Photon finder

Introduction

• After the deficiencies of cluster and match after approach were clear we have started to developed a bit more sophisticated procedure

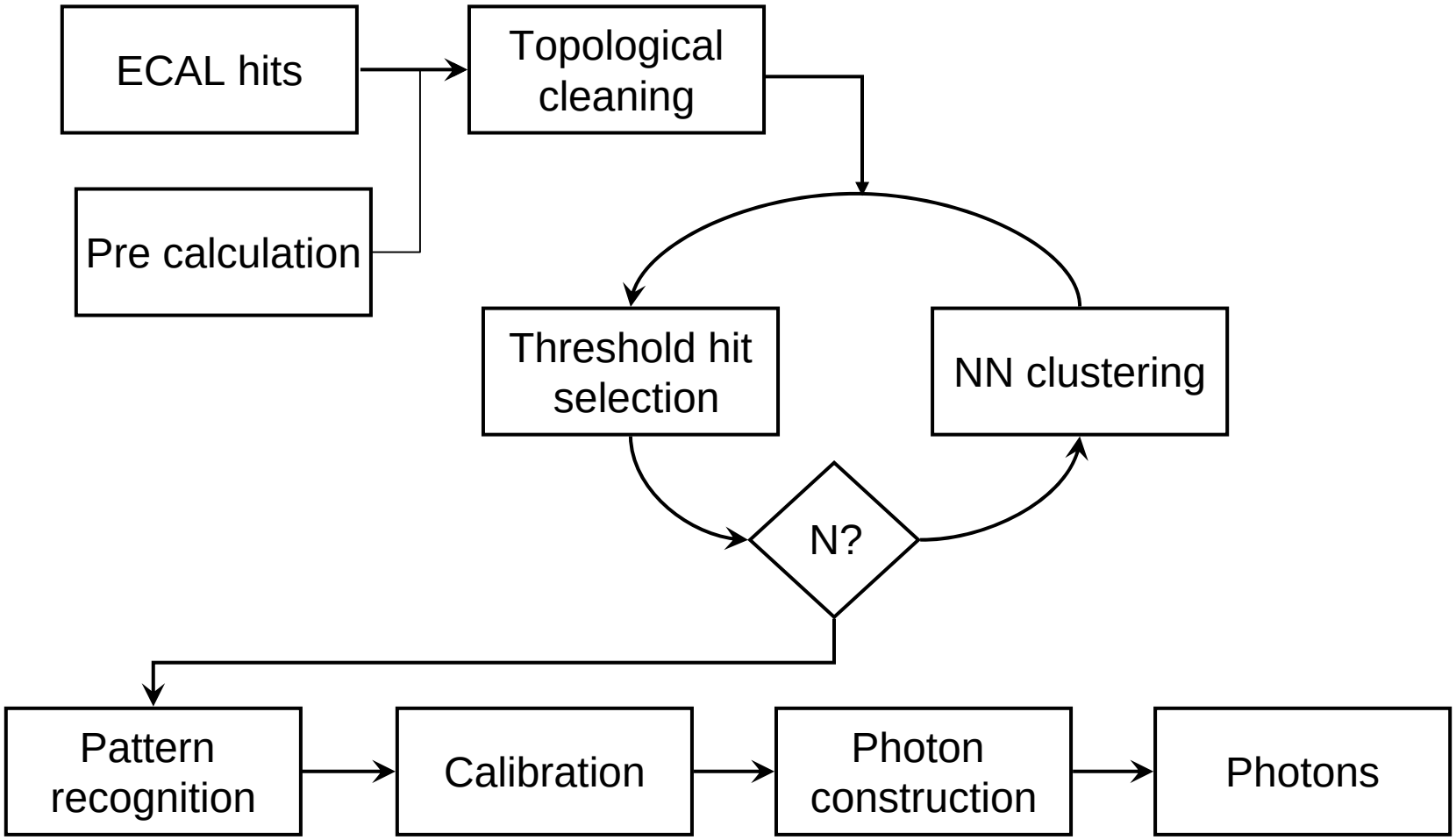
• Since one of the major problems was the charged to neutral energy transfer (and other way around) it ‘s important to have good procedure to collect neutral energy

• Explain the first stage of physics based algorithm

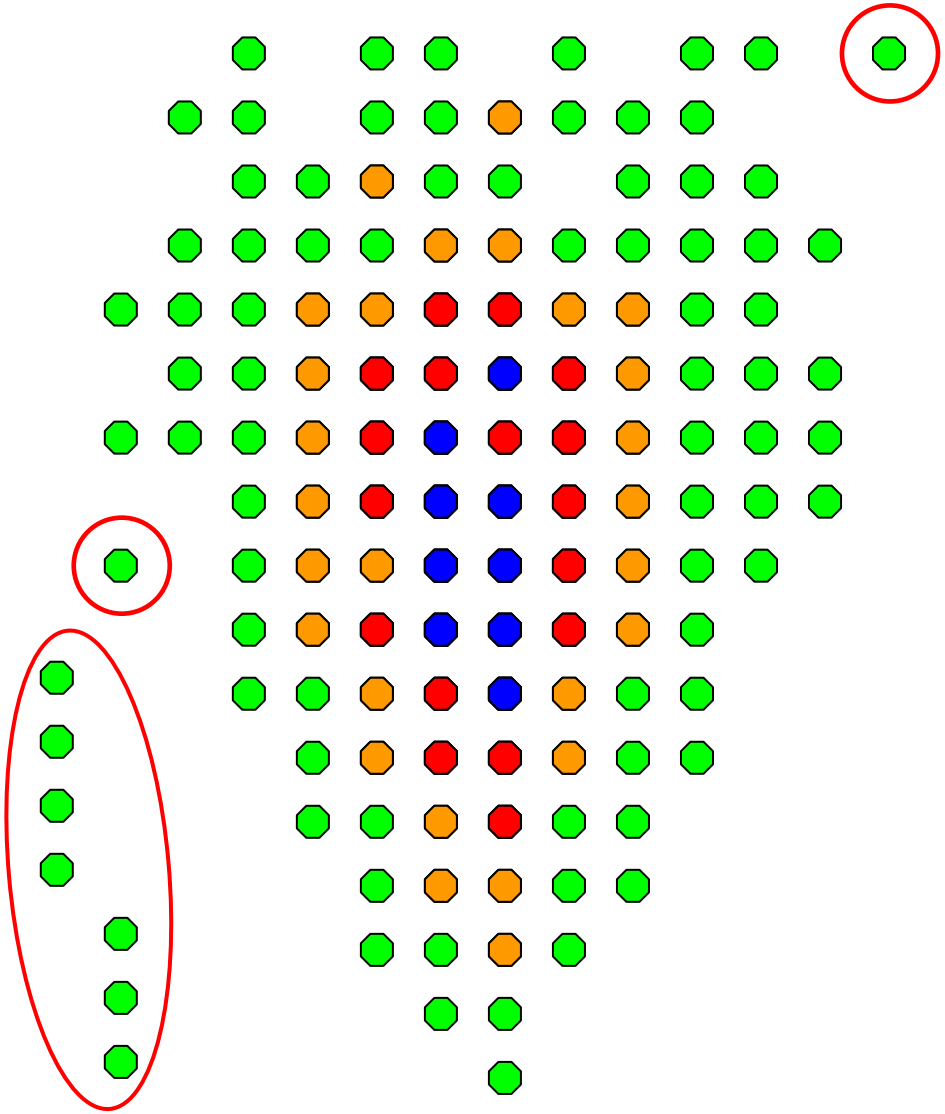
• Show first results

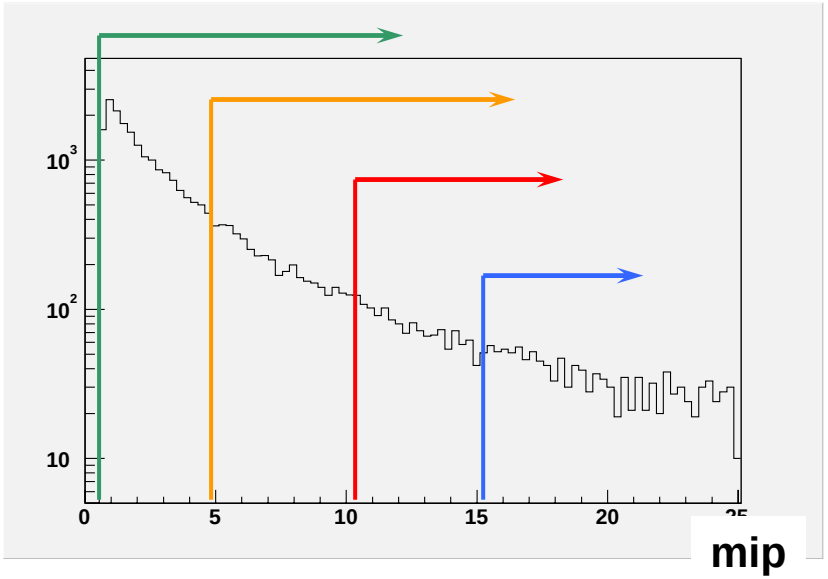
• Development and functioning of the algorithm is possible only with geometry package - do not try this at home !

Algorithm


ECAL hits
Topological cleaning
Pre calculation
Threshold hit selection
NN clustering
N?
Pattern recognition
Calibration
Photon construction
Photons

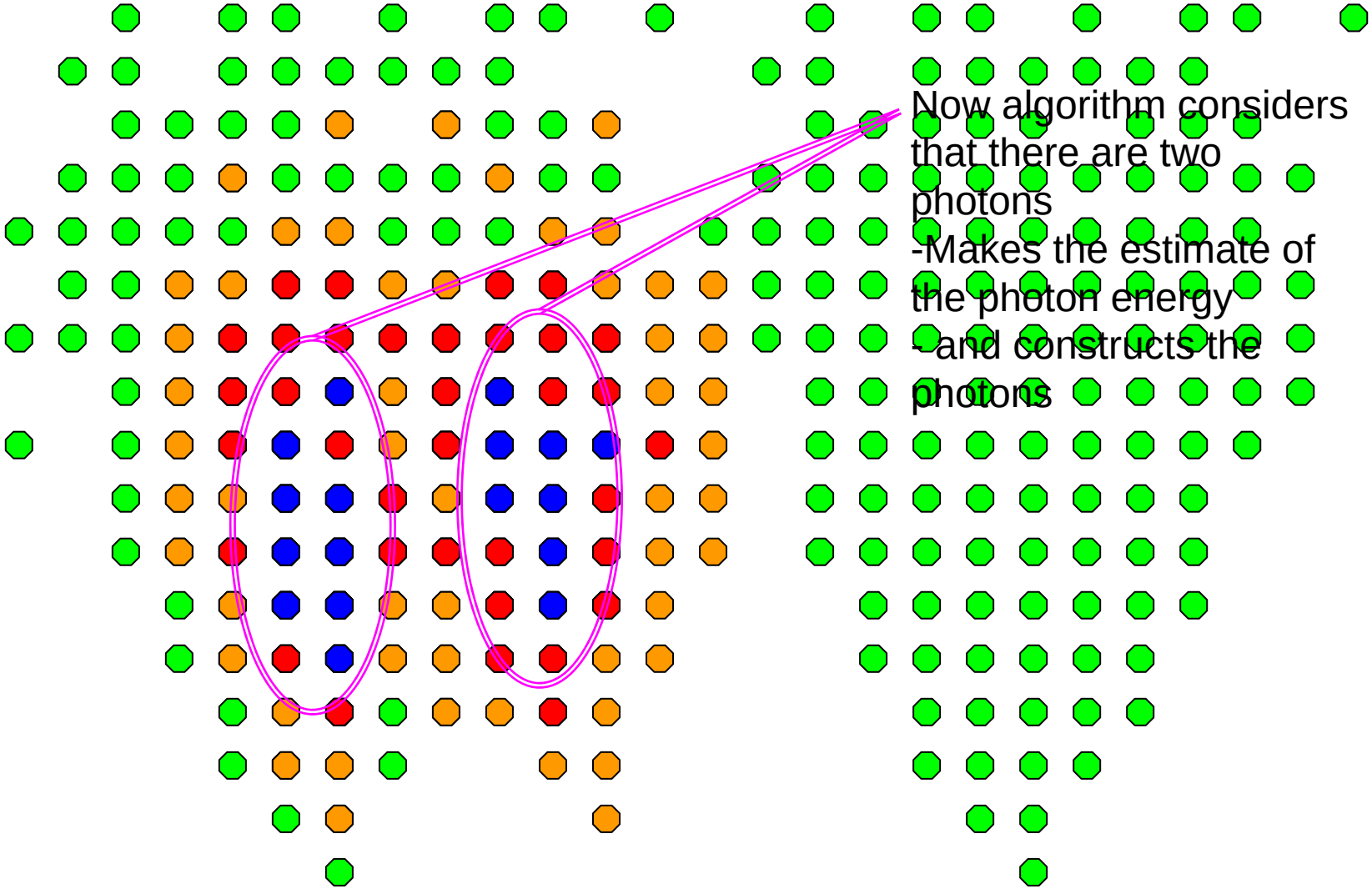
Algorithm





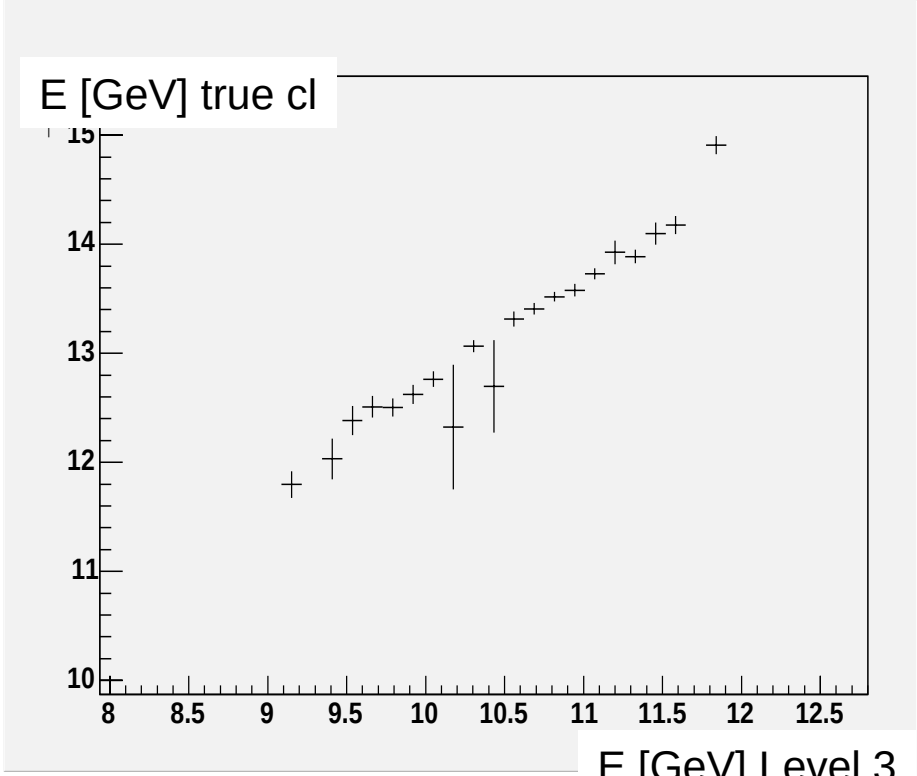
mip

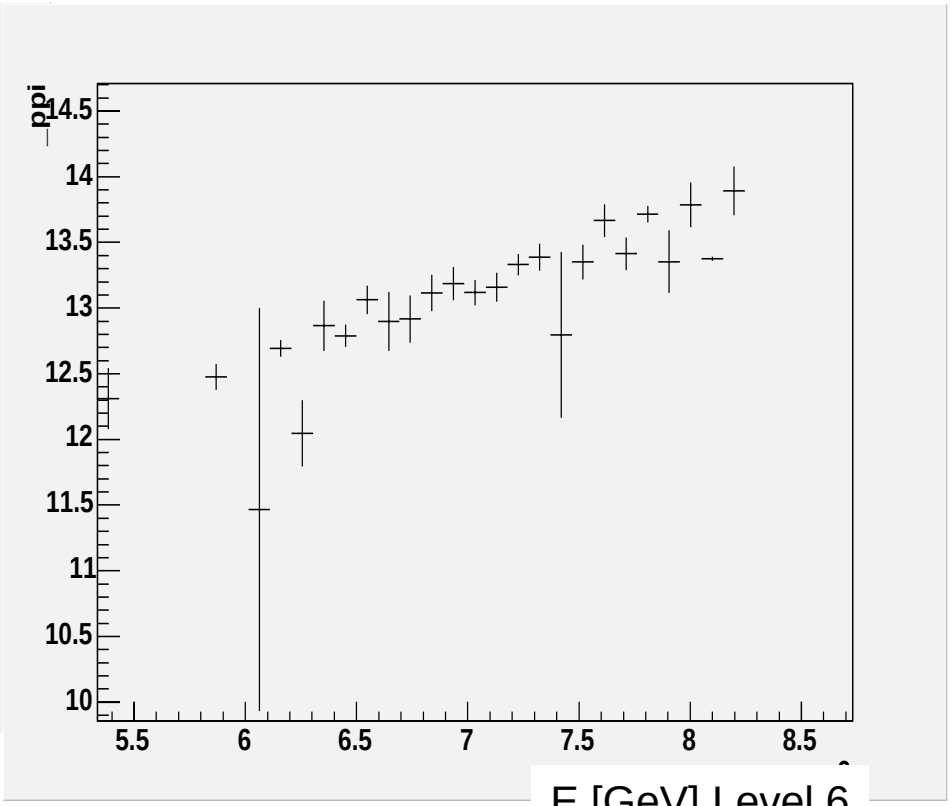
Algorithm


Now algorithm considers that there are two photons
-Makes the estimate of the photon energy
- and constructs the photons

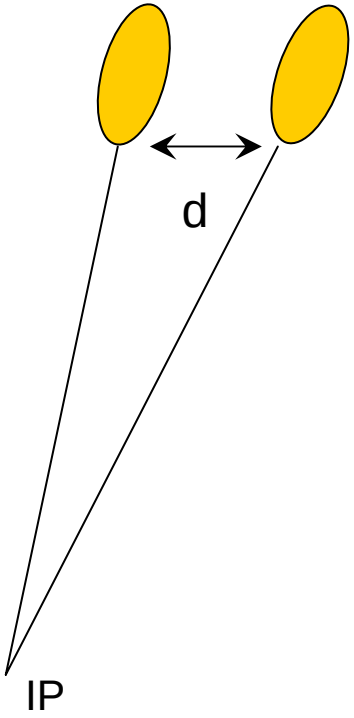
Algorithm

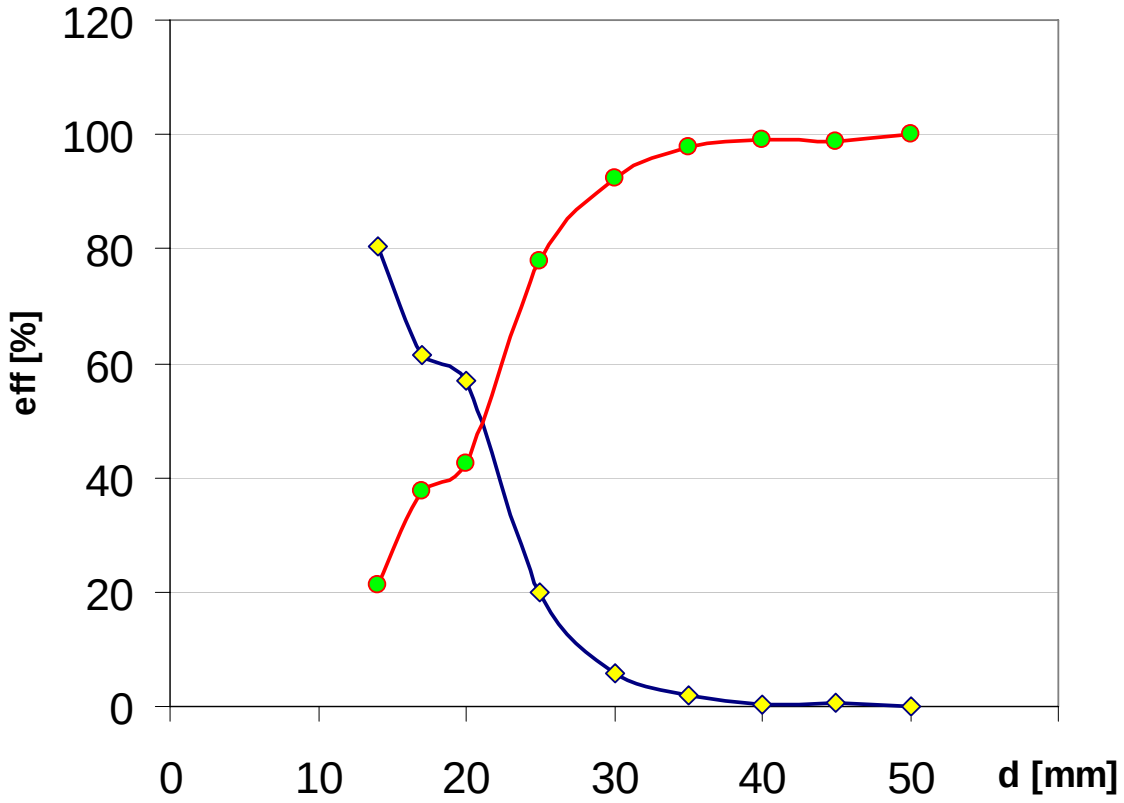
• procedure needs a large initial effort to make the N level x energy matrix filled with calibration parameterization that is covering the full range of energies
• for initial tests linear calibration was chosen as appropriate



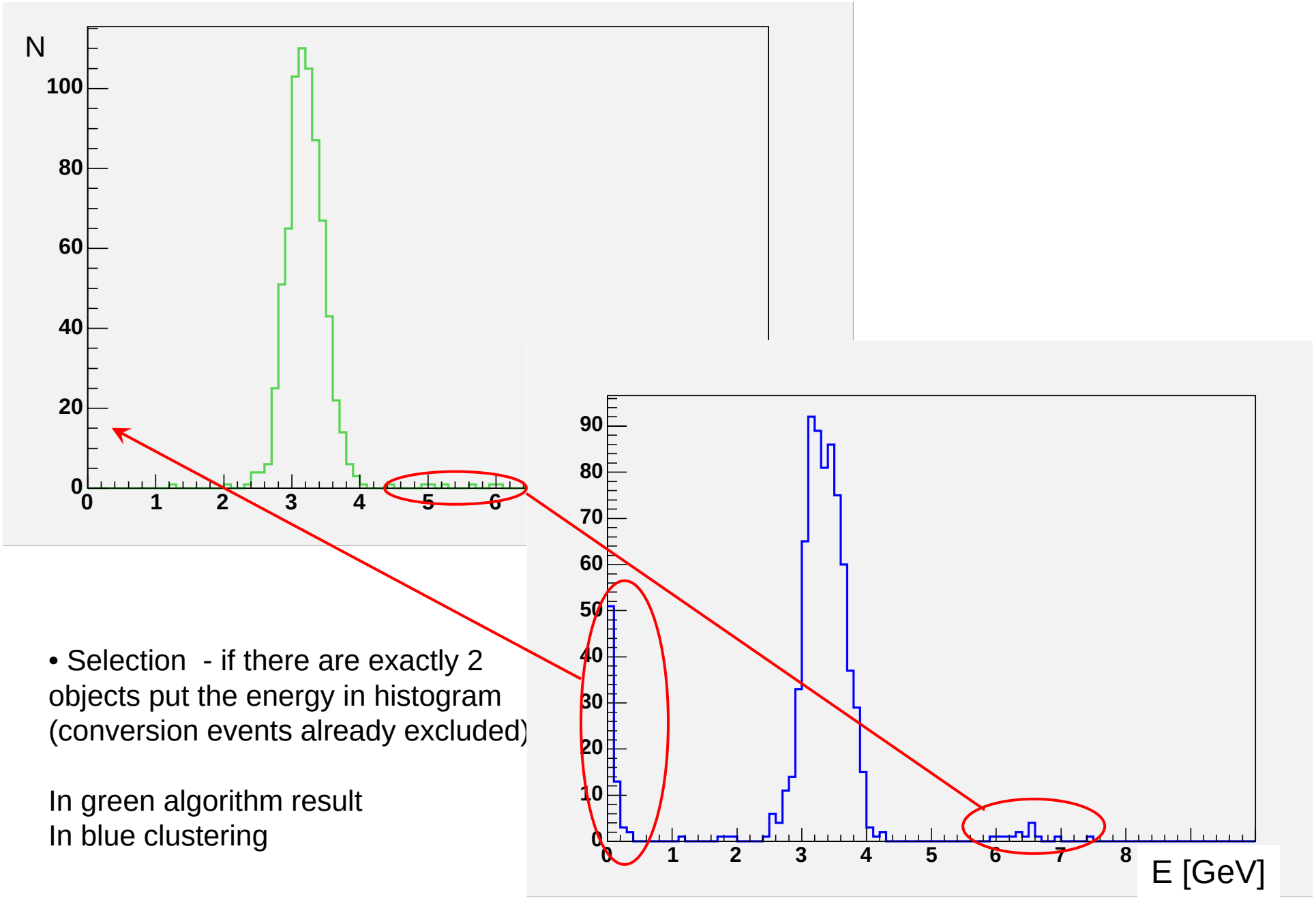


two photons





Samples with two photons (each 3GeV) were shoot from IP with different distances of impact point on the face of ECAL (LDC00 type)
1 photon found in blue , 2 photons found in red .

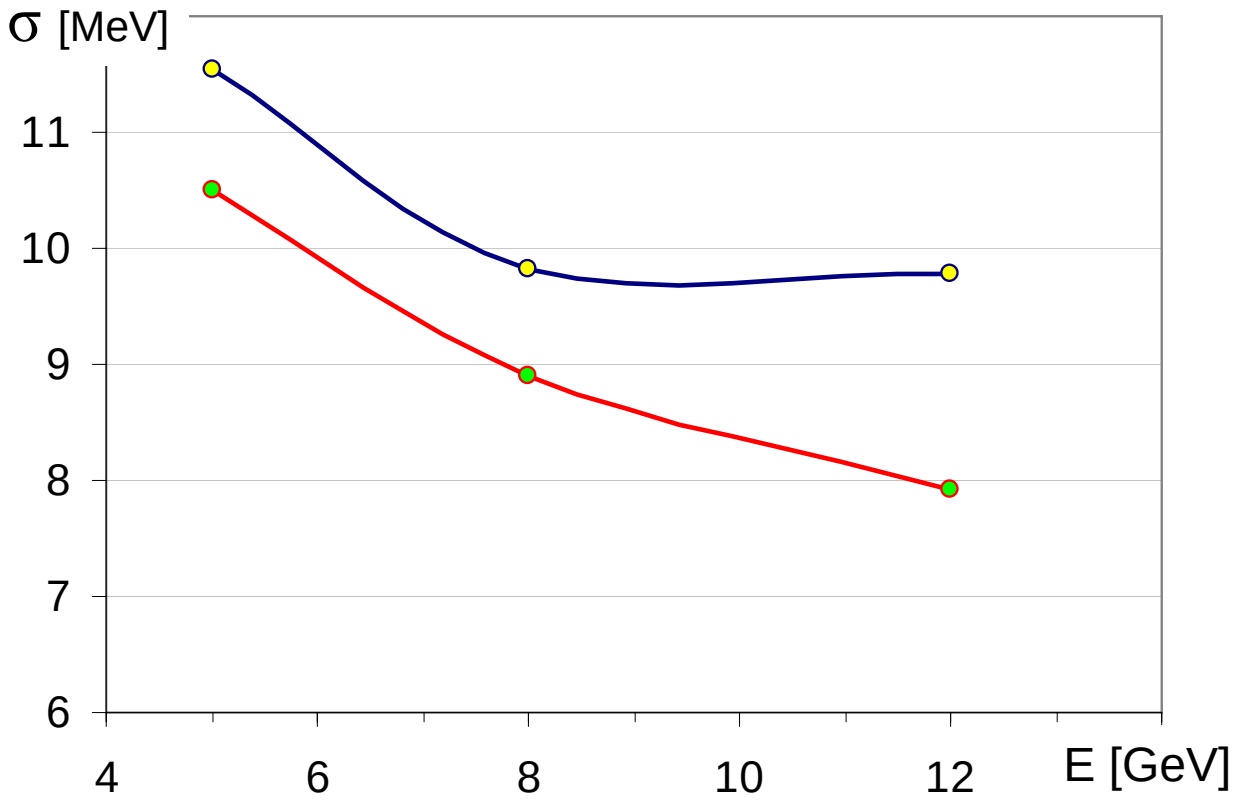


• Selection - if there are exactly 2 objects put the energy in histogram (conversion events already excluded)

In green algorithm result
In blue clustering

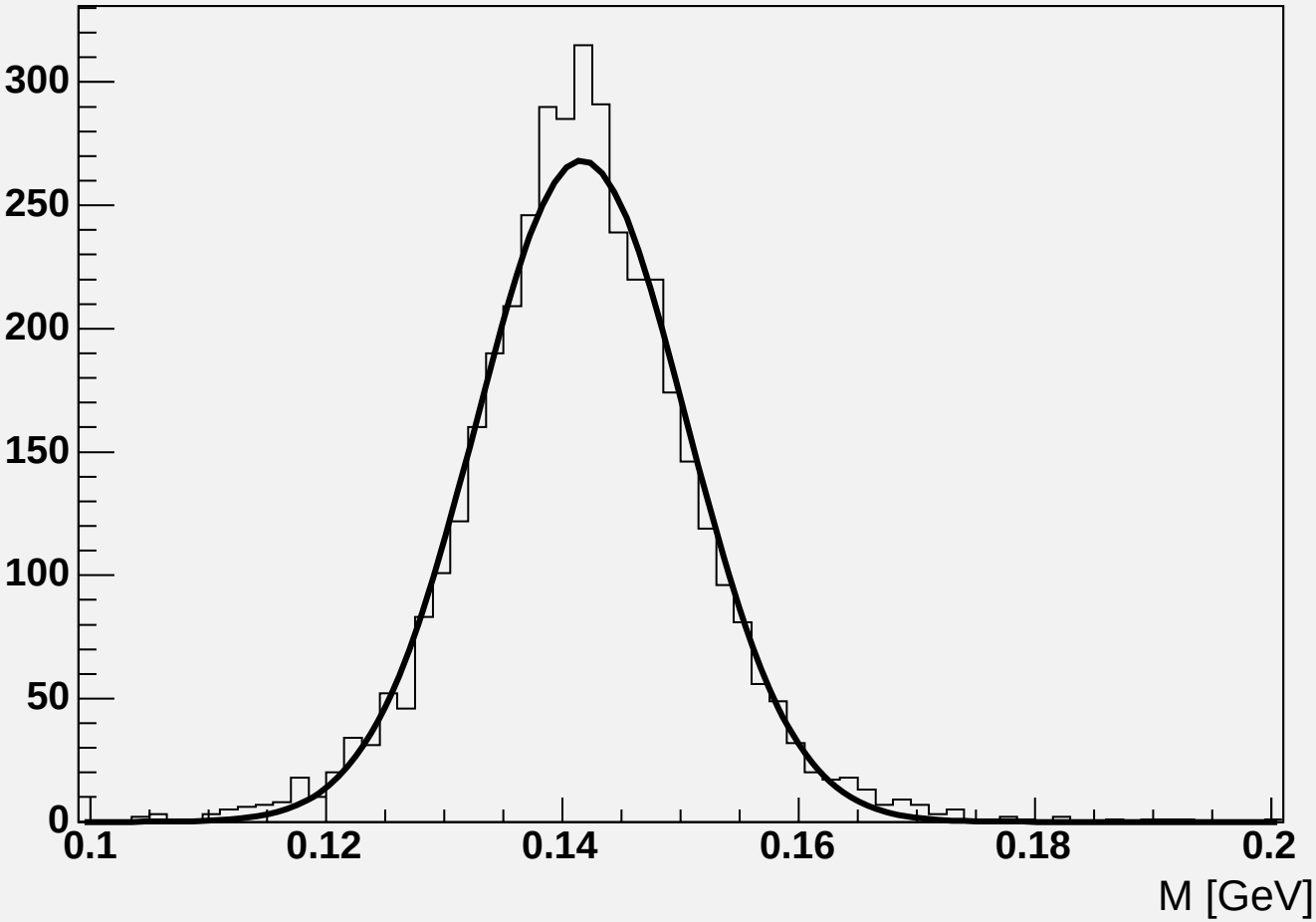
pi0

• Pions generated from IP , if found 2 clusters mass of the event was calculated and the resulting plot was fitted with Gaussian , in blue clustering , in red explained algorithm



pi0

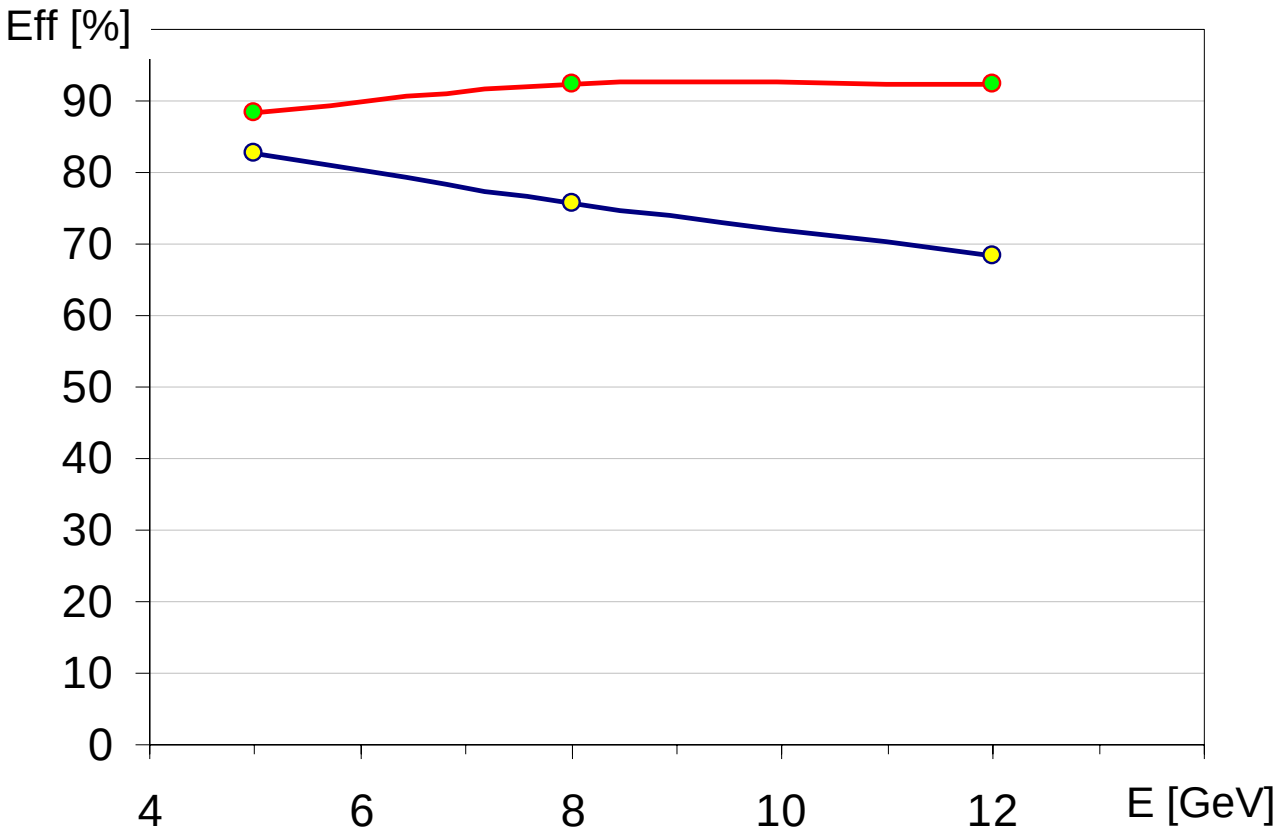
Mass distribution for 8GeV pi0 (just to show that there are no systematic effects gauss is still a gauss)



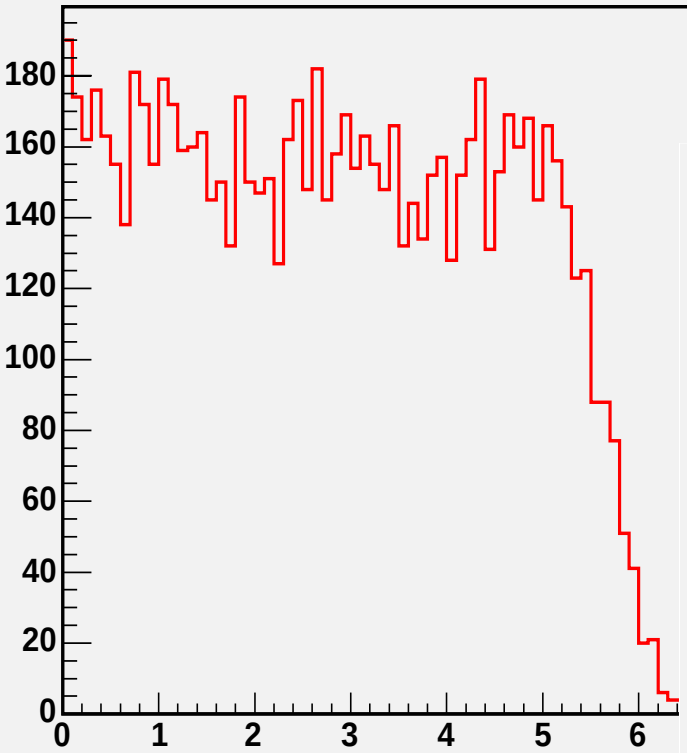
pi0

Events are selected on the base of only two reconstructed particles (in pre selection events with hits in tracker were rejected)

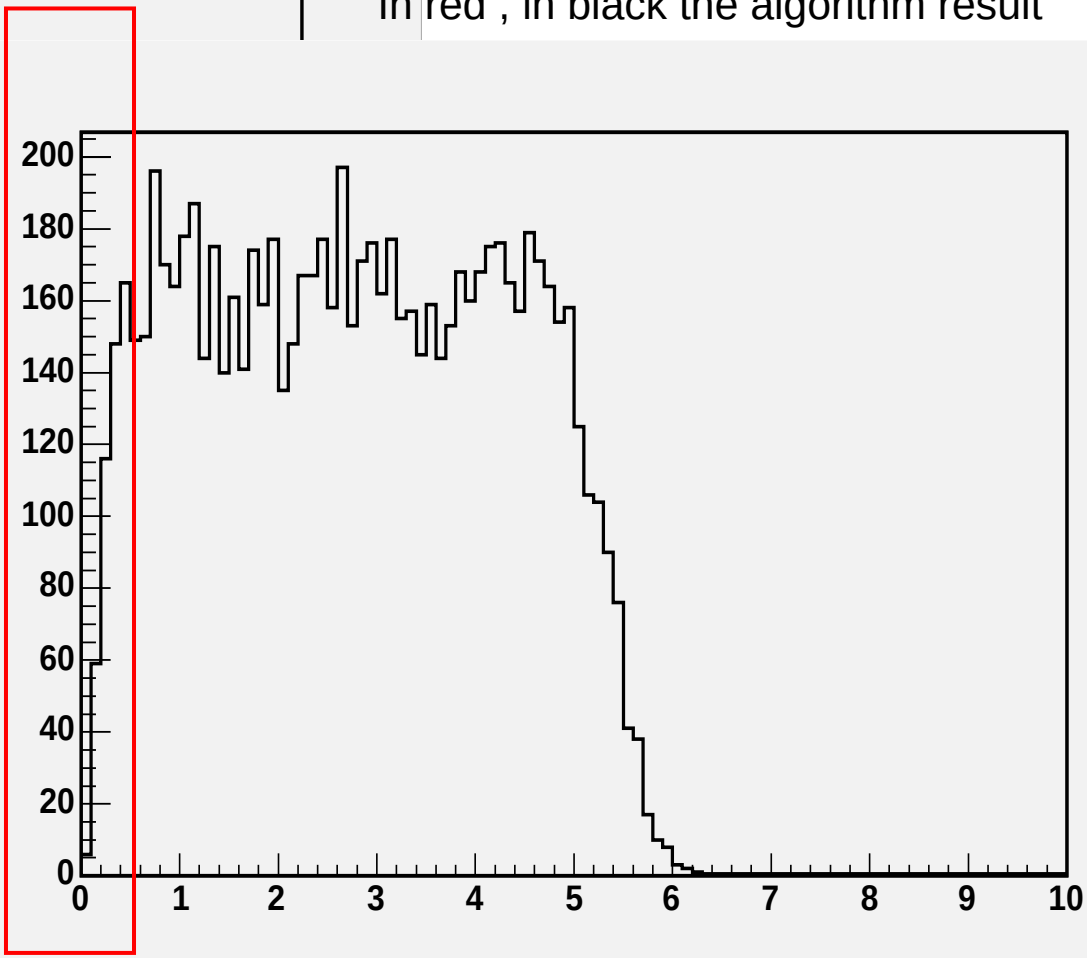
In red result of the algorithm
In blue clustering approach



Problems and to be done



Pions of 5 GeV
Energy distribution of all true clusters
In red , in black the algorithm result



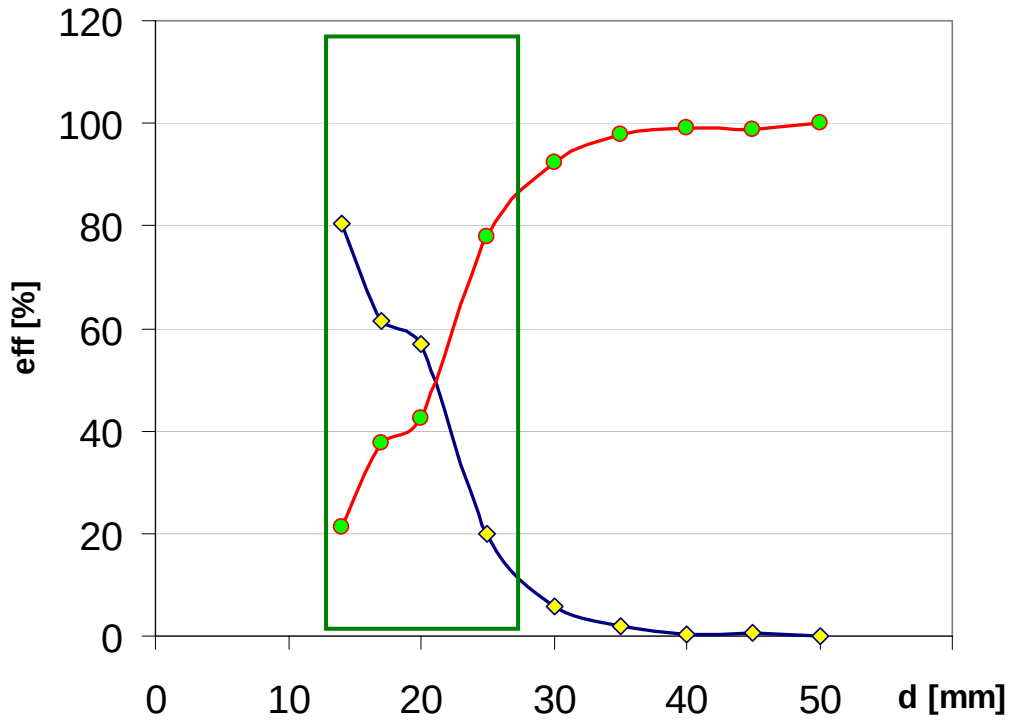
- below 0.4GeV inefficient
- another method needed for low energy

Problems and to be done

- still not optimal performance

- can be significantly improved by fitting – still not done and there are some speed consideration

- deterministic assignment of hits still to be compared with weighted one



Conclusion

• Physics supported reconstruction in photon case even in this early stage of algorithm shows a potential

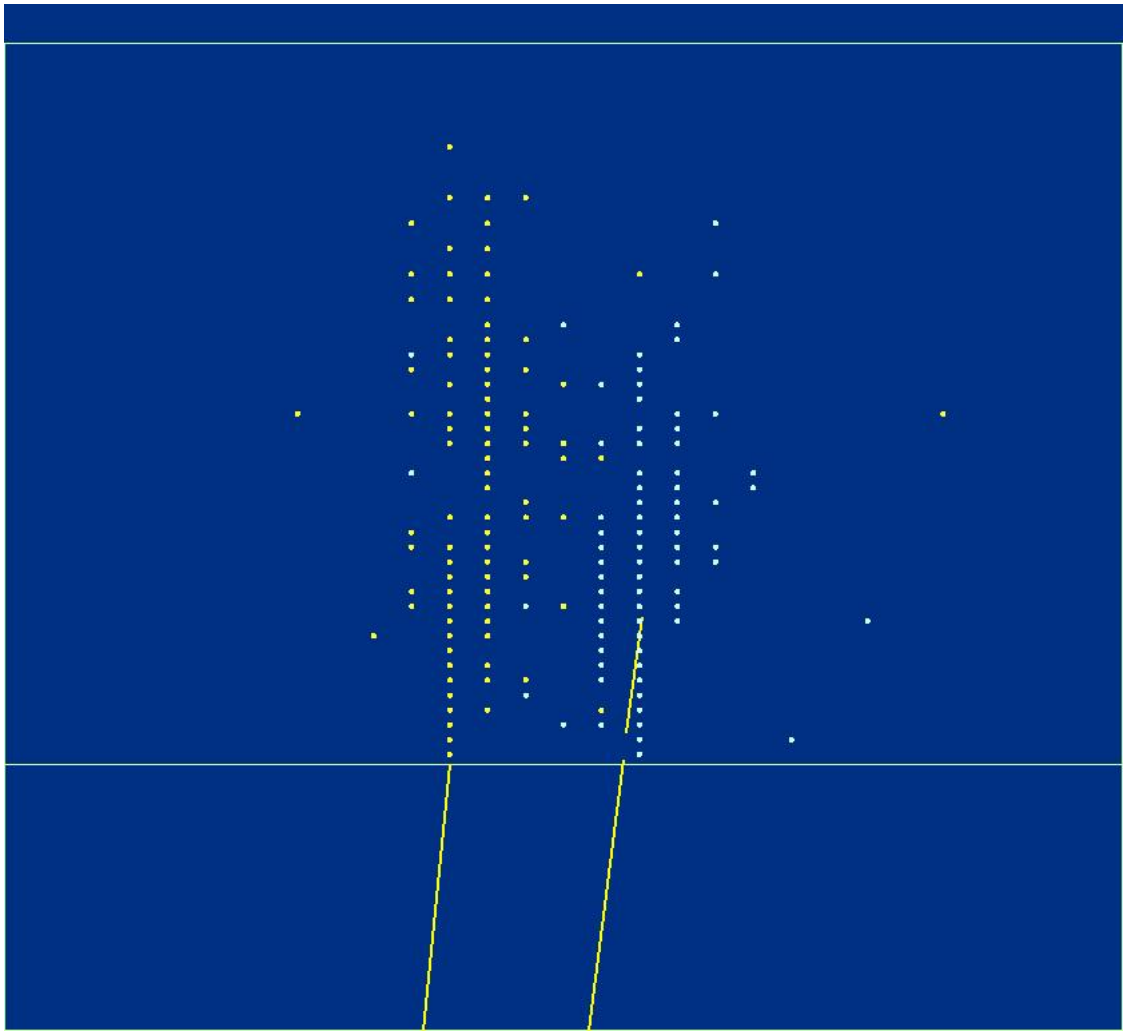
• additional procedure for low energy photons needed

• It will be interesting to see it’s stability over proposed detector designs and cell sizes – soon ☺

• Without a geometry package development would be impossible

• “ computing time is not an issue “ ☺

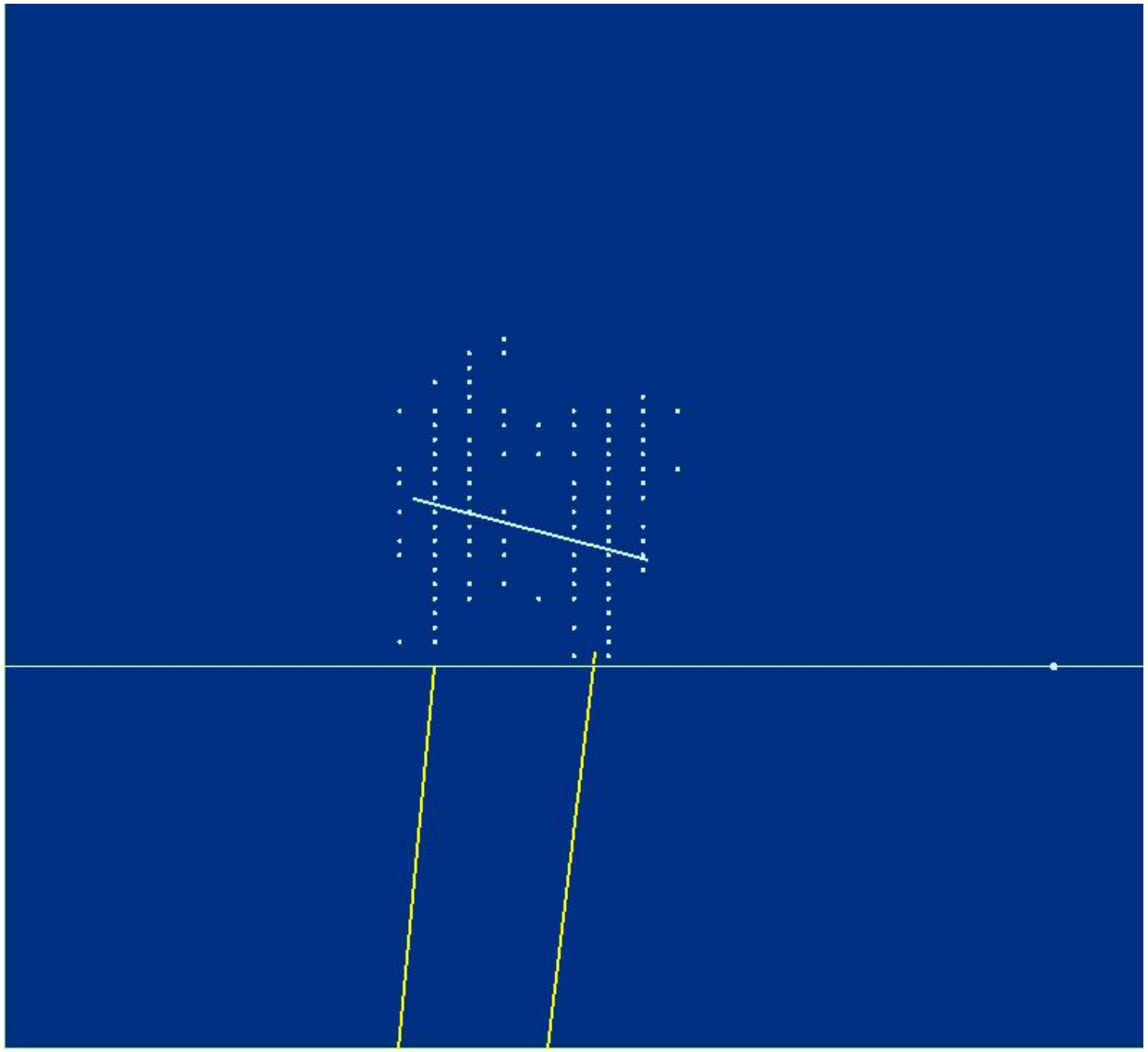
appendix



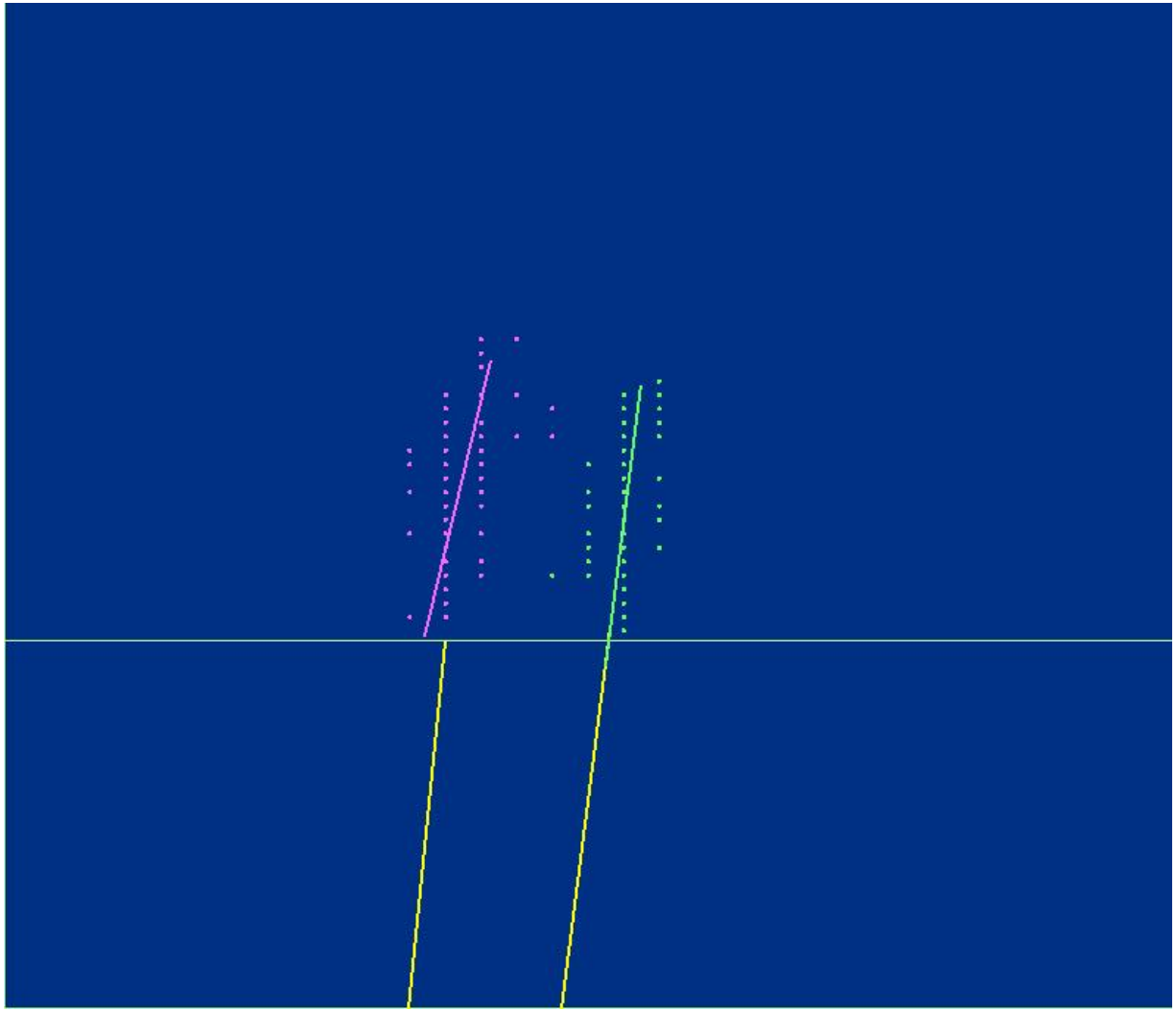
- true clusters of two photons in different colors
- yellow lines represent the direction of the photon

ECAL face

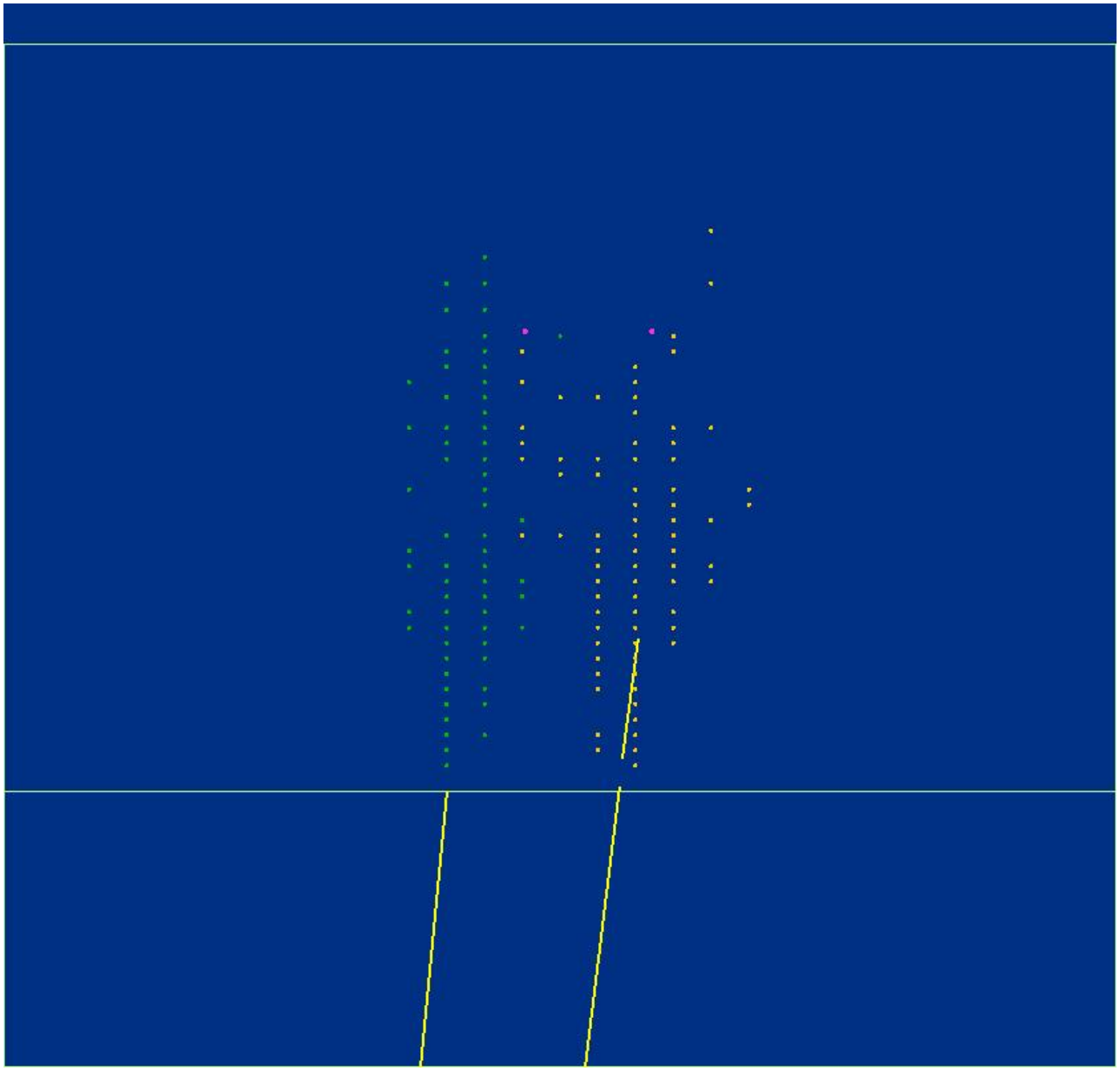
Keep in mind that picture is a projection in plane !



• Starting 0 level cluster Line is the main axis from the inertia tensor



- at the end of the core finding two cores isolated



• finally the two photons are constructed (in different colors two Photon clusters)

Pink dots are the intersection of photon direction with second ECAL structure and are not hits !