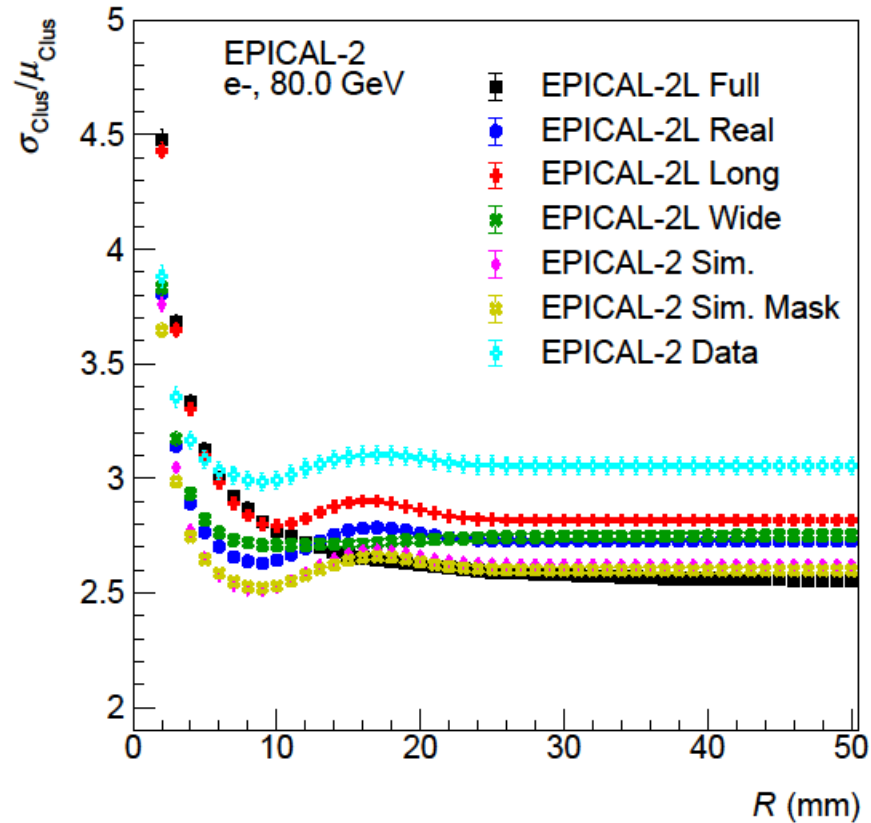# Resolution in Long Detector Geometries

Johannes Keul

Reminder: Radial cut, open questions
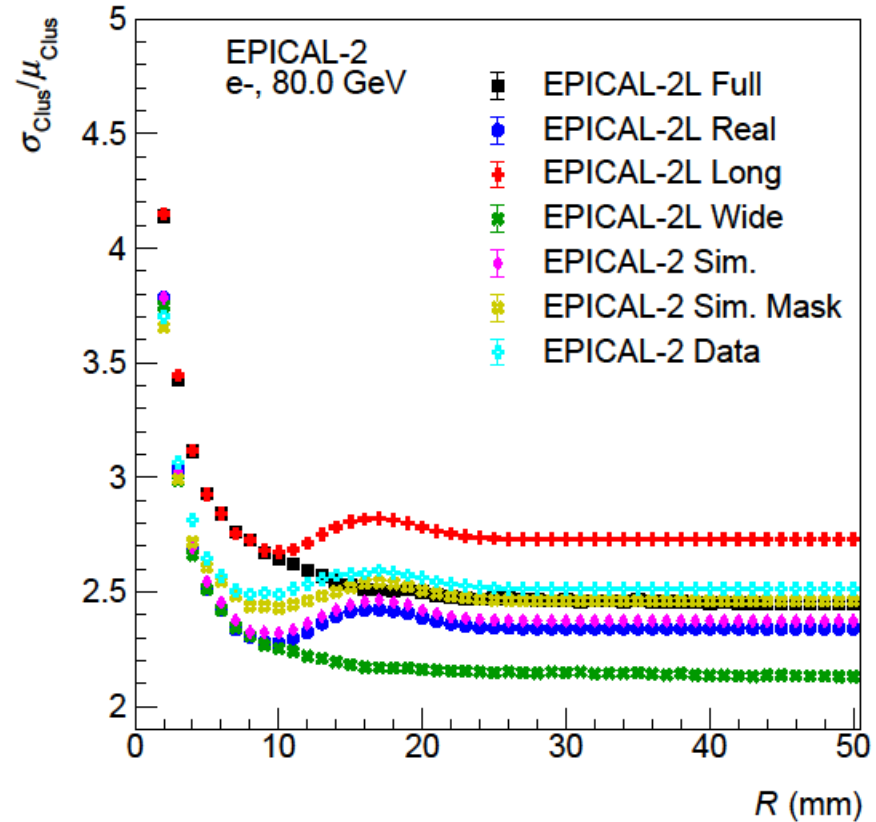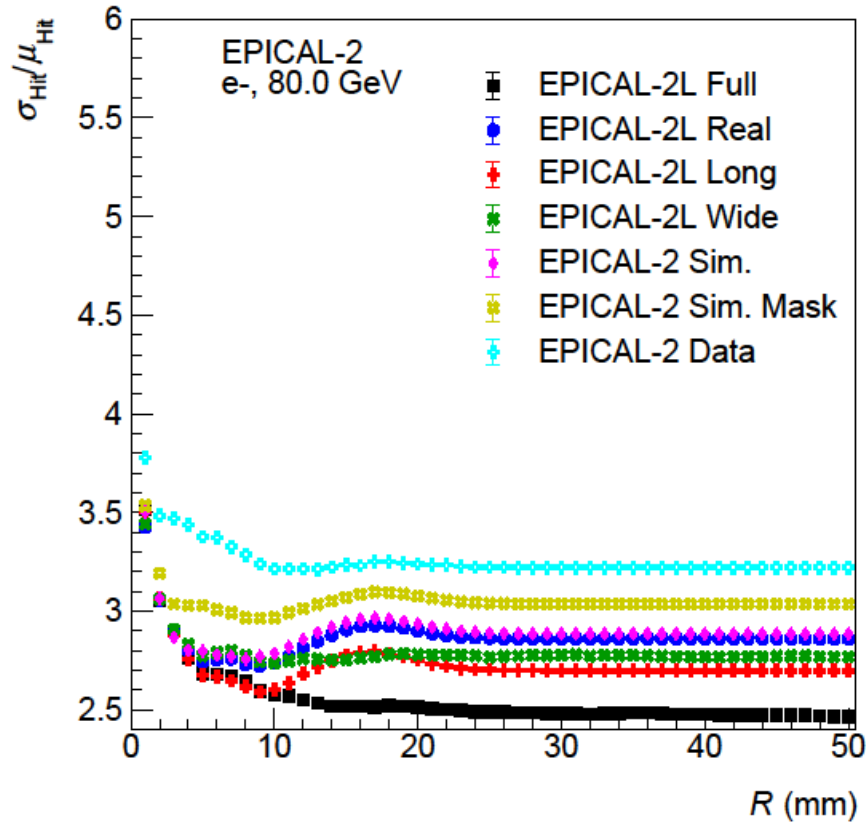

Why are L Real and Sim different?
Why are L Real and L Wide different for R<7mm?
Why is Data for R<5mm smaller than L Full and L Long?
Why is L Wide not monotonic?

Reminder: Using a Gaussian parametrization

Some observations have changed:
- L real and Sim. are similar
- Real and wide are similar for R<7mm
- L Wide seems to be monotonous

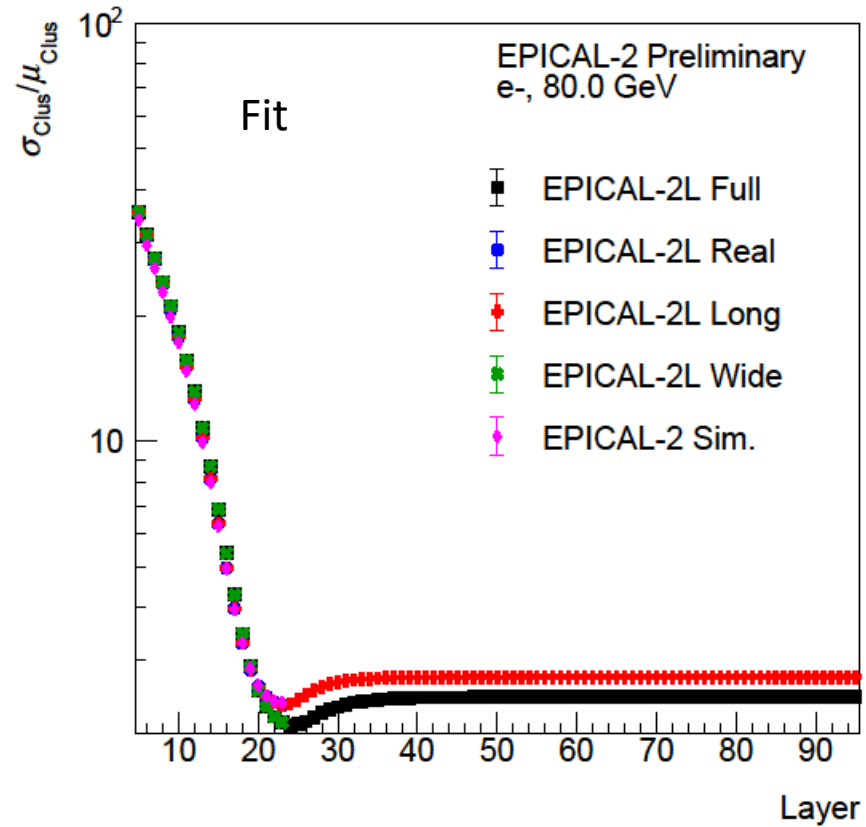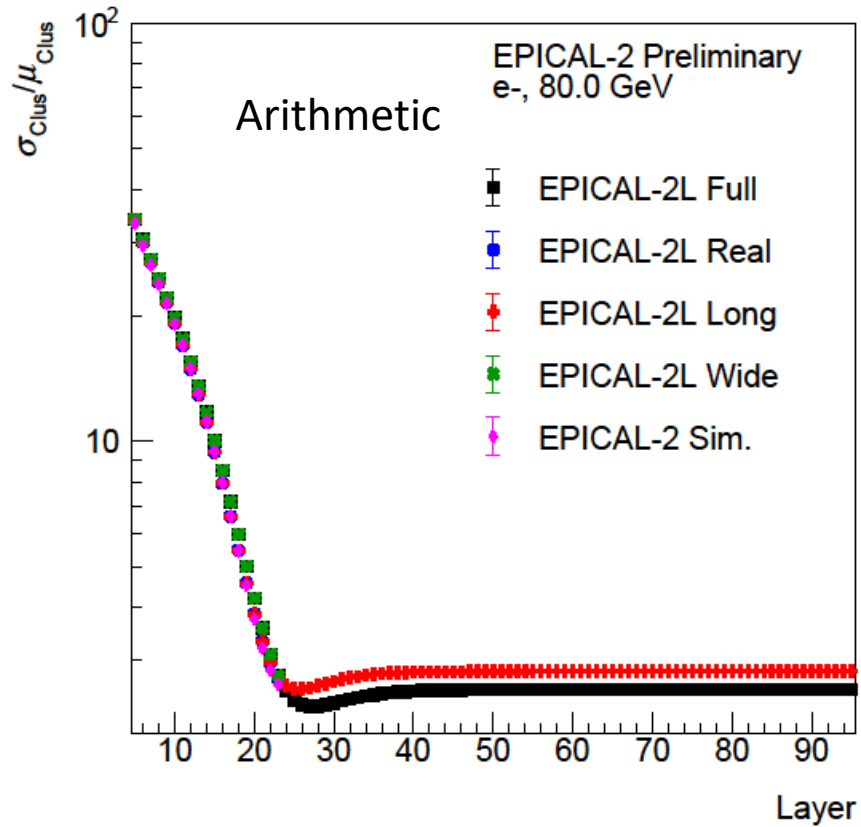➢ Observations likely come from fluctuations caused by elongated events
➢ Fluctuations get suppressed by a fit

Strange:
Longer geometries perform worse for clusters???

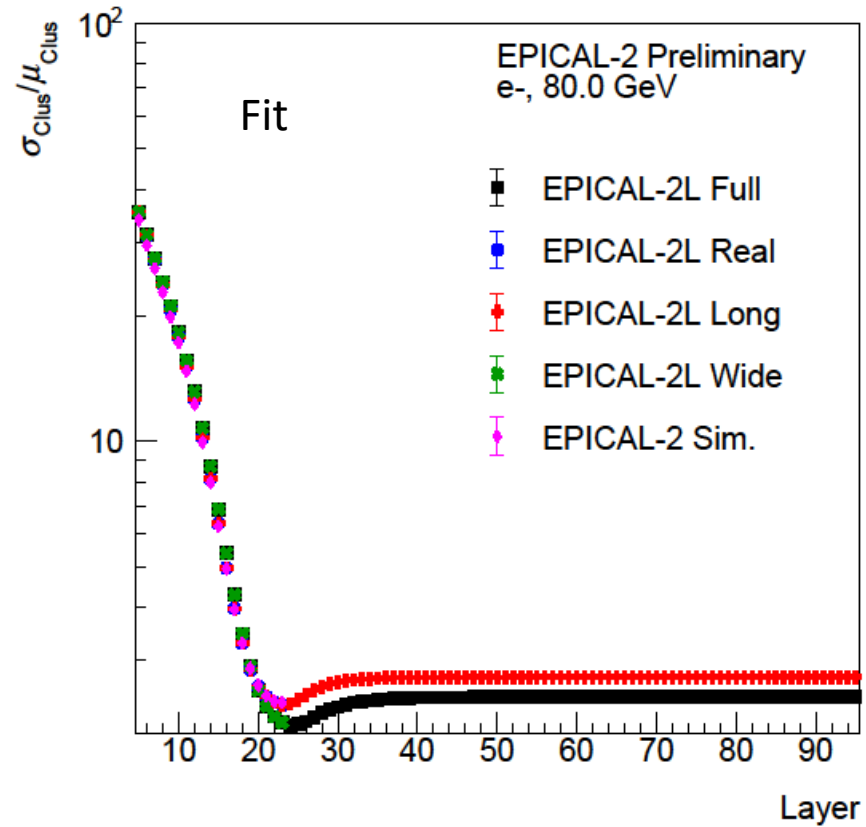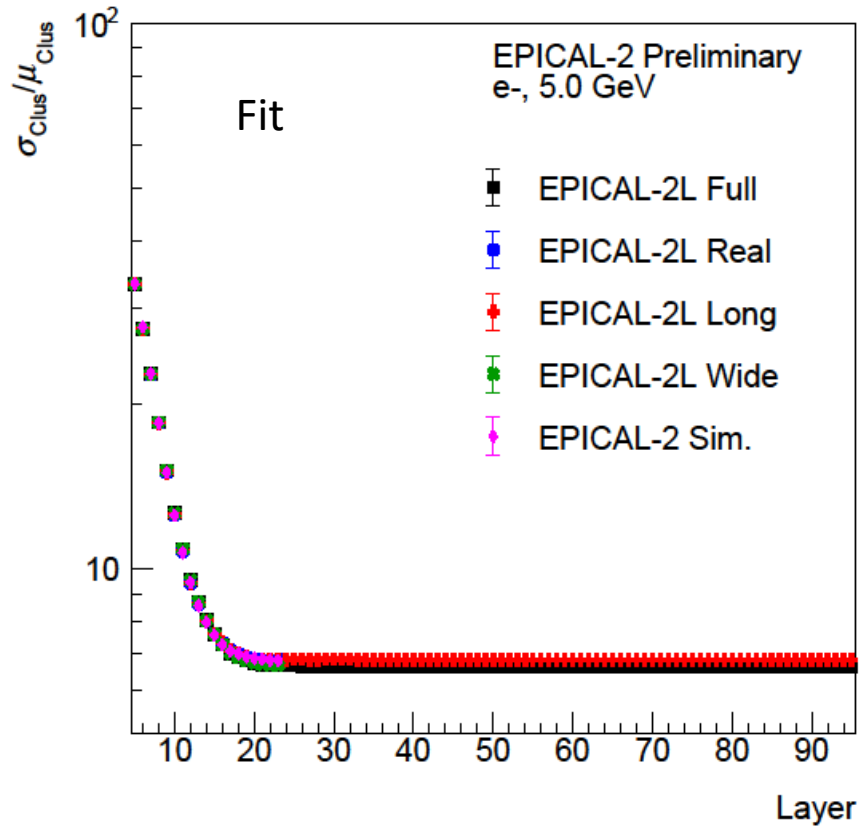# Why do longer geometries perform worse for clusters?

- Did I do something wrong?
- Does Allpix^2 do something unexpected?
- Is there a real physics effect?

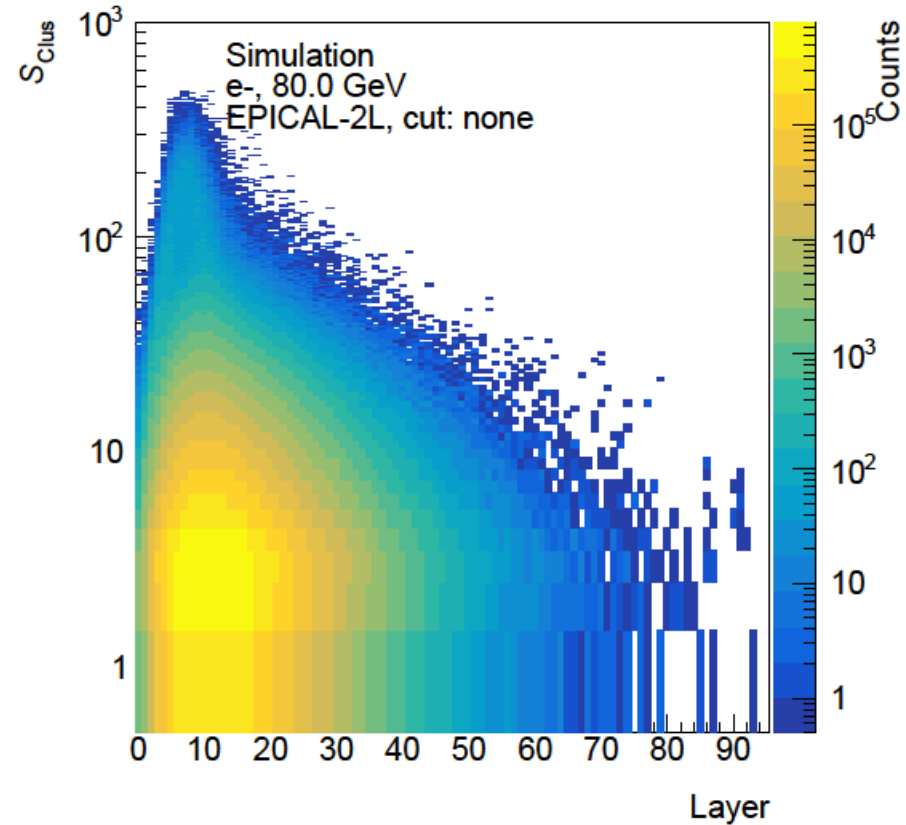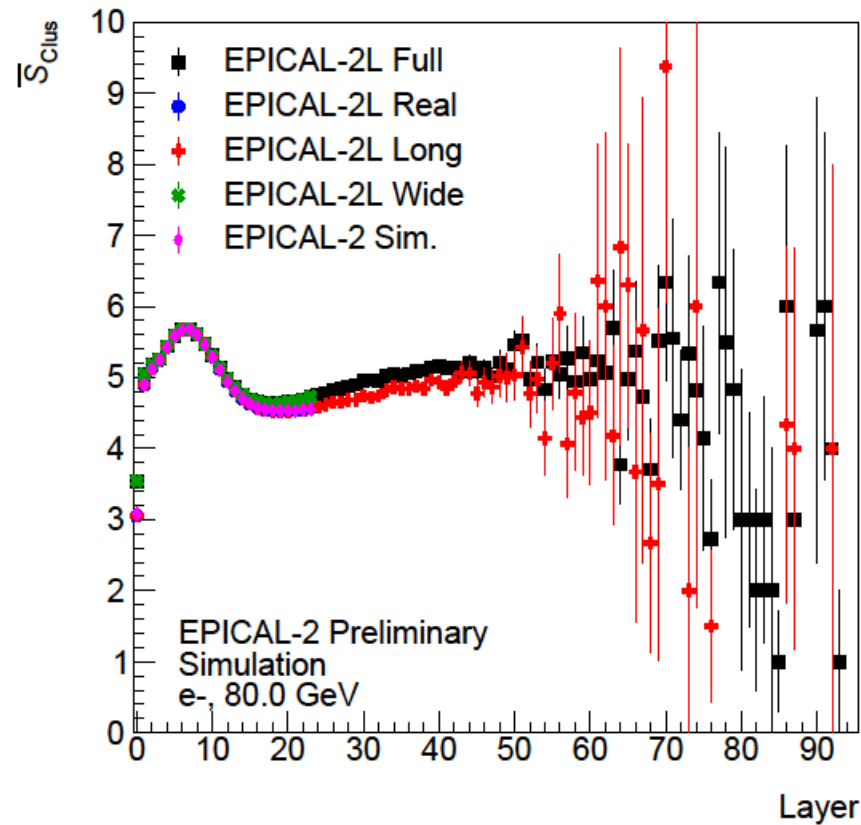# Resolution as a function of detector length

- Resolution has a minimum for a 24 to 28 layer long detector
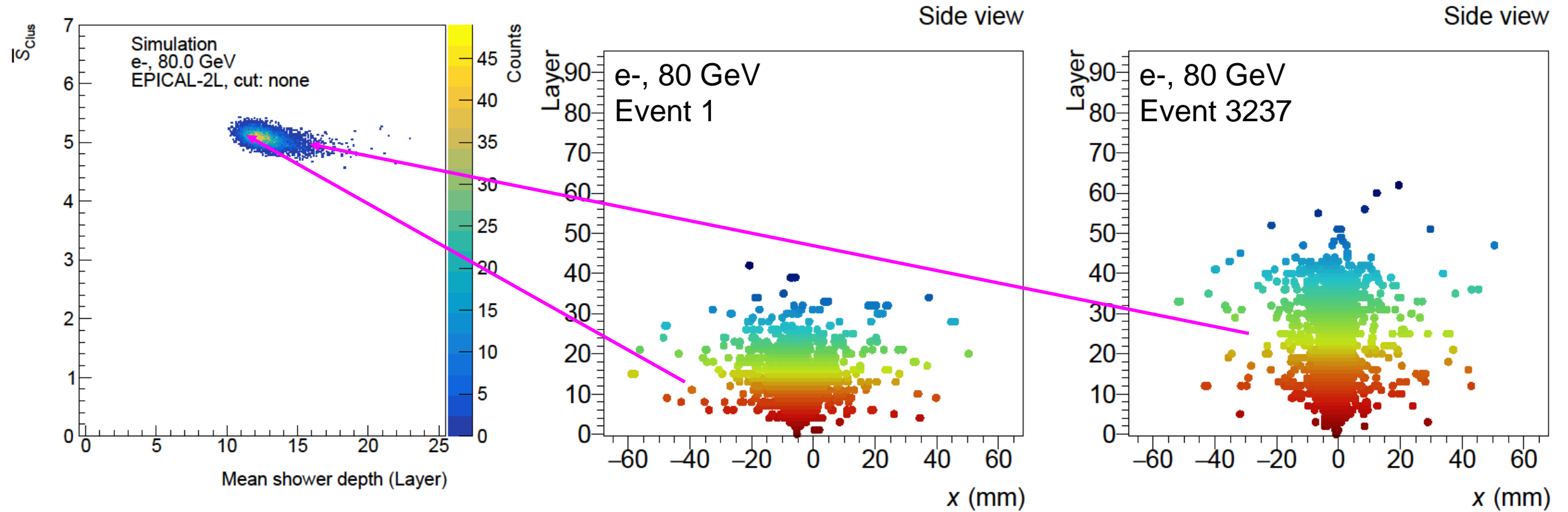
Resolution as a function of detector length

- Resolution has a minimum for a 24 to 28 layer long detector
- Effect only observed at high energies

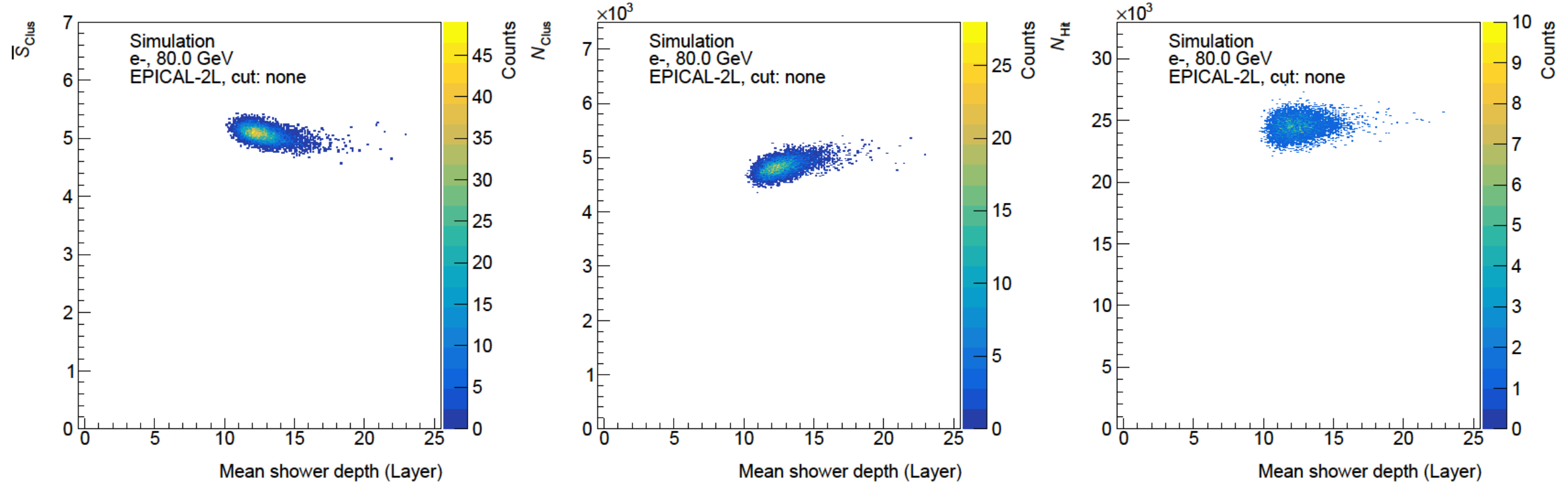# Cluster size in different layers

- Peak around Layer 10 caused by cluster merging
- Increase in later layers (>20), likely caused by particles traversing the chips at an angle

Mean shower depth correlations (EPICAL-2L)
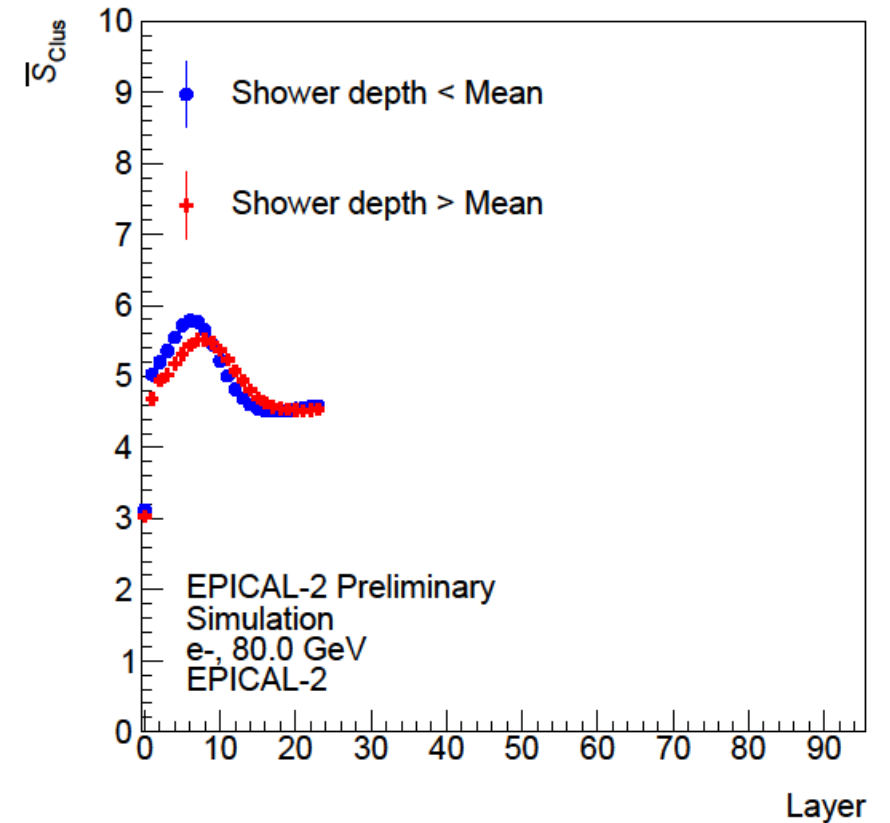
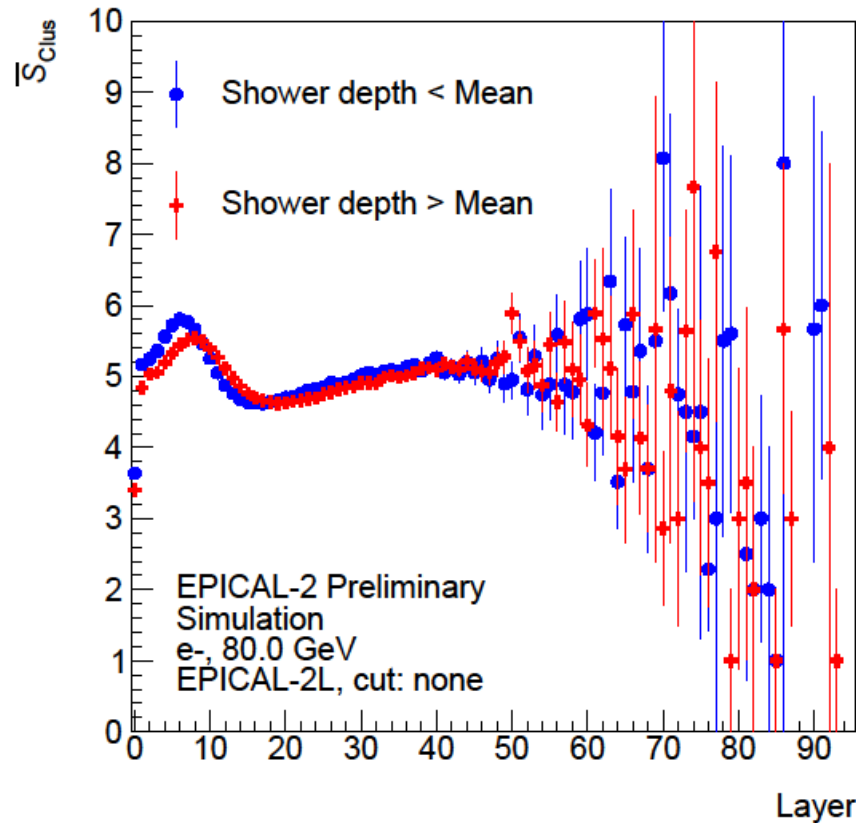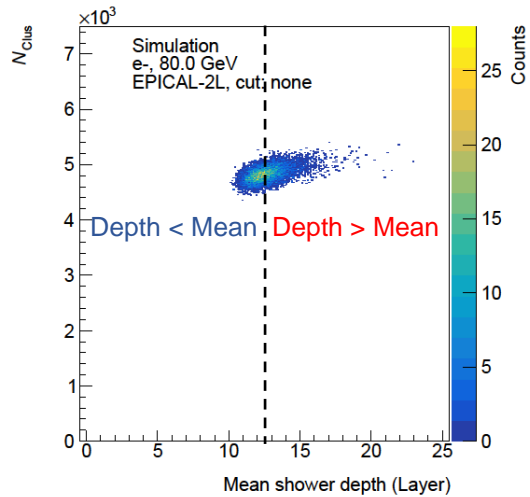# Mean shower depth correlations (EPICAL-2L)

- Deep events generate smaller clusters (maybe reduced cluster merging?)

- Deep events generate more clusters (maybe reduced cluster merging?)

- There is no correlation between shower depth and N_{Hit} (increased number and decreased size of clusters equalize?)

Is cluster merging the cause of the correlations?
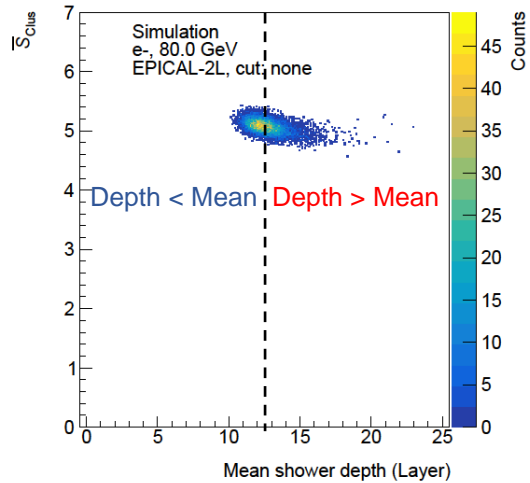
- Cluster merging peak is smaller for deep events
- ➤ Correlation between N_{Clus} and shower depth is likely caused by reduced cluster merging in long events

Mean shower depth correlation: effect on resolution

- This correlation might be the cause of the worsening resolution

- **Real**: Width that we use to calculate the resolution
- **Ideal**: Smallest possible width if there would be no correlation between shower depth and N_{Clus}

Mean shower depth correlations (EPICAL-2)

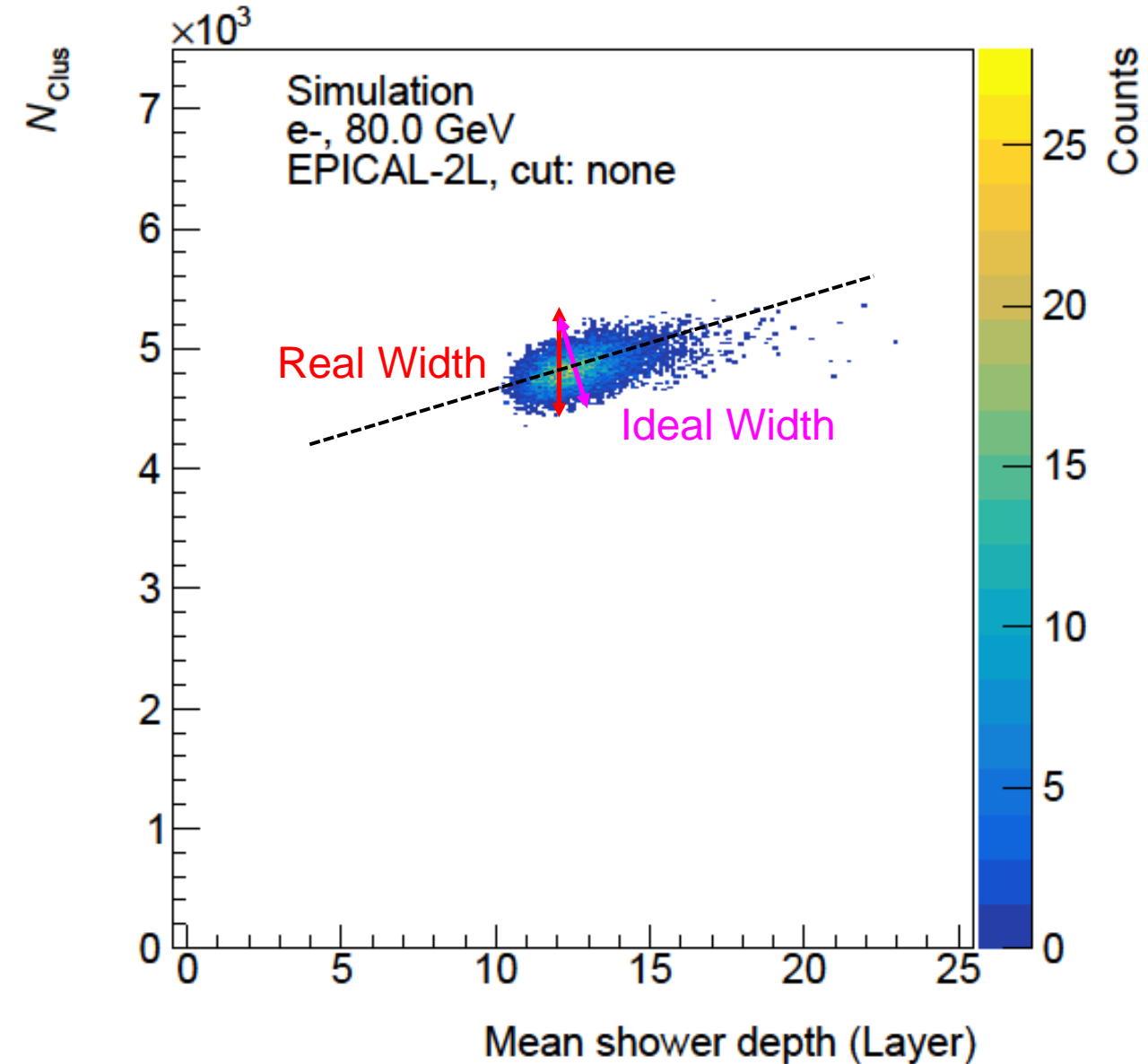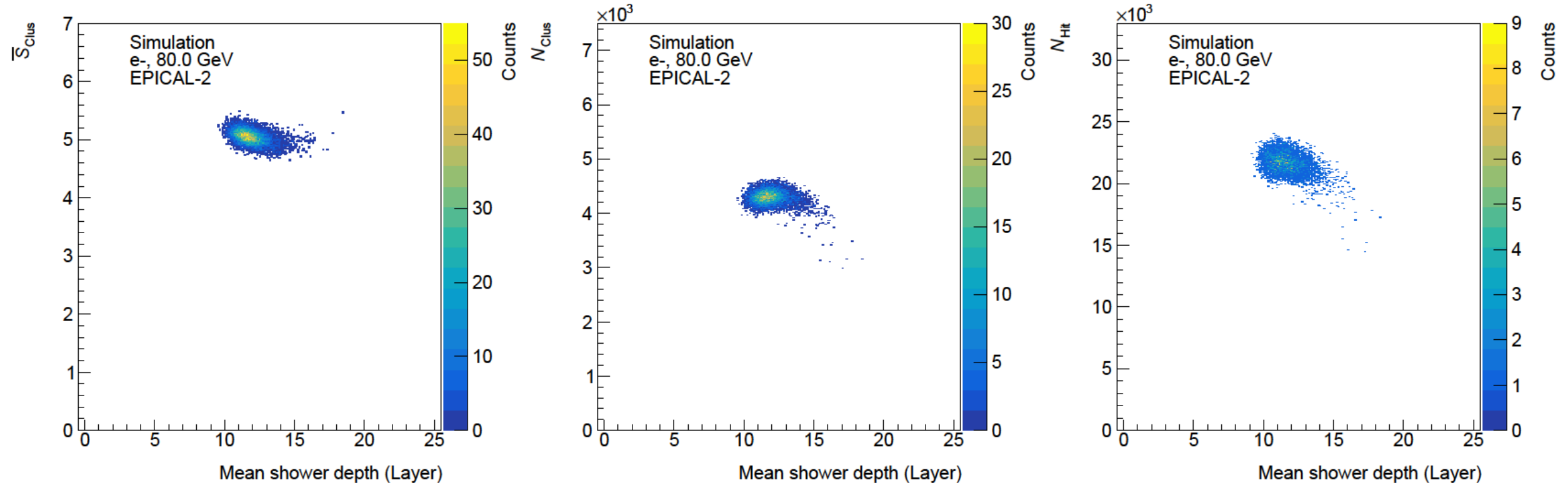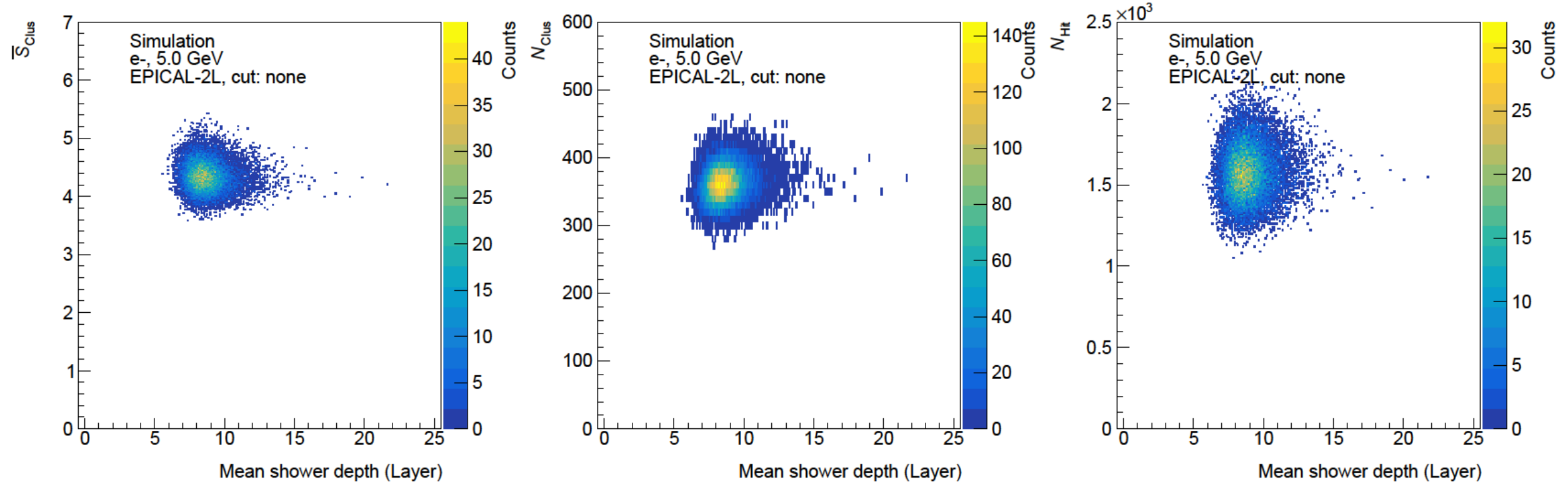- Deep events generate smaller clusters (less cluster merging)

- Deep events generate an equal amount or fewer clusters (counteraction between less cluster merging and the shower being cut off)

- Deep events generate less hits (shower is cut off)

Mean shower depth correlations (EPICAL-2L, 5 GeV)

- No correlations observed
- ➤ Effects don't appear at low energies (<20 GeV)

Summary

Why do long geometries perform worse for clusters at 20-80 GeV?
- ➤ Correlation between shower depth and N_{Clus} caused by the amount of cluster merging being dependent on shower depth
- ➤ This correlation widens the N_{Clus} distribution and leads to worse resolution
- ➤ For short geometries long events get cut off, leading to fewer clusters which compensates the effect of reduced cluster merging