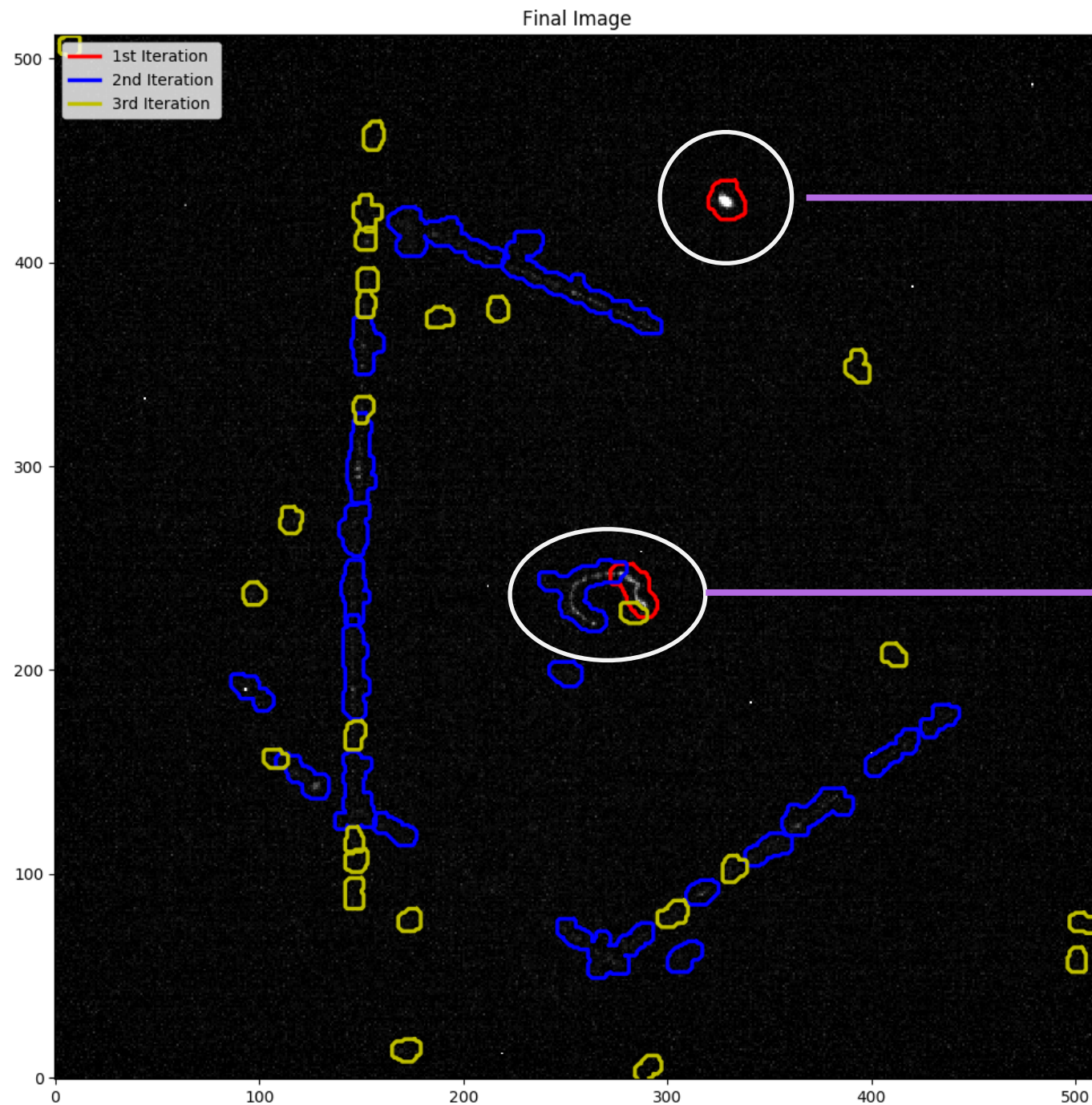


New data taking with AmBe

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CYGNO General Meeting, 19 December 2019

- Tuned the cluster reconstruction parameters to get efficiently α 's and what seem nuclear recoils in iteration 1, and the rest into iteration 2
 - reminder: **iteration 1 is made for "high-density" clusters**
 - **iteration 2 is made for medium/low-energy clusters** (e.g. 5.9 keV spots from Fe55, typical ambient radioactivity, cosmics products...)
- Achieved:
 - all the Fe55 is well separate (checked with the energy peak) => go to iter-2
- Problem:
 - there are clusters, pieces of the ubiquitous cosmics, that go into iteration 1
 - **=> iter-1 is not a pure sample of recoils**
- Possible solutions:
 - these are pieces of longer tracks, so they could be rejected by the supercluster length
 - at the moment not done, because the supercluster runs on separate classes (iterations) of clusters
 - **=> need to run the superclustering on the OR of it1 + it2 clusters**



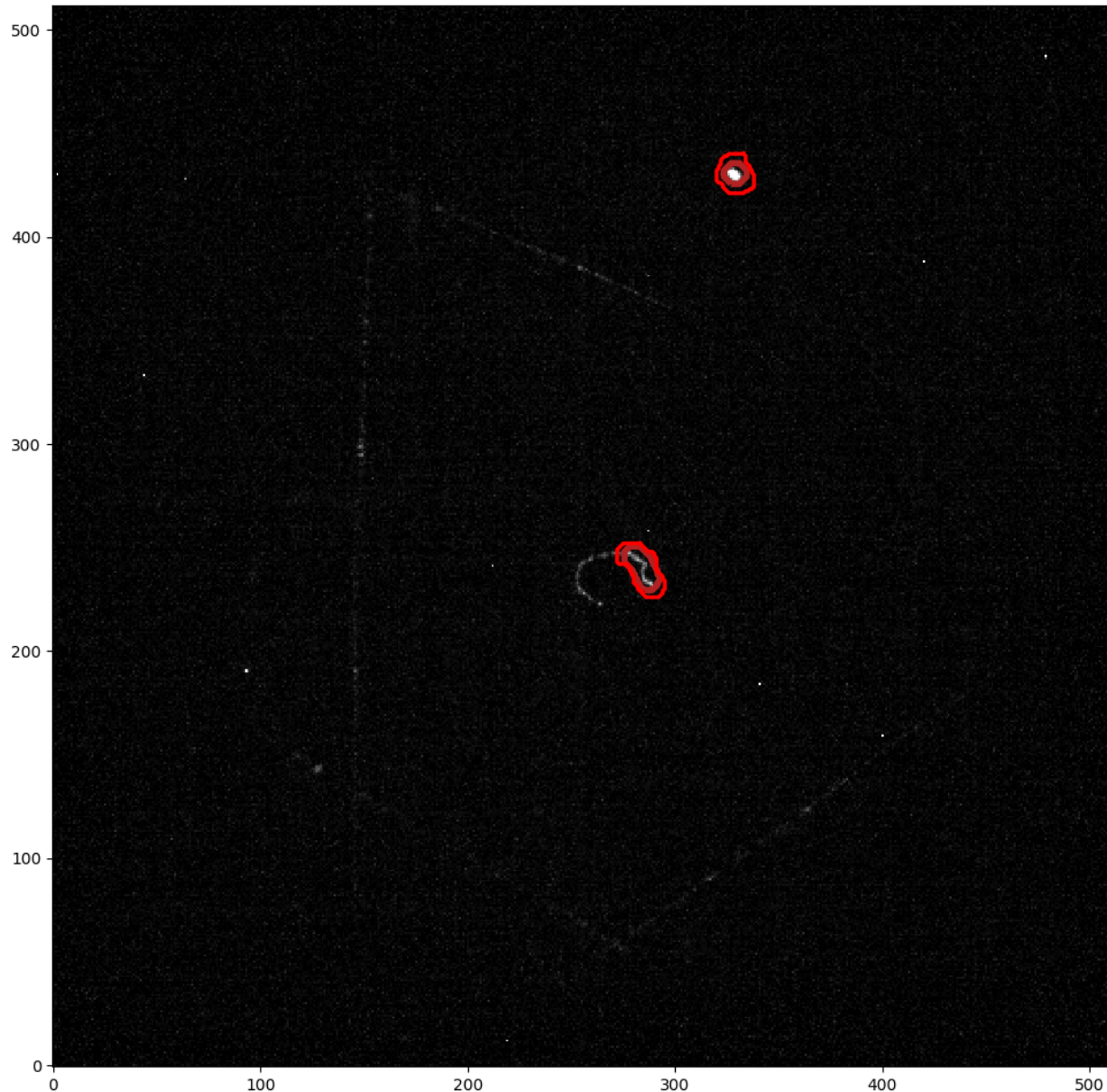
Good recoil?

Two clusters with different iterations clearly from the same track

Clustering step

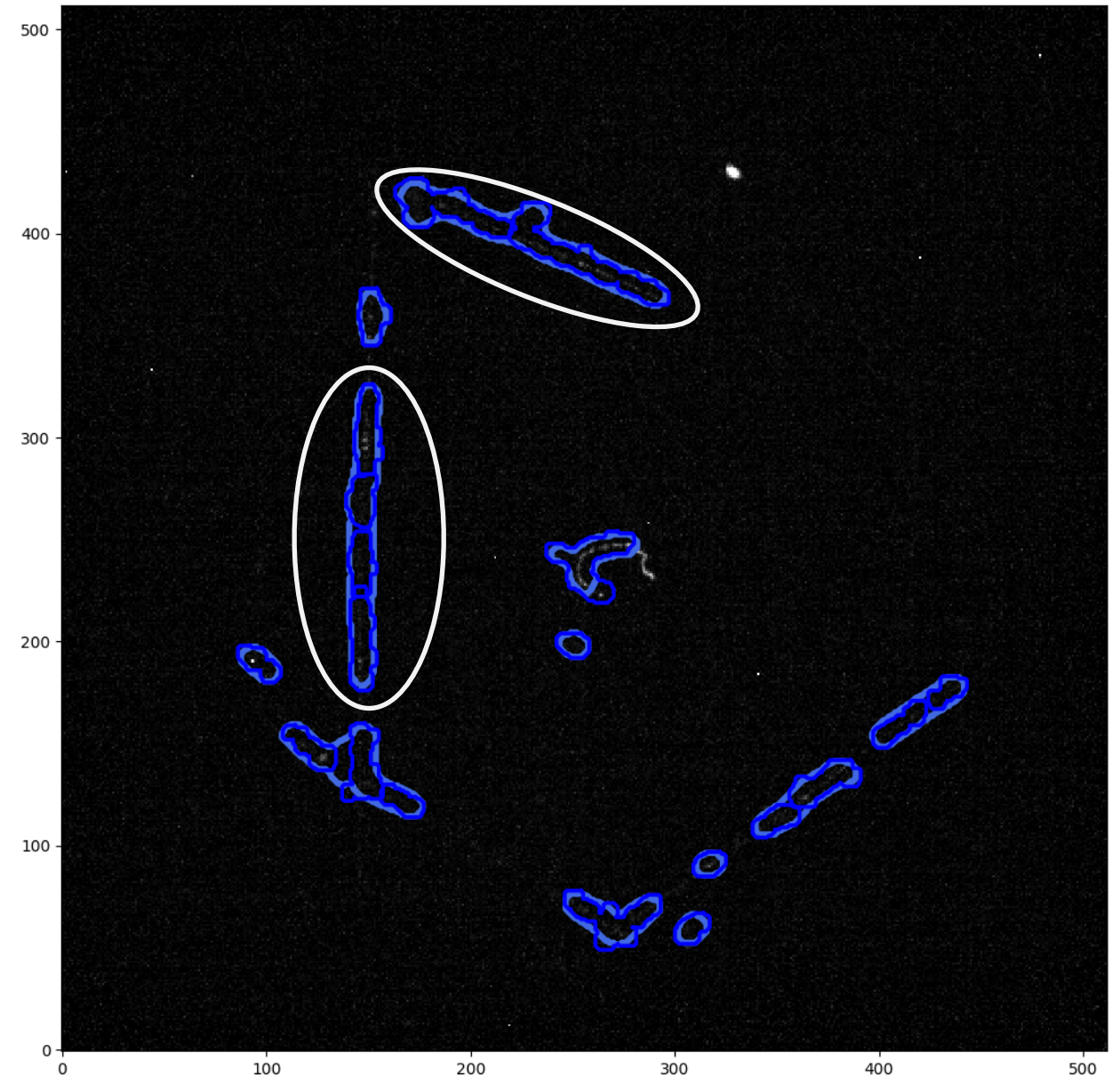
iteration 1: high density

Clusters found in iteration 1



iteration 2: medium density

Clusters found in iteration 2

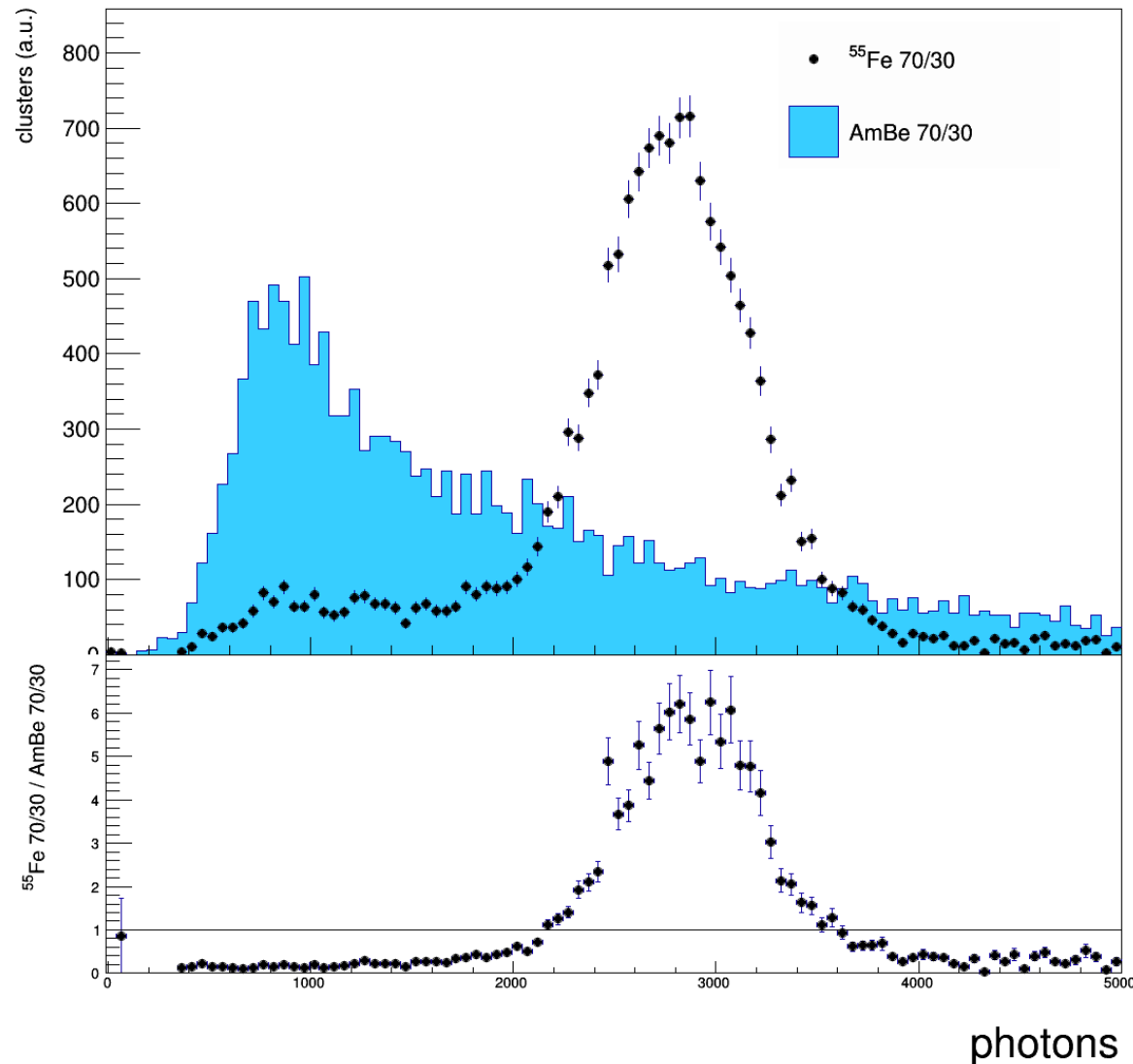


superclusters in it2 join pieces of tracks belonging to the same iteration, but by construction cannot join it1 + it2

Will change that to help the discrimination against “cosmics”
side note: not a big problem underground...

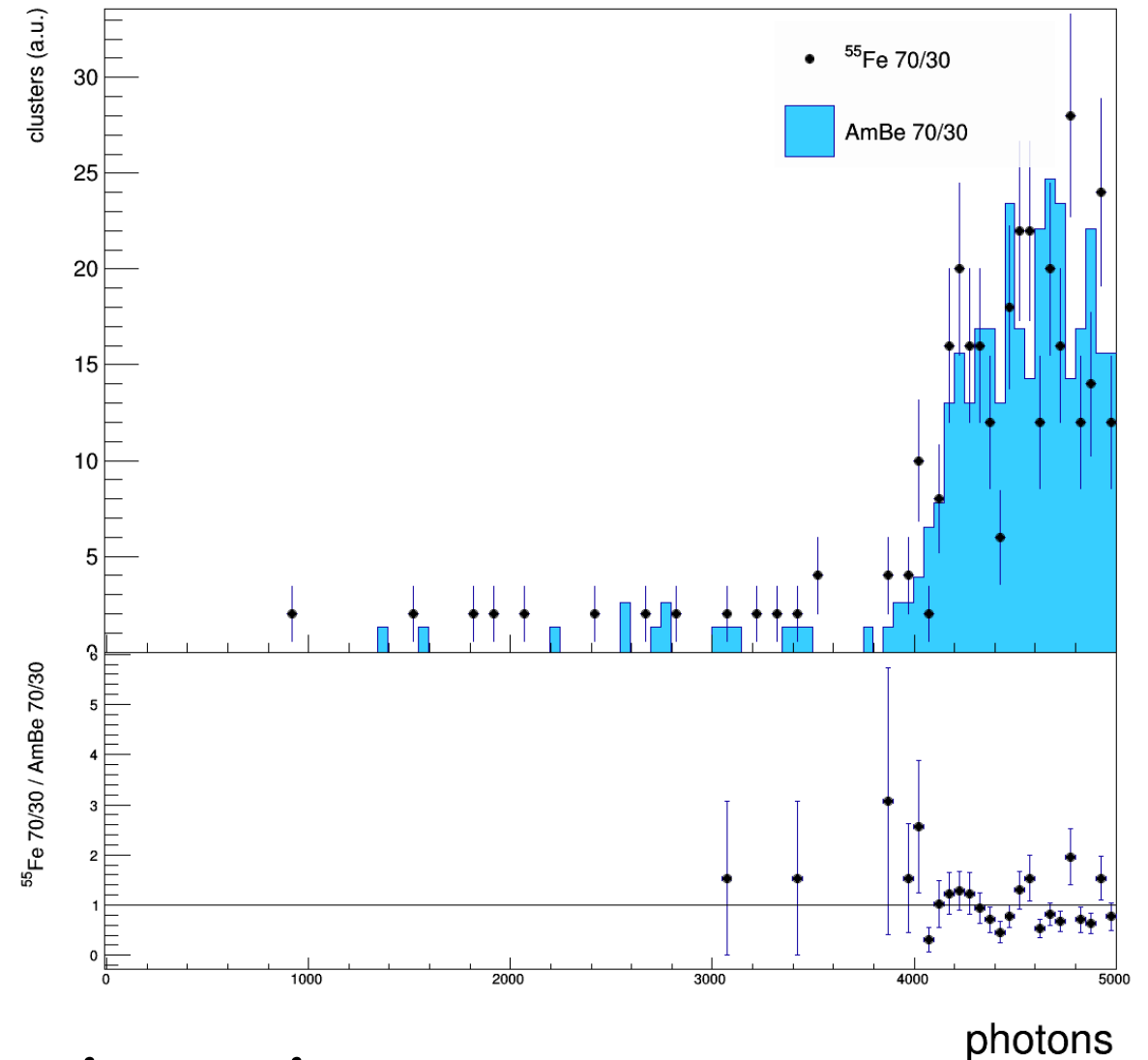
^{55}Fe vs AmBe: energy of the 2 classes

- Reconstructed Fe55 and AmBe with the same reconstruction parameters (runs of the same day)



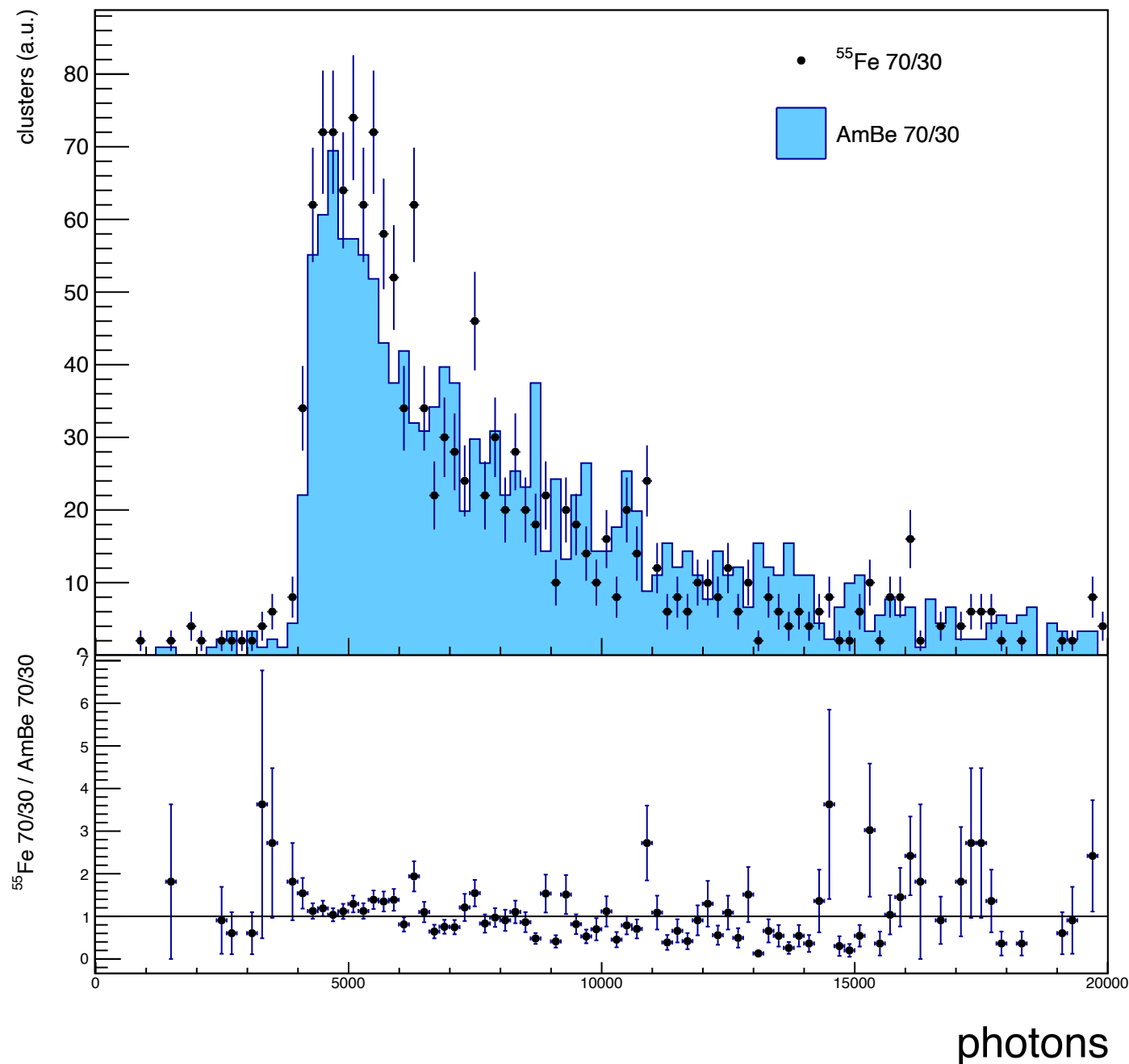
iteration 2:

- gets the Fe55 peak (~2.8k photons)
- gets the bkg (note: same shape in Fe and AmBe)



iteration 1:

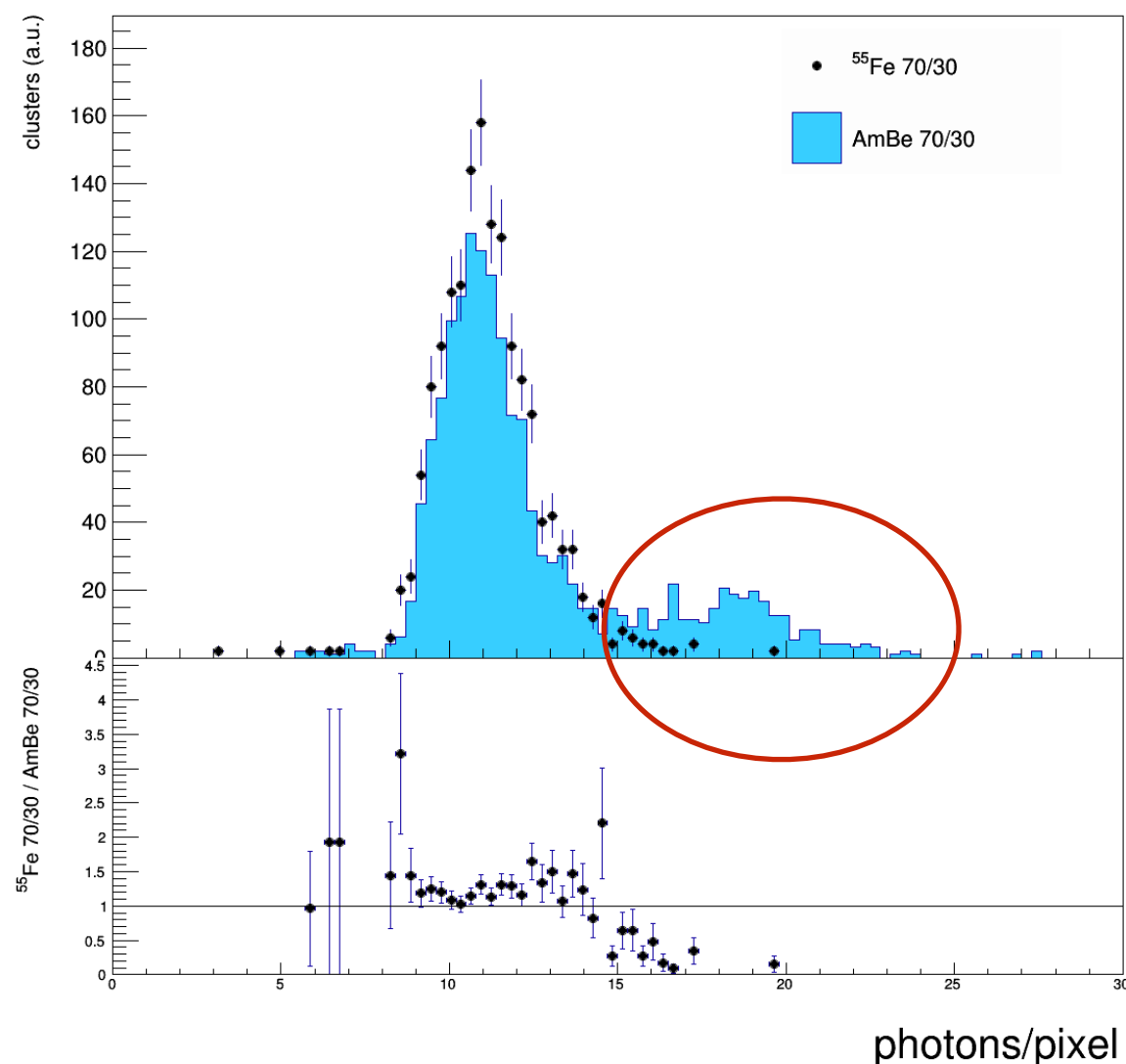
- do not get any part of the Fe55 peak (i.e. it's a decent discriminator)
- gets higher energy (full spectrum later)



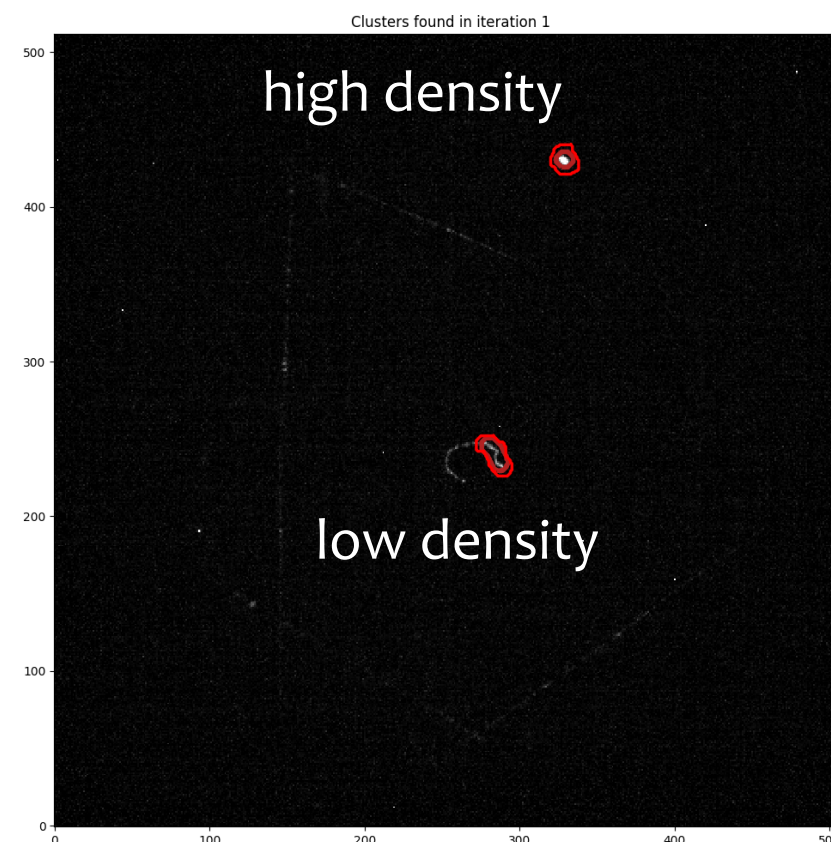
- The spectrum **in the mid-range** (calibrated energy in [10.3 - ~40 keV]) is very similar between the AmBe and Fe55 run
- indeed these are **MOSTLY** pieces of cosmic-induced background, which are present both in Fe55 and AmBe runs
- Also, the AmBe source was screened a lot, so it's a small contribution to this spectrum (if any, in the tails also, see later...)

do we see anything?

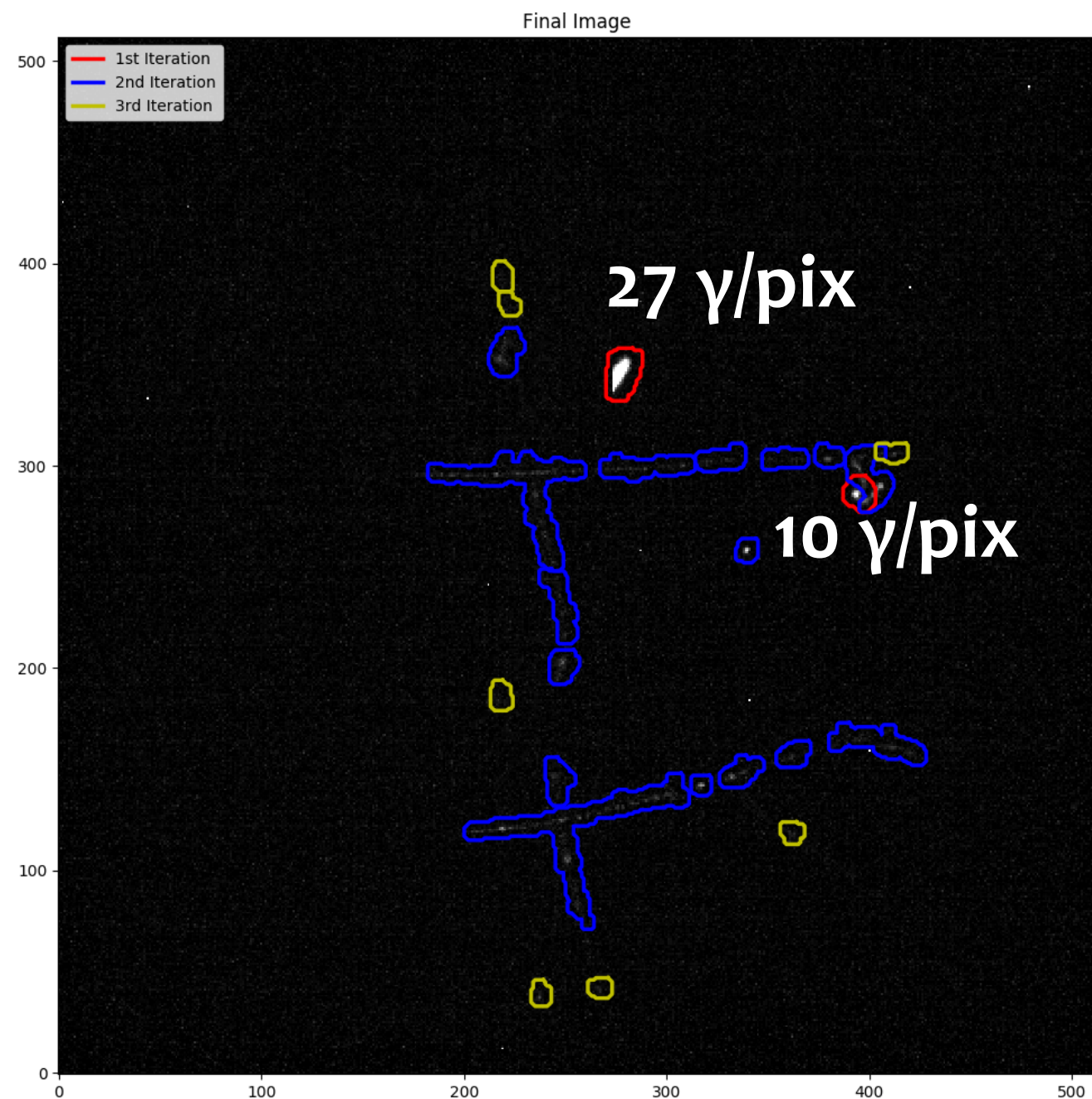
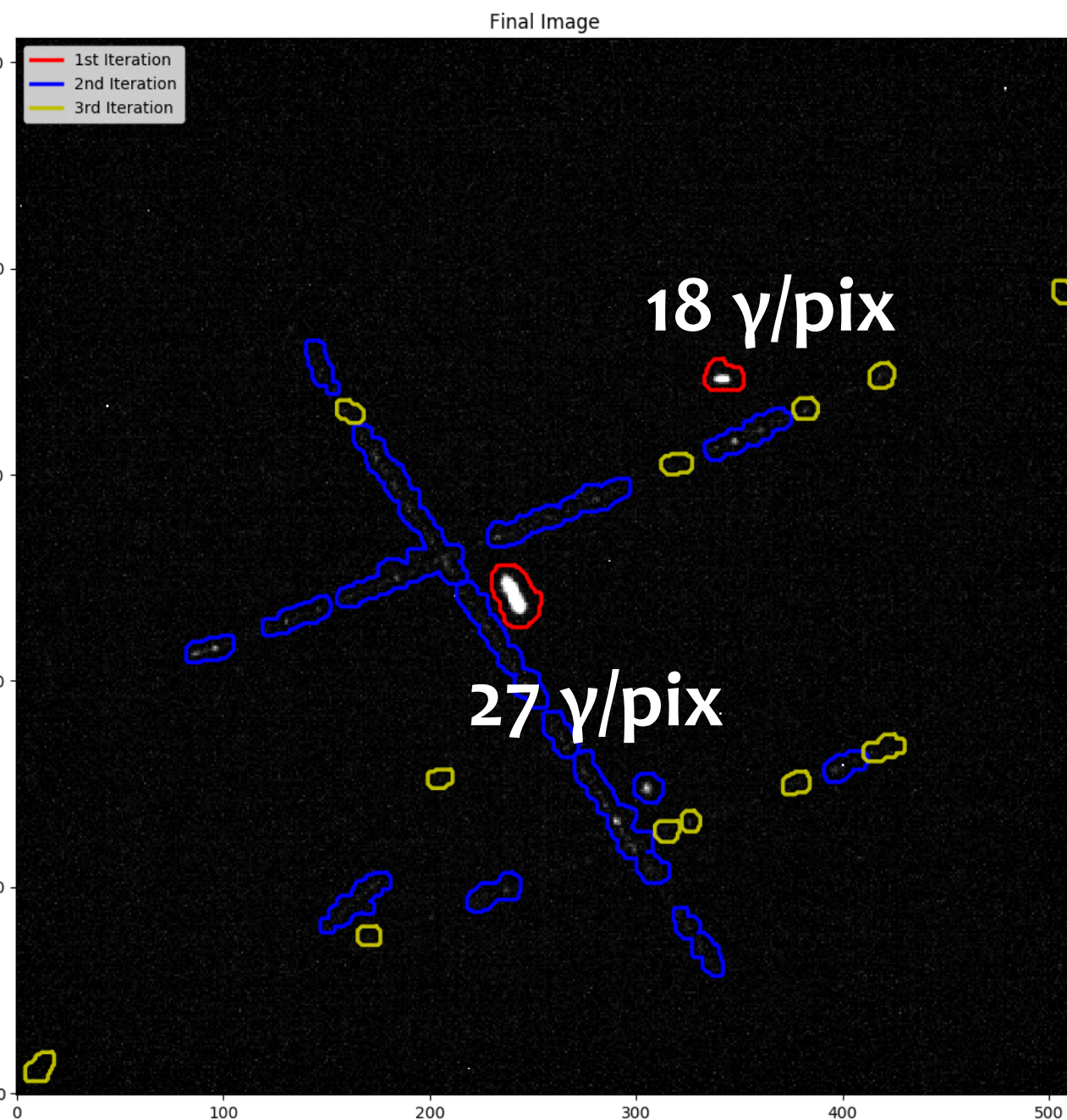
- Length, width, slimness, etc. are all very similar (should be solved as said by “superclustering” the OR of it1 and it2)
- apart the density: #photons/pixels in the cluster: the bump > 15 is only in AmBe runs**



can try to select those
e.g. the two it1 clusters of the
previous image were 1 high/1low density

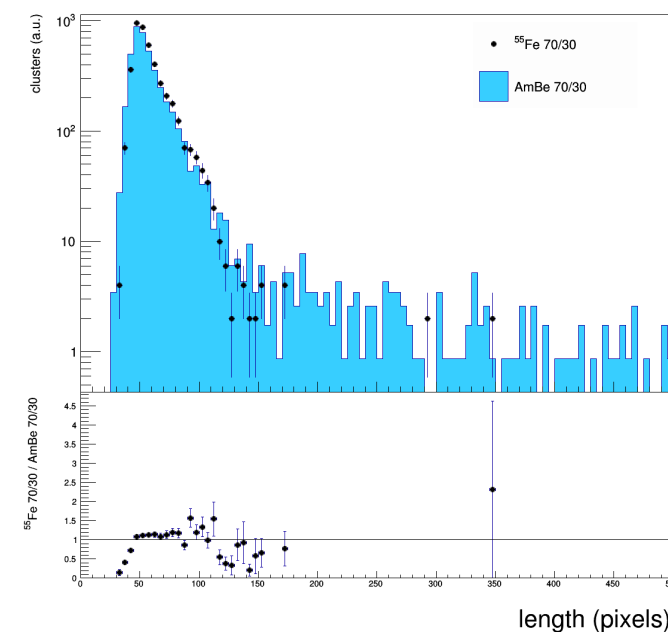
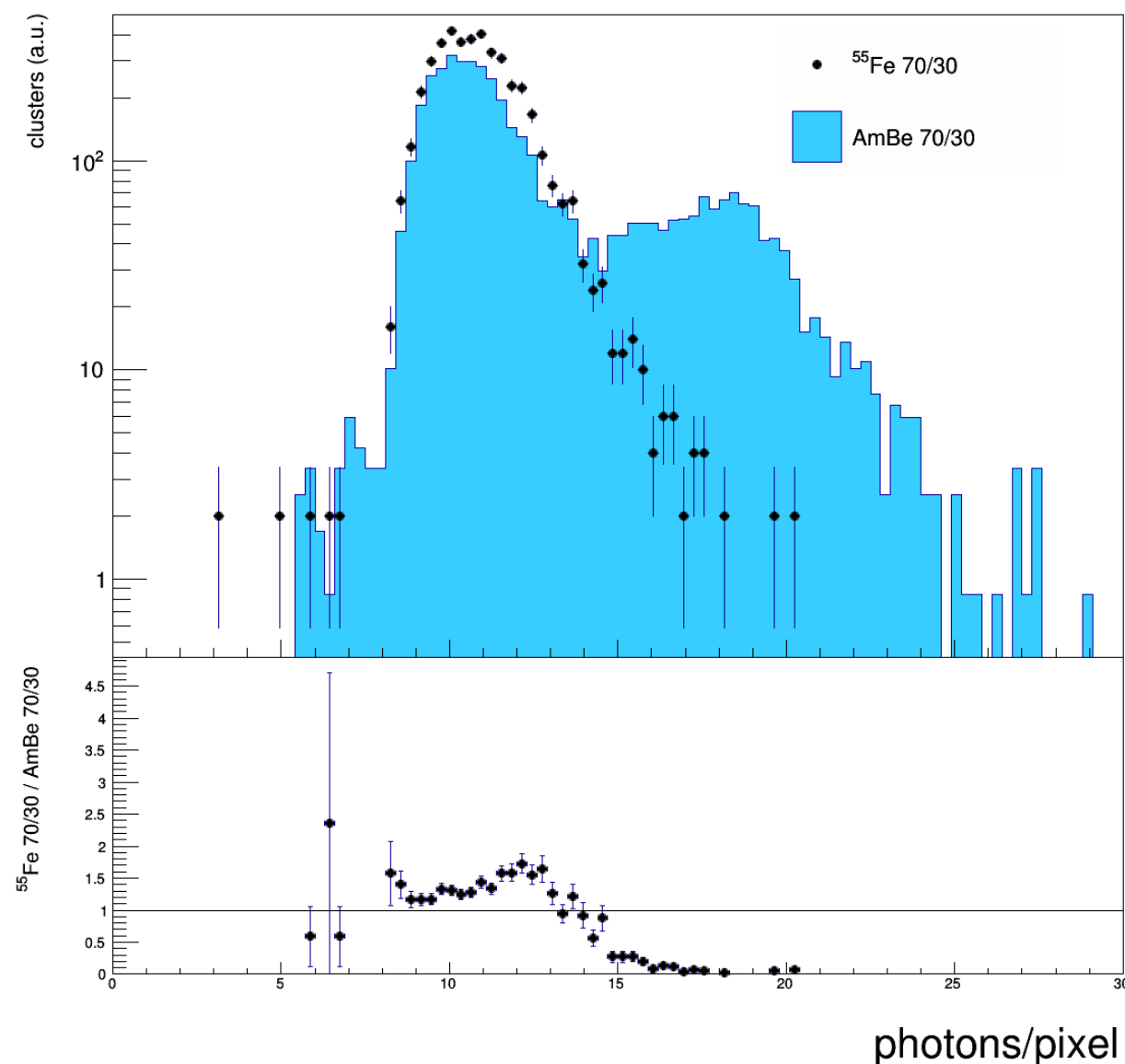


- looking at O(10) images, it seems that $\text{density} > 15$ selects good recoil candidates

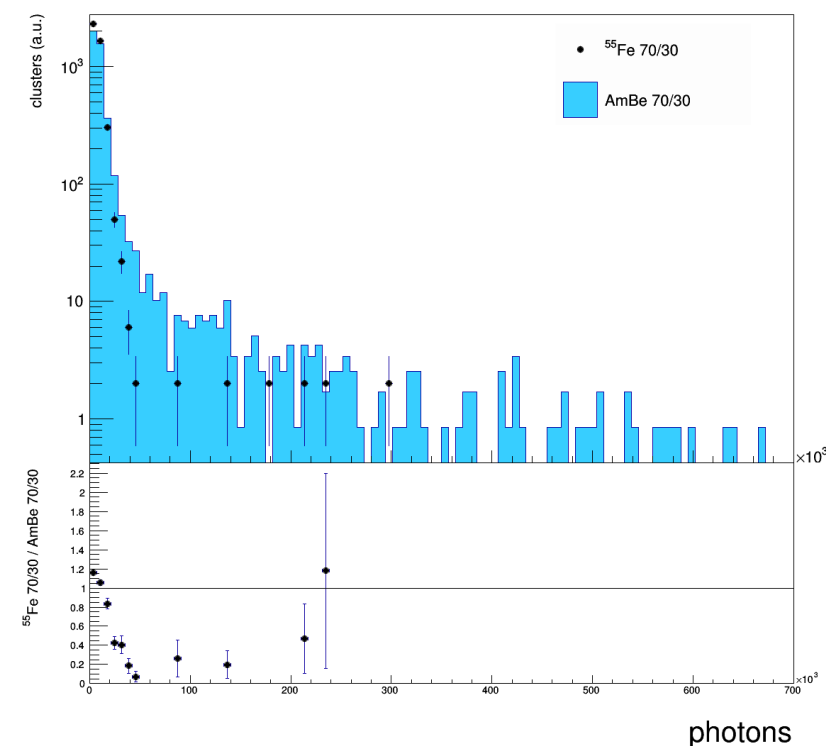


Very similar to α 's

- N.B. The previous plots are cutting in the center of the FC ellipse ($\sim 1/2$ of the area), to remove the protons coming from the interactions with the FC.
- Looking at the full volume the number of high-density clusters increases, as it should, because very long α tracks

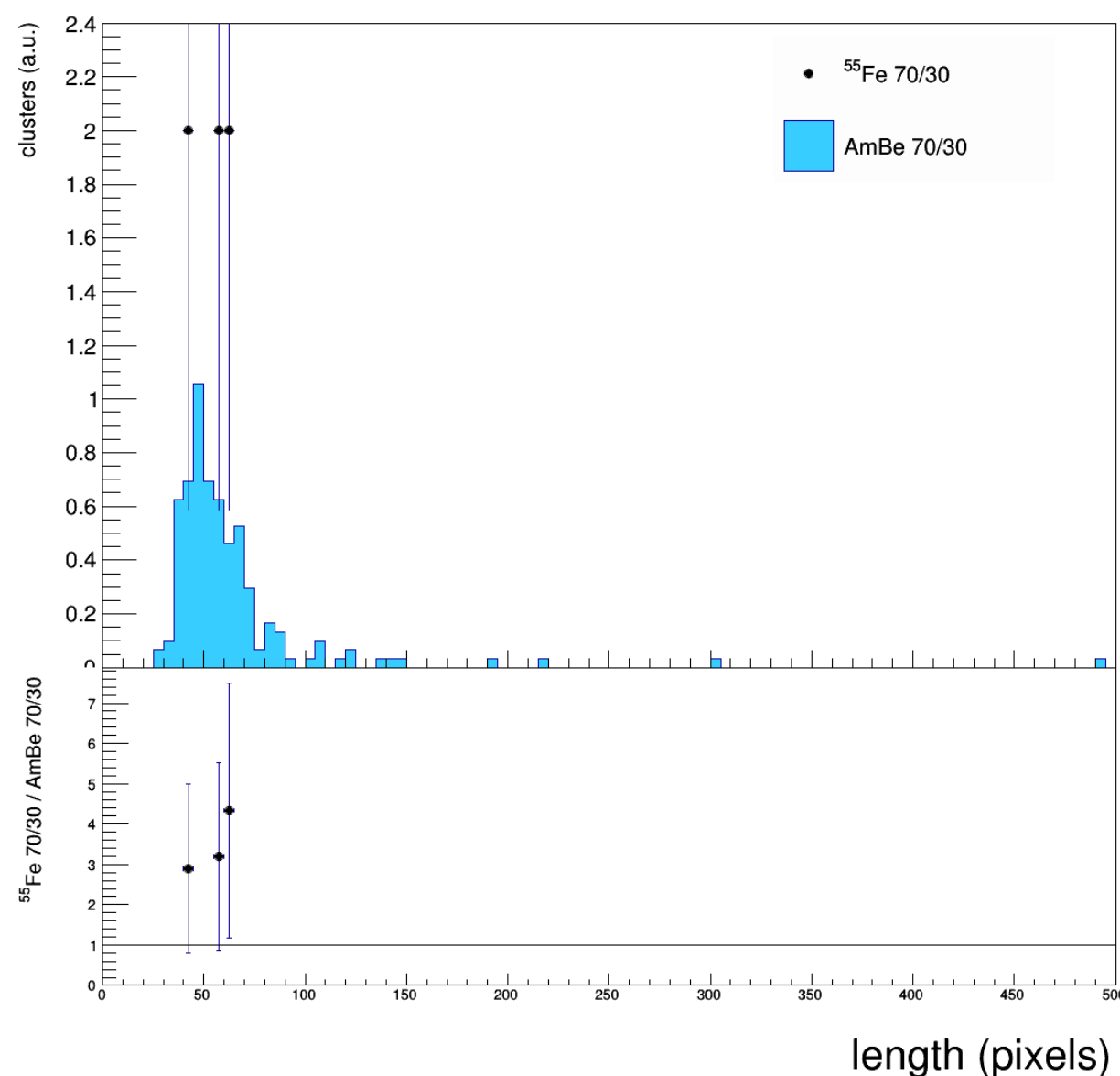
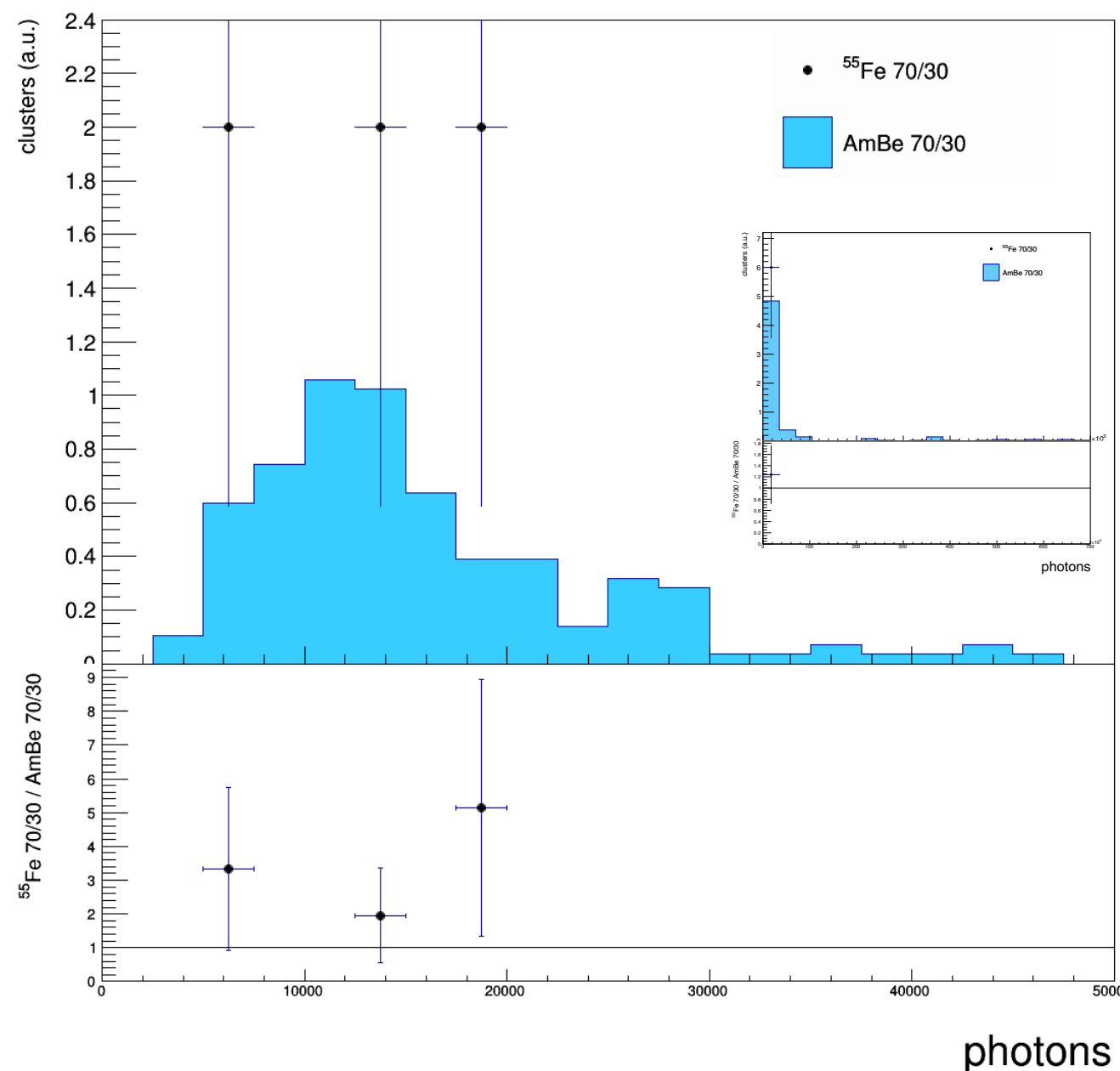


up to 10 cm
long tracks



up to 1.5 MeV

- I.e. iter1 superclusters with density >15 γ /pixel inside the center of the FC
- what remains are not many candidates, with mode energy ~ 4 keV, but with a tail up to 1.5 MeV
- length up to ~ 1 cm (average 0.5 cm)



The End