

Status of the analysis on MC tracks

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CYGNO Weekly Meeting

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Goal, Inputs & Tools

Goal is to use simulated tracks to:

1. find a procedure for particle ID (simple cuts to start with, then...);
2. estimate particle ID efficiency;

Inputs:

- G4 simulations: electron recoils @ different energies (1keV-100keV, 10^5 events per point)
- SRIM simulations: nuclear recoils @ different energies (1keV-100keV , 1k events per point)

SW tools

- Digitization (produce images starting from MC tracks, adding diffusion, background,...)
 - Runs on both root files from G4 and txt files from SRIM
- Analysis code from Igor&Emanuele
 - Need to interact with Emanuele to run reconstruction with updated code and DBSCAN parameters used for real data analysis
- Full chain running on the Roma Tre Cluster

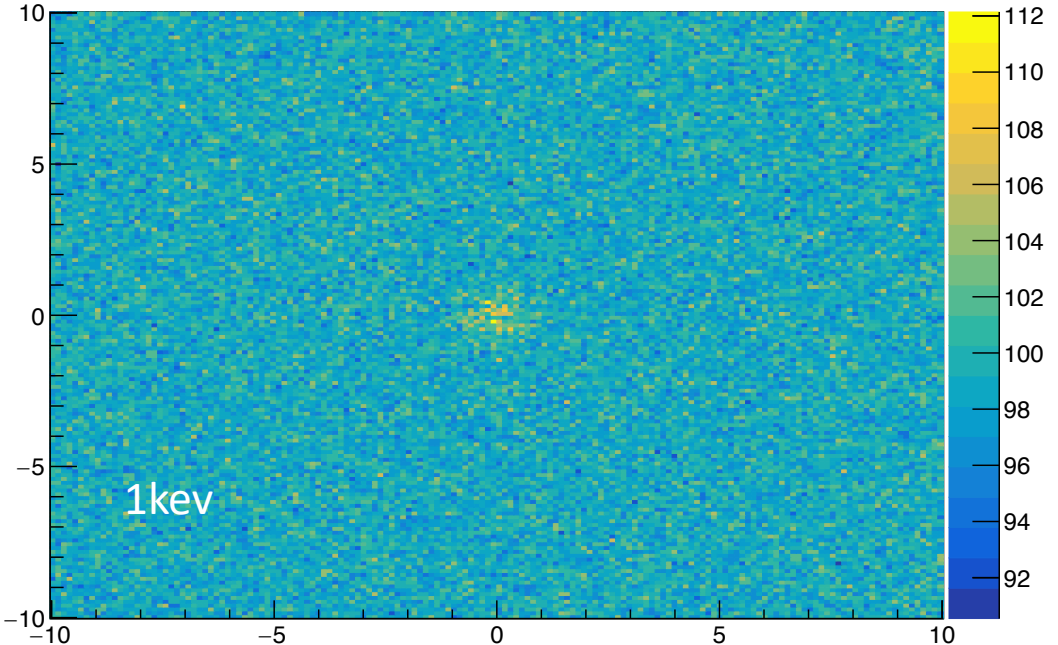
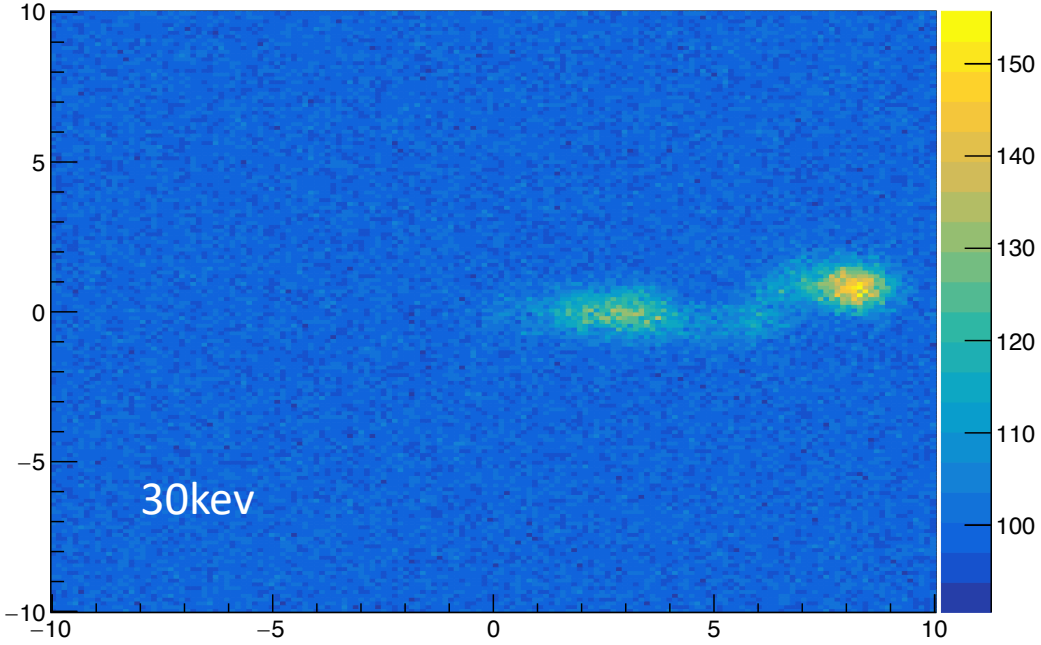
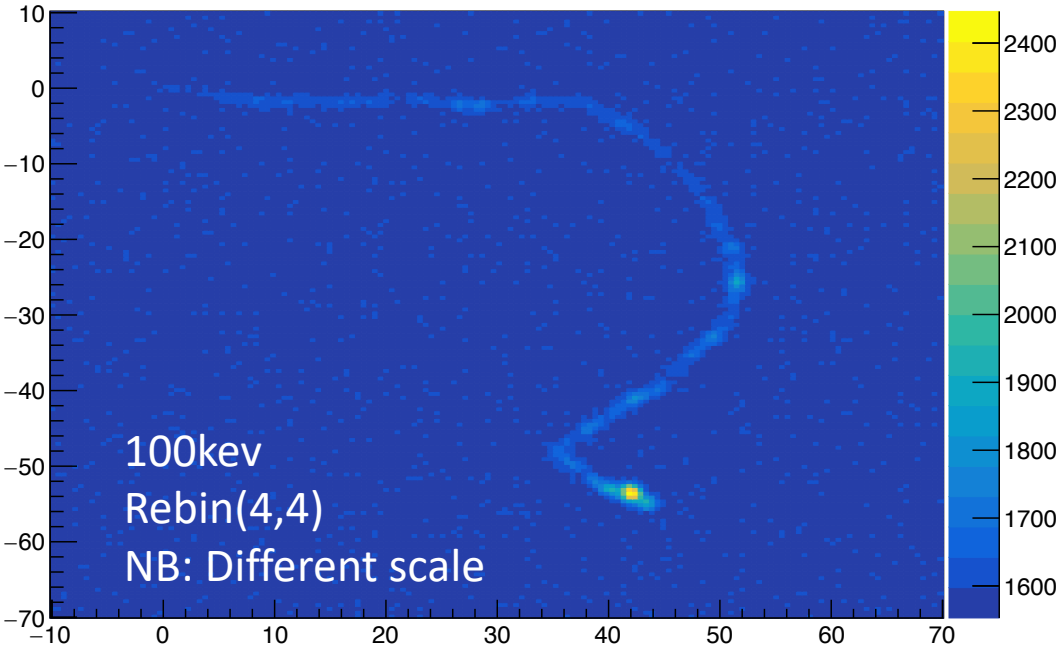
Digitization parameters

3 different configurations of the digitization for Orange, LEMON and Lime/CYGNO

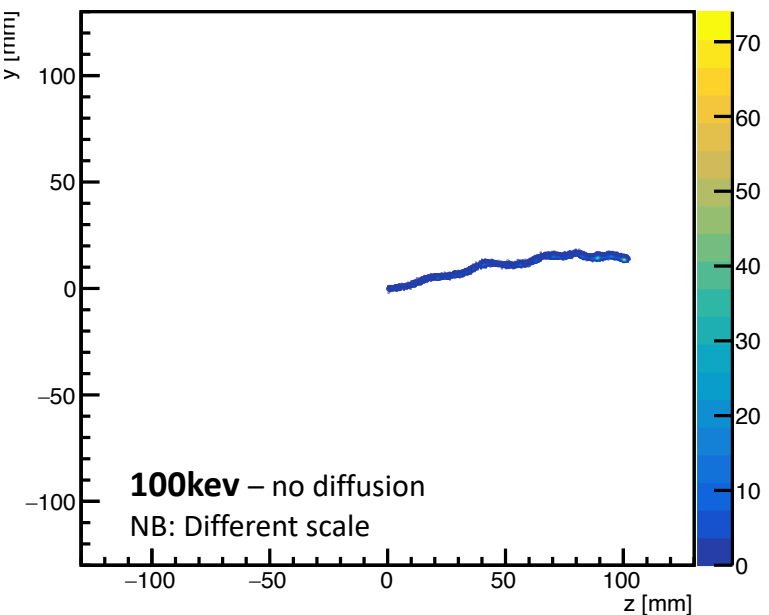
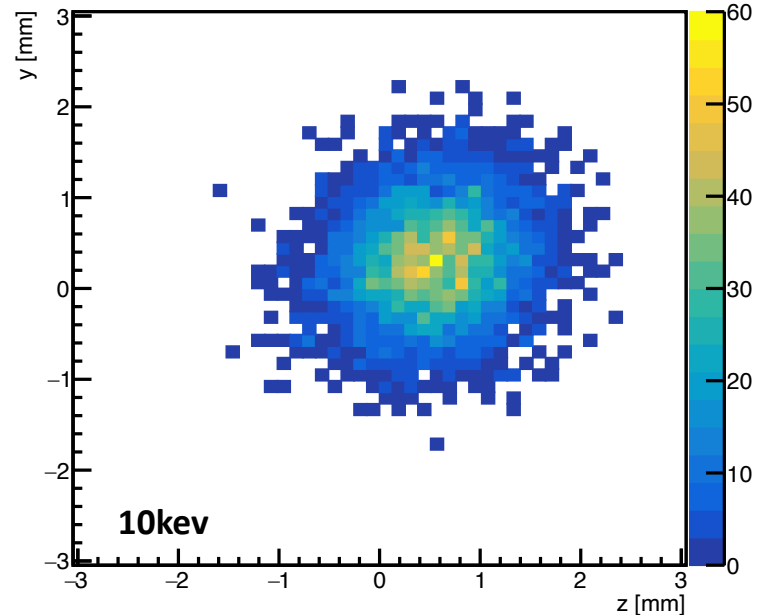
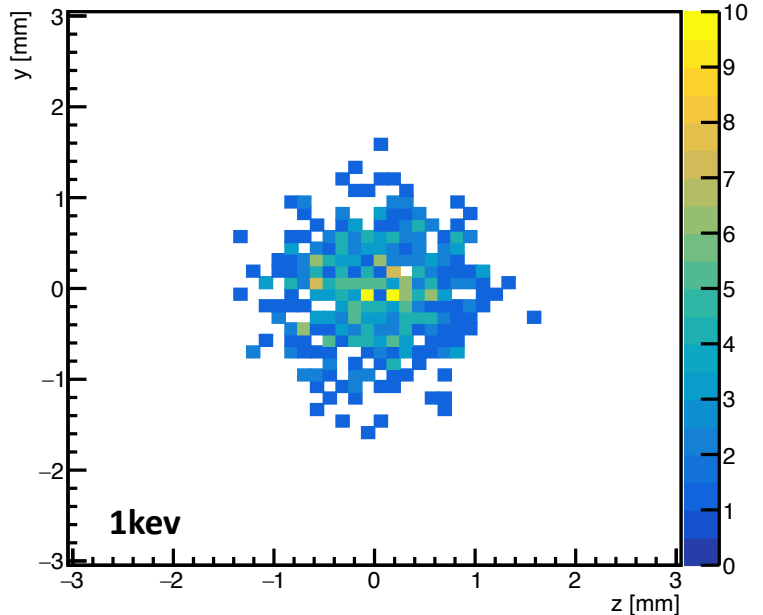
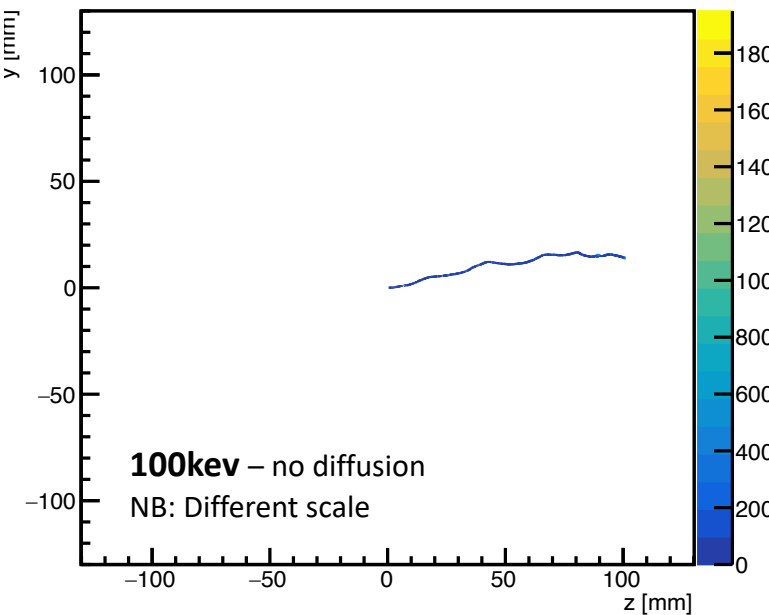
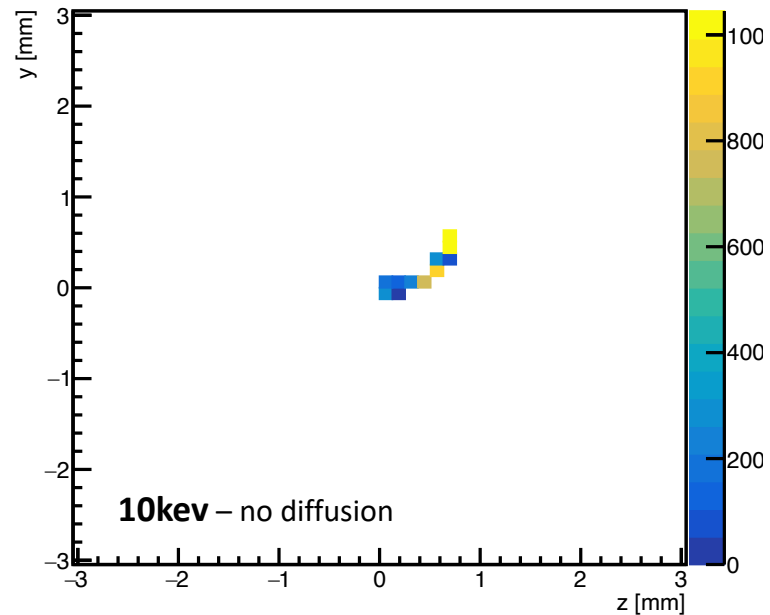
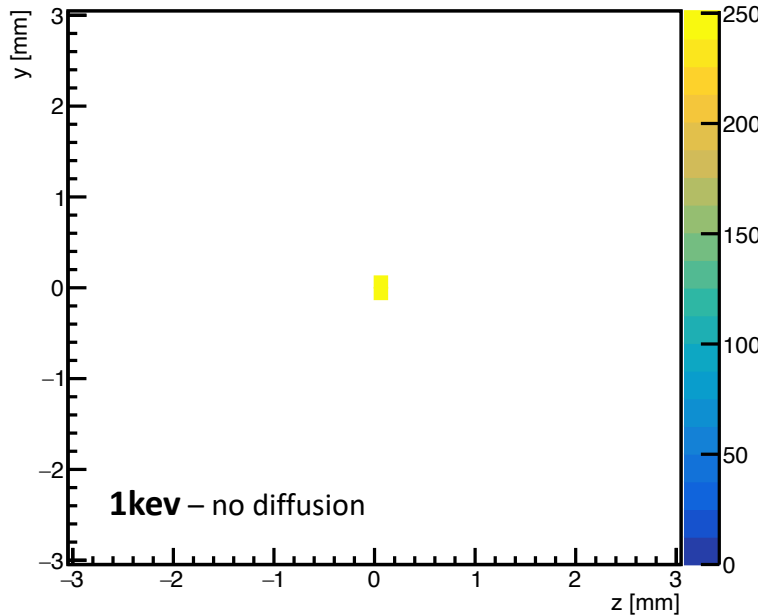
(Lemon parameters used in the following examples)

	Orange	Lemon	Lime/CYGNO
Diffusion parameter (mm)	0.11	0.5	0.8
Conversion factor (ph/keV)	$5.82 \cdot 3000 / 6$	$3000 / 6$	$0.56 \cdot 3000 / 6$
Electronic noise mean	99	99	99
Electronic noise sigma	2	2	2
Dimension of the detector (mm ²)	100*100	260*260	350*350
pixels	2048*2048	2048*2048	2048*2048

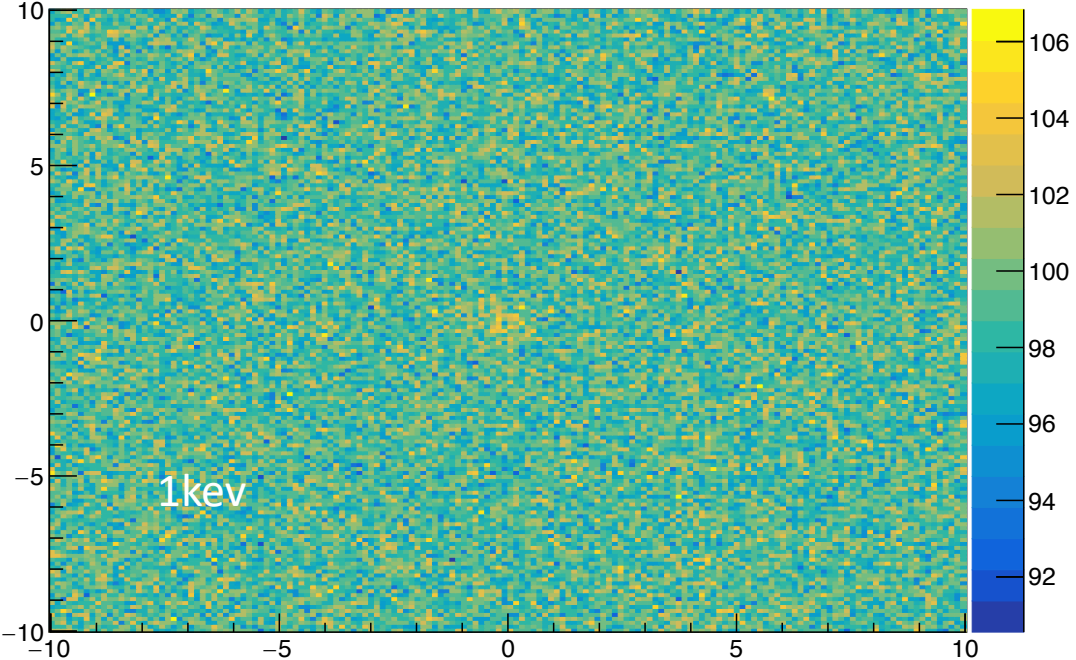
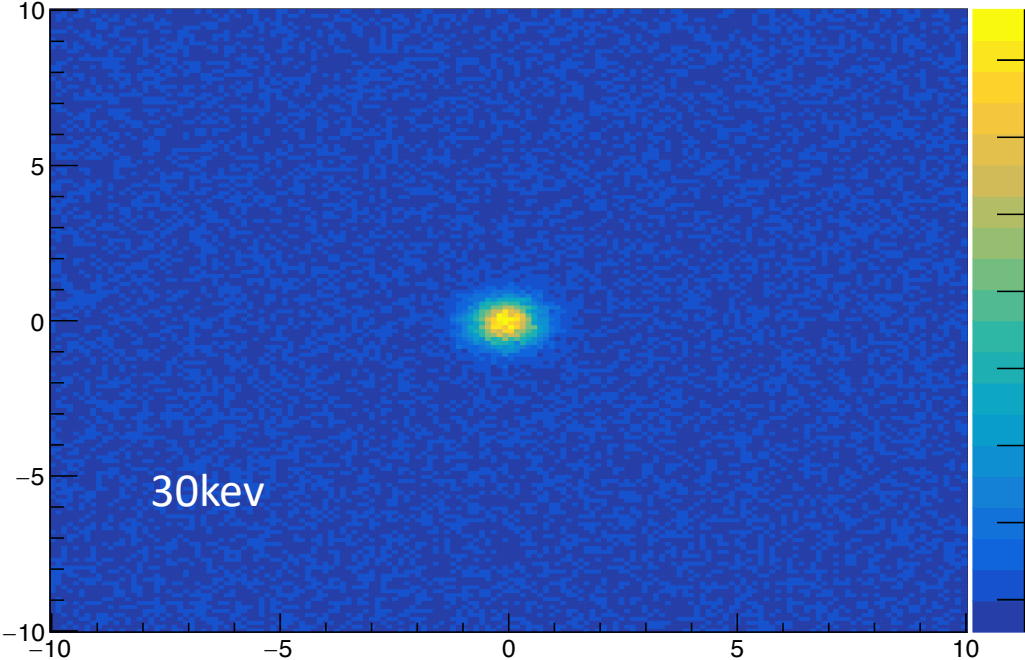
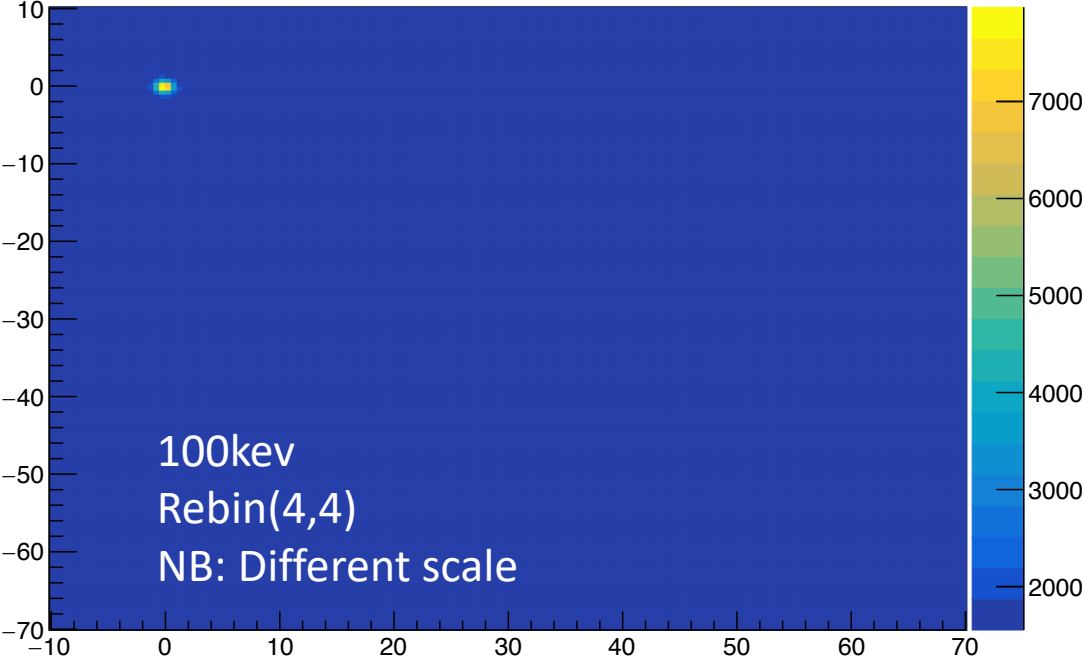
Electron recoils (G4)



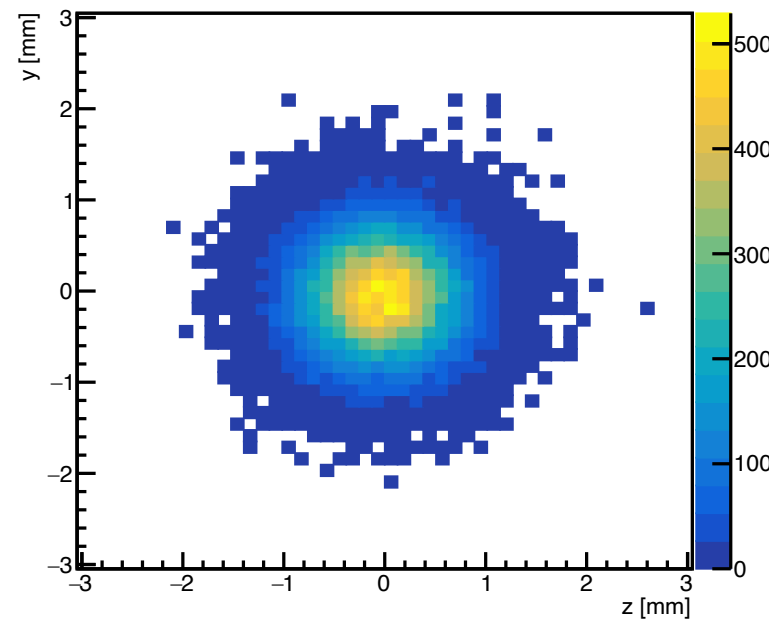
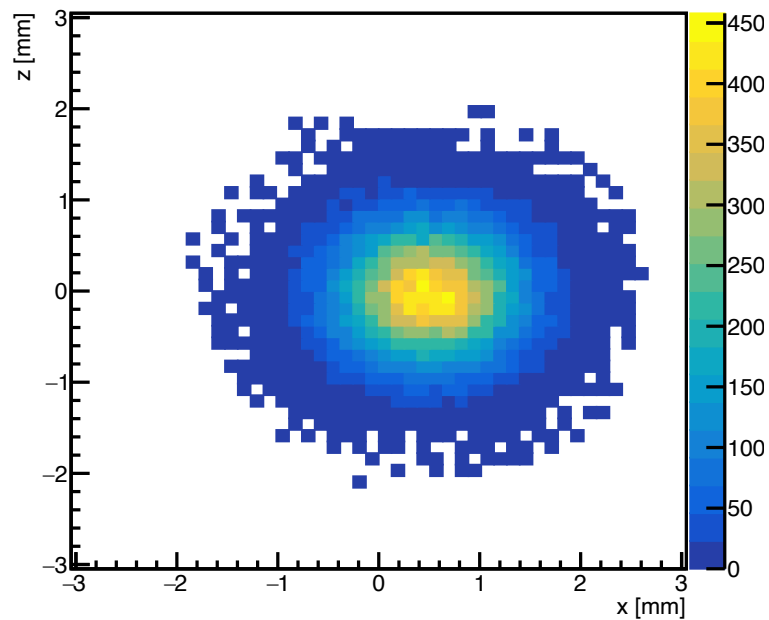
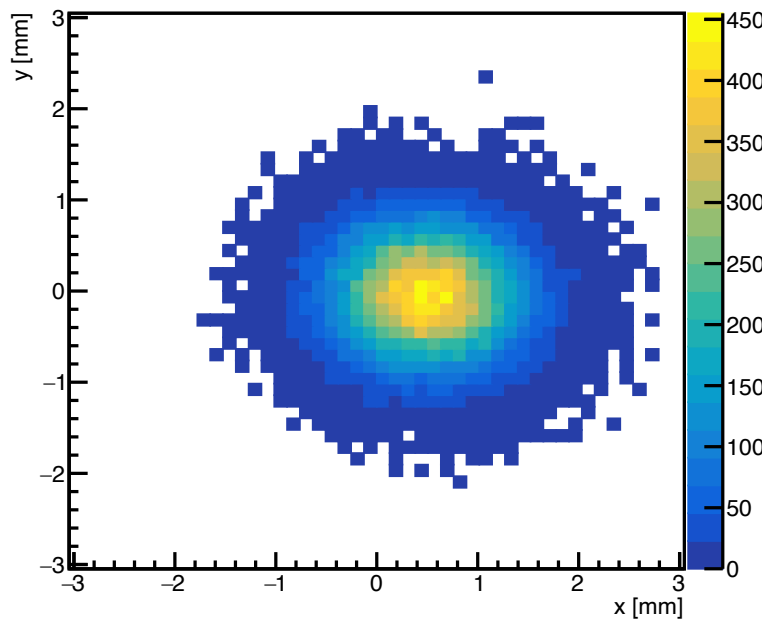
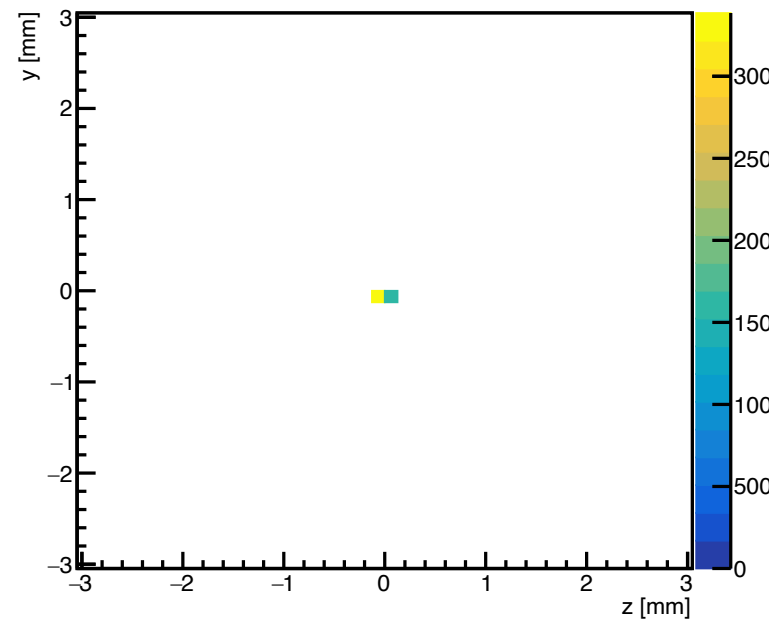
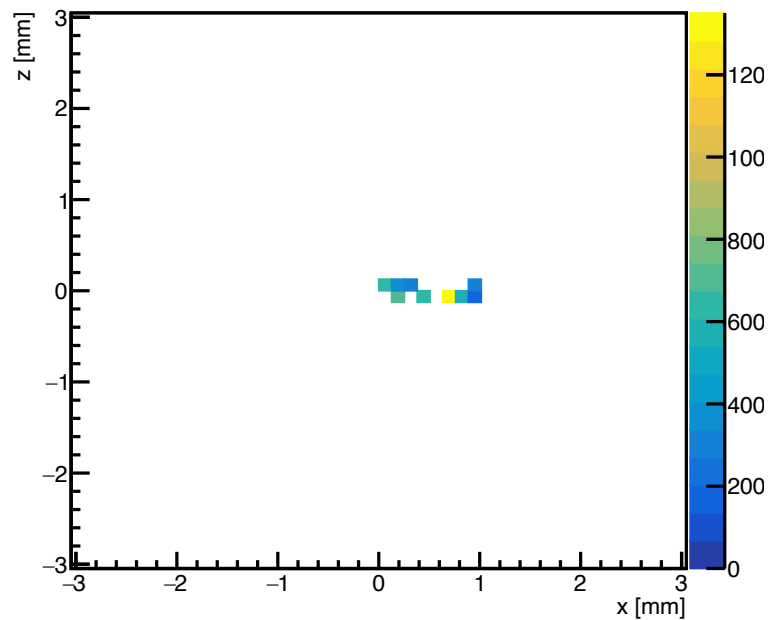
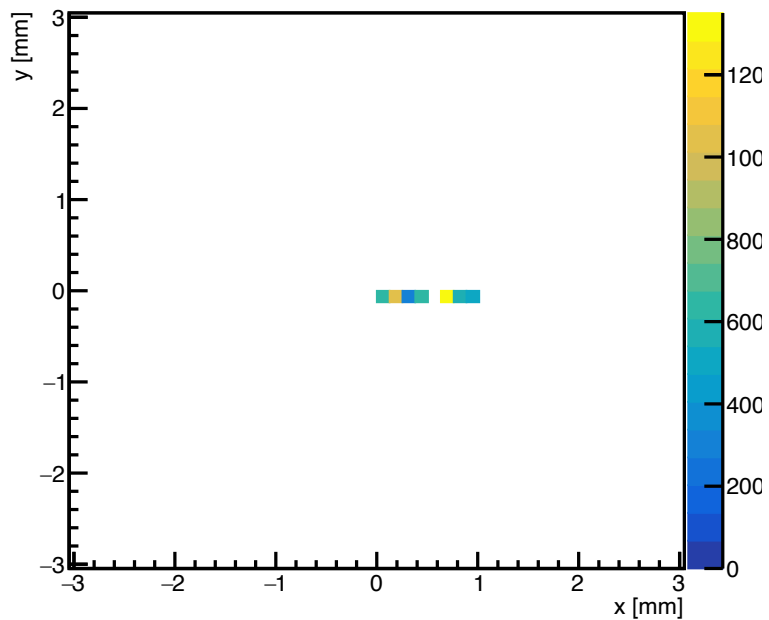
G4 Electron Recoils (no background...)



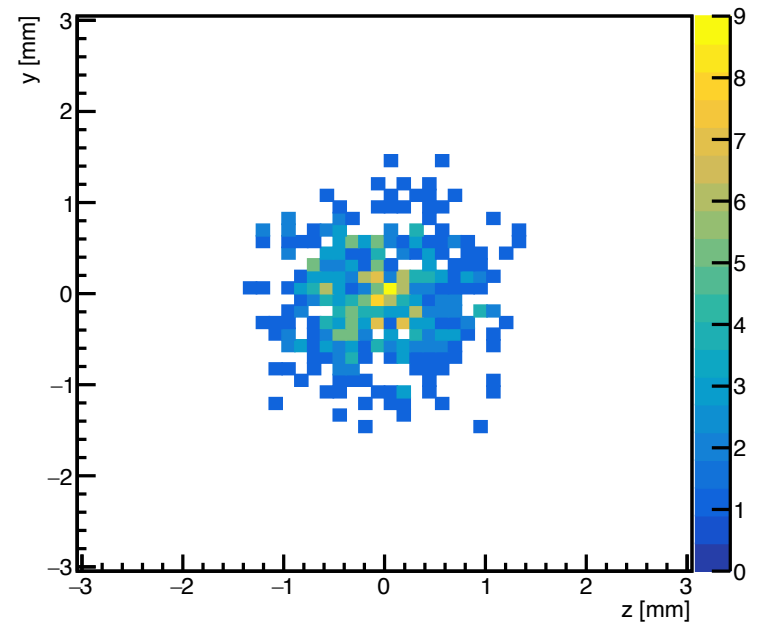
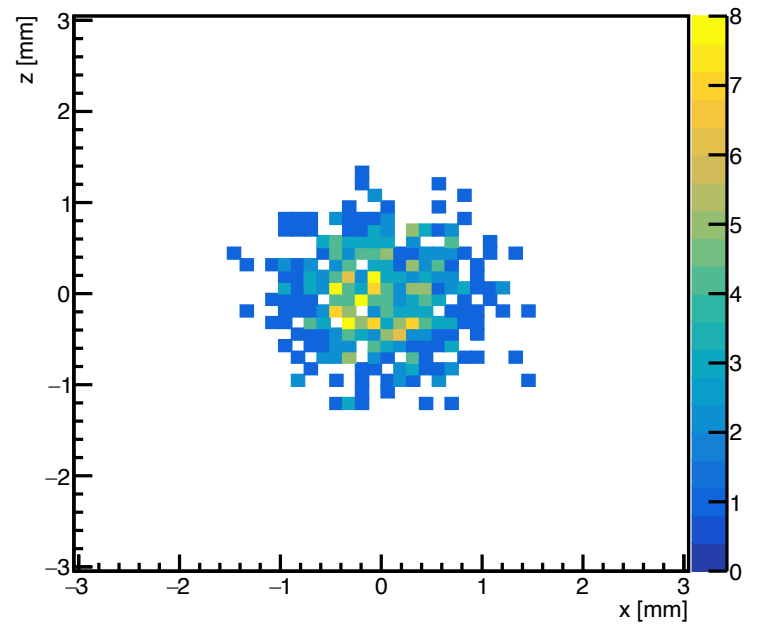
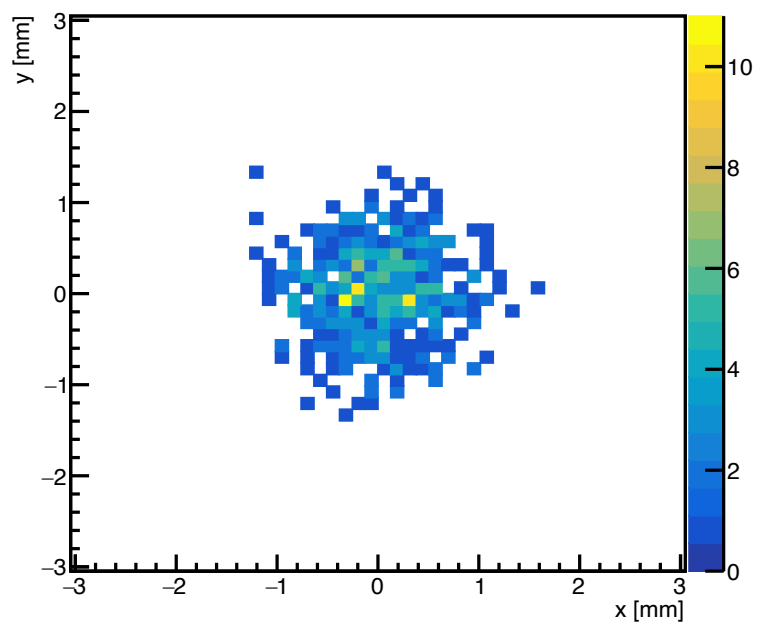
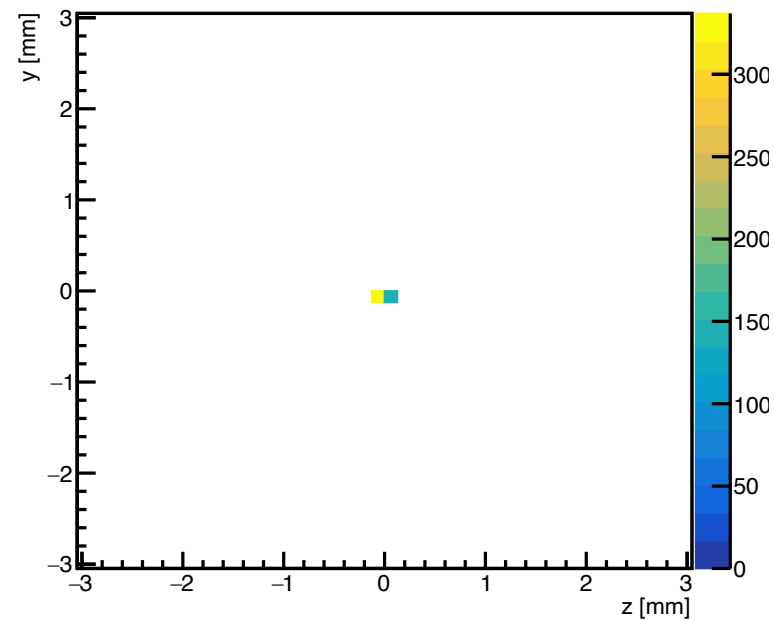
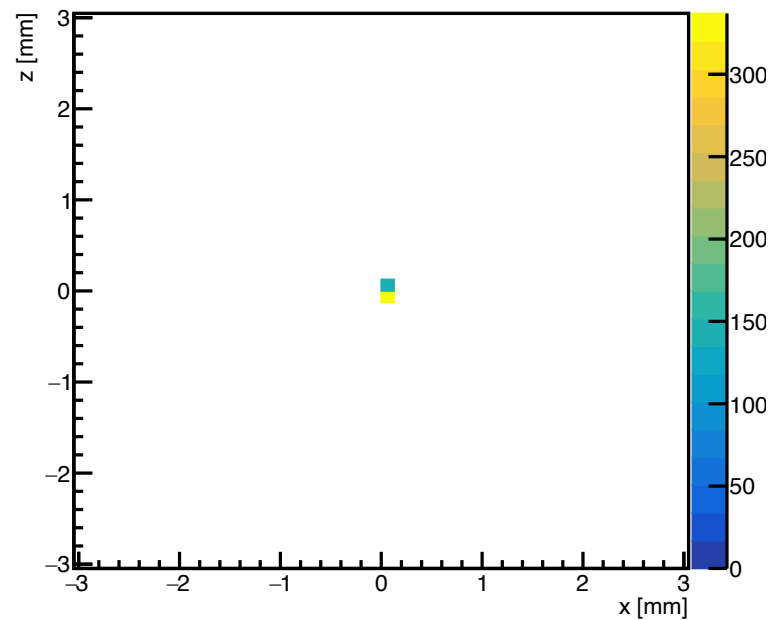
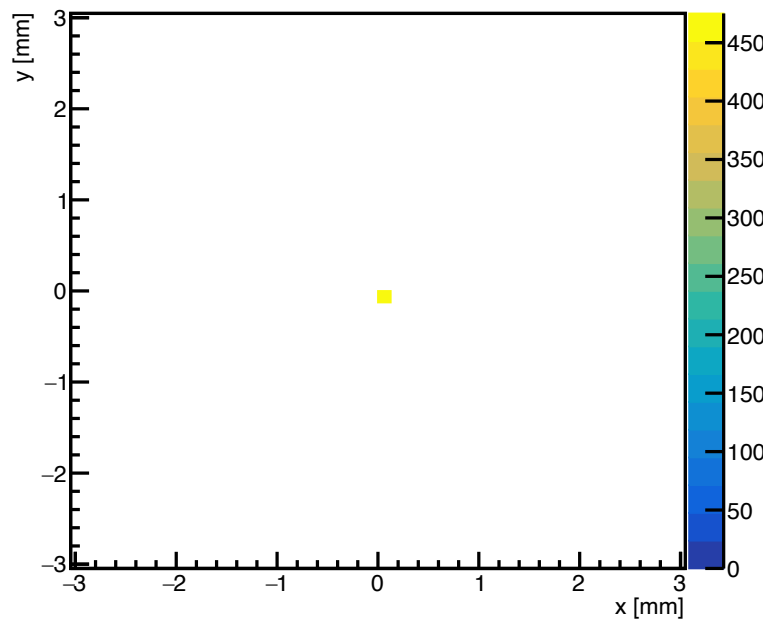
Nuclear recoils recoils (SRIM)



100 keV SRIM Nuclear Recoil (no background...)



1 keV SRIM Nuclear Recoil (no background...)



Disk storage

- Each image is large (~13 GB for 1k image)
- We should analyze $O(10^5)$ images of ER per energy value \rightarrow ~1TB per point
- We already using ~4.5TB for CYGNO MC data (shielding simulations, etc...) on the Roma Tre cluster
- If we want to keep all the images, we basically already fill up our share (we asked for ~6TB with an addition of 2-3 TB if needed).

So:

- 1) Can we delete something?
- 2) How much more space do we think we need for CYGNO simulations?
- 3) Is there a smart way to compress the images? (not that I'm aware of)

Maybe we have to run digitization & reconstruction in one go, without saving the images (not all of them anyway).

I would avoid it because it would slow down the analysis (we will have to run reconstruction many times...)

Outlook & last remarks

- The machinery is in place;
- Need to check/optimize the parameters of the clusterization algorithm, start from parameters used for online reconstruction.

- SRIM NR images are available on the Roma Tre cluster:
 /storage/scratch/petrucci/CYGNO-MC-digitization-fullstat/signal_He_60_40

- I should still commit in GIT the latest version of the digitization code...