Reconstruction, analysis

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CYGNO general meeting,

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Outline

Data analyses ongoing on multiple fronts:

- Electro-luminescence with MANGO data (G. Dho, E. Baracchini)

- Head-tail studies using LEMON and MANGO data

- Nuclear Recoils analysis with LIME AmBe data

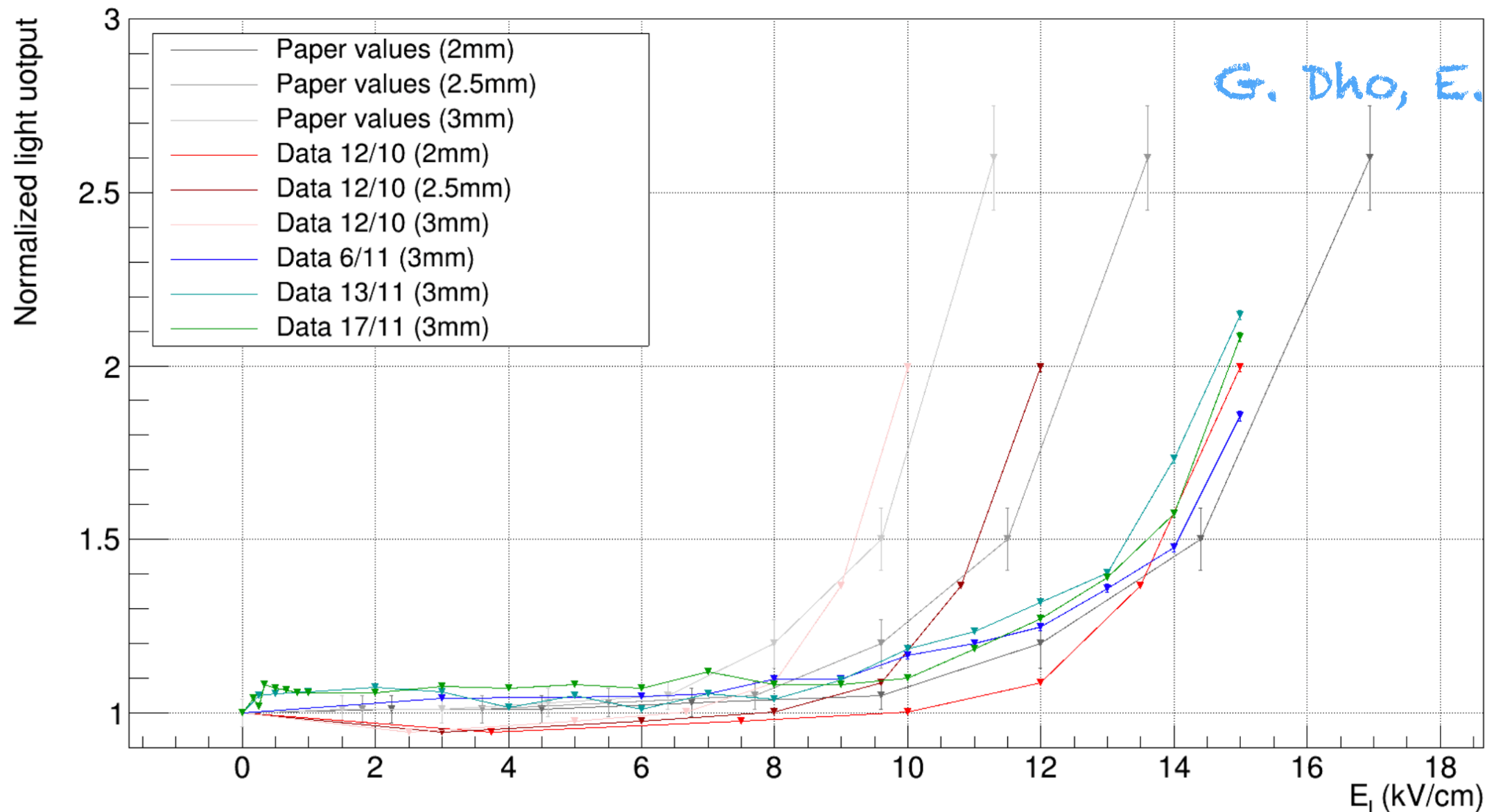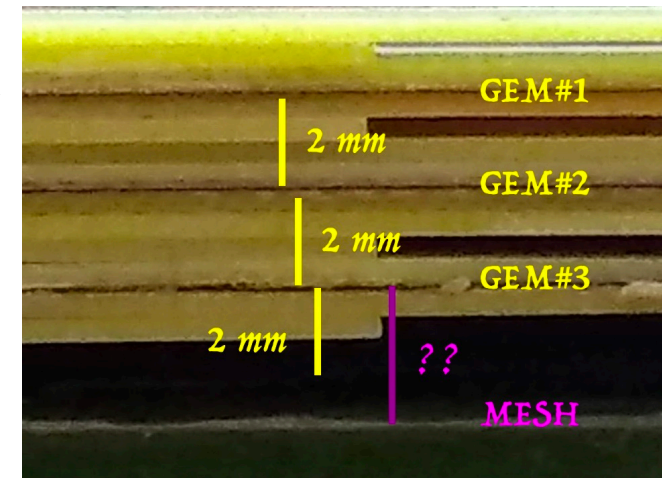**Event Reconstruction developments:**

- directional clustering "iDDBSCAN" (I. Pains)

- vignetting correction, cosmic-killer

Computing: setup of batch queues at LNGS

Electro-luminescence in MANGO

Light output as a function of the GEM-MESH gap.

Mistery on the gap: was 2mm or 3mm for the paper? Seems really 3mm
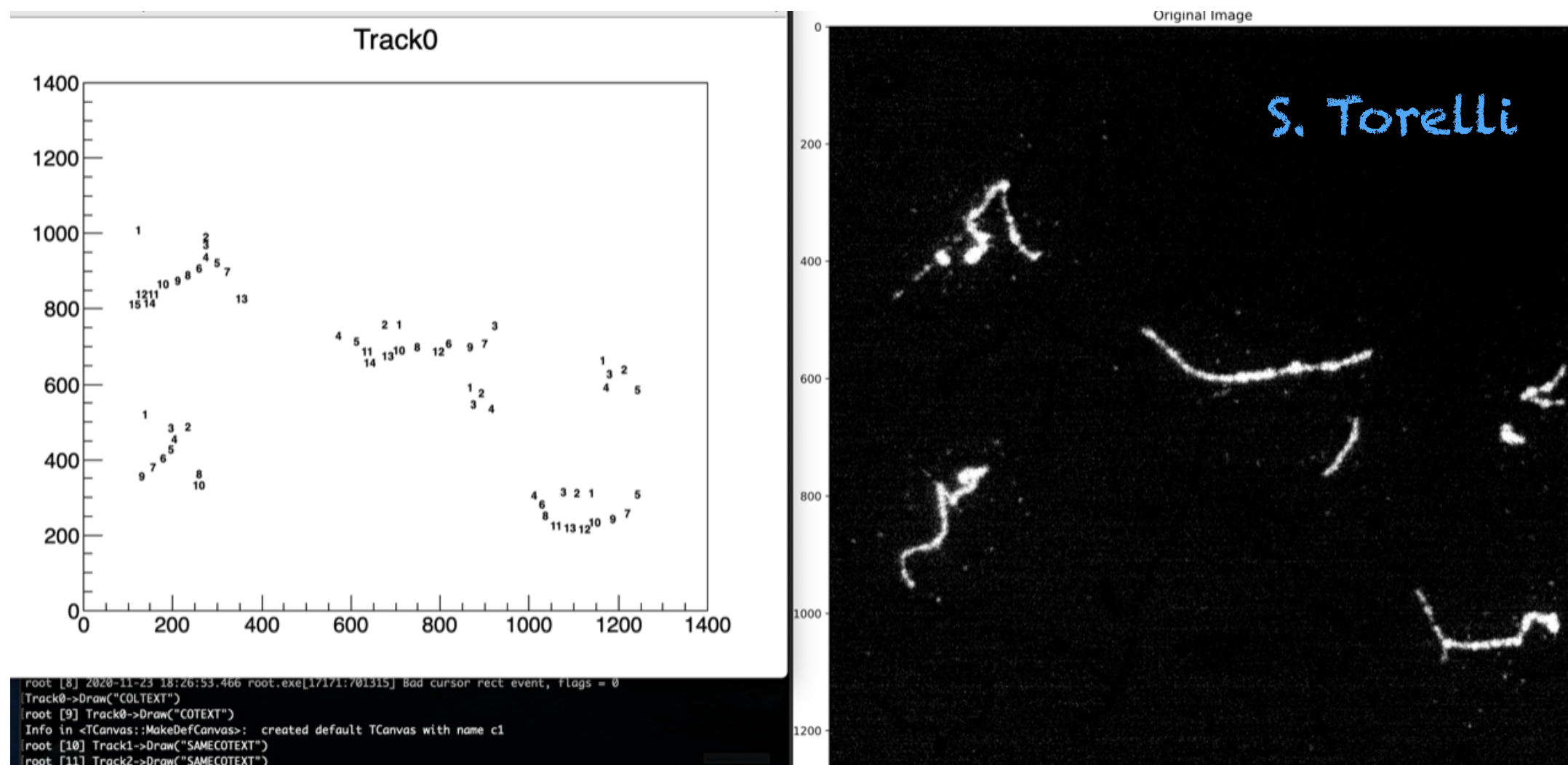

3s exposure

G. Dho, E. Bracchini

Head-tail studies

Using LEMON data with AmBe

Needs larger granularity of the slicing along the track pattern

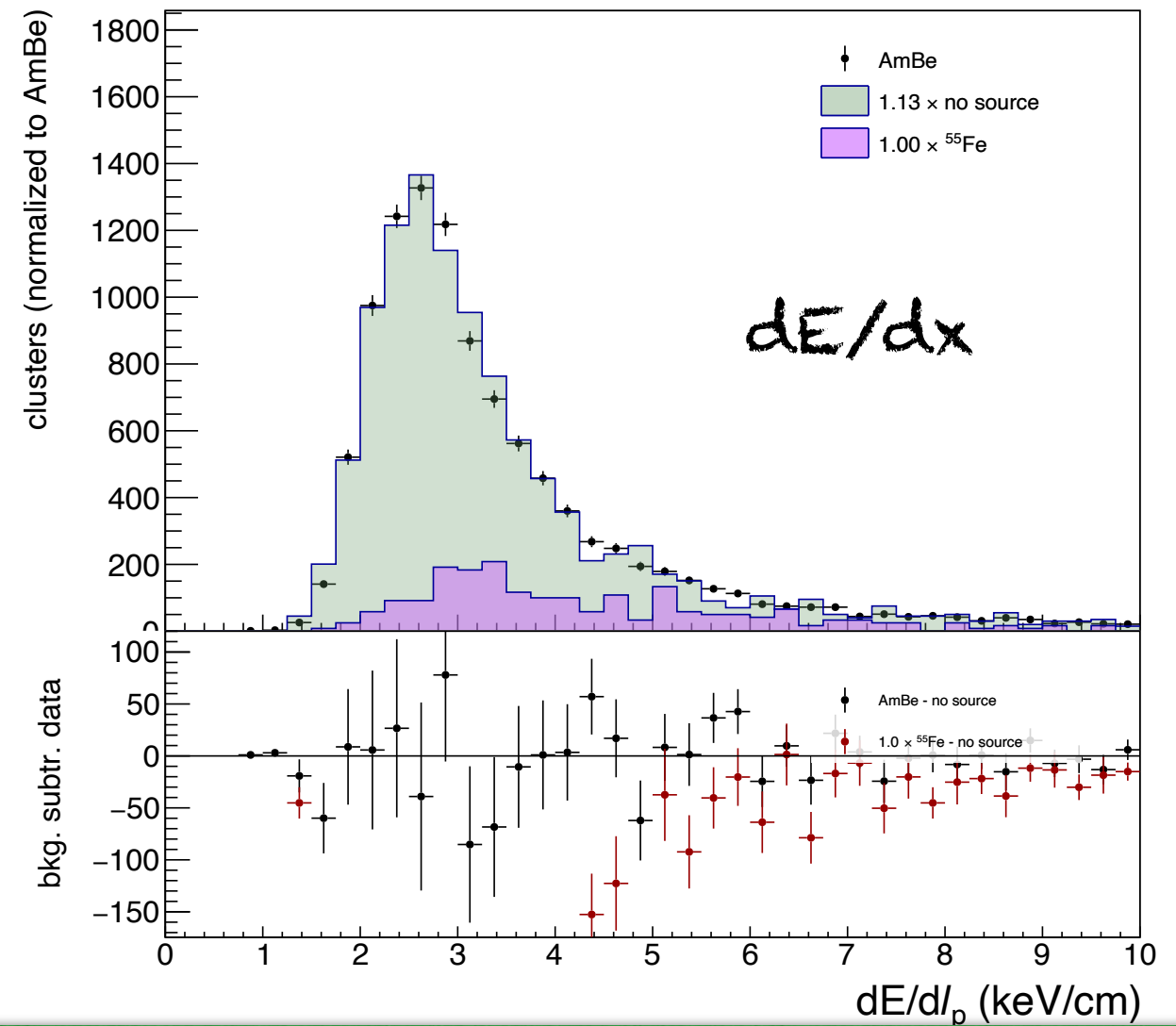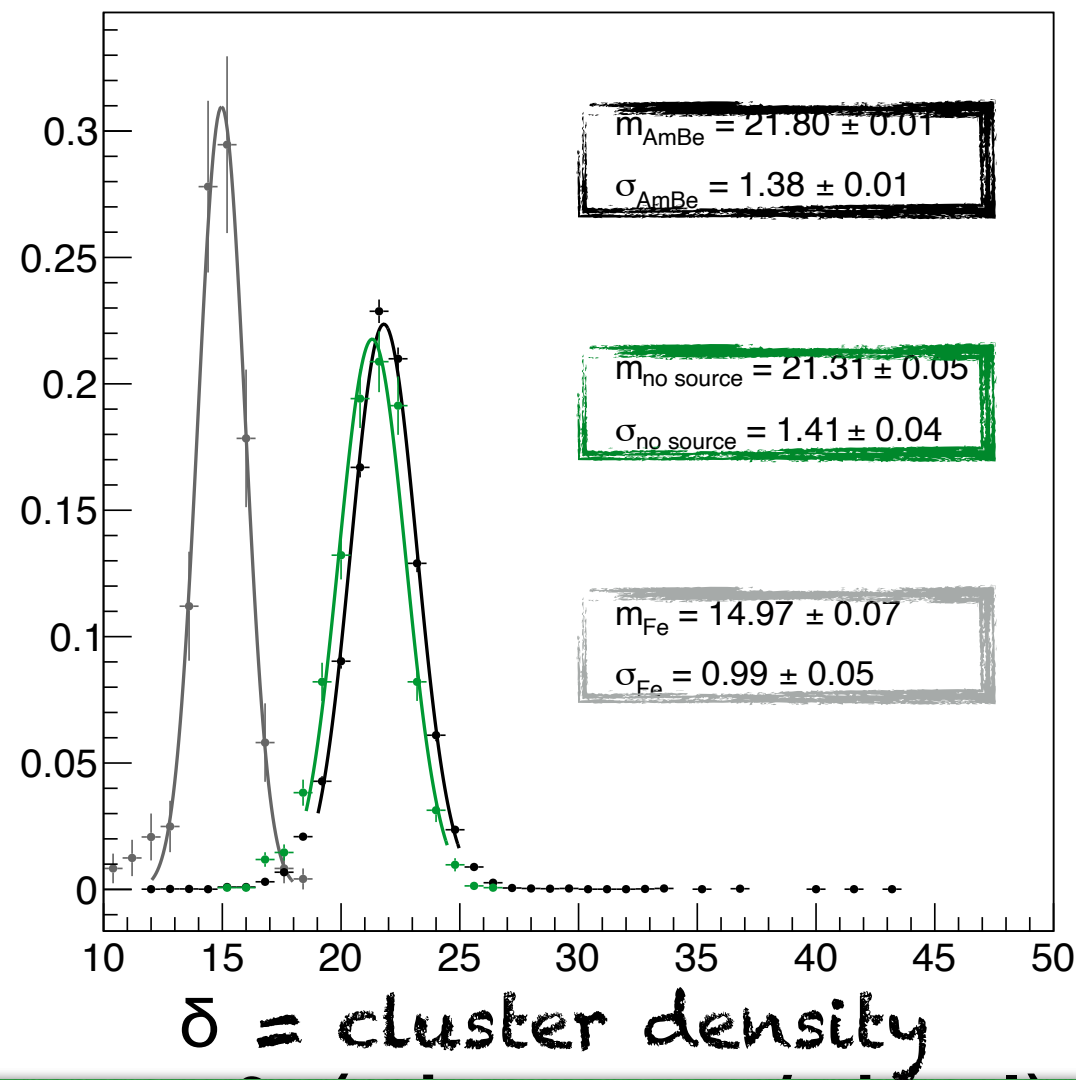Needs sorting of the slices from one side to another (ongoing)

AmBe data with LIME

Repeated the analysis of the AmBe paper with LIME data

Energy drift with time needed energy calibration with the cosmics (needed to do the bkg-subtraction from no-source data)

$m_{AmBe} = 21.80 \pm 0.01$

$\sigma_{AmBe} = 1.38 \pm 0.01$

$m_{no\ source} = 21.31 \pm 0.05$

$\sigma_{no\ source} = 1.41 \pm 0.04$

$m_{Fe} = 14.97 \pm 0.07$

$\sigma_{Fe} = 0.99 \pm 0.05$

δ = cluster density

dE/dx

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

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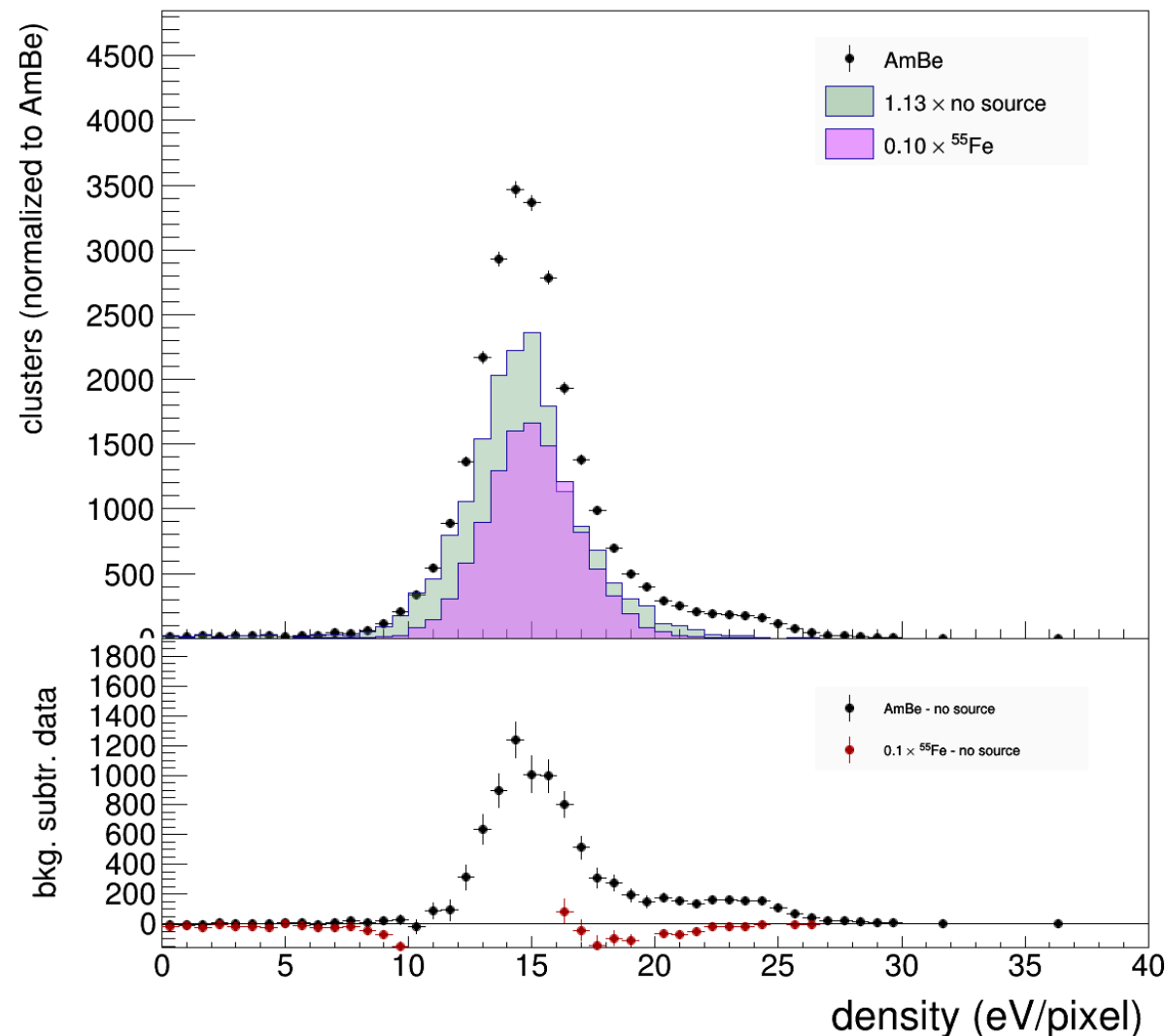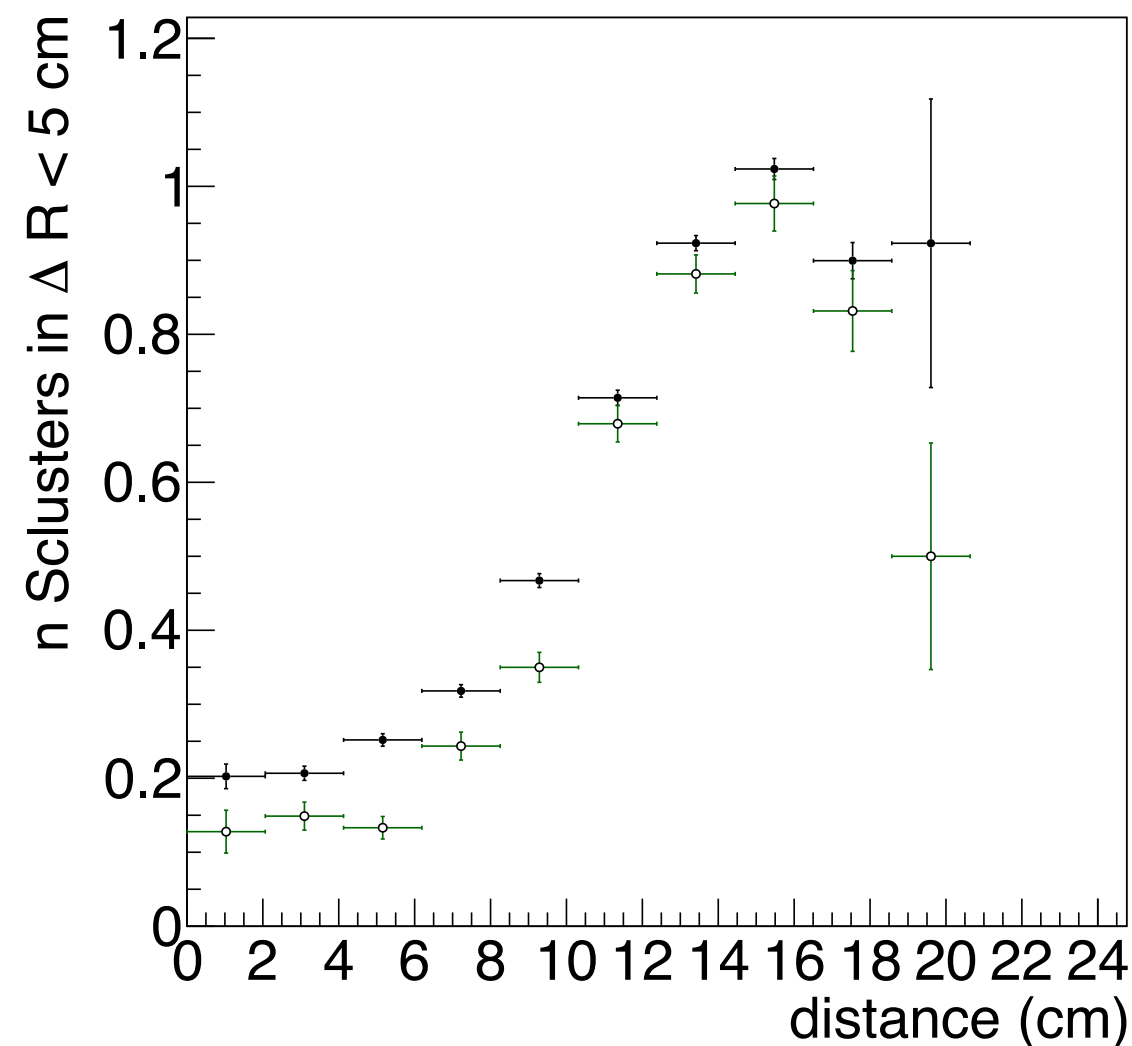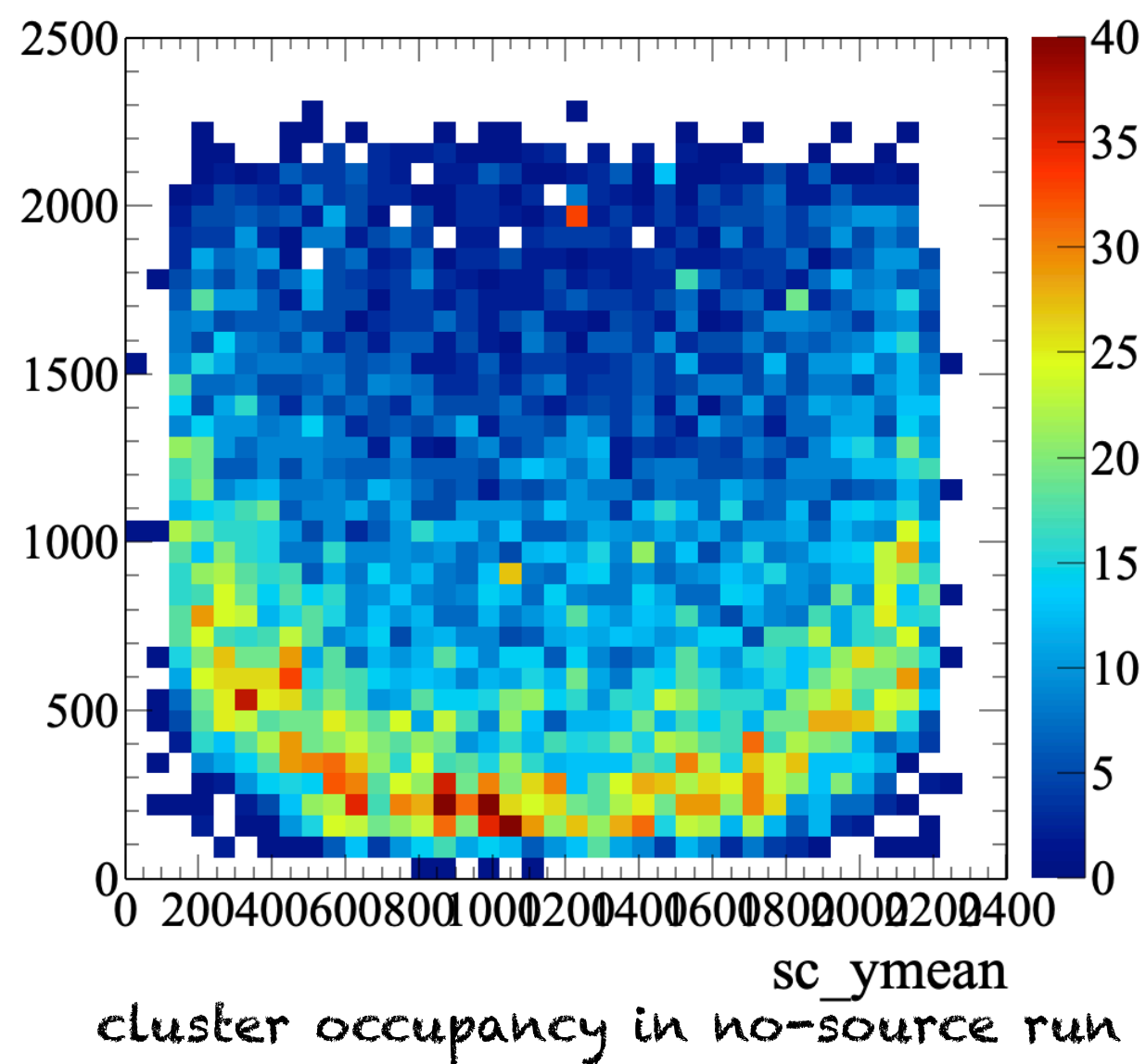
Clusters with >20 eV/pix are clean high-E recoils. OK.

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

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

New findings

Found large occupancy of small/low-density clusters in both AmBe and cosmics data

cluster occupancy in no-source run

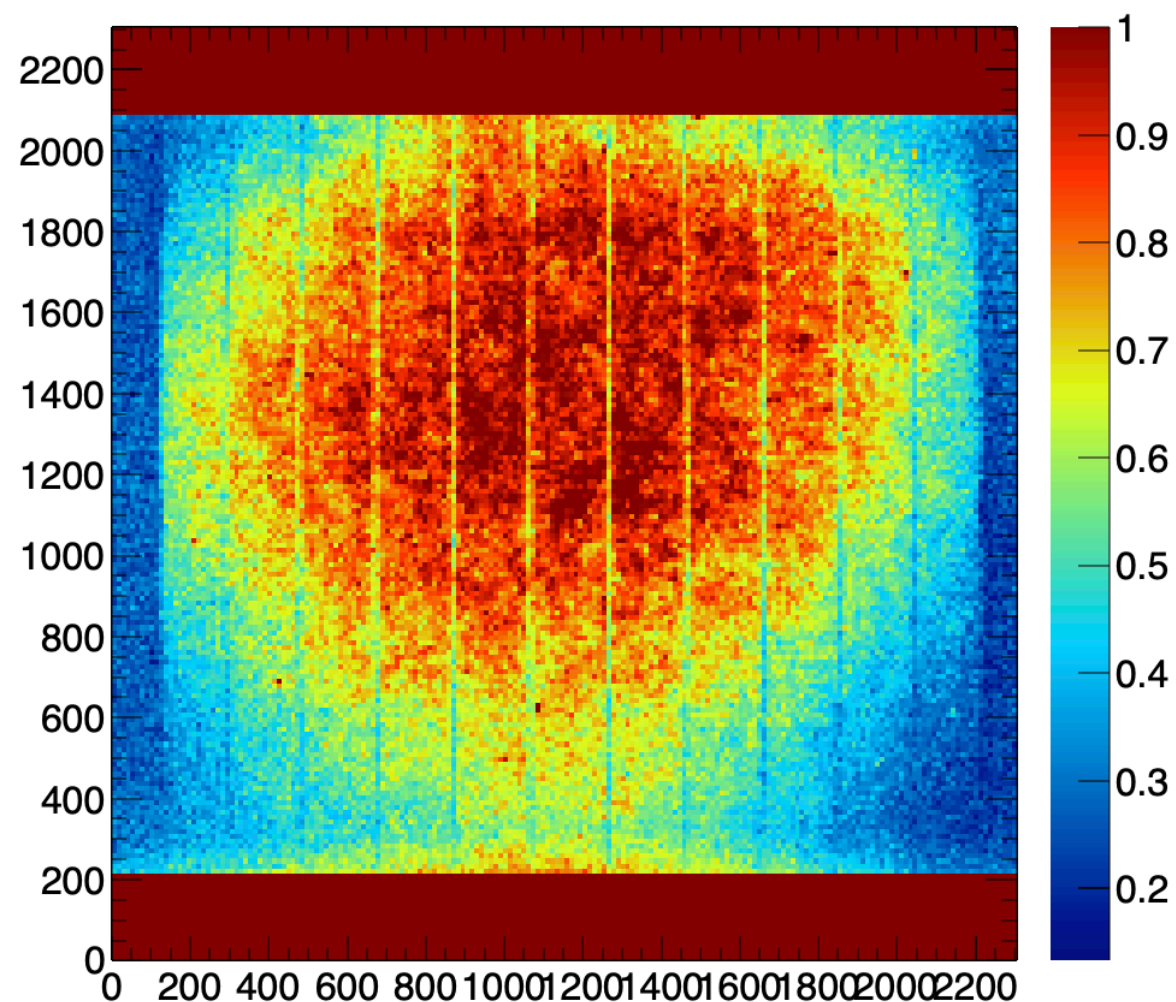number of superclusters in ΔR<5cm from a supercluster vs distance from center
points towards split tracks in that region

vignetting effect

The high occupancy region suspiciously matches with low LY from vignetting effect

LY normalized to the center average

LIME
LEMON
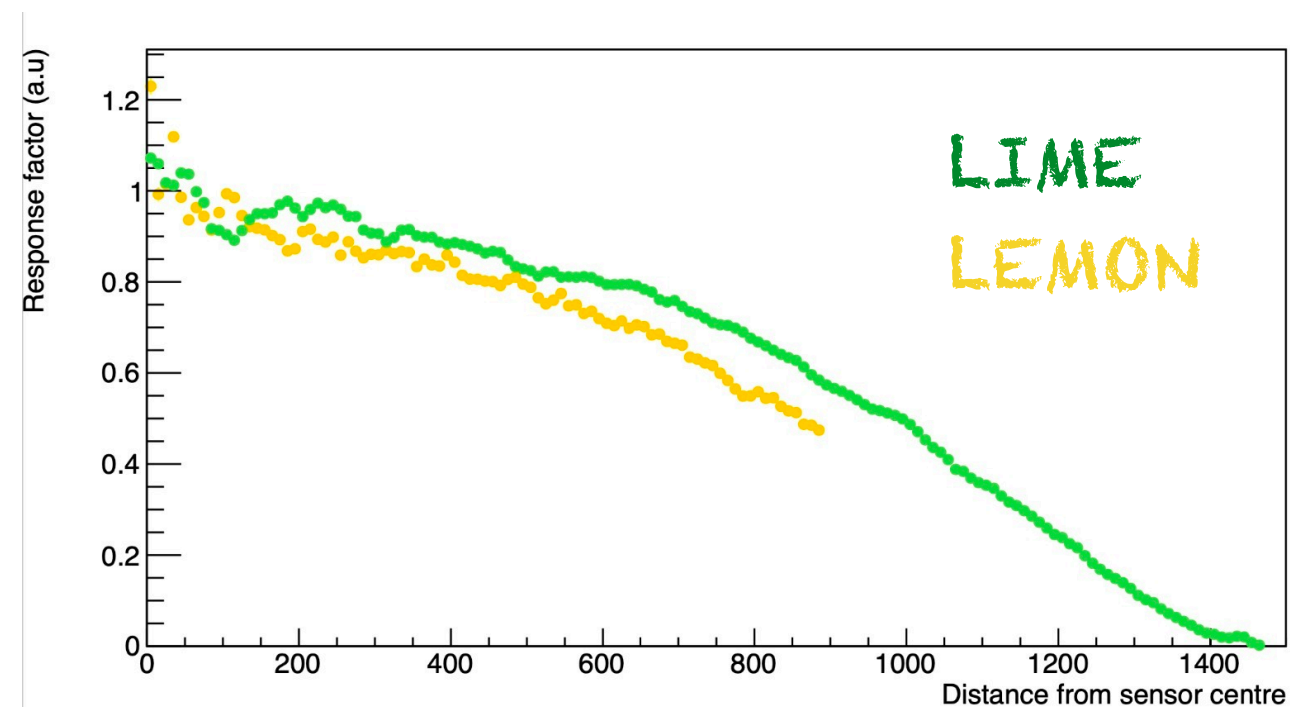
D. Pinci

Looking at images it seems indeed that the low LY induces faint pieces of cosmics to go under the zero-suppression thr.

# new reco developments

This triggered reconstruction developments:

1. **vignetting correction**: 1/vignetting map is applied to the raw pixel counts, before ZS

   > still, the surviving noise is amplified. The clustering seems robust enough, but expect some more fake clusters in that region

2. **Cosmic killer:** inspired by I. Pains, simple straight, long enough cosmics are fitted with a line and intercepts with other clusters are found.

   1. save in the ntuple the #pixels intercepted and minimimum distance by the closest "killer" for each supercluster

   2. nominal and 1 alternative fit saved

fixes & additions
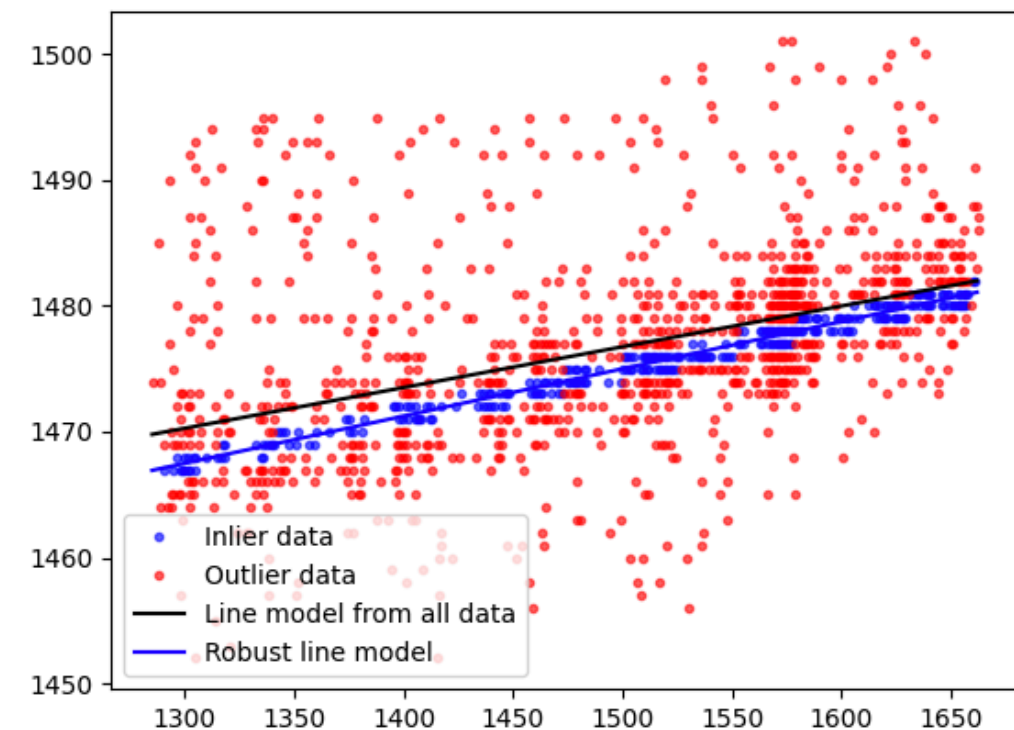
Triggered by Elisabetta, Giorgio, found that the "pathlength" (curved length) was < length (major eigenvalue of the cluster covariance matrix)

Pathlength / length can be useful for as an estimate of the "straighness" of the track. Add the χ^2 of the linear fit

Rebinned image
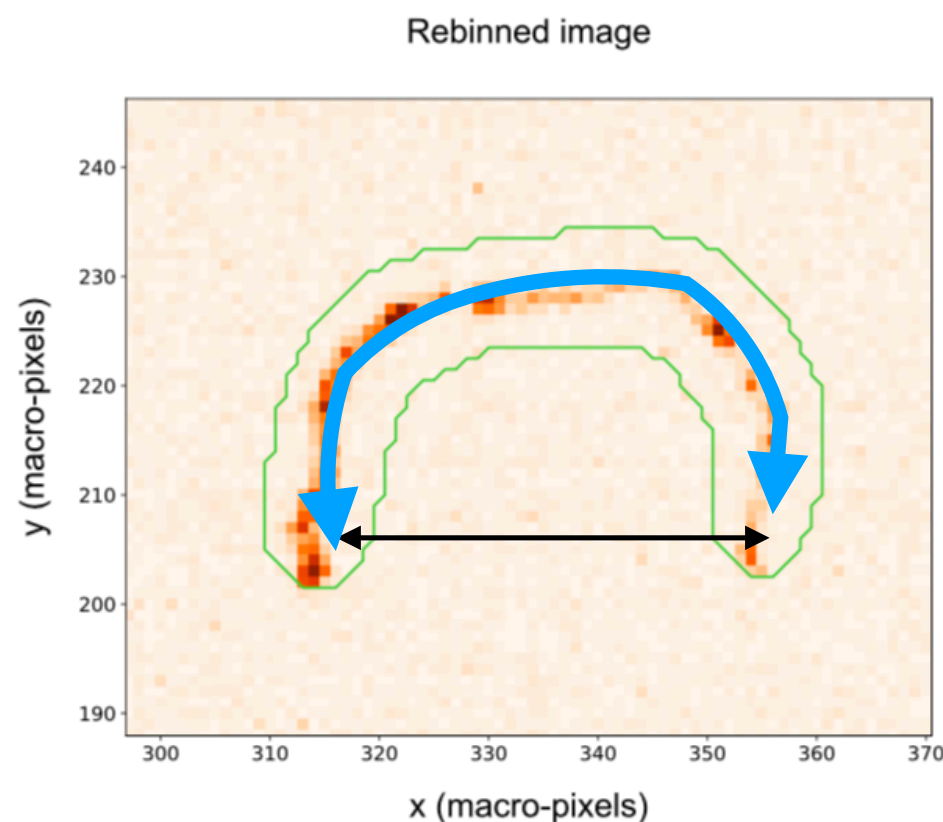
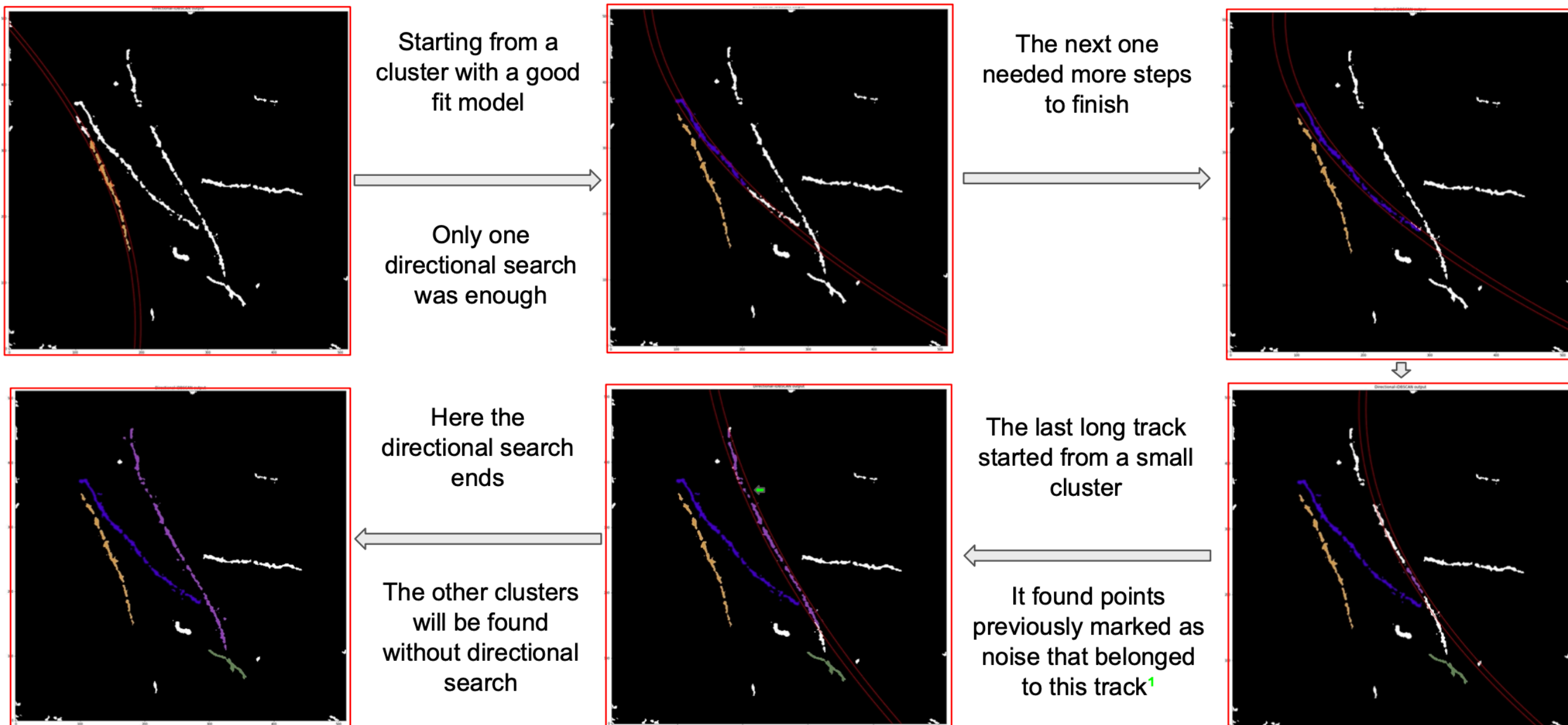Problem found, due to pixels which can be ZS along the track skeleton and not counted

Approximate estimate now in the code. See Pull-Request #122

Added the track inclination wrt the vertical ("sc_theta")

Directional clustering

Directional clustering with polynomial RANSAC studied to better find long tracks

I. Pains

Run 2317 - Event 05

Starting from a cluster with a good fit model

Only one directional search was enough

The next one needed more steps to finish

Here the directional search ends

The other clusters will be found without directional search

The last long track started from a small cluster

It found points previously marked as noise that belonged to this track[1]

Conclusions & todo

Studies on saturation, electro-luminescence ongoing with different detectors and sites (Frascati, GSSI)

Study on Head-Tail started with LEMON data

Study with Summer data and LIME revealed the need to improve the reconstruction code: need to reprocess data to estimate the performance

Alternative algorithms like iDBSCAN studied to attack the cosmics background

Computing resources: Giulia & I, with the help of S. Stalio managed to use the batch queues for SIM and RECO. We have o(100) CPUs -> try to use them and no cygno-login for heavy tasks