Simulation update

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CYGNO general meeting 09/04/20

Simulation activities overview

- Reconstruction & analysis of CYGNO MC data (Fabrizio, Giulia, Emanuele)
  ➜ study performance of reconstruction algorithm

Other activities in progress (no updates for today):

- Simulation of PMT (Brazilian group)
- Calibration sources for CYGNO (Flavio)
- Simulation of LIME (André)
- limits calculation, including background estimates (Giorgio)

Digitized MC

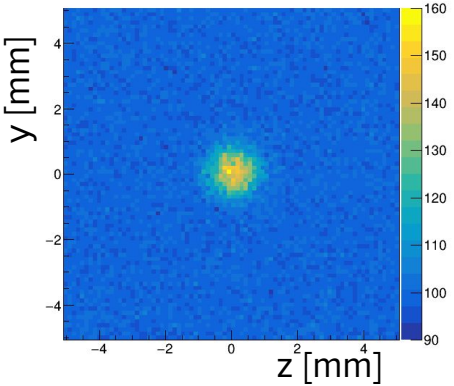
Datasets:

- **Electron recoils** (GEANT4) of 1, 3, 6, 10,30, 60, 100 keV
- He **nuclear recoils** (SRIM) of 1, 3, 6, 10,30, 60, 100 keV

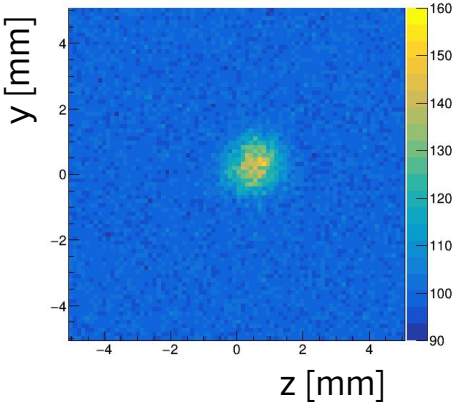
Digitization parameters: LEMON **with noise** and **without noise**

	Orange	Lemon	Lime/CYGNO
Diffusion parameter (mm)	0.11	0.5	0.8
Conversion factor (ph/keV)	5.82*3000/6	3000/6	0.56*3000/6
Electronic noise mean	99	99	99
Electronic noise sigma	2	2	2
Dimension of the detector (mm2)	100*100	260*260	350*350
pixels	2048*2048	2048*2048	2048*2048

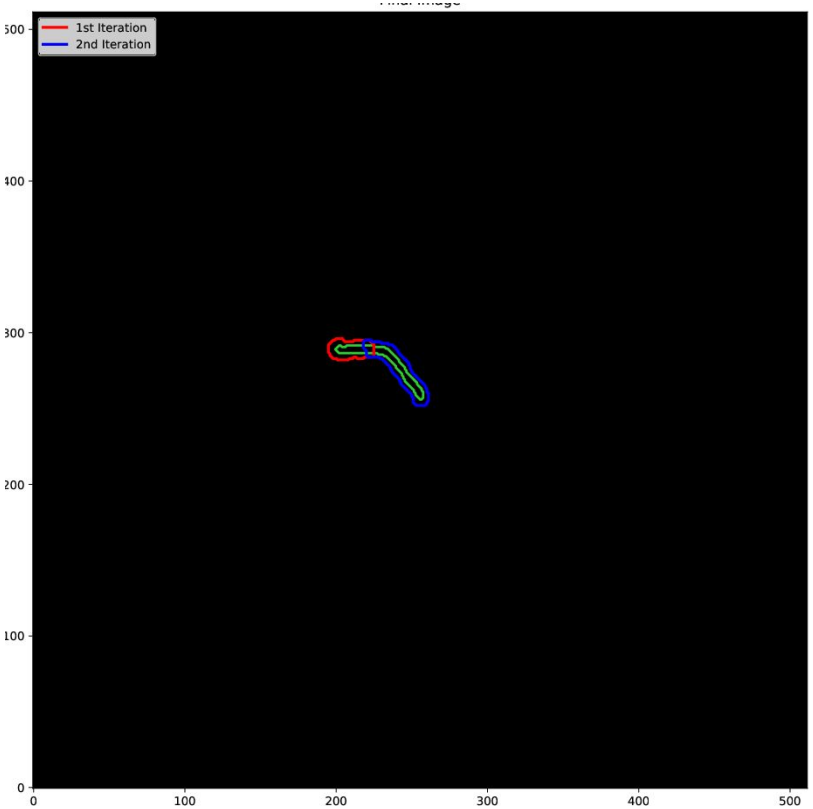
NR 10 keV Diffusion, + noise

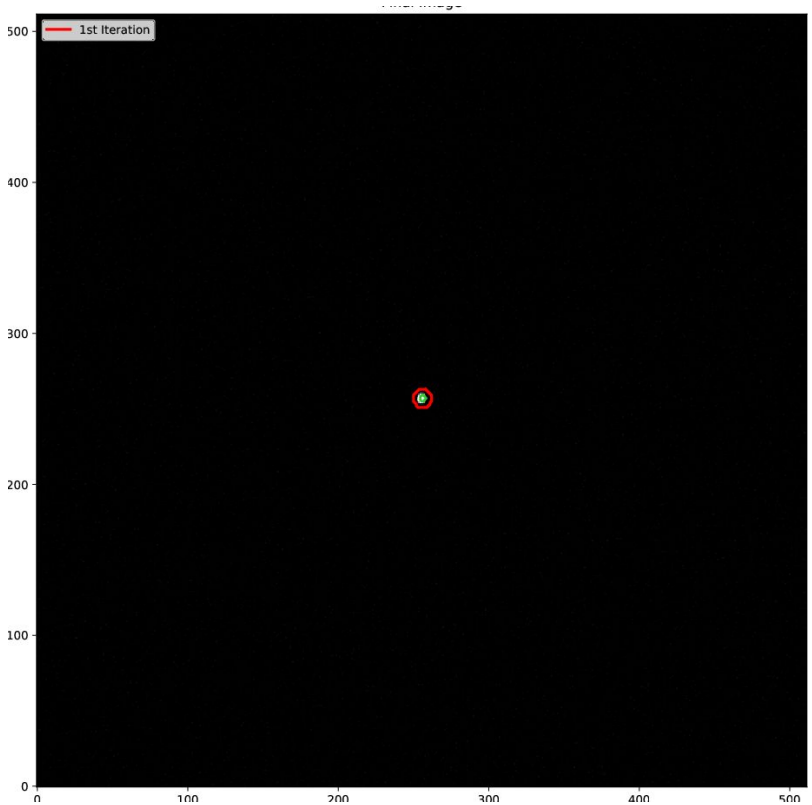


ER 10 keV Diffusion + noise



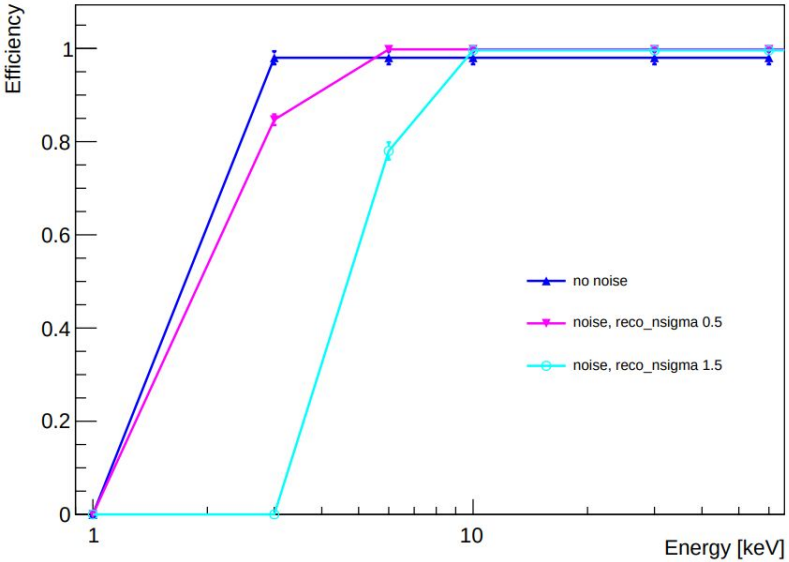
Some examples



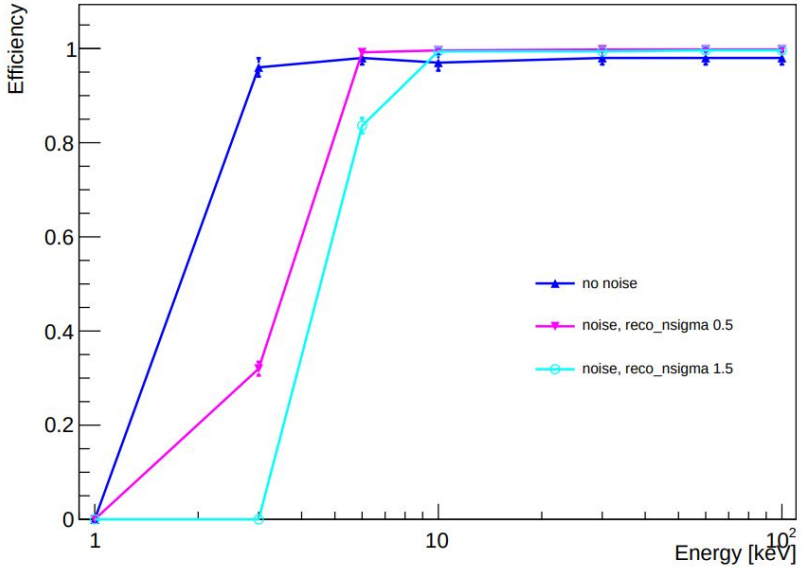


Cluster reconstruction efficiency

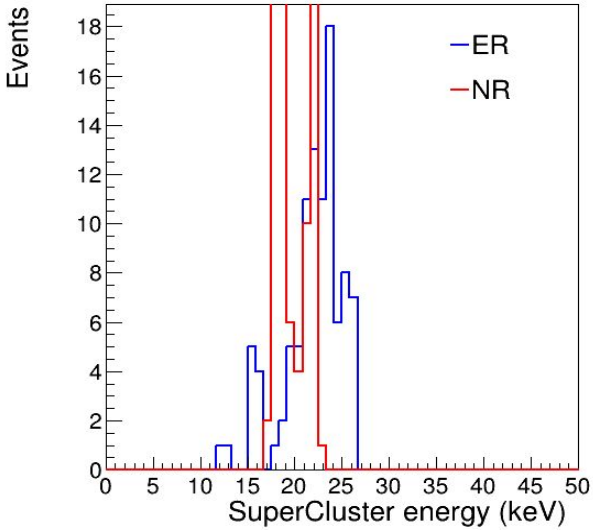
Electron recoils

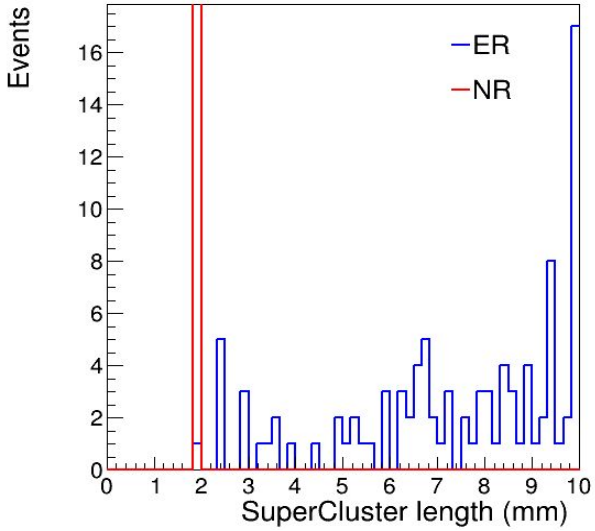


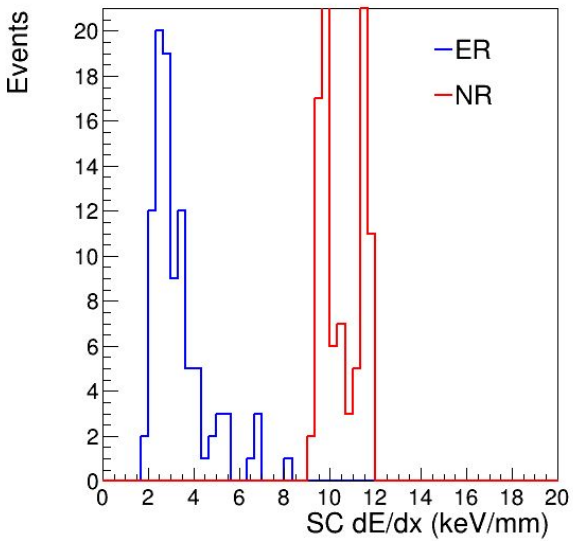
Nuclear recoils



NR vs ER 30 keV no noise

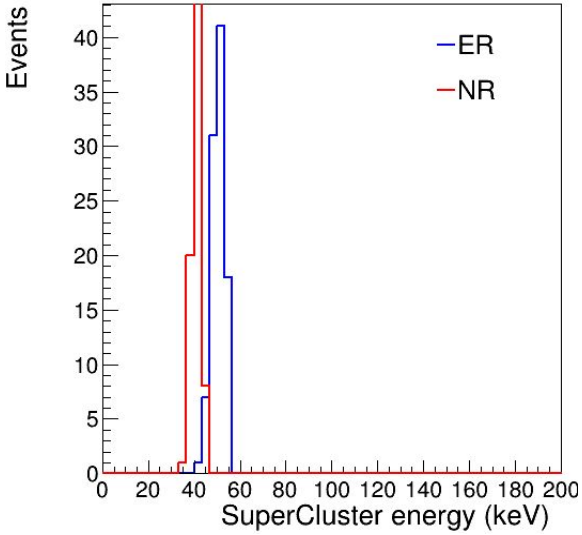


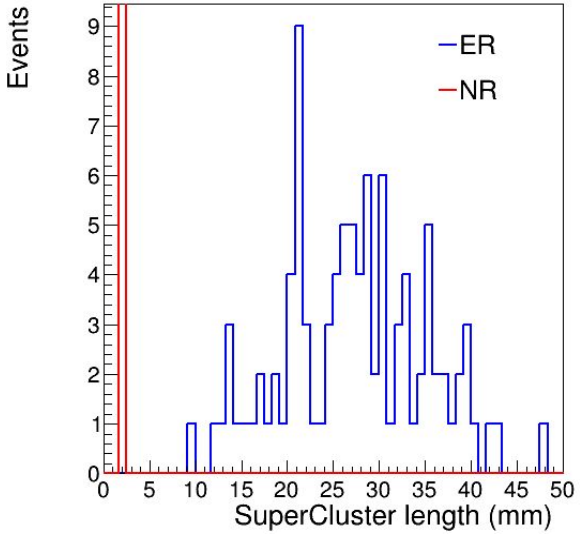


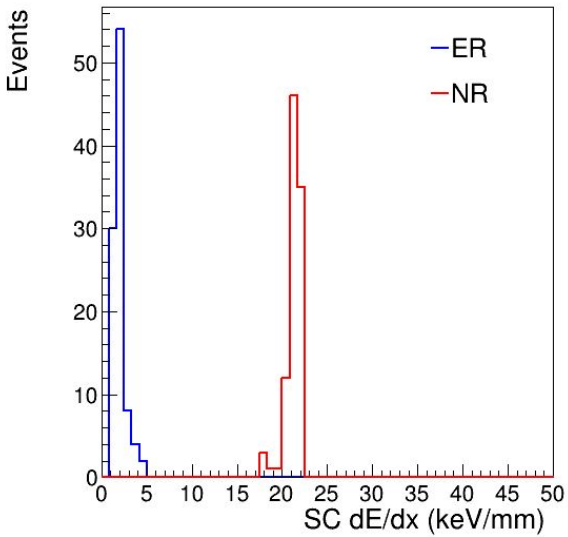


All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped0sigma0/

NR vs ER 60 keV no noise





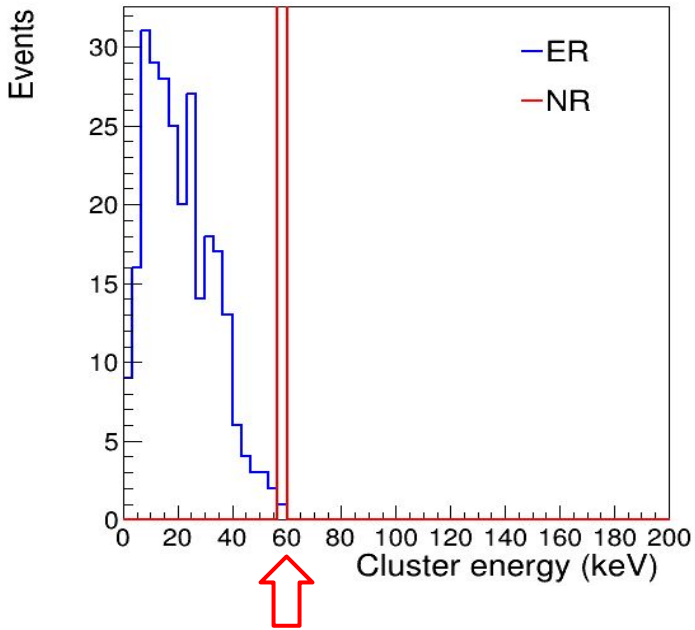


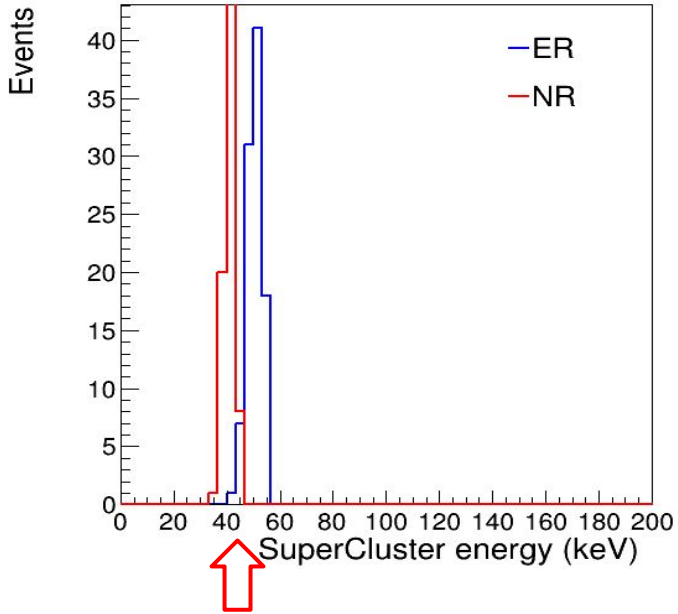
All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped0sigma0/

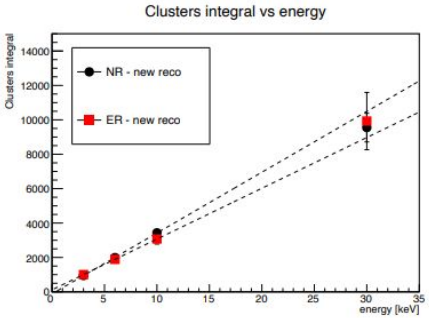
Cluster vs SuperCluster energy reconstruction

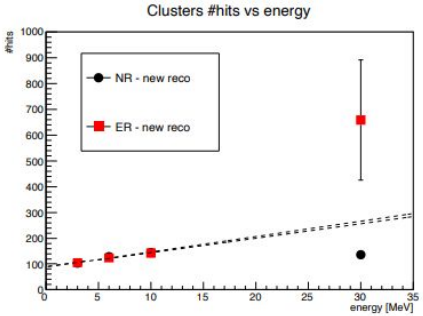
Seems that the SC definition is too tight

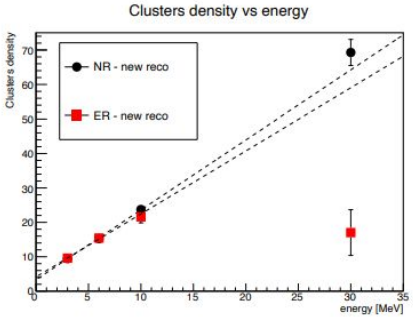
➜ compare cluster and SC energy for NR (typically made of one “round” cluster)

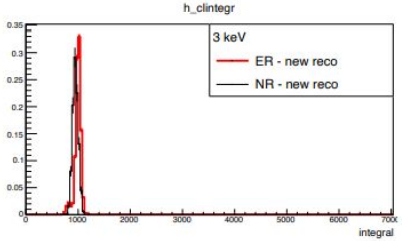


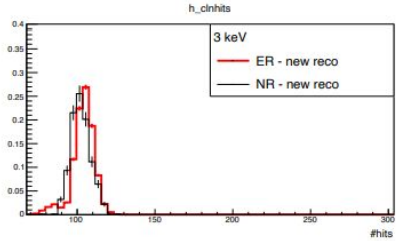


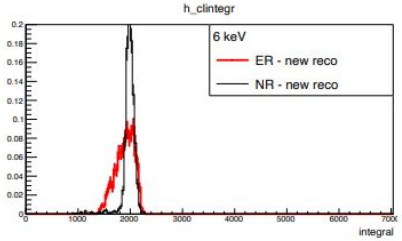


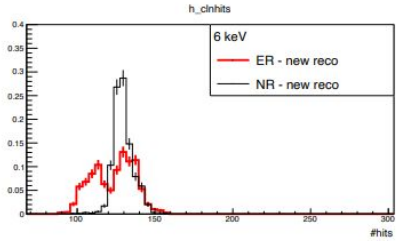


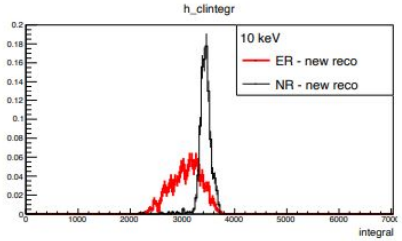


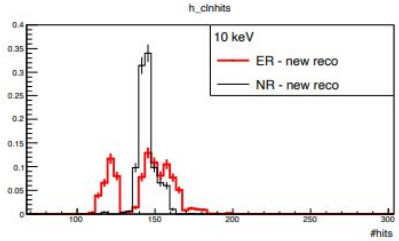


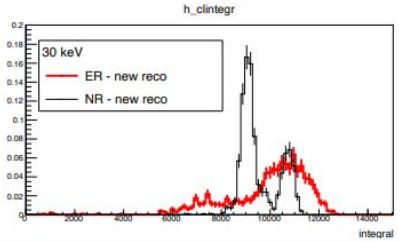


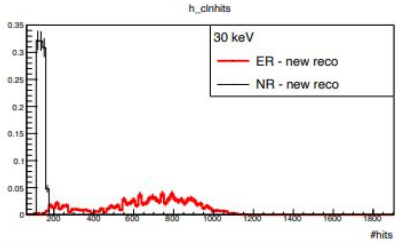












NR-ER comparison
(“new” recostruction code)

Conclusions & to do

- Reconstruction on MC seems to work, tested with and without noise
- Most of the variables behave ~as expected
- Some technical details still to be clarified (Fabrizio, Emanuele)
- Other study WIP: study the effect of the diffusion
- Digitized+reconstructed only partial statistics at the moment

- Brazilian group will work on the task of PMT simulations
  - start from txt files of x-y-z and energy of interaction in gas from MC
  - evaluate number of electrons, time of arrival at the GEM, longitudinal dispersion
  - digitise the signal with different sampling rate according to DAQ designs
  - develop tools for wf analysis and compare with data (as we are doing for 2D simulation)