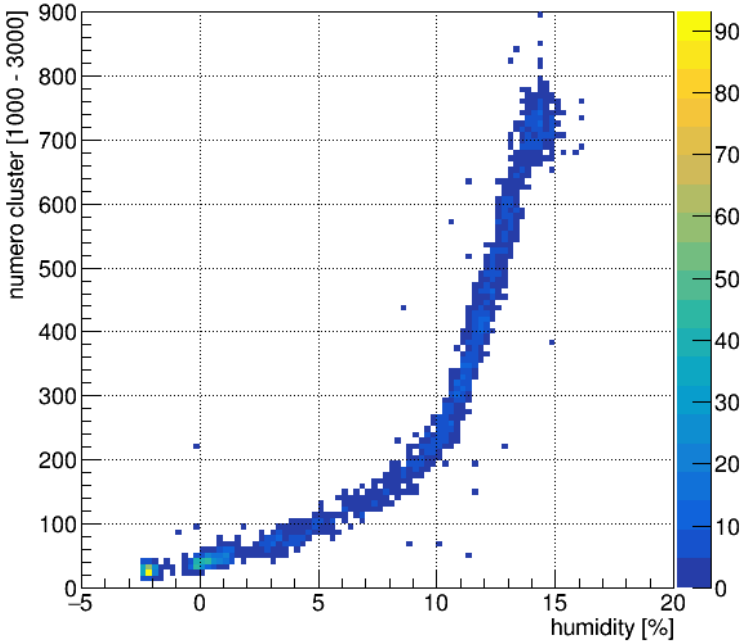
^{55}Fe peak = mean of the Cruijff function

To fit the distribution the cut suggested by Emanuele are applied:

sc_integral > 1500
0.15*sc_length< 50
sc_rms > 6
sc_tgausssigma/sc_lgausssigma > 0.6
sc_tgausssigma/sc_lgausssigma < 1.1
R< 900

Number of cluster

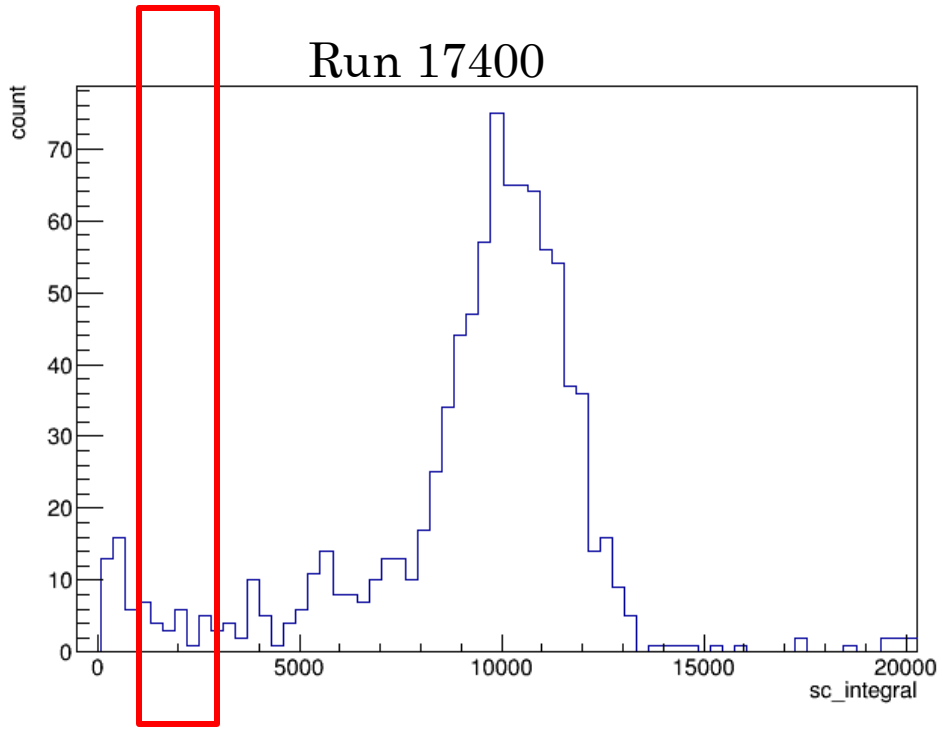


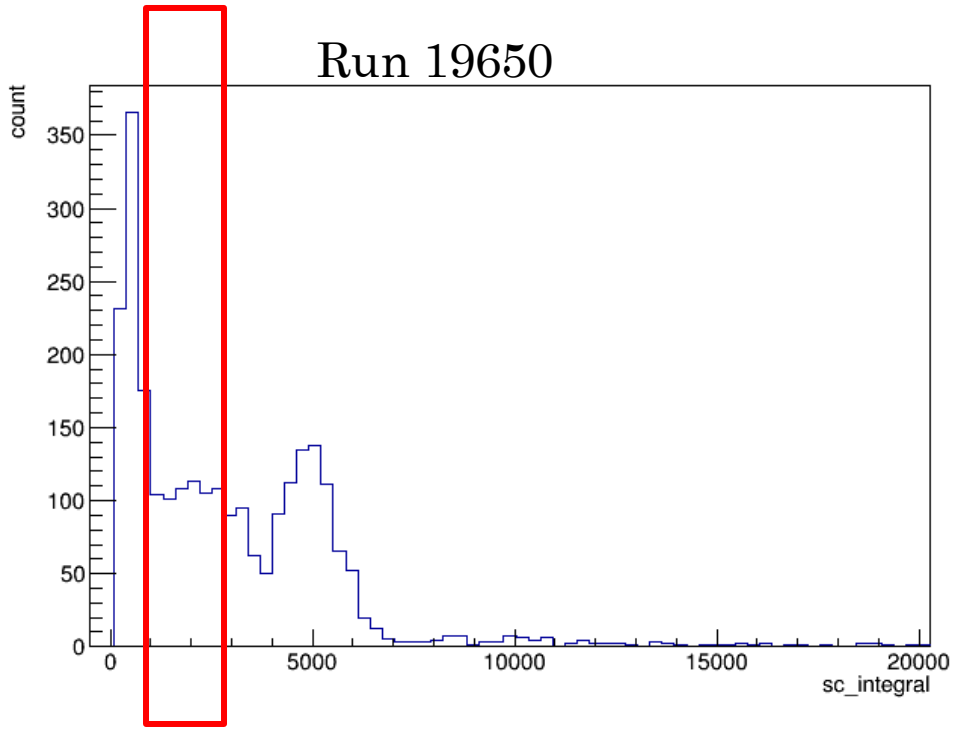


Human intervantion

The number of cluster increases increasing the humidity

Focus on region between 1k and 3k

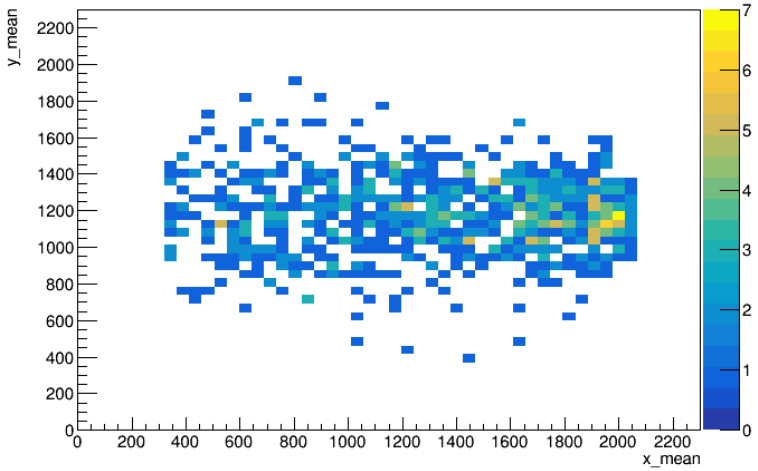




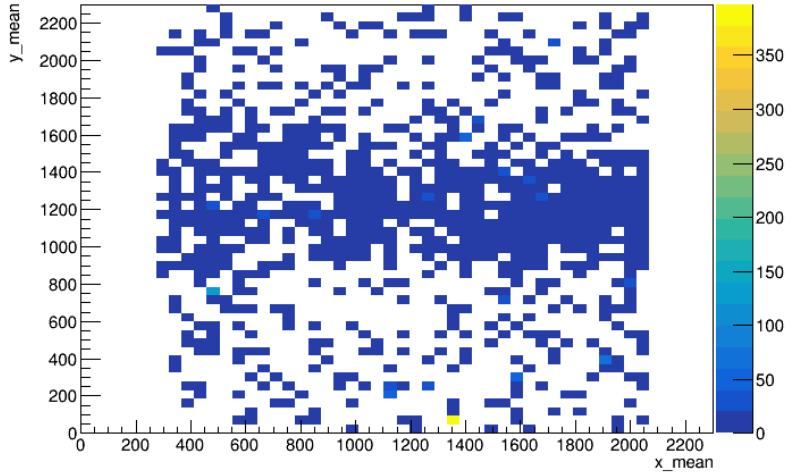
-> The number of cluster betwenn 1k and 3k is increased

Watching the position of the cluster…the number of cluster increased increasing the humidity

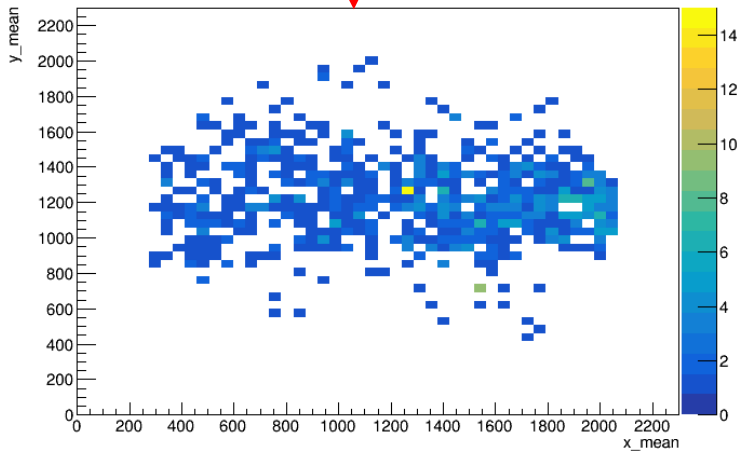
Run 17400



Run 19650

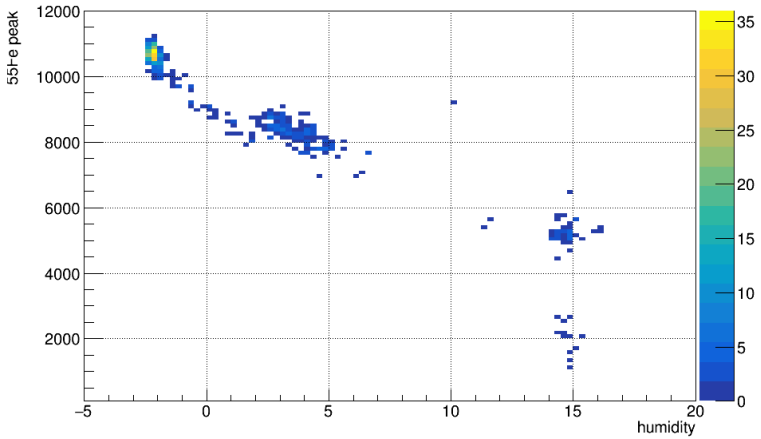


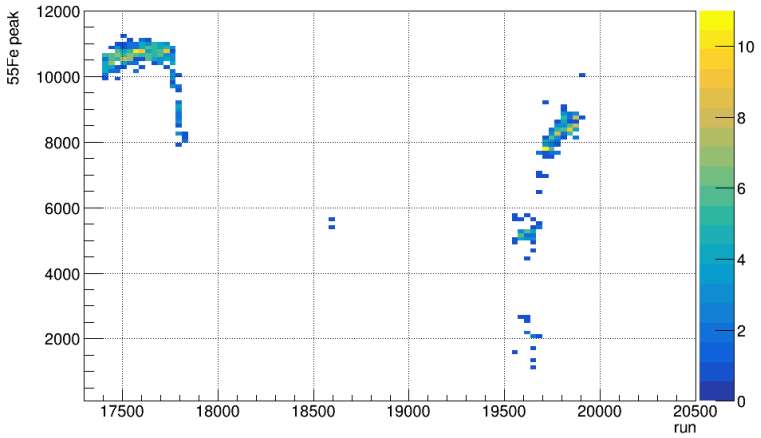
After appling the cut suggested by Emanuele

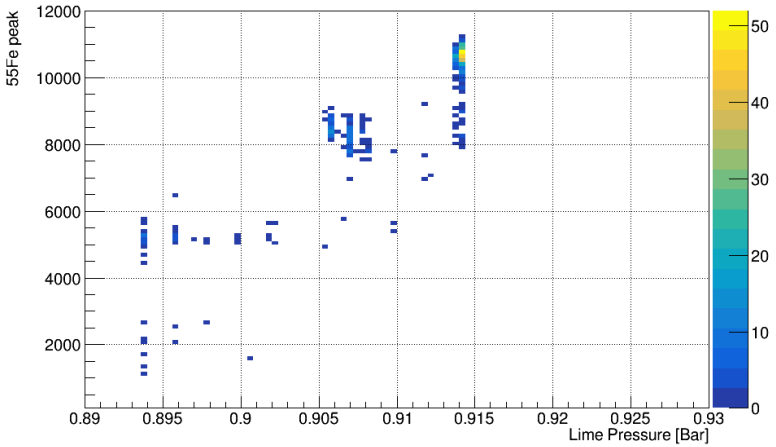


^{55}Fe peak

The cut are applied to the integral distribution and the ^{55}Fe peak is fitted by the Cruijff function



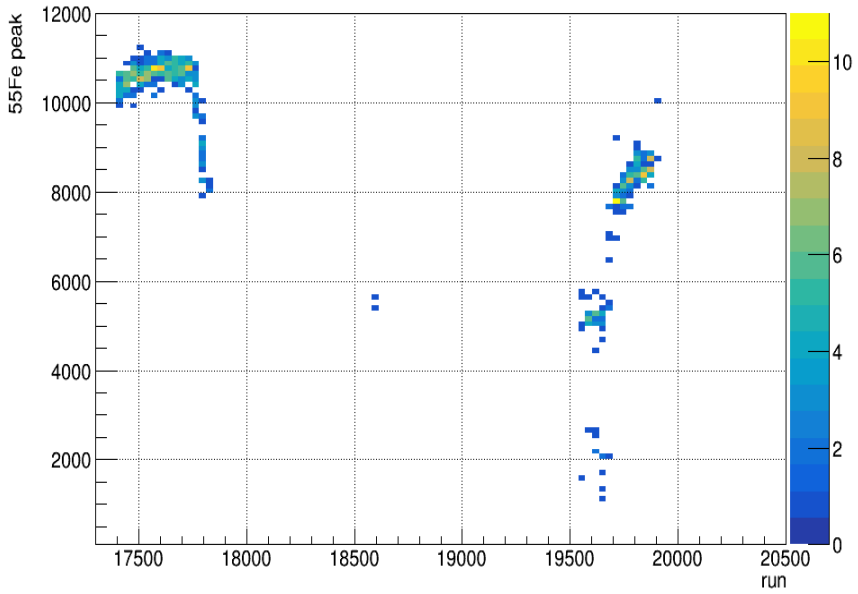


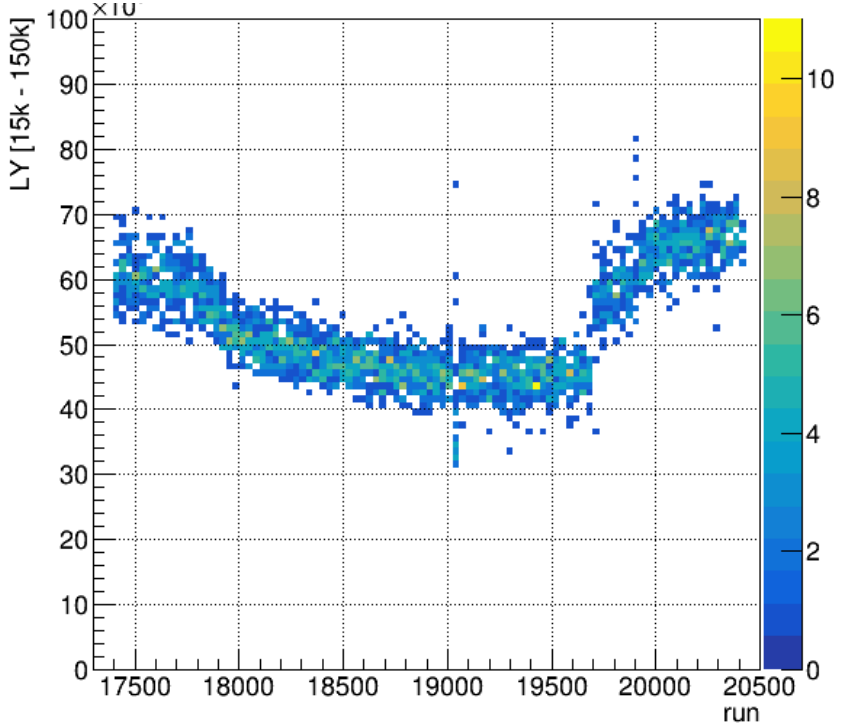


- The ^{55}Fe peak decreases increasing the humidity
- The ^{55}Fe peak increases increasing the pressure, which is a different behaviour than the Run1

Comparison between ^{55}Fe peak and LY

The ^{55}Fe peak seems to follow the behaviour of the LY
It could be a variable to check





Conclusions

- At LNF and Run1 the light yield decreases of about 0.6% per millibar;
- From the Run1 the minimum gas flow is 3 l/h;
- In Run3 the action of the humidity is studied and it increases the backgroud;
- In Run3 the LY increases, increasing the LY, differently than the Run1;