CYGNO reco and analysis meeting,
19 November 2020

Data analyzed

Four sets of data reconstructed and analyzed:

1. Data wih ^{55}Fe, runs of 16 June 2020 [3685 - 3693]: z-scan with same HV of AmBe runs. $V_{GEM1,2,3}$ = 440 V, V_{drift} = 930 V/cm

2. AmBe runs: July xx 2020 runs [3740 - 3751] (more available)

3a. No source, just after the source OFF

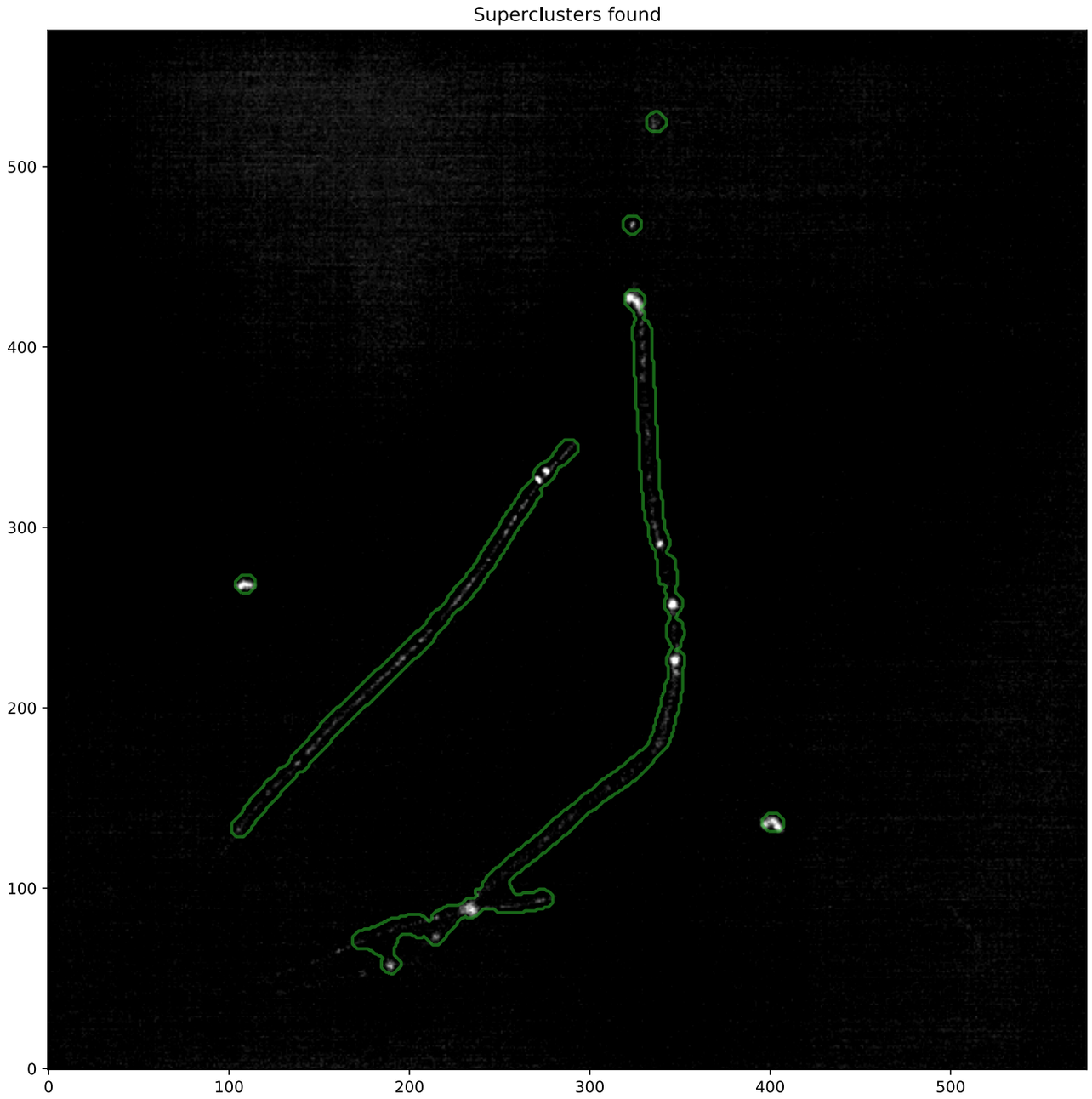
3b. No source, 2hrs after the source OFF

N.B. 1: Fe data questionable: much earlier, different place (clean chamber), probably different temperature, etc.

N.B. 2: data 3b seems to have a visible energy scale drift (shifted tempterature?). Better to use 3a.

tracks example

Run 3760 with AmBe



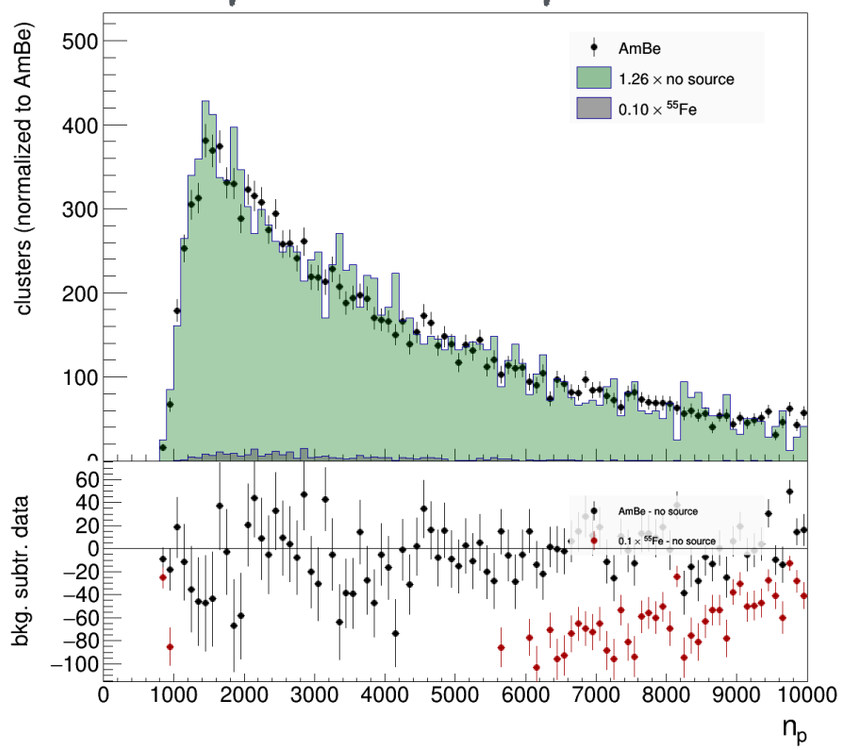
Cosmics region (CR)

First look at ubiquitous cosmics (present in all the types of runs), in the "Cosmic Control Region" (CR):

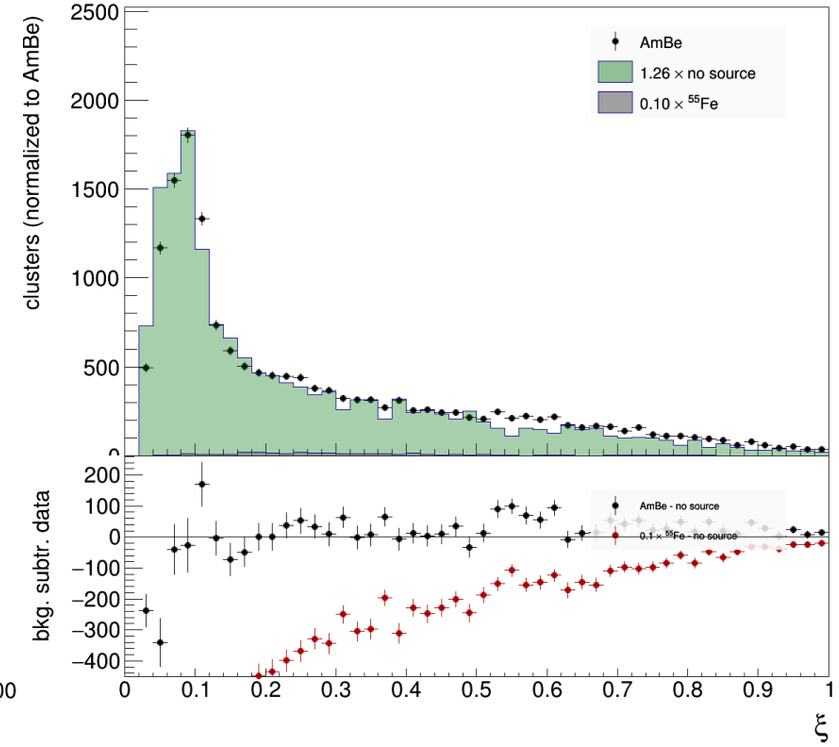
- track length > 7 cm (long)

- σ_{Gauss} < 1mm (remove overlapping cosmic tracks)

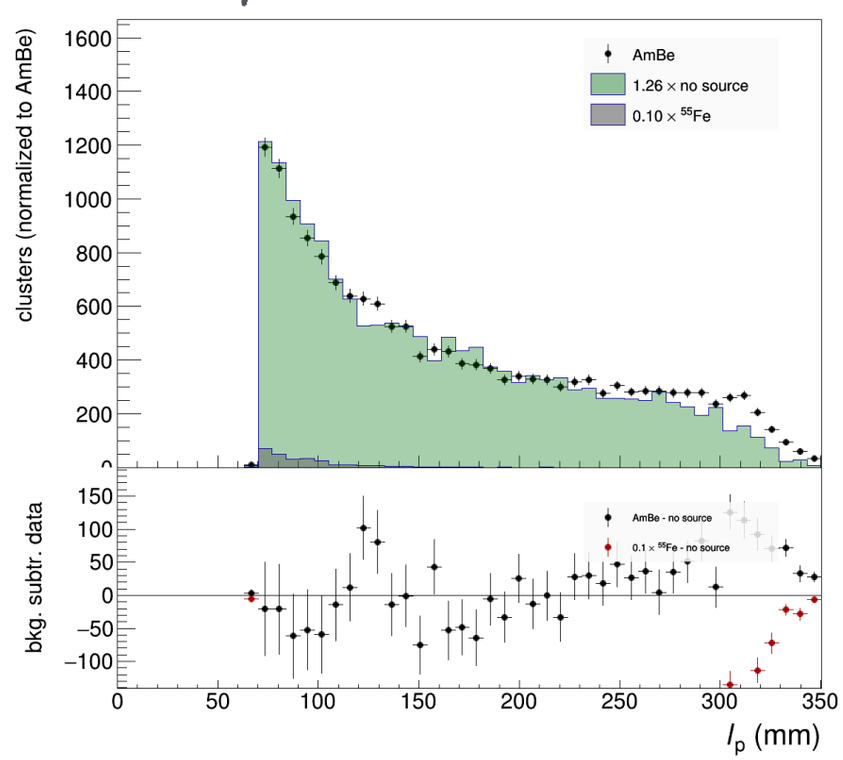
# of pixels in supercluster



slimness ξ



supercluster length



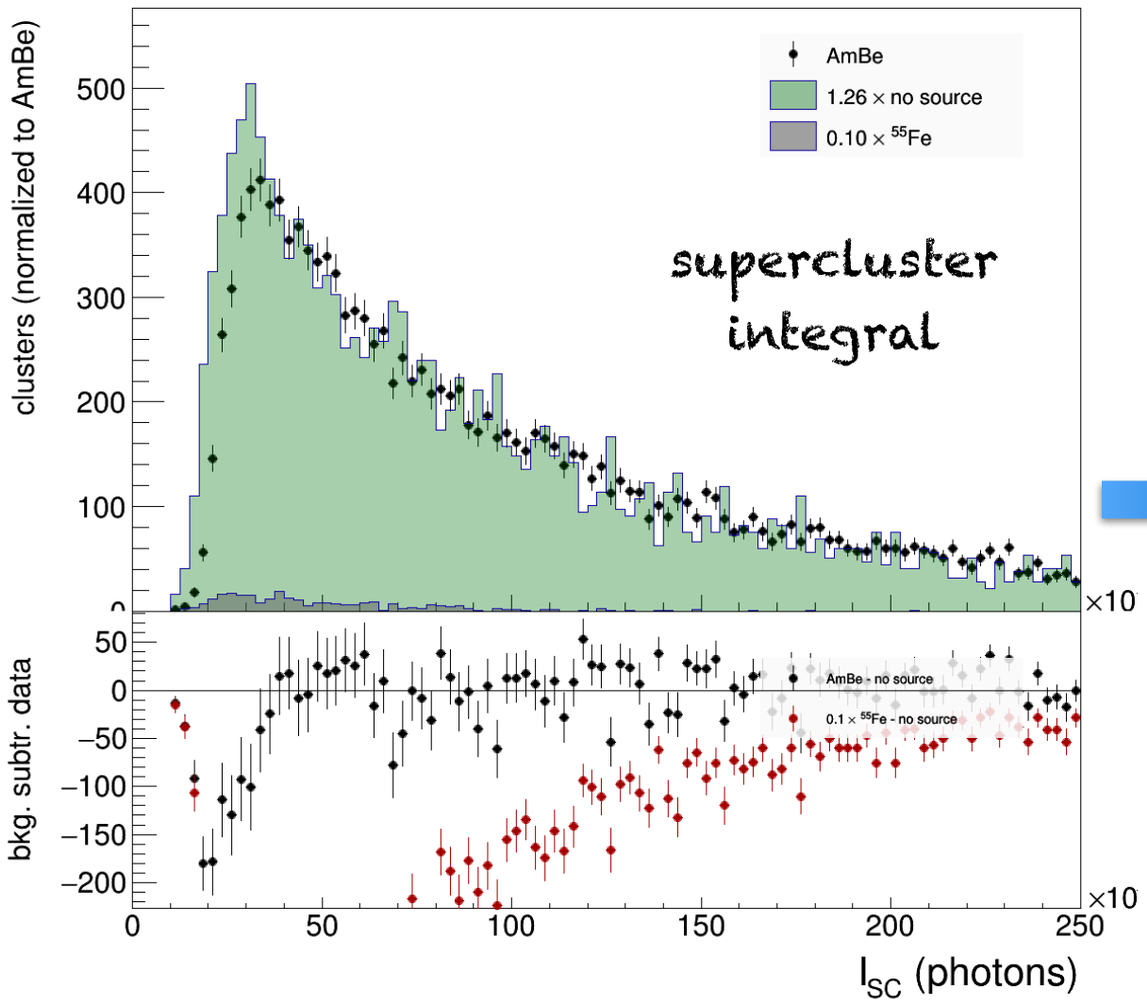
cluster shapes: seem to select "pure" cosmics in AmBe

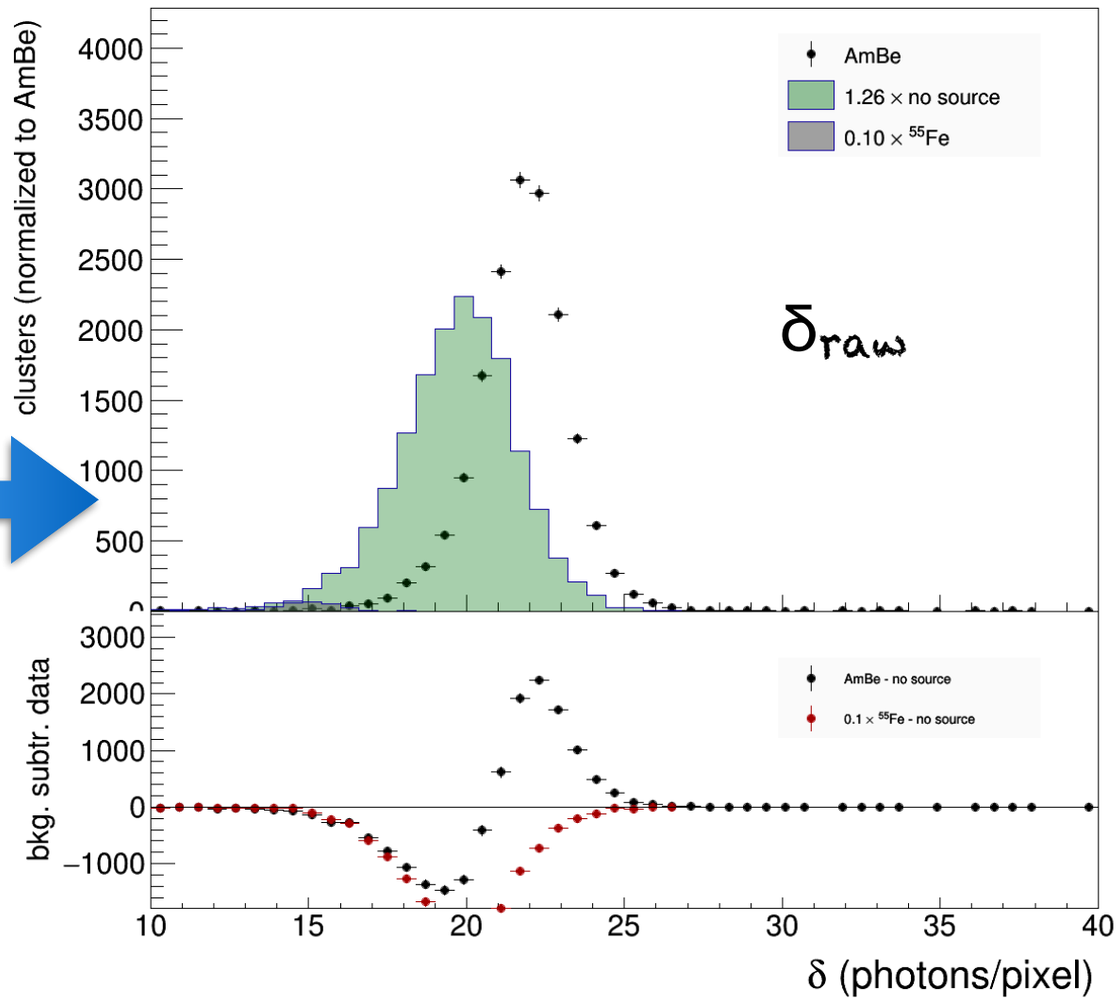
energy scale drift?

Integral = Raw counts / supercluster shows a shift

=> Our money-variable: δ = photons/pixel is badly shifted

no-source runs: 3b (>2hrs after AmBe)



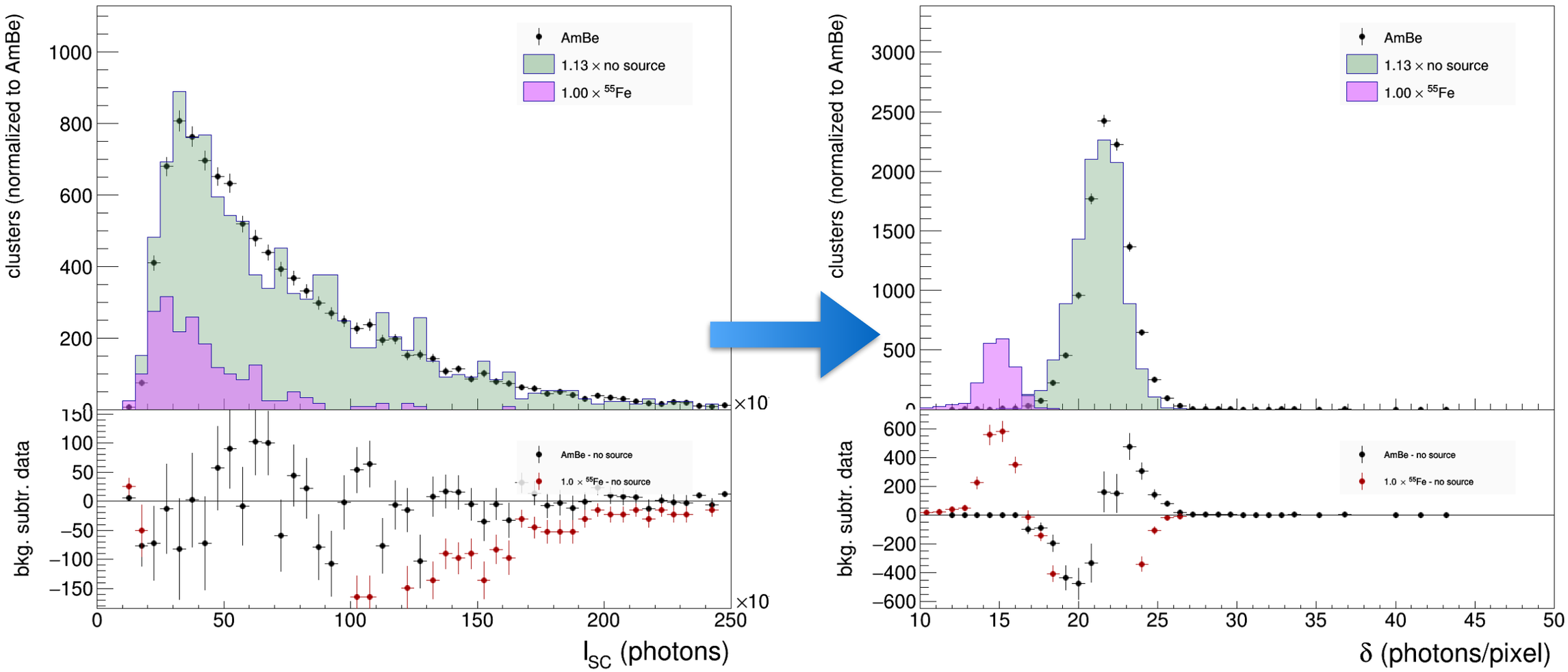


=> Use a fit to δ on CR sample
to inter-calibrate the energy among runs

earlier no-source runs

An energy shift could be due to a change in the ambient temperature.

=> Check on the no-source runs "3a" (just after AmBe runs):



much smaller shift (still present, though)

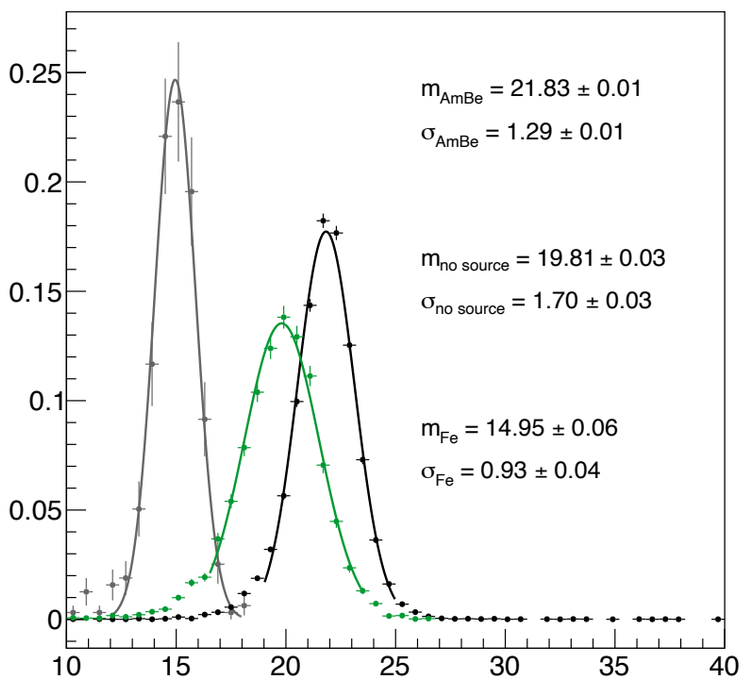
energy inter-calibration

The procedure can be applied also to inter-calibrate the scale of Fe runs.

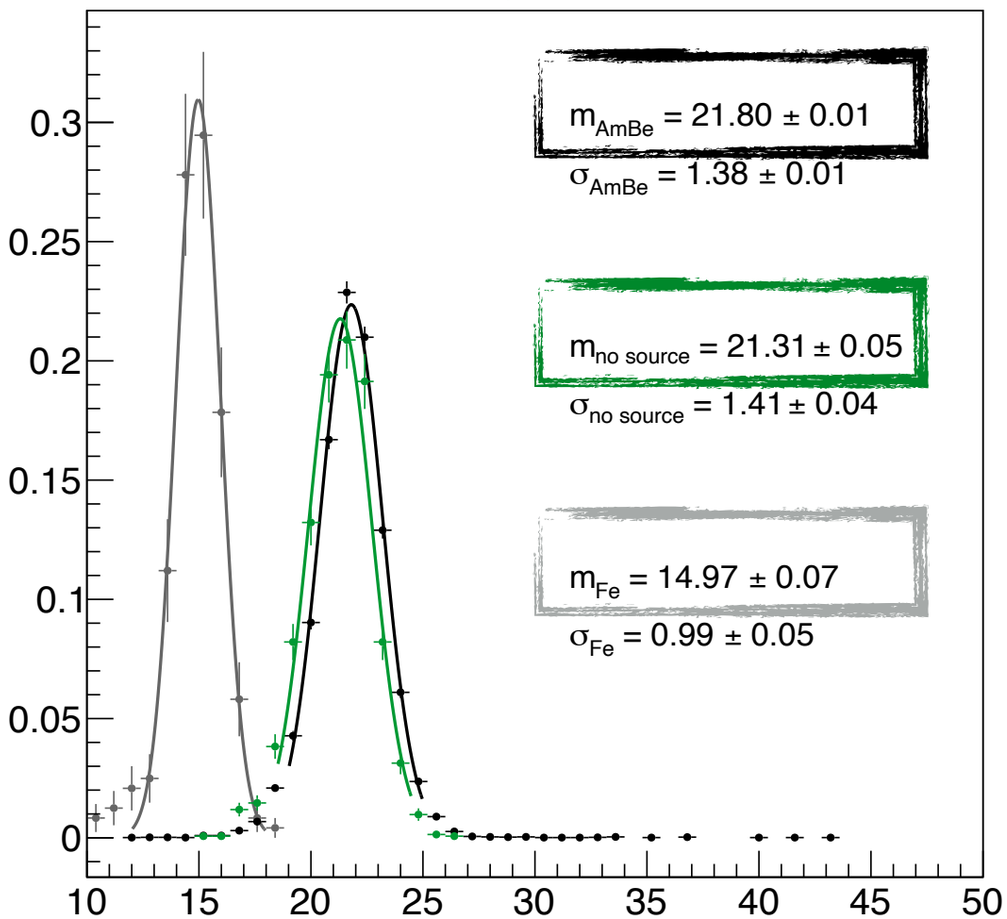
Fe runs affected by DAQ issue that sliced the images

=> problematic for selecting long tracks. Still, some remain

no-source "3b"



no-source "3a"



iC_{cosm}=+3%
iC_{Fe}=+46%

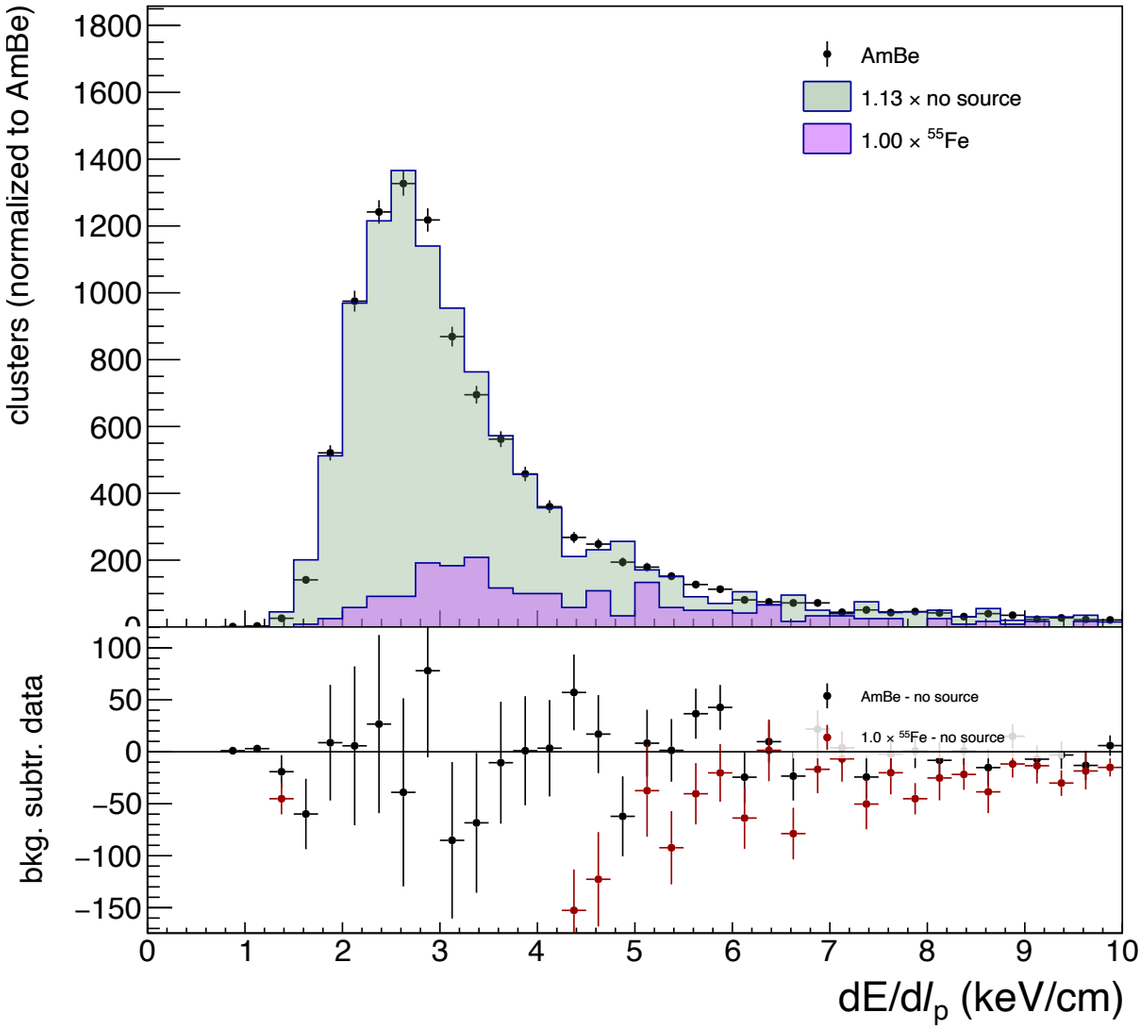
Fe too suspect to use it to set absolute E-scale

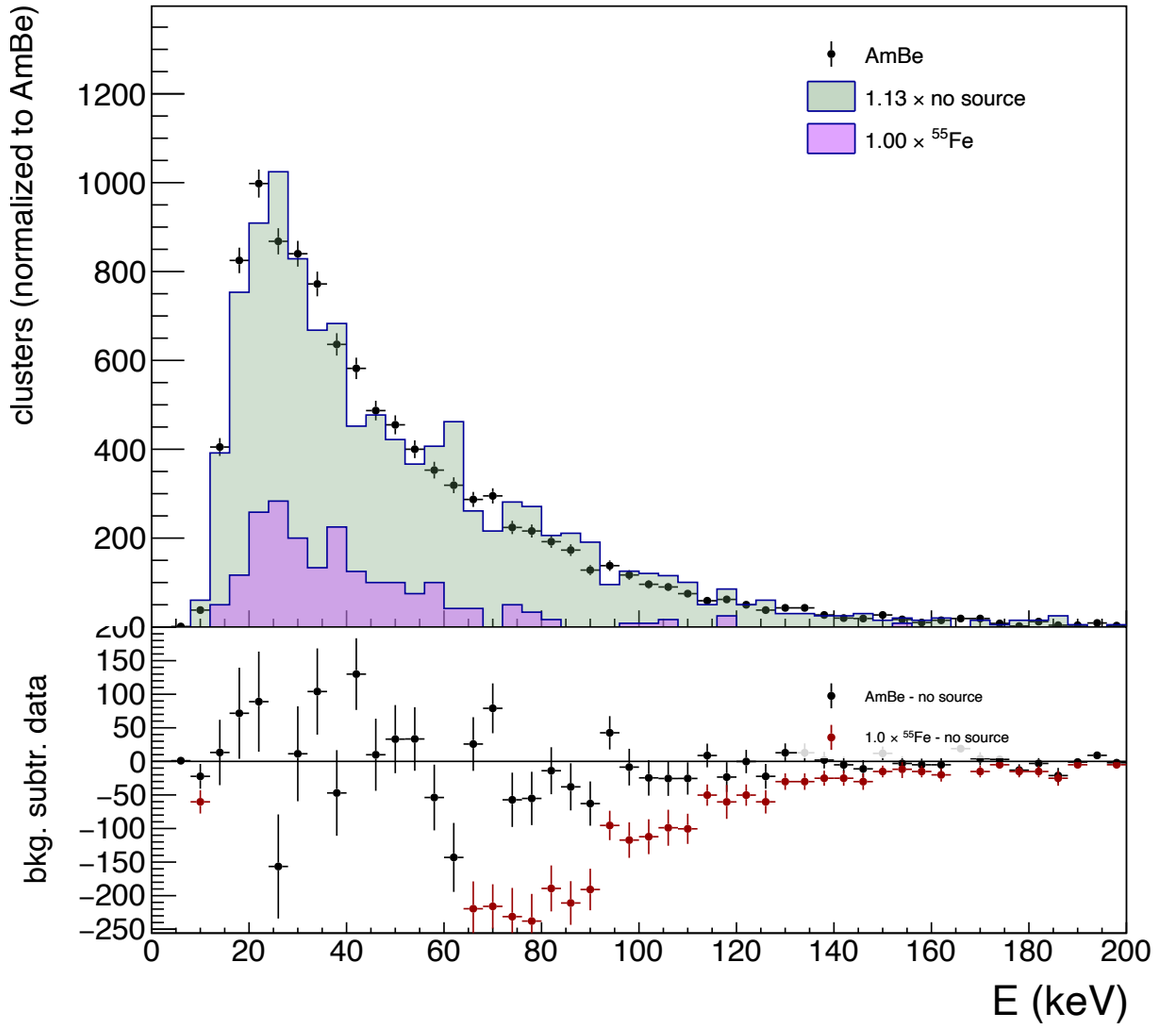
Absolute E-scale

We can use the ubiquitous cosmic tracks.

We expect dE/dx = 2.3 keV/cm as the MPV of the distribution

(modulo the angle along the z...)





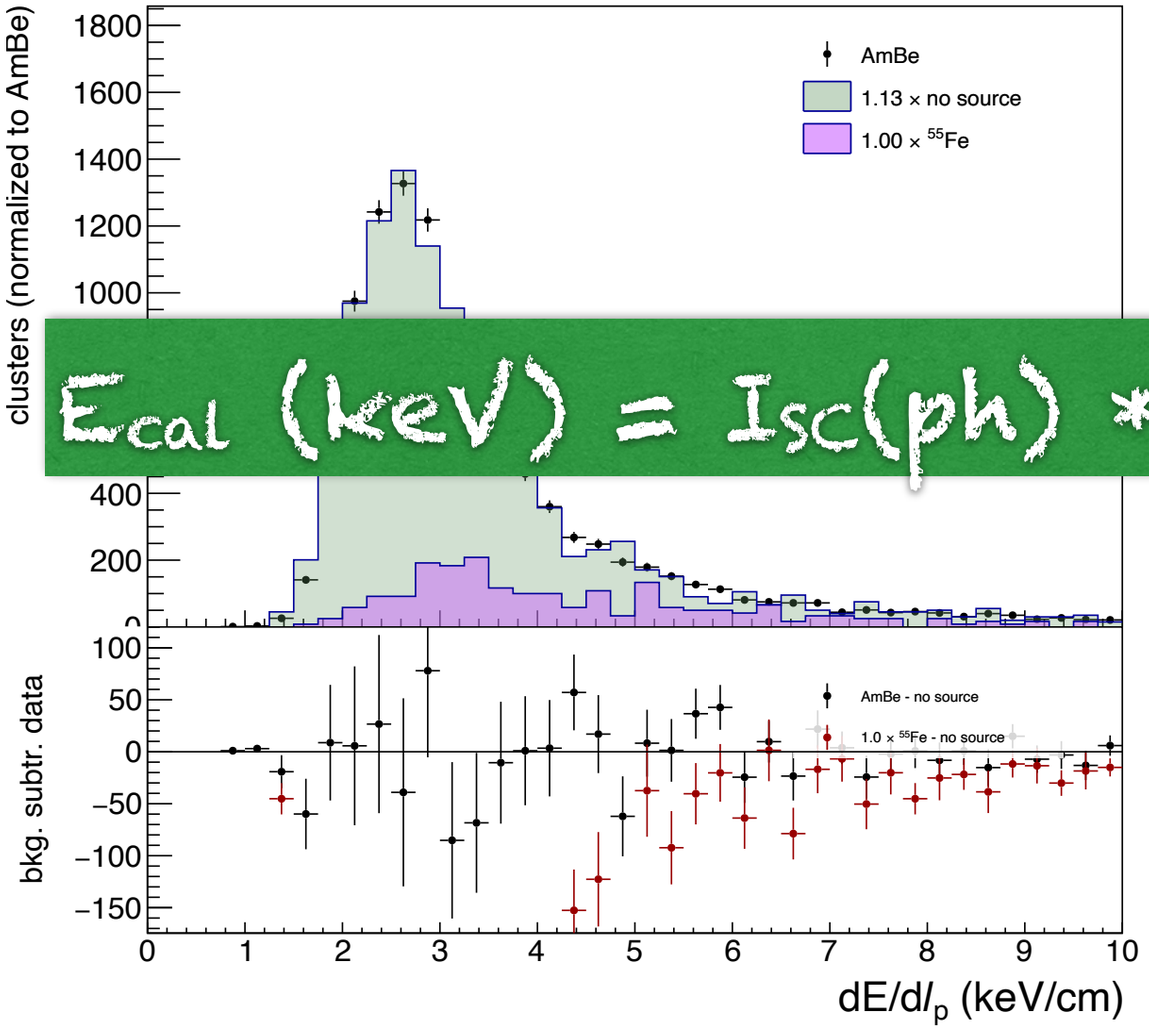
dE/dx and E spectrum seems aligned between runs and similar in shape

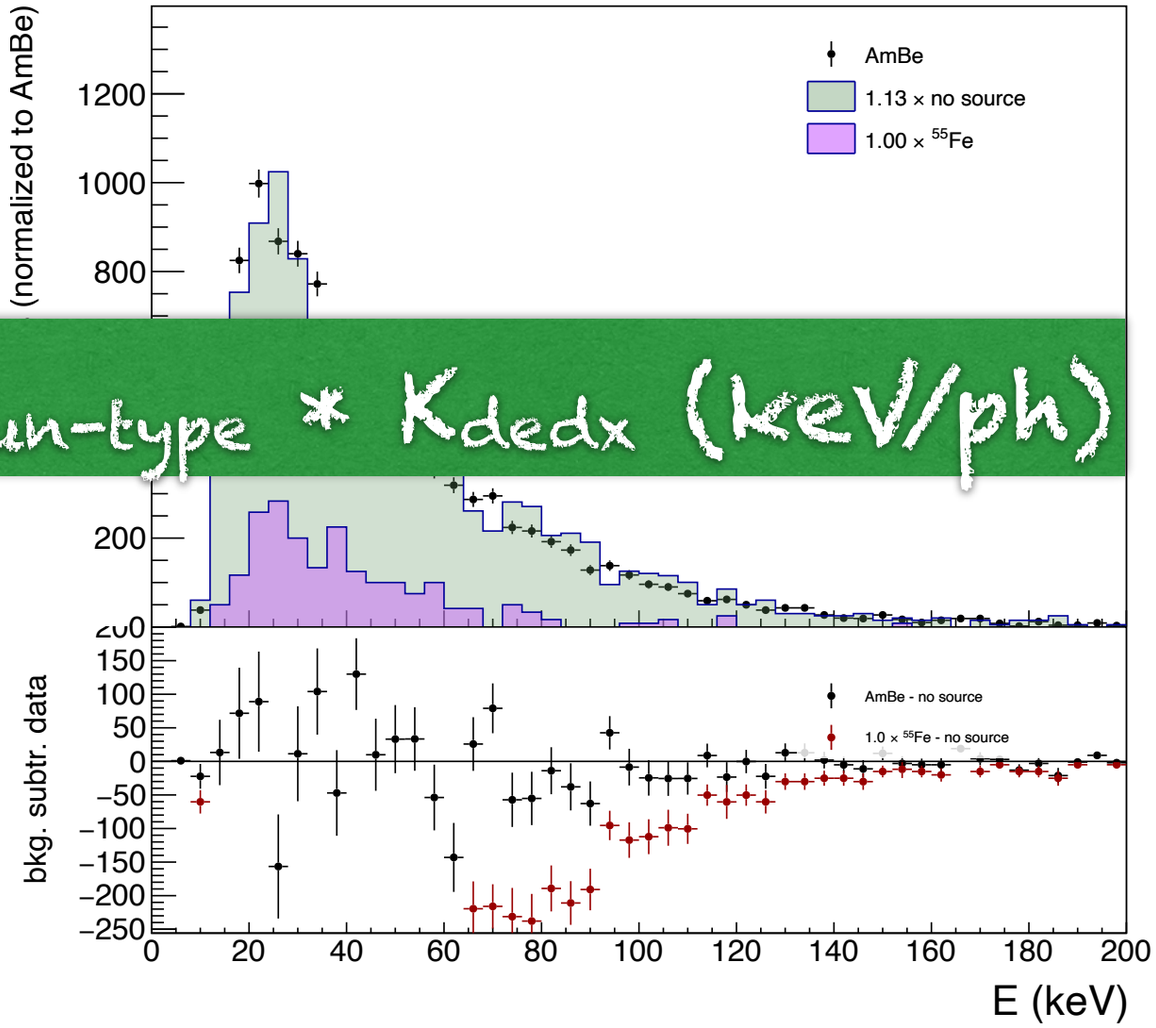
Absolute E-scale

We can use the ubiquitous cosmic tracks.

We expect dE/dx = 2.3 keV/cm as the MPV of the distribution

(modulo the angle along the z...)





E_{cal} (keV) = I_{SC}(ph) * $iC_{run-type}$ * K_{dedx} (keV/ph)

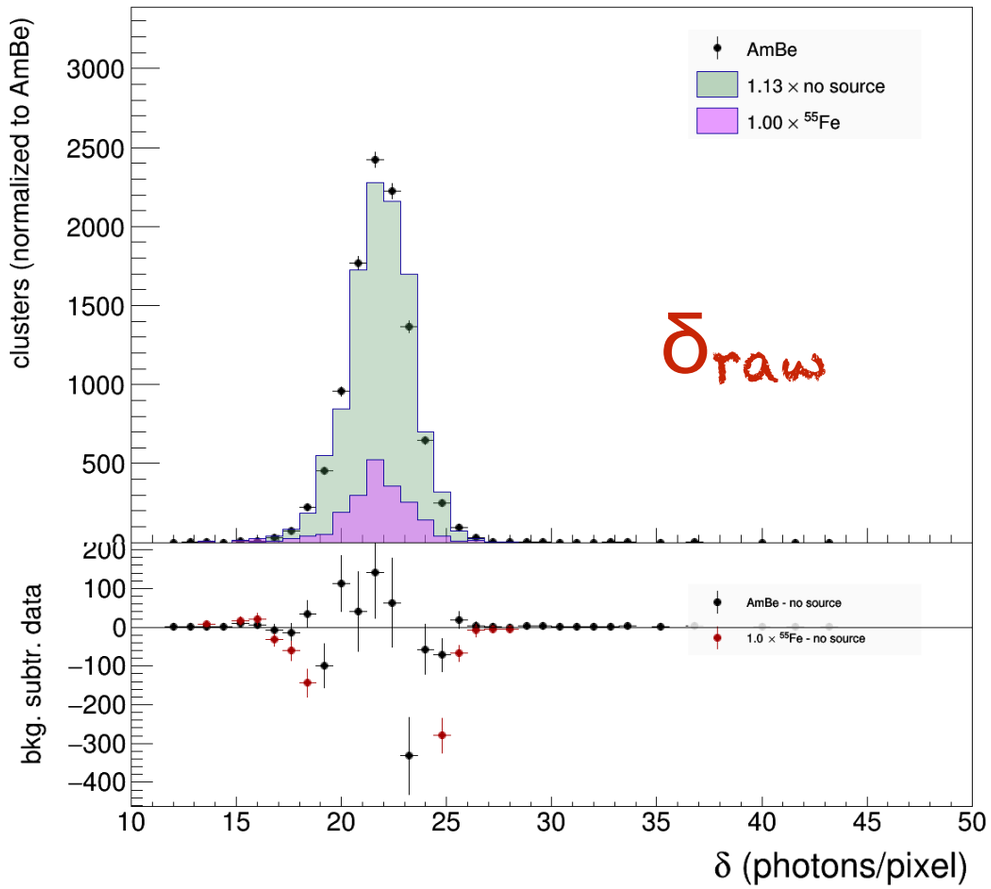
dE/dx and E spectrum seems aligned between runs and similar in shape

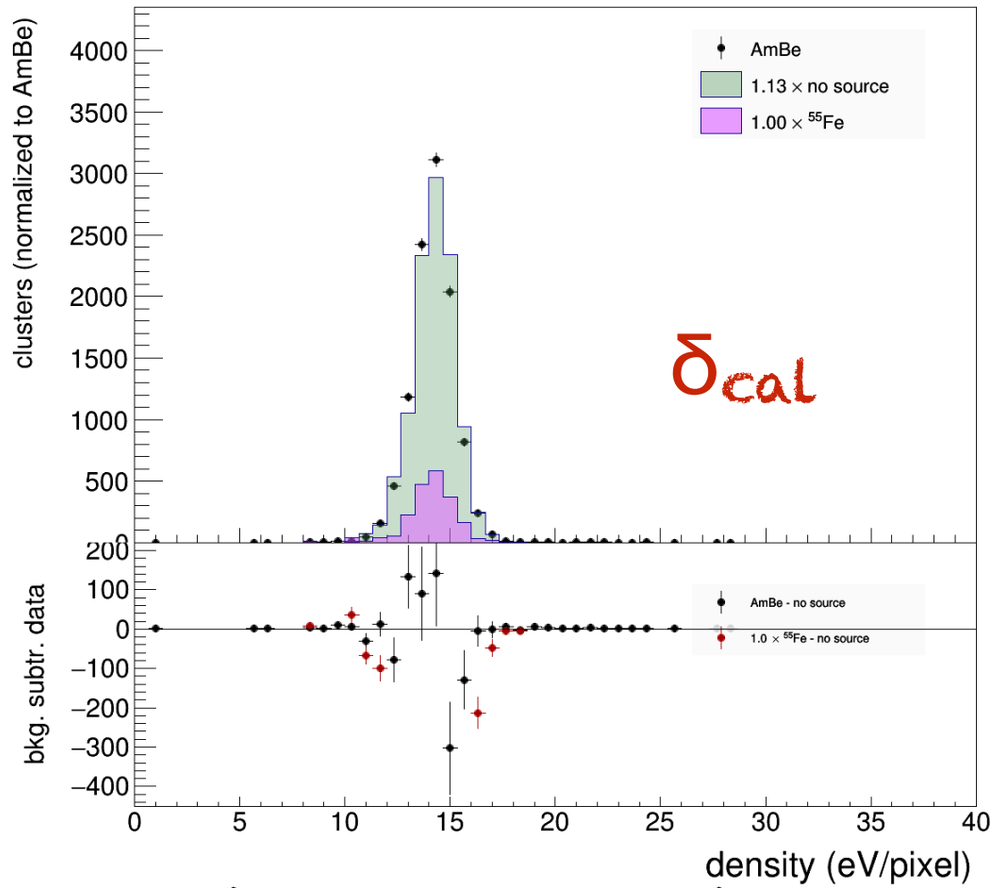
E density (CR)

Energy density in the CR, raw (ph/pix) and calibrated (eV/pix)

The mean is the same by construction (inter-calibration)

The shape differs a bit – not very good news (need to check the presence of 4 MeV electrons that may look similar to μ)





Assuming this is pure cosmics, find a scale factor

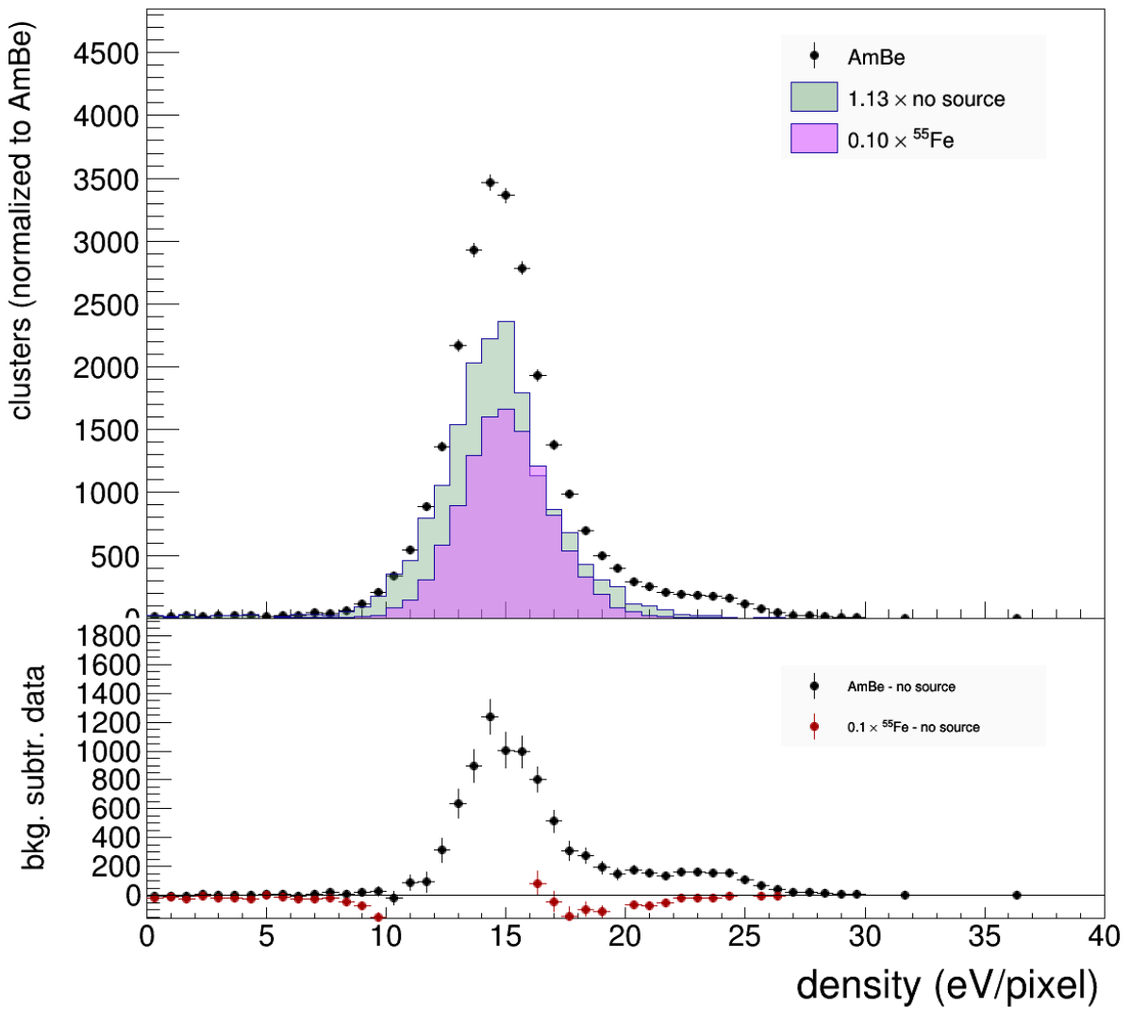
$SF_{cosm} = 1.13$ for the cosmics normalization.

To be used in the signal region (SR)

Signal region (SR)

"Unblind" the signal region:

- length < 1cm (expected from SIM for E <~ 100 keV)
- slimness > 0.4 (further suppress pieces of cosmic tracks)



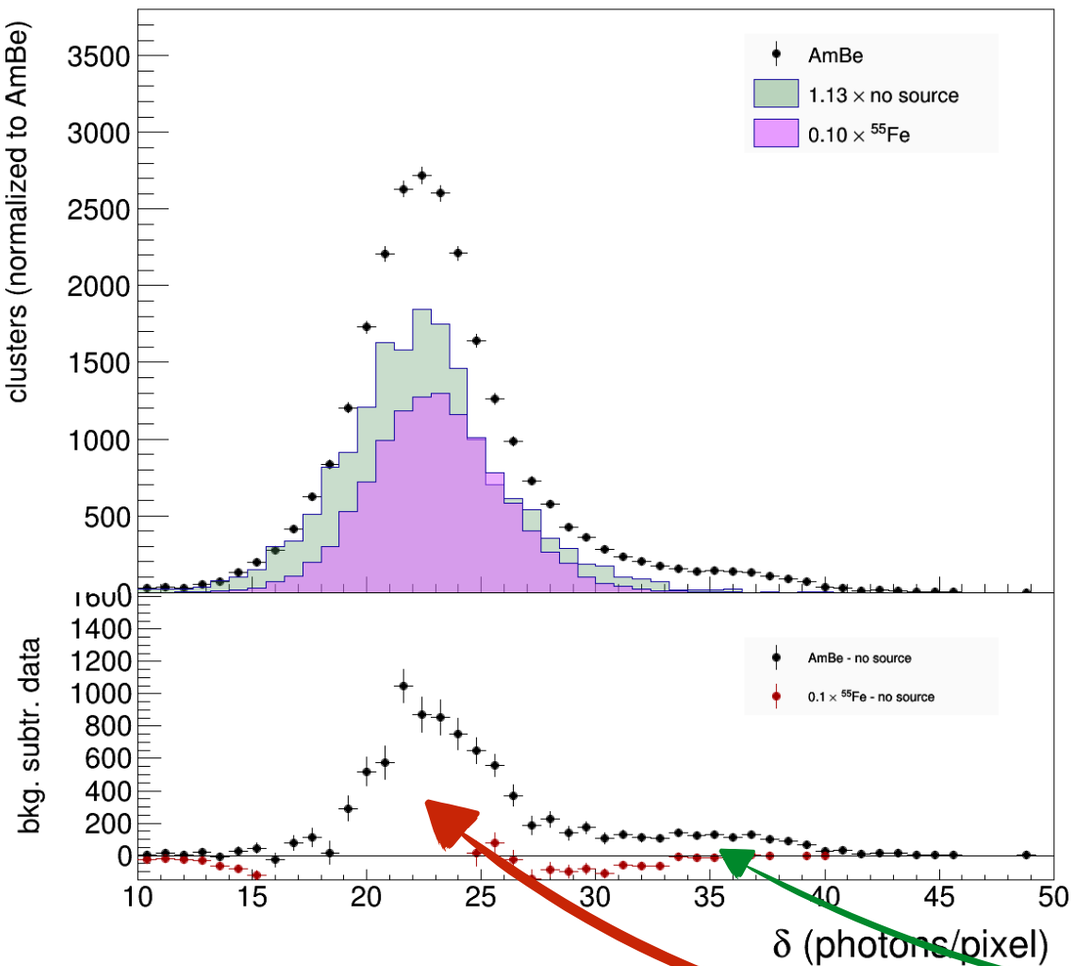
Clusters with >20 eV/pix are clean high-E recoils. OK.

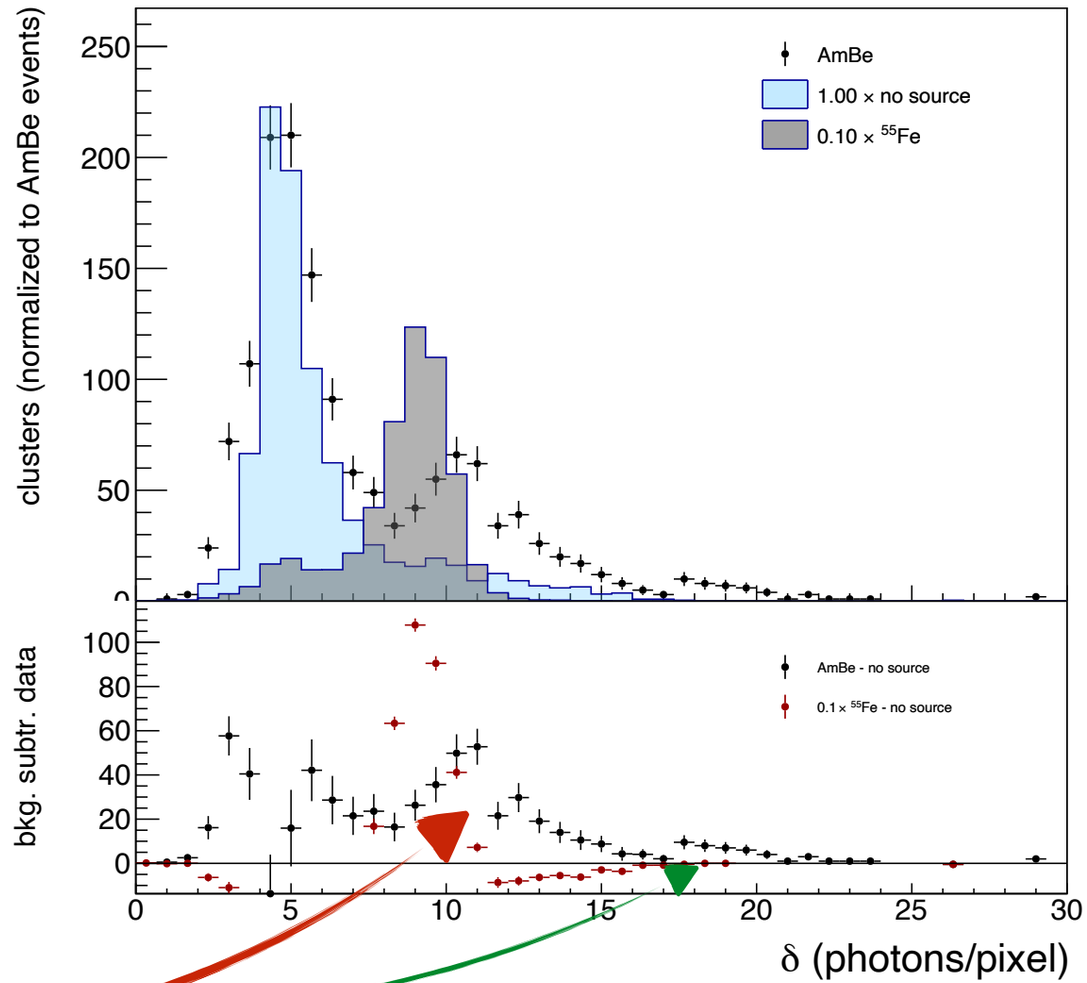
The region [10-20] eV/pix less clear: can one trust the cosmics normalization ?

=> Important, because these could be the low-E NRs

raw density (SR)

The density of the clear NRs seems similar to LEMON:
factor 2 expected in #counts/photon for LIME

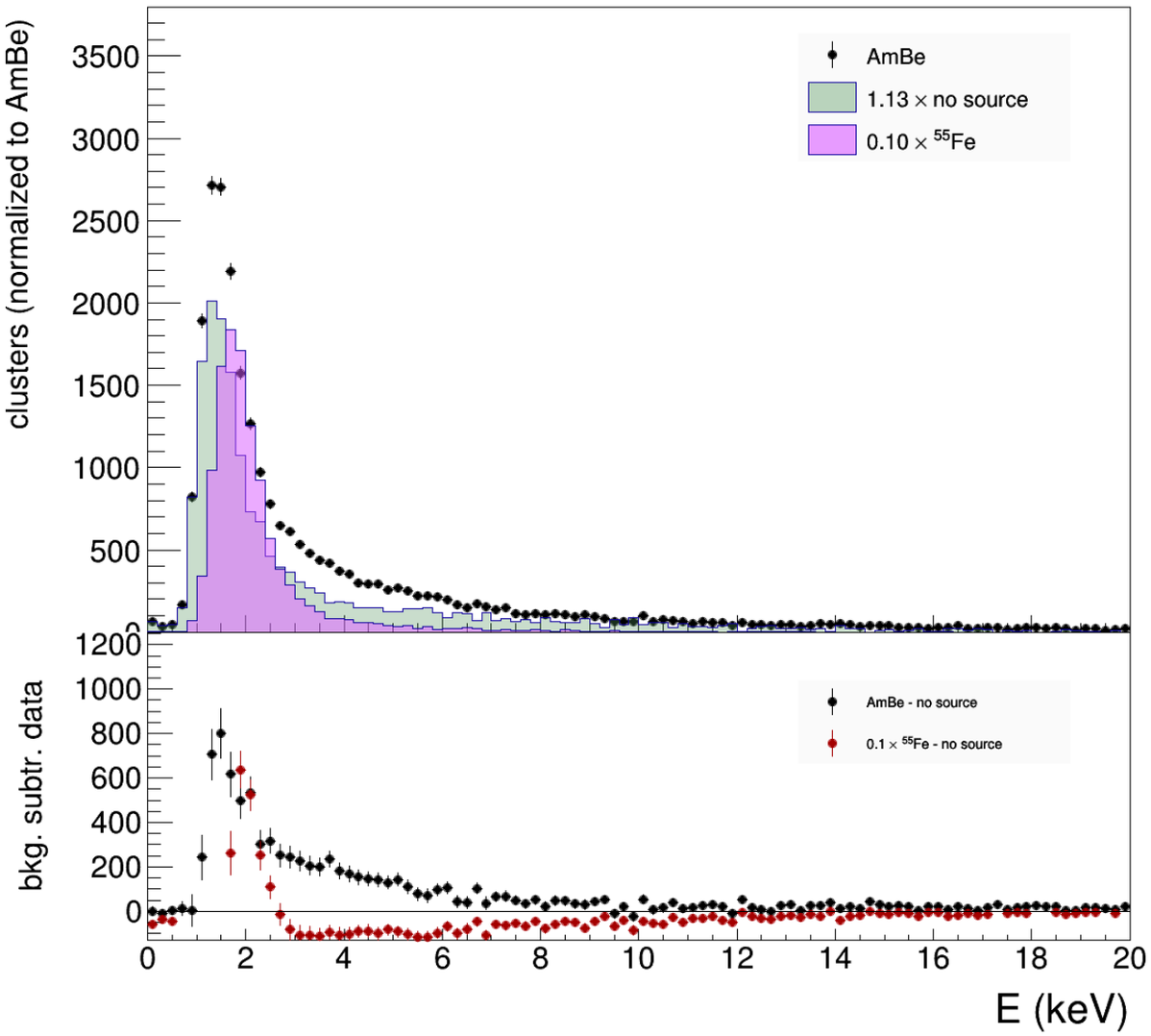


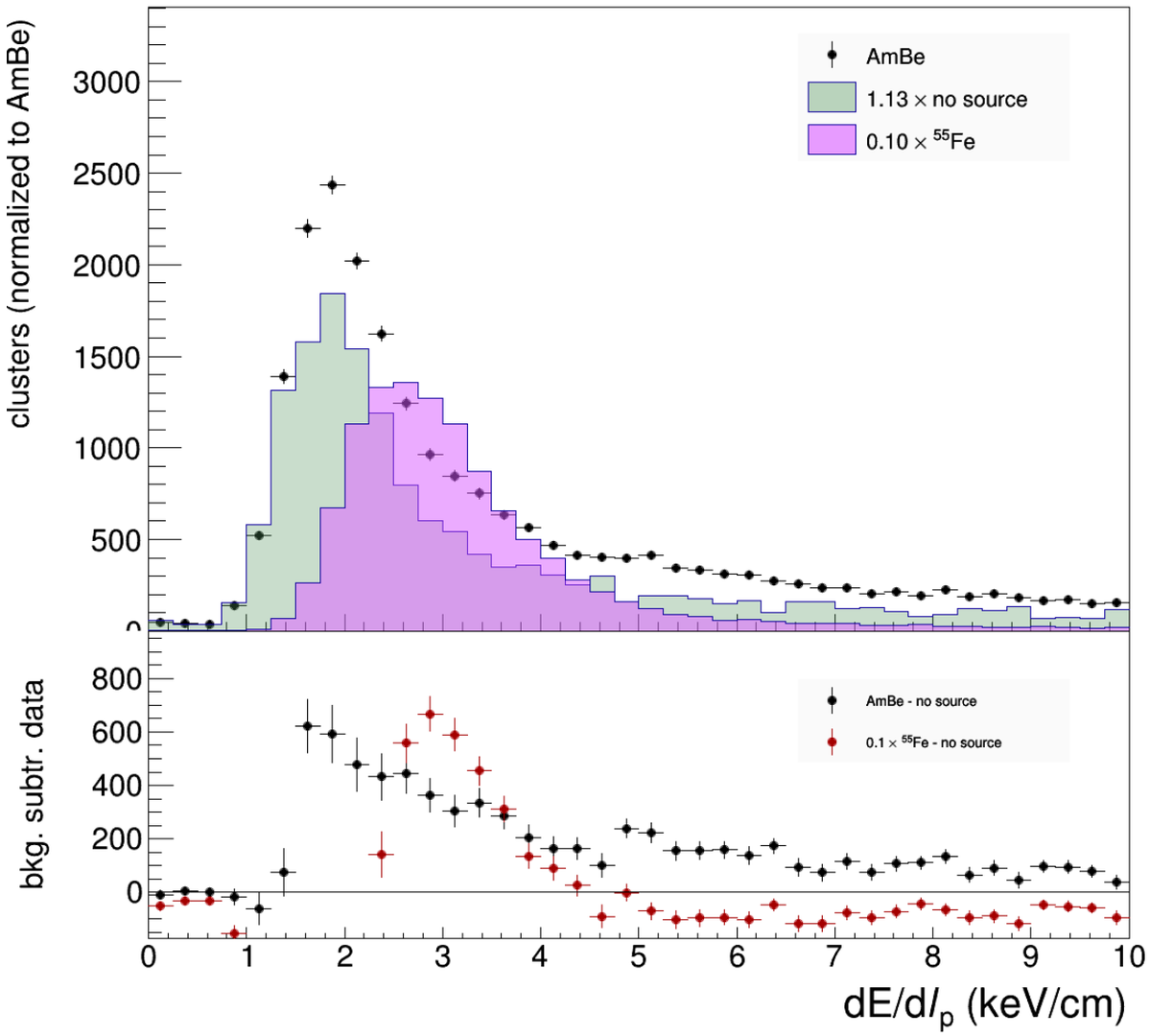


can we trust cosmics subtraction?
=> need to think a better discriminating variable

SR Energy spectrum

E spectrum different for E > 2,3 keV. Seems legitimate to think that this comes from the AmBe source



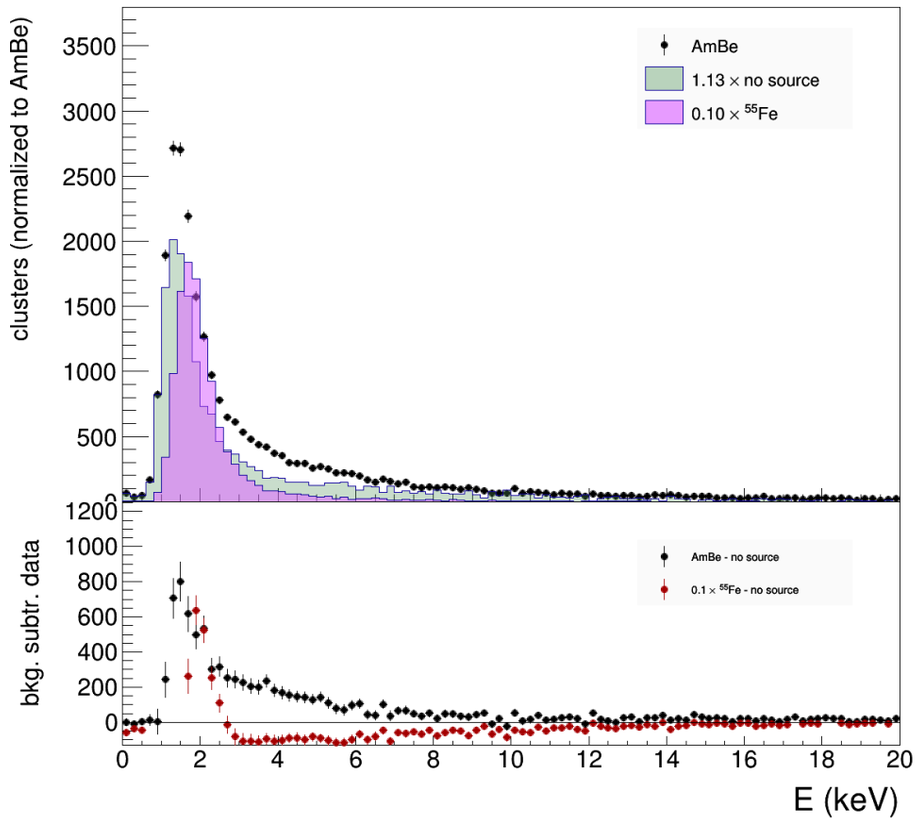


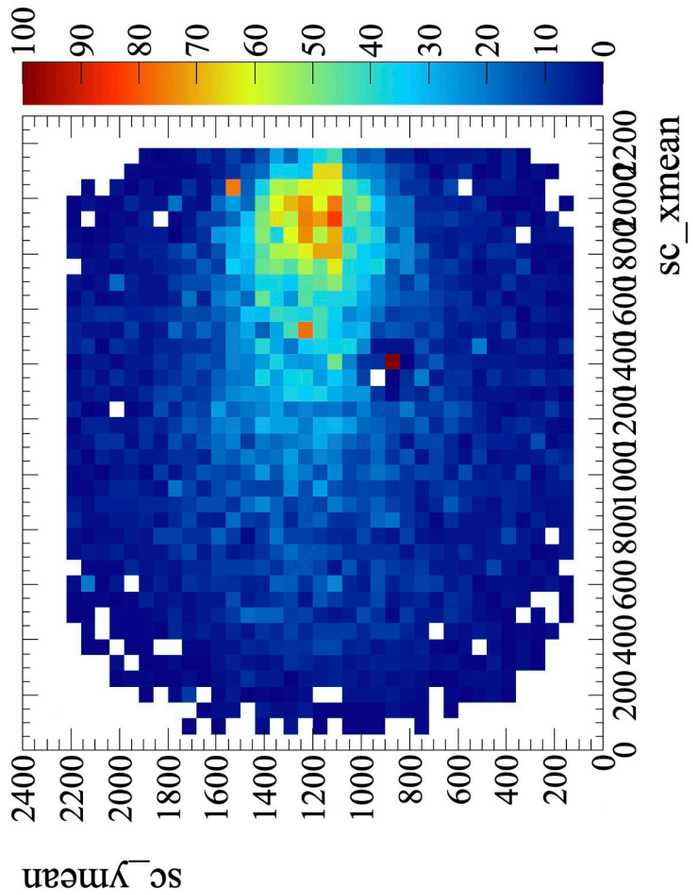
For E < 2 keV seems more a bad normalization of cosmics?

Need to check on raw images. Need to think seriously to stat uncertainty

And Fe?

Wasn't it 6 keV? Here it seems peaked at 2 keV.





occupancy of Fe spots

Not applied the "vignetting" Energy correction: the light yield decreases as a function of R up to factor [3-4].

The Fe is the most biased being concentrated at the top of LIME => can raise up to 6 keV

Davide has the correction map. Need to apply it (coming soon...)

Conclusions & todo

First look at the Summer data with LIME: AmBe, Fe, no-source

The clear high-density NRs are where expected

Calibration procedure in place to compare different run-types and to do a correct cosmics-background subtraction

Need to apply the vignetting correction. This will help to:

1. recover the Fe in the correct place

2. it could change the shape difference in \delta between cosmics and AmBe (because cosmics are uniformly distributed in space, NRs are a spray from the source?)

Need to think seriously to improve the discrimination between cosmics and the signal candidates

Backup