For a fistful of neutrons

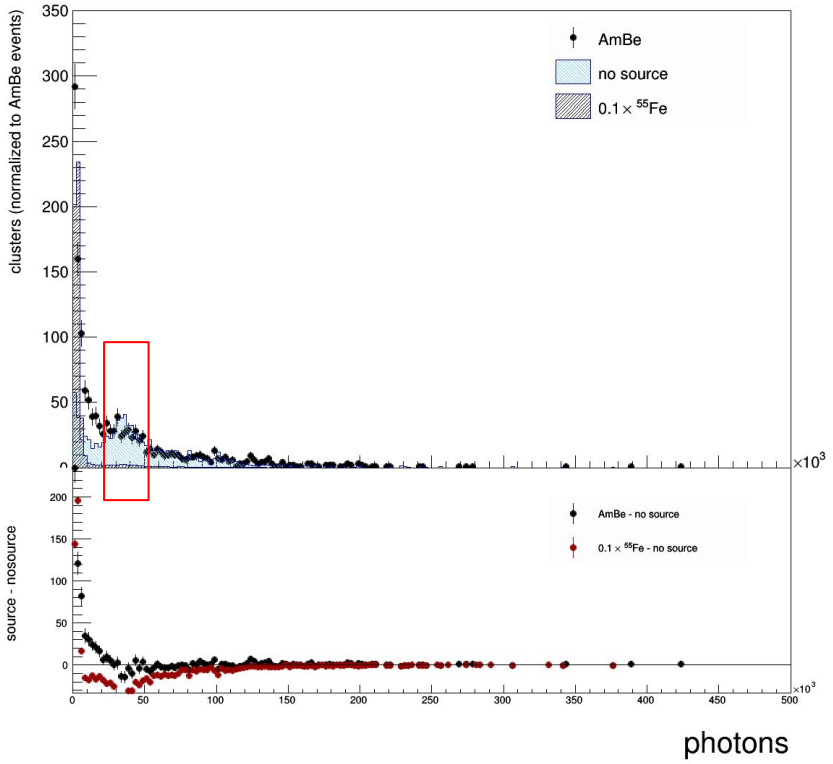
Starring:

Cavoto as "Ramón Rojo"
Di Marco as "The man with no name"
Pinci as "Silvanito"

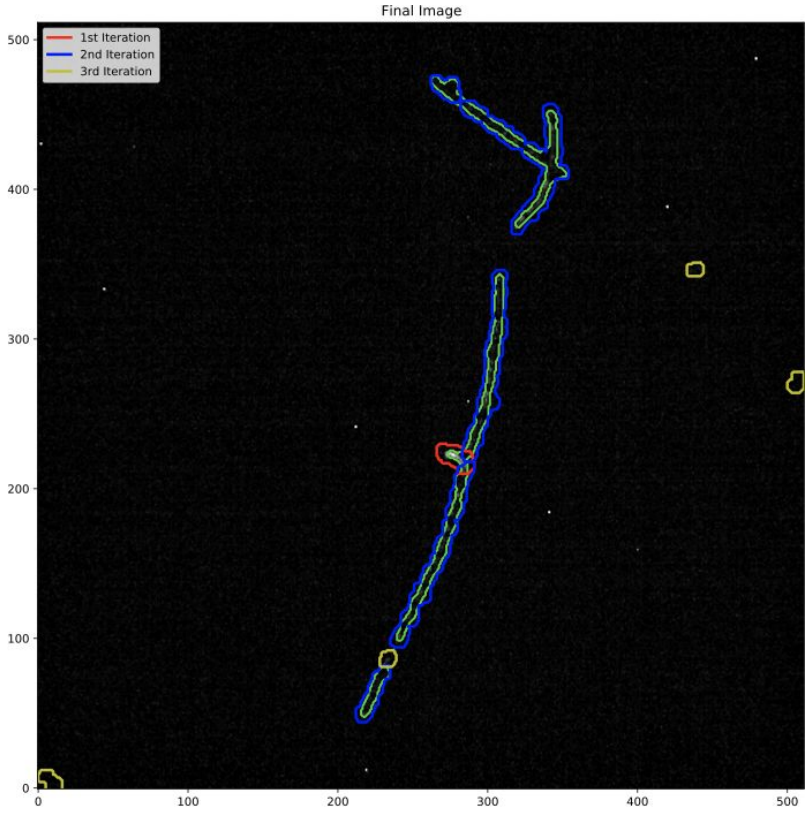
Try to isolate a pure sample of cosmics

Integral ~ [30-40] e+3 photons

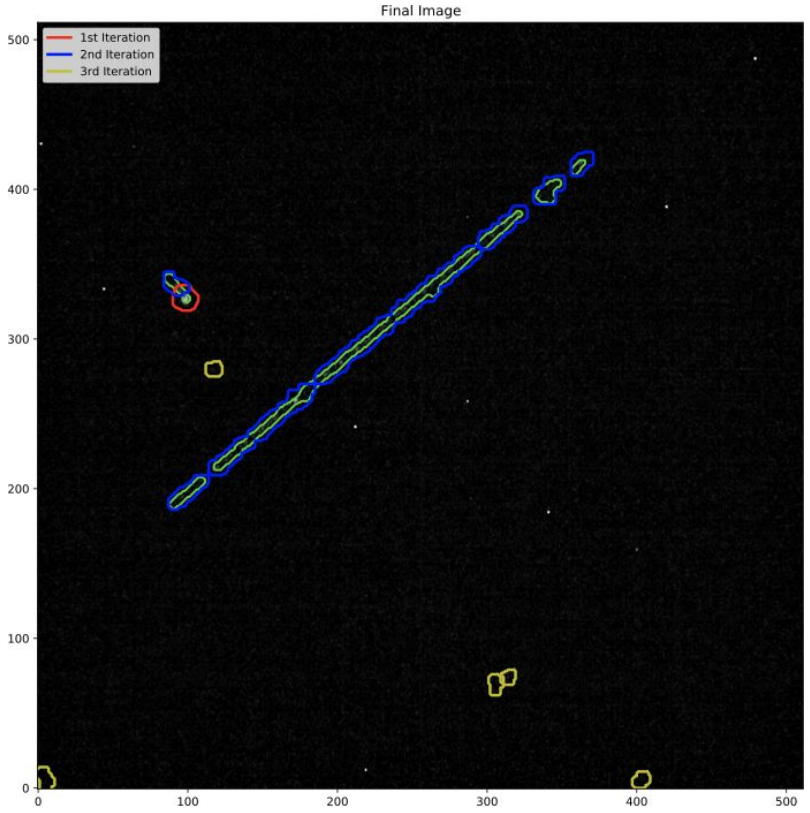
93 clusters in run 2156



Examples #1,2

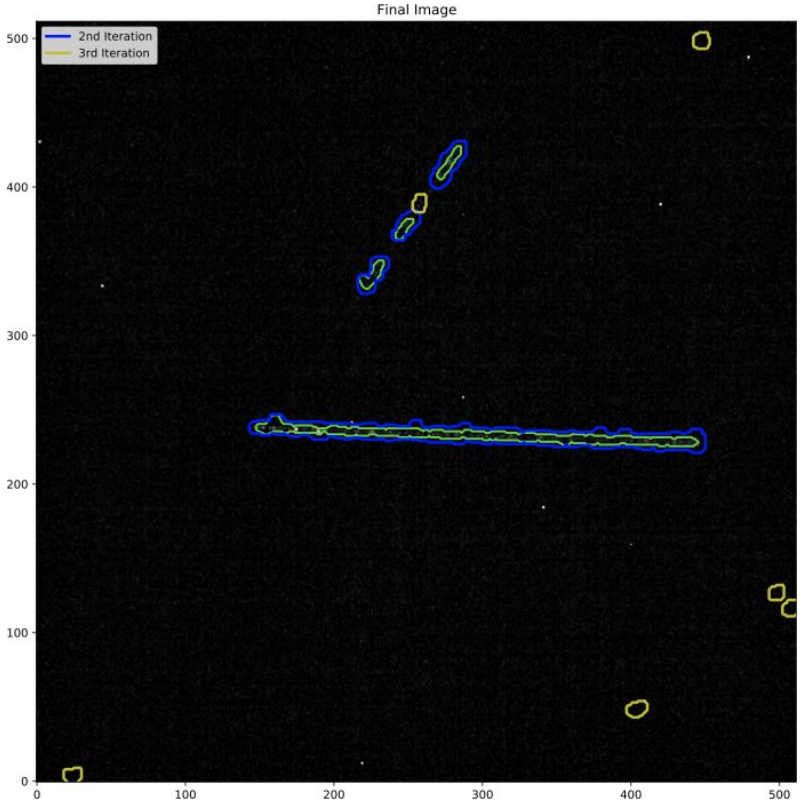


Ev. 49. Int = 33.6k, density = 5.5

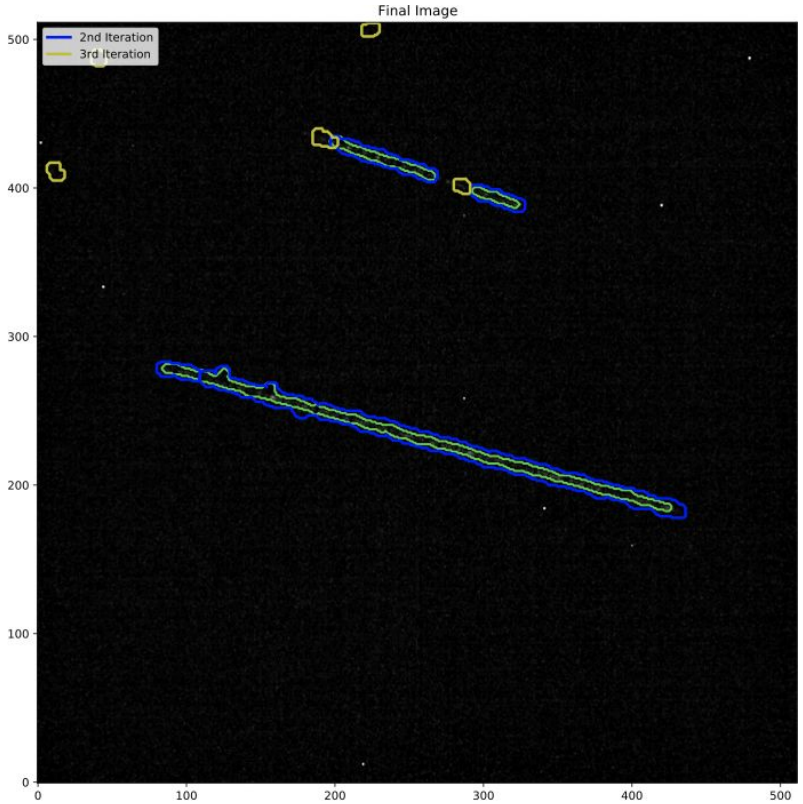


Ev. 516. Int = 33.8k, density = 4.3

Examples #3,4

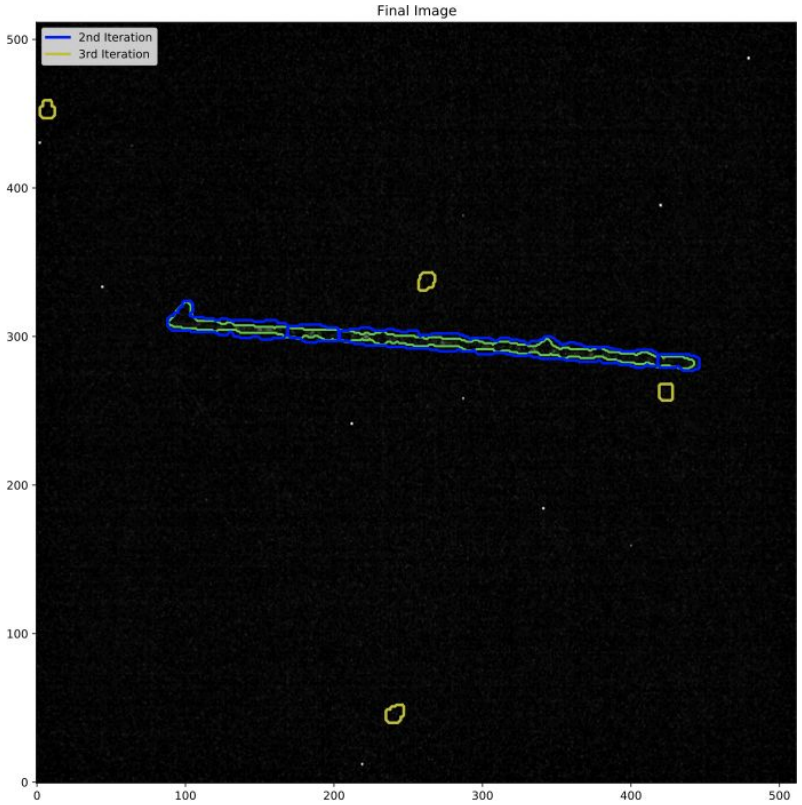


Ev. 527. Int = 36.4k, density = 5.0

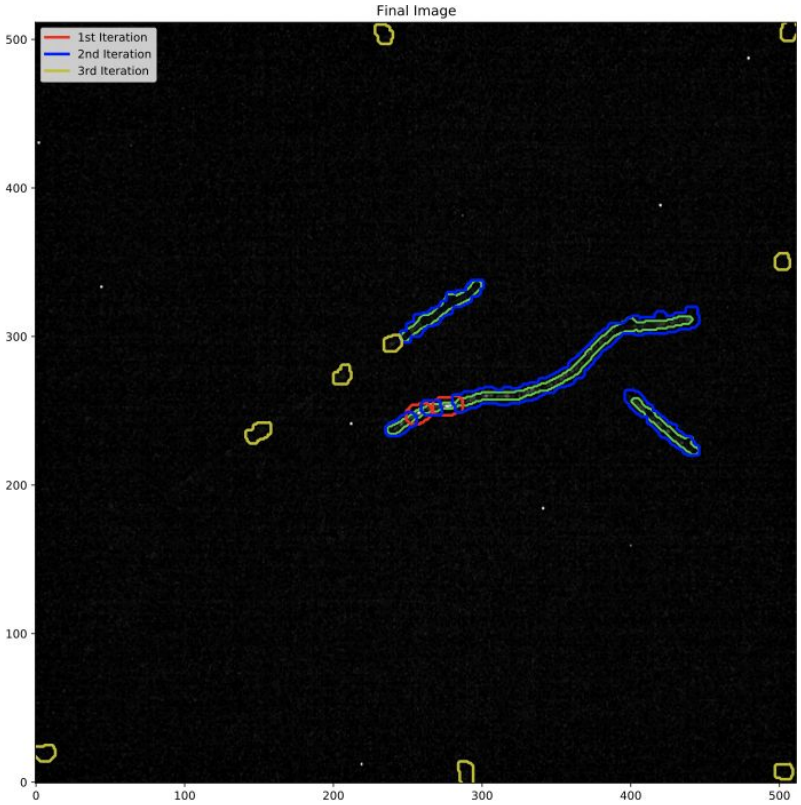


Ev. 538. Int = 36k, density = 4.4

Examples #5,6

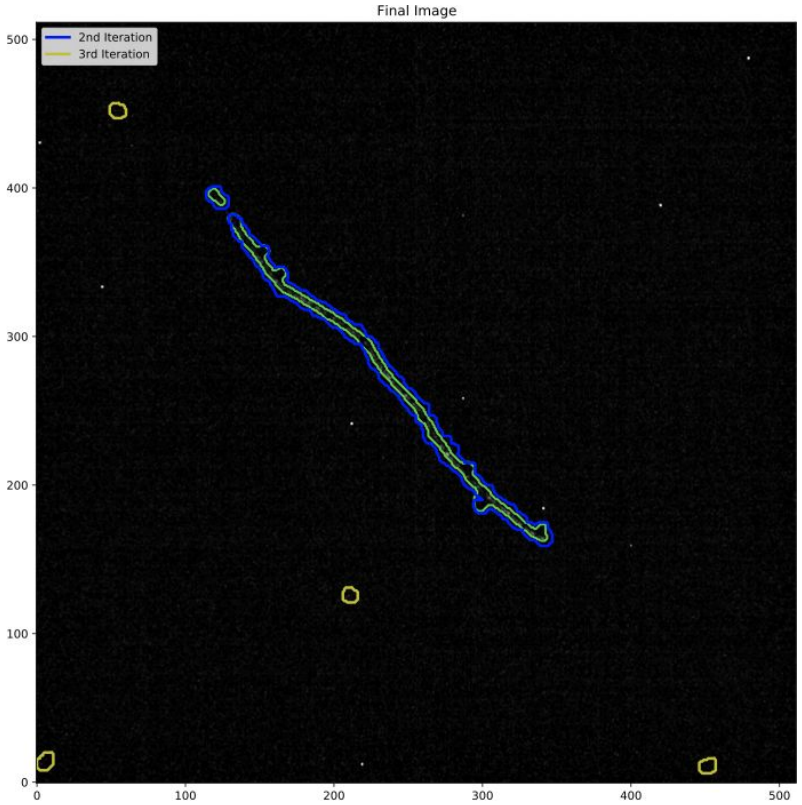


Ev. 527. Int = 34k, density = 4.3

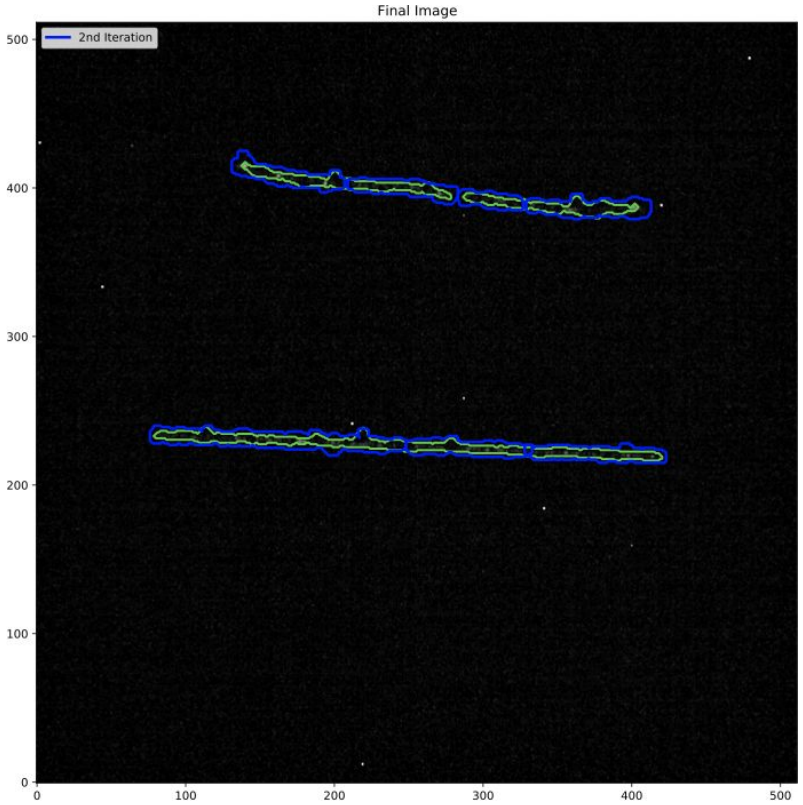


Ev. 577. Int = 31k, density = 5.9

Examples #7,8

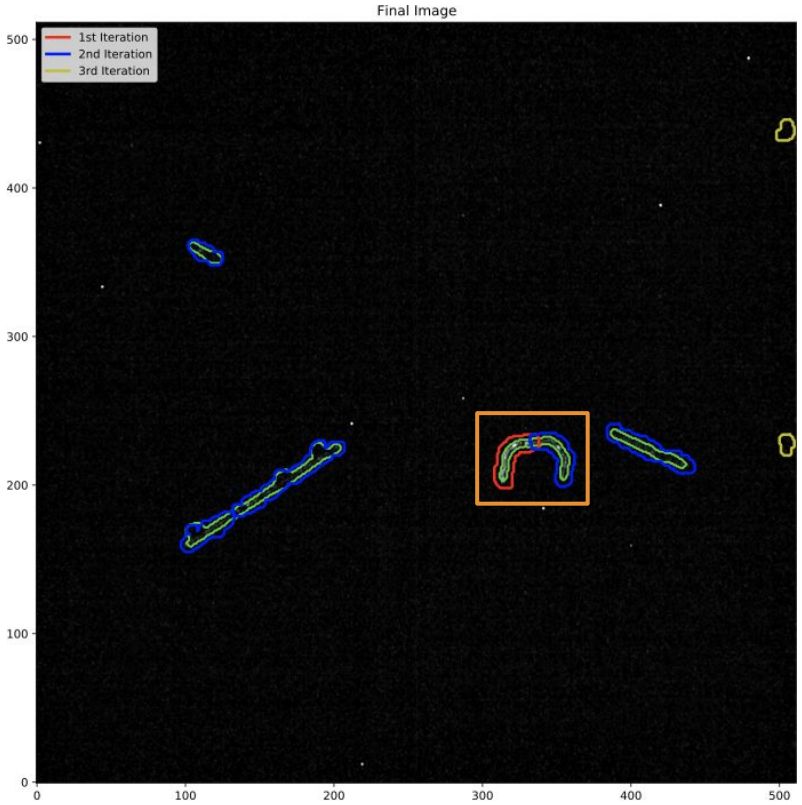


Ev. 800. Int = 36k, density = 5.0

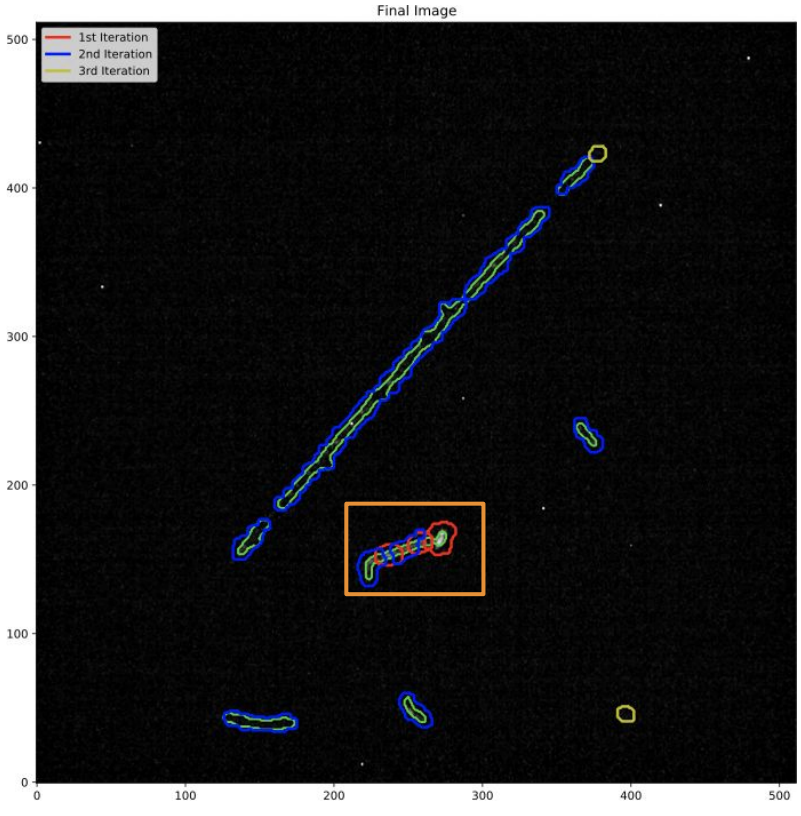


Ev. 955. Int = 38k, density = 4.7

Example of the few clusters with large density (~5%)



Ev. 641. Int = 31k, density = 10



Ev. 631. Int = 33k, density = 9.9

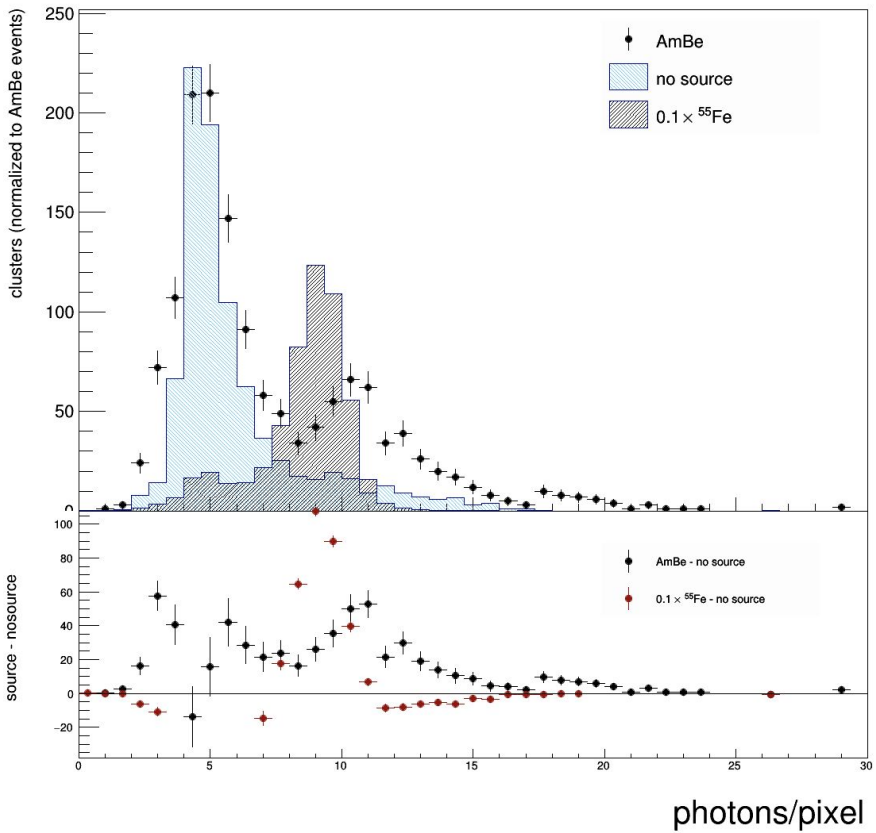
First conclusions

The sample of **low density** clusters (i.e. ~5 photons/pixel) **long**, **straight** seems visually to be pure cosmics

Higher density clusters in the same sample seem to be other background (natural radioactivity?). They are not straight, and short(er)

Can use this sample to normalize the cosmics?

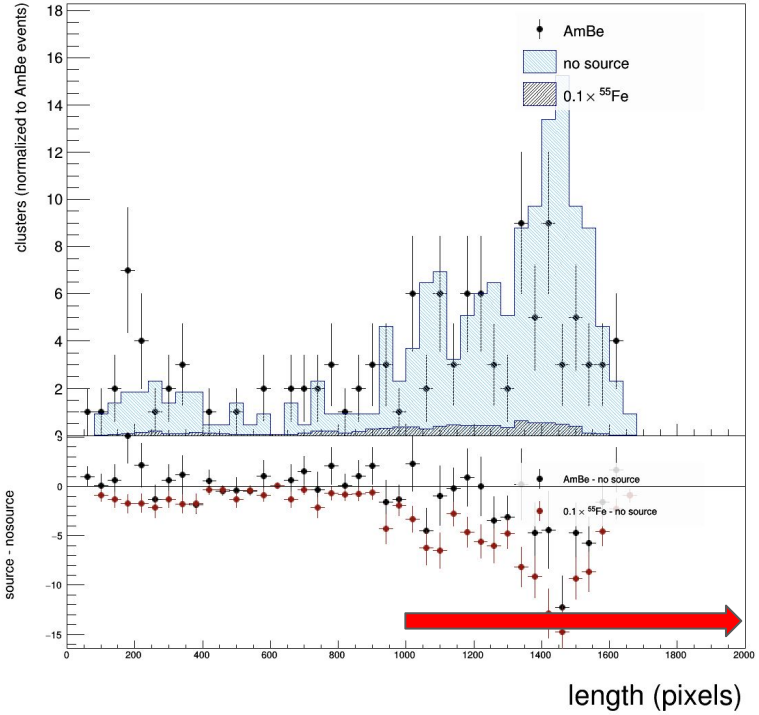
The target



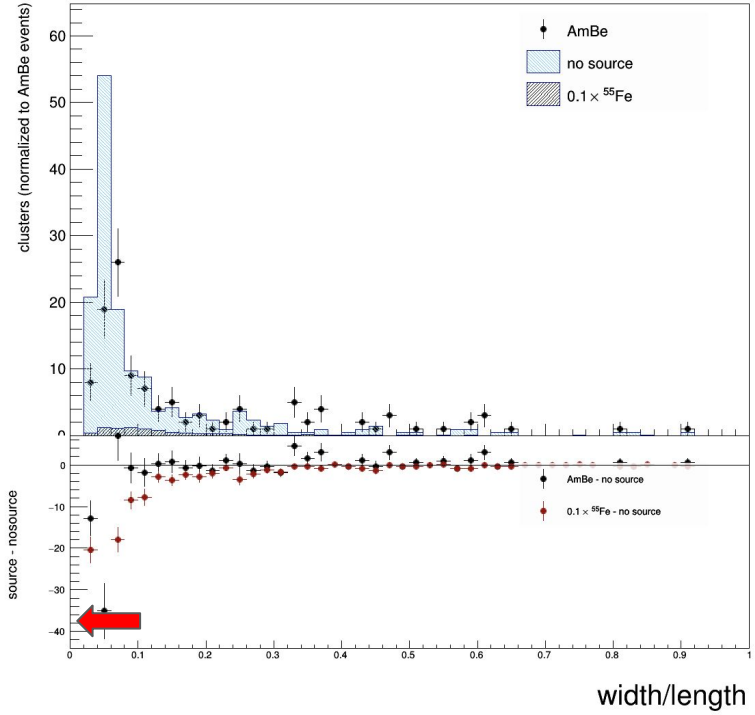
Try to isolate a sample of pure cosmics to normalize the template PDF of the background and statistically subtract from the AmBe distribution

Cluster shapes for clusters in the energy slice

Length, slimness (=width/length) for clusters with integral = [30-40] e+3 ph/pix

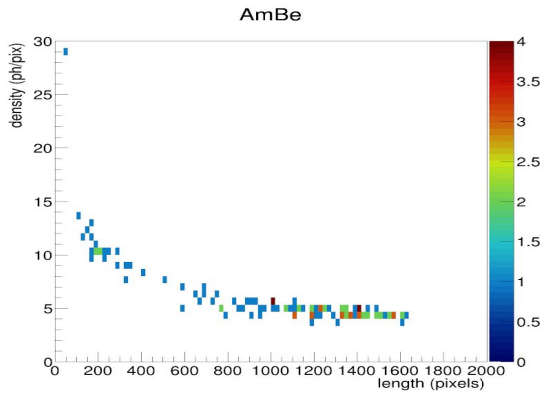


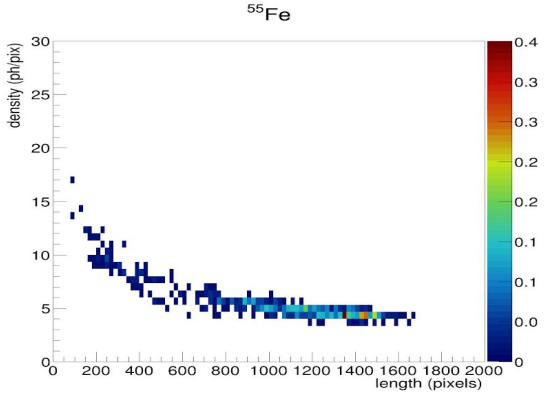
Long clusters: L>1000 pixels (>13cm)

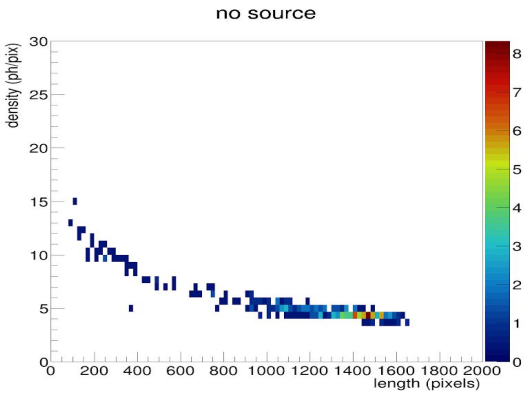


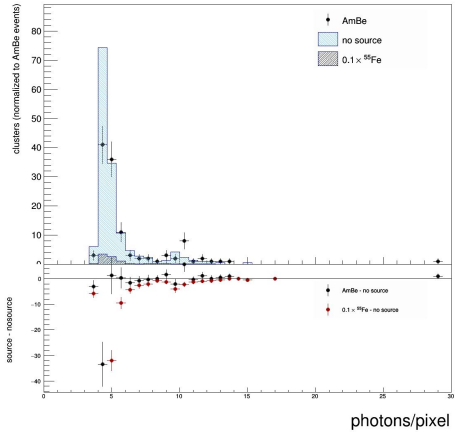
Straight: slim tracks: w/l < 10%

Density before the “cosmics” cluster shape cuts









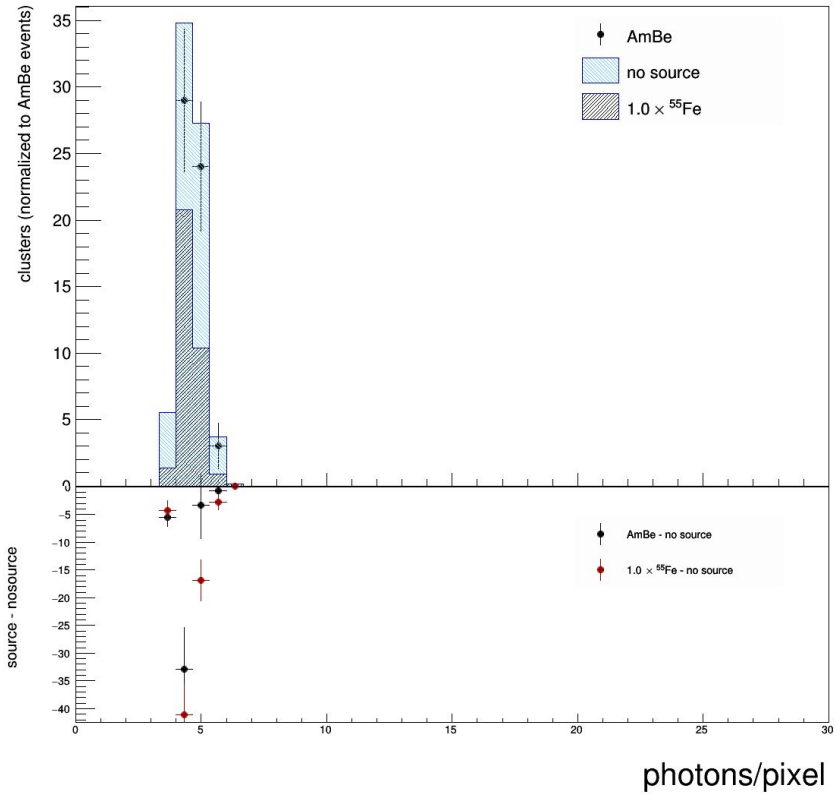
Integral ~ [30-40] e+3 photons

This is before the “pure cosmics” cuts, but within the energy slice where it seems that we have the cosmics “peak”.

First hints that the clusters with density<6 are dominated by cosmics (long tracks with same distribution in all the 3 “sources”)

N.B. Hyperbola shape due to ~fixed energy slice

Density after the “cosmics” cluster shape cuts



Full selection:

- Integral: [30-40]e+3 ph/pix (~[60-80] keV)
- Length > 1000 pix (~13 cm)
- slimness<0.1

Seems to leave only the density peak ~5. The normalization seems to be ~correct.

Residual difference attributed to trigger (cosmics-only vs cosmics+AmBe)

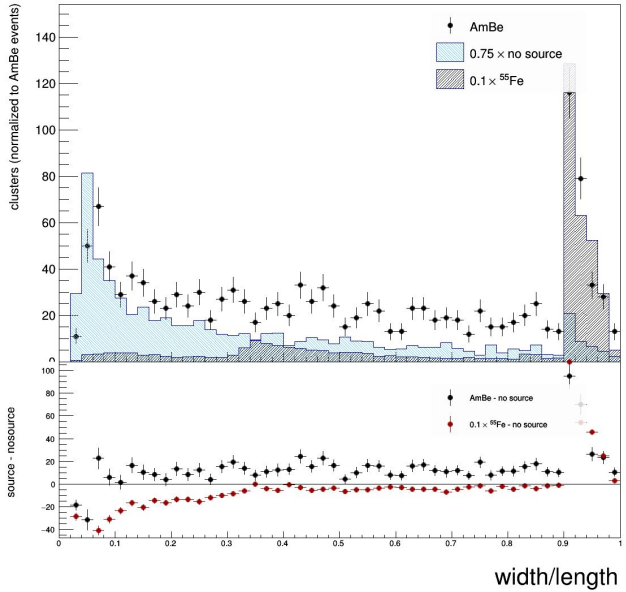
This gives the normalization factor for cosmics bkg in AmBe runs: K = 0.75 +/- 0.02

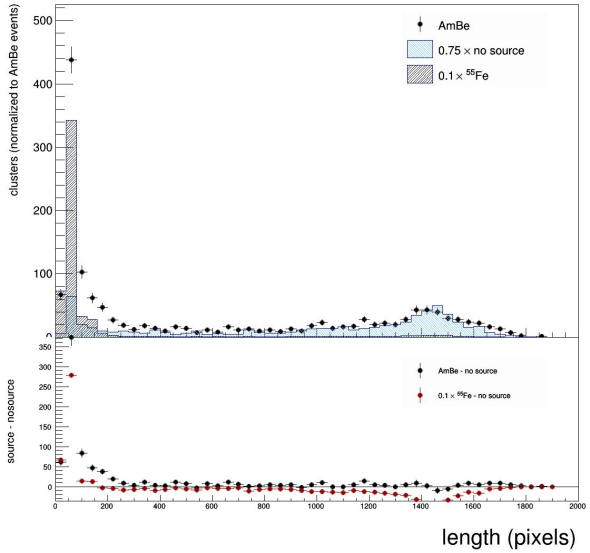
The “density” plot for all clusters with rescaled bkg

Full selection:

- Length < 1000 pixels
- Slimness > 30% (clear cosmics-dominated)
- Density > 5 ph/pix (because the shape is not exactly the same in AmBe vs only cosmics in that region. Could be overlap between signal+bkg)

Efficiency on signal ~100% for the first two cuts (obtained by the bkg-subtracted distributions)
Efficiency of the density cut assumed ~100%, but cannot say because the shape of density is a bit different in AmBe and cosmics in this region





ROC curve

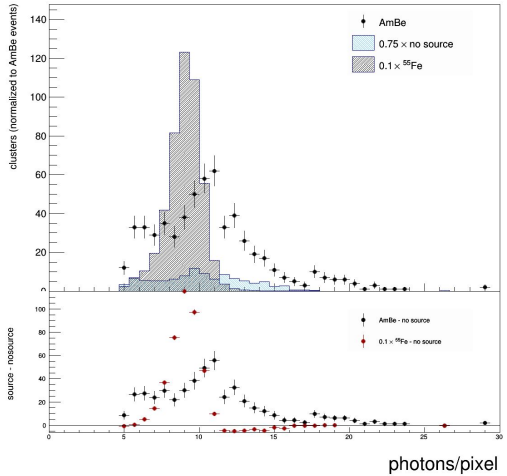
Full selection:

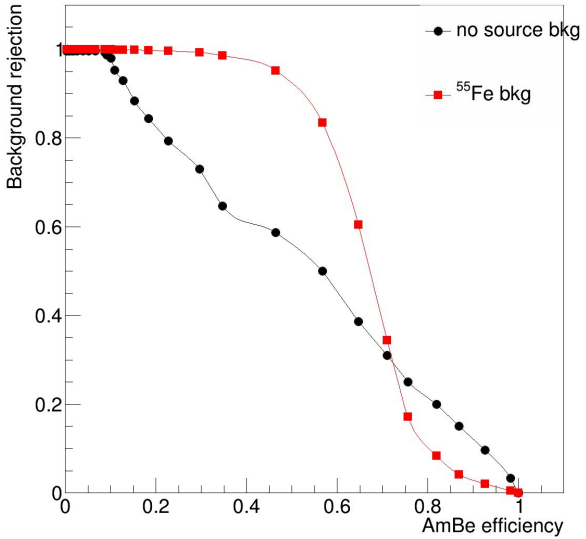
- Length < 1000 pixels
- Slimness > 30% (clear cosmics-dominated)
- Density > 5 ph/pix (because the shape is not exactly the same in AmBe vs only cosmics in that region. Could be overlap between signal+bkg)

Efficiency on signal ~100% for the first two cuts (obtained by the bkg-subtracted distributions)
Efficiency of the density cut assumed ~100%, but cannot say because the shape of density is a bit different in AmBe and cosmics in this region

Bkg efficiency:

- No-source: 16%
- Fe55: 88%



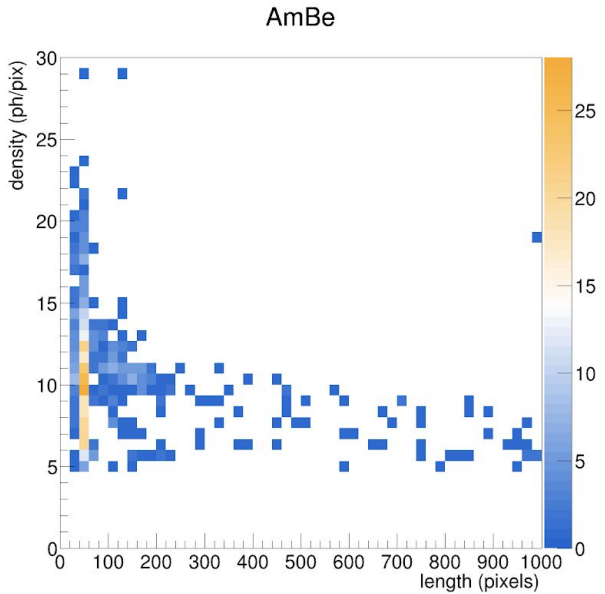


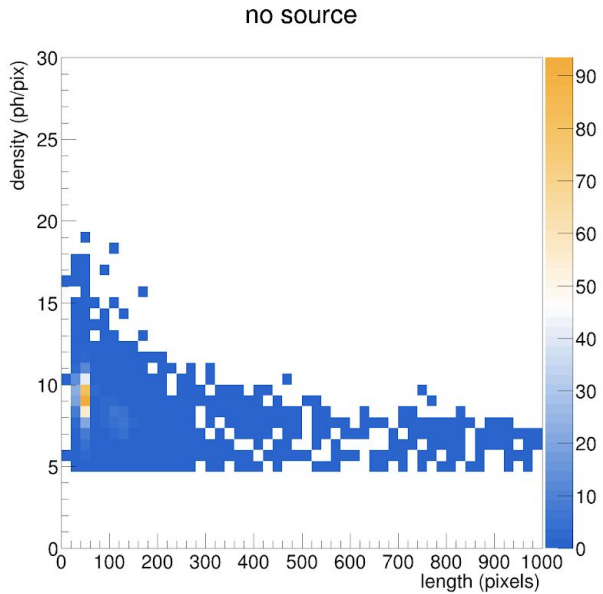
	Eff Sig	Eff cosm	Eff Fe55
WP 1	50%	6%	4%
WP 2	20%	1.6%	0.2%

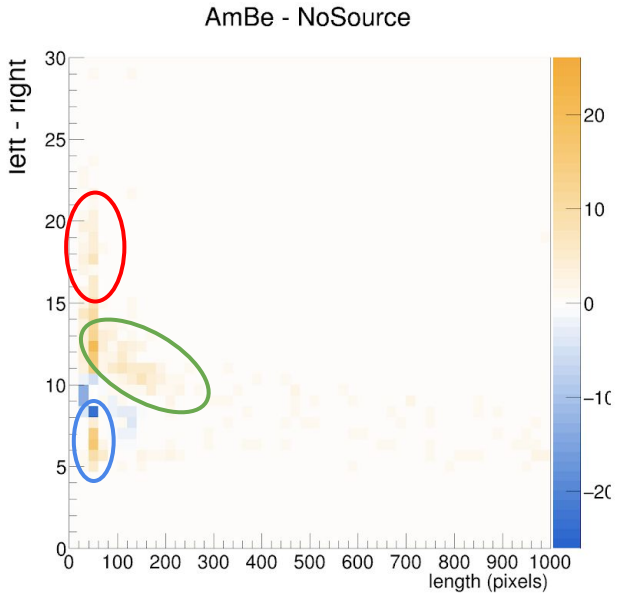
Background-subtracted density vs length

AmBe - K*cosmics. 3 Populations:

1. Short (spot like) and very dense (18 ph/pix). This is signal.
2. Longer (~1-2 cm) and medium dense (12 ph/pix). Is this signal ?
3. Short (spot like) and low dense (could be the tail of cosmics). Is this signal ?







The end?

To be continued in:

For a few neutrons more