Clustering etc

Noam Tal Hod

WEIZMANN INSTITUTE OF SCIENCE

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Intro

- So far we were only talking about seeding and track-fitting, but never on clustering
- This was true for the fast simulation as well as what Arka does now with the proper GEANT4 simulation
- Since the procedures starting from the Tracks trees are questionable in several ways, we decided to look also on the Hits trees and start the procedures from there
  - Arka has kindly produced text files which have all the information needed already
- However,
  - the hit-to-track(s) association isn't trivial yet
  - assuming it is done properly, we must consider some kind of pixel clustering before starting the seeding (and track fitting)

Clustering

- There are many clever ways to do this and we should not invent the wheel but we wanted to do something very simple to start with

- Naive alg:
  - put all live pixels of one chip in a list
  - exclude pixels where (all) the track(s) are associated with an origin we cut, e.g. the Cherenkov wall.
  - go to the first live pixel (pivot) and recursively search in the live-pixels-list if the pivot has immediate neighbours
    - kill all pixels associated with the cluster as they are being added
    - stop the recursion when there's no pixels to add
    - move to the next live pixel in the list and redo the recursion
  - future: cut on cluster properties (e.g. shape) to remove bkg →
  - start the seeding from clusters rather than pixels

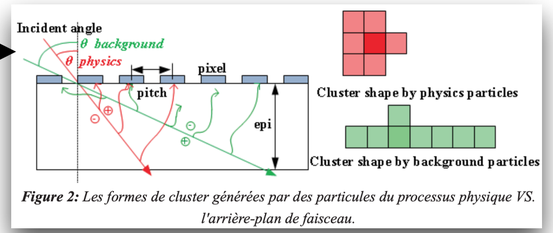
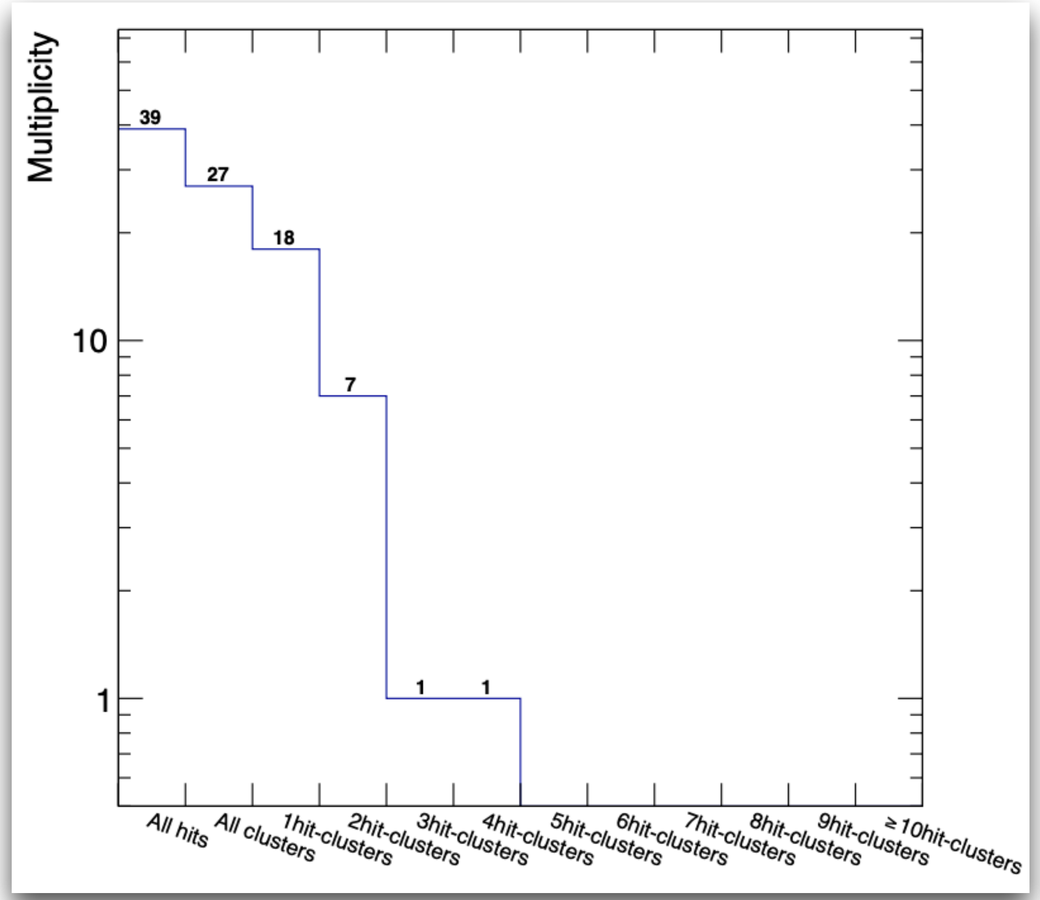
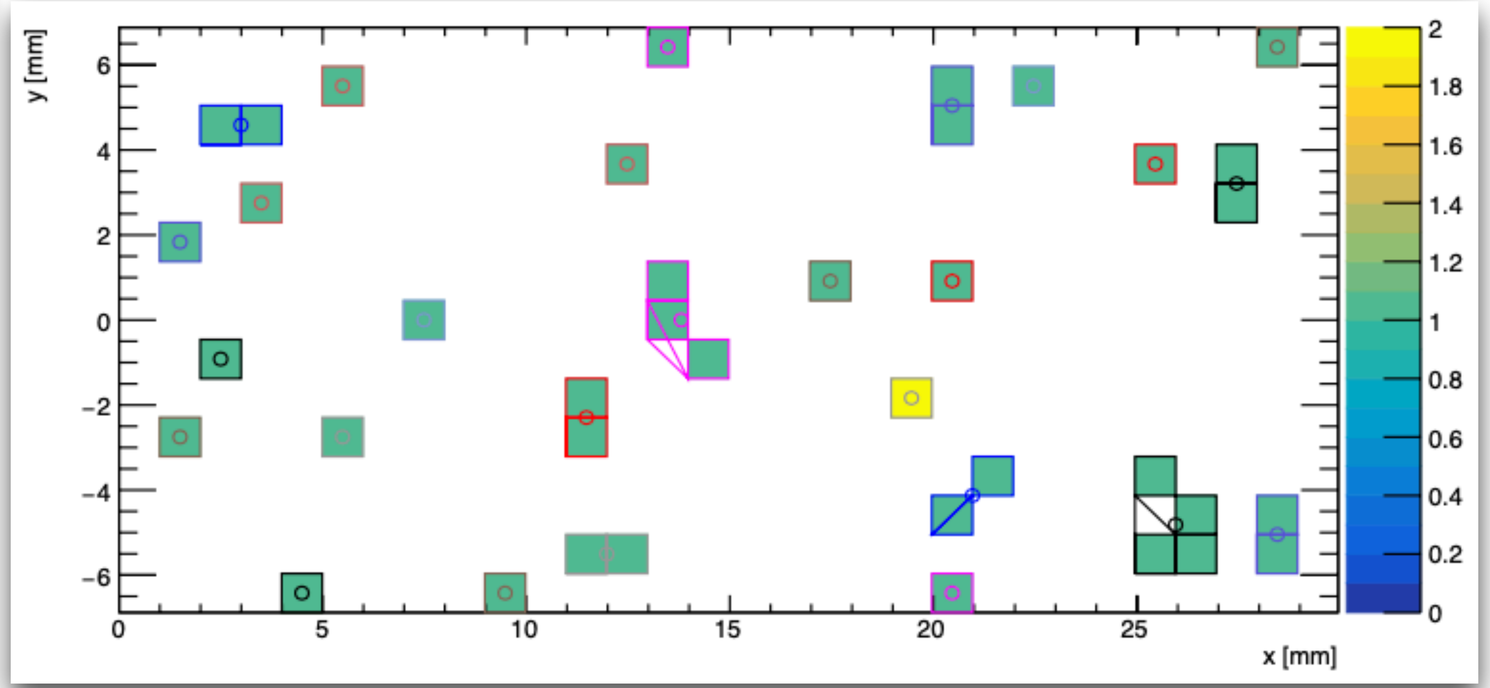


Figure 2: *Les formes de cluster générées par des particules du processus physique VS. l'arrière-plan de faisceau.*

Toy example

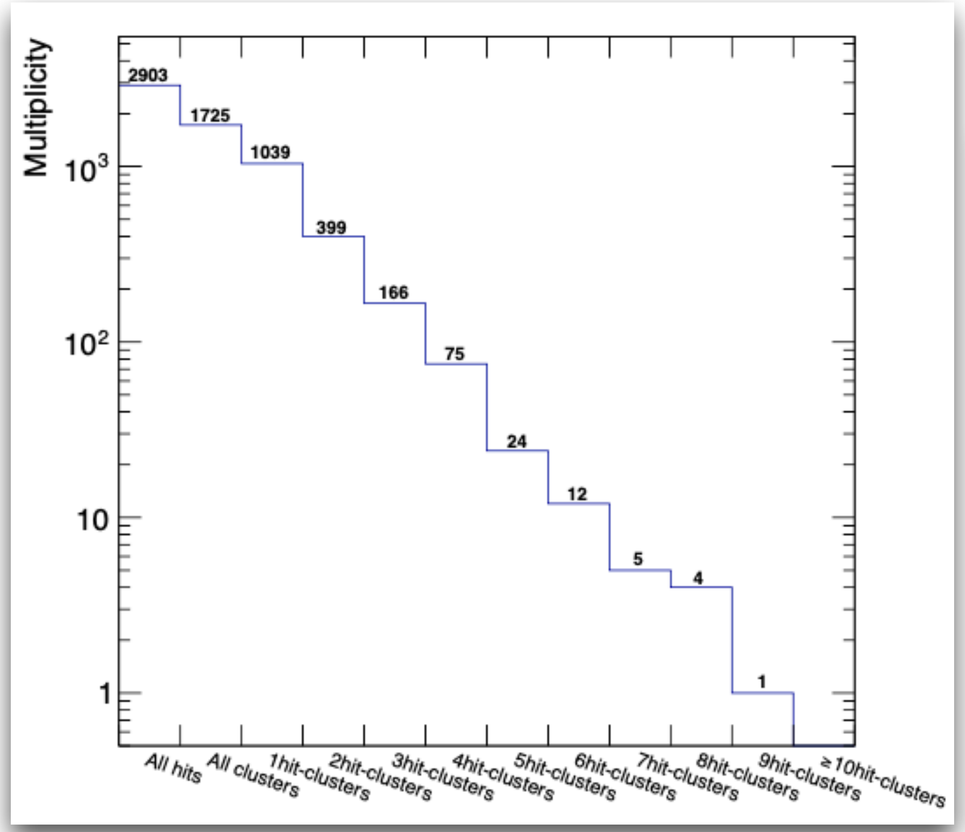
- 30 columns x 15 rows “chip”
- 40 hits drawn randomly (and uniformly) across the chip’s surface
- lines define the clusters, colours are random, points denote the CoM of the cluster

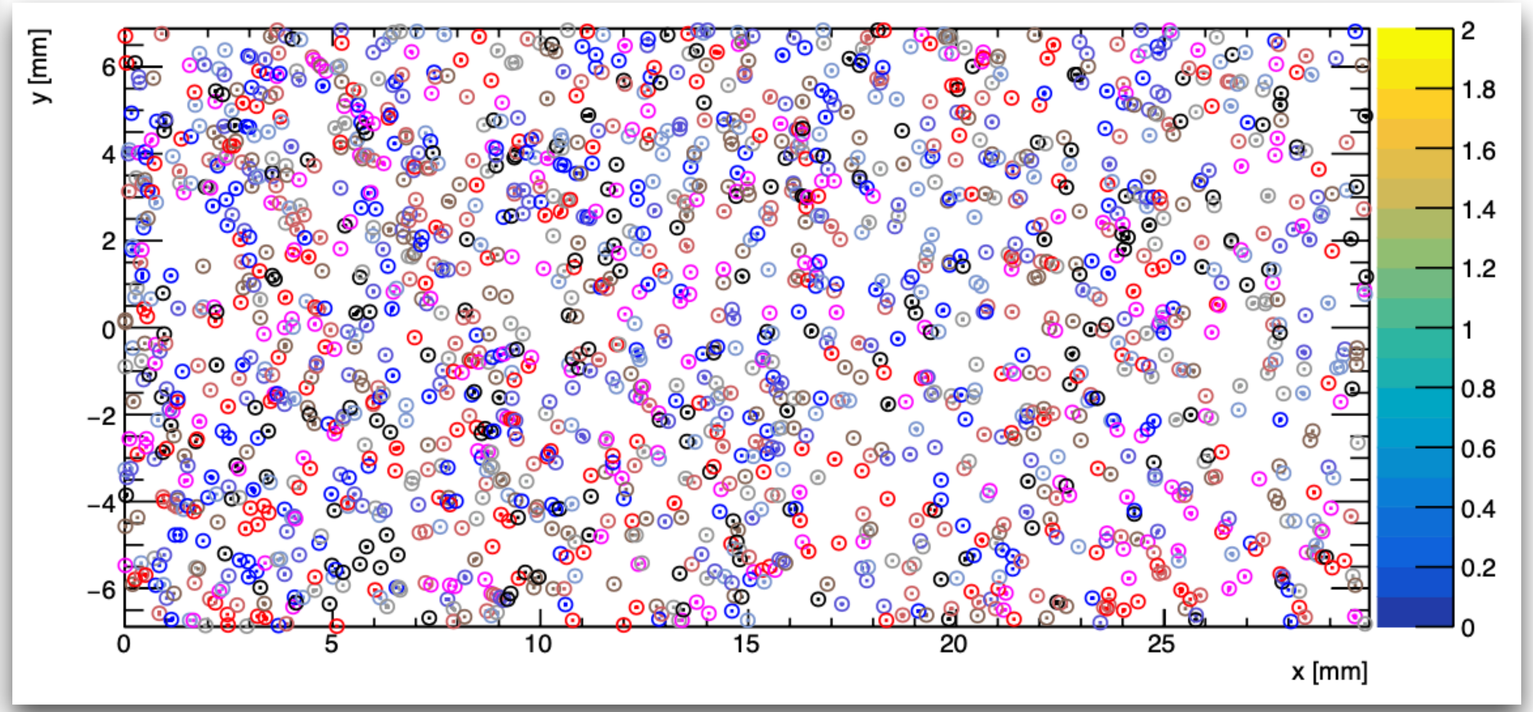




Example with e-beam bkg

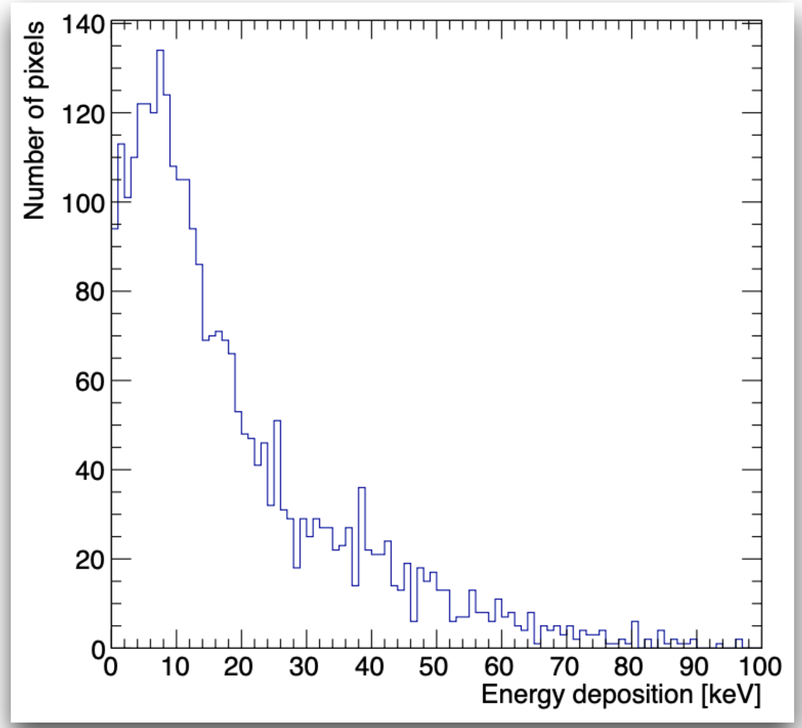
- live pixels are taken from the Hits tree
- **NOT** removing hot-spots if all tracks associated with a live pixel originate from a hot-spot in the setup as discussed multiple times
- chip has the proper 1024 columns x 512 rows

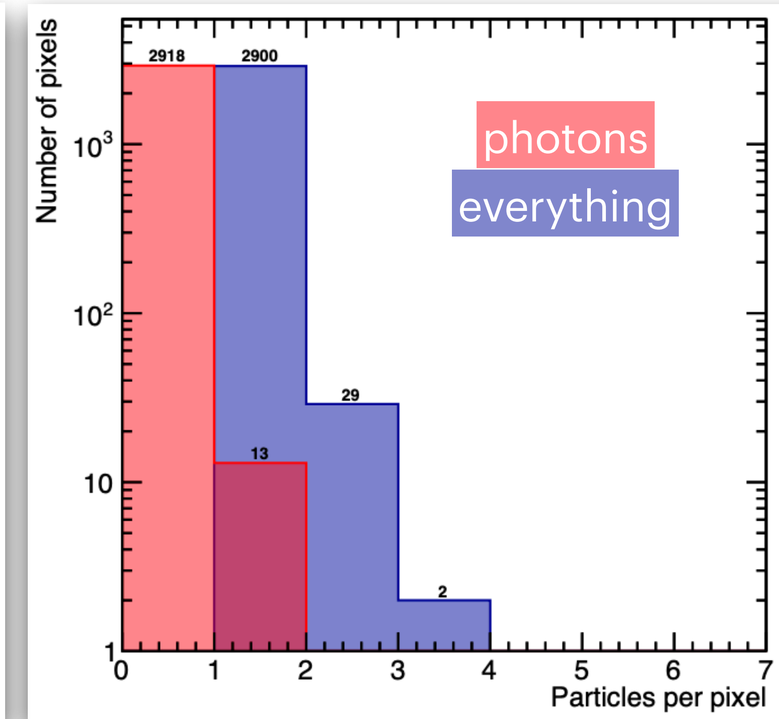


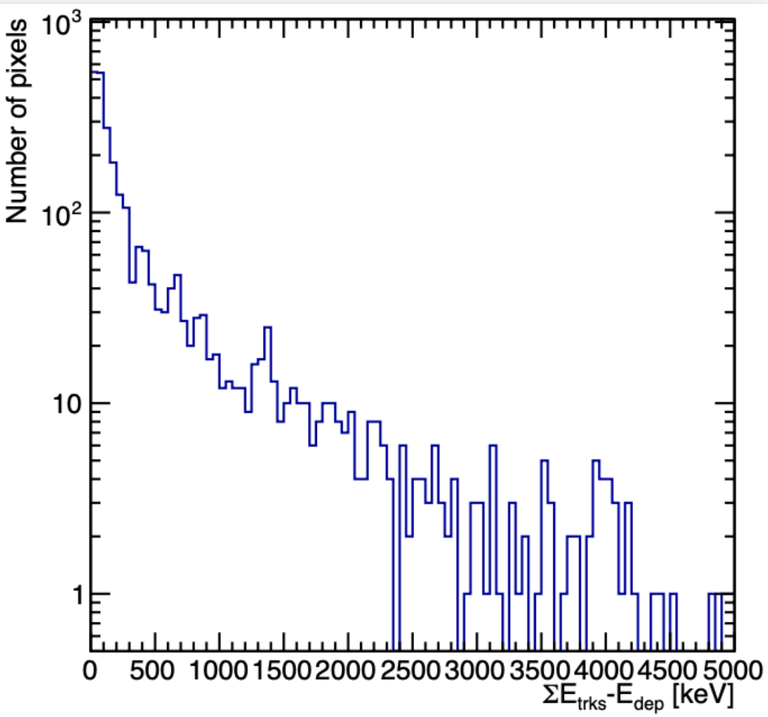


Example with e-beam bkg

- live pixels are taken from the Hits tree
- **NOT** removing hot-spots if the track(s) associated with a live pixel originate from a hot-spot
- ~99% of the pixels have only one particle associated $\Longrightarrow$ can check the origin of these!
- about ~0.5% of the single-track pixels have photons

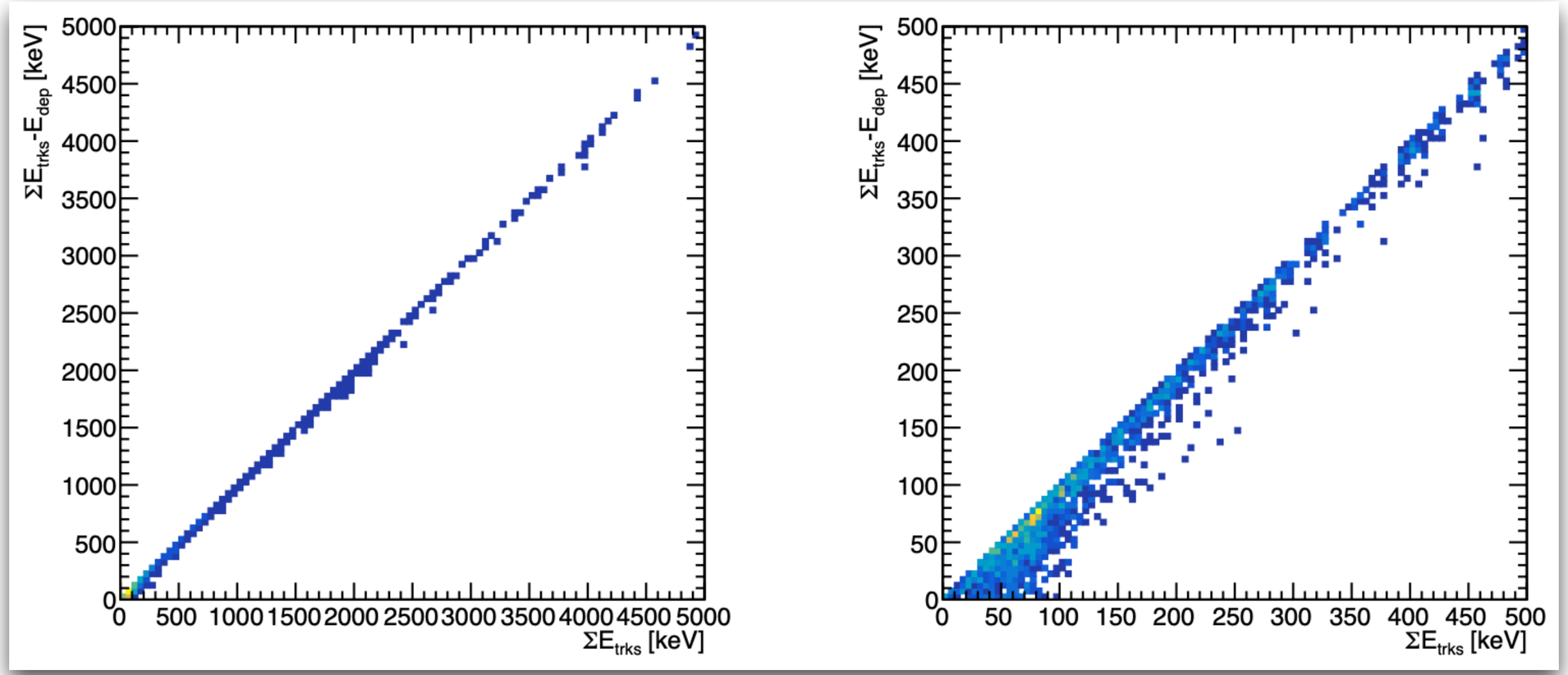






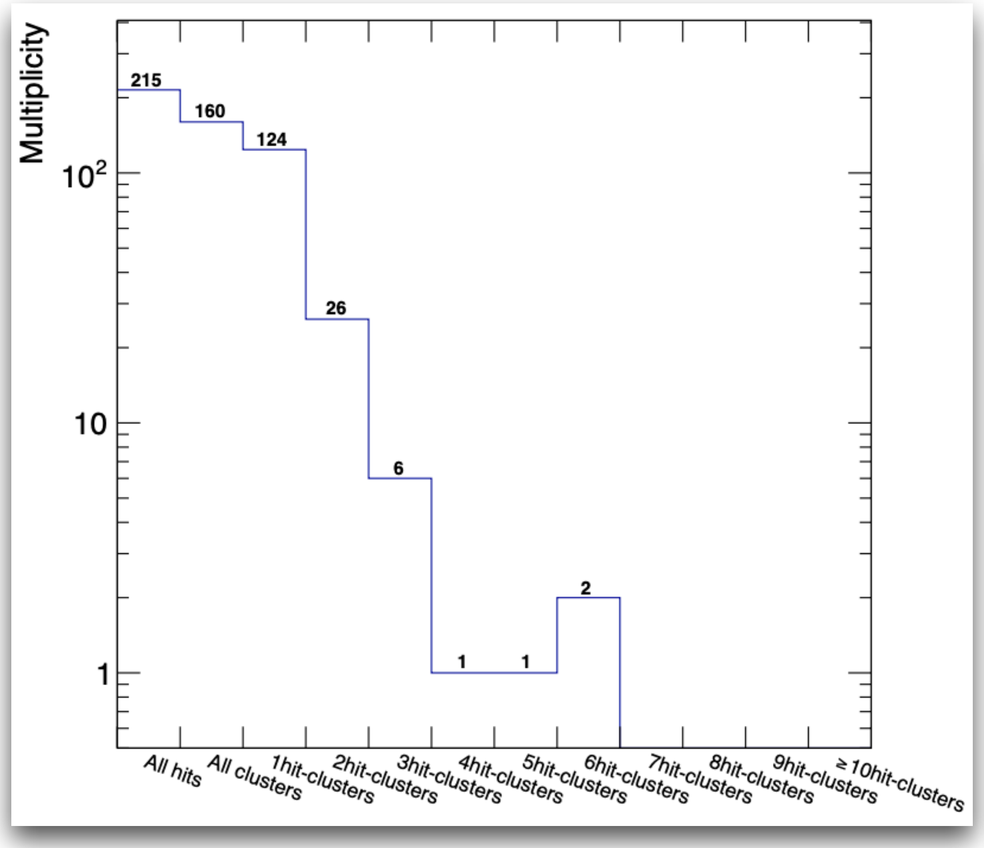
Example with e-beam bkg

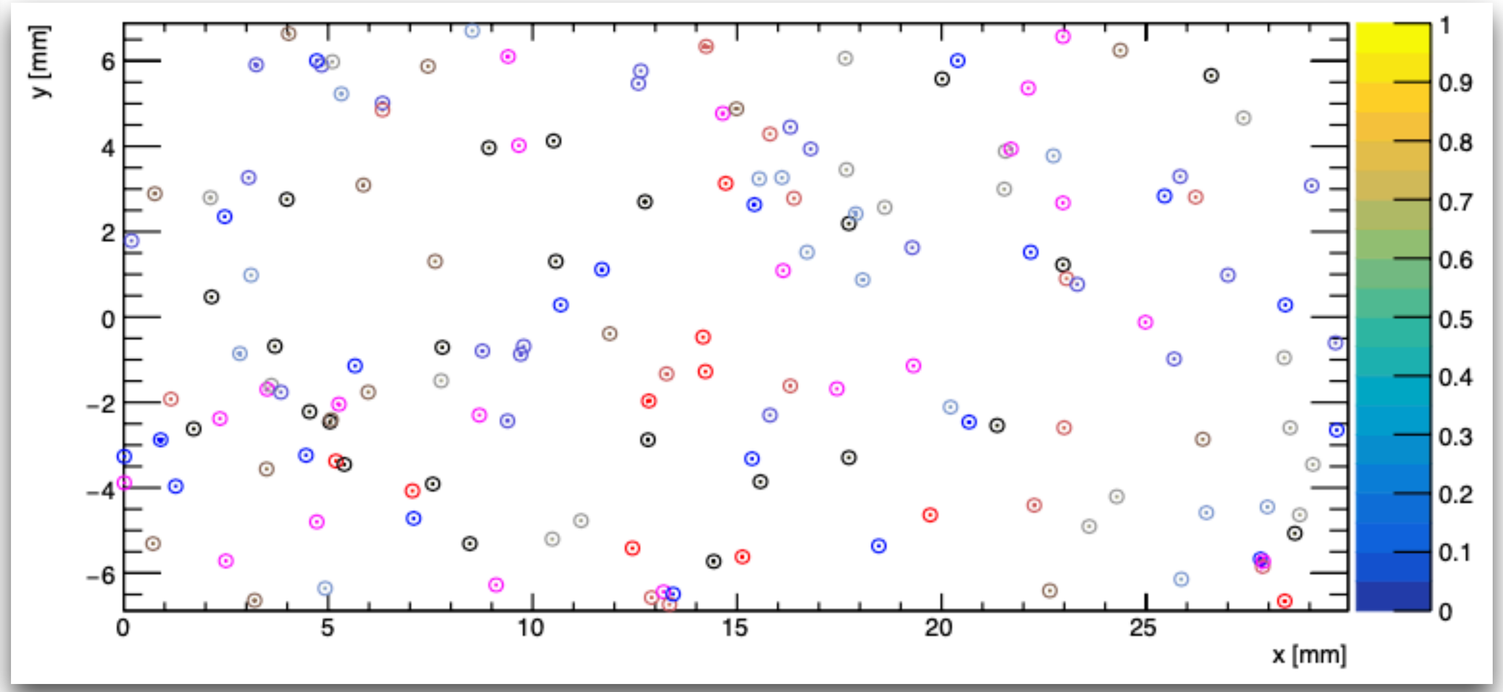
- live pixels are taken from the Hits tree
- **NOT** removing hot-spots if the track(s) associated with a live pixel originate from a hot-spot
- in almost all pixels the incoming particles lose all (or almost all) their energy



Example with e-beam bkg

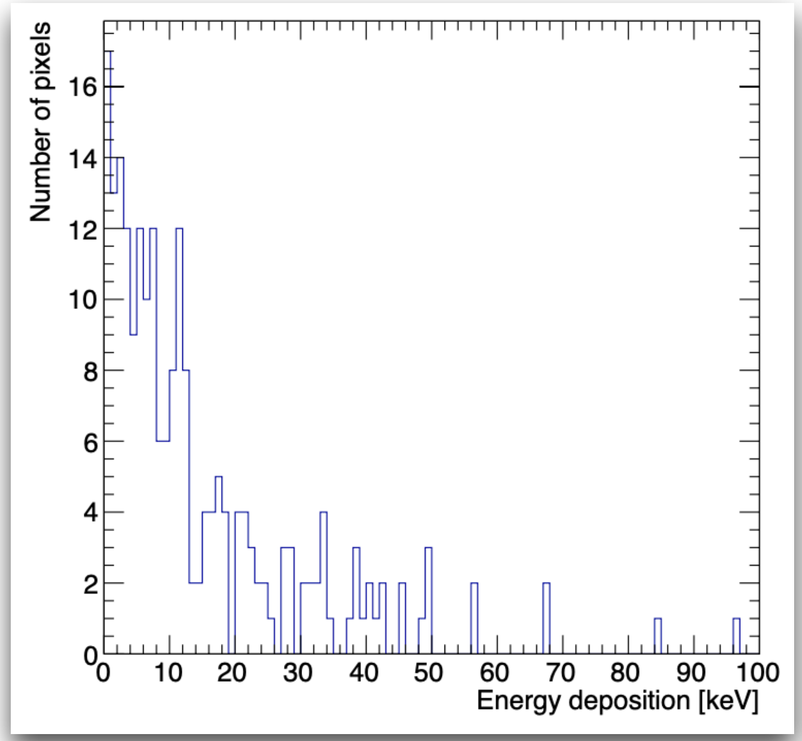
- now **WITH** removing hot-spots if all tracks associated with a live pixel originate from a hot-spot in the setup as discussed multiple times
- As expected, numbers reduce by a factor of ~10

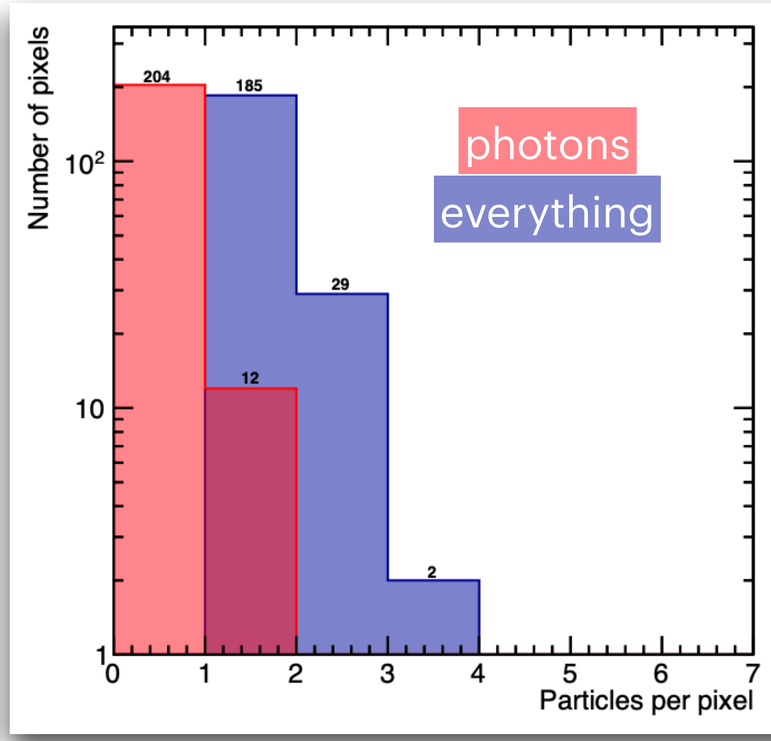


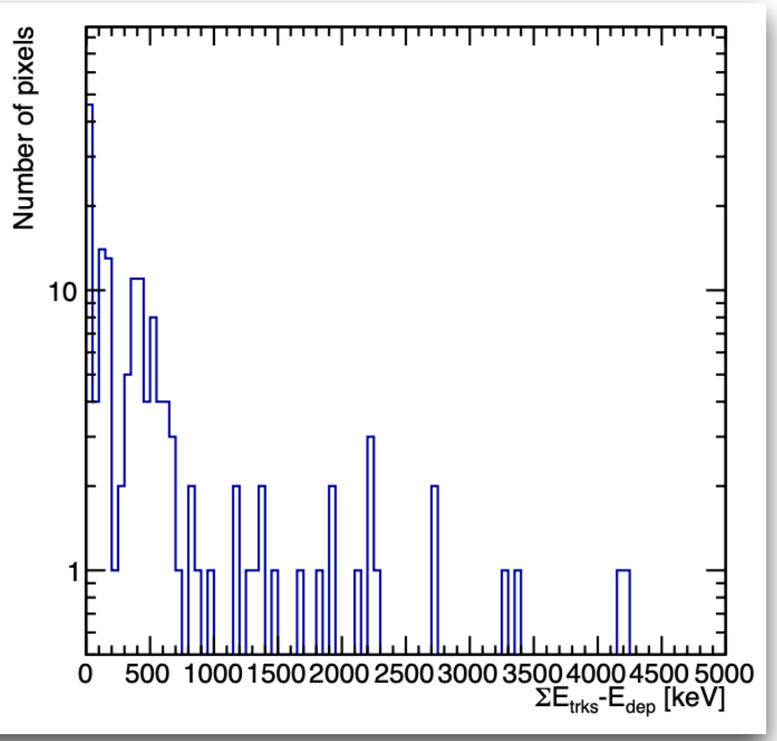


Example with e-beam bkg

- now **WITH** removing hot-spots if the track(s) associated with a live pixel originate from a hot-spot
- composition is a bit different







Example with e-beam bkg

- now **WITH** removing hot-spots if the track(s) associated with a live pixel originate from a hot-spot
- in almost all pixels the incoming particles lose all (or almost all) their energy