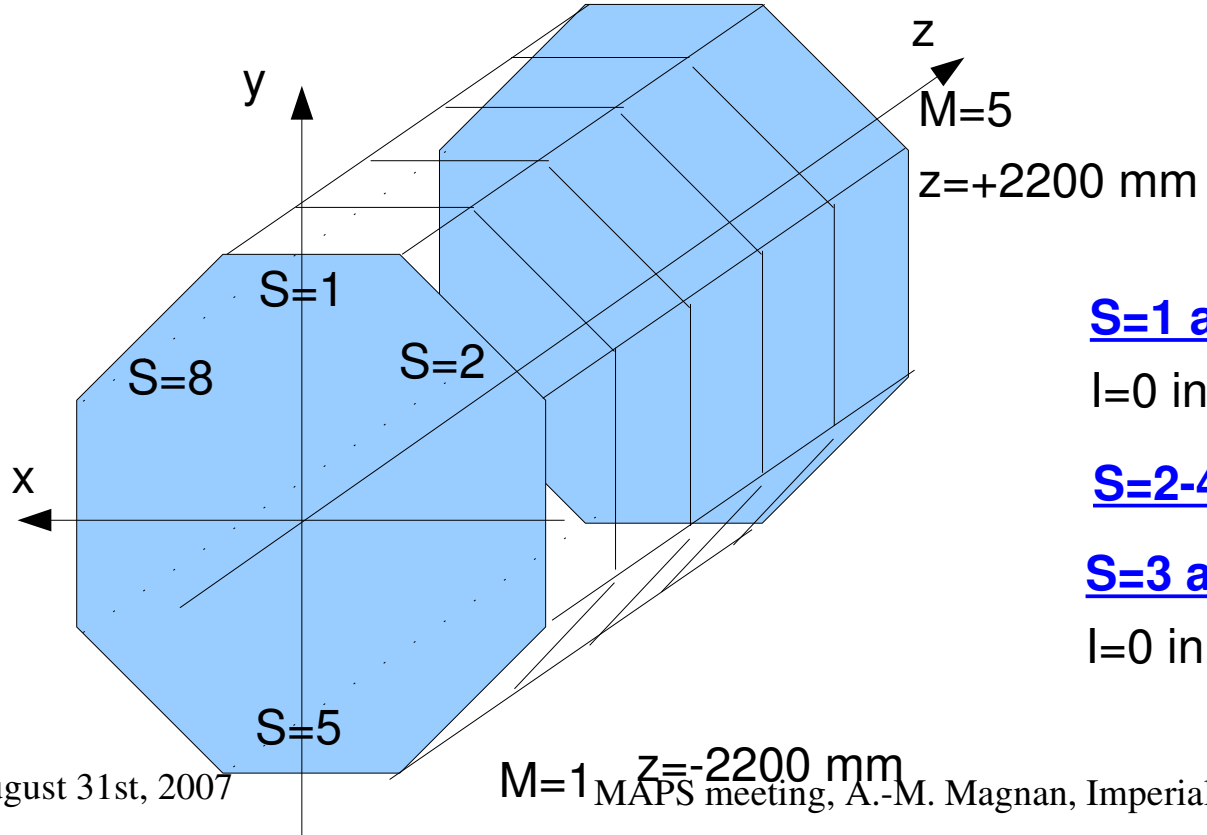
A bit of several thing

- Digitisation status: connection to PandoraPFA
- Geant4 and low energy bump
- Mokka for test setup description

Digitisation status

- Corrected an important bug when running on several input collections (i.e. Barrel+Endcaps) + I and J start at 0...
- Checked the geometry: for tesla-like ECAL



STAGGERING in I

S=1 and 5: I // x and J // z

I=0 in x=-652 mm, I=31000 in x=+888 mm

S=2-4-6-8: I // √2/2(x+y) and J // z

S=3 and 7: I // y and J // z

I=0 in y=-652 mm, I=31000 in y=+888 mm

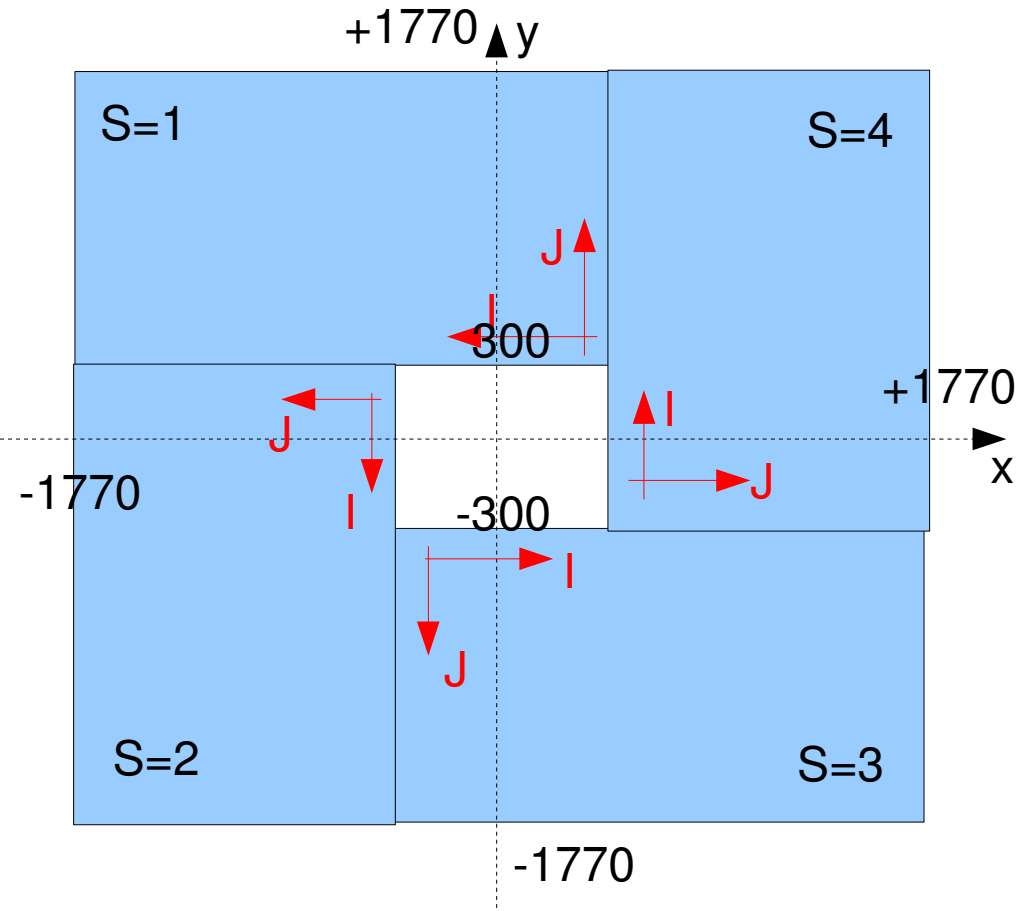
Max I ~ 31000, max J ~ 17572

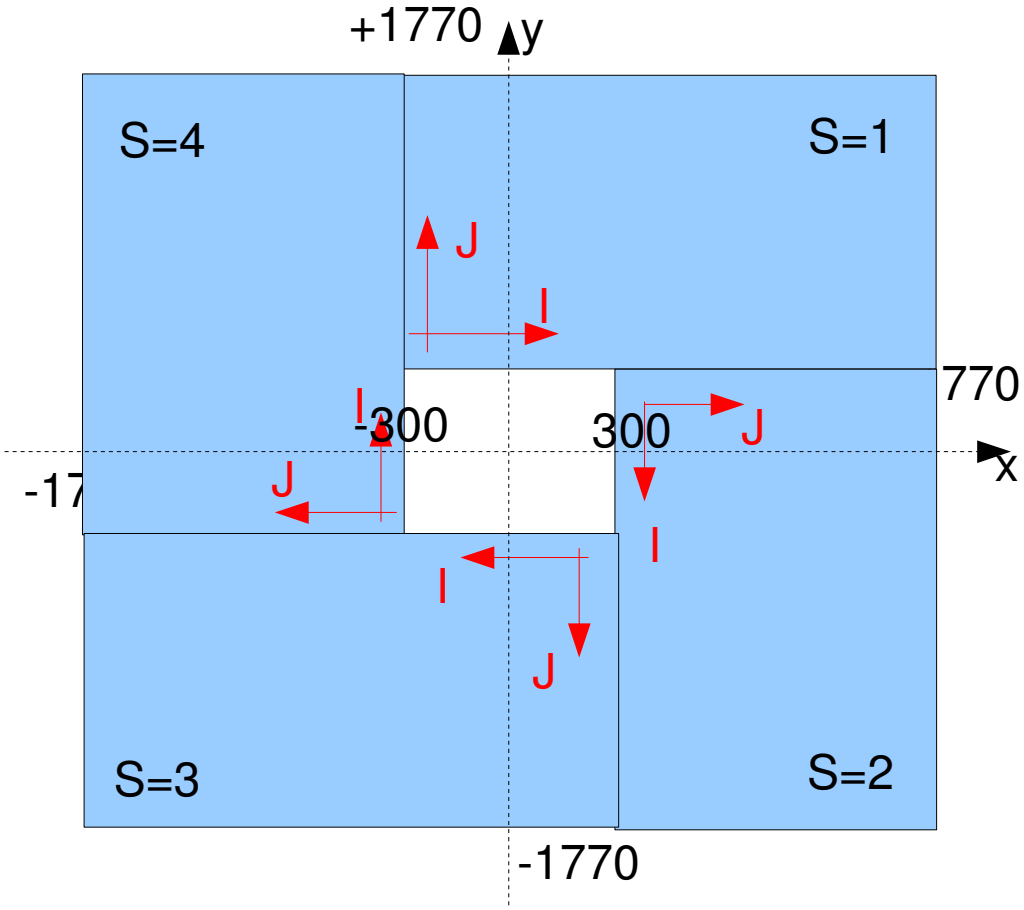
End cap geometry

M=0, negative endcap (-2470 < z < -2300 mm)

M=6, positive endcap (2300 < z < 2470 mm)

Max I ~ 41400, max J ~ 29400





Pandora PFA and Digitisation

- Ran PandoraPFA on a digitized ZH file, working fine.
- Next step, when adding noise only hits:

  10^6 SimCalorimeterHit = 10^6*(4*(int)4+4*(float)4) = ~32 Mbytes/event

  10^6 CalorimeterHit = 10^6*(3*(int)4+5*(float)4+(*)4 = ~36 Mbytes/event

  10^6 LCGenericObj = 10^6*(4*(int)4) = 16 Mbytes/event if position of hits is saved (4 Mbytes else...).

- Interface to PandoraPFA: better idea! Rewrite the internal MokkaCaloDigi processor to have as input LCGenericObj, output calibrated CalorimeterHit ⇒ minimum changes in Pandora.

  Critical missing bits: find a link to a "representative" SimCalorimeterHit for Pandora, or skip this step in Pandora, and to save disk space: NEED THE CODE TO FIND THE POSITION OF ANY CELL FROM ITS CELLID....

- **Head version in CVS:** contains the new CalibrationProcessor that needs to be run instead of MokkaCaloDigi, before running Pandora. Noise only hits still not handled properly.

CalibrationProcessor output

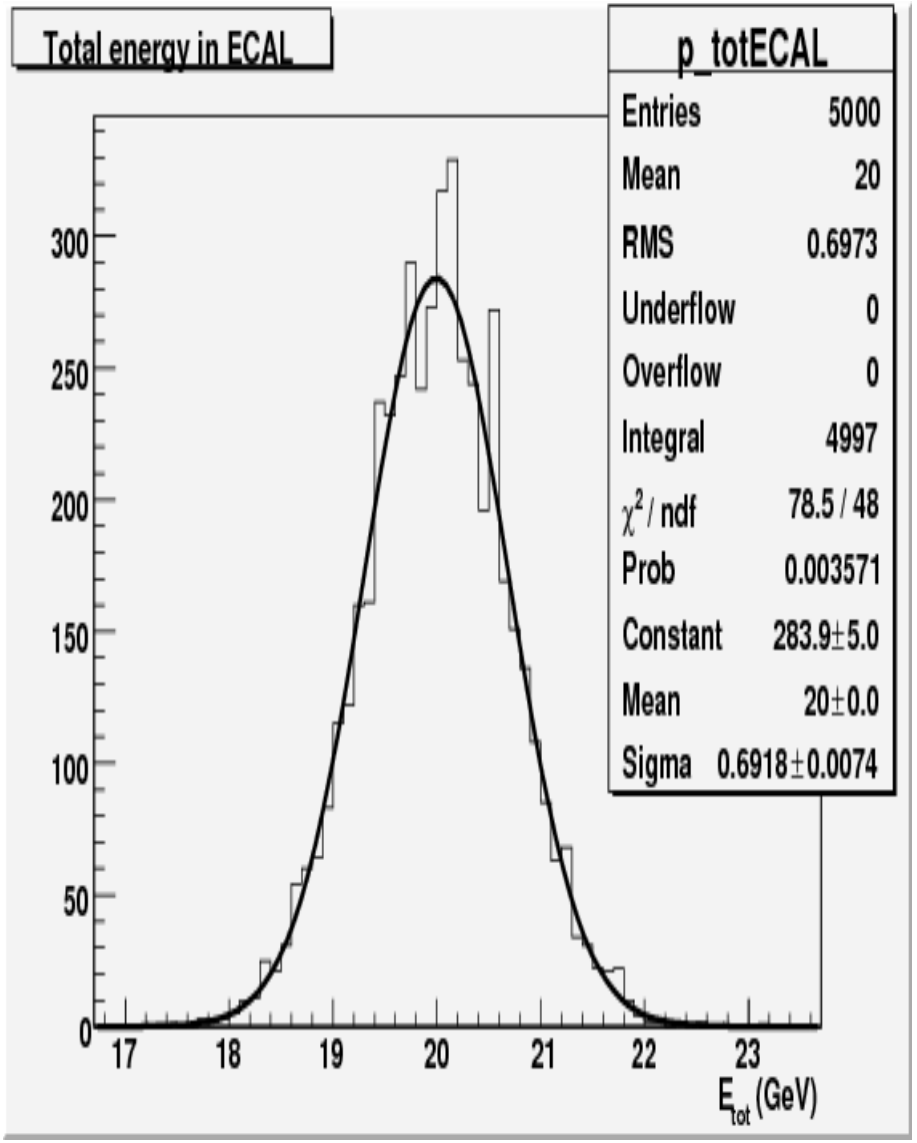
- Input: collection ClusterList after digiMAPS step, containing $N_{MODULES}$ LCGenericObject, each having :

  getIntVal(0) = KSM of the wafer, then IJ_{hit1}, Ij_{hit2},....,IJ_{hitN}

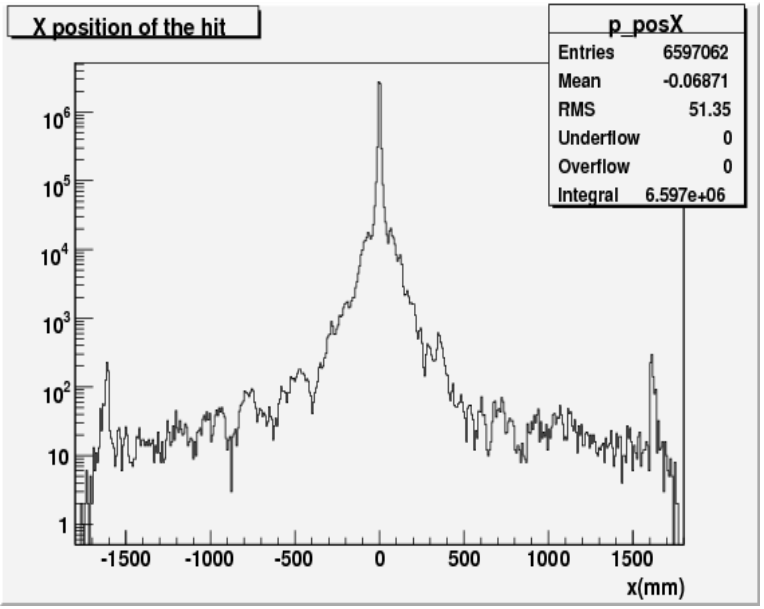
  getFloatVal(0)=x_{hit1}, then y_{hit1},z_{hit1},x_{hit2},y_{hit2},.....,z_{hitN}

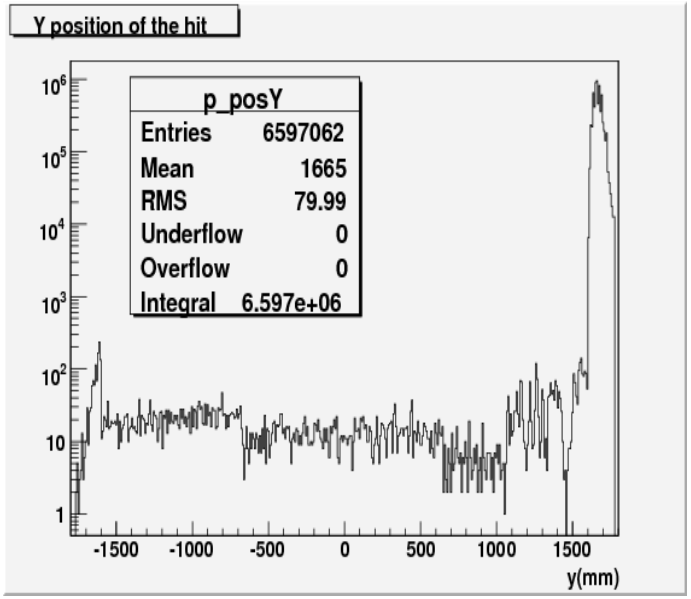
- It's a copy of MokkaCaloDigi: need an input gear xml file with hcal geometry, ex. can be found in PandoraPFA folder.

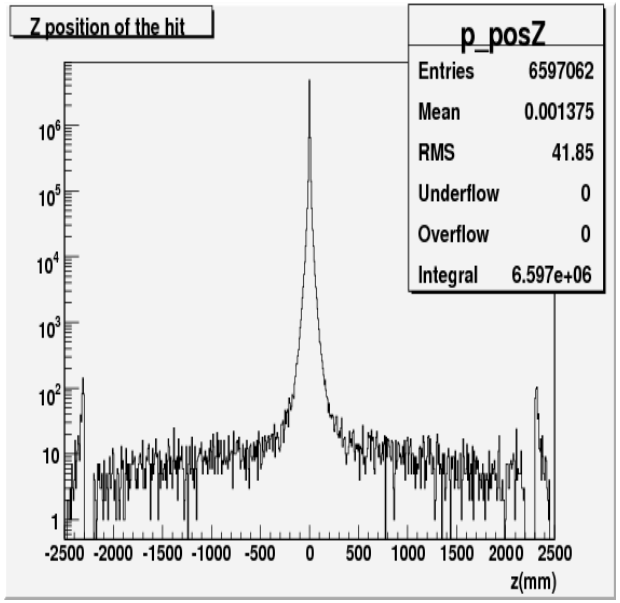
- File size without noise only hits, 5000 events, 20 GeV photons : before 598 MB , after 687 MB. Run time: 45 minutes real time on 1 CPU. Expect 20-80 GB with noise only !!

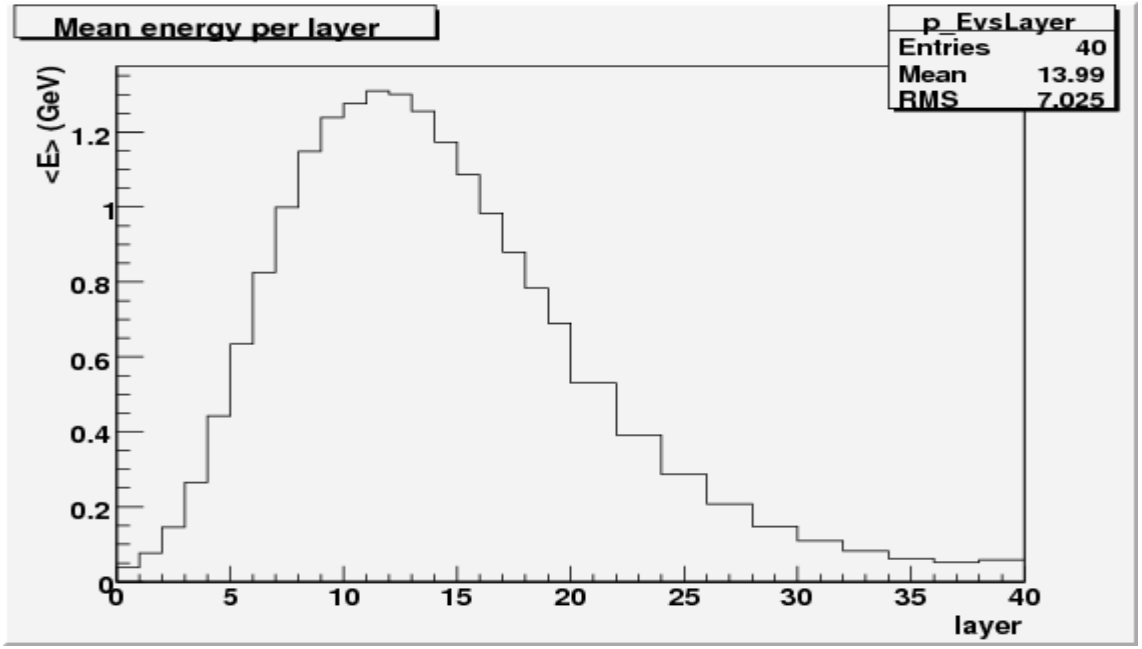


at calibrated hits level









Noise only hits

- Size of files
- In current digiMAPS clustering: will loose the information of noise only hit !
- Add them after clustering ?? i.e. independently of clustering ?
- Any other idea on how to handle them “properly+efficiently” ?

Geant4 and low energy bump

Geant4 and low energy bump

- Processes are decided in PhysicsList. Default in Geant4: LHEP 4.1
- In Mokka, LCPhys has to be explicitely chosen via /Mokka/init/physicsListName LCPhys
- By editing Mokka/source/LCPhys/src/LCLeptonPhysics.cc and LCBosonPhysics.cc, can change the chosen processes.
- In Geant4: low energy processes exists for electrons, valid between 100 eV and 200 GeV. 3 generators: TSAI, 2BS and 2BN, but only TSAI is found working... ?? Low E processes exists also for photon, but not for positrons....
- rangeCut = "To avoid infrared divergence, some electromagnetic processes require a threshold below which no secondary will be generated. Because of this requirement, gammas, electrons and positrons require production thresholds which the user should define. This threshold should be defined as a distance, or range cut-off, which is internally converted to an energy for individual materials." (G4Users Manual)
- But: there is also an absolute minimum. Default value: 990 eV. To change it, add G4ProductionCutsTable::GetProductionCutsTable() ->SetEnergyRange(0.100e-3*MeV, 100.0e6*MeV); in LCLeptonPhysics.cc

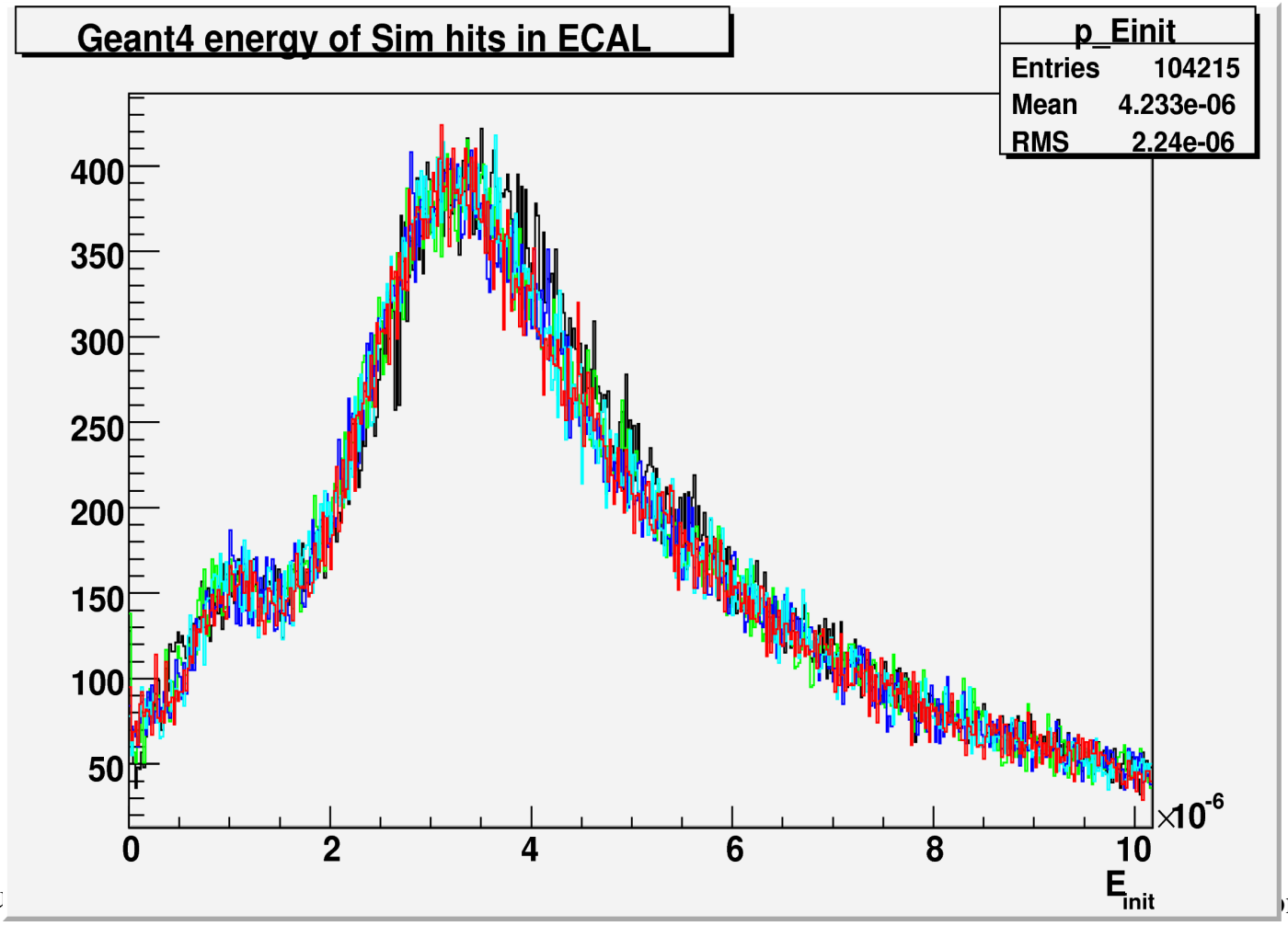
Minimum energy vs range

	Energy cut (keV)			
Range cut	Tungsten		Silicon	
(um)	γ	e+/e-	γ	e+/e-
500	87.5	1200	4.96	330
50	22.8	220	1.67	80
20	12.3	120	1.01	47
5	4.82	53	*	6.7
1	1.64	8.9	*	0.9
0.5	0.94	3.6	*	0.2
0.1	*	0.32	*	0.015
0.02	*	0.023	*	*

Photons: decrease really rapidly to fixed min, i.e. below 1 keV, jump to minE. Even if work function in W is 4.5 eV ... Photoelectric effect will dominate up to 300 keV, then Compton scattering, and after ~3 MeV, pair production dominates.

Influence of rangeCut on the energy

Generating 10 GeV photons, 100 events, in 5*5 um^2 cells, energy added in 50*50 um^2 cells, or directly generated as 50*50.

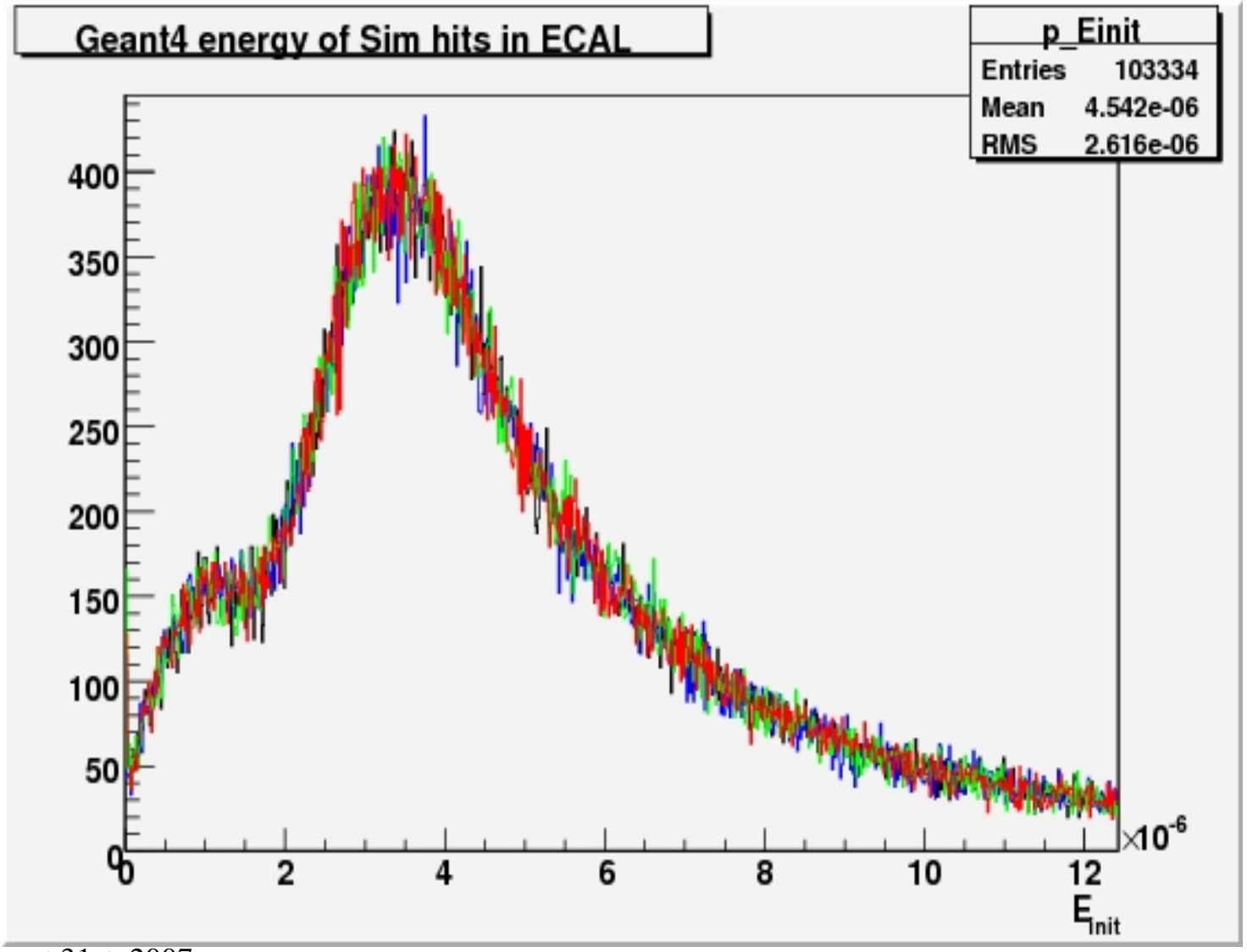


Default Emin = 990 eV

Default LCPhys

- 1 um
- 5 um
- 10 um
- 15 um
- 20 um

Influence of min Energy cut



rangeCut = 1um

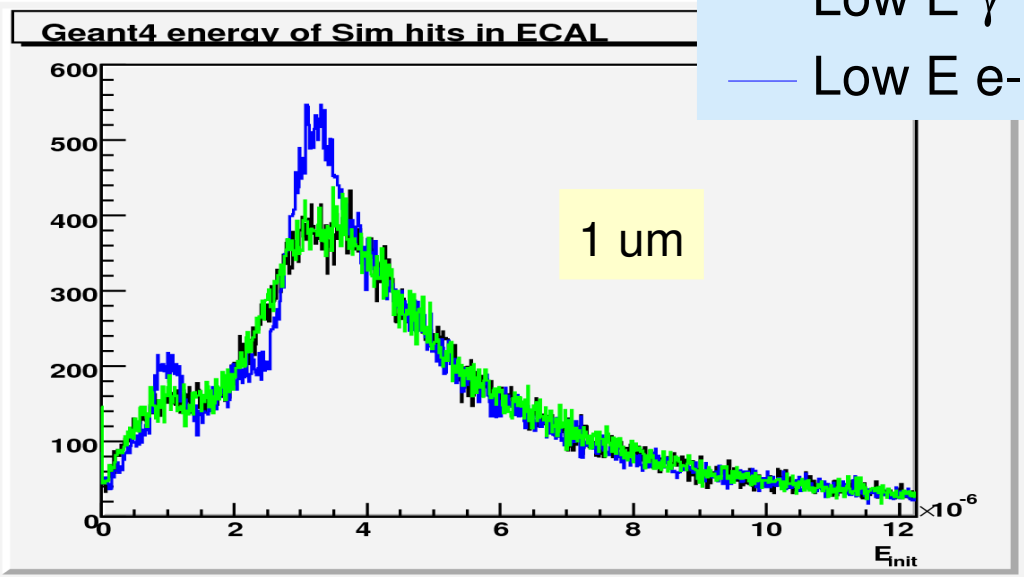
Default LCPhys

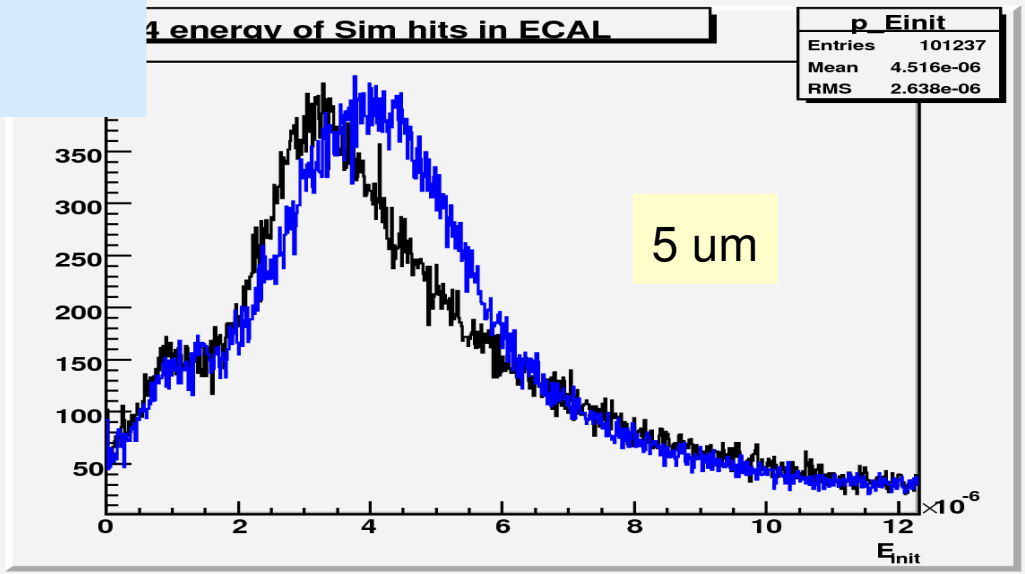
- 10 eV
- 100 eV
- 500 eV
- 990 eV

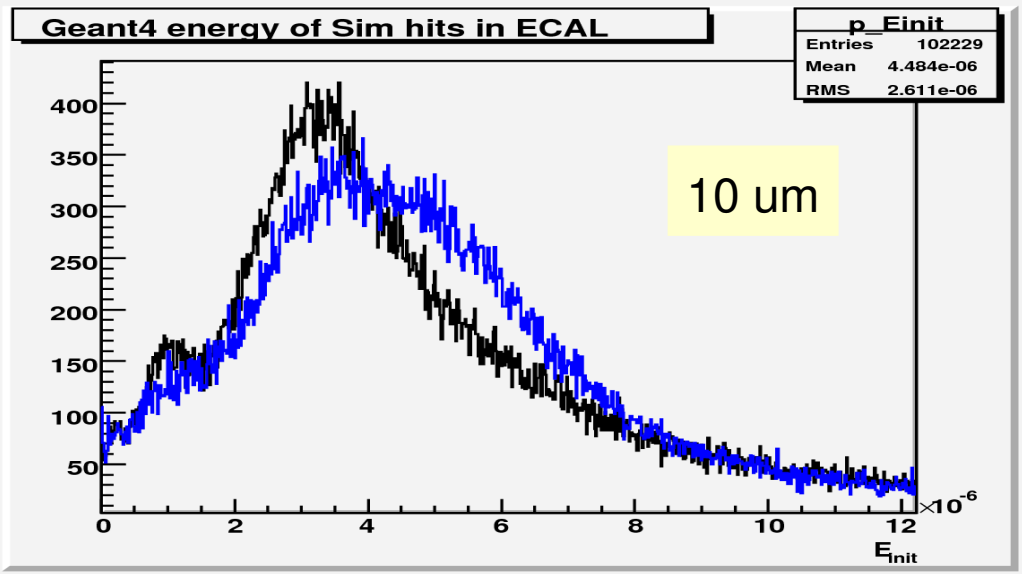
Influence of e- physics processes

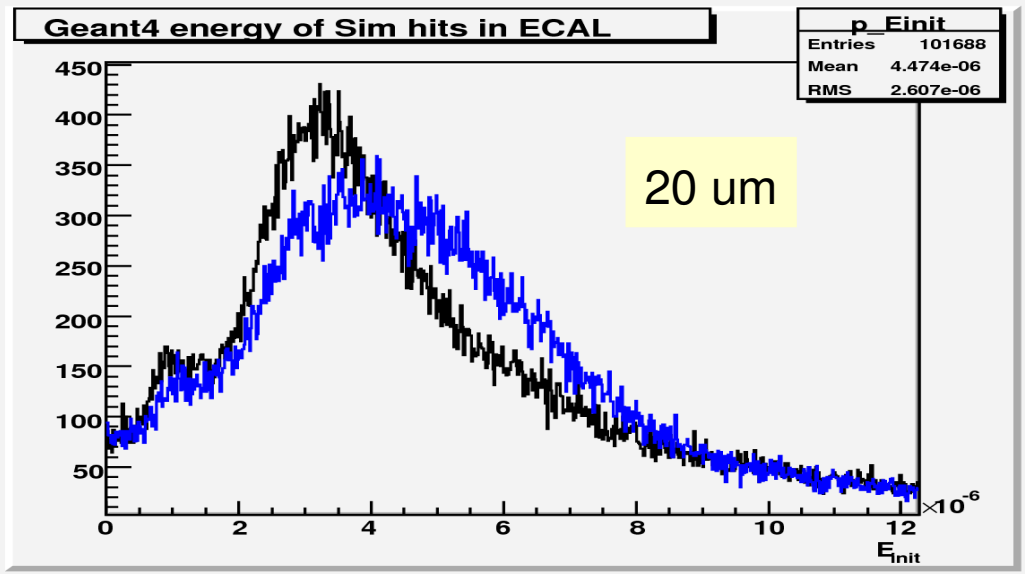
Default LCPhys
Low E γ
Low E e-

MinE = 100 eV







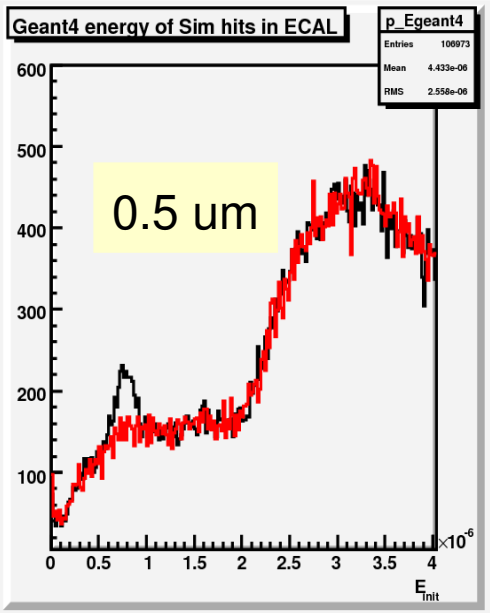


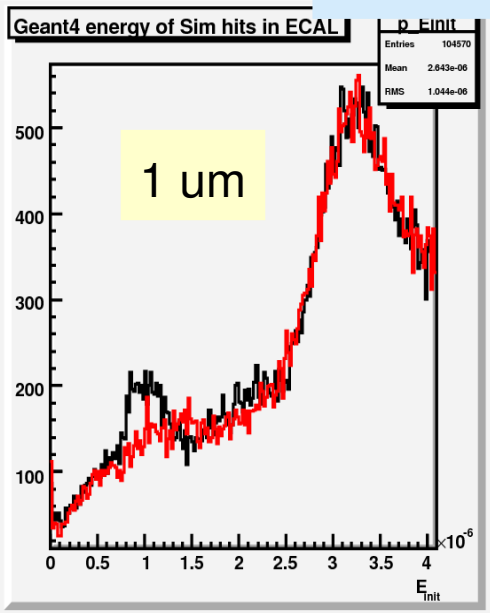
Range effect for low energy model

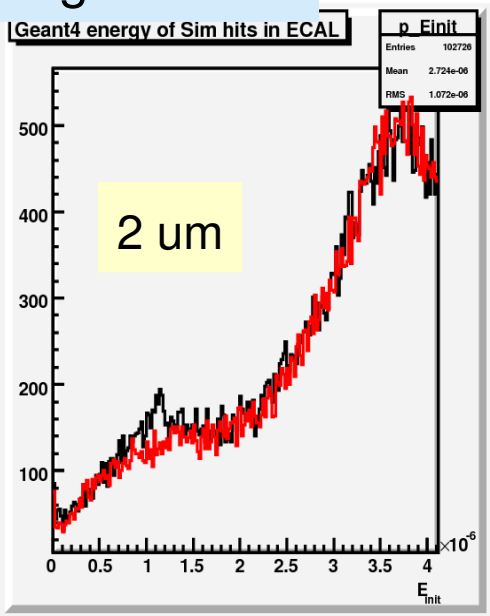
MinE = 100 eV, low energy models

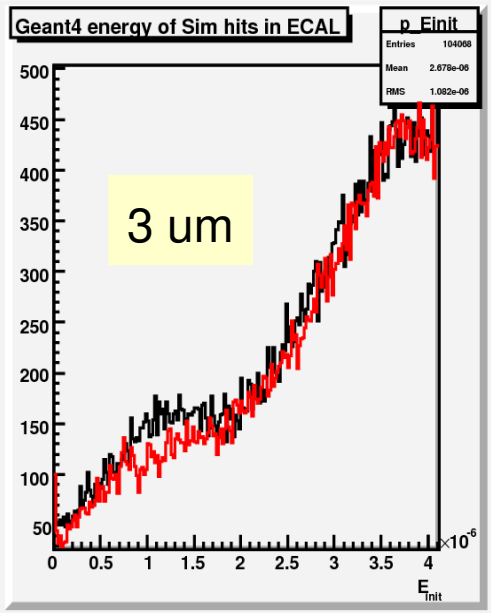
5*5 summed

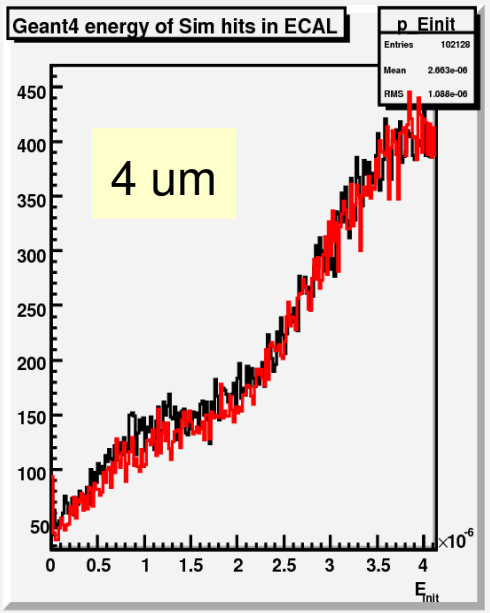
50*50 generated

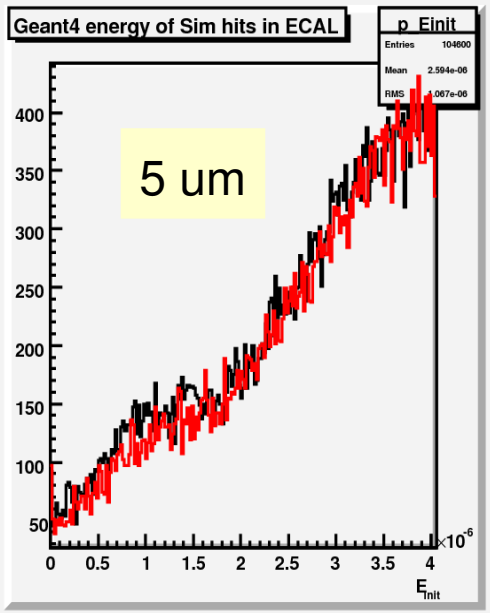


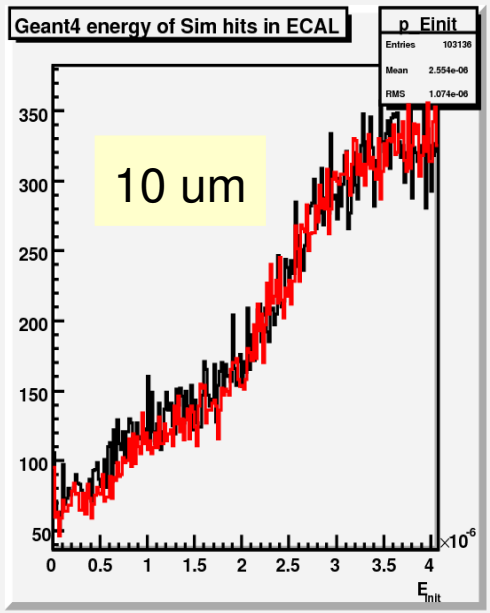


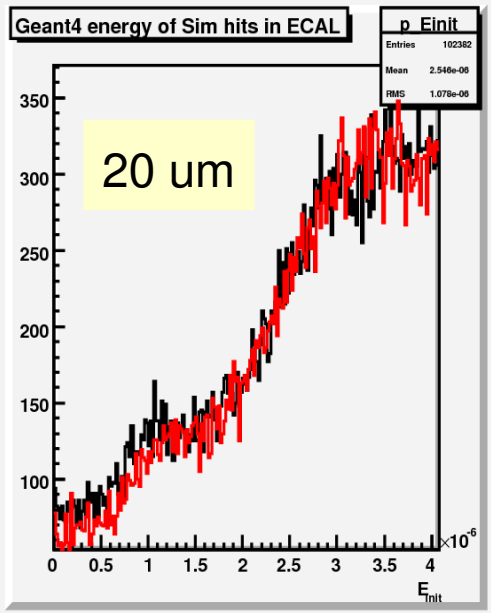






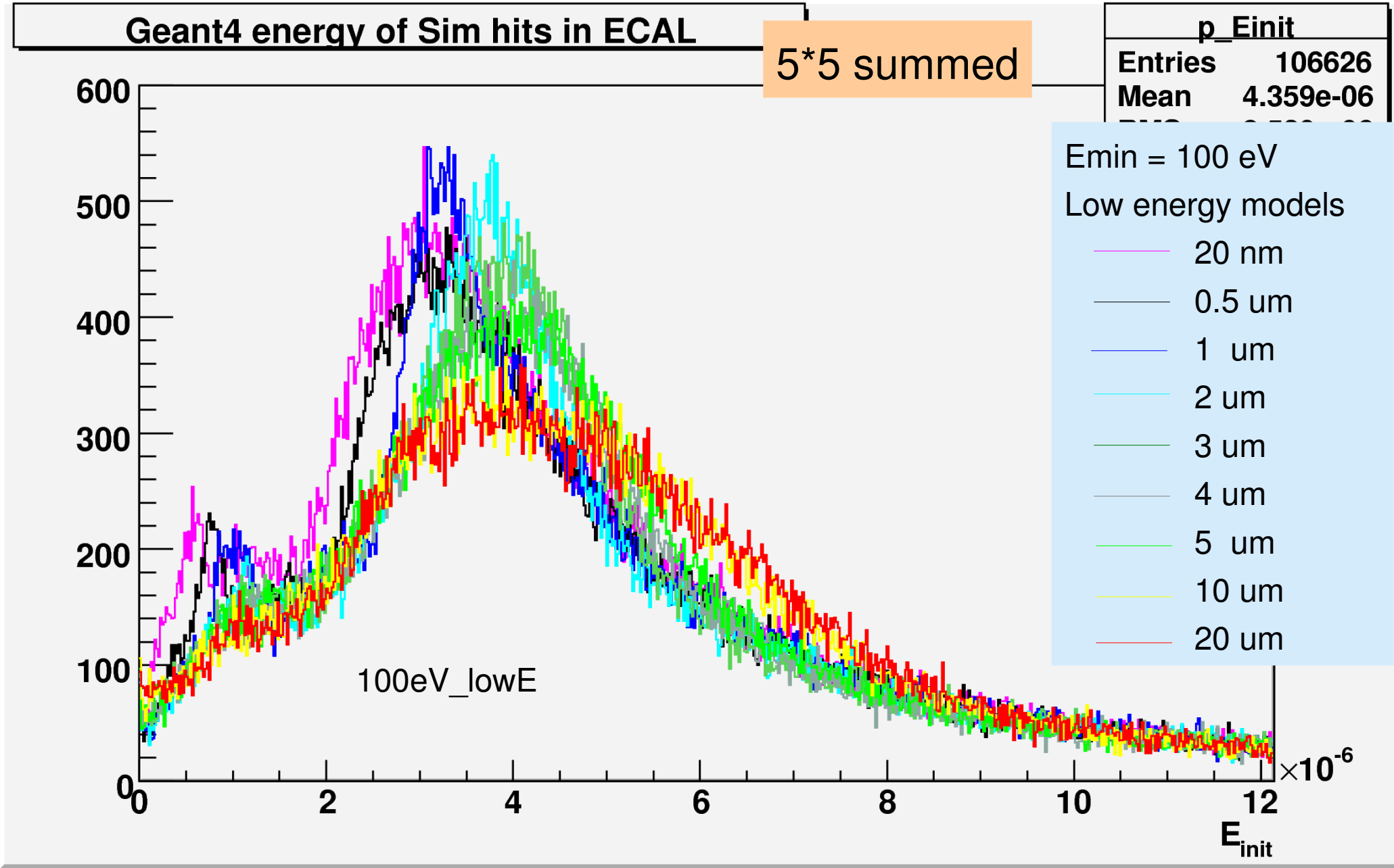






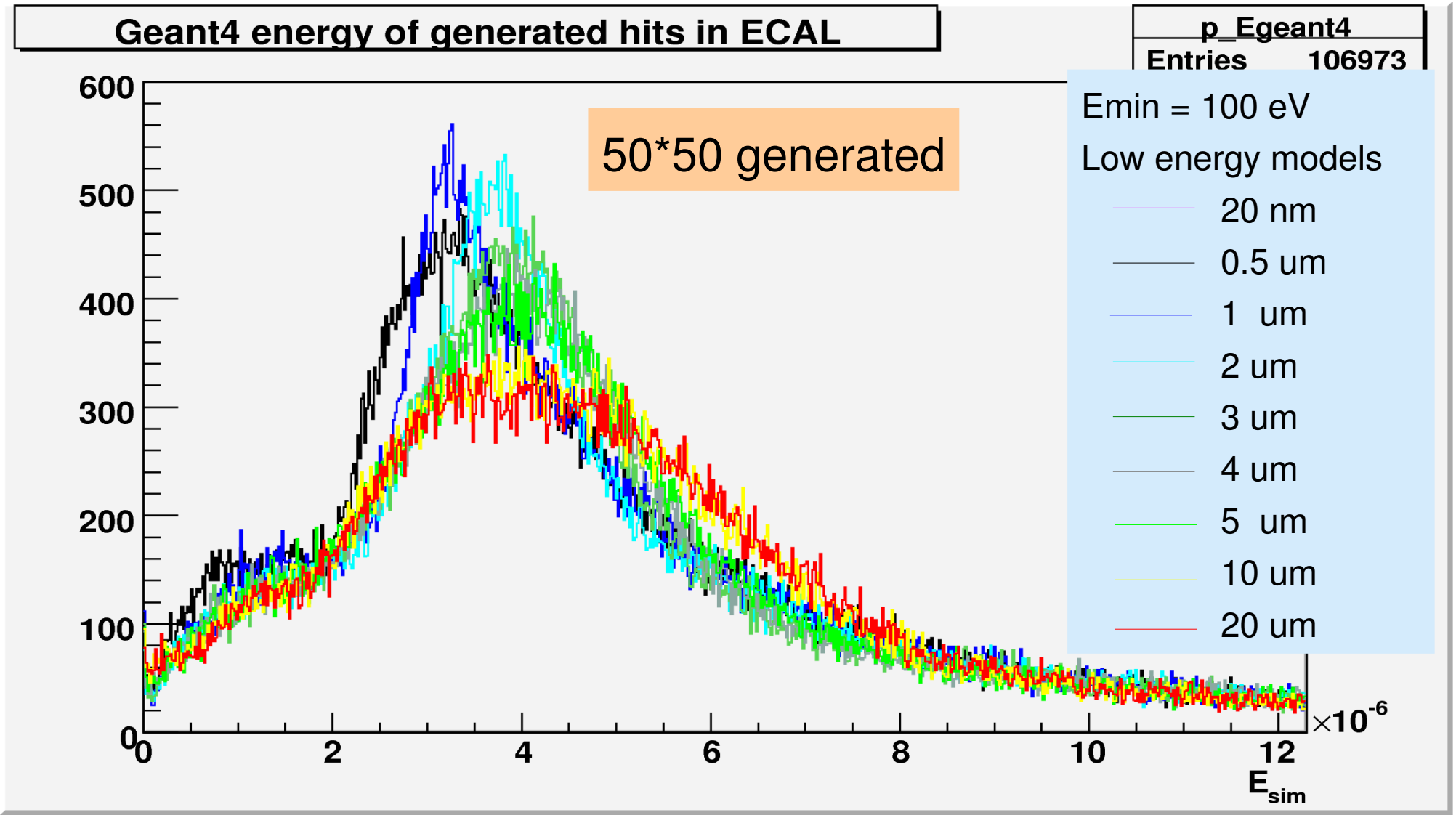
A

Range effect for low energy model



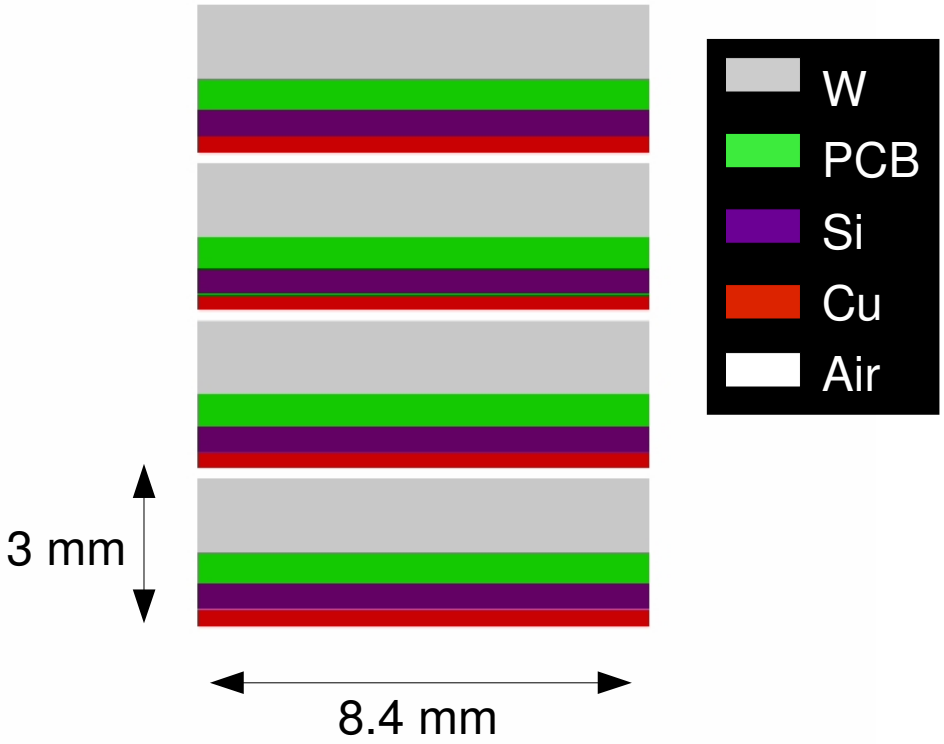
A

Range effect for low energy model



Mokka for TB setup

Mokka for TB setup



- From Calice Testbeam model TBecal02, created a TBMapsEcal driver, with a really simple geometry description.
- Hacked CGAGeometryManager to hardcode the driver properties instead of having them in the Mokka database.
- Can add a model in the database when fixed.
- Still something weird with the geometry, cannot see tracks in event display !
- But seems feasible and would allow minimum changes in existing codes.

Conclusion

- Digitisation: need to find a solution for link to SimCalorimeterHit in PandoraPFA + need to handle noise only hits.
- Low energy bump: ???????
- Mokka for testbeam setup simulation ?