

# **Studies on LIME performance stabilities**

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## Outline

- Study of the hot pixels;
- Study of the total intensity;
- Reconstruction of the cluster to study:
  - The mean number of cluster
  - The mean number of pixel per cluster
  - The mean number of photons per cluster

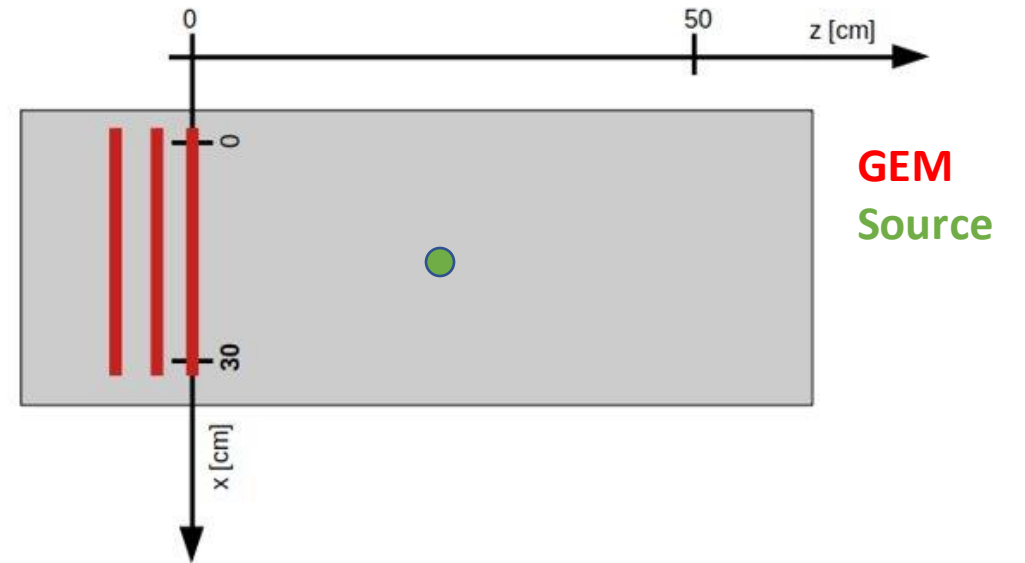
A sequence of data and pedestal run are acquired

Exposure time = 1 or 0.05 s

PMT trigger

$^{55}\text{Fe}$  source  $z = 26\text{cm}$  (distance from the GEMs)

He:CF<sub>4</sub> (60:40)



## Study of the hot pixels

Run: 5300 - 5451

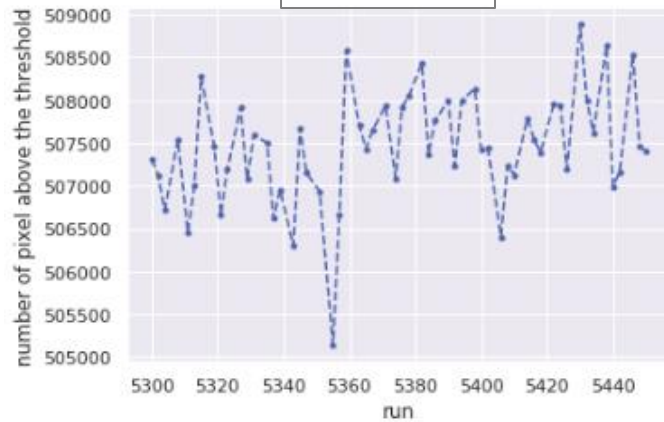
Date: 24/10/2021 - 29/10/2021

Exposure time: 1s

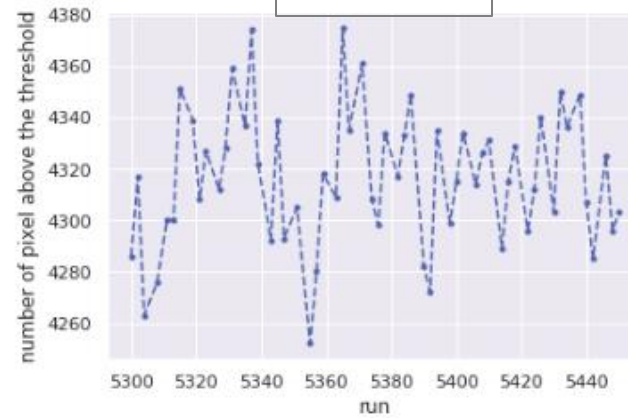
GEM Off

A threshold on the intensity is fixed and the number of pixels above the threshold (th) in each run are searched

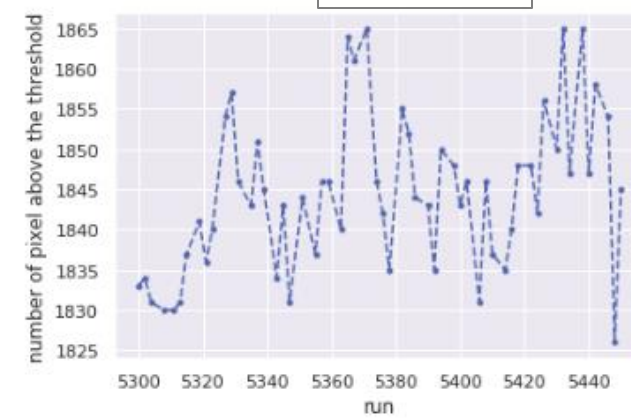
th = 105



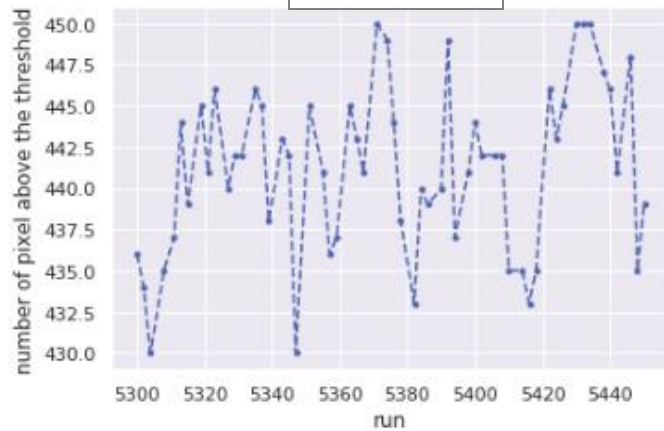
th = 120



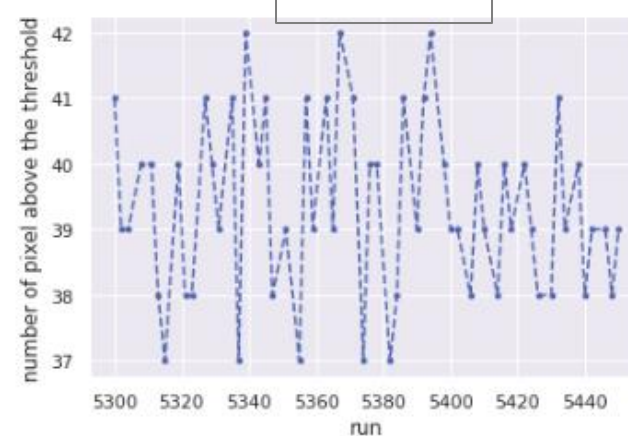
th = 150



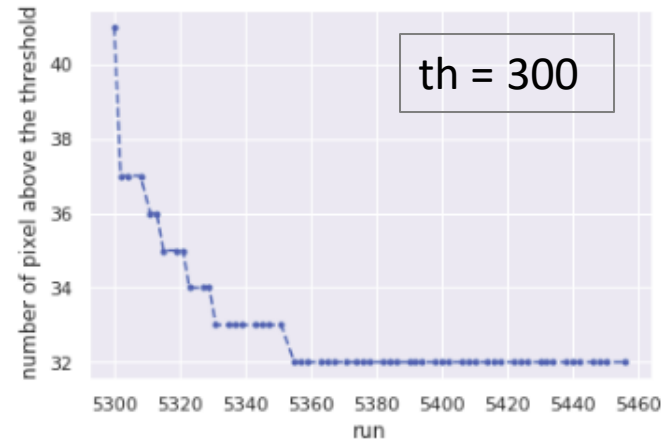
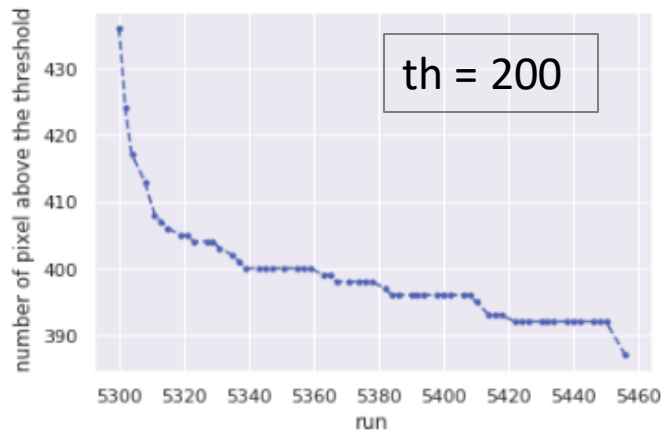
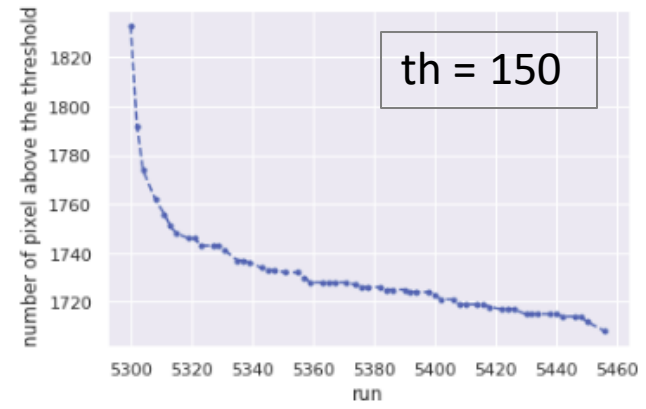
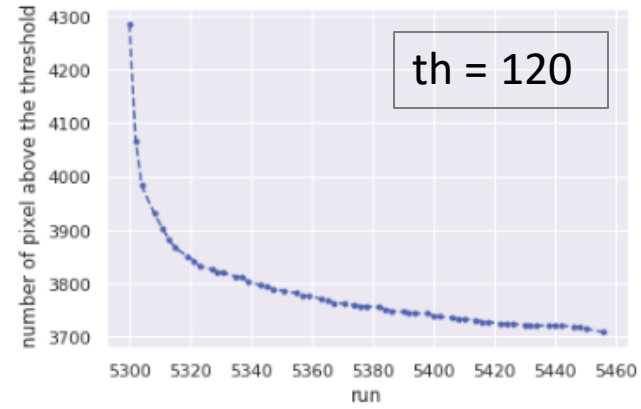
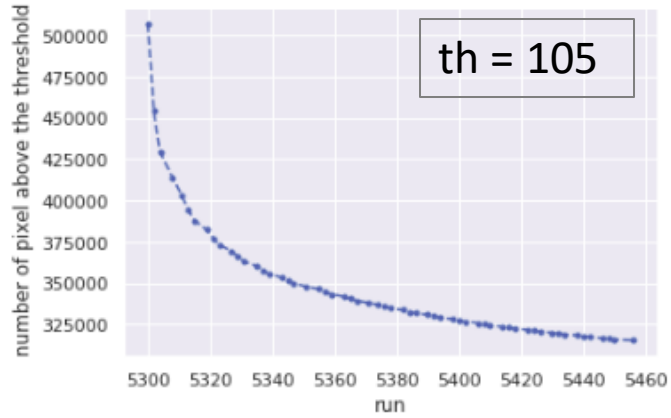
th = 200



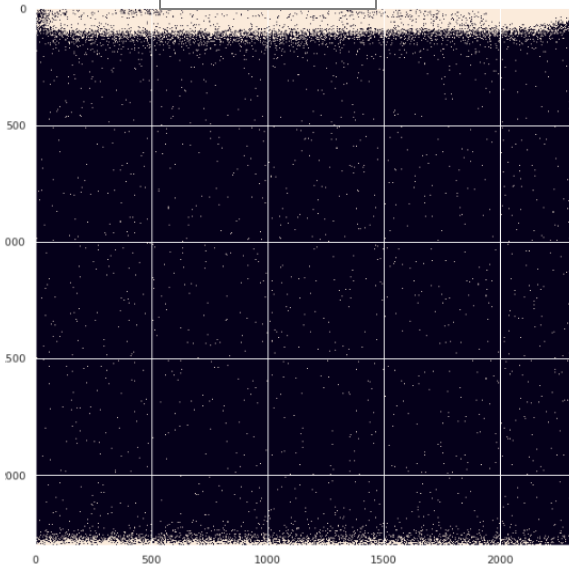
th = 300



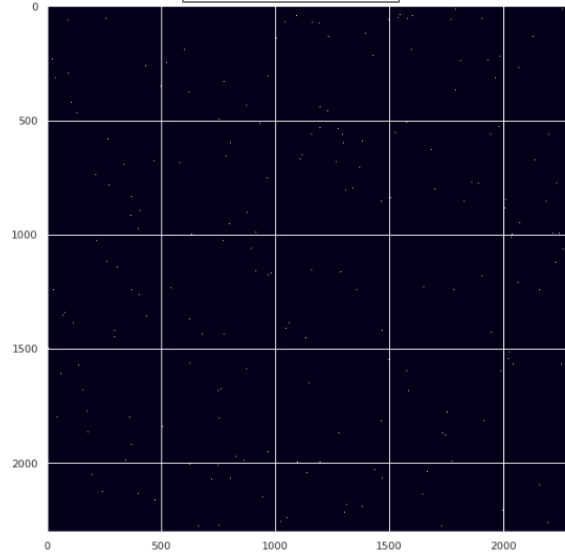
# Number of pixel which are always above the threshold



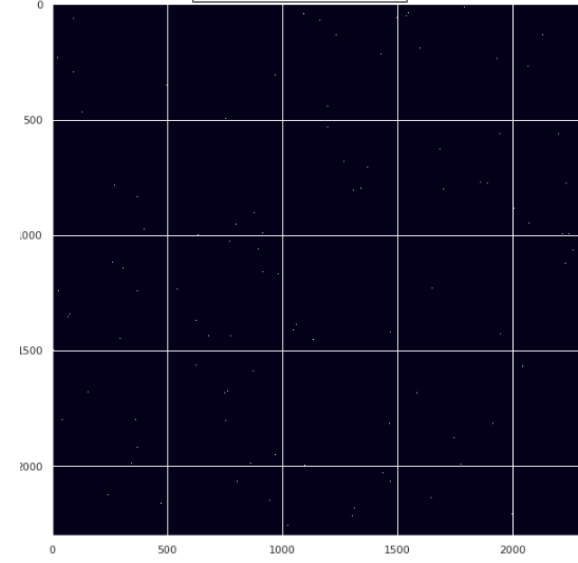
th = 105



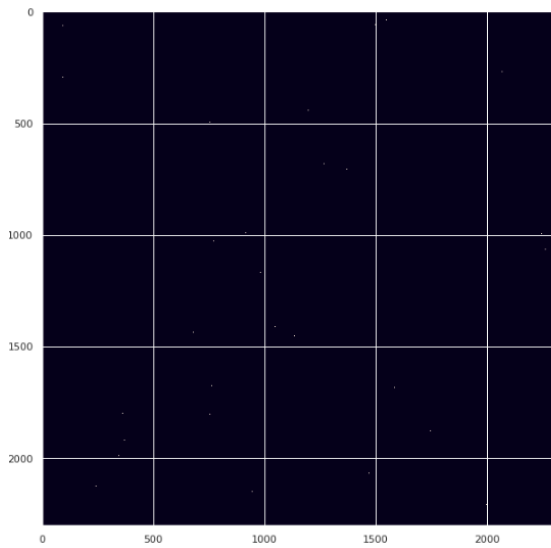
th = 120



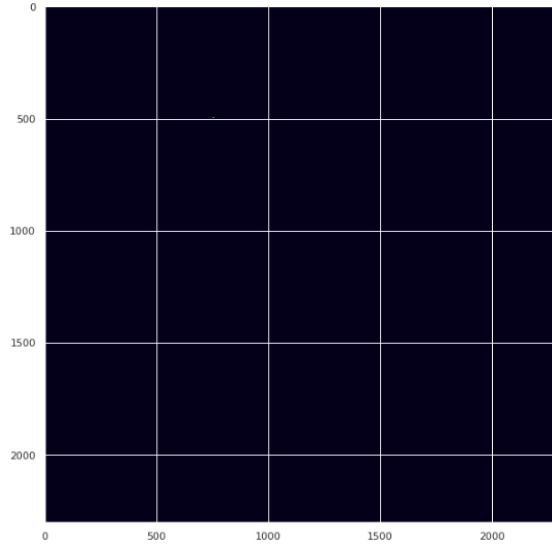
th = 150



th = 200

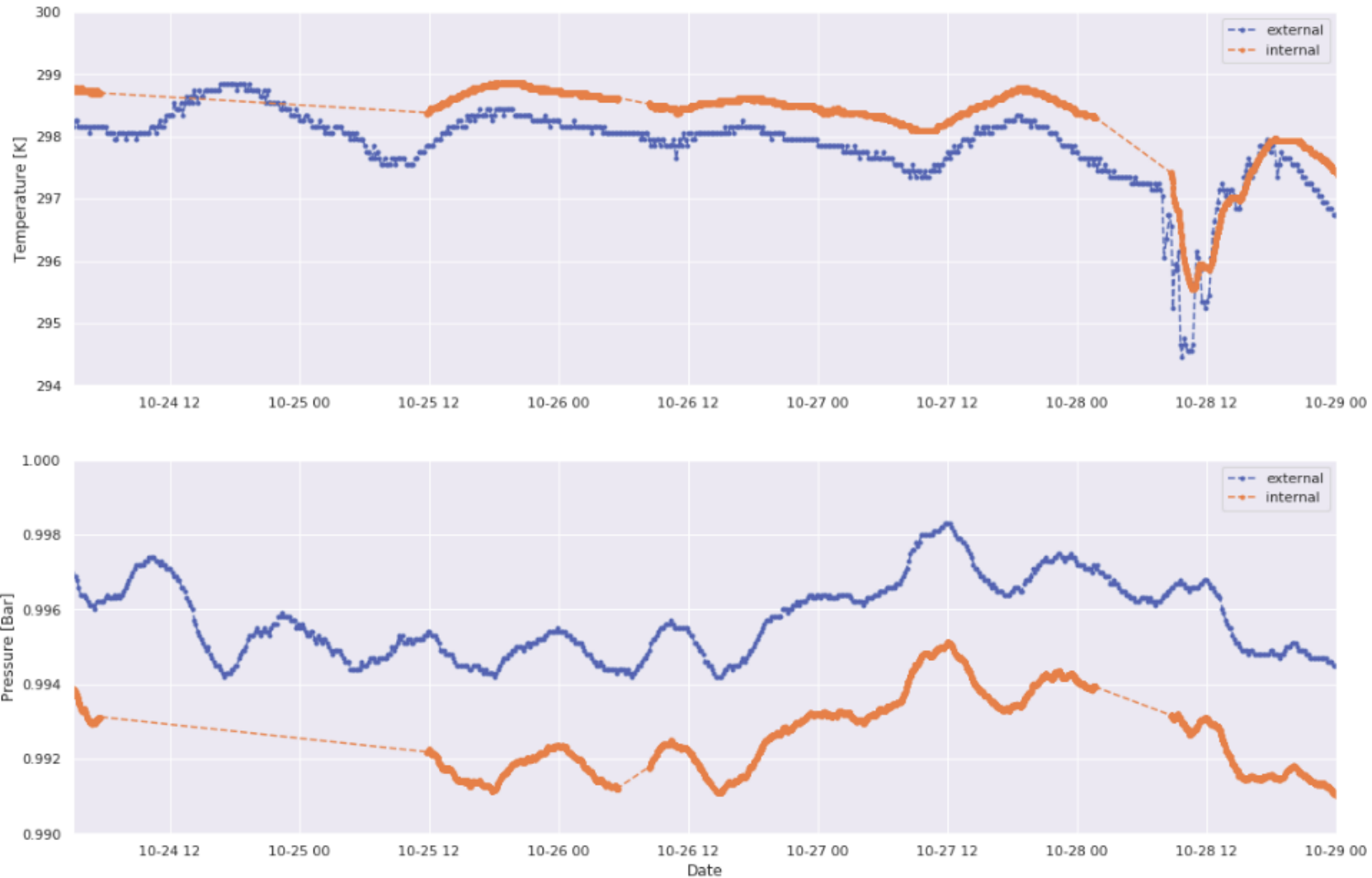


th = 300



## Environment sensor: Pressure and Temperature

Internal Temperature = the sensor is exposed to the outgoing gas, outside the faraday cage  
External Temperature = the laboratory temperature



Run: 5300 - 5451

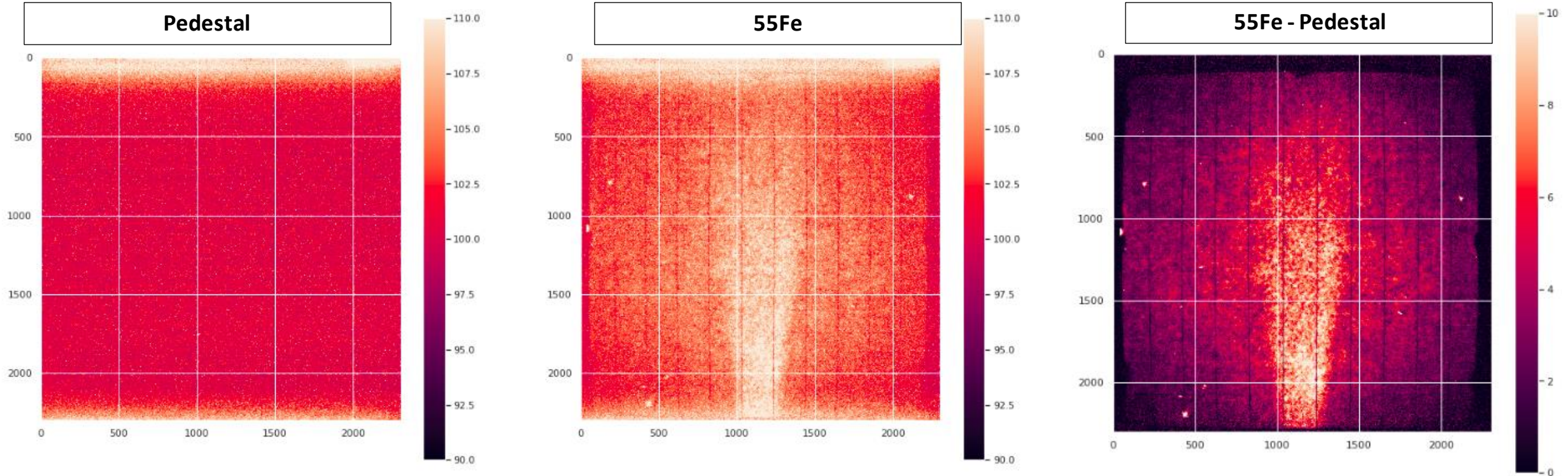
Date: 24/10/2021 - 29/10/2021

Exposure time: 1s

**Procedure:**

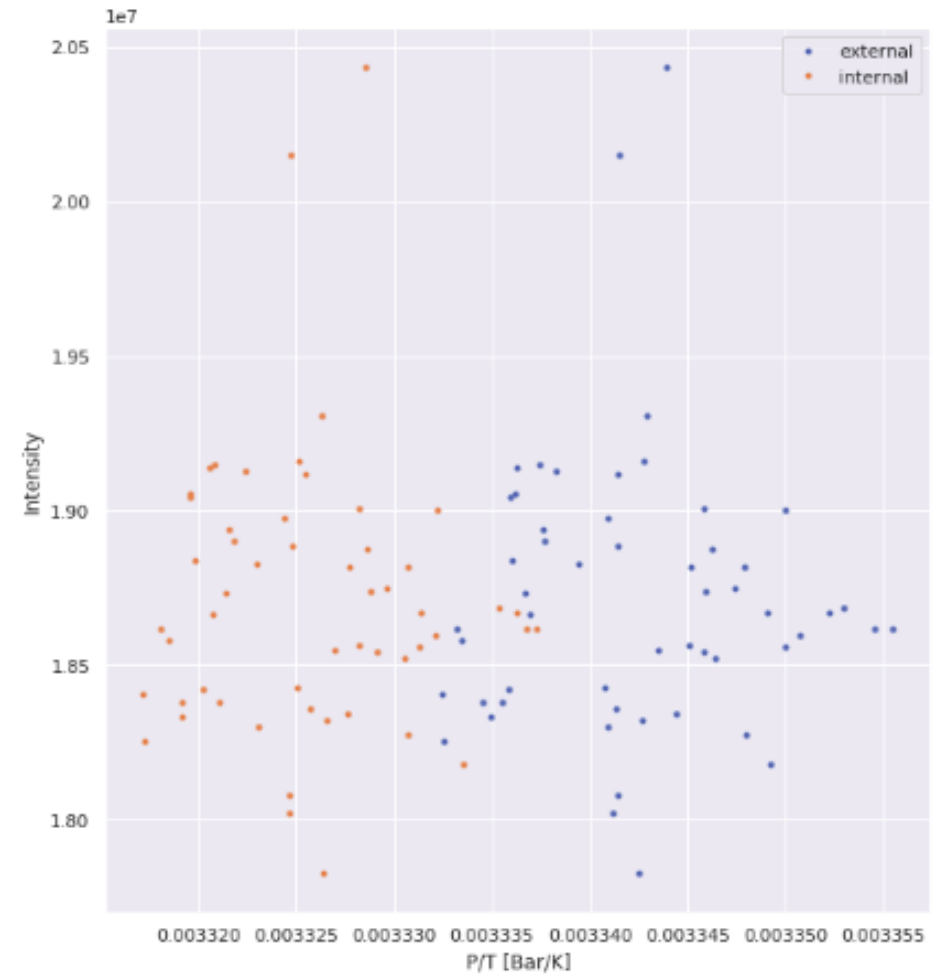
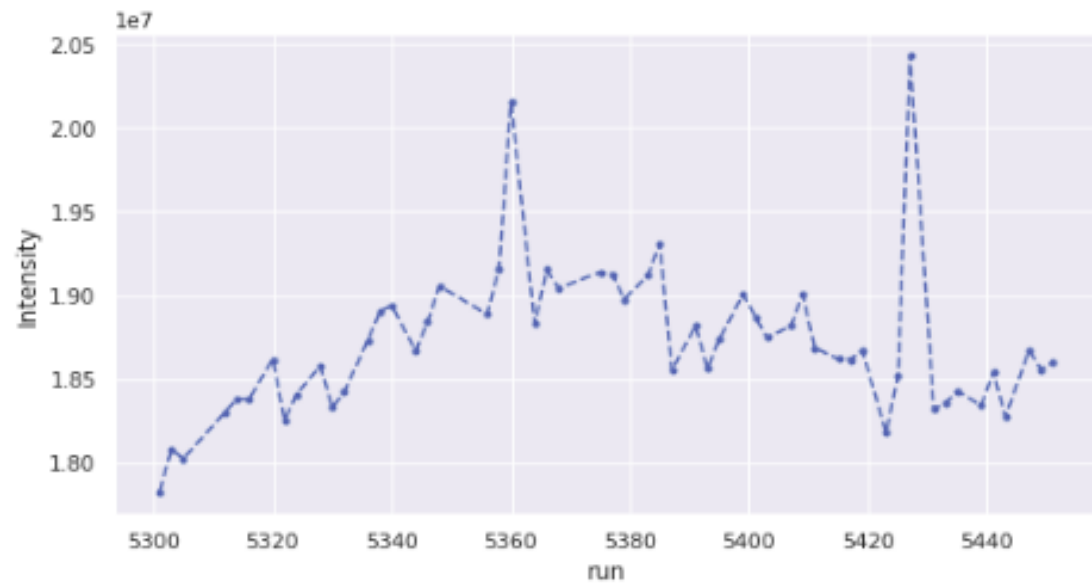
1. For each run (pedestal and  $^{55}\text{Fe}$  signal) 100 images are acquired and the mean given by the images is evaluated
2. For each signal run the pedestal is subtracted
3. The total intensity is evaluated like the sum of the intensity of each pixel

The procedure is done for each run



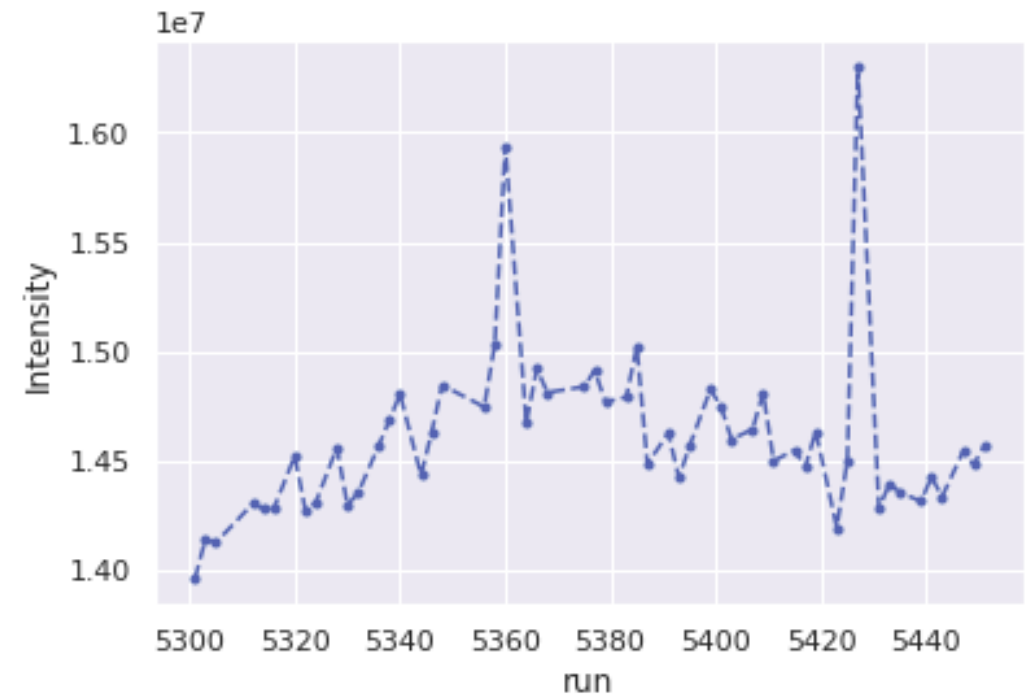
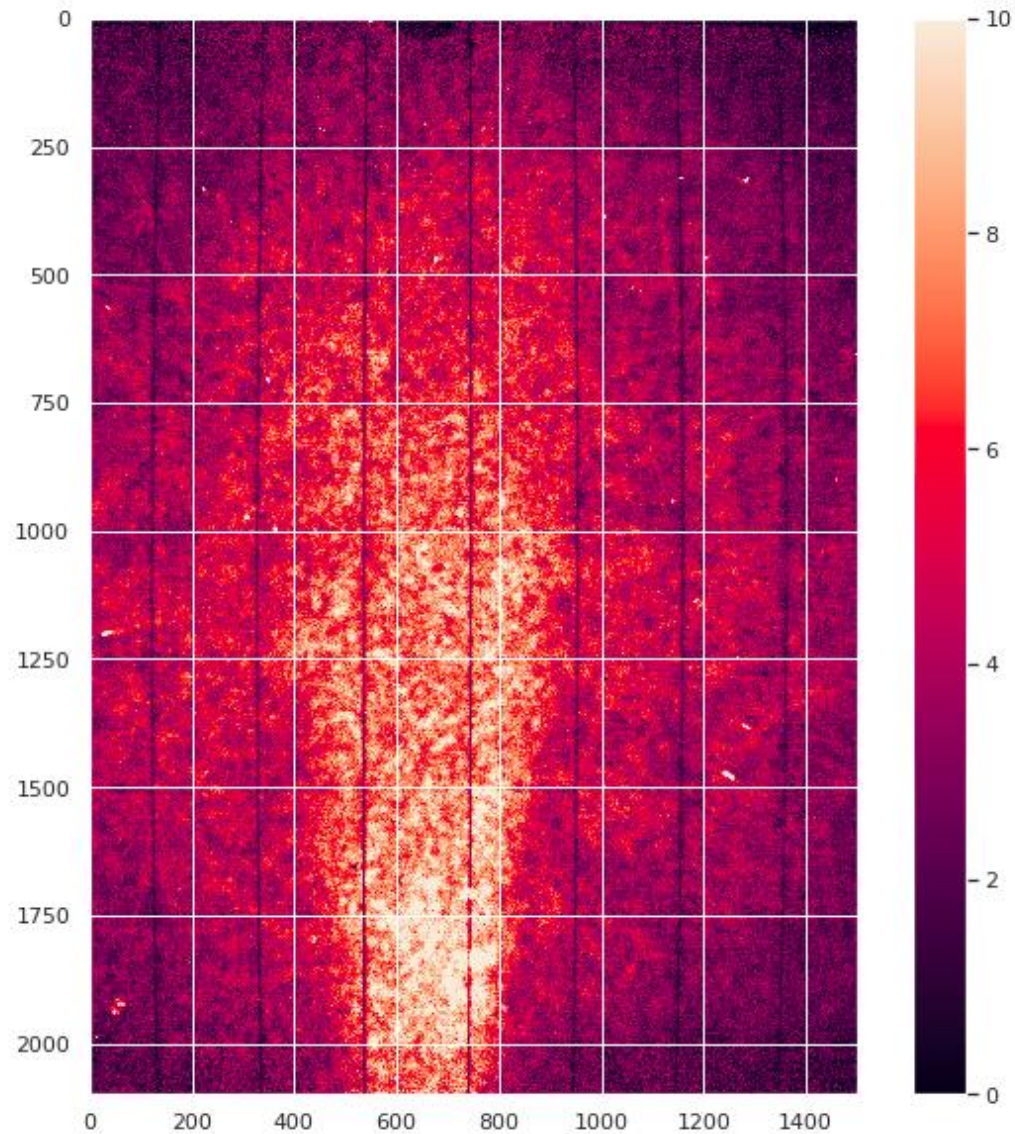
# Total intensity

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



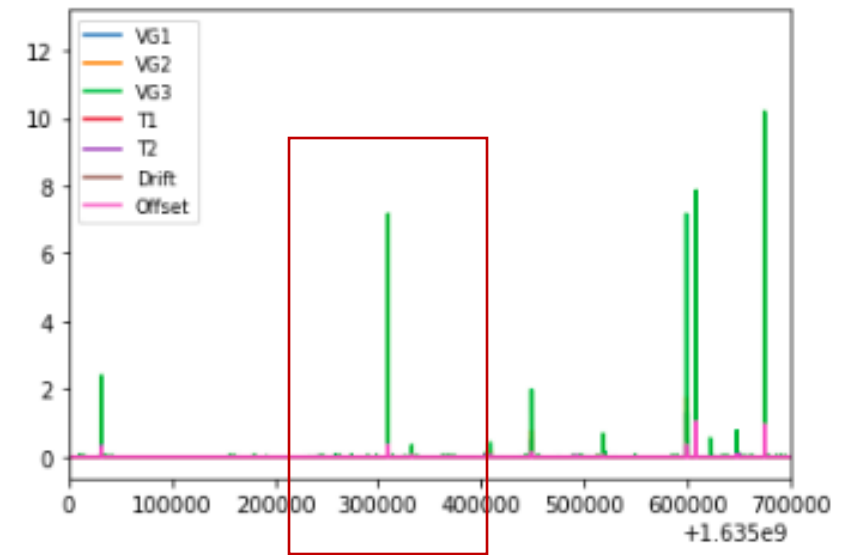
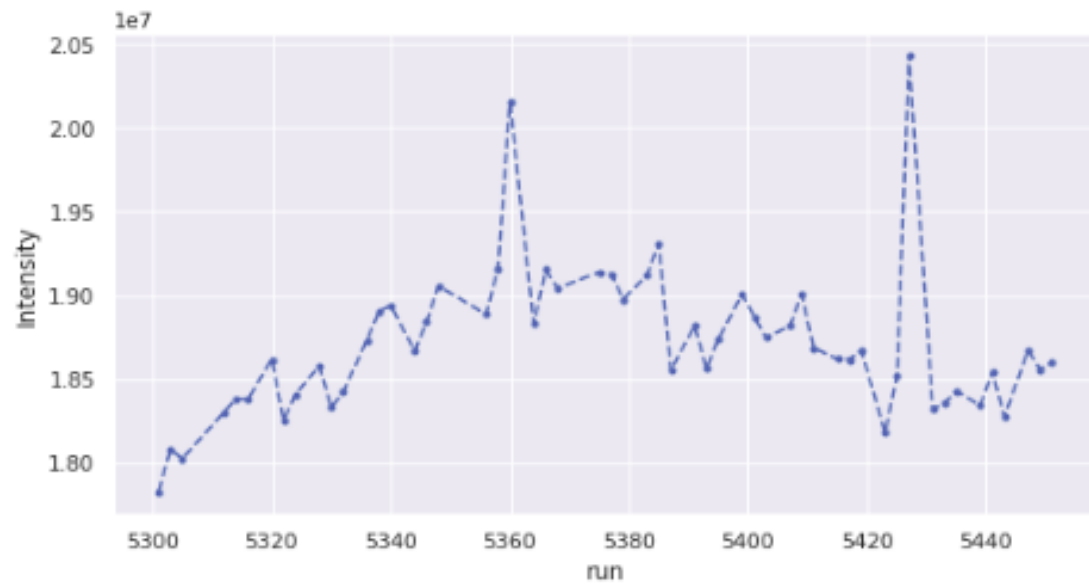


Using the same procedure the intensity has been evaluated only in the signal region:



## Current

To understand the peaks, the currents are studied:



## 55Fe peak

Run: 5300 - 5348

Date: 24/10/2021 - 29/10/2021

Exposure time: 0.05s

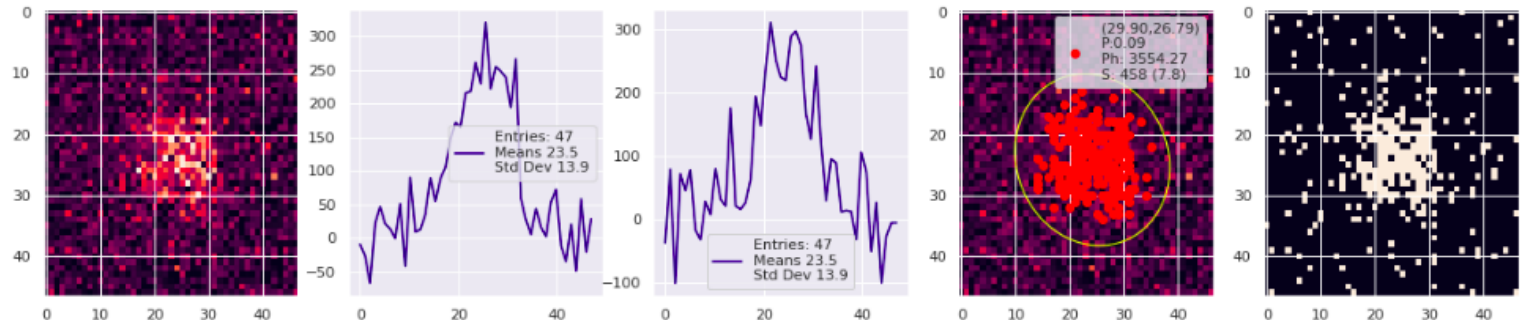
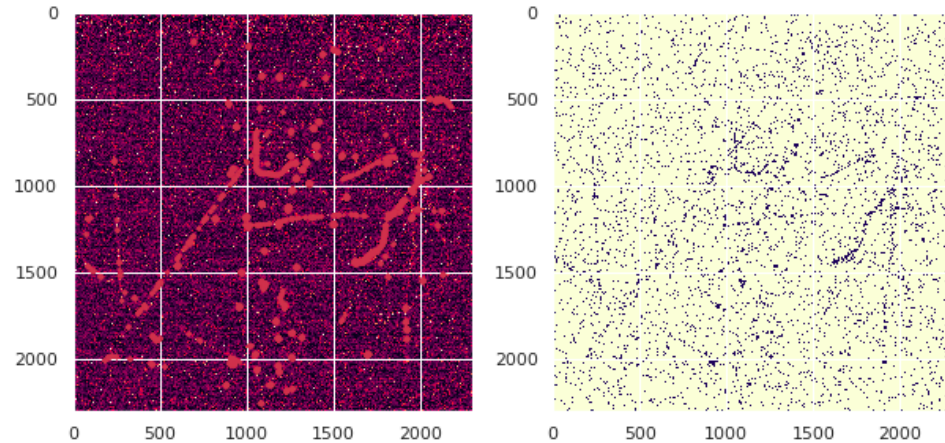
### Cluster reconstruction

Using the DBSCAN algorithm the clusters are reconstructed

Parameters:

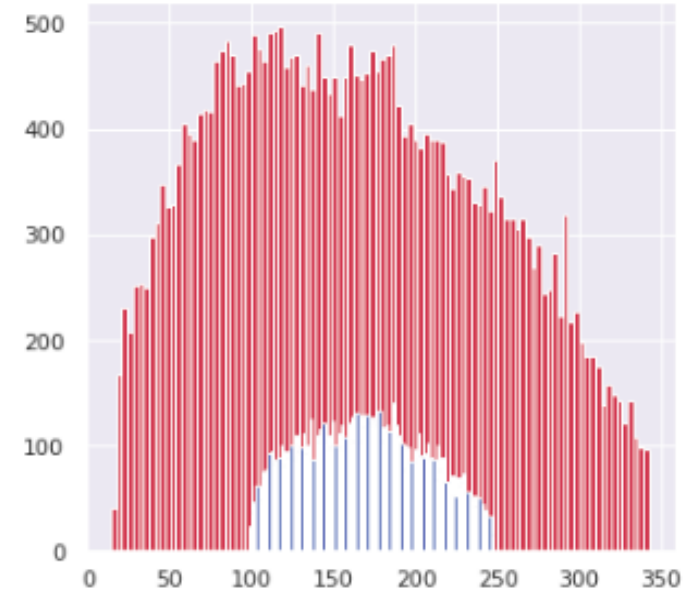
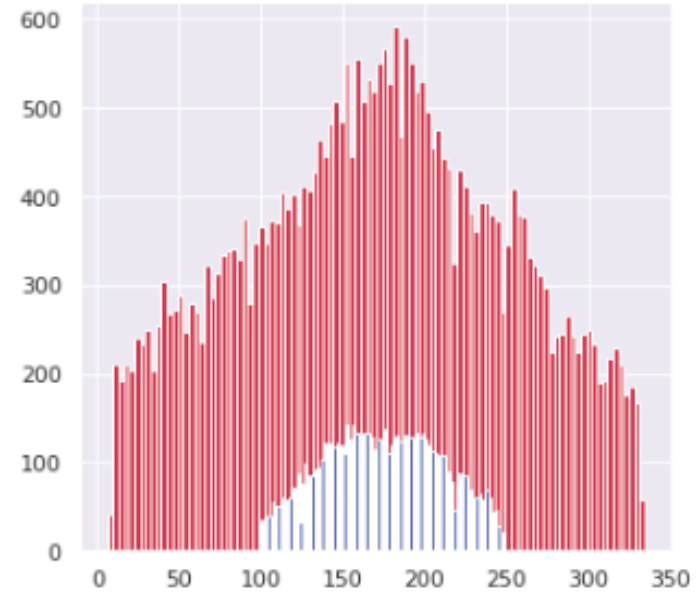
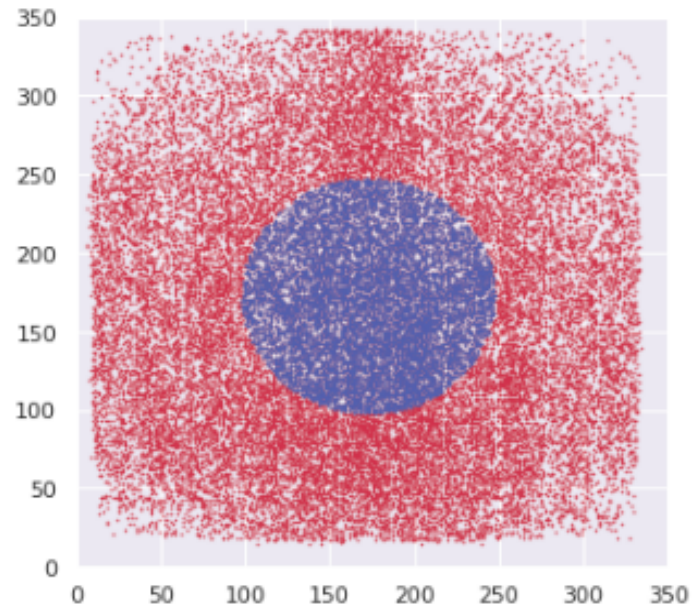
- minimum number of points in one cluster = **40**
- distance between the points = **5**

```
rascale: 1
RELOAD maen file: /workarea/cloud-storage/cygn0-analysis/ped/mean_Run05307 sigma file: /workarea/cloud-storage/cygn0-analysis/ped/sigma_Run05307
light over Th: 38845786.72
Open file: https://s3.cloud.infn.it/v1/AUTH_2ebf769785574195bde2ff418deac08a/cygn0-data/LAB/histograms_Run05306.root
Find Keys: 8181
# of Images (TH2) Files: 101
# of Waveform (TH2) Files: 8080
Camera X, Y pixel: 2304 2304
>>> Processing RUN: 5306 Event: 0
DEBUG: number of points, clusters: 362494 203
Elapsed time 10 events: 12.3
['iTr: 0.00', 'cluster_lable: 203.00', 'pixels: 458.00', 'photons: 3554.27', 'ph_pixels: 7.76', 'x0start: 1076.00', 'y0start: 2241.00', 'x0end: 1080.00', 'y0end: 2262.00', 'width: 29.90', 'height: 26.79', 'pearson: 0.09']
```

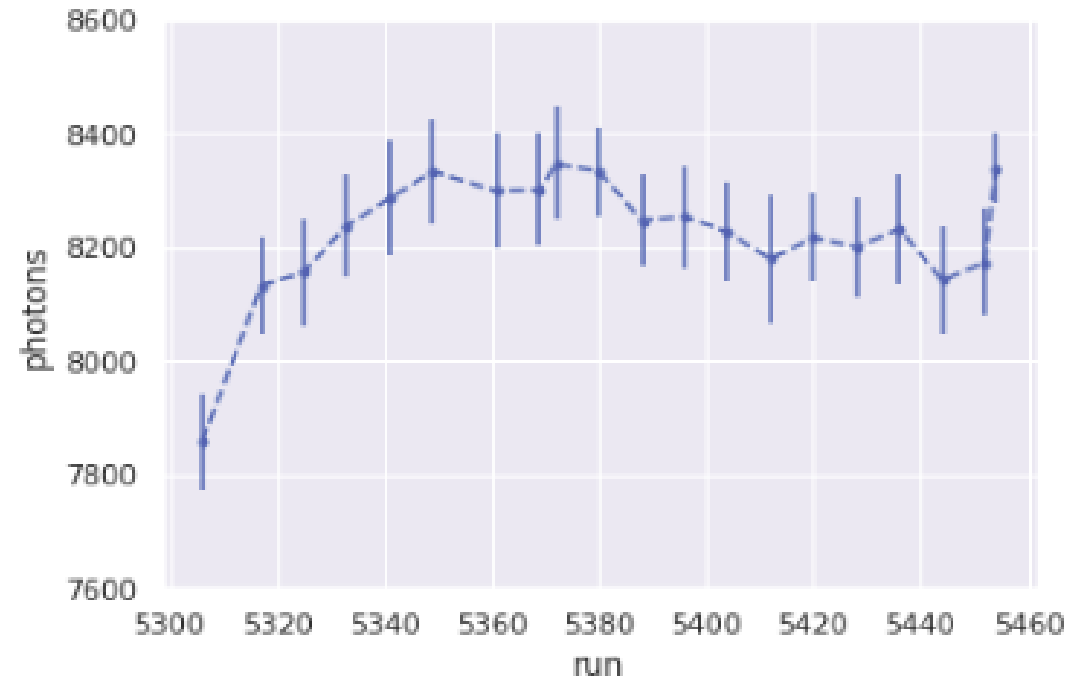
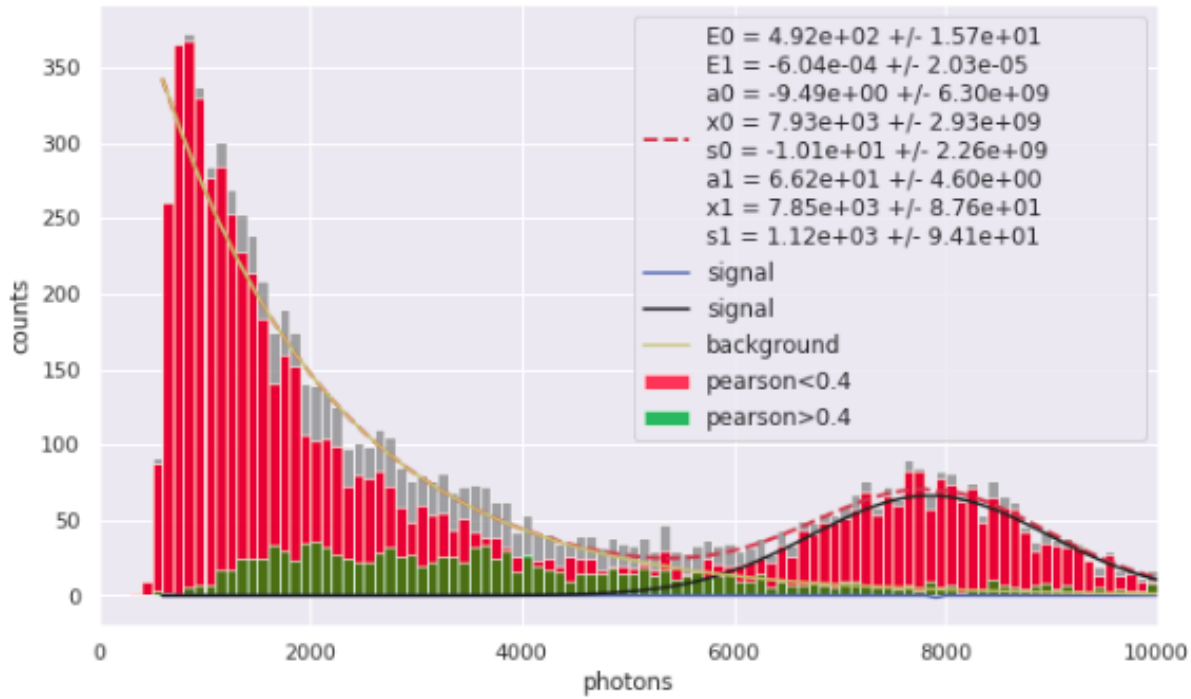


## Cut

- Pearson  $< 0.4$
- The Fiducial circle is built -> only the cluster in the blue region are taken

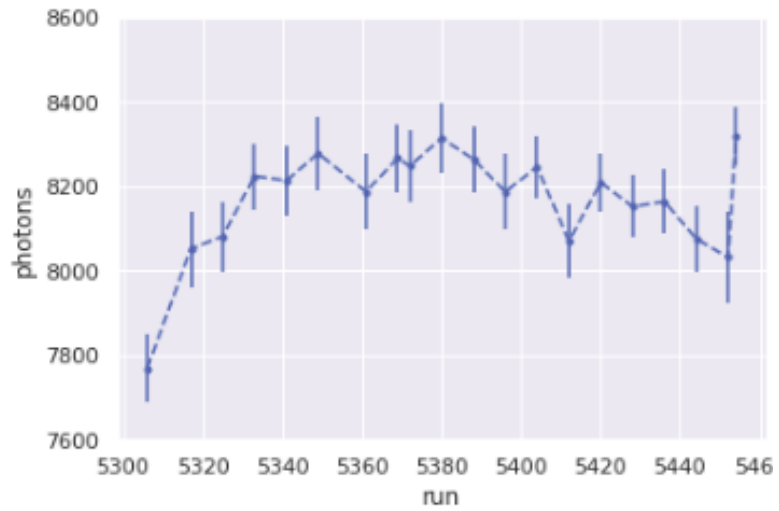


For each run the photons per cluster distribution is build and a gaussian fit in the signal region is done

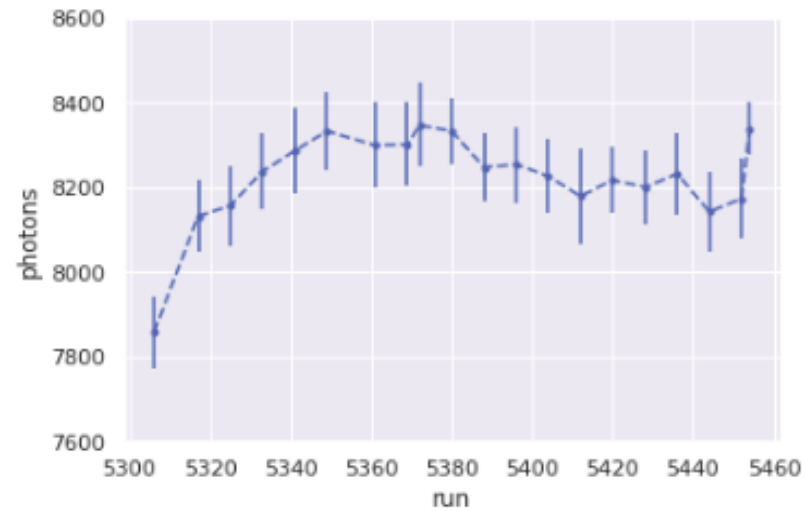


The studies have been done with different values of nsigma

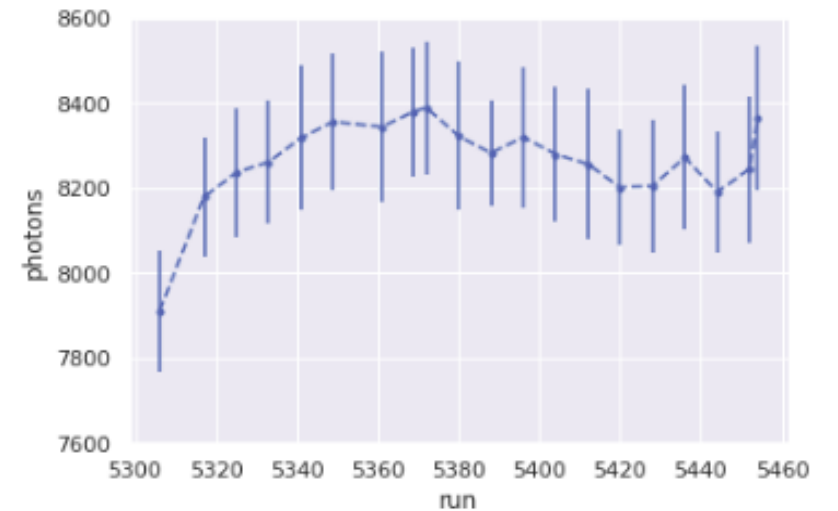
nsigma = 1.0



nsigma = 1.5

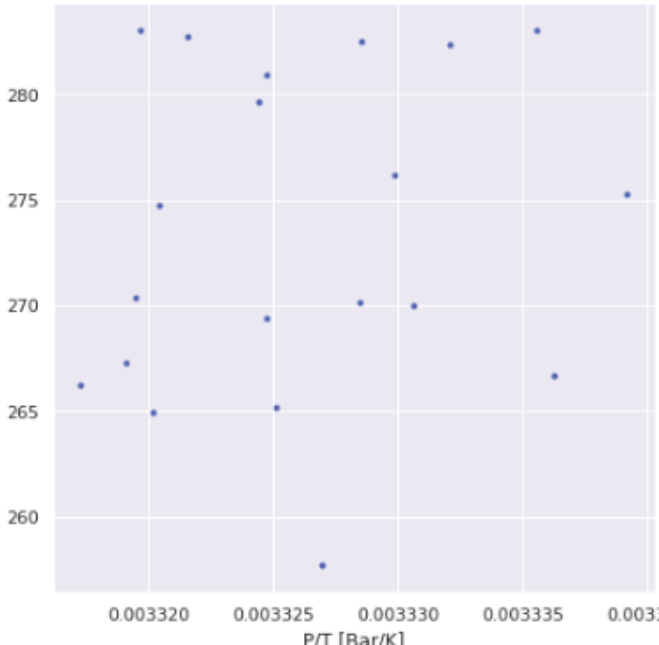
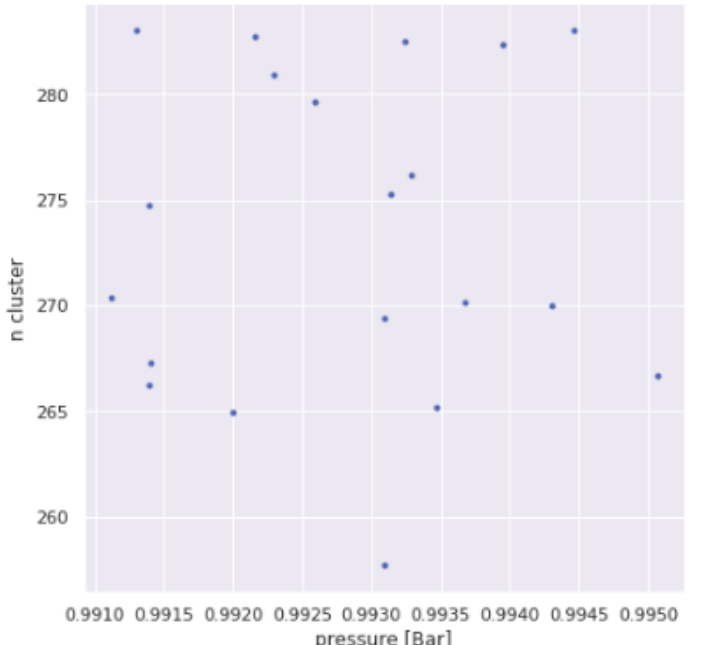
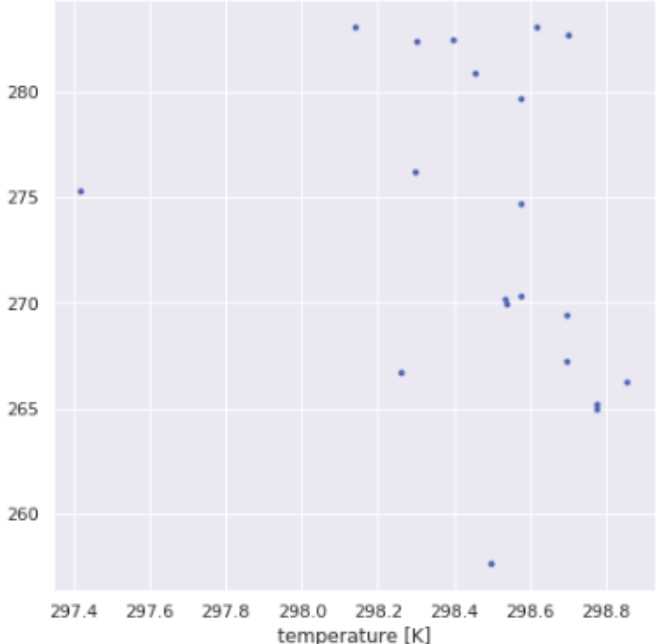
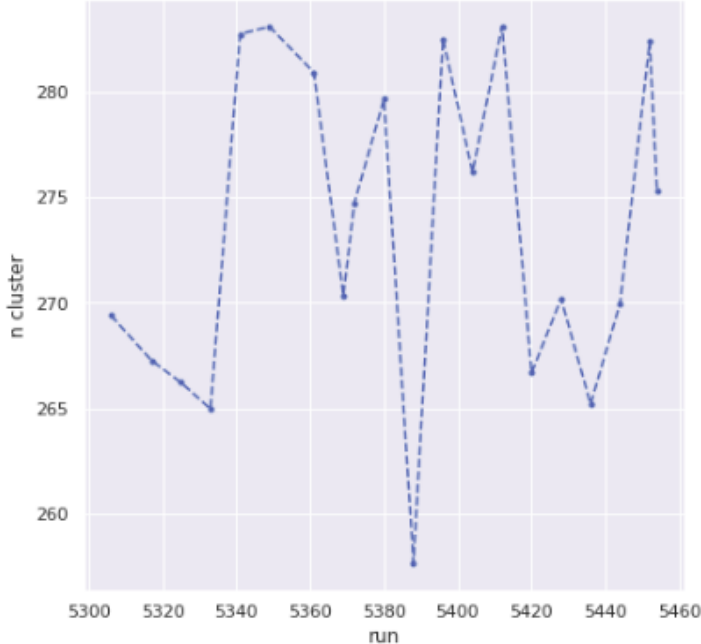


nsigma = 2.0

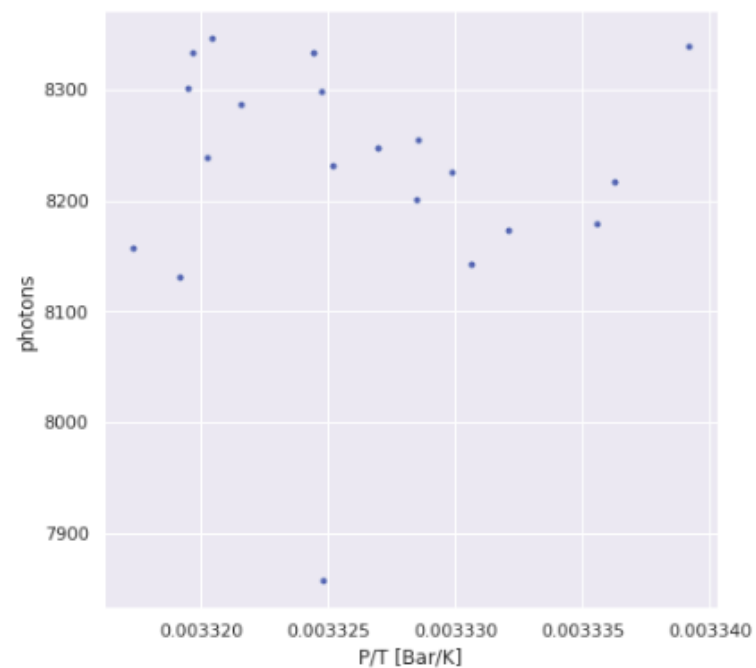
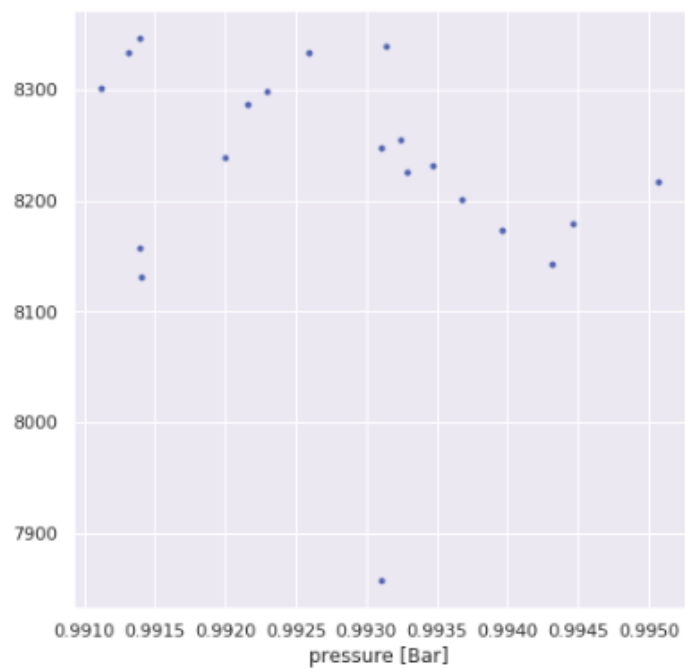
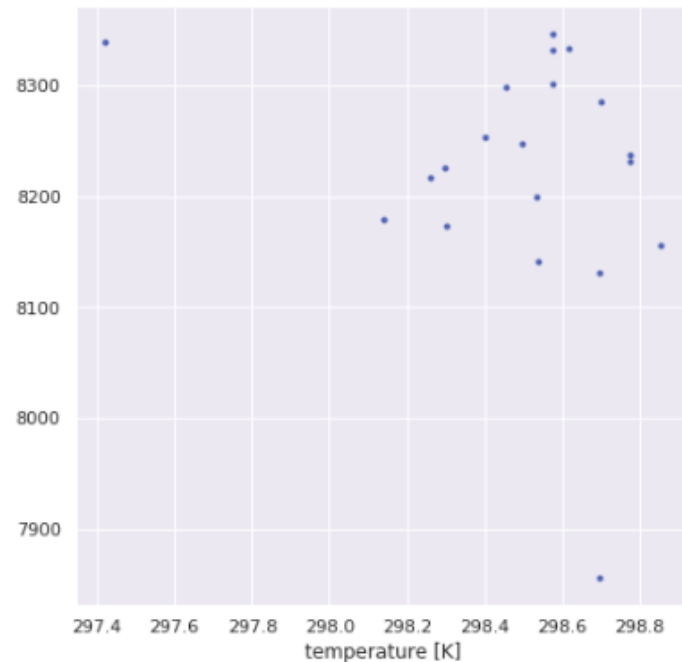
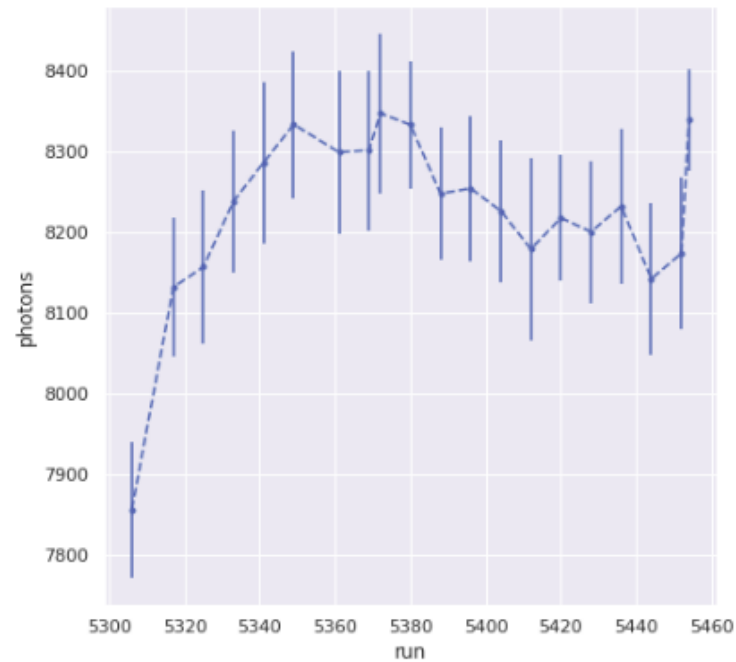


The analysis is done with nsigma = 1.5

mean number of cluster

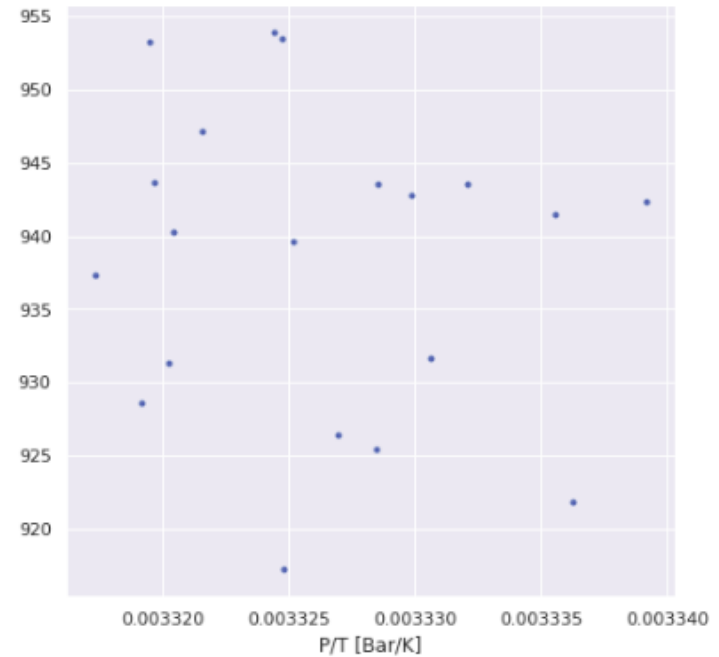
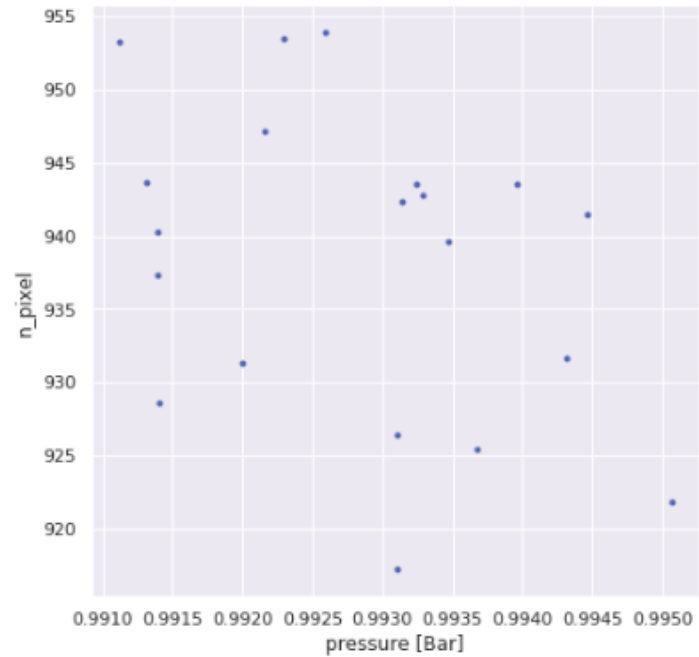
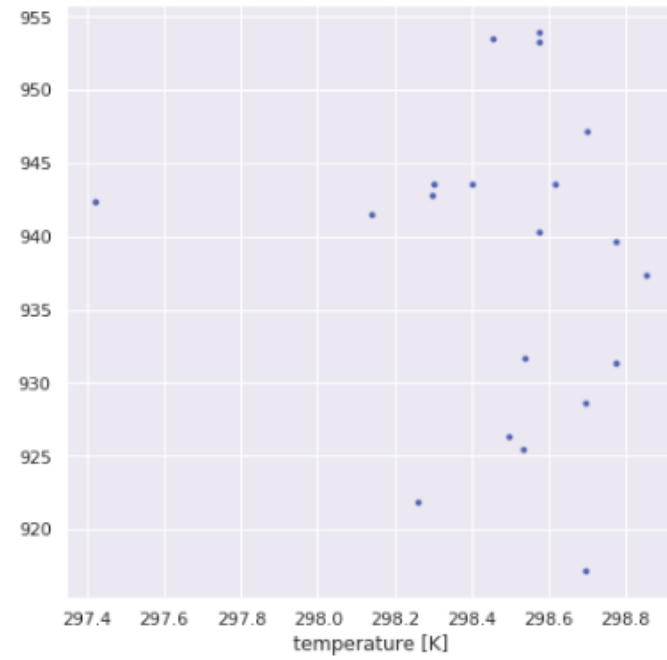
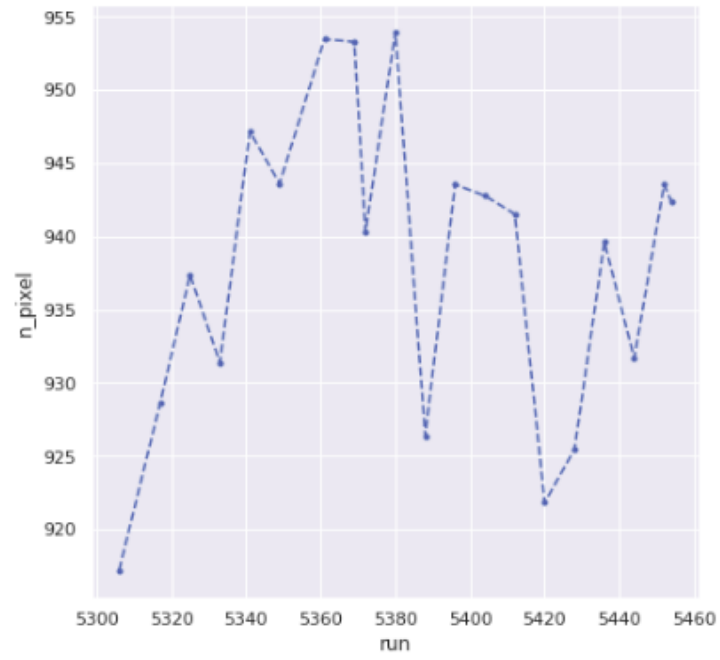


mean number of photons  
per cluster





mean number of pixel per cluster



## Conclusion

- Correlations between the total intensity and the P/T are not seen ;
- There is a delay between the temperature values saved by the two sensor -> It has to be investigated, maybe with hardware works;
- The LIME prototype seems to be stable