Once Upon a Time in Frascati

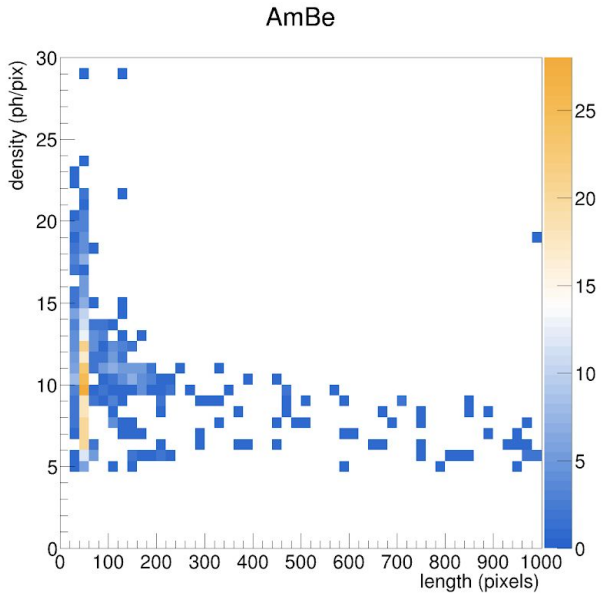
Starring:

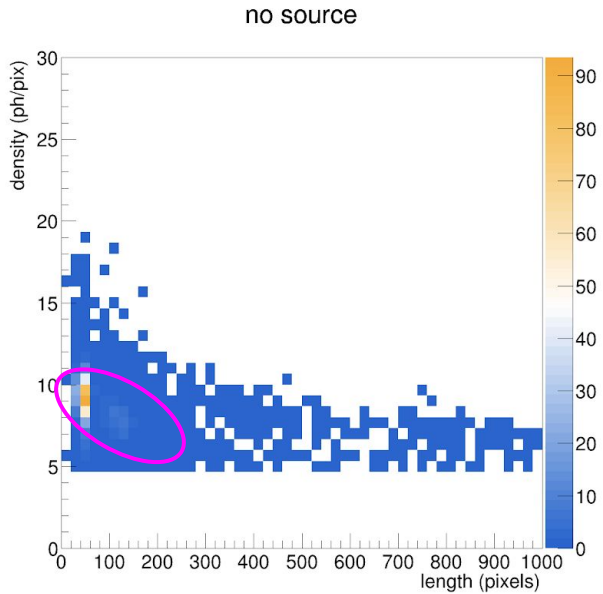
Cavoto as "Armonica"
Di Marco as "Cheyenne"
Pinci as "Frank"

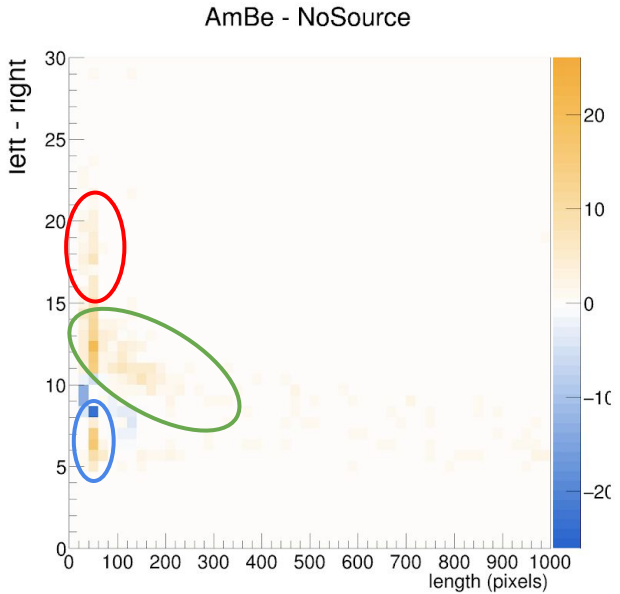
Remainder of the situation

AmBe after background subtraction. 3 Populations are evident:

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. These are remaining split cosmics**





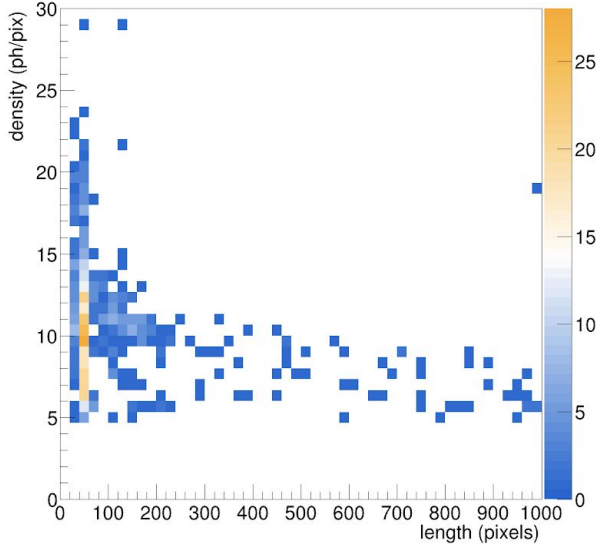


Focus on the population #2

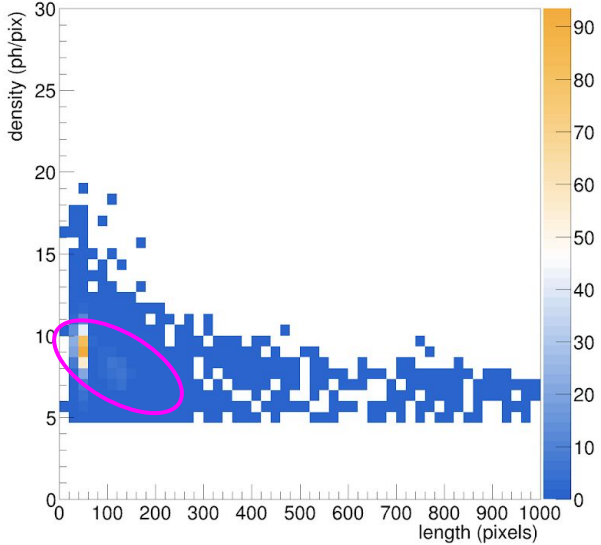
AmBe after background subtraction. 3 Populations are evident:

1.
2. **Longer (~1-2 cm) and medium dense (12 ph/pix). Is this signal ?**
3.

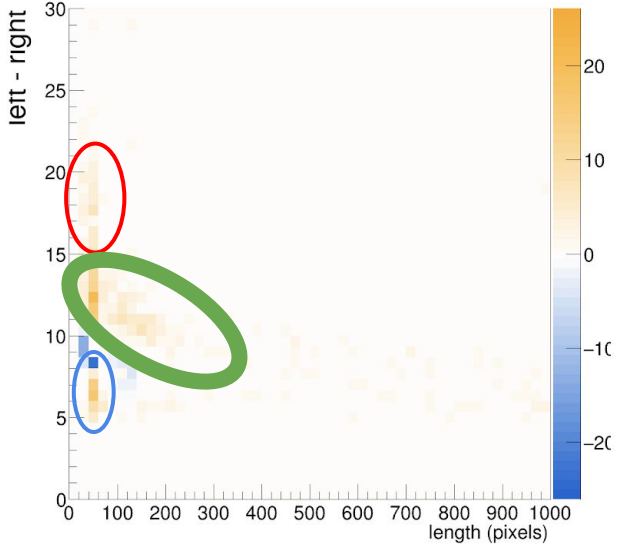
AmBe



no source



AmBe - NoSource



Focus on the population #2

Working hypothesis last time: could be the 59.5 keV γs from Am decay (1γ/1α).

If this is true, those events are background and need to be removed from the signal (S) when computing the S eff vs B rejection.

Need to calibrate the energy for the effect of saturation to test this hypothesis (to see if those events have E ~ 60 keV

Two methods implemented, third one is Francesco+Karolina

1. Average calibration. Apply a calibration factor to the clustered energy
2. Calibrate energy in slices with size ~ Fe spot
3. Calibrate single pixels

Calibration strategies

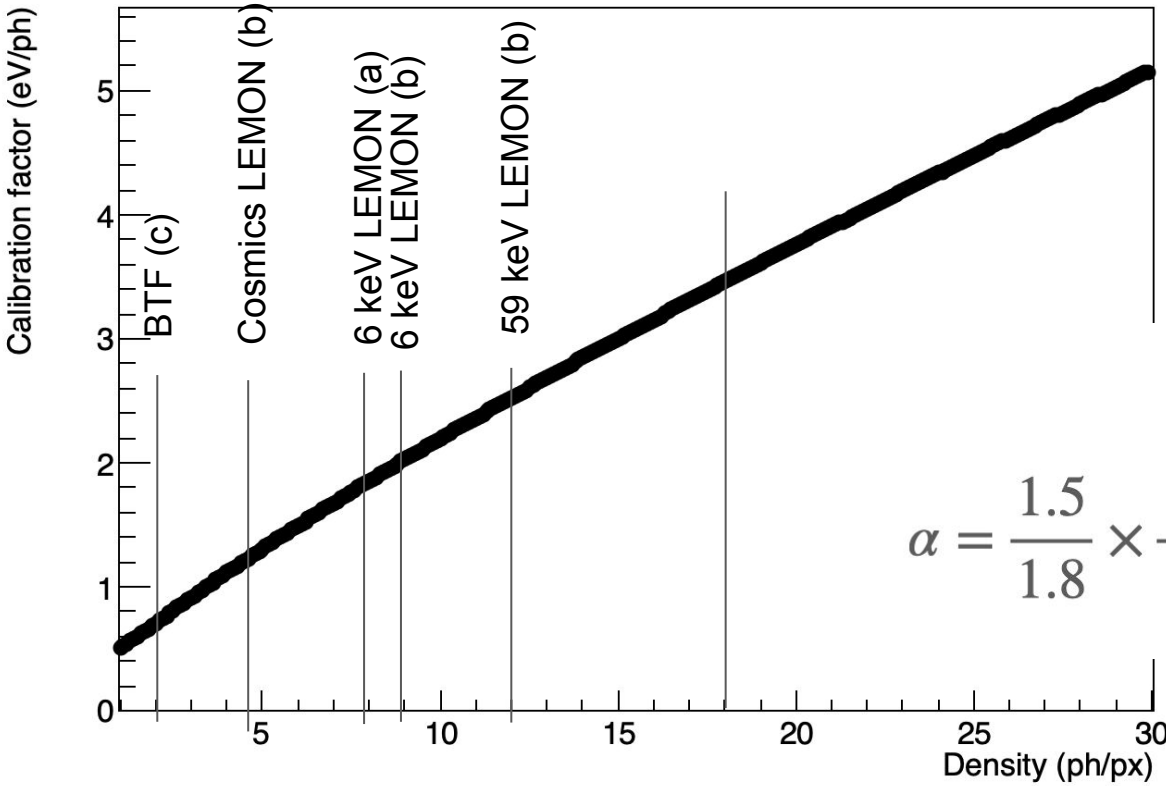
1. **Average calibration. Apply a calibration factor to the clustered energy**
   a. Simple and immediate. No need to re-run the reconstruction
   b. Works in the approximation that the clusters are similar to the Fe spots on which the calibration curve was derived. Which is ~OK for short OR uniform tracks like the ones in the green blob
2. **Calibrate energy in slices with size ~ Fe spot**
   a. Pro: it corrects the cluster energy in small Fe-like slices along the (curved) track.
   b. Implemented. Need to correct the formula and re-run reconstruction
3. **Calibrate single pixels**
   a. The ultimate solution. Corrects pix-by-pix energy. Ref. Karolina/Francesco. Need validation + re-reco

Calibration strategy for the following

1. **Average calibration. Apply a calibration factor to the clustered energy**
   a. Simple and immediate. No need to re-run the reconstruction
   b. Works in the approximation that the clusters are similar to the Fe spots on which the calibration curve was derived. Which is ~OK for short OR uniform tracks like the ones in the green blob

IN THE NEXT FUTURE …

The master formula from Francesco measurements

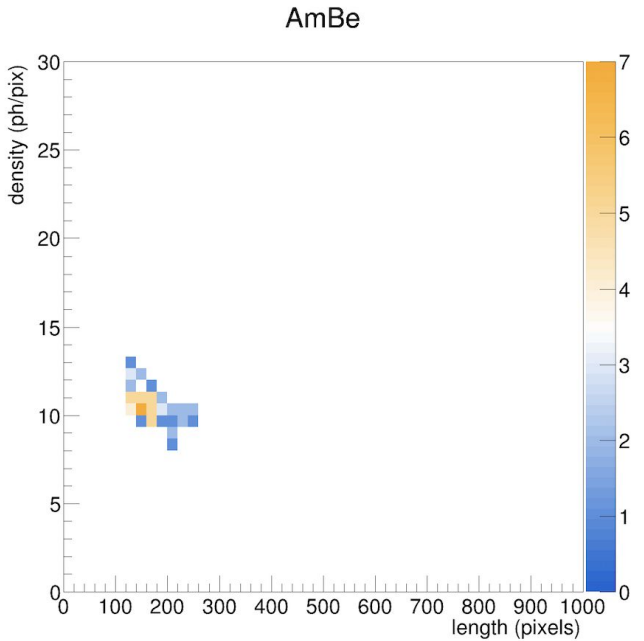


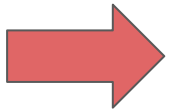
(a) Vgem = 450 , Et = 2.0 kV/cm
(b) Vgem = 460 , Et = 2.5 kV/cm
(c) Vgem = 455 , Et = 2.0 kV/cm

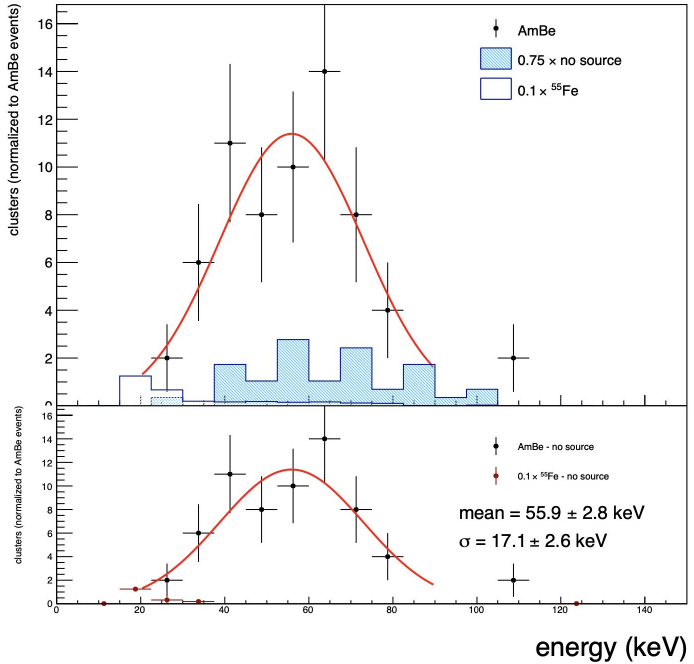
$$\alpha = \frac{1.5}{1.8} \times \frac{\left[5980 \times \ln\left(\frac{20512}{20512 - x}\right)\right]^{1.8}}{0.27x - 0.1}$$

Events in the “green” blob

Selecting events within the “interesting” region in the plane density vs. length gives something around 60 keV with 30% resolution. Compatible with monochromatic emission? Maybe.





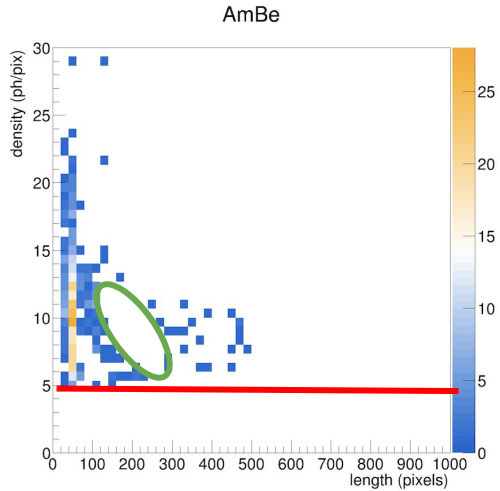


Final event selection

Convinced that they come from 60 keV γ's and not from neutrons, remove them.

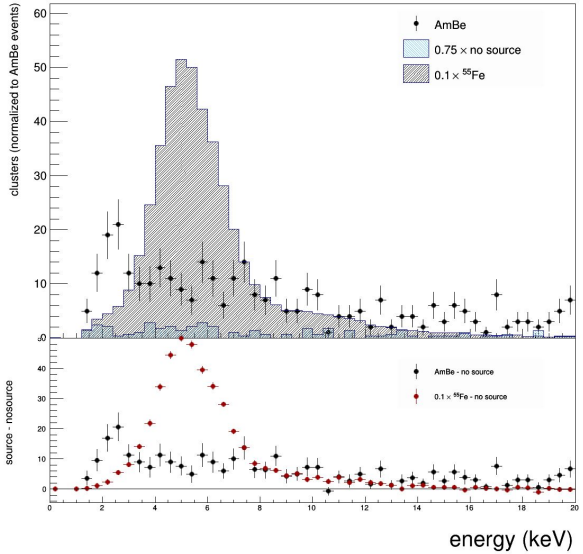
Full selection for our "pure" neutron recoils sample is:

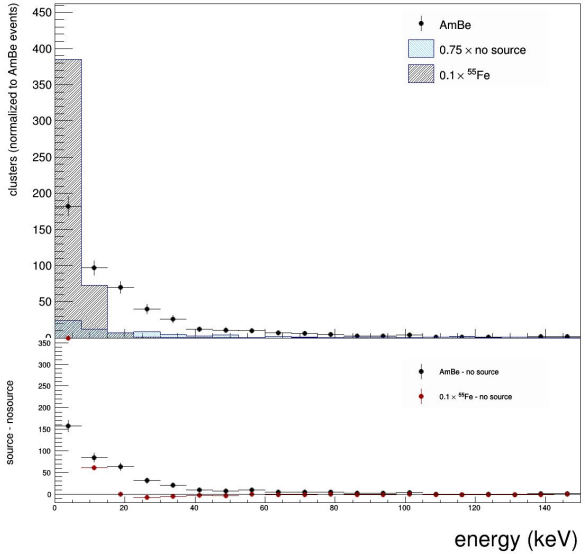
1. Field cage efficient region (geometry)
2. Track length < 500pix and slimness > 0.3 (remove cosmics)
3. Density > 5 ph/pix (remove residual split cosmic tracks)
4. 60 keV "diagonal" density vs length cut

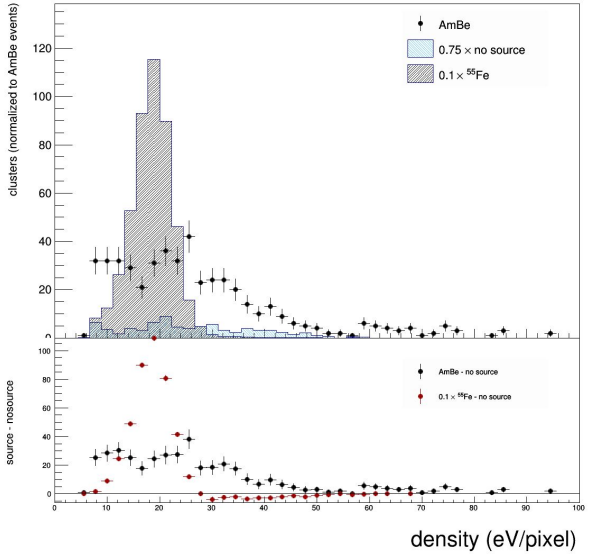


Events for the full selection

Distributions of calibrated energy / density for the selected samples

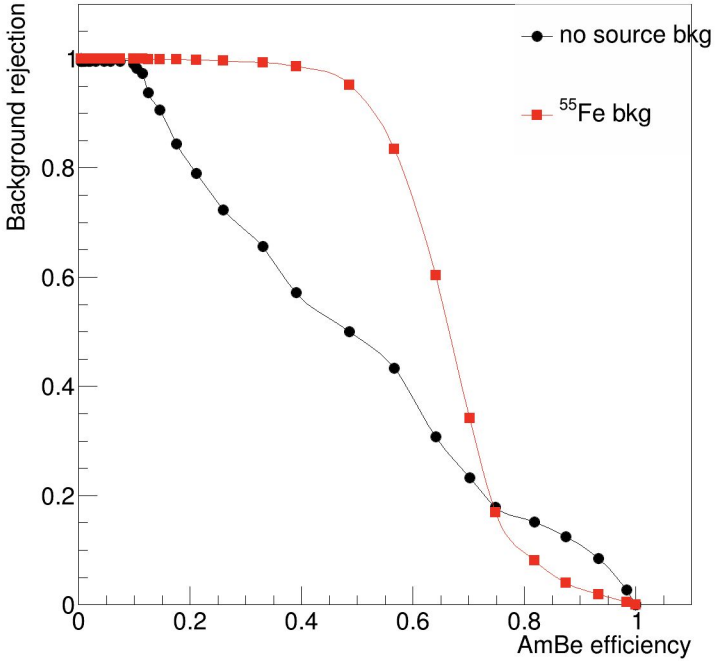






Background rejection

Compute background rejection after subtracting the (normalized) cosmic background from AmBe



N.B. Rejection on “no-source” bkg has too large stat uncertainty

=> Focusing on electron rejection.
Efficiency of the full selection:

- ~100% efficient on S
- 88% efficient on B

Adding selection on the final variable (energy density):

- **eff(S) ~ 50% [40%]**
- **eff(B) ~ 0.88 * 0.05 [0.012] ~ 4% [1%]**

The end