

Update on PMTs

Reconstruction & analysis meeting 11/05/23

E. Baracchini, F. Borra, M. Folcarelli, D. Marques, A. Messina, S. Piacentini

Analysis of the efficiency of the x,y,L fit (1)

Dataset:

- ^{55}Fe runs: 9785, 9830, 11051, 11101

Fit:

- integral of 50 samples around a majority2 peak (65ns ~ 0.4cm resolution in z)
- converged ~95% of the time (99.7% for the “Fe” ones)

Waveform cuts:

- Majority2 peak == 1 → 19% of the converged peaks
- $R < 800$ px → 68% of the mj2==1 peaks
- 12% of the starting peaks

Cluster cuts:

- Typical ^{55}Fe selection (as suggested by Emanuele):
 - **sc_rms > 6**
 - **$R < 800$ px**(distance from center to cut the noisy part of the sensor)
 - **$0.152 * \text{sc_tgausssigma} > 0.3$** (cut on spikes, interaction on CMOS)
 - **$0.152 * \text{sc_length} < 80$**
 - **sc_width/sc_length > 0.8** (rounded clusters)
 - **sc_integral > 1000**

Analysis of the efficiency of the x, y, L fit (2)

Coordinate transformation PMT \rightarrow camera:

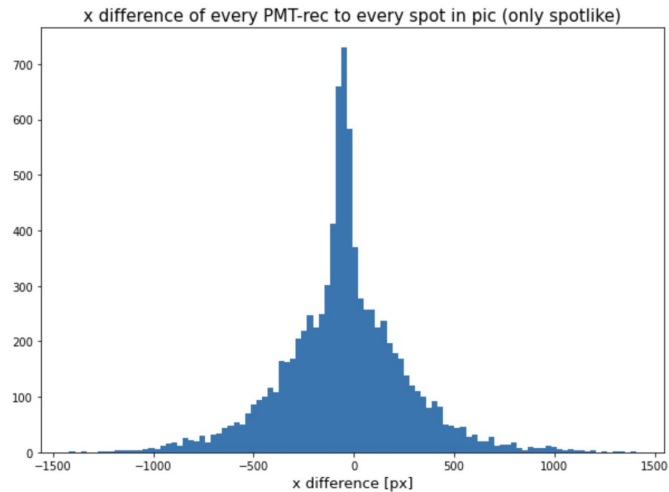
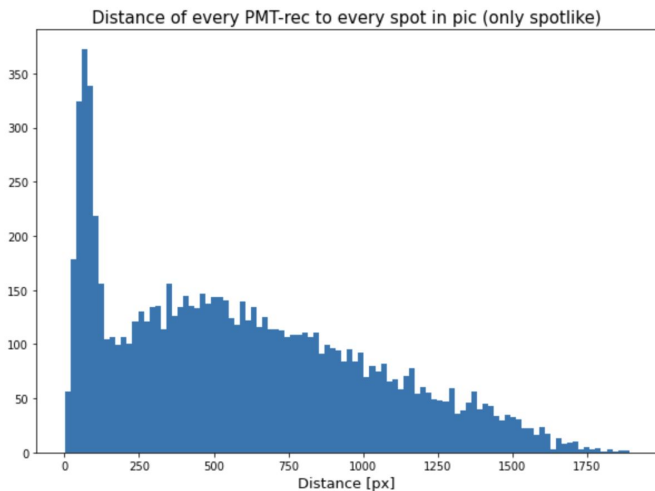
$$\begin{aligned}x_{\text{new}}(\text{px}) &= 180 + x_{\text{old}}(\text{cm}) * 1970/33 \\ y_{\text{new}}(\text{px}) &= 370 + y_{\text{old}}(\text{cm}) * 1970/33\end{aligned}$$

Needs to be improved!

60 px \sim 1 cm

Distance between cluster's x/y mean and fitted PMT's x/y .

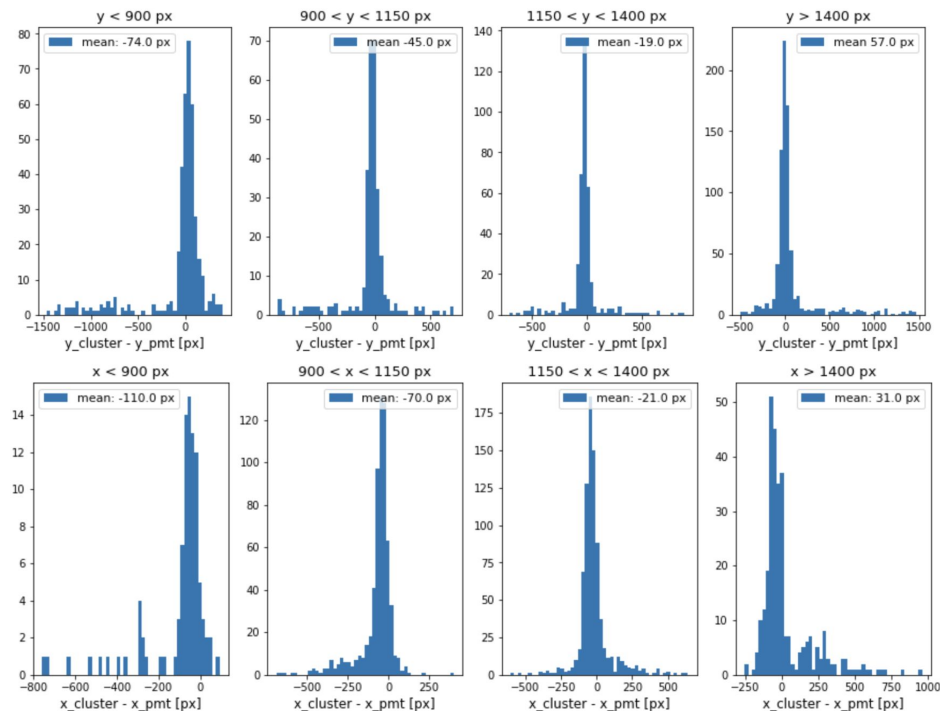
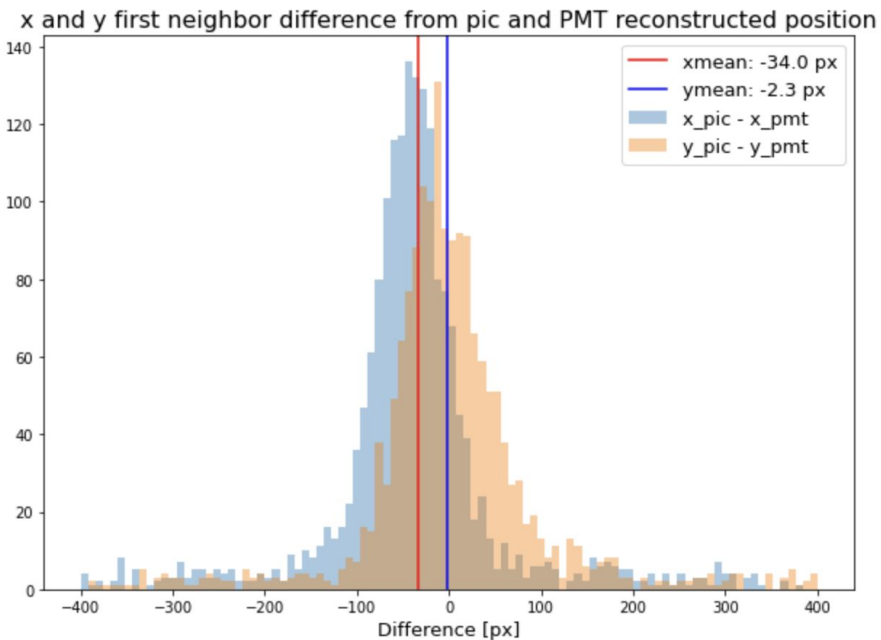
All the clusters vs all the reconstructed waveforms:



Analysis of the efficiency of the x, y, L fit (3)

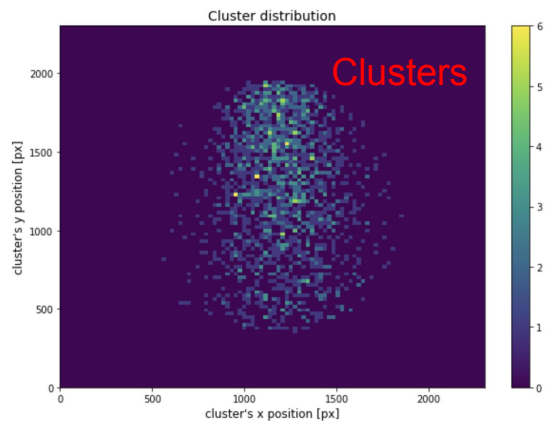
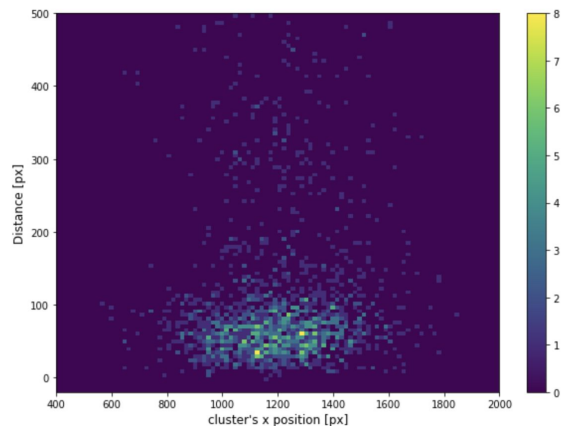
Closest neighbor (PMT waveform assigned to the closest cluster found)

Same plot but with slices of the GEM plane

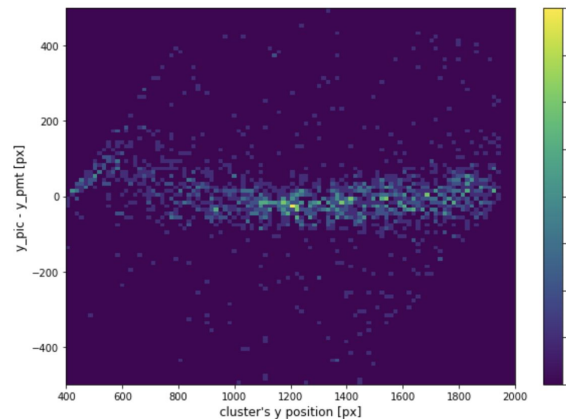
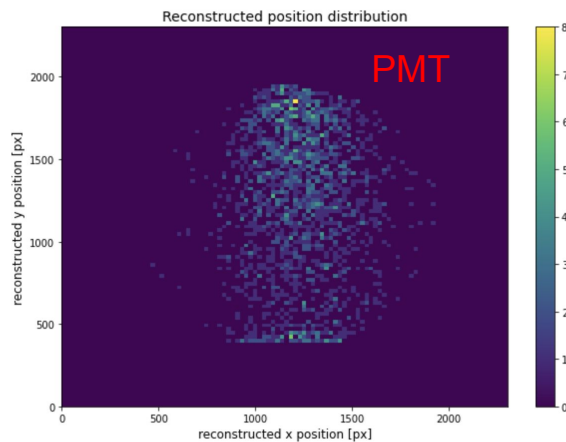
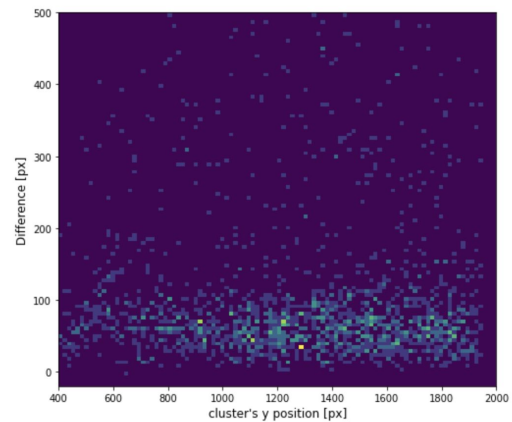
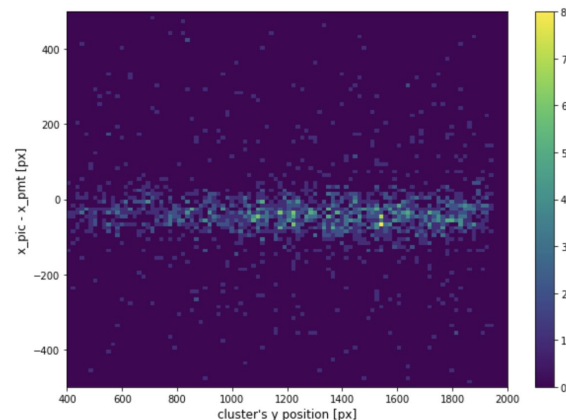


Analysis of the efficiency of the x, y, L fit (4)

Distance vs cluster position:

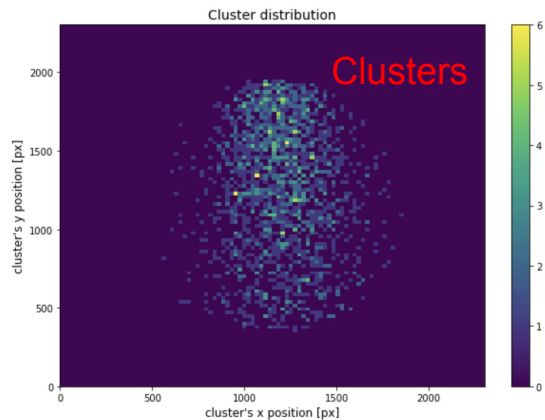
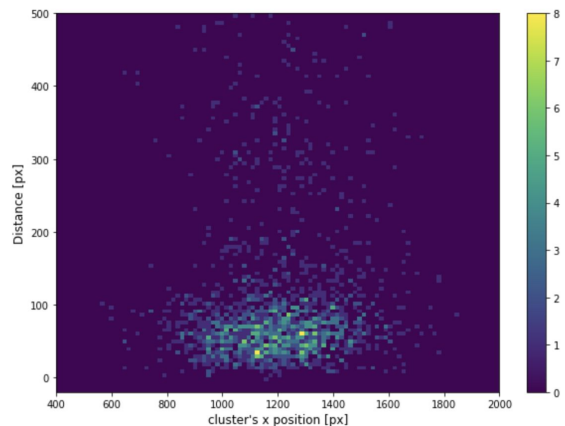


Differences vs cluster position:

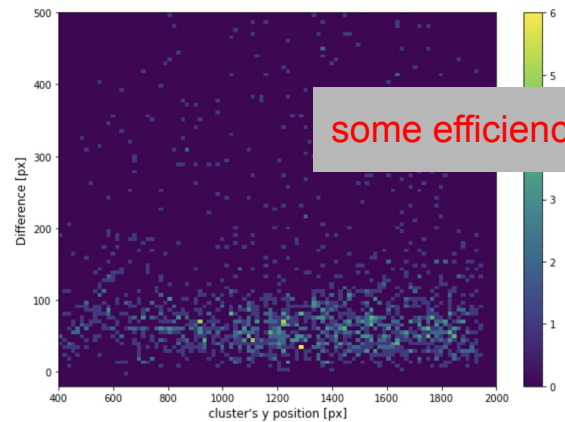
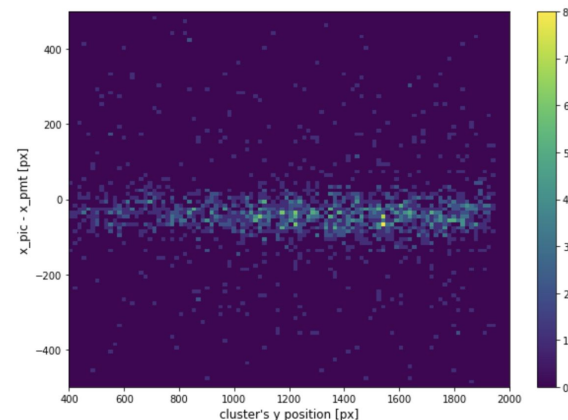


Analysis of the efficiency of the x,y,L fit (4)

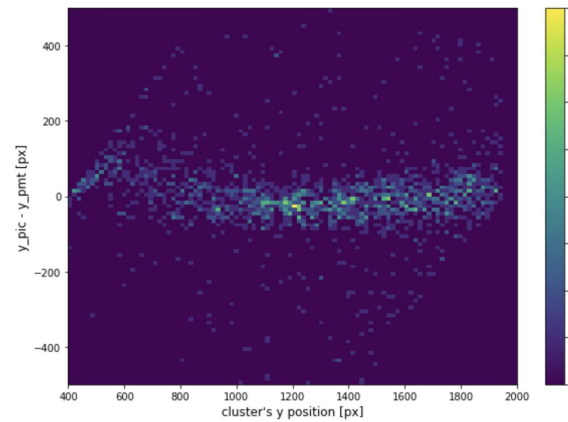
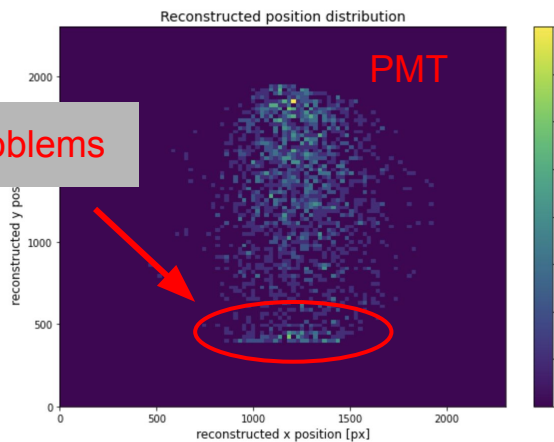
Distance vs cluster position:



Differences vs cluster position:



some efficiency problems



Analysis of the efficiency of the x, y, L fit (5)

Performance:

- Combined 46% of the possible waveforms → we expect ~1.6 times more waveforms
- Combined 86% of the possible clusters → **why not all?** Are we losing some waveforms?

Issues:

- Coordinate conversion not totally clear

Next steps:

- Same analysis with different source position (ongoing)
- Optimization in the fit
- Same analysis with long tracks → need for “small clusters” division in the image reconstruction
- Work on other sources? → important for the Am-Be run