



June 9, 2021

Update on SiD ECal MAPS Simulations

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Introduction



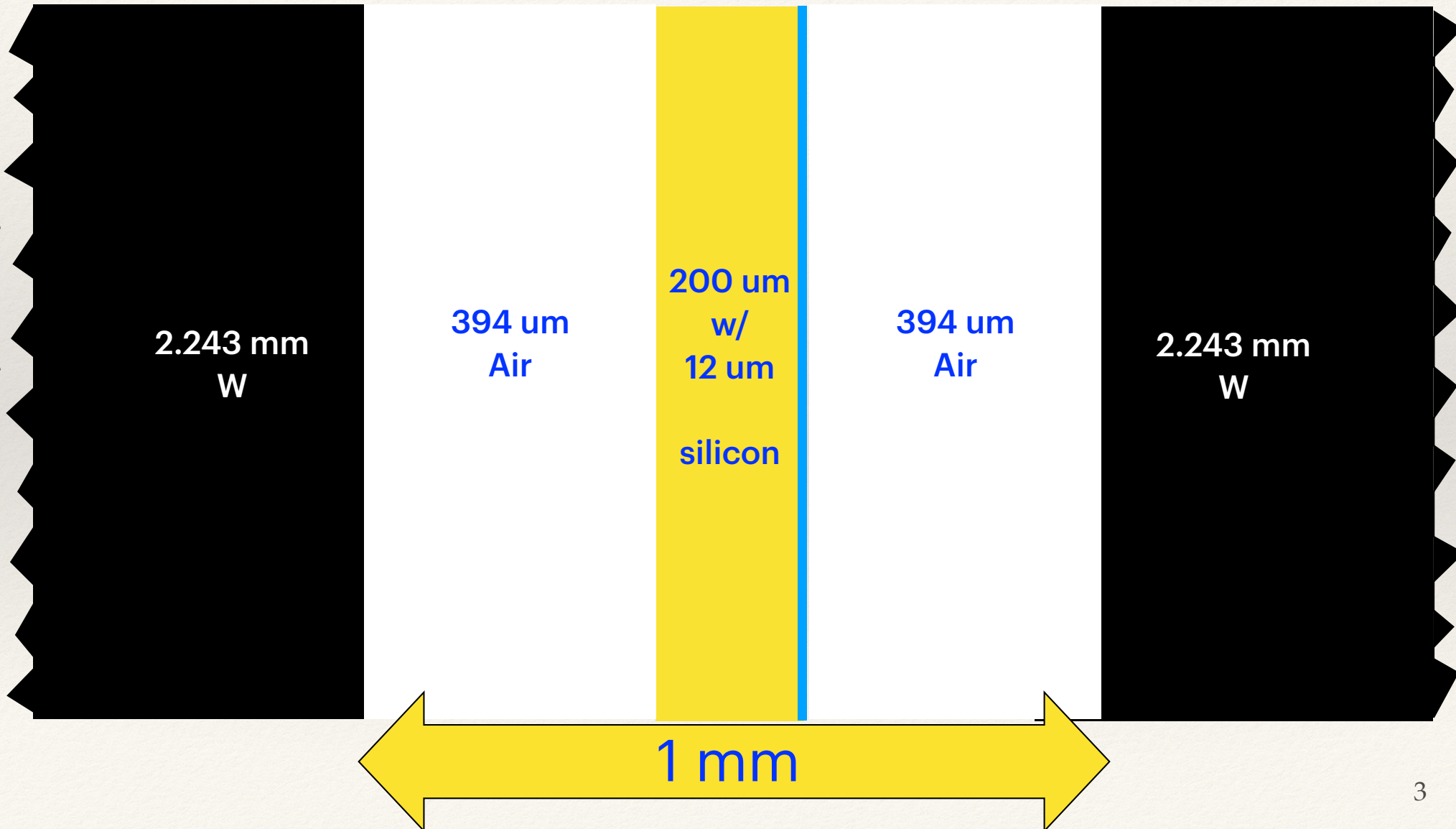
- ❖ New simulation geometry (more realistic)
 - ❖ 1 mm gap
 - ❖ 200 um substrate with 12 um epi-layer
 - ❖ Plus air
- ❖ Separate clusters into
 - ❖ Clusters with all hits below $2 \times E_{min} = 8 \text{ keV}$
 - ❖ “Mip produced”-like.
 - ❖ Clusters with ≥ 1 hit greater than $2 \times E_{min} = 8 \text{ keV}$
 - ❖ “delta ray produced”-like

New Simulation Geometry

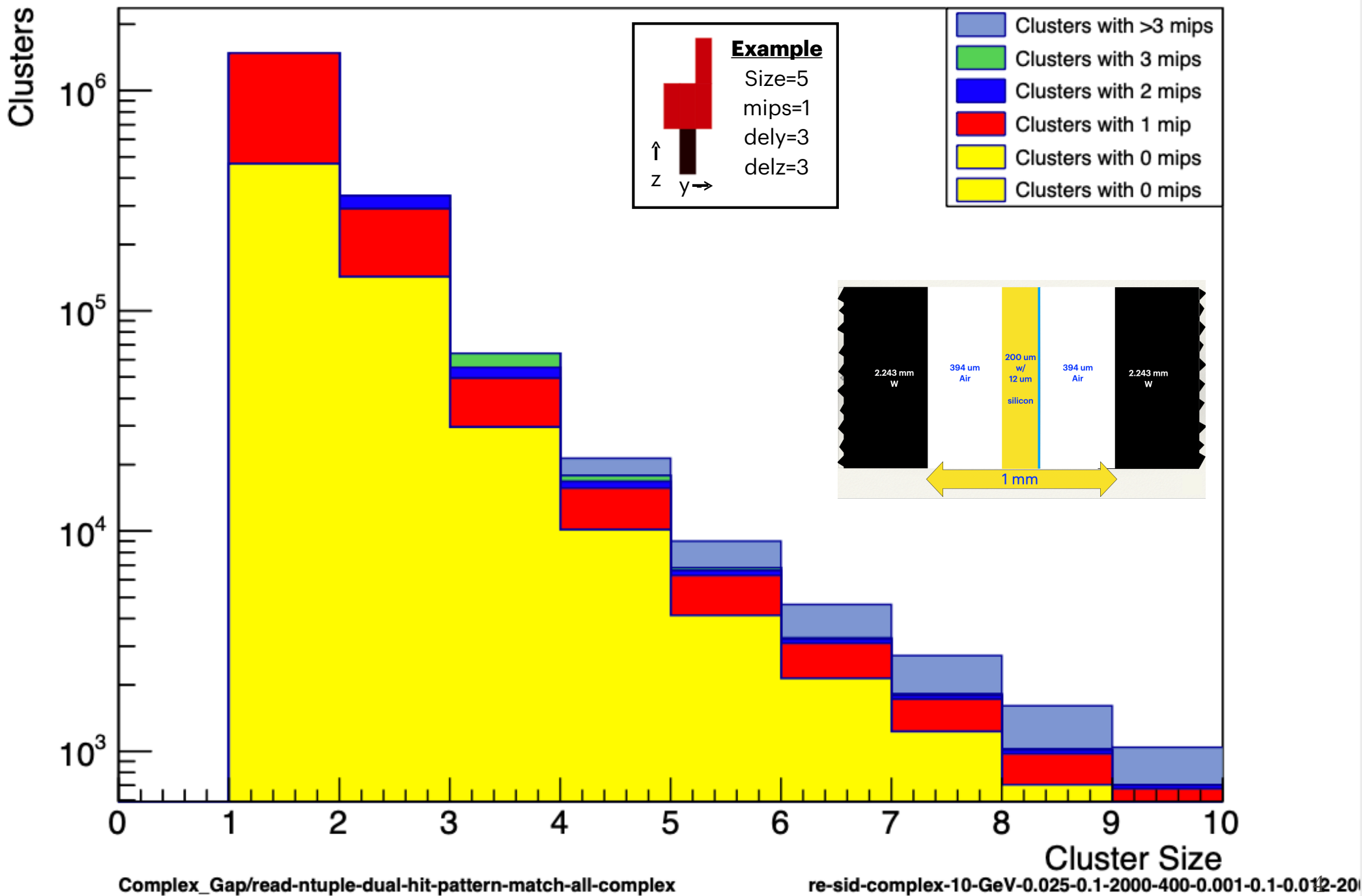


J. Brau - 9 June 2021

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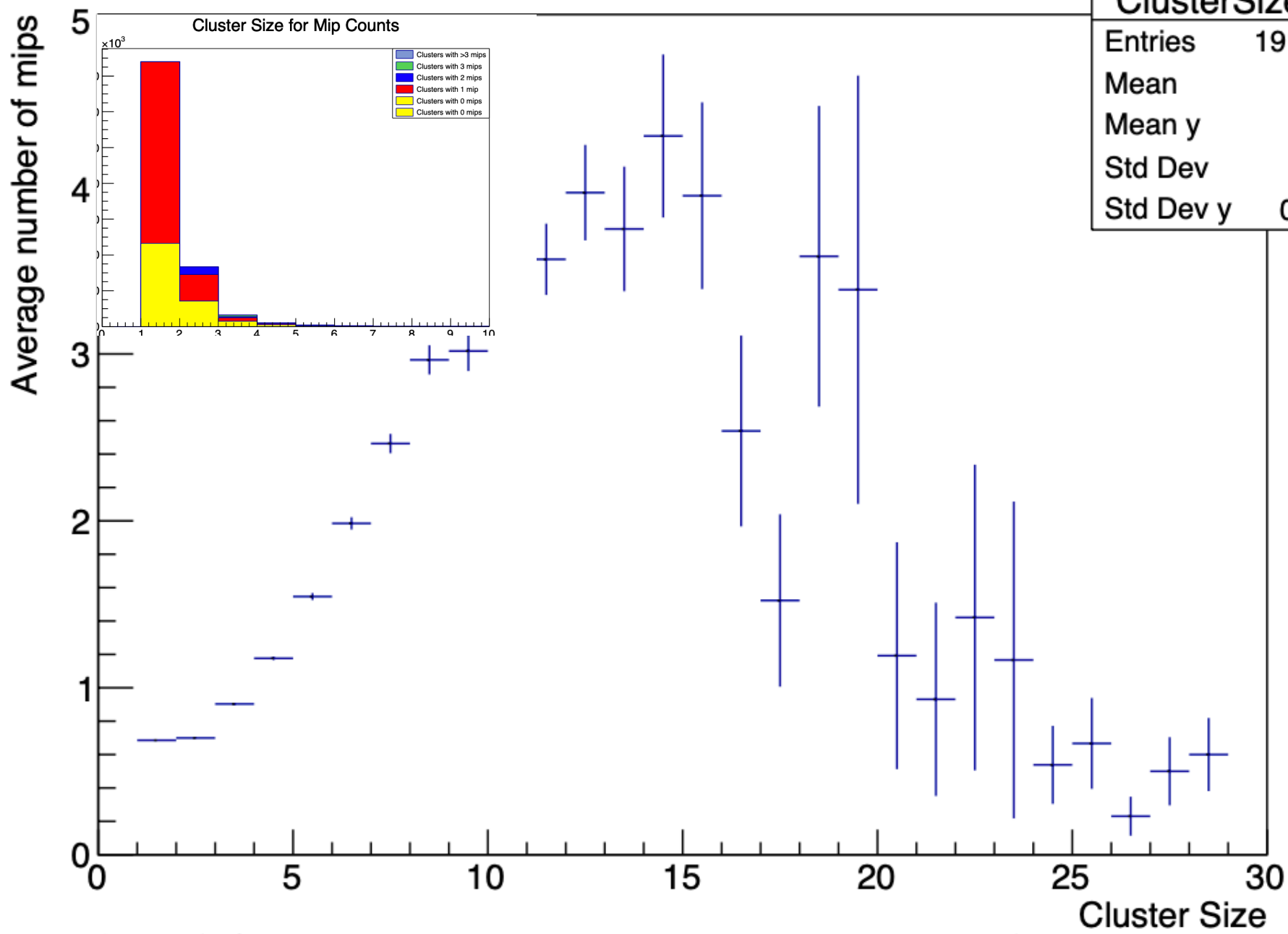


Cluster Size for Mip Counts



Average mips vs. Cluster Size -

ClusterSizeMP	
Entries	1918797
Mean	1.337
Mean y	0.717
Std Dev	0.856
Std Dev y	0.6583

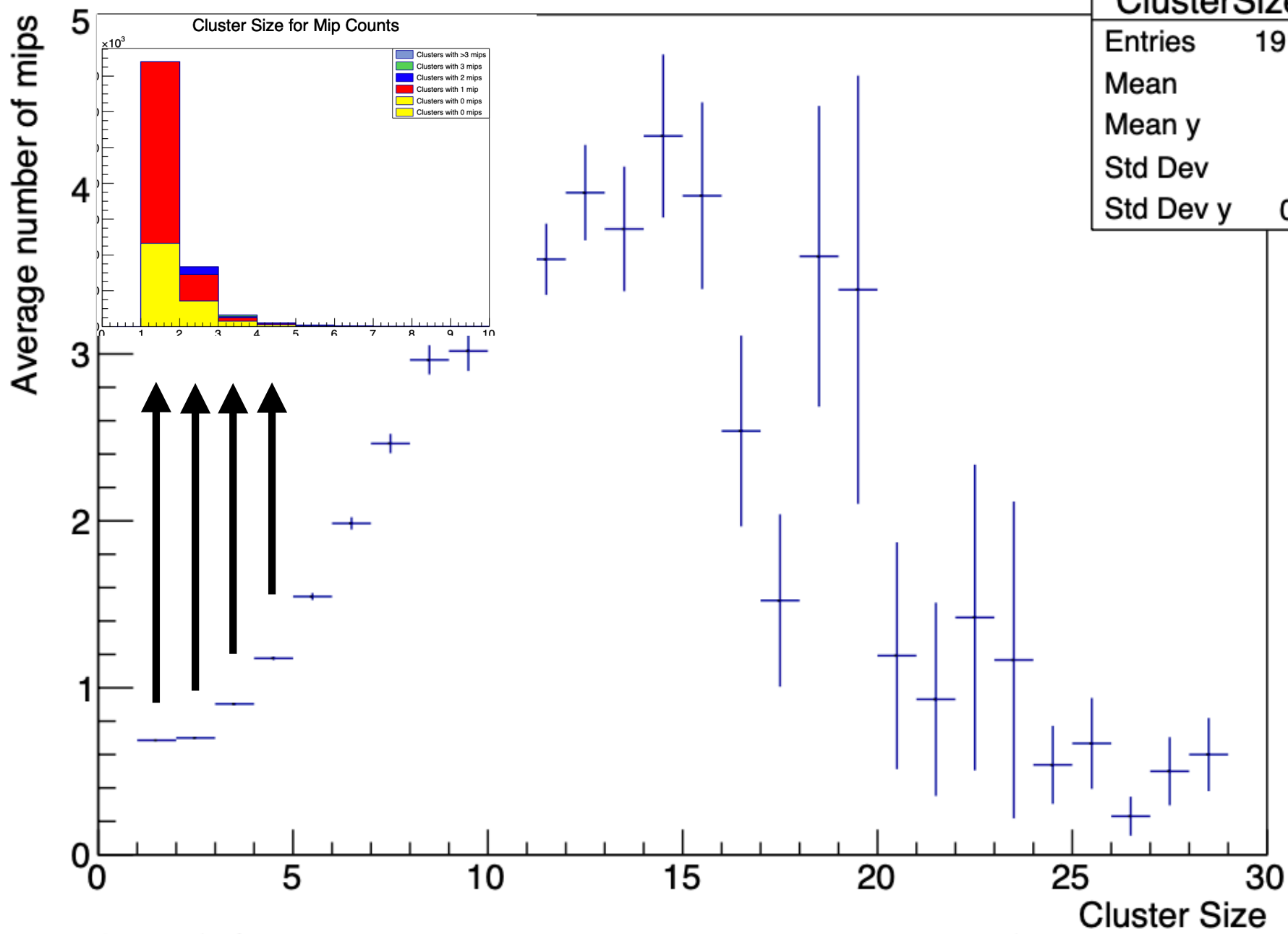


Complex_Gap/read-ntuple-dual-hit-pattern-match-all-complex

re-sid-complex-10-GeV-0.025-0.1-2000-400-0.001-0.1-0.012-20

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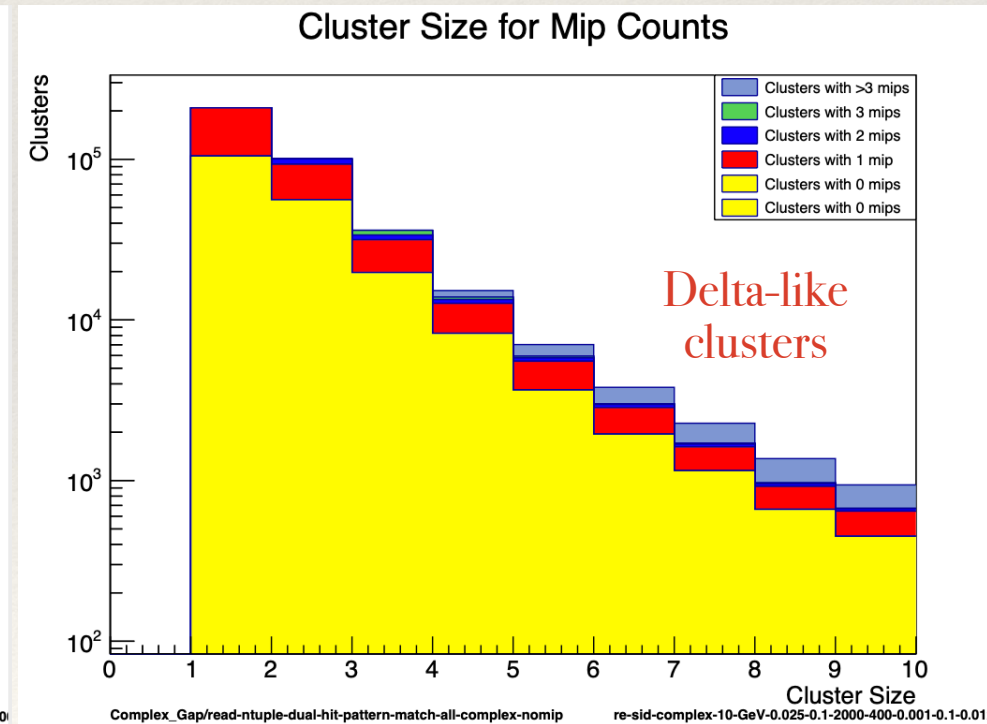
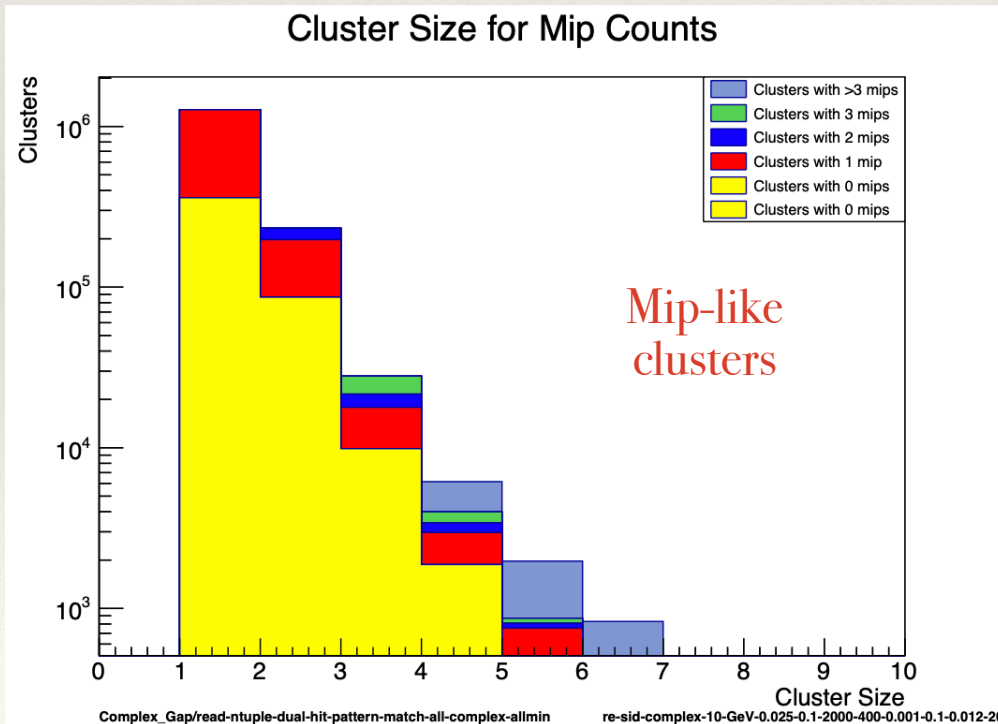


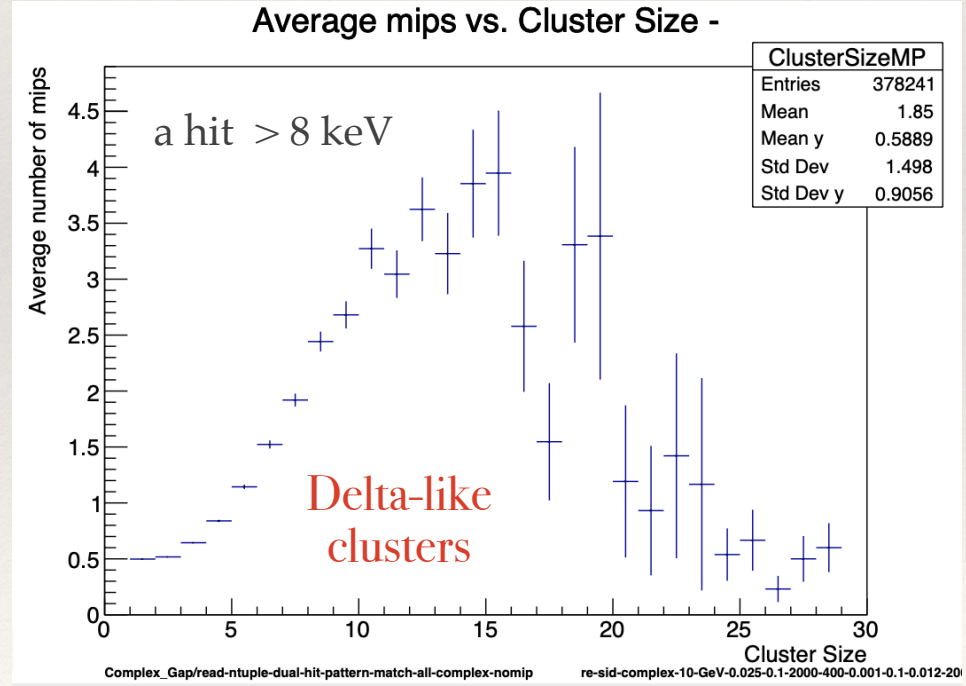
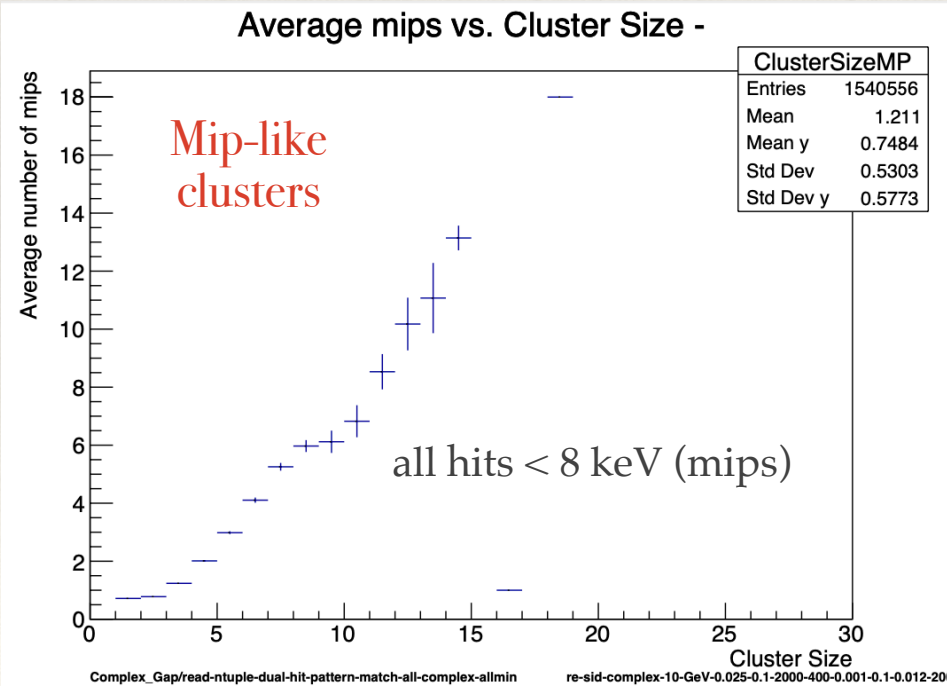
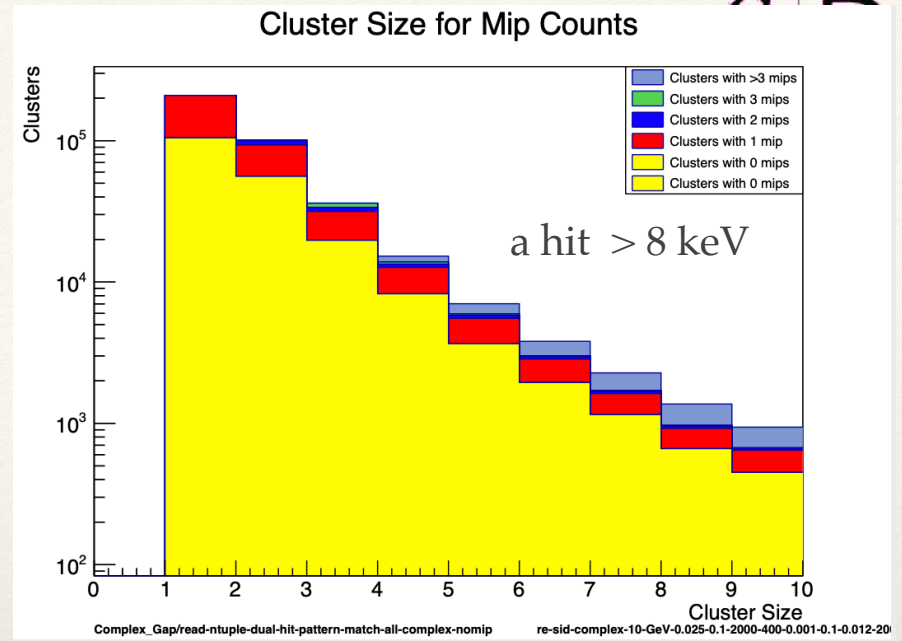
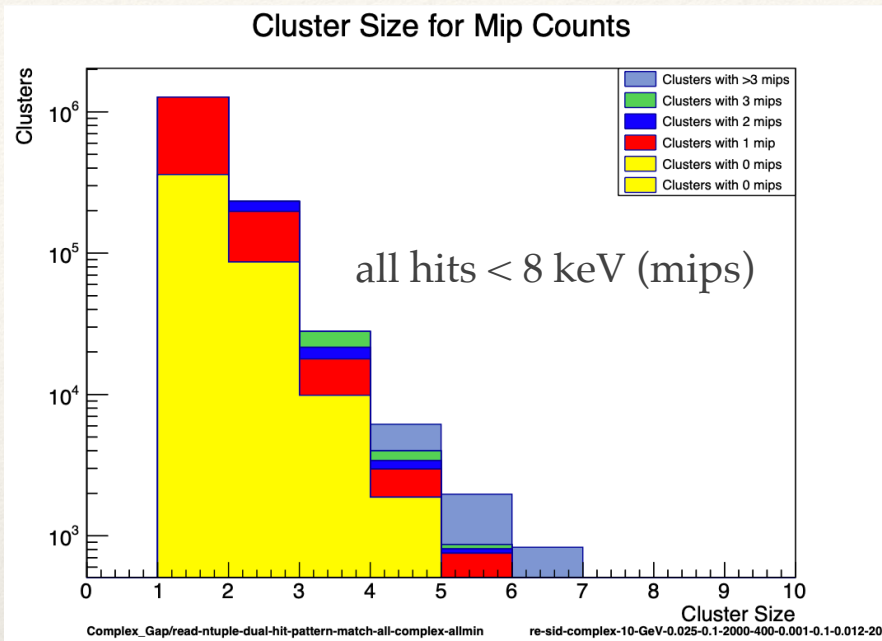
Complex_Gap/read-ntuple-dual-hit-pattern-match-all-complex

re-sid-complex-10-GeV-0.025-0.1-2000-400-0.001-0.1-0.012-20

- ❖ Clusters with all hits below $2 \times E_{min}$
= 8 keV
- ❖ “Mip produced”-like

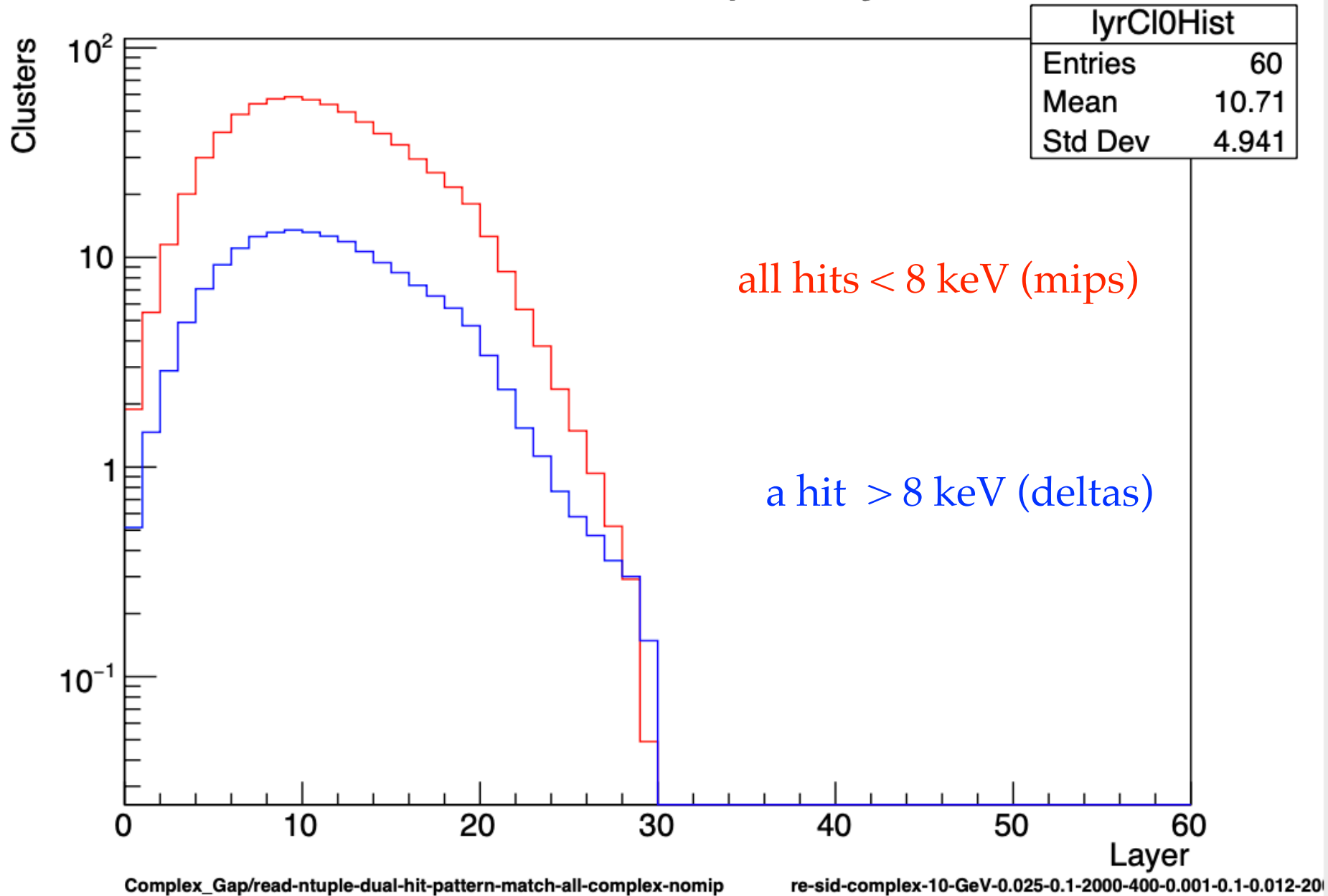
- ❖ Clusters with a hit greater than $2 \times E_{min} = 8$ keV
- ❖ “delta ray produced”-like



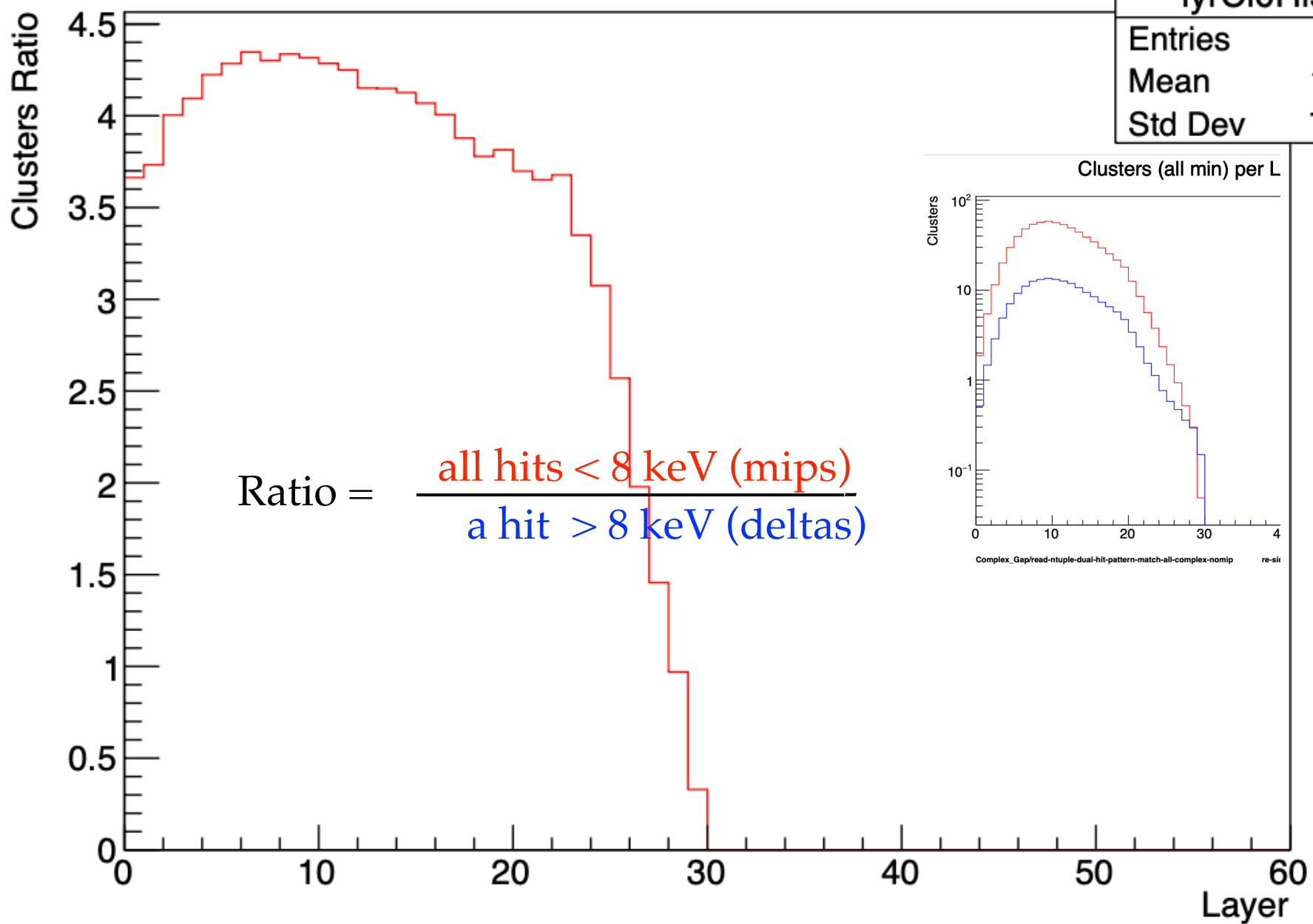




Clusters per Layer -

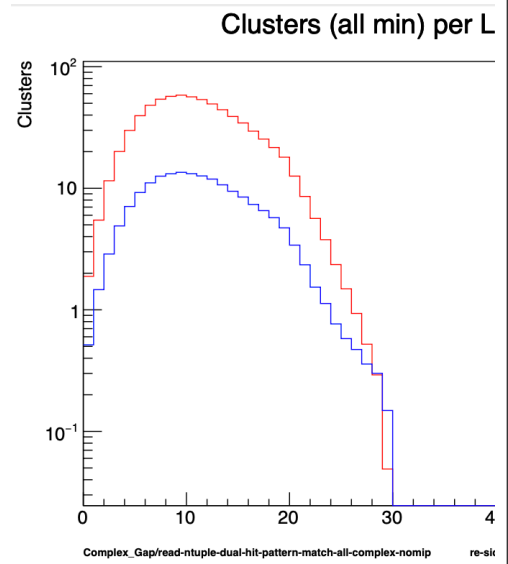


Clusters per Layer -



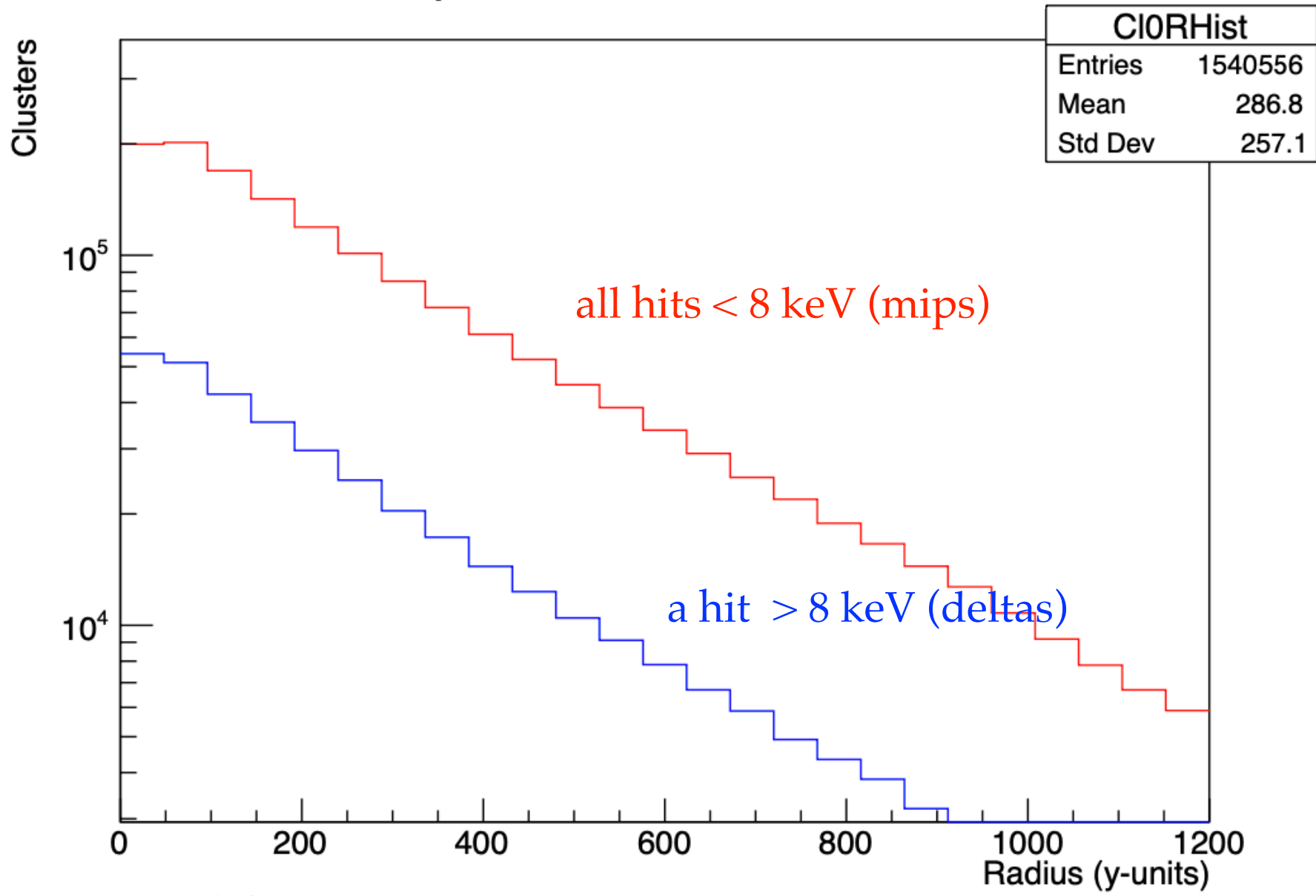
lyrCl0Hist	
Entries	14
Mean	13.16
Std Dev	7.702

$$\text{Ratio} = \frac{\text{all hits} < 8 \text{ keV (mips)}}{\text{a hit} > 8 \text{ keV (deltas)}}$$





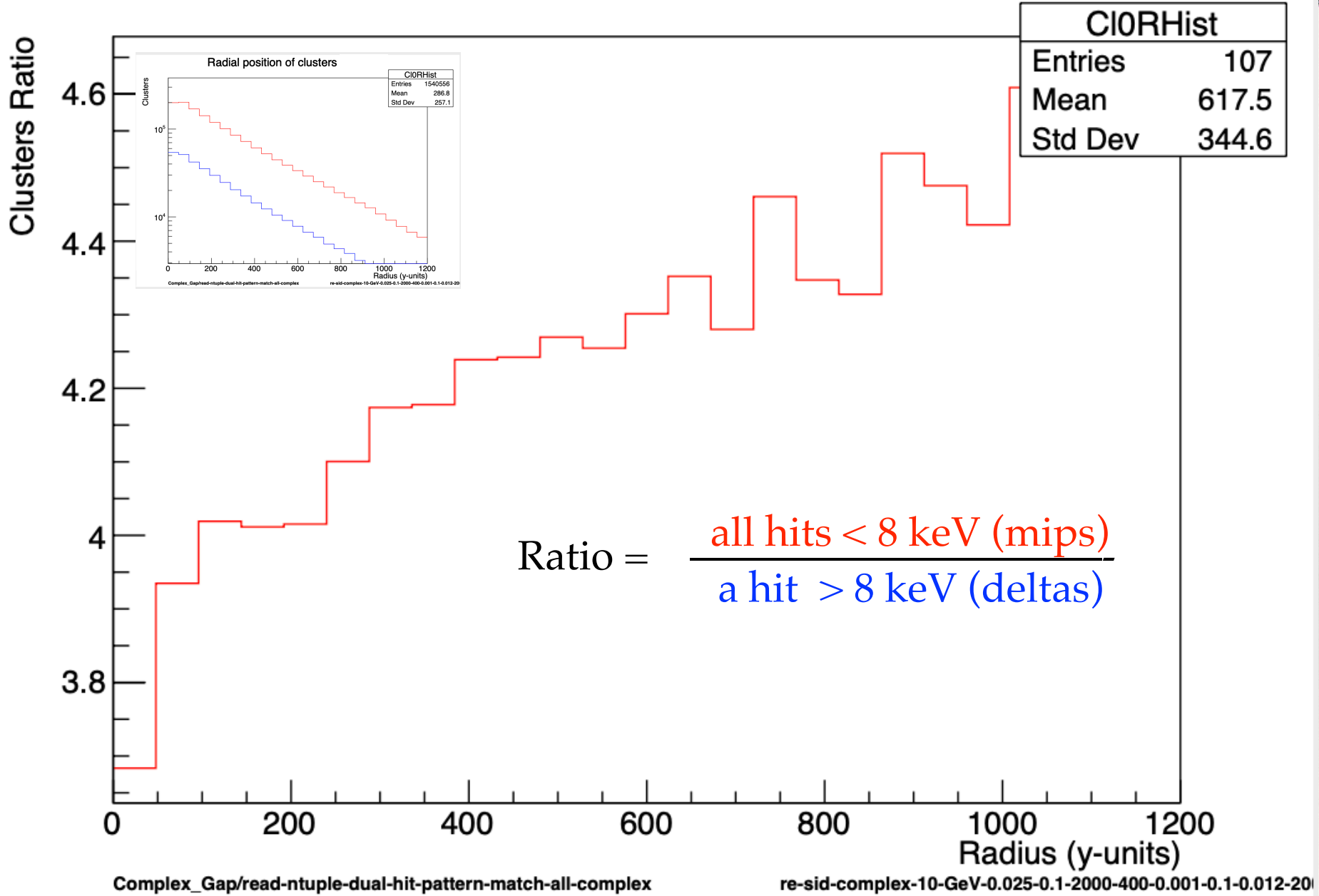
Radial position of clusters



Complex_Gap/read-ntuple-dual-hit-pattern-match-all-complex

re-sid-complex-10-GeV-0.025-0.1-2000-400-0.001-0.1-0.012-20

Radial position of clusters



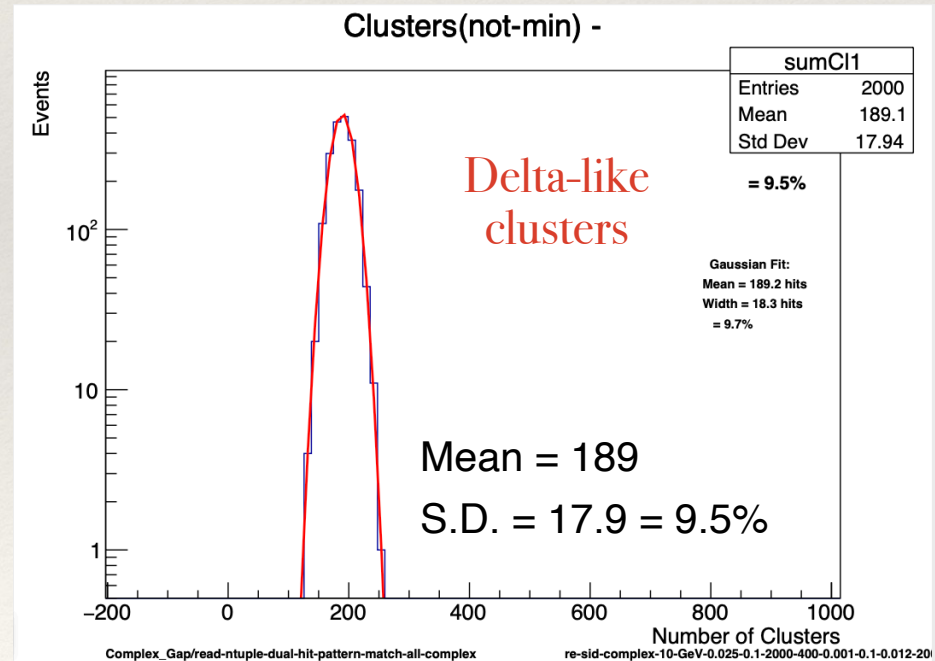
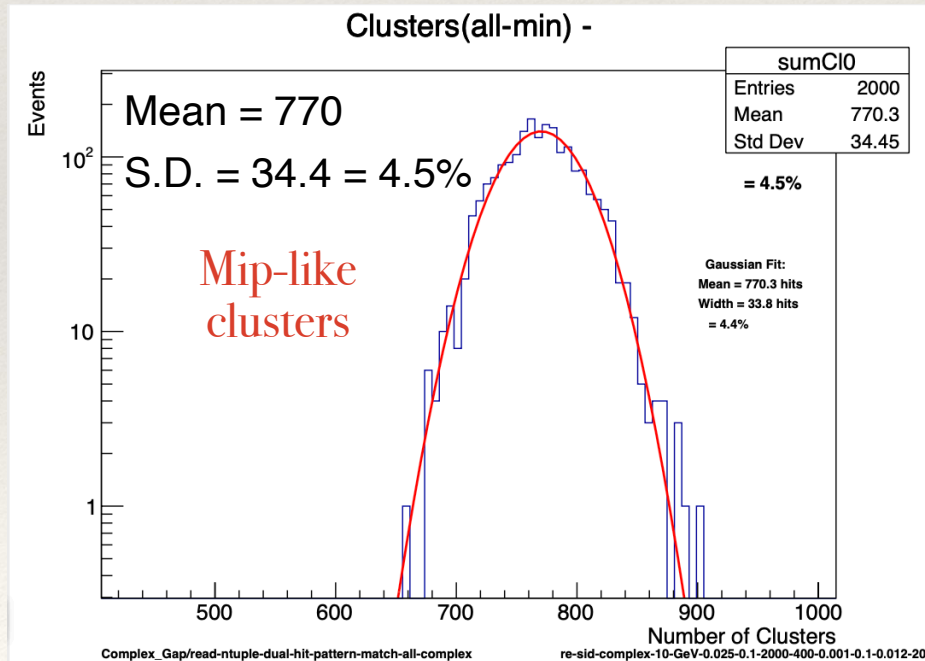
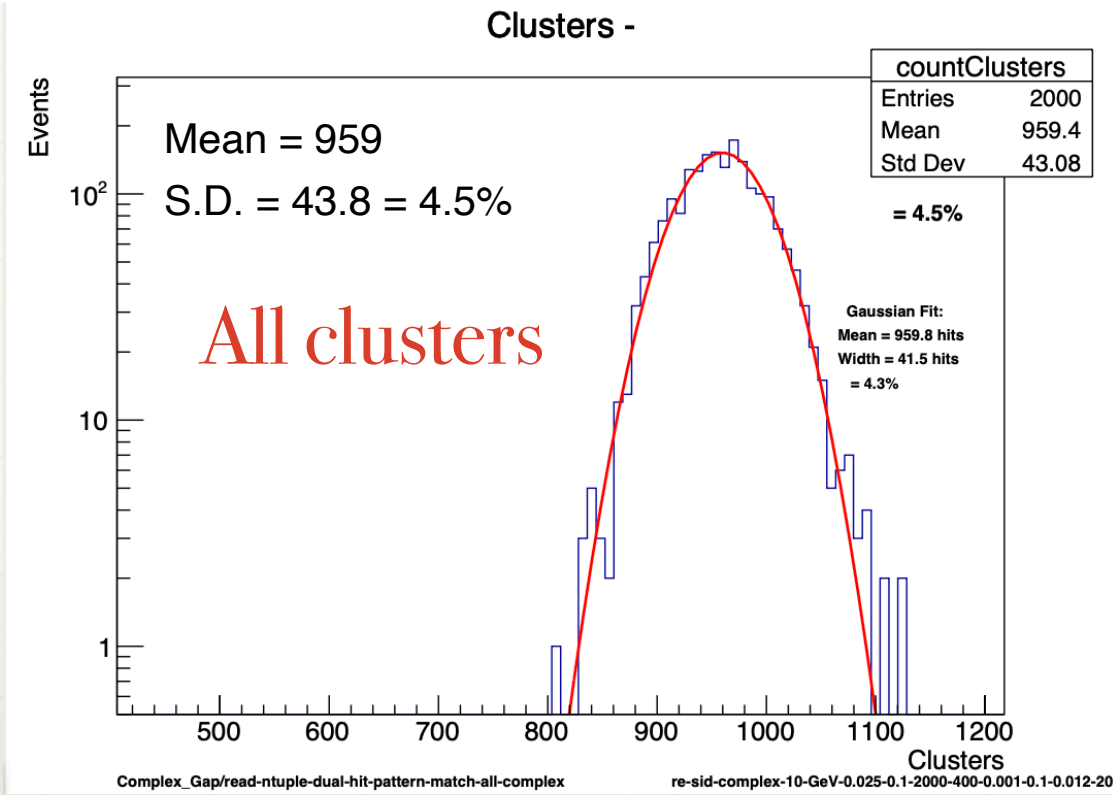


Energy Resolution:

All clusters
Mip clusters

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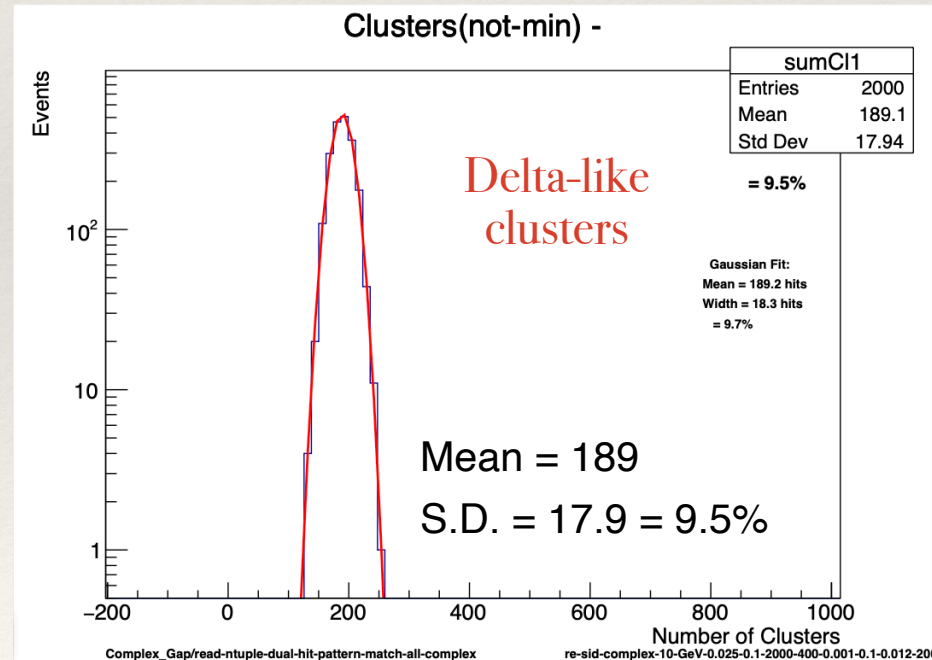
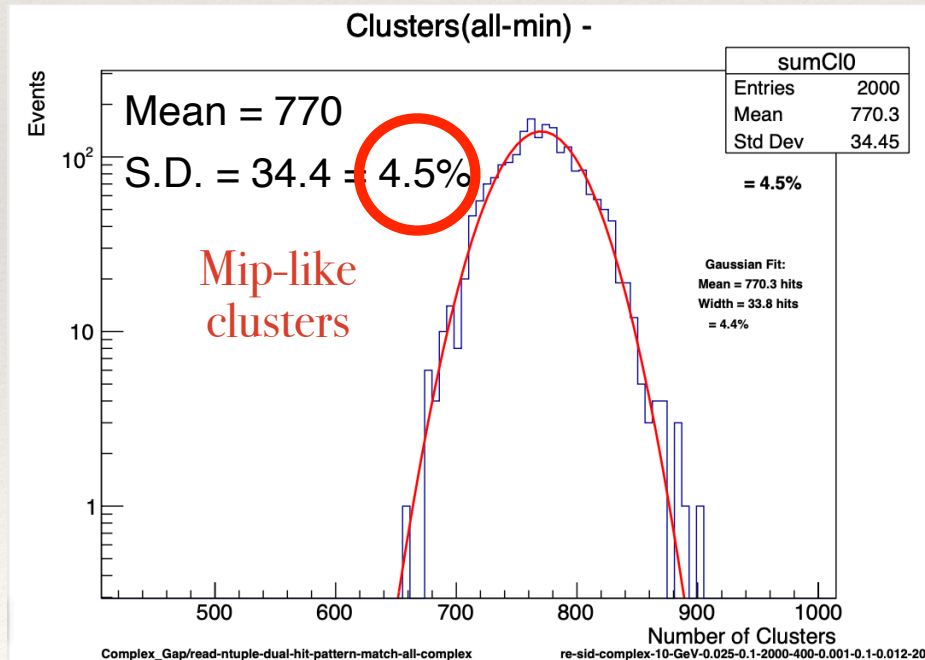
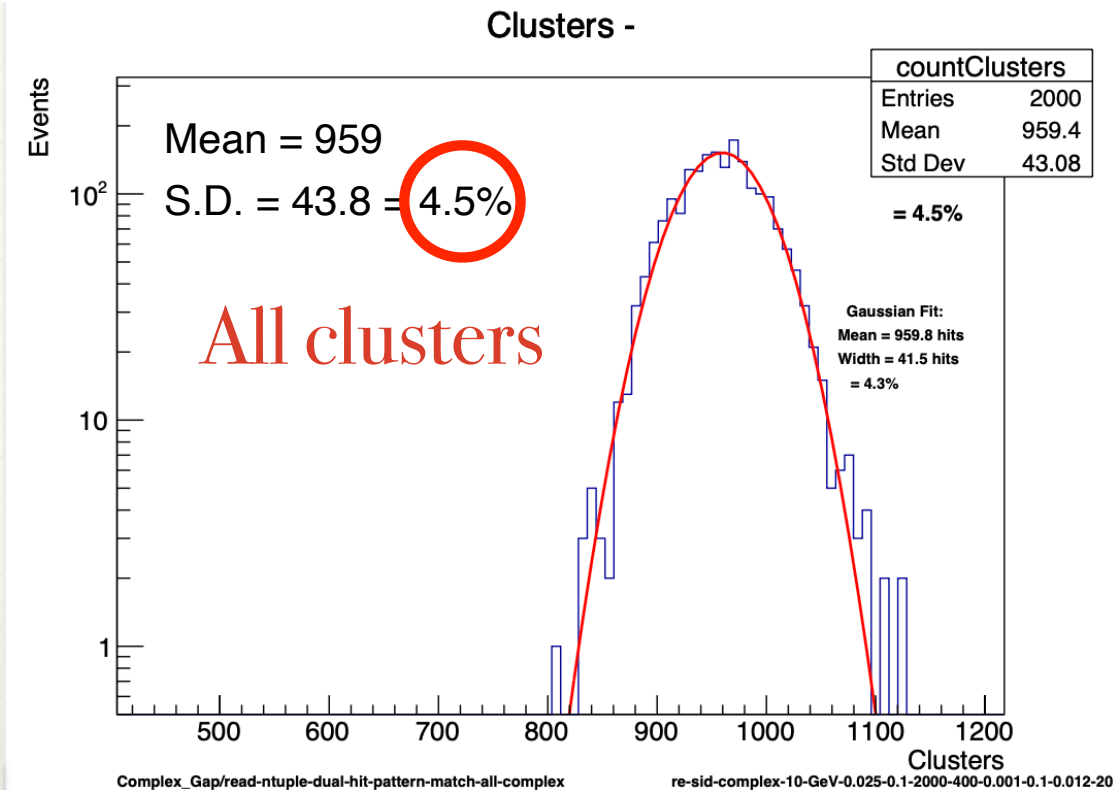


Energy Resolution:

All clusters
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Conclusions



- ❖ New, closer to realistic geometry.
 - ❖ More clusters and lower multiplicity than simpler geometry.
- ❖ Separation of clusters into “mip-like” and “delta-like” shows differences:
 - ❖ “Delta-like” in larger clusters.
 - ❖ “Delta-like” have fewer mips for given cluster size.
- ❖ No change in resolution for “mip-like” clusters after removing “delta-like”; ~20% fewer clusters.

Next



- ❖ Refine definition and separation of “mip-like” and “delta-like” clusters.
- ❖ Investigate longitudinal and radial dependences.
- ❖ Continue search for improved cluster formation.
 - ❖ eg. hits separated from clusters of origin.
- ❖ Look at energy dependence:
 - ❖ 3 GeV, 20 GeV, etc.
- ❖ Code cleanup.