A Cluster Energy Study

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- 06.10.2020

Analyzing the energy in each cluster of ^{55}Fe
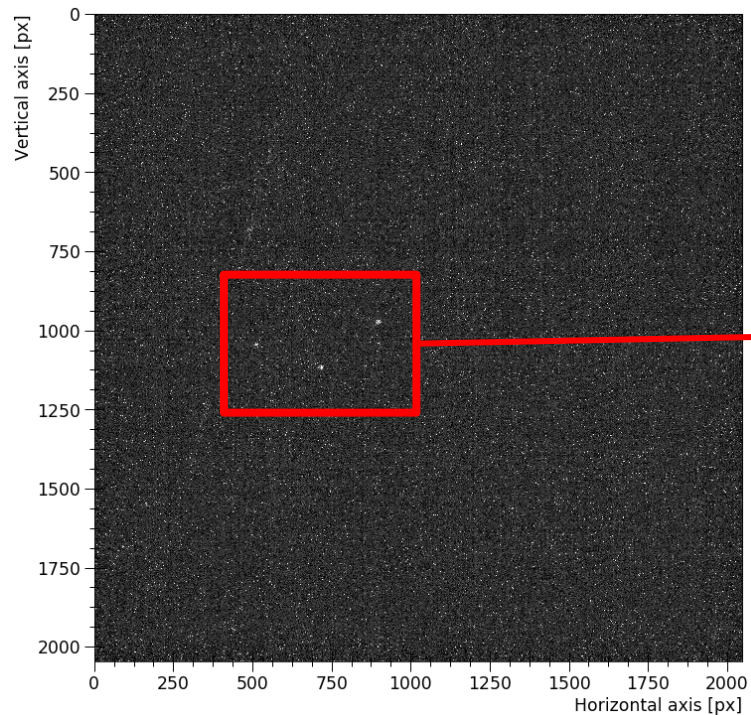
Default configuration:

Detector =	LEMOn
Camera =	Flash
Run =	02163
Vgem =	460V
Drift Field =	500 V/cm
Transfer Field =	2.5 kV/cm

- Look at three 55Fe spots in the same image.
- Applying pedestal subtraction and zero suppressing
- Scan the energy in the cluster as a function of the radius

Image 31

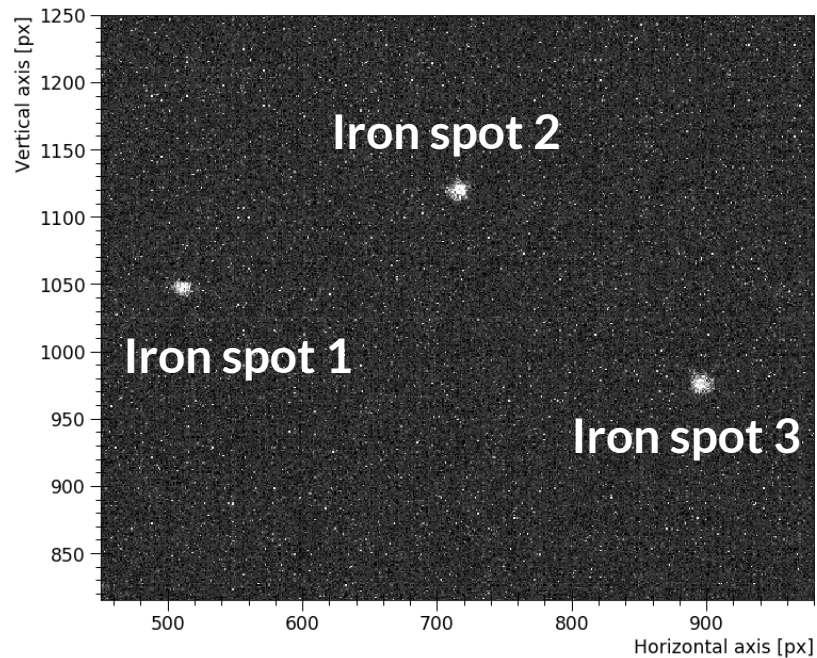

Zoom in the three 55Fe spots

Image 31 - Cluster radius analysis

- In order to calculate how big a cluster need to be to get all the energy we created a circle around ^{55}Fe clusters and scanned over its radius, starting at the center of each spot.
- Below you can see an example of clusters with radius equal to **10**, **50** and **100** (from the left to the right).
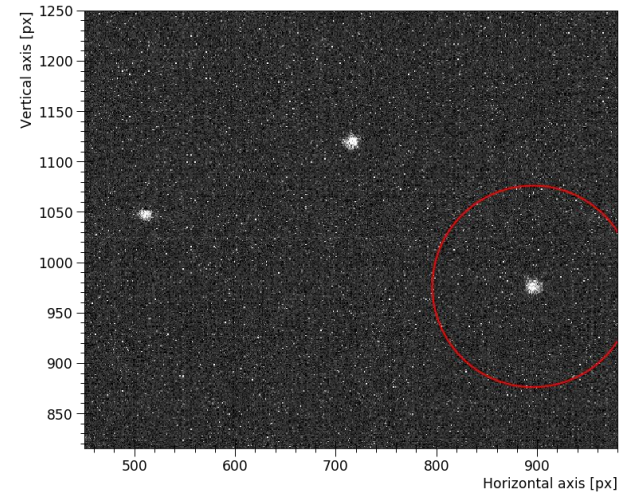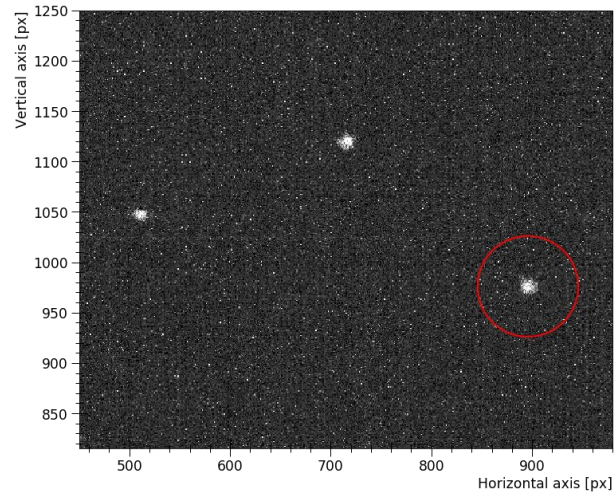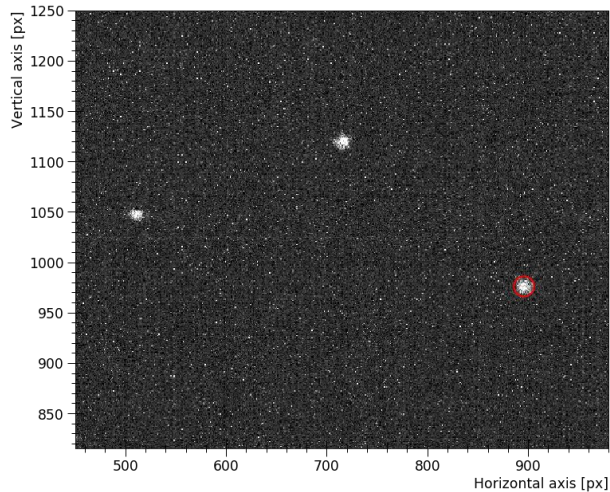
Image 31 - Cluster radius analysis
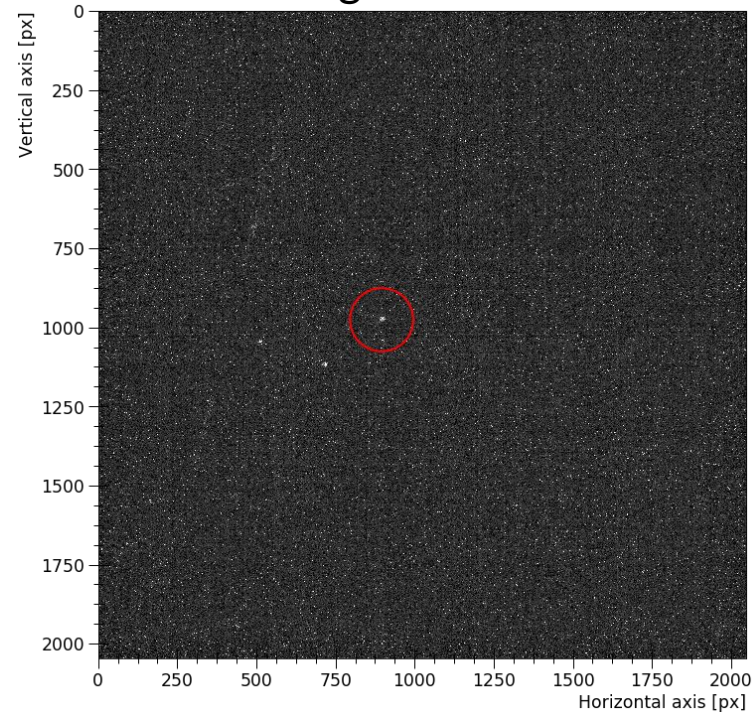
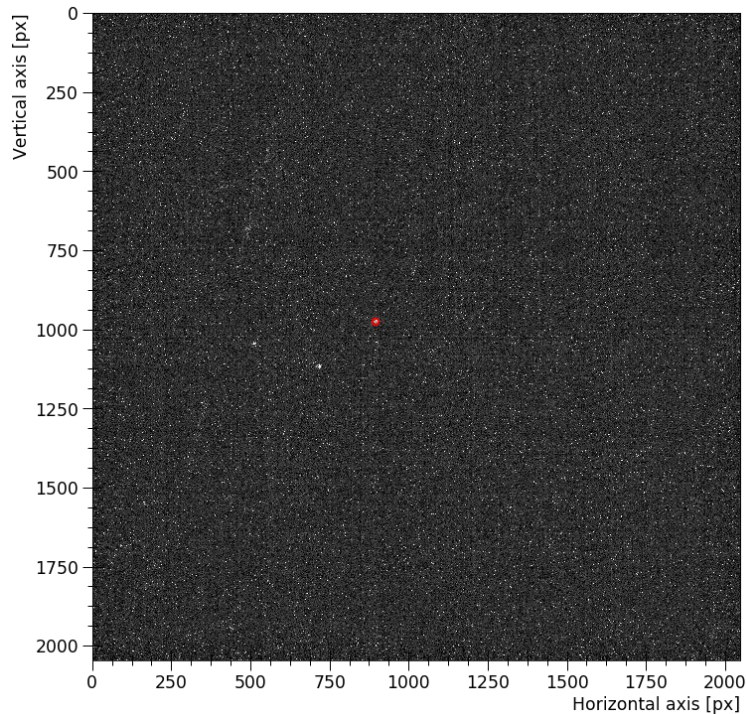- Example of **10** and **100** radius in a full image

Image 31 - Cluster radius analysis

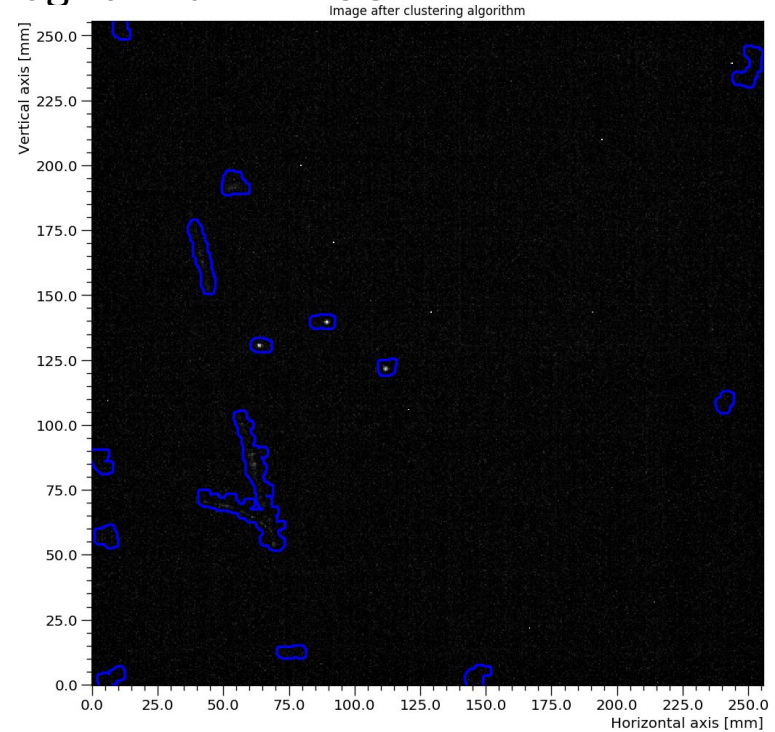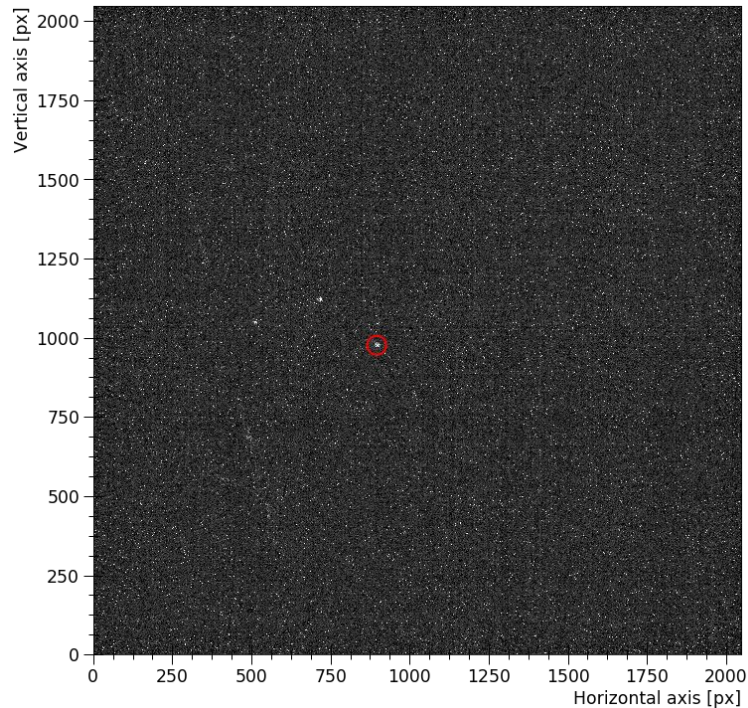- Example of **30** radius in a full image and the iDBSCAN

Image 31 - Cluster radius analysis

Taking into account that we are not using a clustering algorithm the only preprocessing applied to the image was **steps 1 and 2.**

And the next results were made using **only step 1** and **steps 1 and 2**, in order to see the difference between them.

Preprocessing

(1) Pedestal subtraction

(2) Noise thresholding

(3) Rescale

(4) Filtering

Detector output

(5) Coordinates (X, Y, Z)

Clustering algorithm

NNC

or

DBSCAN

or

iDBSCAN

Clusters coordinates

Extract Features
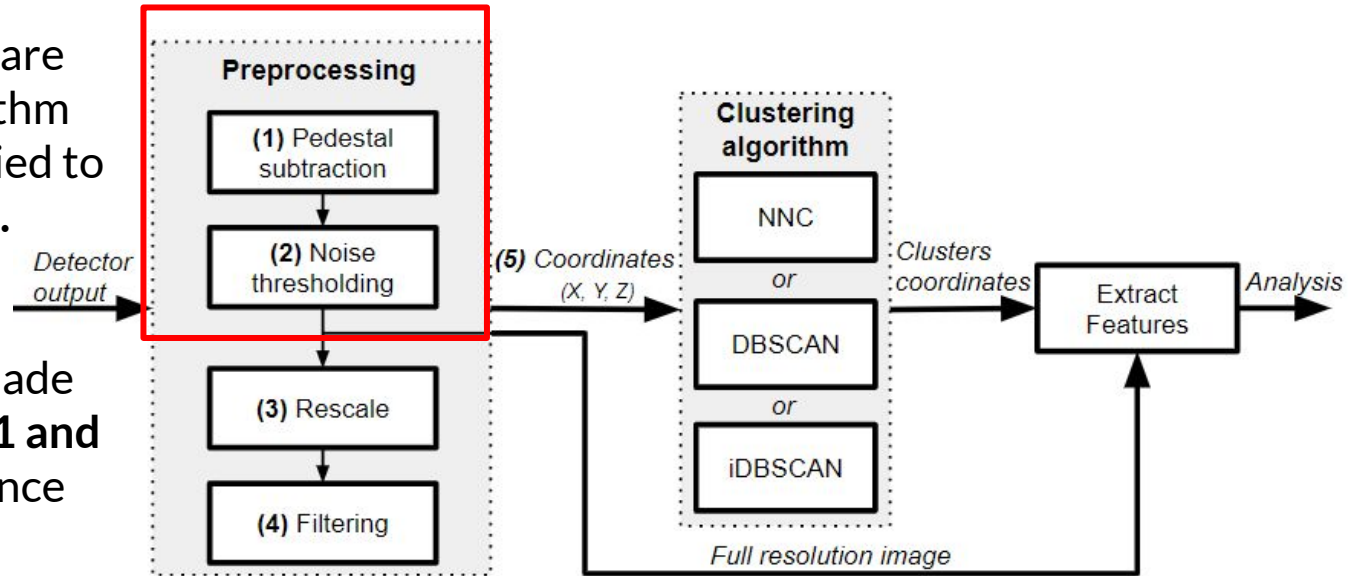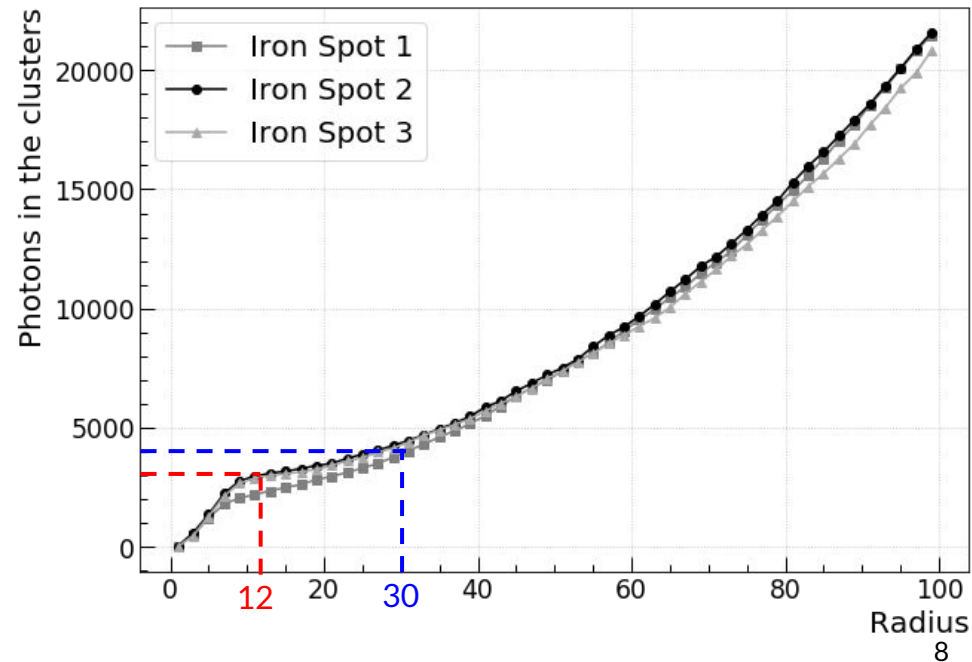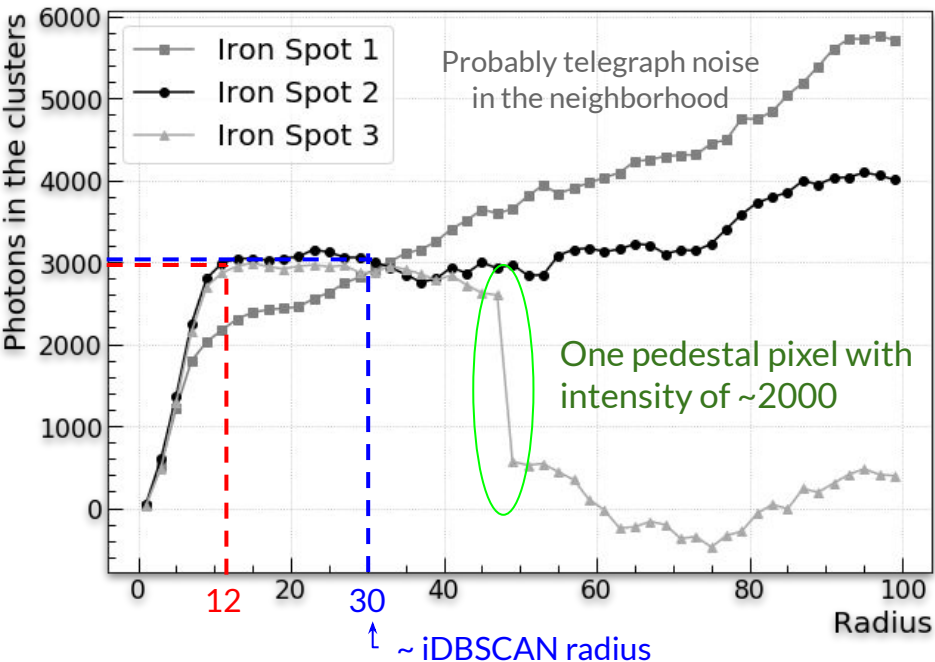
Analysis

Full resolution image

Image 31 - Cluster radius analysis

- Accordingly to these plots we can get the full energy when the radius is around 12.
- The energy keep increasing when increasing the radius, even in the left plot, which can indicate that the noise fluctuation is not gaussian.

Analyzing the energy in the background
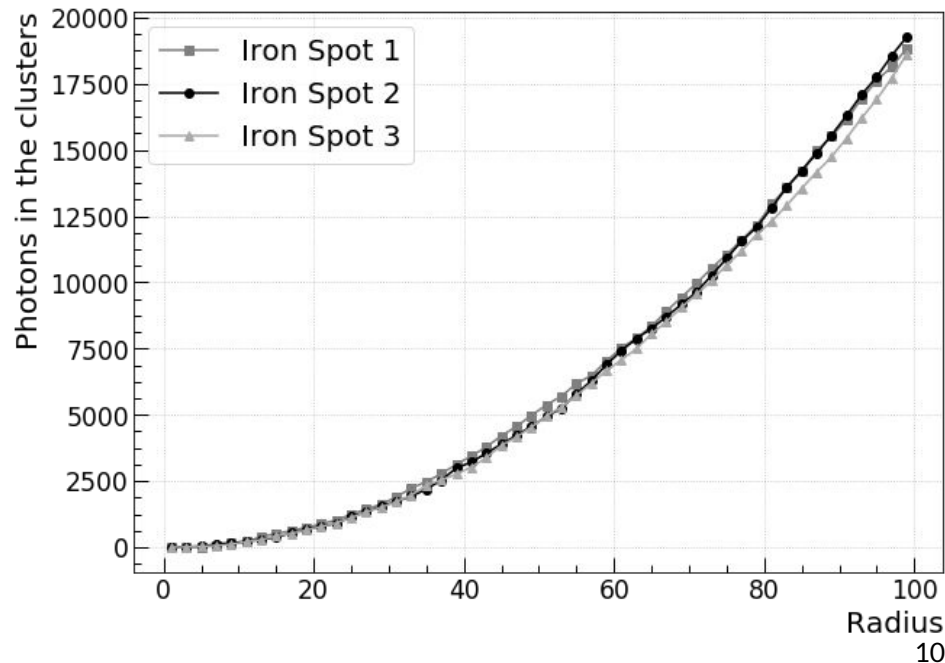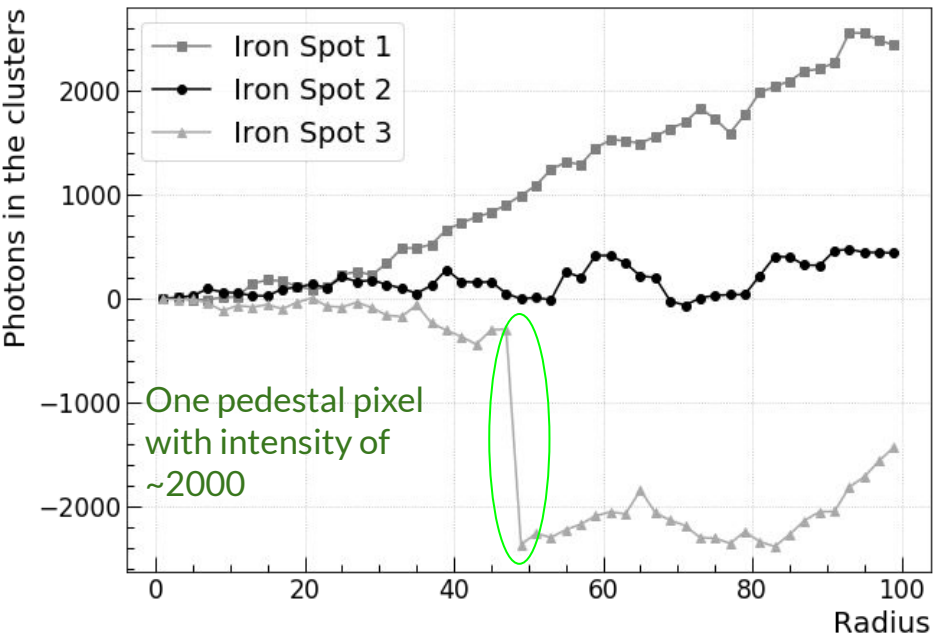
Default configuration:

Detector =	**LEMOn**
Camera =	**Flash**
Run =	**02155**
Vgem =	**260V**
Drift Field =	**-----**
Transfer Field =	**2.5 kV/cm**

- Look over a pedestal image
- Applying pedestal subtraction and zero suppressing
- Scan the energy in randomly circle cluster with radius equal to 10, 15 and 20.
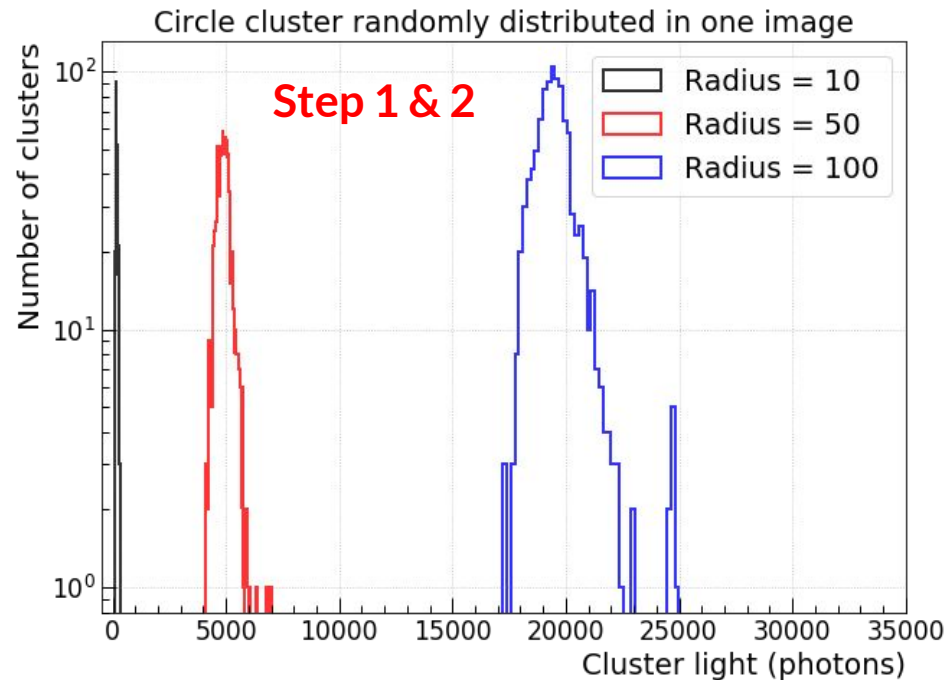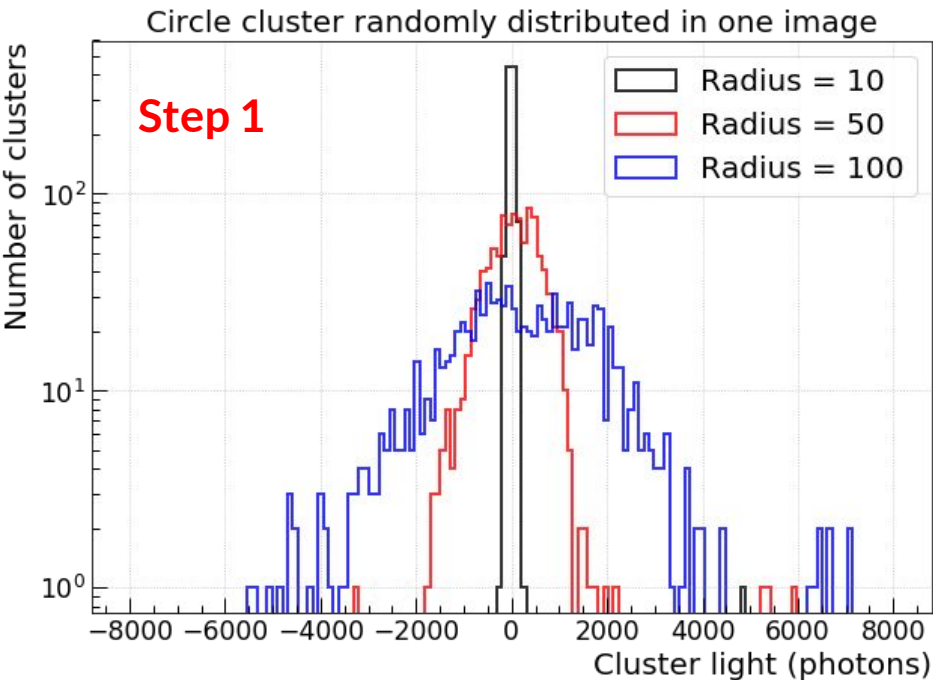
Pedestal image 31

- Starting a new radius scan in the same position of the three iron spots shown before **BUT in a noise-only image.**

One pedestal pixel with intensity of ~2000

Randomly distributed circle clusters

(n=1000)

Circle cluster randomly distributed in one image

Step 1

| Radius = 10 |
| Radius = 50 |
| Radius = 100 |

Circle cluster randomly distributed in one image

Step 1 & 2

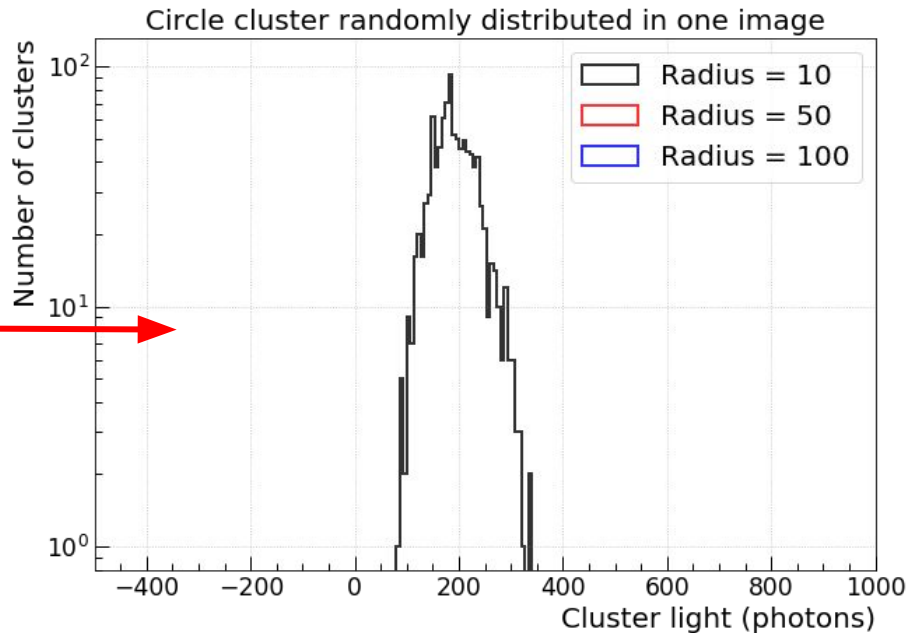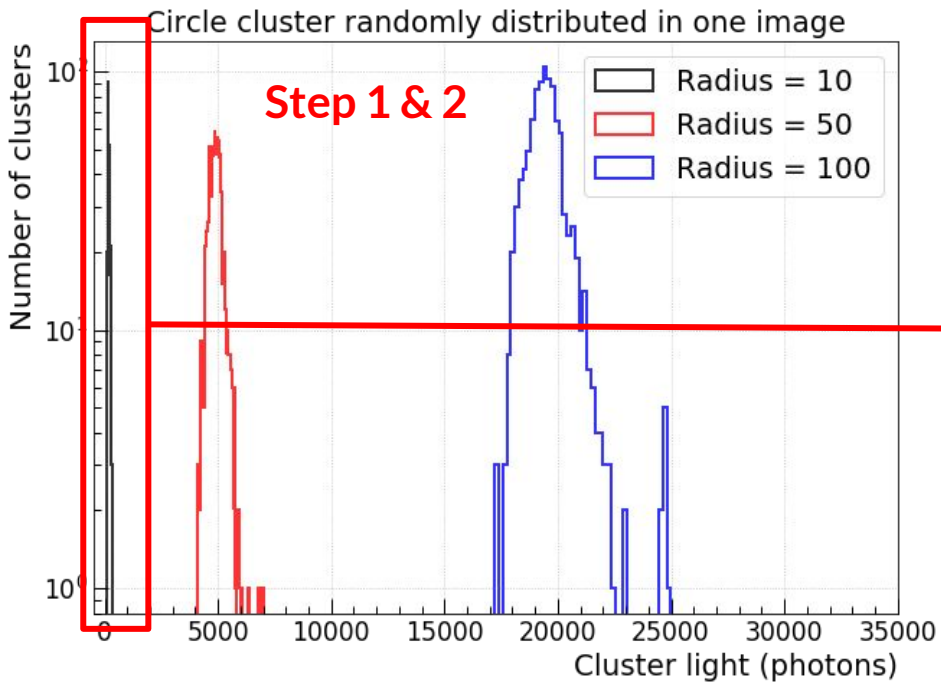| Radius = 10 |
| Radius = 50 |
| Radius = 100 |

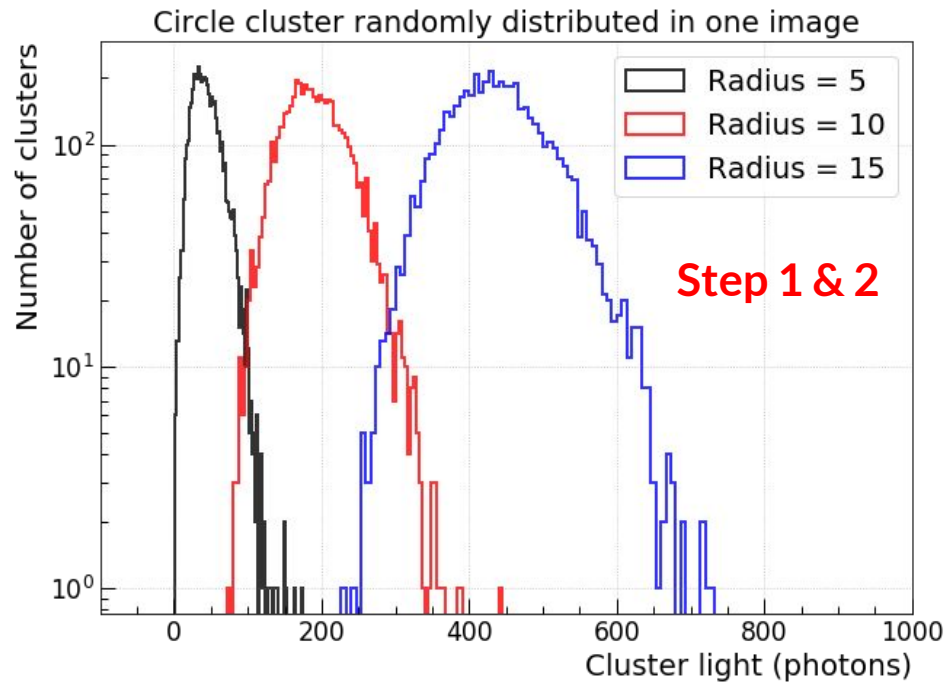*A good background rejection of the clustering algorithm might be important to avoid high energy meas. error*

Randomly distributed circle clusters

(n=1000)

Step 1 & 2

Randomly distributed circle clusters

(n=5000 and Radius 5, 10 and 15)

Circle cluster randomly distributed in one image — Step 1

Circle cluster randomly distributed in one image — Step 1 & 2
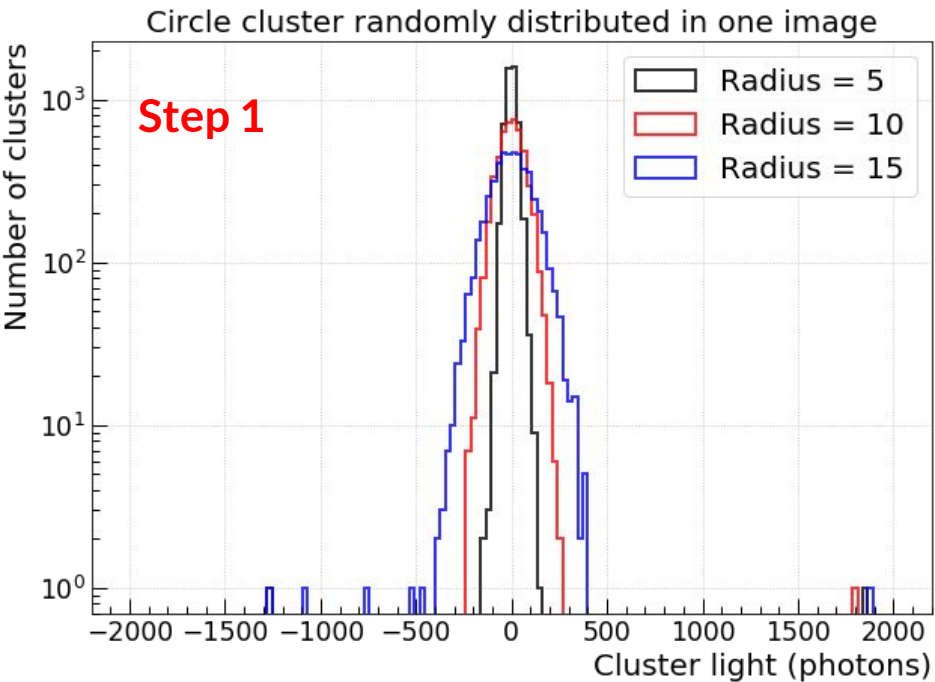
Conclusions

❏ Noise is not Gaussian and tends to have more positive spikes than negative ones;

❏ Computation of energy without threshold has low bias in energy estimation, however if background rejection is low, its error might be high;

❏ Computation of energy after threshold might add an elevated bias to energy estimation if background rejections is low;

❏ For the ^{55}Fe spots the iDBSCAN seems to be working well.