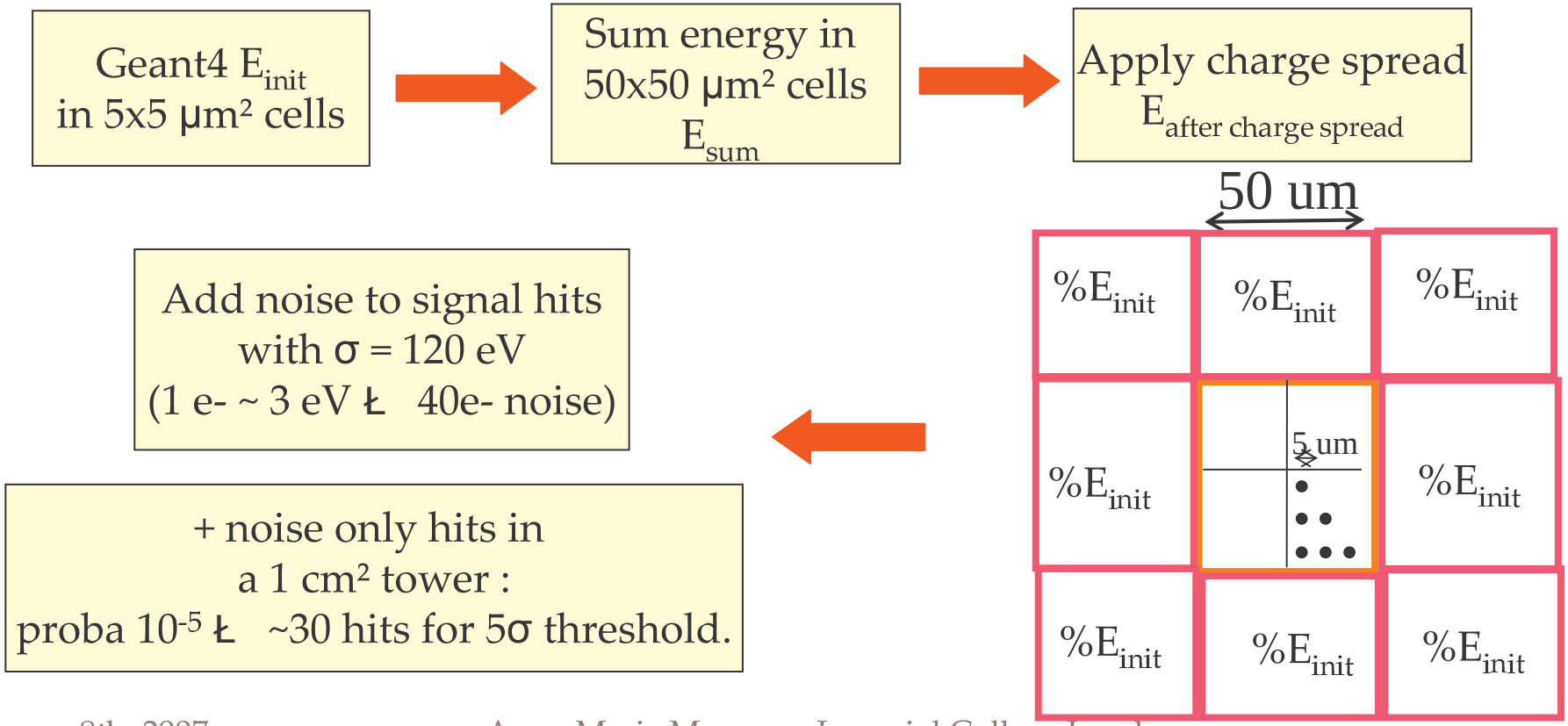
Update on clusterisation studies for MAPS

Comparison between 2 methods of clustering

Geant4/LCIO problem with 5 µm cells

IDEAL vs REAL cases

- IDEAL = just geant4 information for the hits.
- REAL =

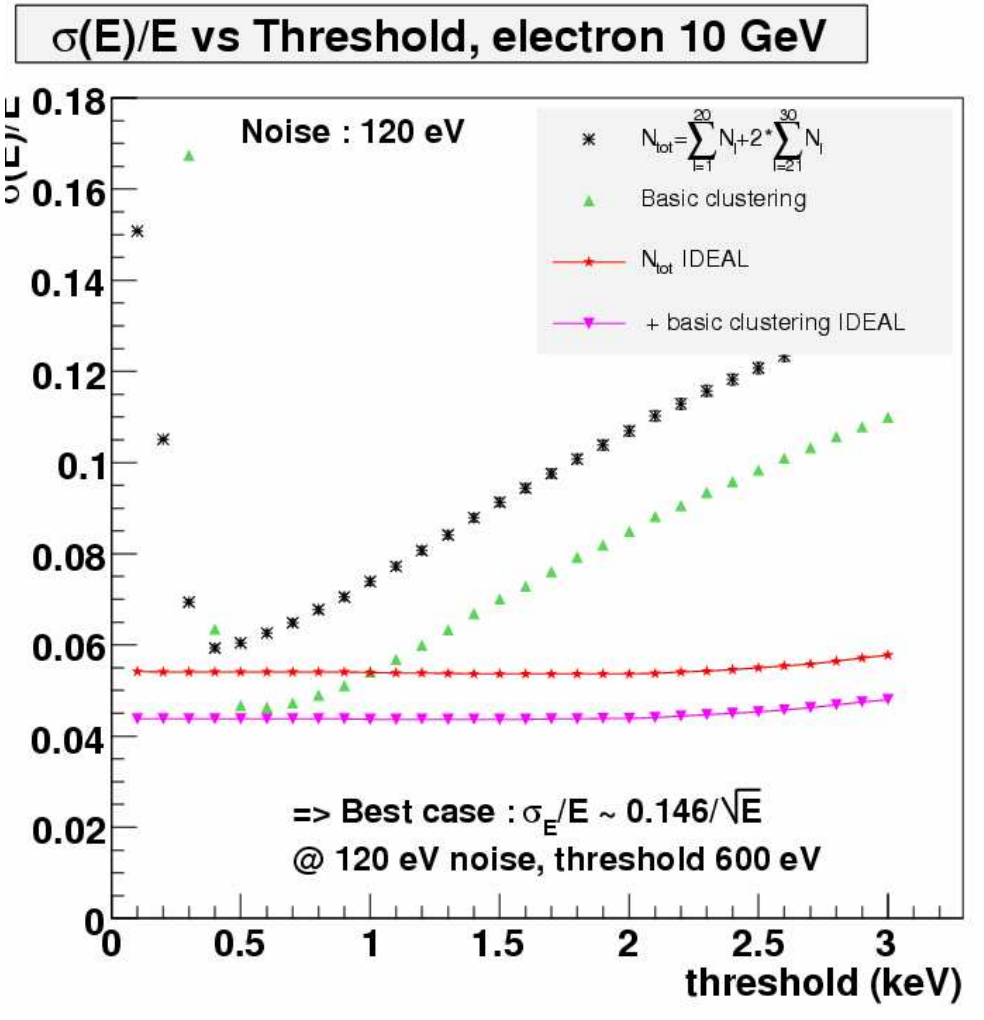


Counting vs basic clustering
First method

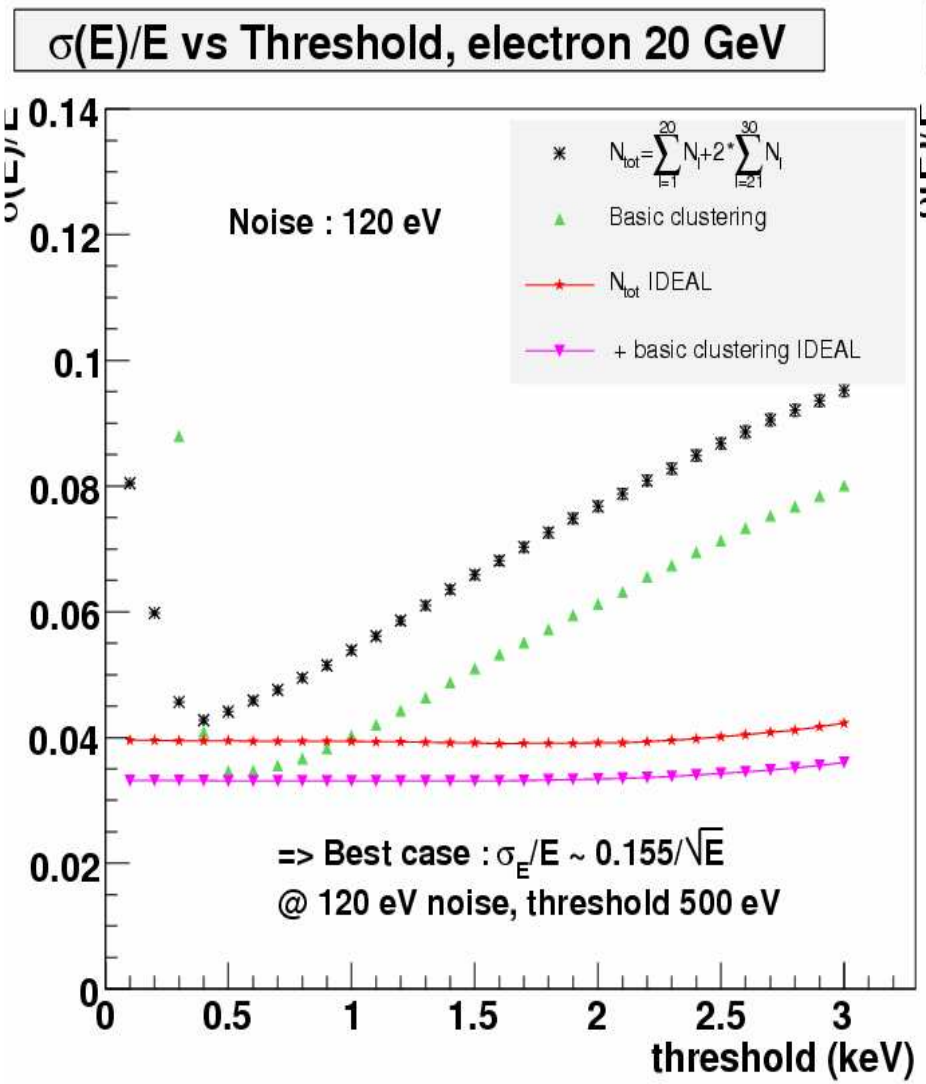
- Always : factor x2 in the last 10 layers to account for the double tungstene thickness.
- Counting =

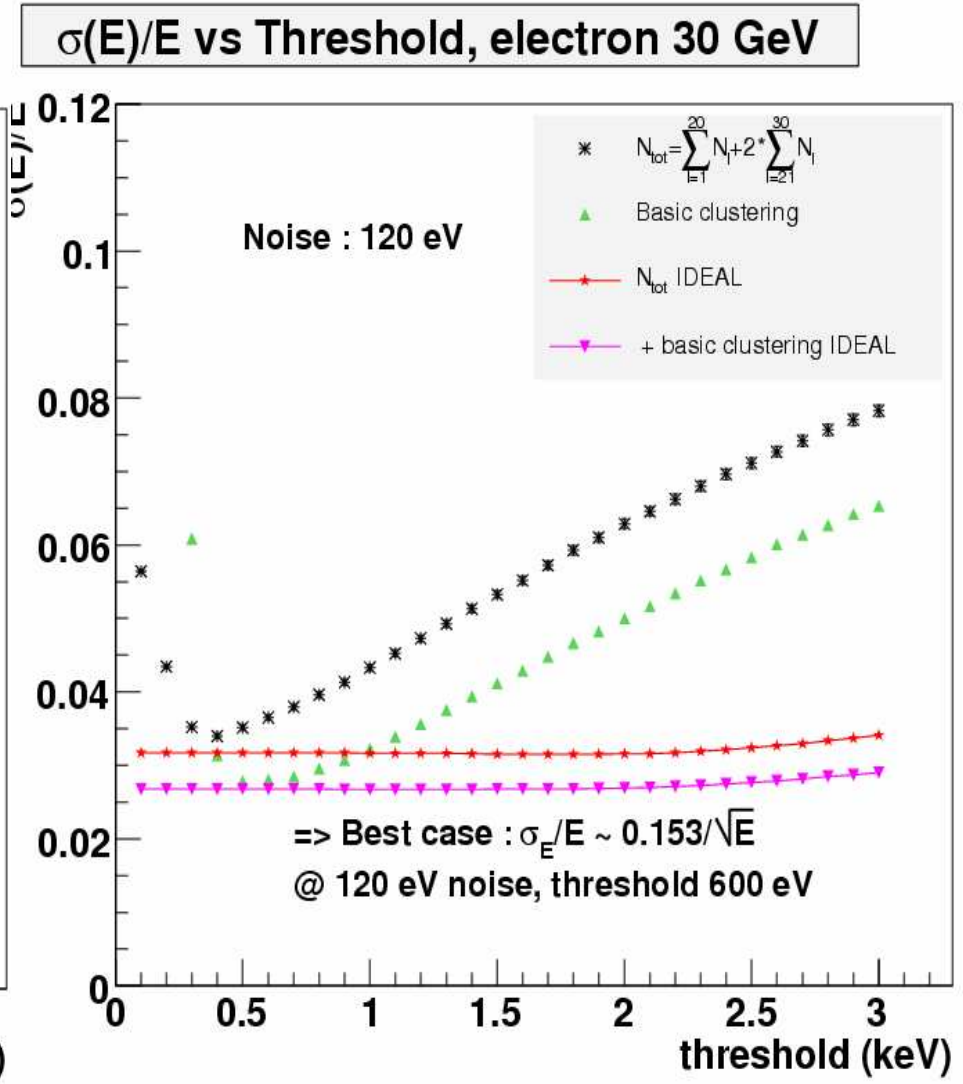
$$N_{tot} = \sum_{l=1}^{20} n_l + 2 \times \sum_{l=21}^{30} n_l$$

- Clustering =
  - Loop over hits classified by number of neighbours,
  - number of neighbours < 8 : count only 1 (or 2 for last 10 layers) and discard the neighbours.
  - 8 neighbours AND one of the neighbour has 8 neighbours : count 2 (or 4) and discard the neighbours.



Results for 20 and 30 GeV





2nd method
Minimisation method

- Let's consider 9 cases : hits having between 0 and 8 closest neighbours.
- E is defined per event i by :

$$E_i = k \times \sum_{j=0}^{8} w_j N_{ij}$$

with N_{ij} the number of hits having j neighbours for the i^{th} event, and w_j the weights that have to be optimised.

- The average energy for M events is then defined by :

$$\langle E \rangle = \frac{1}{M} \times \sum_{i=1}^{M} E_i$$

- We optimise the quantity X :

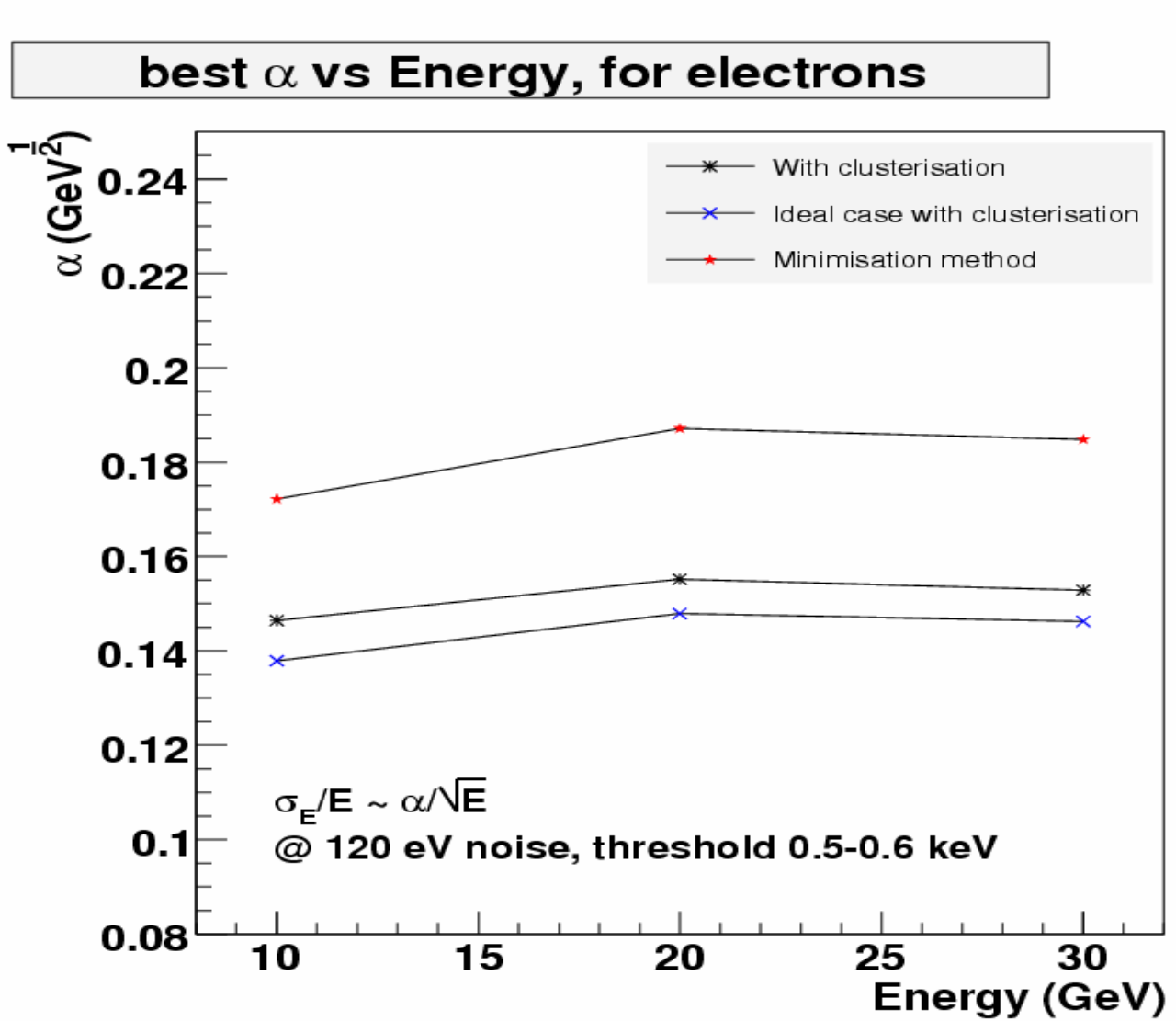
$$X = \frac{\left\langle (E - \langle E \rangle)^2 \right\rangle}{\langle E \rangle^2}$$

to find the weights, fixing w_0=1.

Results of 2nd method

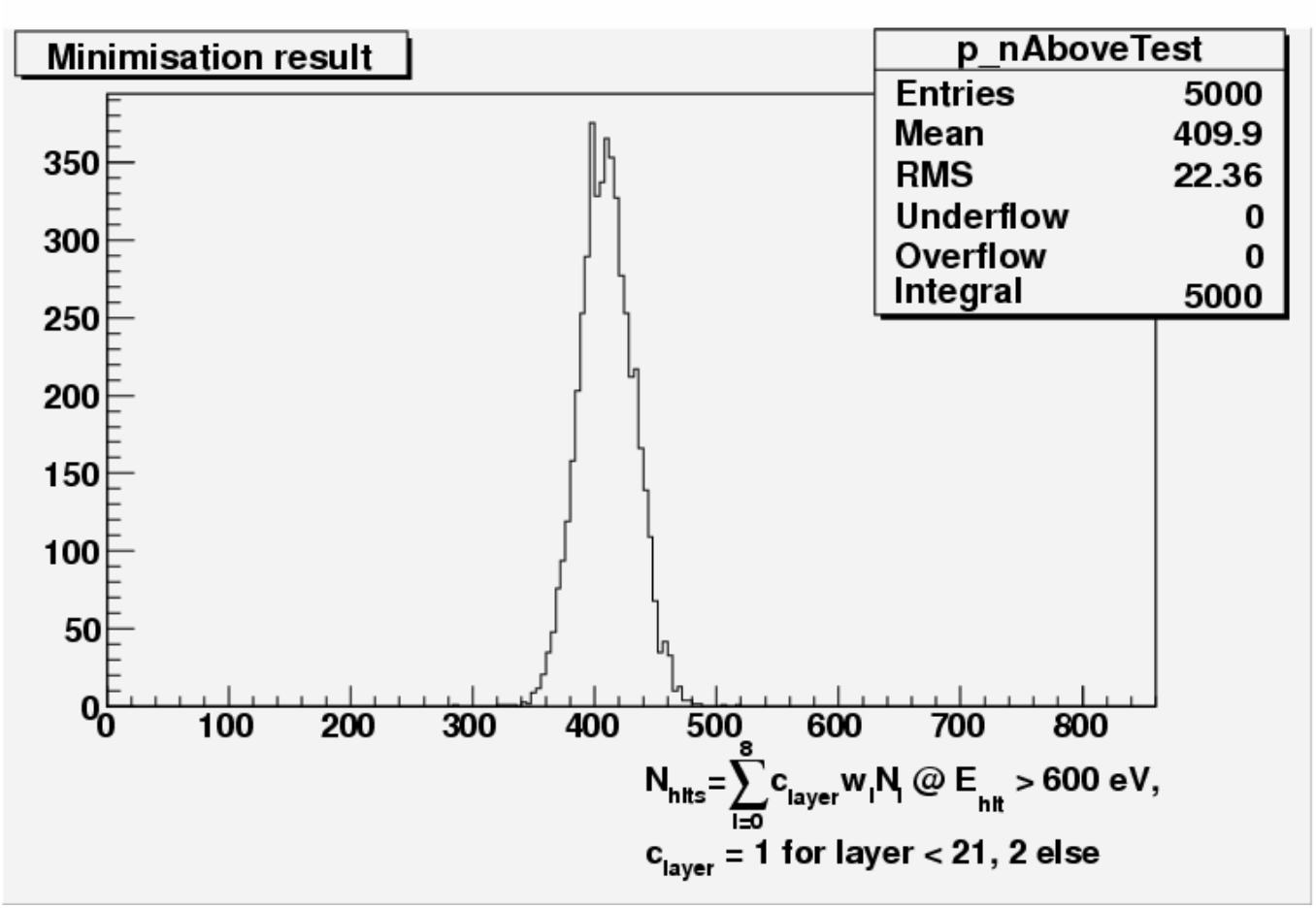
weight	w_0	w_1	w_2	w_3	w_4	w_5	w_6	w_7	w_8
10 GeV	1	0.860883	0.945681	0.302817	0.337008	0.211053	0.280682	0.0514401	-0.327783
20 GeV	1	3.44195	2.10775	0.715102	0.858828	0.542701	0.789538	0.174164	-0.500572
30 GeV	1	1.99086	1.82946	0.636283	0.8079	0.393166	0.621365	0.143223	-0.0650524

Comparison of 3 methods



Check of minimisation

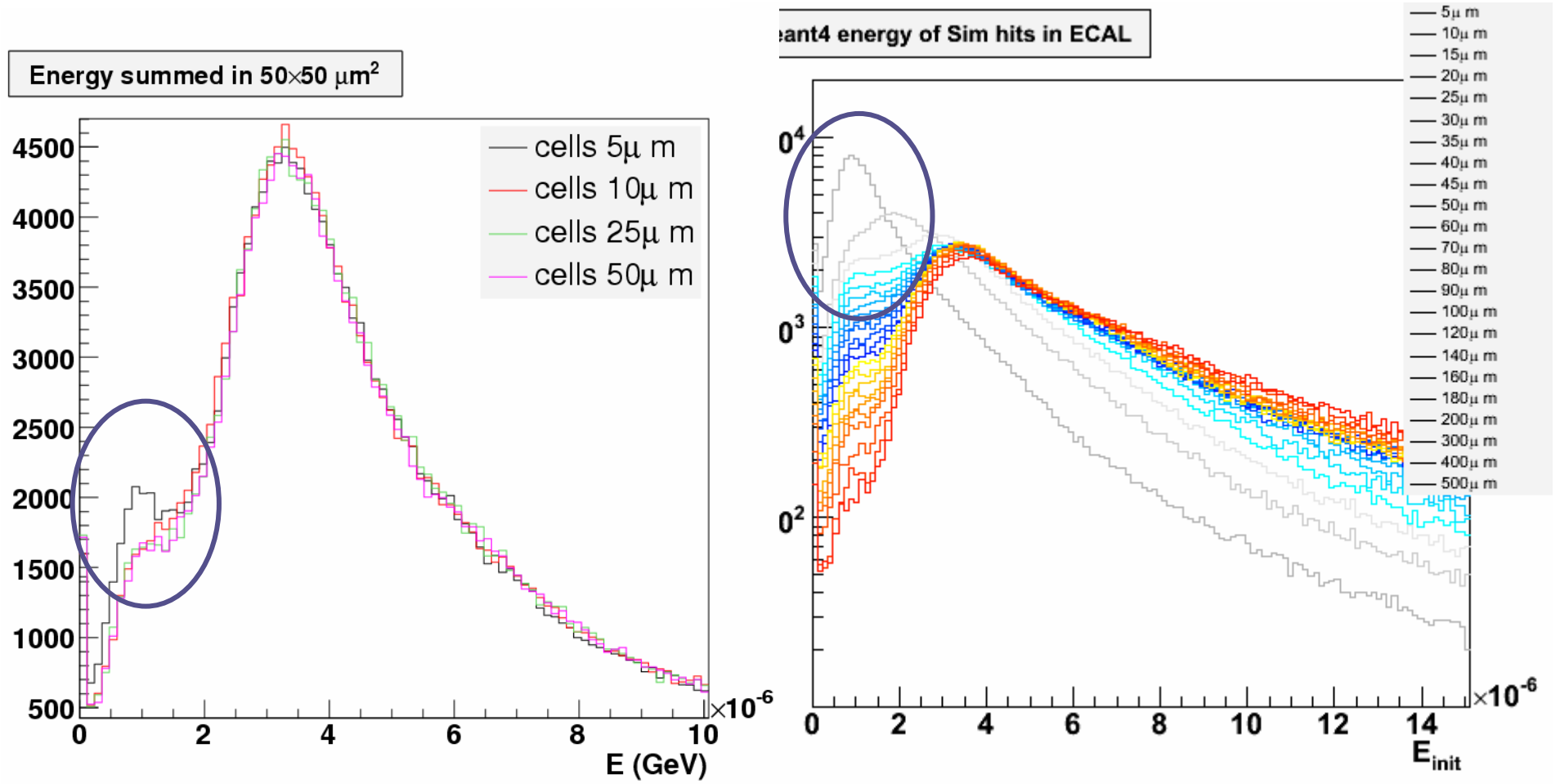
- Reapplying the weights on the same sample :



check :
22.36/409.9 = 0.05454

minim : 0.05446

Problem with small cells (5x5 μm²)



Just by curiosity : optimised cell size ?

IDEAL energy, with only 100 events per point…