

# PRELIMINARY ANALYSIS ON $^{55}\text{Fe}$

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## Goal of the analysis

- We wanted to test MANGO to see its performance.
- We aimed at analysing the  $^{55}\text{Fe}$  spectrum, in order to compare the results with ORANGE prototype.
- To analyse data we exploited Emanuele and Igor's code.

↓  
Optimized for LEMON  
prototype data

↓  
We added some extra cuts to  
select events of  $^{55}\text{Fe}$

# Data Acquired

Analysis on data acquired on Friday and Monday, using  $^{55}\text{Fe}$  source.

- Friday:

- Camera placed at 22 cm from the GEM;
- Data triggered on PMT (30 mV threshold);
- 1 cm drift;
- Scan on voltage of GEM from 400-460 V;
- 500 ms exposure;
- 2 spacers (1.0+0.1 mm)
- Acquired image, PMT trace and GEM signal after preamplifier

- Monday:

- Camera placed at 18 cm from the GEM;
- Data triggered on PMT (30 mV threshold);
- 1 cm drift;
- Scan on voltage of GEM from 410-450 V;
- 500 ms exposure;
- 1 spacer (2 mm)
- Acquired image, PMT trace and GEM signal after preamplifier

## Configuration studied for cuts

- Two different working conditions were tested to define the better operating selection cuts:

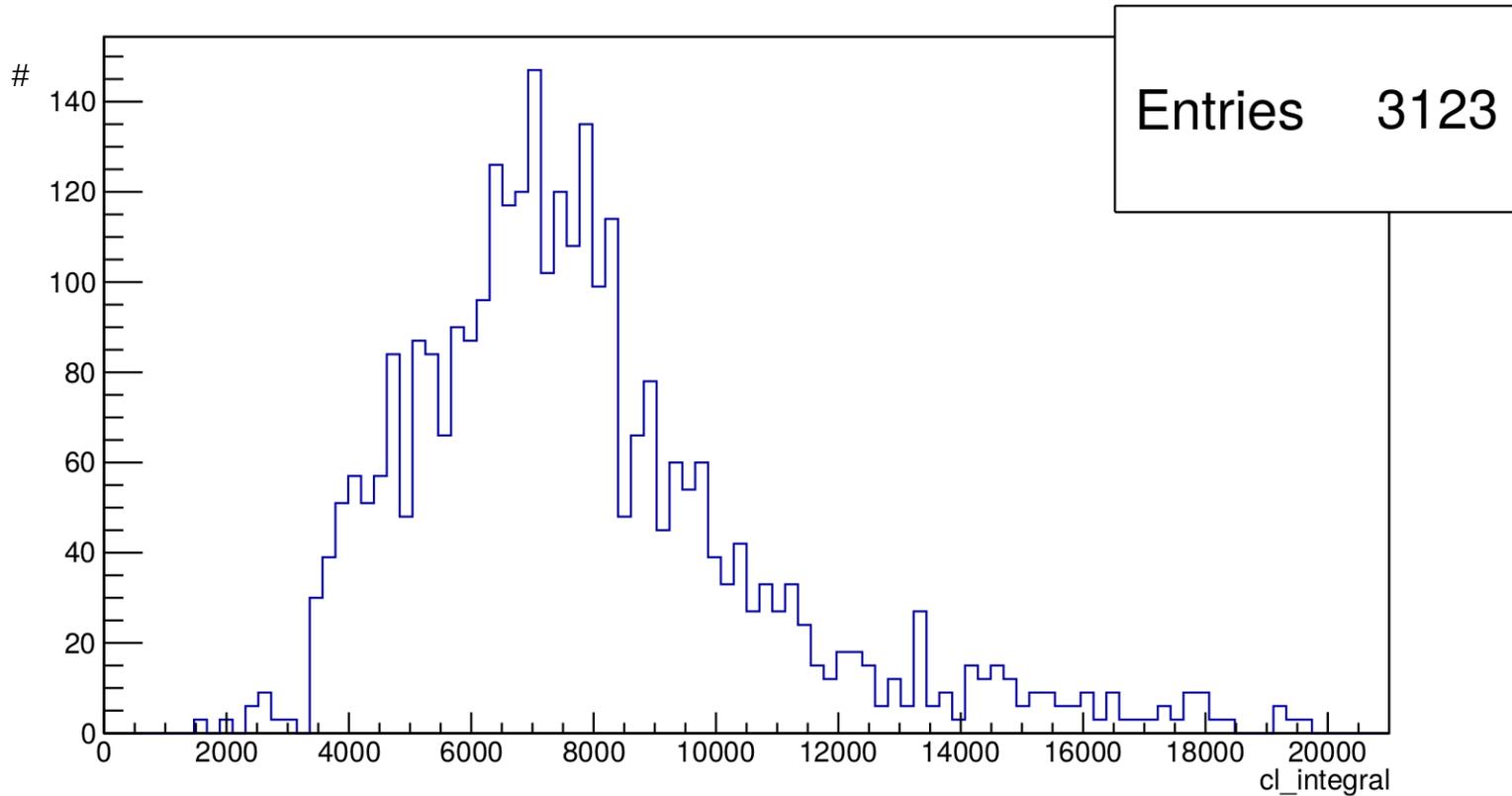
**High gain:** 460 V (22 cm)

**Low gain:** 410 V (22 cm)

- Different cuts tried:
  - **Iteration:** we expected the signal to be on iteration 2;
  - **Roundness:** we expected the signal to be round;
  - **Length:** we wanted to eliminate very small round circles (noise).

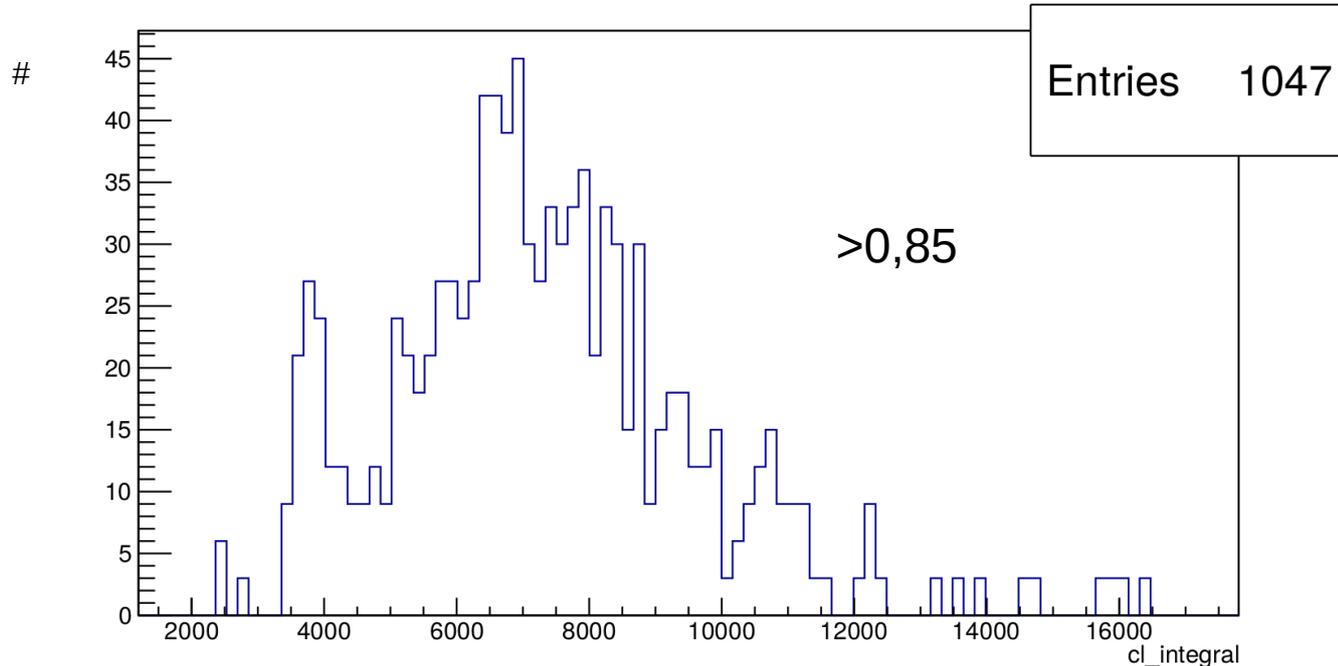
## High gain, cut on iteration

We eliminated iteration 3 clusters because they should only include noise



## High gain, cut on roundness

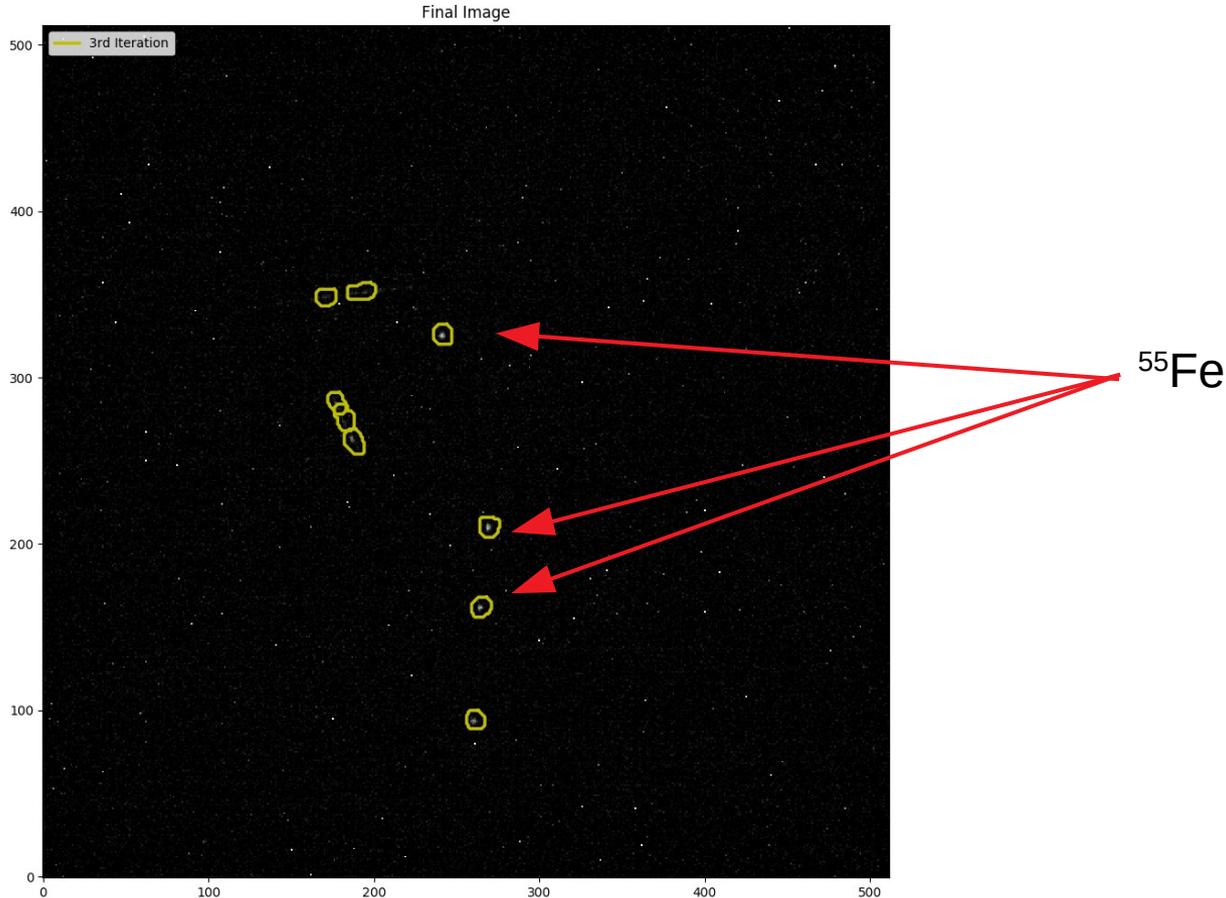
Due to the shape of the  $^{55}\text{Fe}$  signal we included a cut to keep the ones with a more round shape:  $\text{width}/\text{length} > 0,85$



Since more than 1000 events are still available when roundness is bigger than 0,85, we opted to use this cut, to have better efficiency in  $^{55}\text{Fe}$  selection.

# Low gain, difficulties in event classification

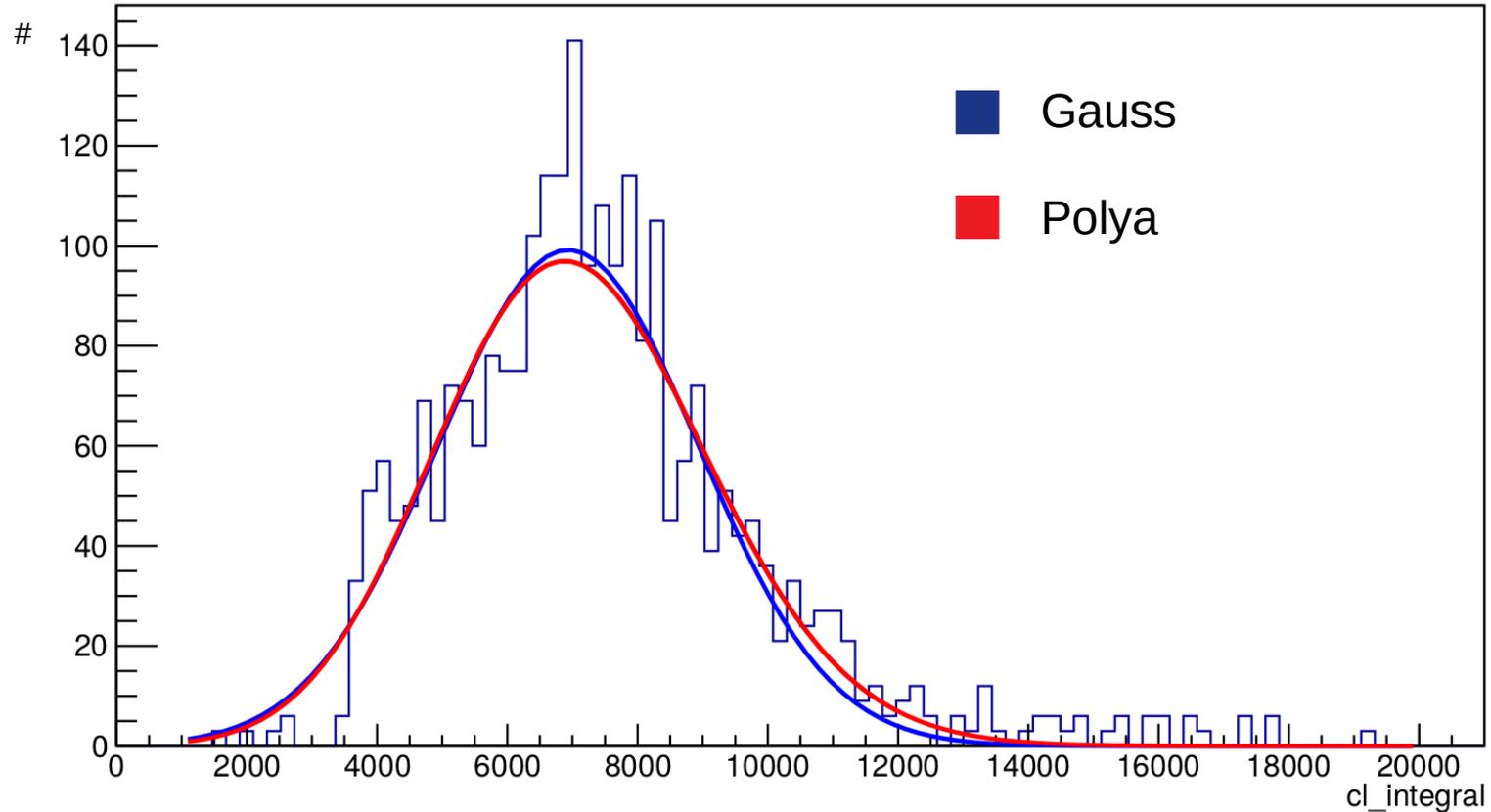
From the debug mode of the code, we found out most of the  $^{55}\text{Fe}$  ended up in iteration3



We applied the same cuts as at high gain, but the correct approach would be to optimize the reconstruction parameters

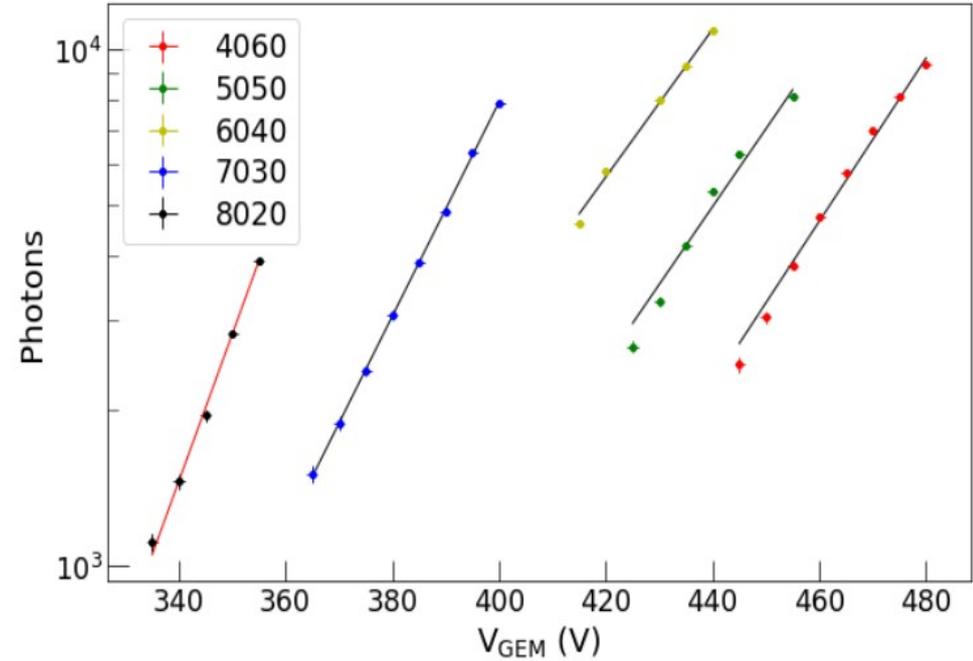
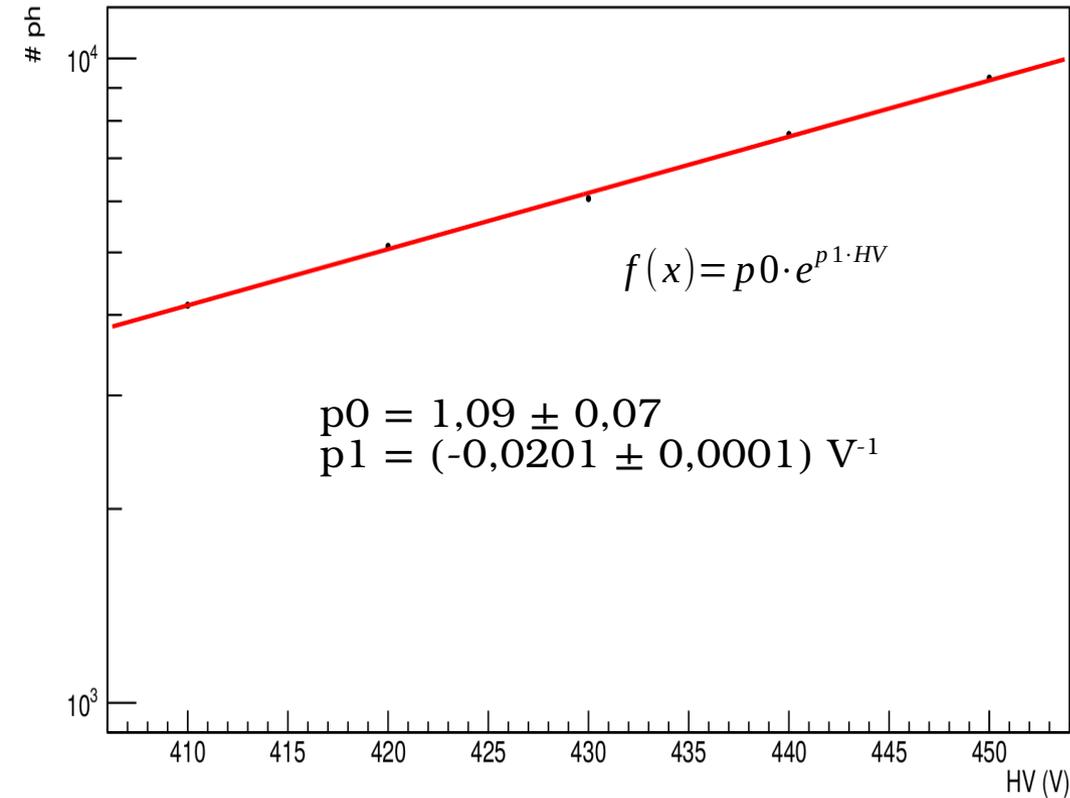
## Fit of the peak

We performed both gaussian and Polya fit on a sample of data and concluded that the same results could be obtained with a simple gaussian fit



# Gain curves

18 cm

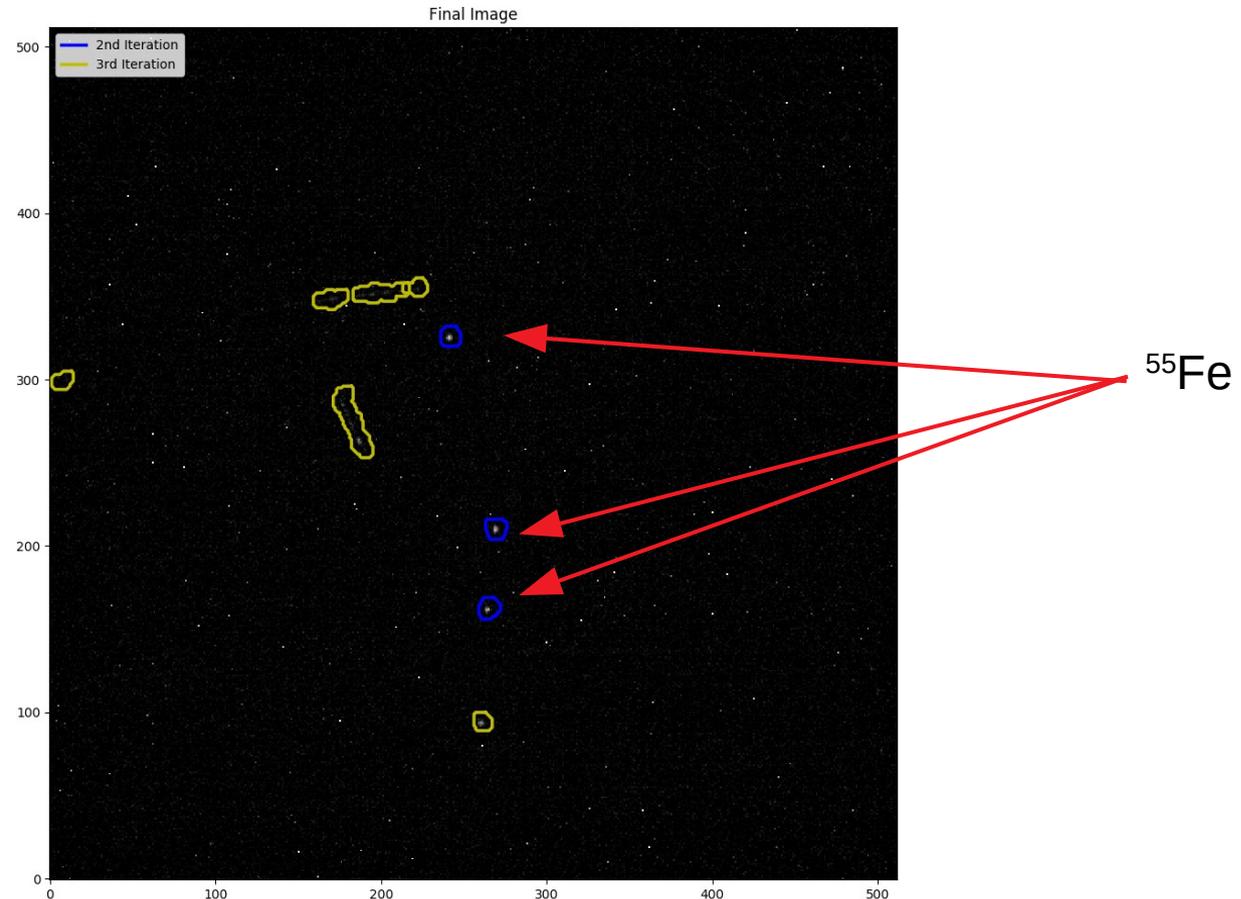


From thesis of R.Campagnola

We see consistency with previous ORANGE prototype data

# Low gain, adapting parameters

Work in progress: we are optimizing the reconstruction parameters



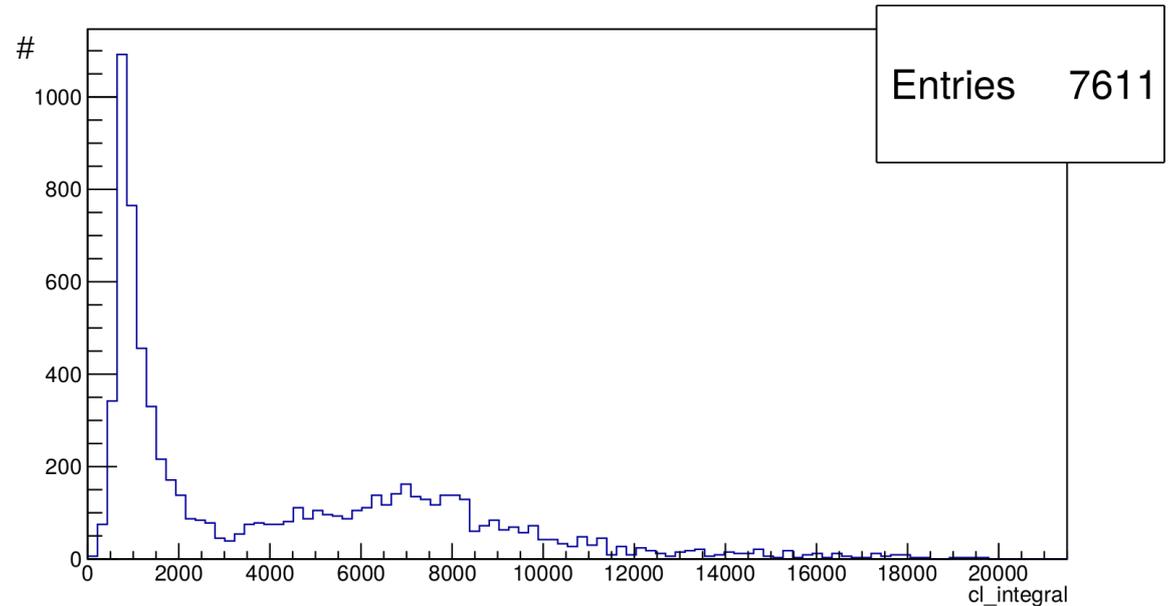
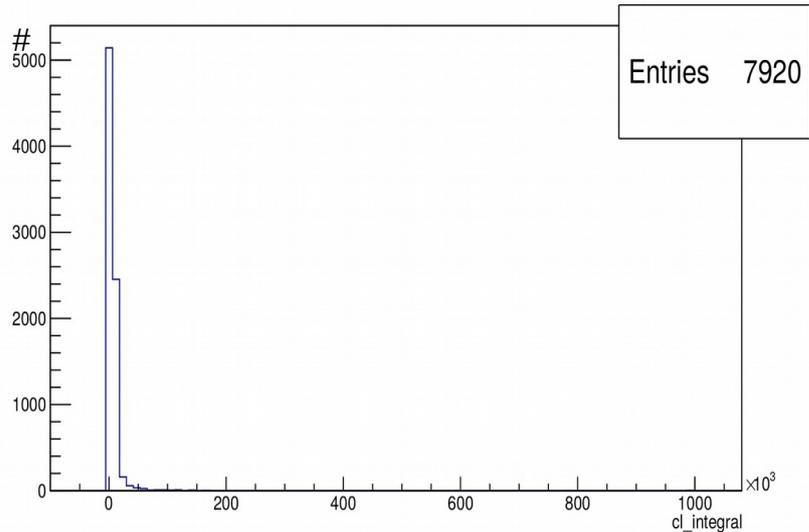
## Ongoing data taking

- Analysis of the GEM and PMT signal to study light and charge ratios.
- Scan on different transfer fields and different GEM voltage configuration, to study the diffusion on the GEM.
- **Kentaro field cage** successfully mounted and working (tested up to 900 V/cm).
- Long data taking with muons to study the field uniformity and develop 3D reconstruction of the tracks.

**BACKUP**

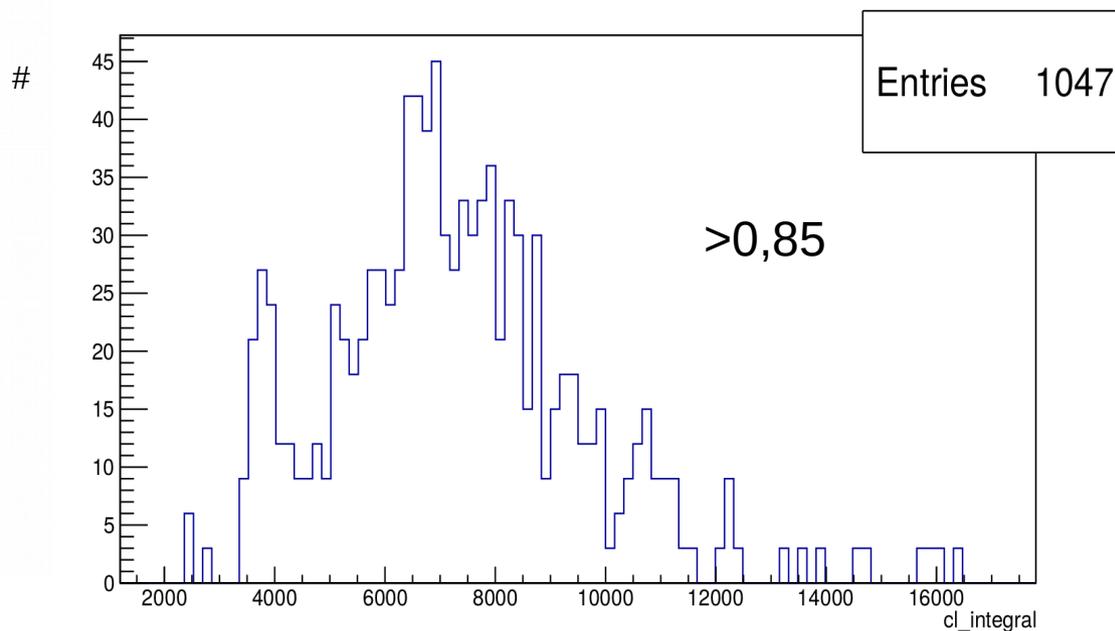
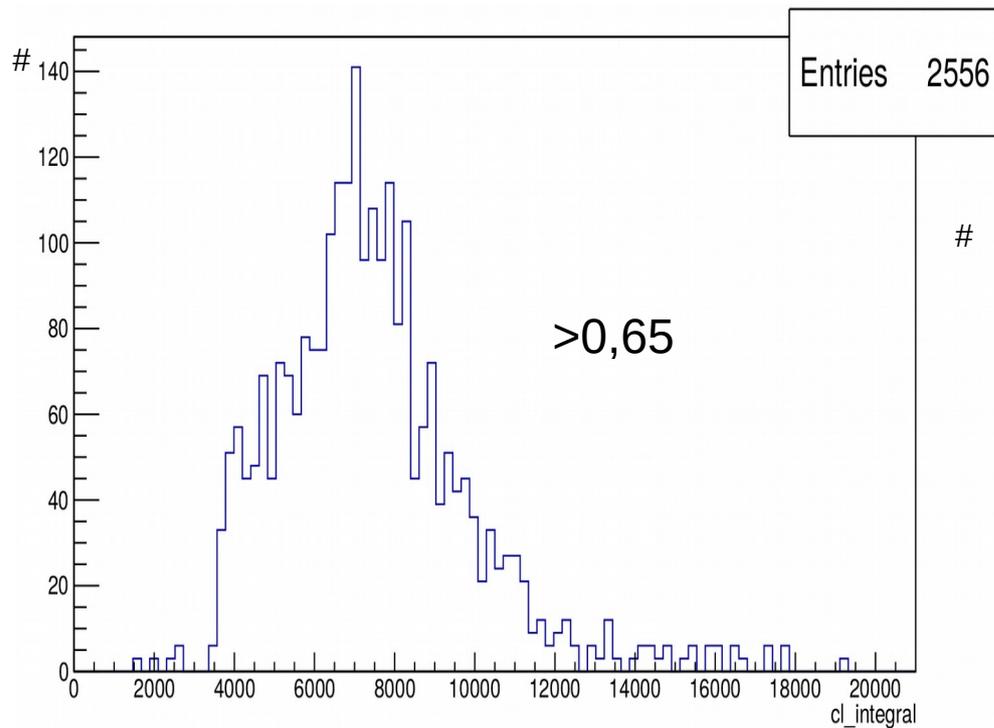
# High gain, cut on integral

After looking at the whole distribution, we shrank the data analysis on a range of energy where the peak could be found



## High gain, cut on length

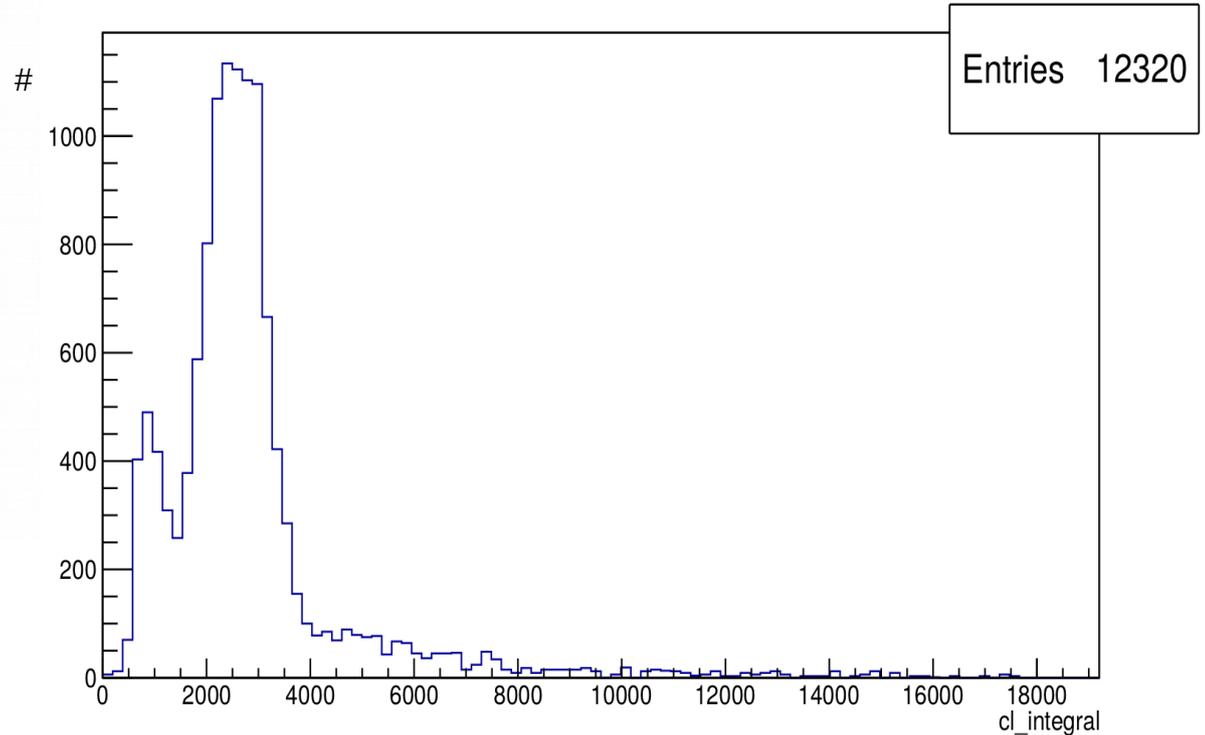
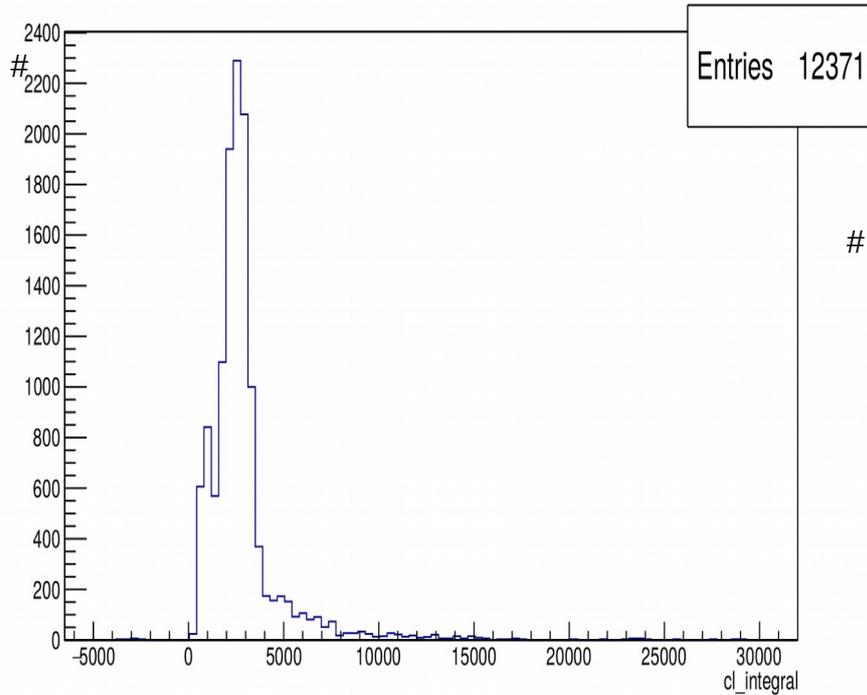
Since the shape is now forced to be round, we also require the length to be larger than 30, in order to reduce small noise spots



Will be more important at low gain configuration

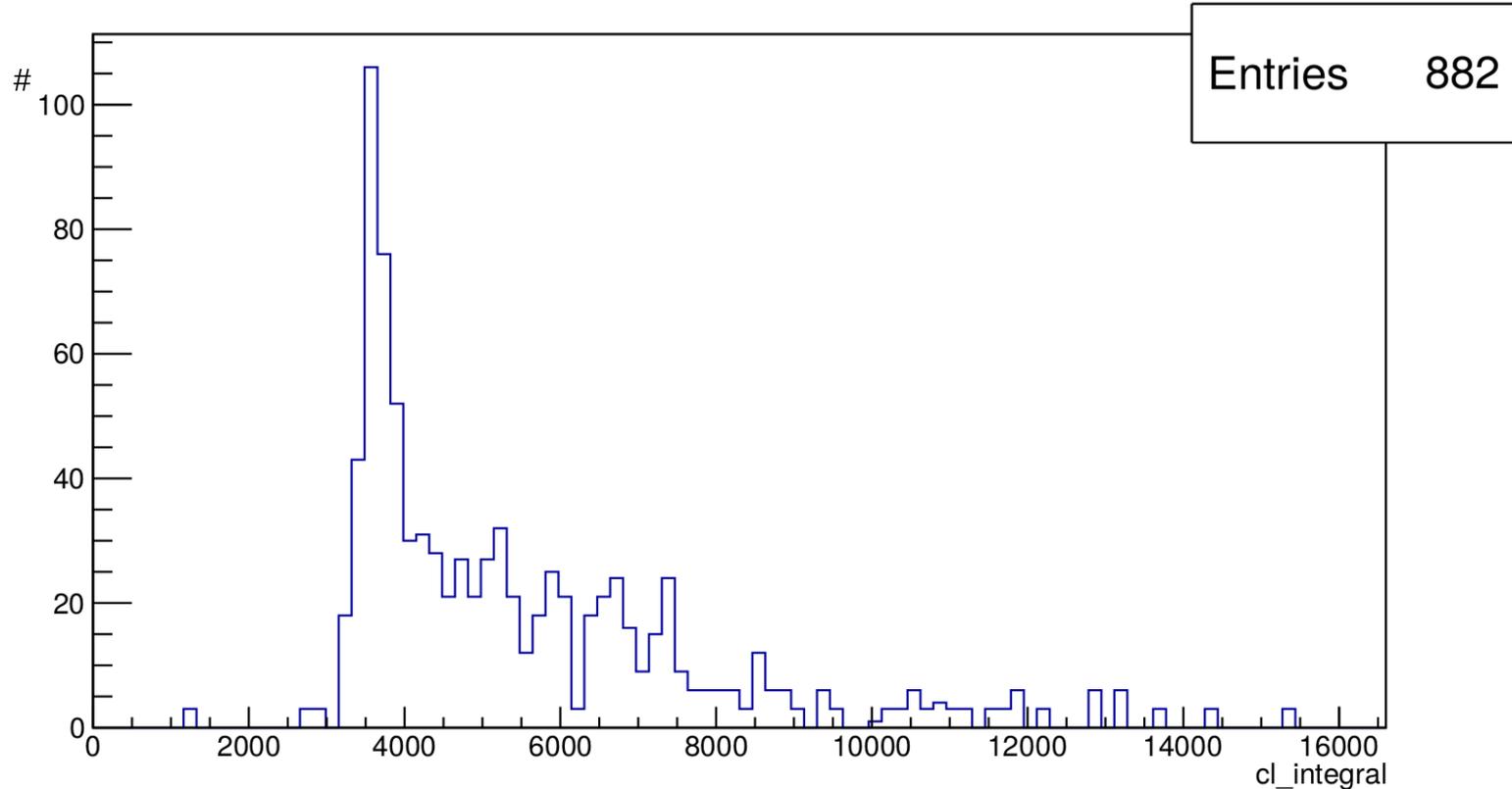
# Low gain, cut on integral

After looking at the whole distribution, we shrank the data analysis on a range of energy where the peak could be found



## Low gain, cut on iteration

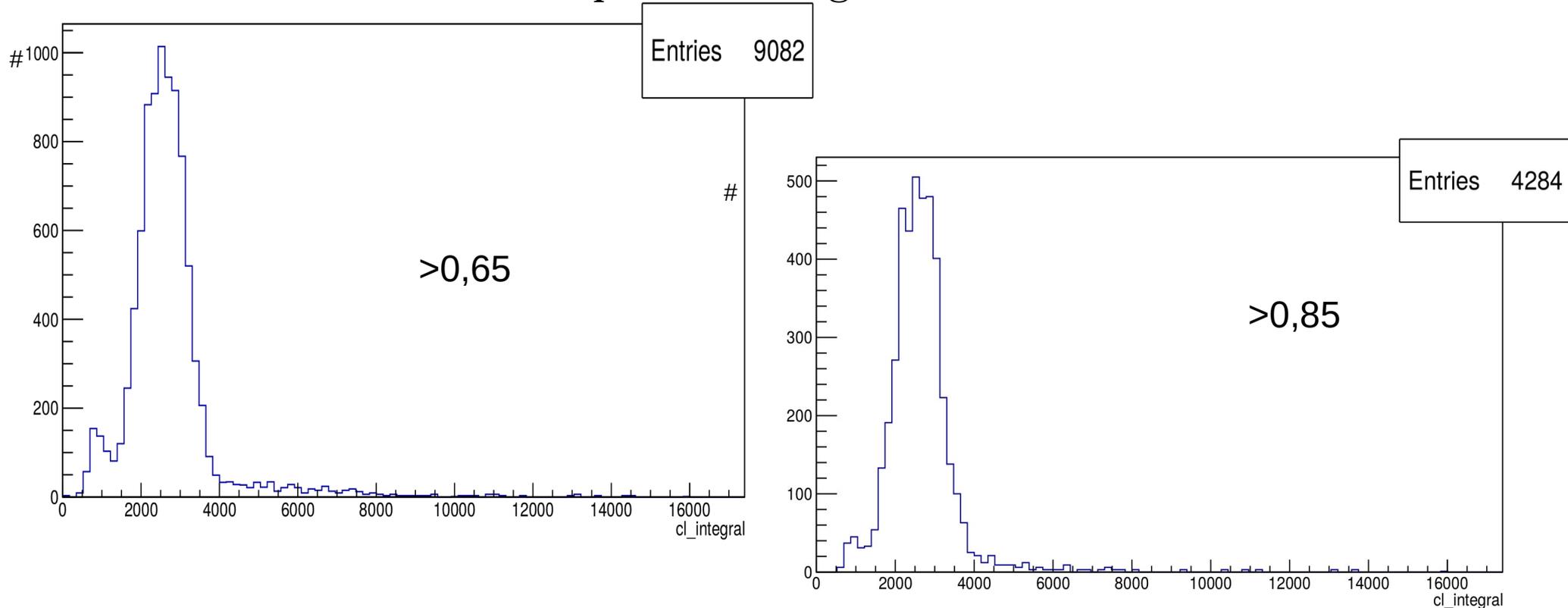
We eliminated iteration 3 clusters because they should only include noise



Also looking in the debug mode, we noticed that the majority of  $^{55}\text{Fe}$  ends up in iteration 3. Thus, it cannot be removed.

## Low gain, cut on roundness

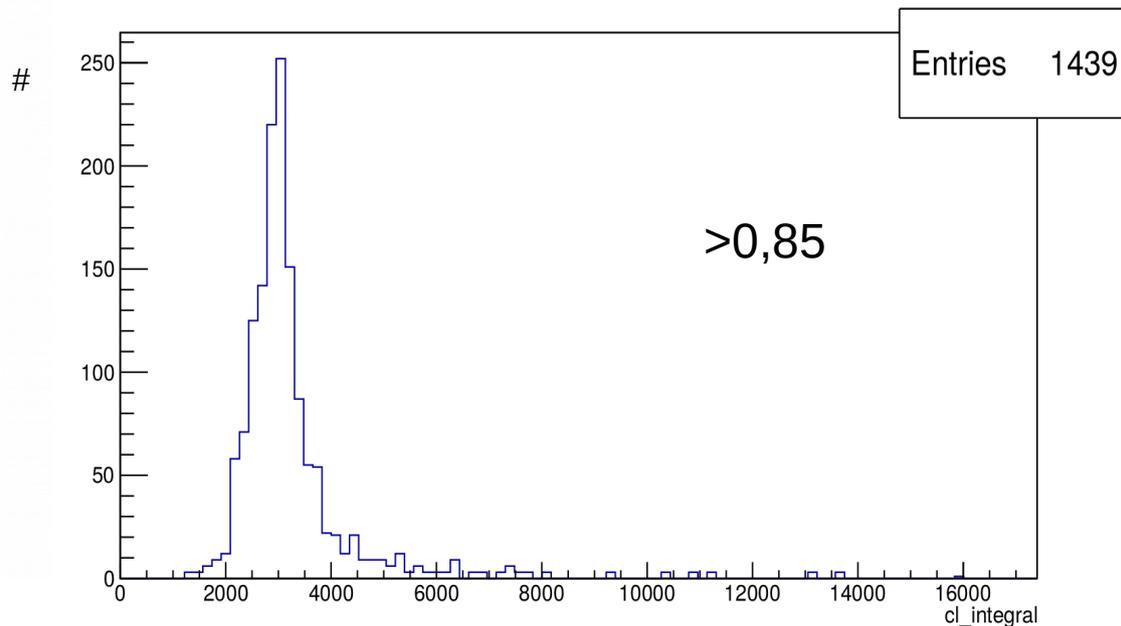
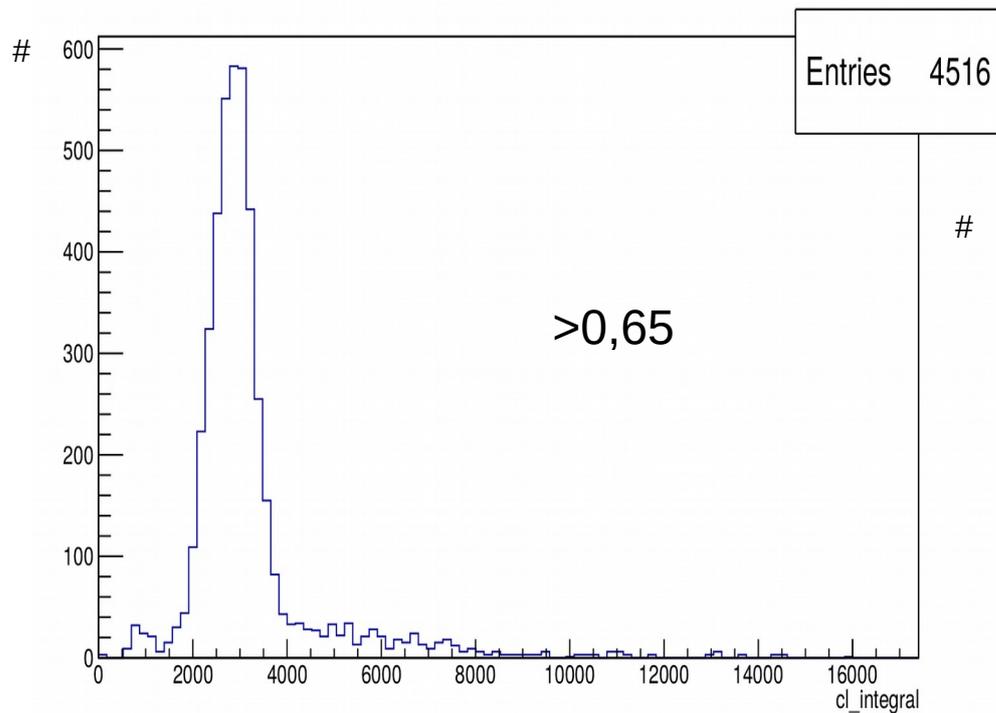
Due to the shape of the  $^{55}\text{Fe}$  signal we included a cut to keep the ones with a more round shape: width/length  $> 0,65$  or  $0,85$



It appears we still have a lot of noise, thus a more strict cut on roundness was selected again.

## Low gain, cut on length

Since the shape is now forced to be round, we also require the length to be larger than 30, in order to reduce small noise spots



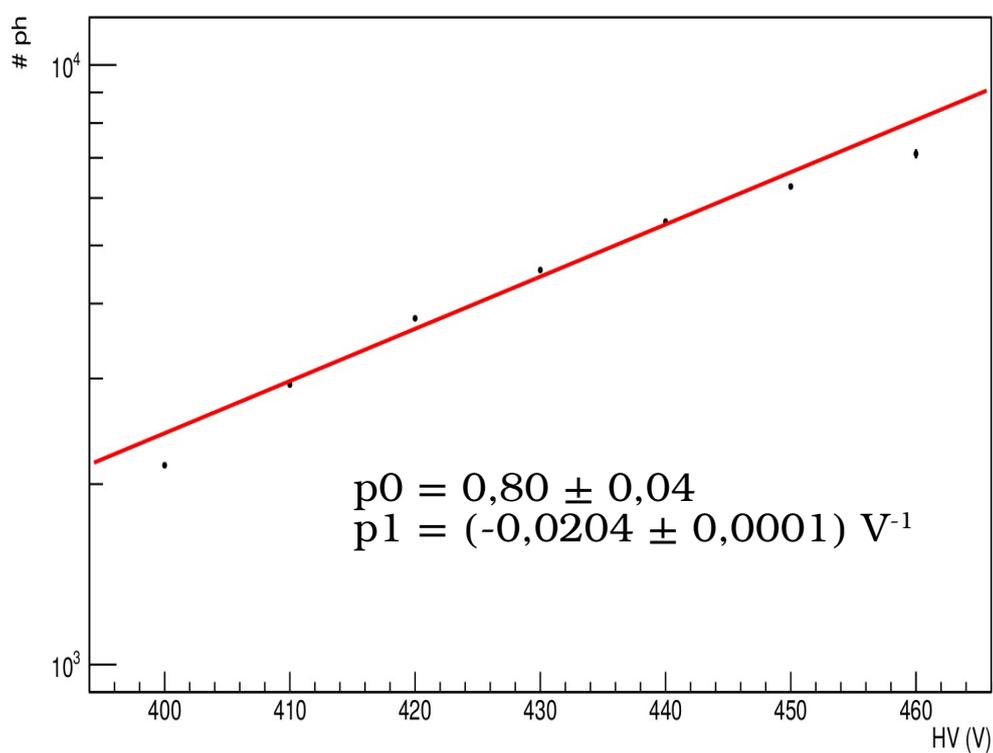
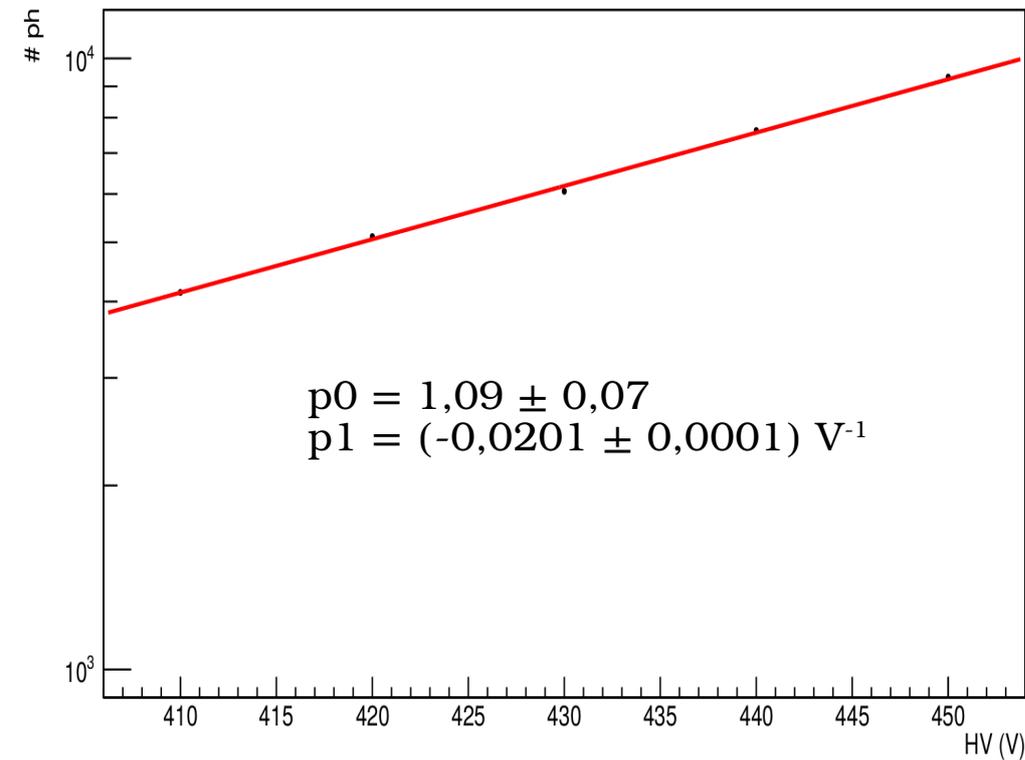
The importance of this cut is now visible to remove other noise.

# Gain curves

18 cm

$$f(x) = p_0 \cdot e^{p_1 \cdot HV}$$

22 cm



# Gain curves

18 cm

$$f(x) = p_0 \cdot e^{p_1 \cdot HV}$$

22 cm

