Algorithm design for MAPS clustering

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Introduction:

- Using LDC01 detector model in Mokka-06-01
- MAPS Mokka geometry (Yoshi Mikami)
- Using MARLIN (v09-04) with MarlinReco (v00-02).
- Compare default 1cm analogue Si with 50μm MAPS (15μm epi layer)
- Event samples – several k events for each of:
  - single electron events c/o Yoshi Mikami (default geometry & MAPS geometry) – should be just 1 large cluster
  - $Z \rightarrow qq\tilde{}$ (uds quarks only) events at 91 GeV – should be ~20 small clusters

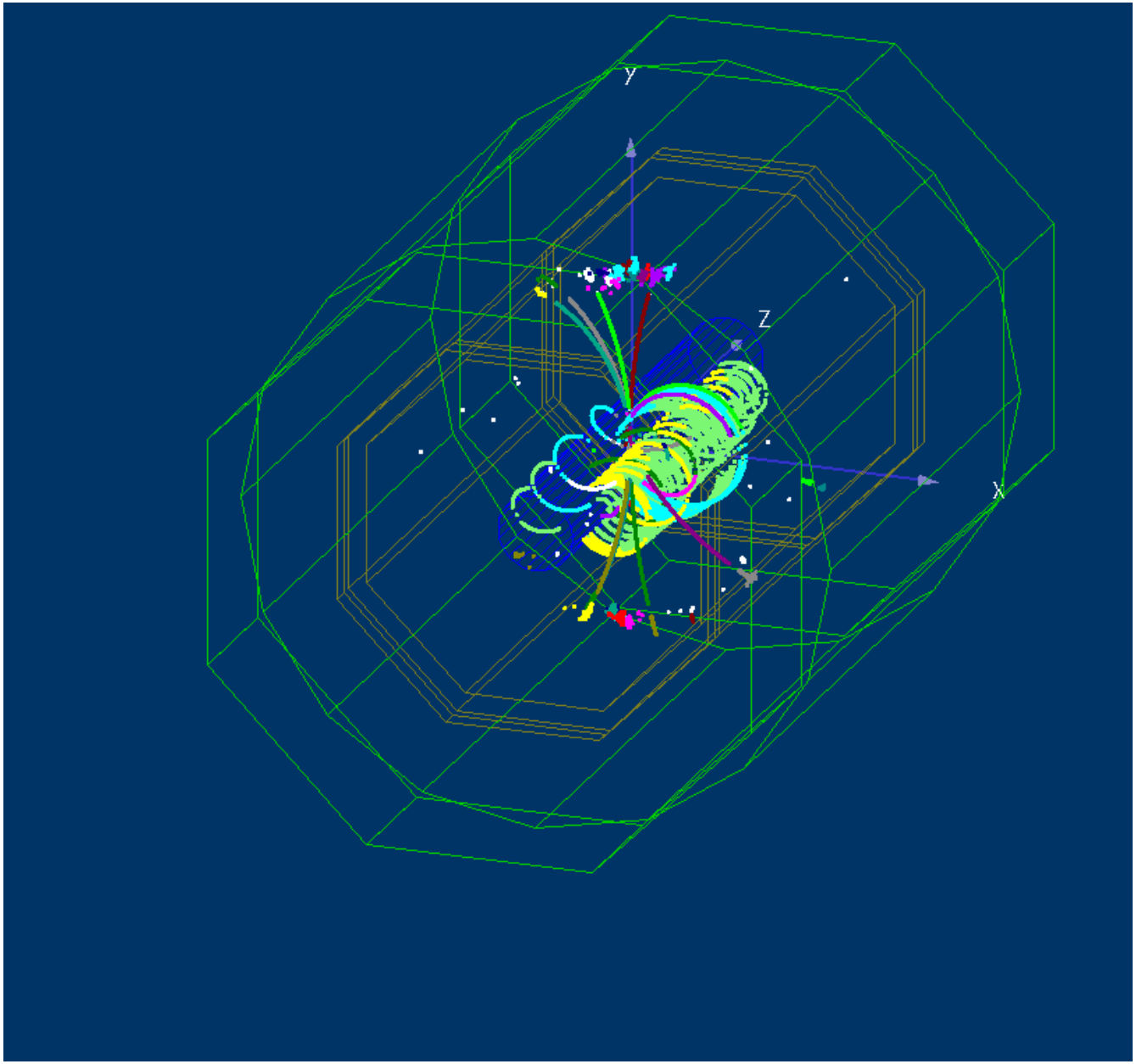
Efficiency and Purity – definition used

Efficiency = $\frac{\text{number of reconstructed hits in a cluster (right and wrong)}}{\text{number of possible hits in the 'True Cluster'}}$

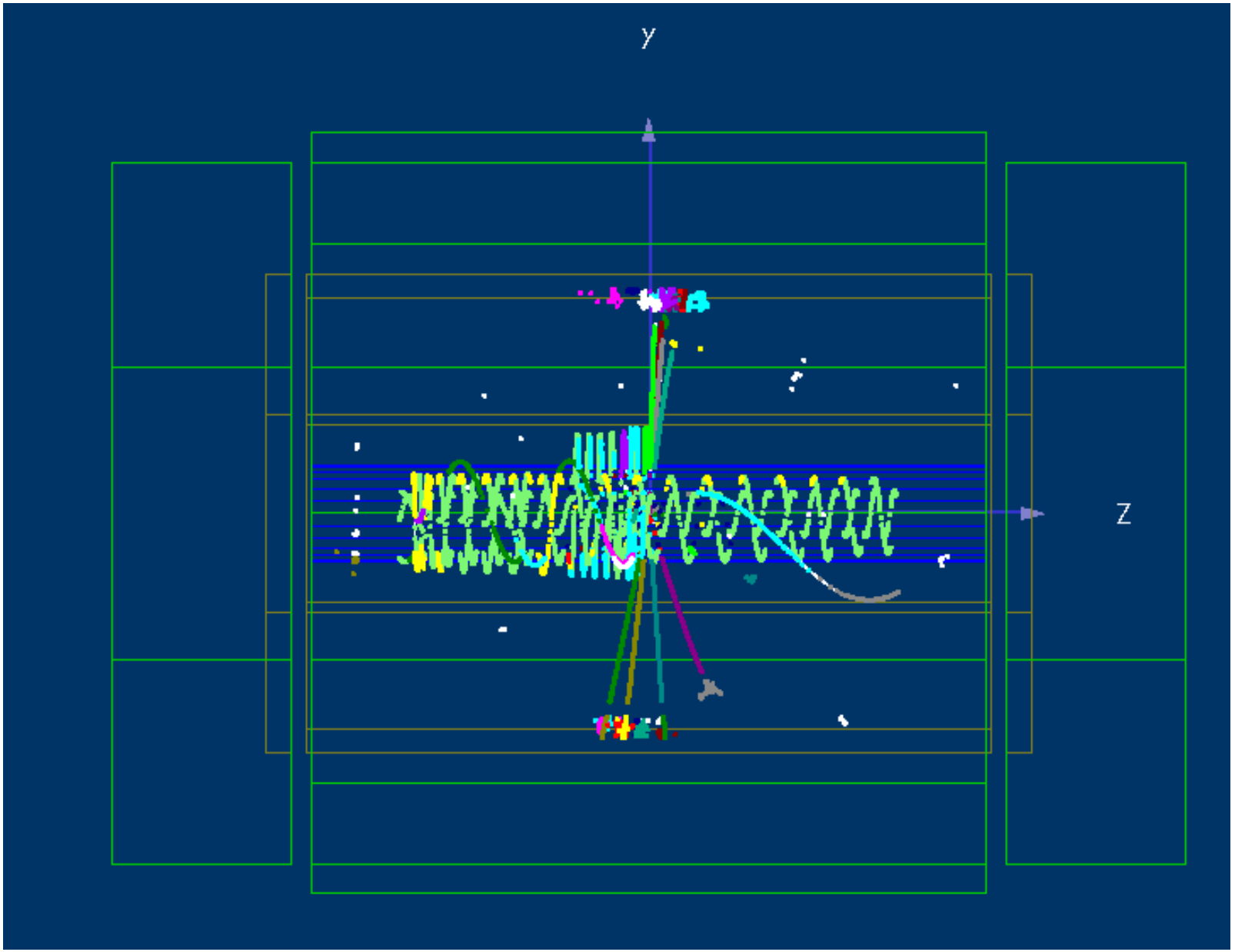
Purity = $\frac{\text{correct hits in a cluster}}{\text{total hits in the cluster}}$

Efficiency of an event = $\frac{\text{number of reconstructed clusters}}{\text{number of possible 'True Clusters'}}$

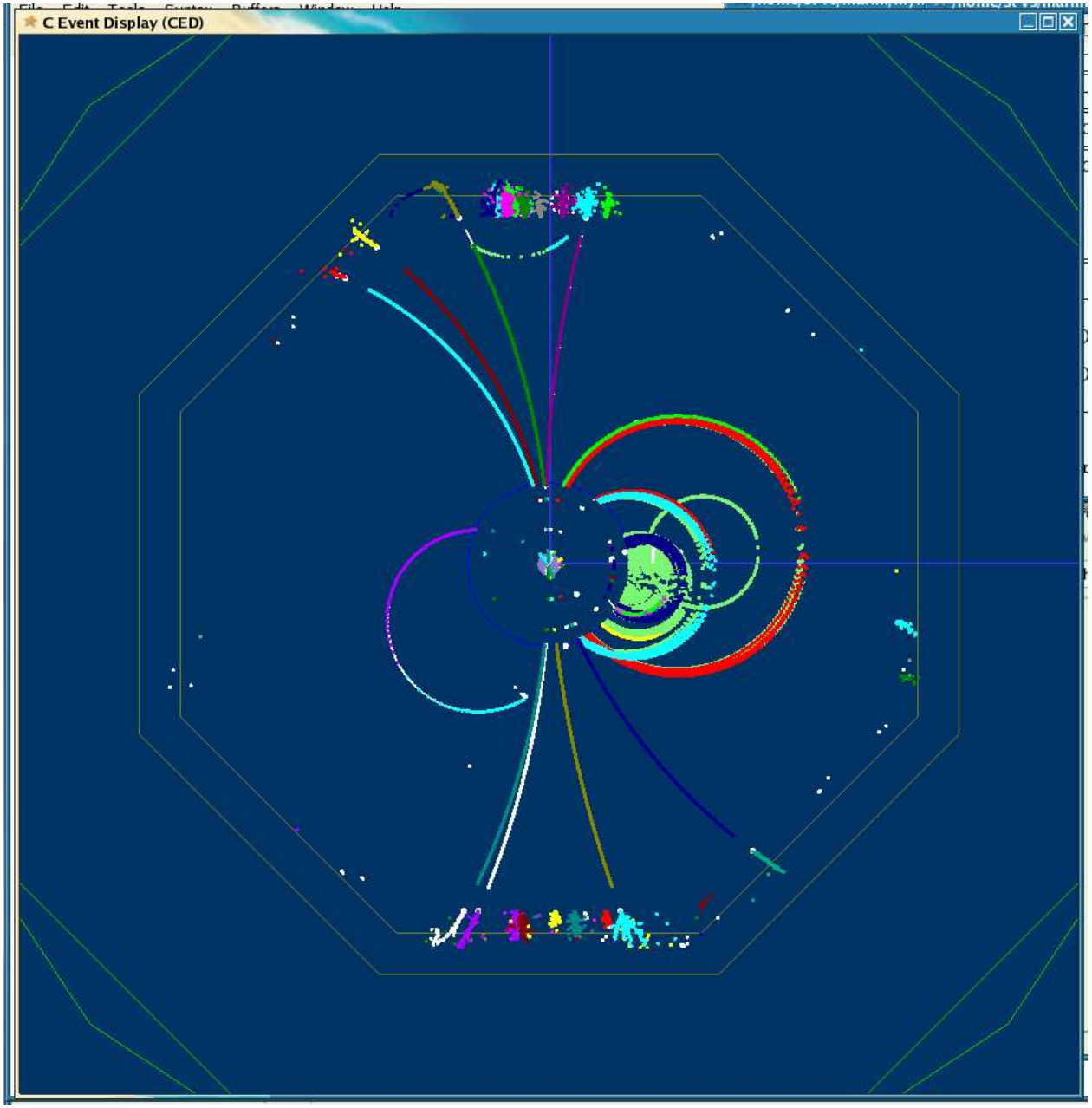
Example Z→ qq event



Example Z→ qq event

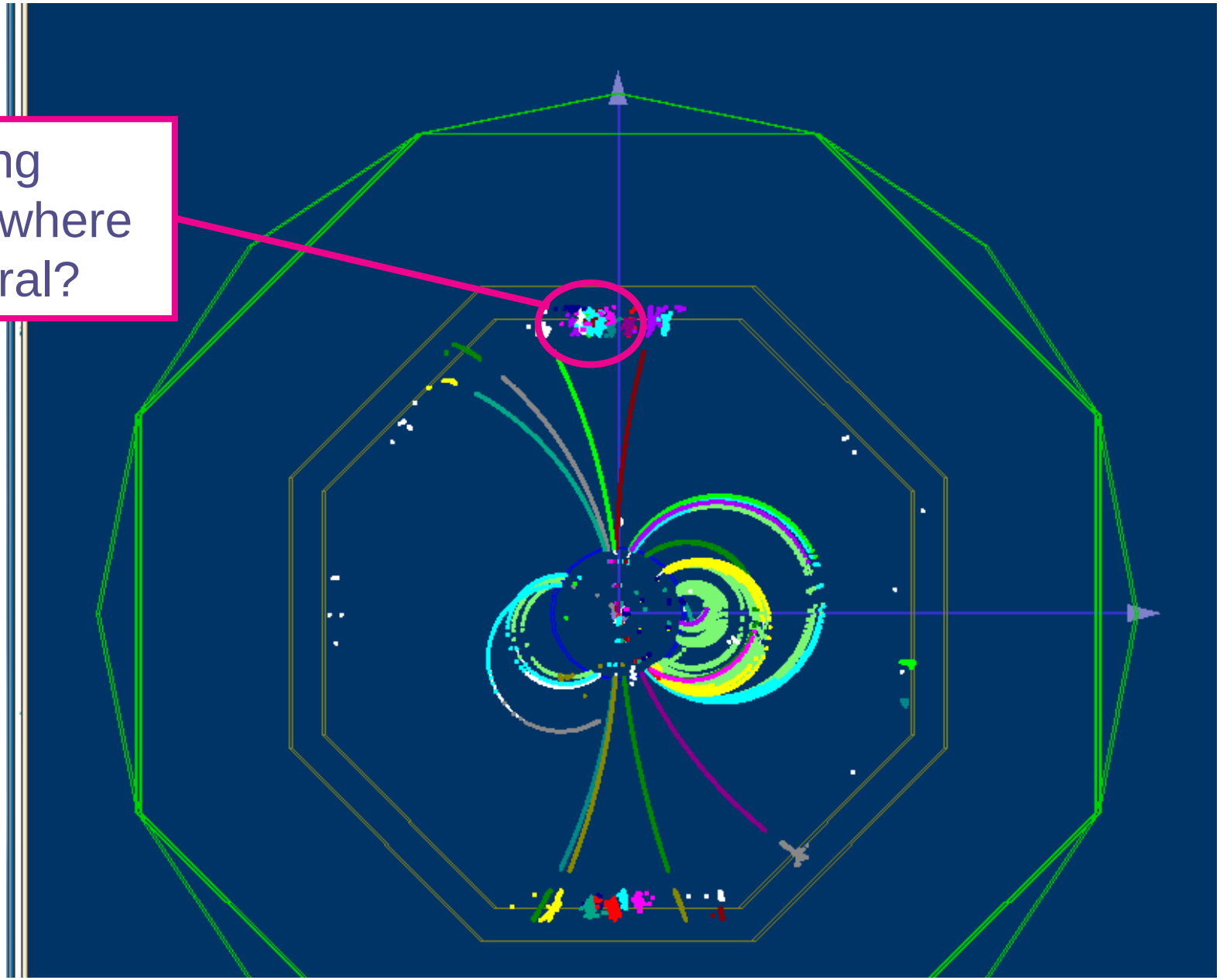


Example events (analogue Si)

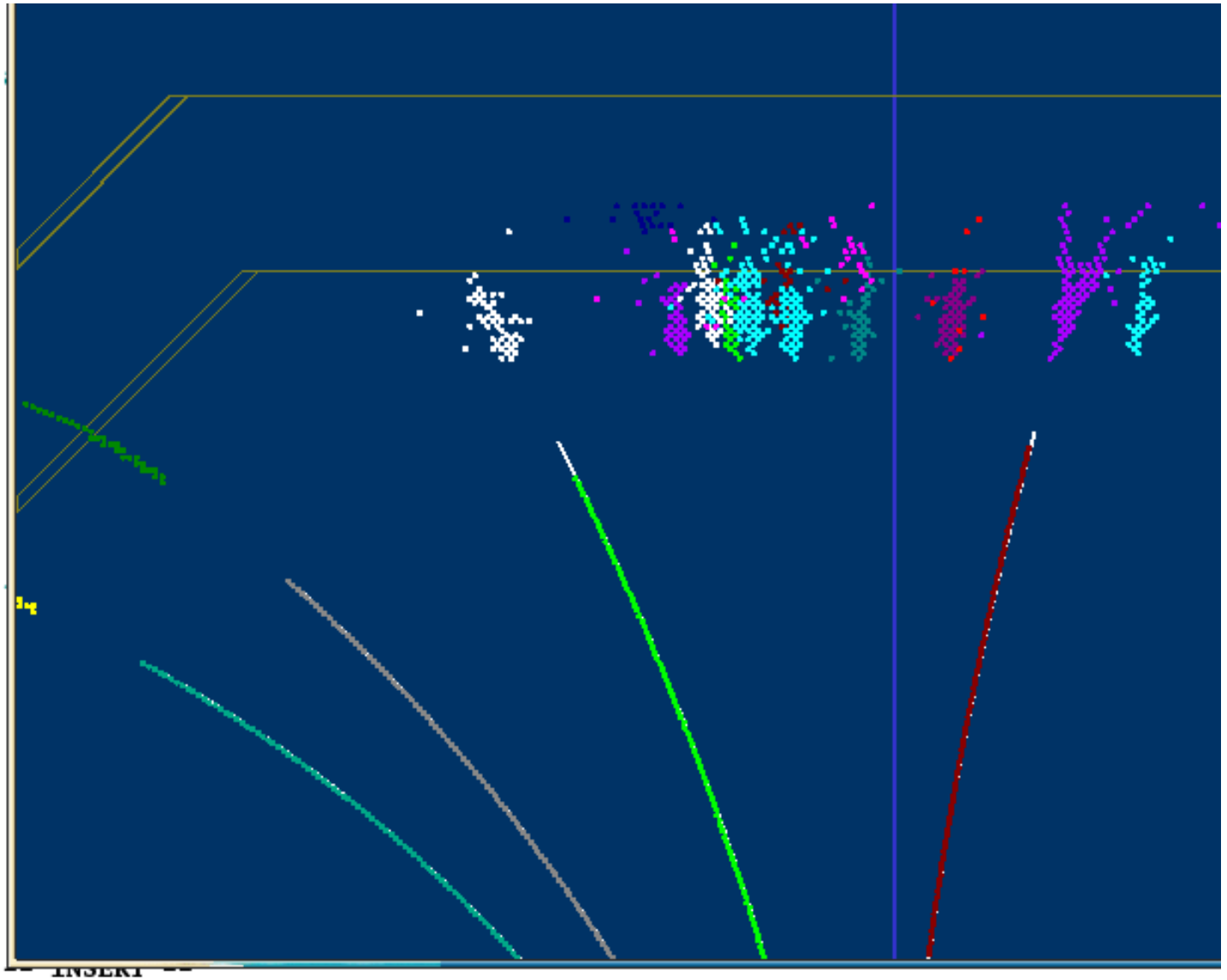


Example events (MAPS geom.)

Clustering merges where not natural?

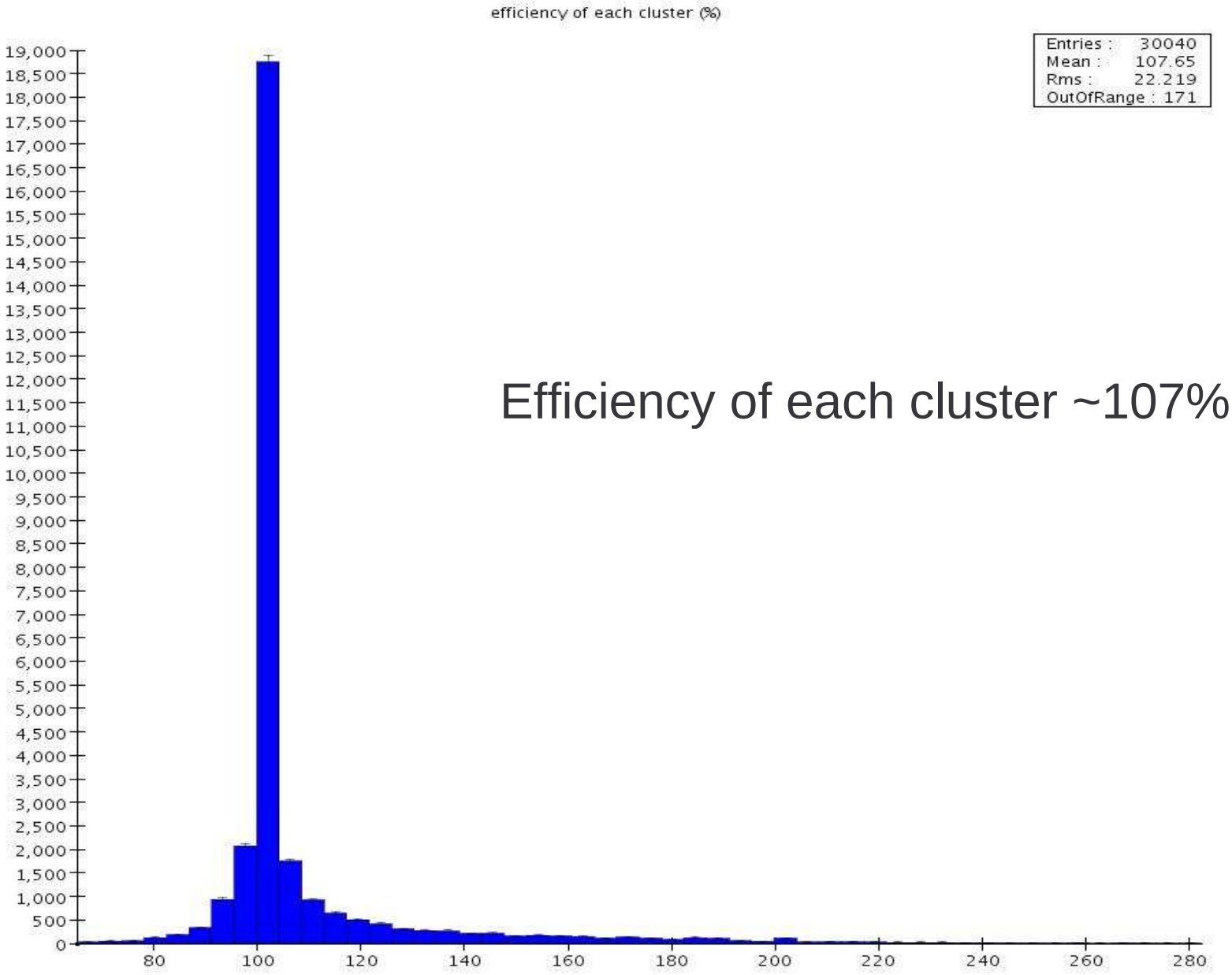


Example events (MAPS geom.)



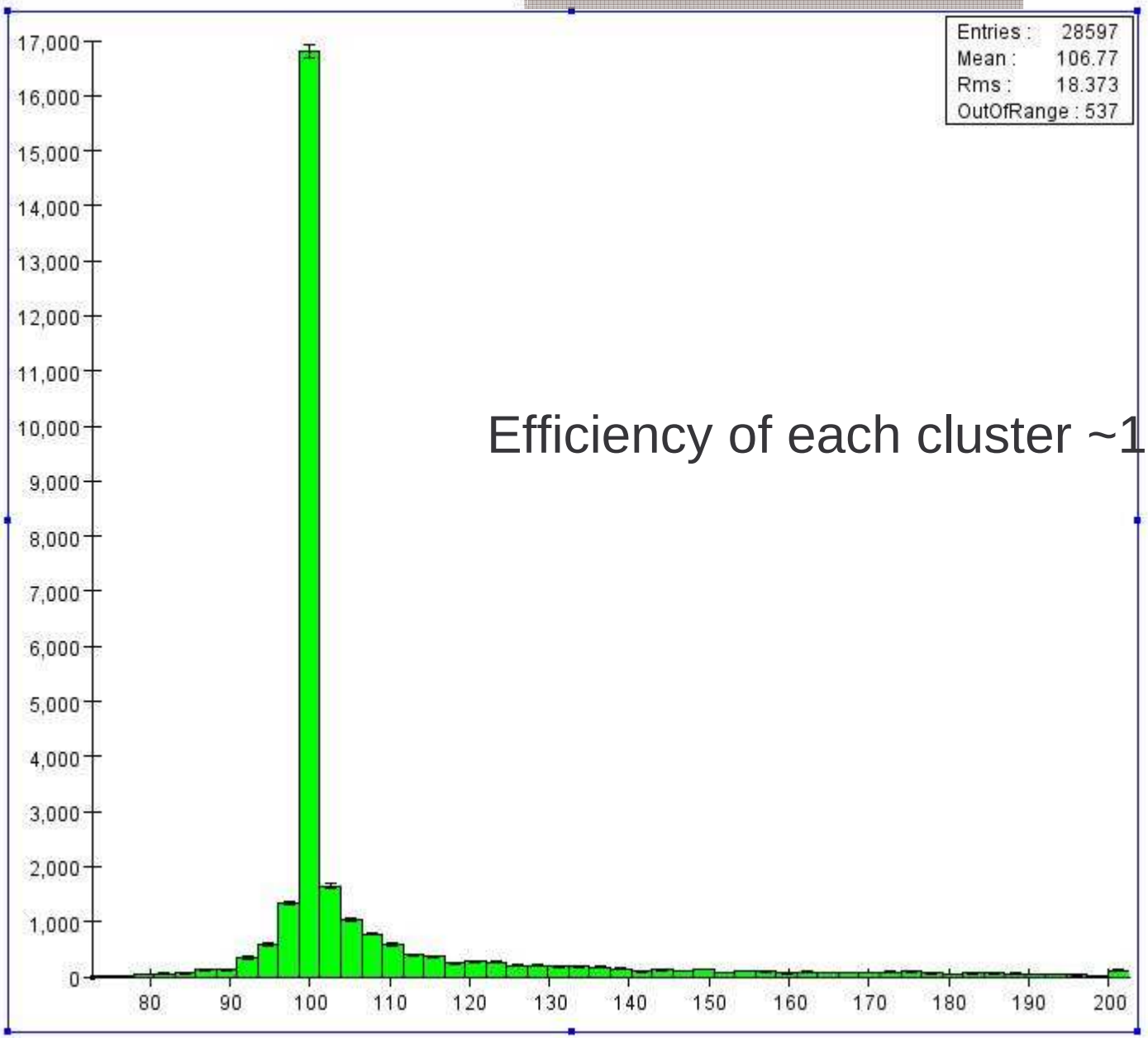
$Z \rightarrow q\bar{q}$ events

Analogue Si (1cm pitch)



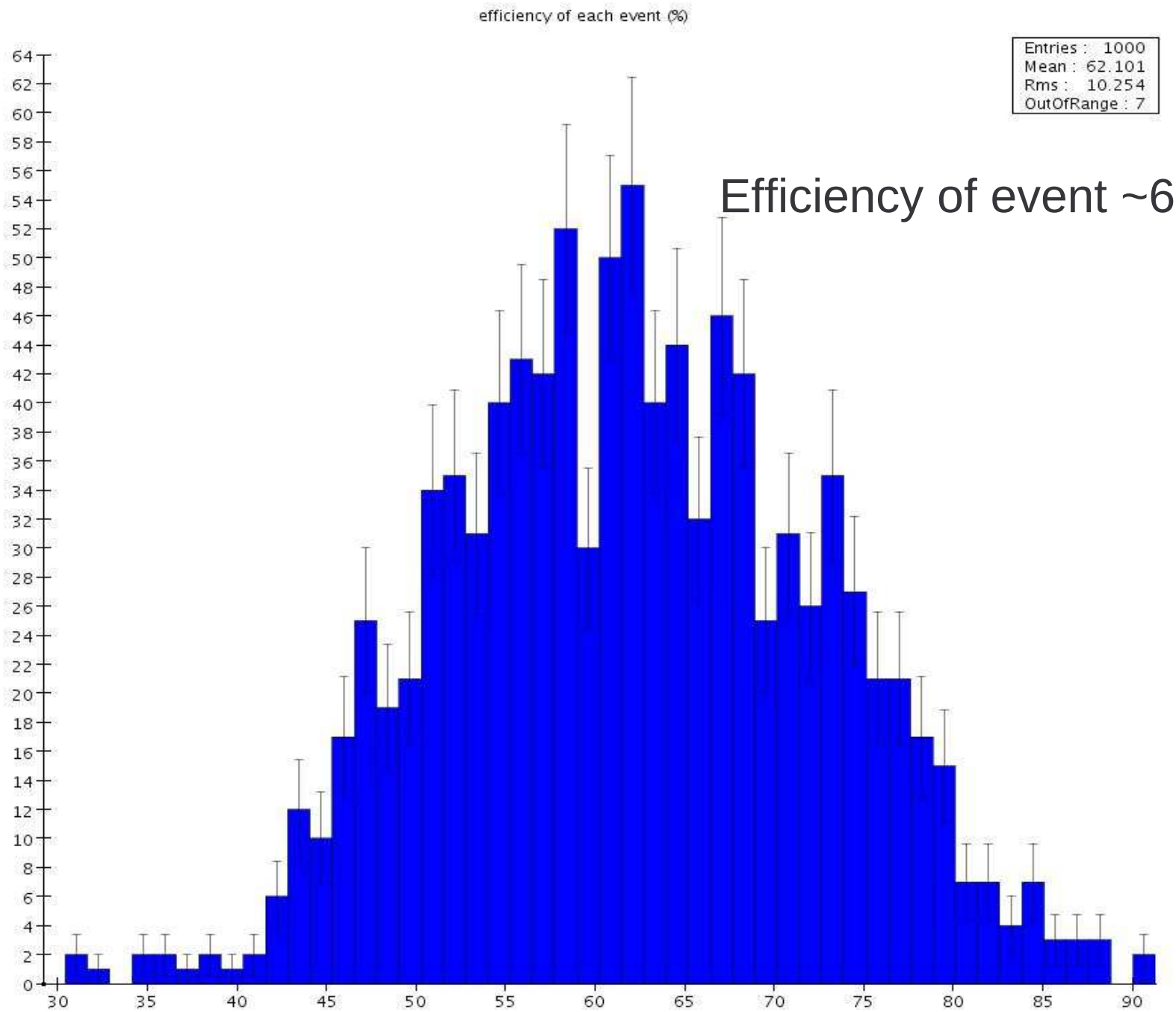
Efficiency of each cluster ~107%

MAPS (50mm pitch)



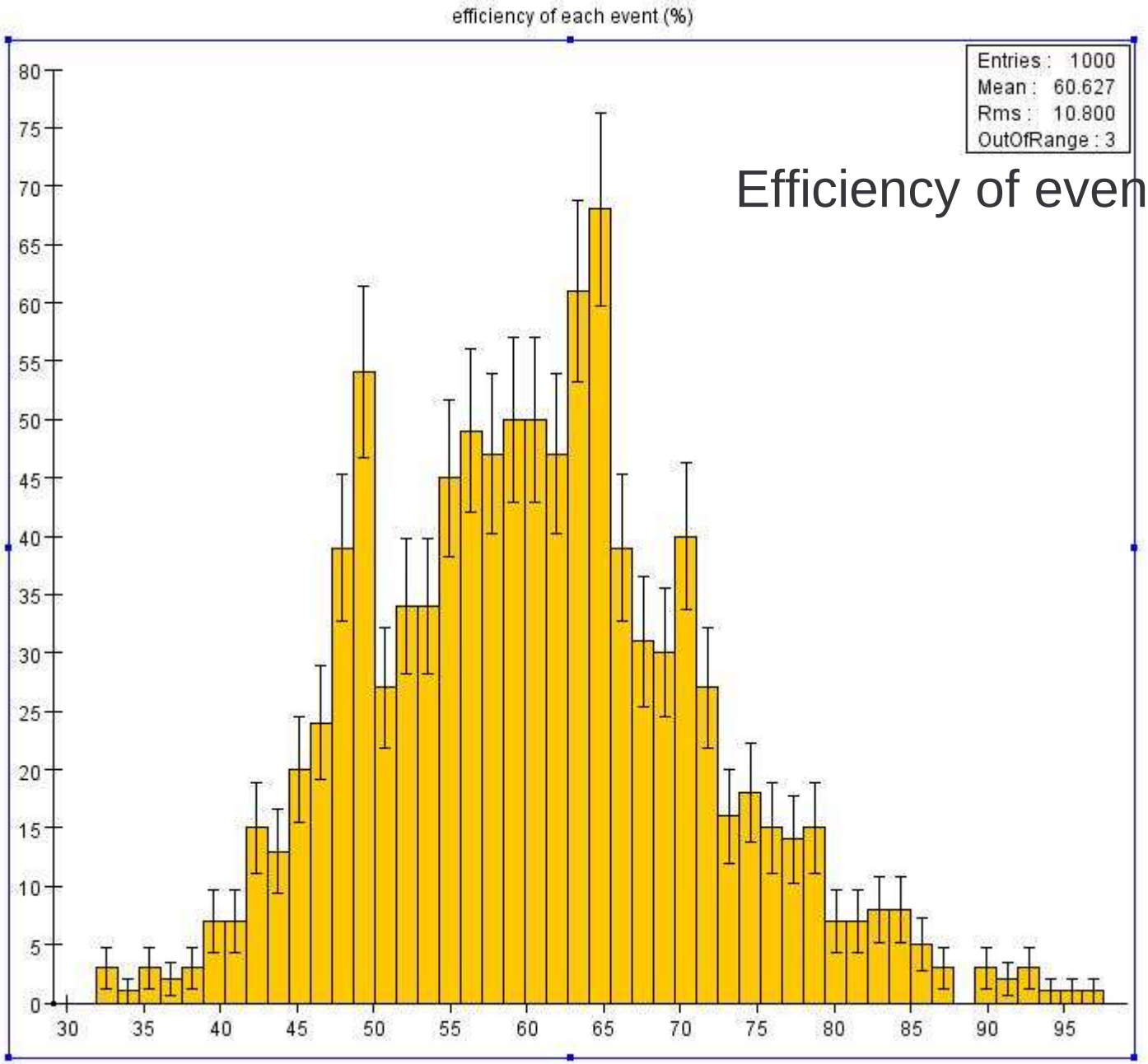
Efficiency of each cluster ~106%

Analogue Si (1cm pitch)



Efficiency of event ~62%

MAPS (50μm pitch)



Efficiency of event ~61%

Conclusion and Outlook

First study of real clustering for MAPS simulated events, realistic sensor geometry

Trackwise clustering algorithm performs well on single electron events, in both the analogue Si and MAPS cases

In MAPS case, clustering does not use energy information

On more complex events, e.g.jets in the Z -> $q\bar{q}$ events, the trackwise clustering algorithm has comparable performance to the default analogue Si case, cluster reconstruction efficiency of ~ 61%. Can be tuned further.

The processor I have written can be adapted to work with different clustering algorithms.

Have not successfully used it on Mark Thomson's PandoraPFA as yet. Would be interesting to see how a newer algorithm like this would fare with MAPS data.