MC reconstruction

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CYGNO simulation & analysis meeting
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Reconstruction code

- Code from https://github.com/CYGNUS-RD/analysis
- Few differences with `configFileNeutrons7030.txt`

```
'nsigma'                : 0. (0.5, 1.5) # Neutrons7030 1.5
'cimax'                 : 1000000,      # Neutrons7030 200 (Upper threshold)
'daq'                   : 'simulation', # Neutrons7030 'midas'
'excImages'             : [], # Neutrons7030 list(range(5))+[],To exlude some images of the
analysis.
'min_neighbors_average' : 0,  # Neutrons7030 3.5 cut on the minimum average energy around a
pixel (remove isolated macro-pixels)
'pmt_mode'              : 0,  # Neutrons7030 1
```

- Other changes ➜ need to turn-off iteration 3 in iDBScan.py

Digitized MC

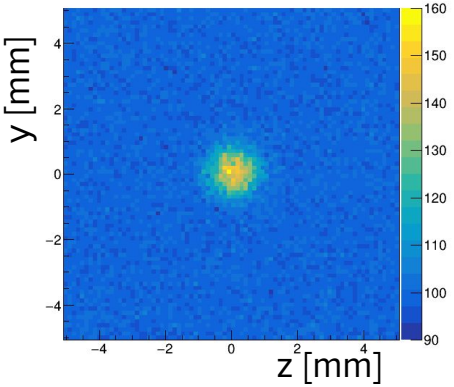
Datasets:

- **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

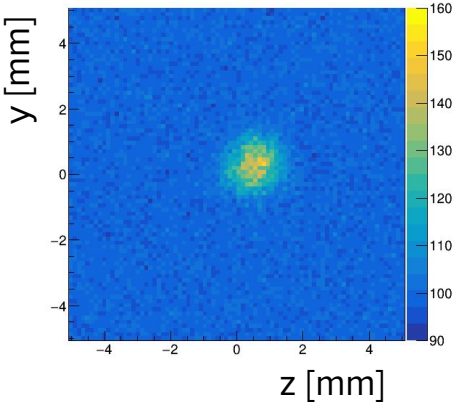
Digitization parameters: LEMON **with noise** and **without noise**

	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



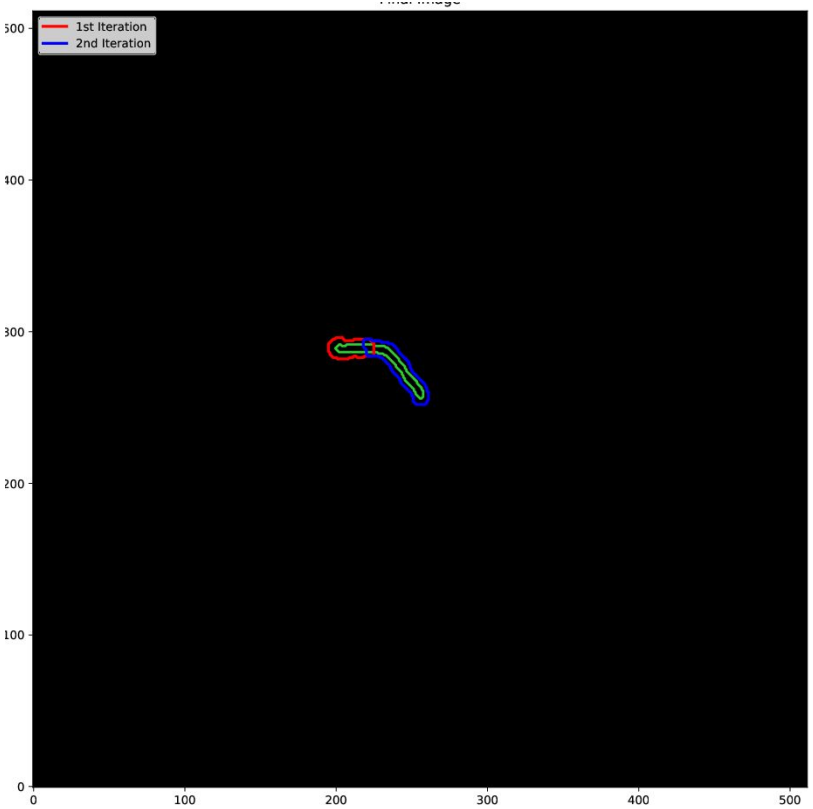
Pedestals and reconstruction parameters

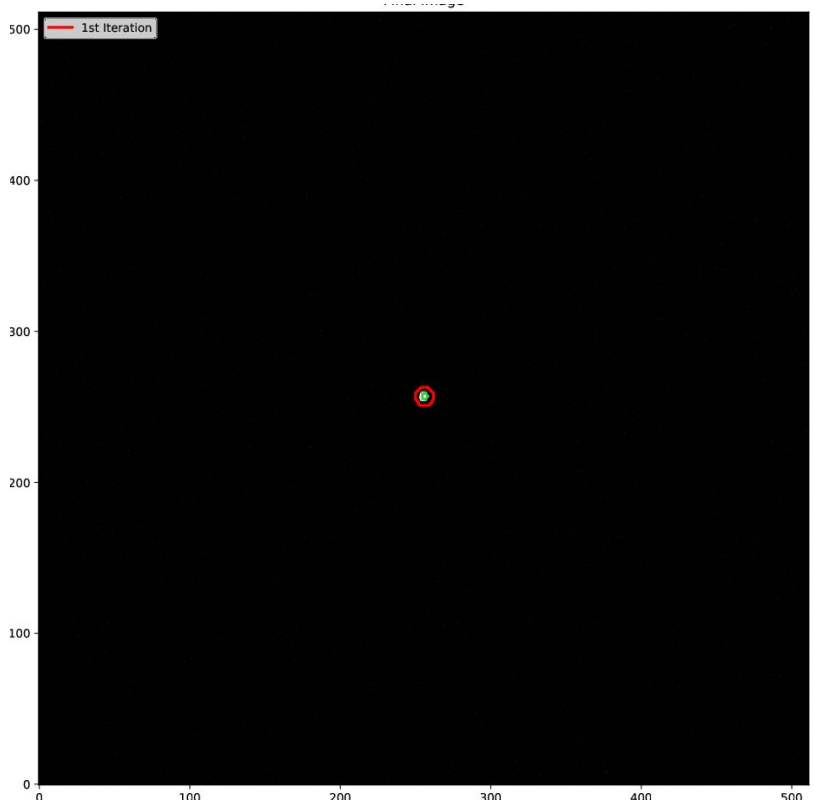
Test reconstruction in different conditions

1. MC with noise (500 evts), pedestal 99 with sigma 2 ph, nsigma = 1.5
2. MC with noise (1000 evts), pedestal 99 with sigma 2 ph, nsigma = 0.5
3. MC without noise (100 evts), pedestal 0 with sigma 0 ph, nsigma = 0.5

➜ Use same reconstruction parameters for ER and NR

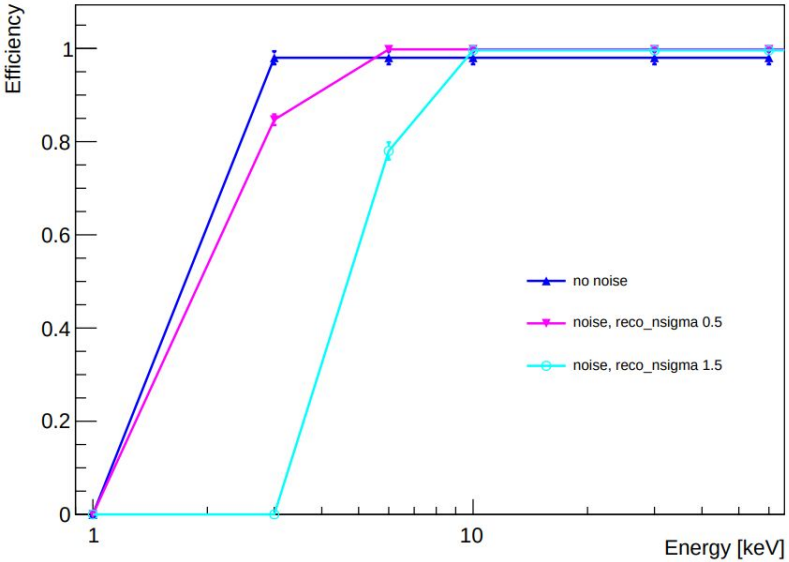
Some examples



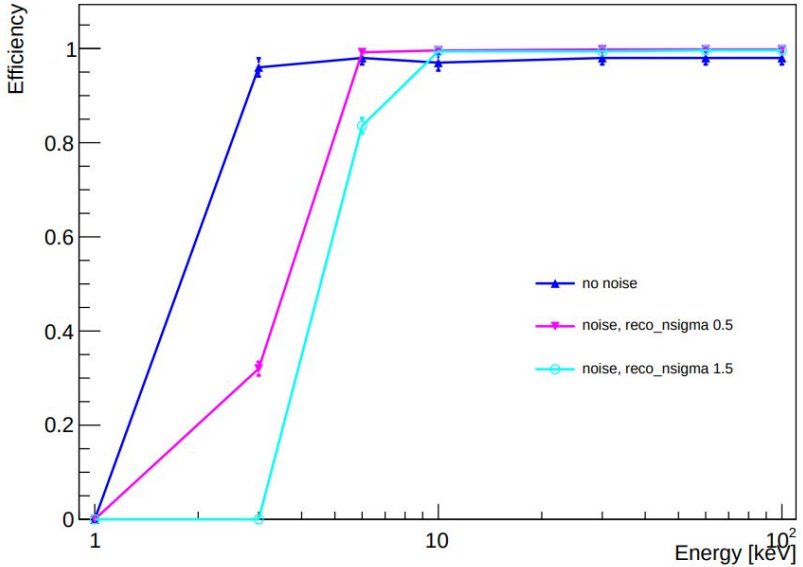


Cluster reconstruction efficiency

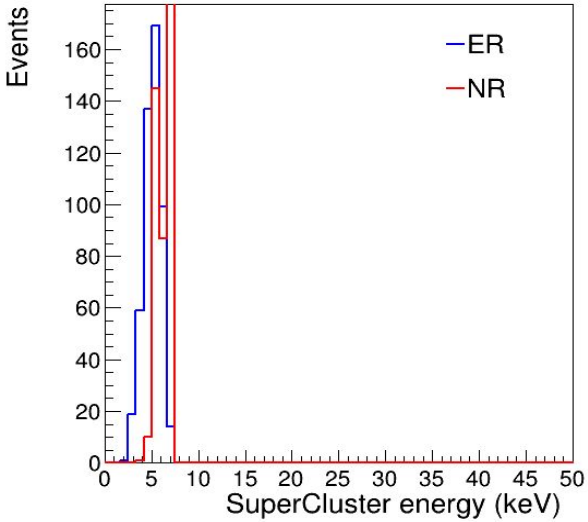
Electron recoils

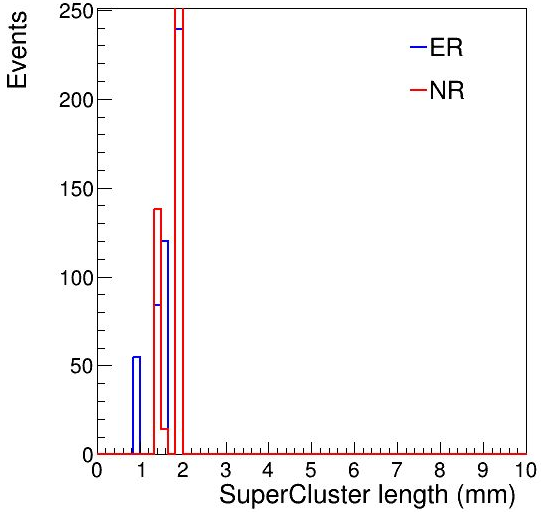


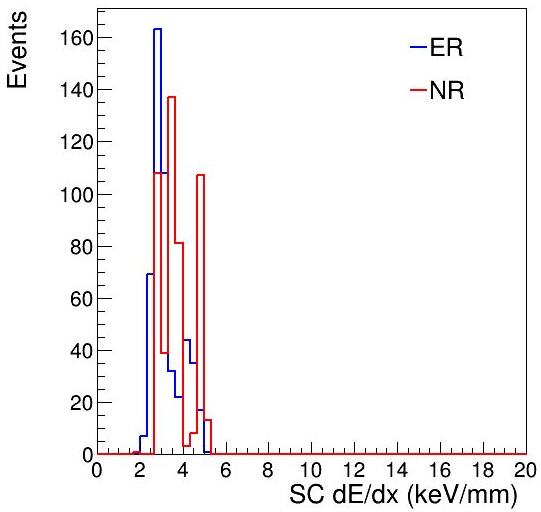
Nuclear recoils



NR vs ER 10 keV reco1

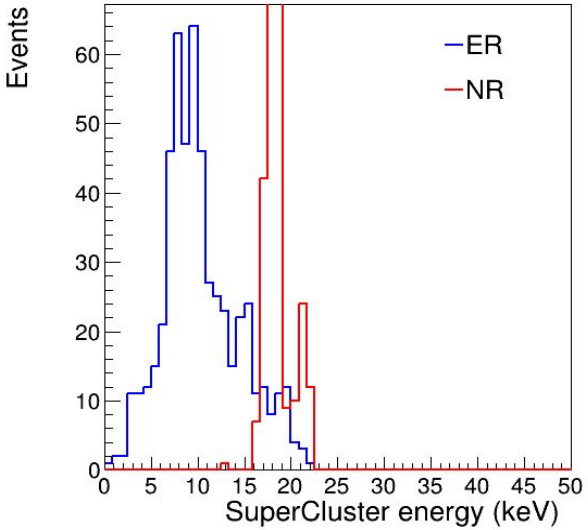


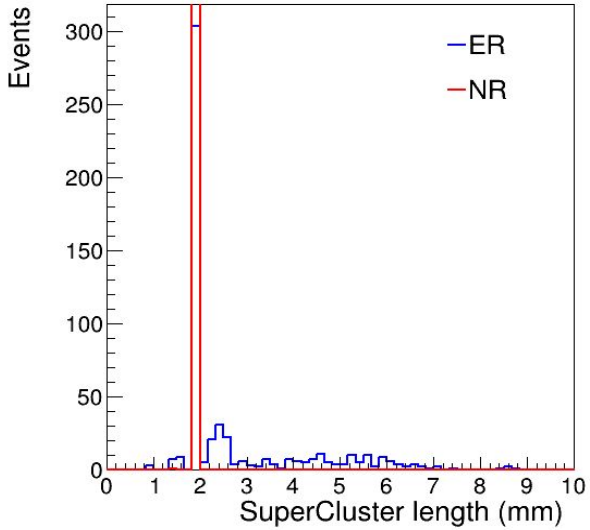


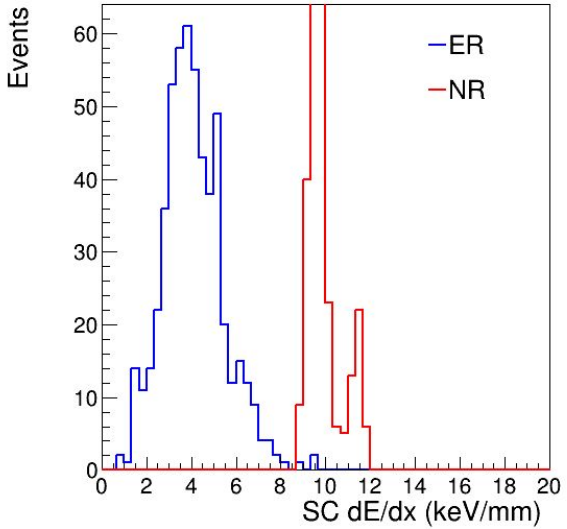


All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped99sigma2_nsigma1p5/

NR vs ER 30 keV reco1

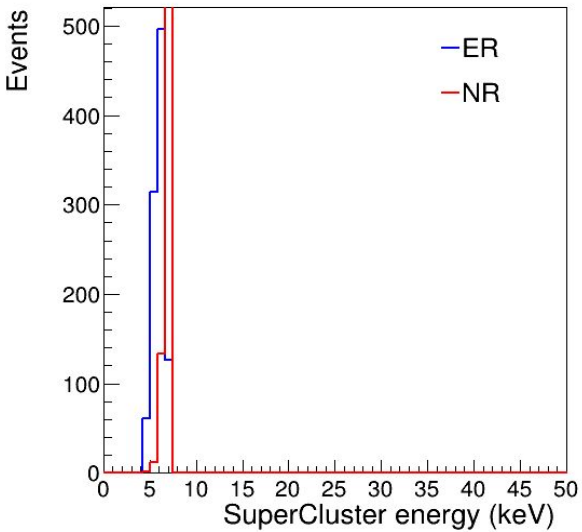


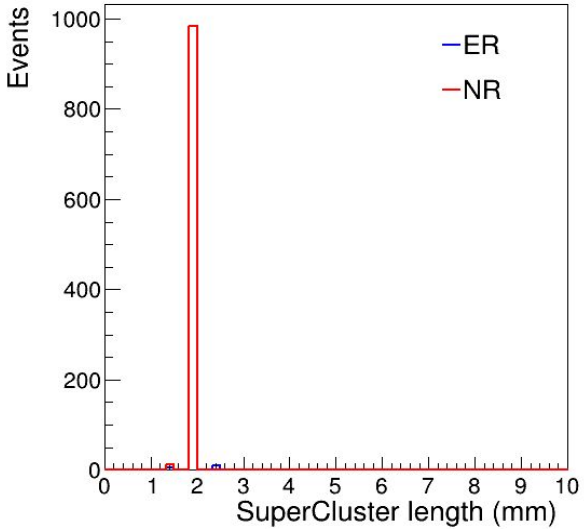


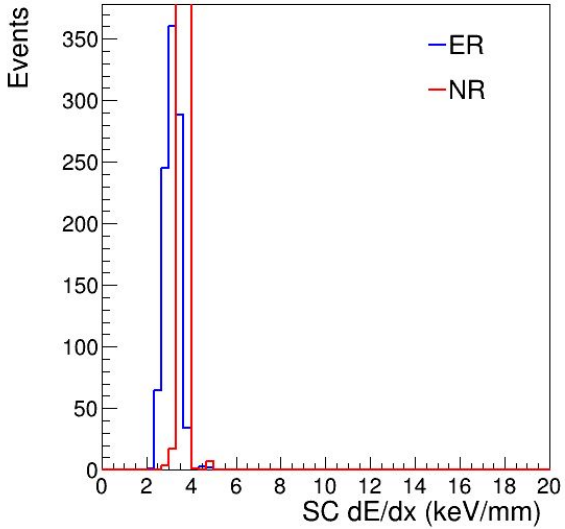


All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped99sigma2_nsigma1p5/

NR vs ER 10 keV reco2

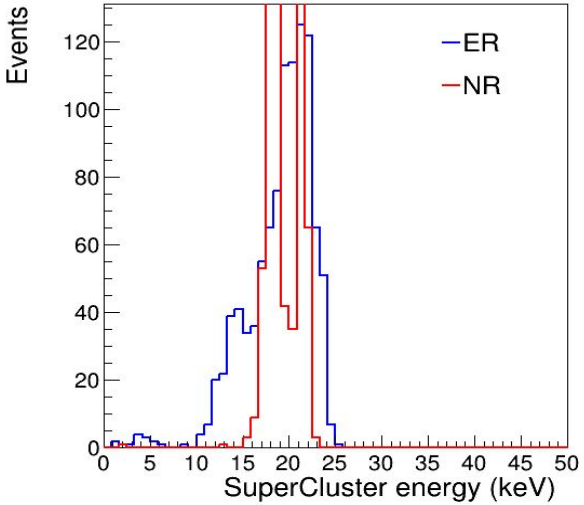


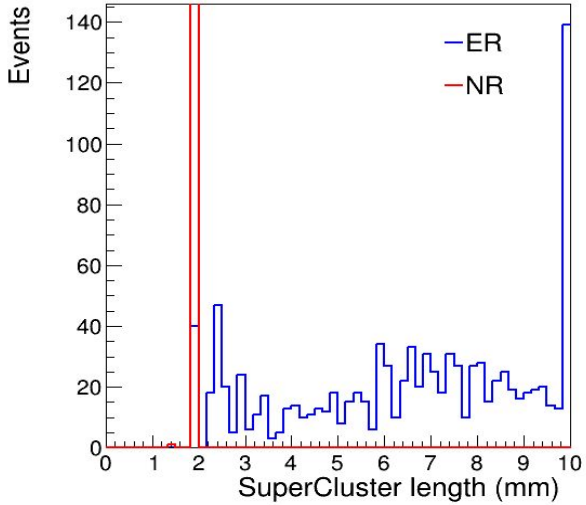


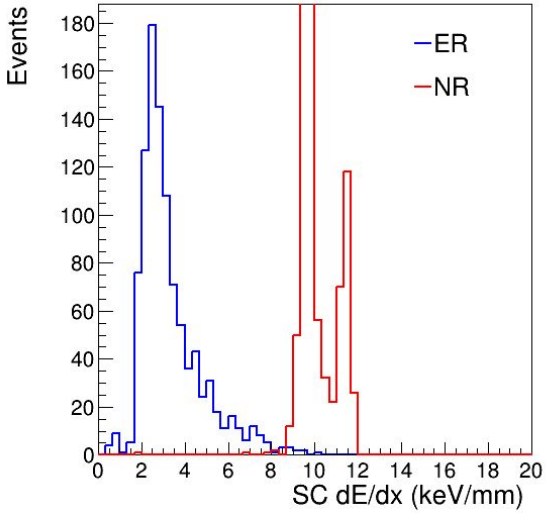


All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped99sigma2_nsigma0p5/

NR vs ER 30 keV reco2

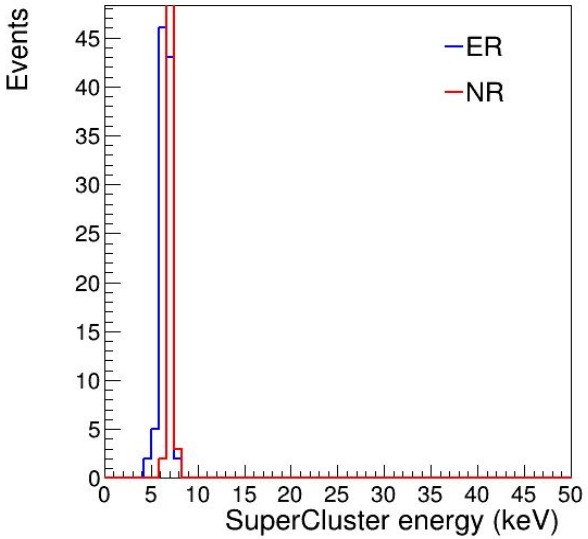


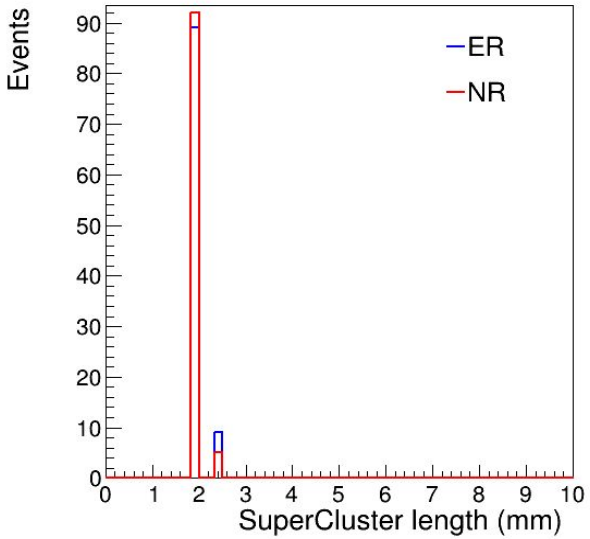


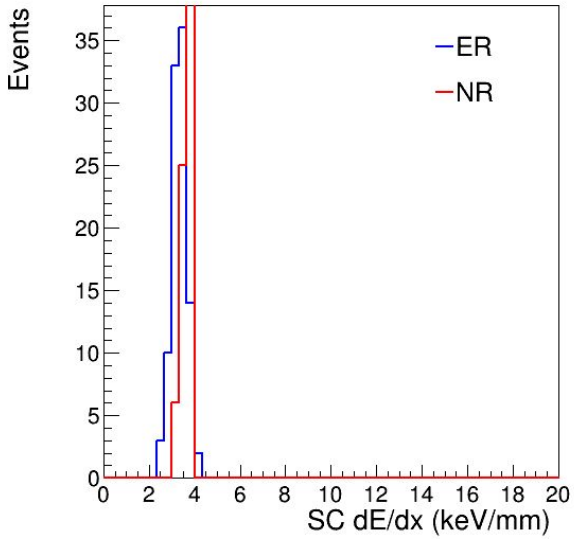


All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped99sigma2_nsigma0p5/

NR vs ER 10 keV reco3

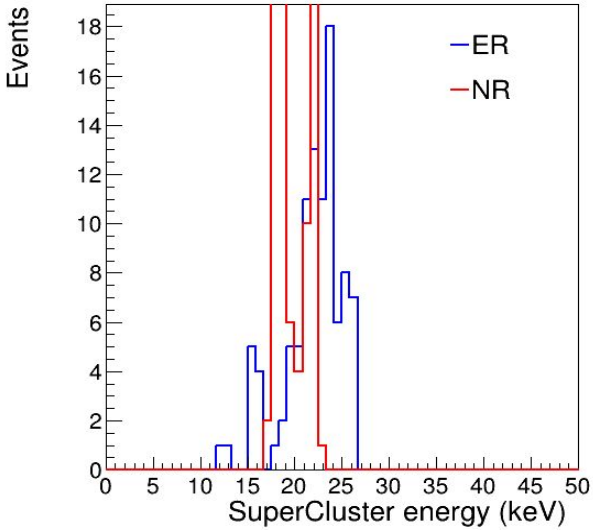


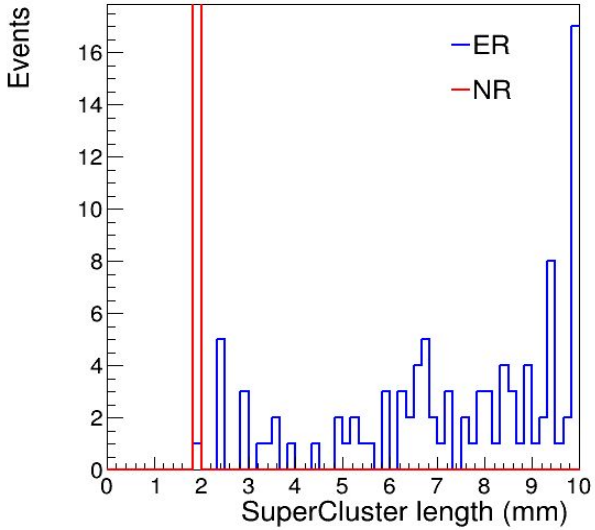


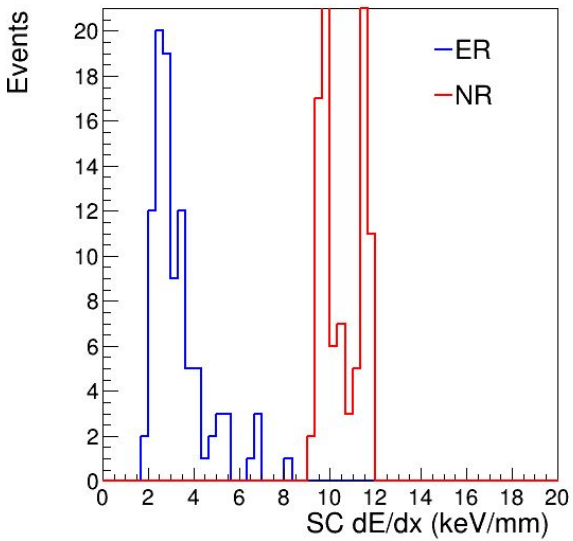


All plots in http://www.roma1.infn.it/~dimperig/CYGNO/reco/ped0sigma0/

NR vs ER 30 keV reco3







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

Summary & to do

- Reconstruction on MC seems to work
- Most of the variables behave ~as expected
- Some technical details still to be clarified (Fabrizio, Emanuele)
- Digitized+reconstructed only partial statistics at the moment
  ➜ we should plan the digitization and analysis of the full statistics
- We have already MC: 10000 evts of ER, 1000 evts of NR
  ➜ NR statistics can be increased using GEANT
- Reconstruction cpu time: 6-12h to analyze 1000 evts
- Digitization cpu time?
- Each digitized MC file of 1000 evts 3.3G
  ➜ we plan to put in the cloud as for data