Reconstruction of Strip-ScECAL

K. Kotera, KEK, stay DESY

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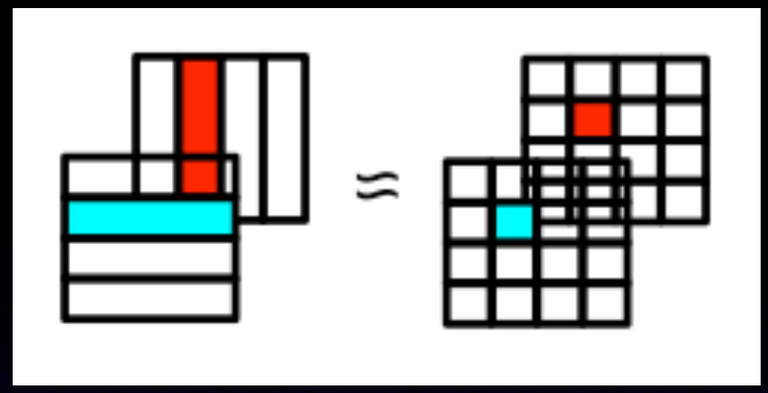
Introduction



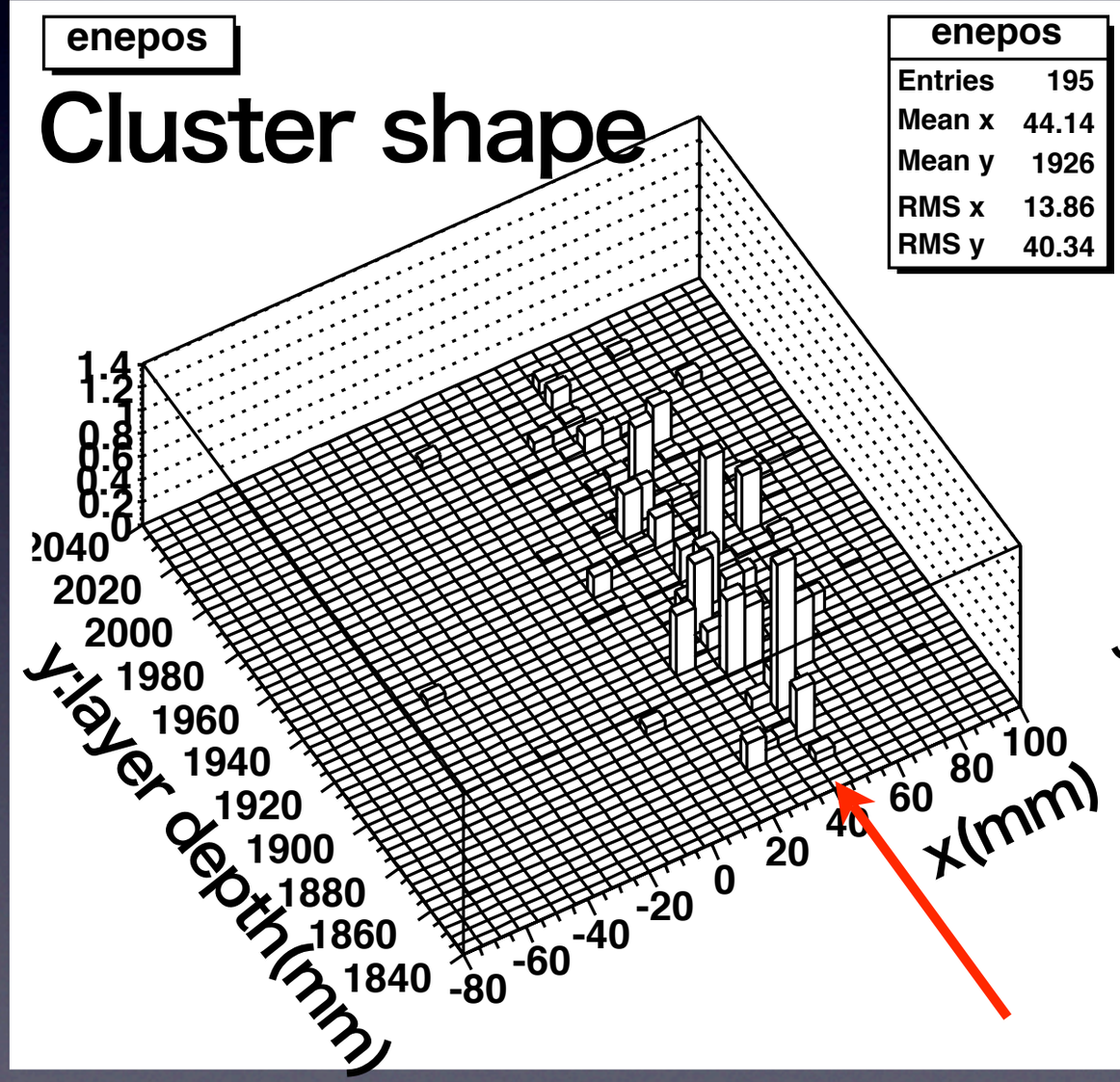
- ScECAL is aiming at “effective” W x W (W=5 mm) granularity using alternately put orthogonal layers of scintillator strips with dimension W x L(L=45 mm or longer).

- Strip-splitting method
  - Last year I developed a simple algorithm, called “Strip-splitting method” to distribute energy deposit in a strip into virtually split square cells.
  - Daniel Jeans implemented this algorithm for Sc-Si hybrid ECAL and brushed up it, called hybridRecoProcessor.
  - I uses this processor for ScECAL in this talk.

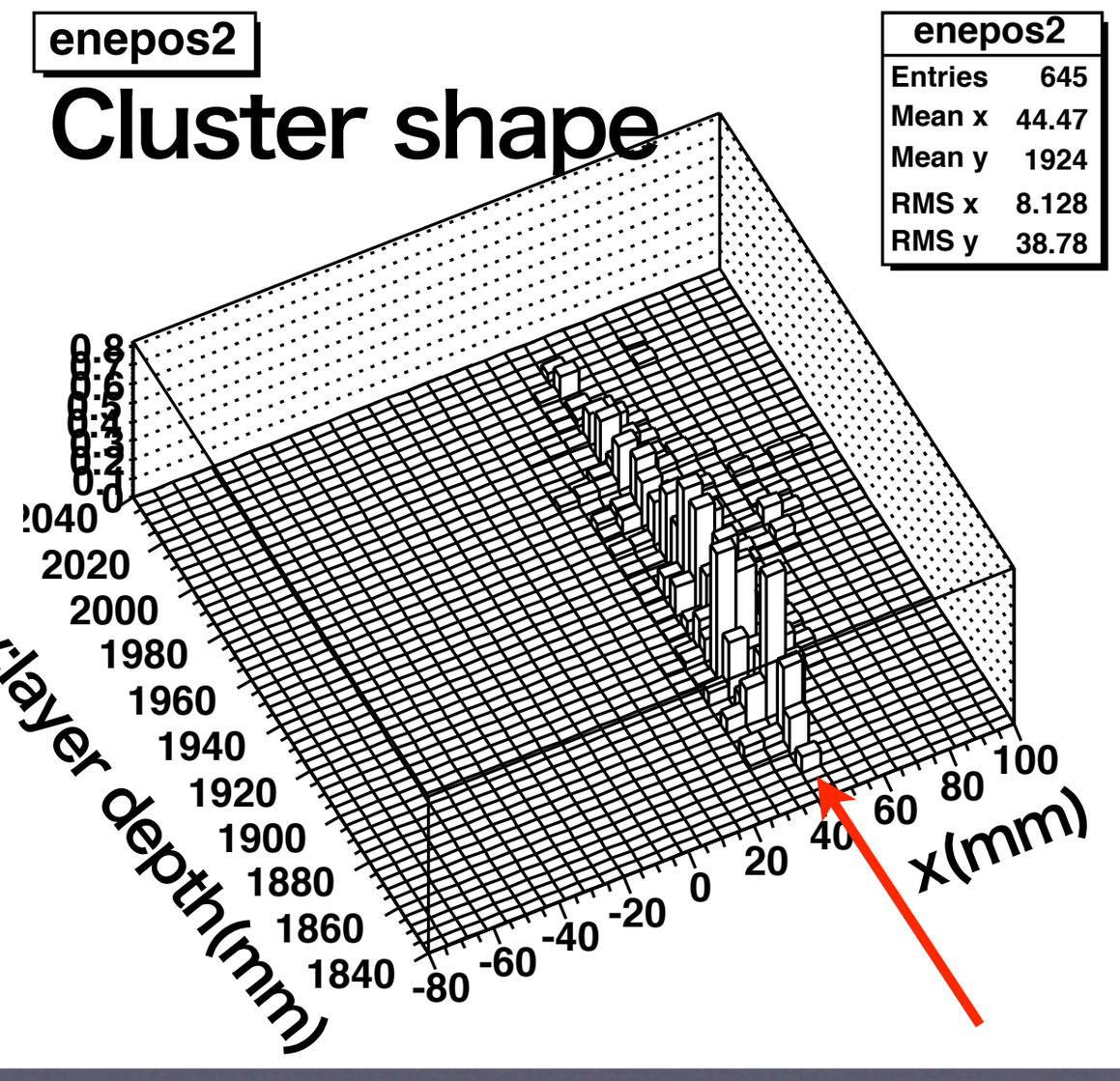
10GeV photon typical event

Energy summed up to z direction (y-x plane)

w/o Strip-Splitting

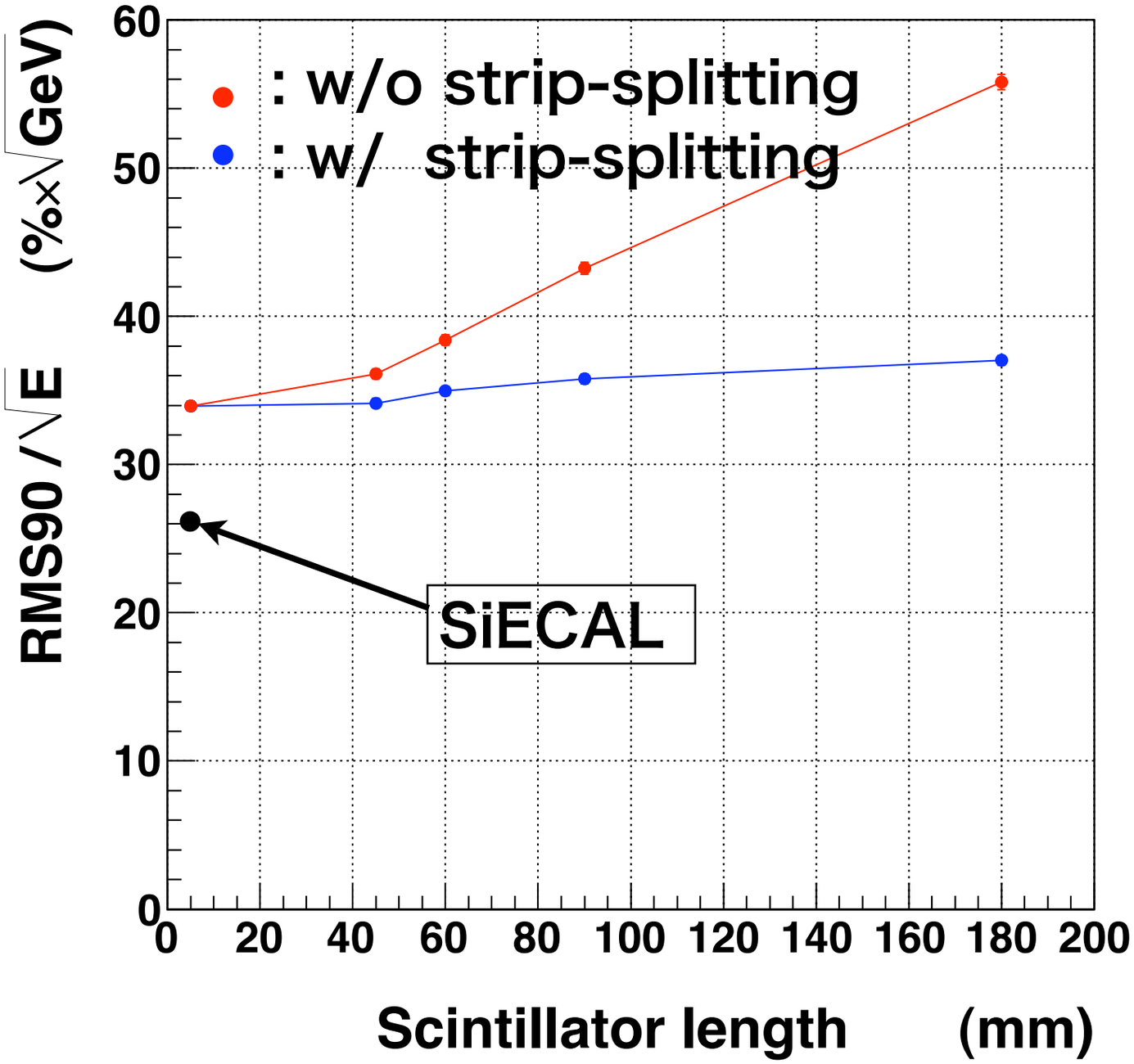


w/ Strip-Splitting



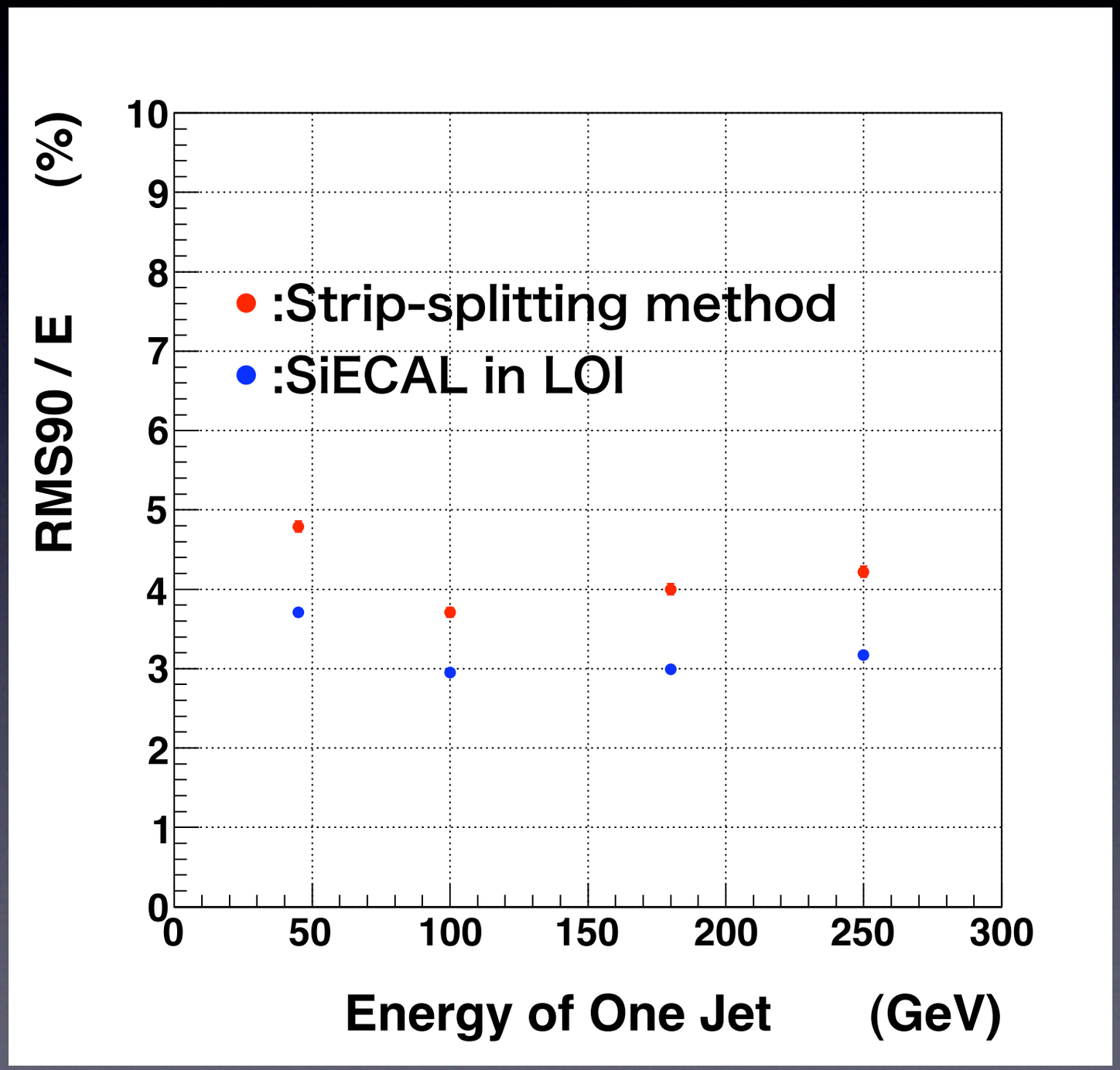
Nice cluster can be seen after Strip-splitting.

Length dependence of JER 45 GeV with realistic generator



- Realistic simulation (generator:Gabriel)
  - intrinsic strip shape
    - not needed to merge square cells to make strip shape(no doubt to accidentally cheat square information)
  - MPPC dead volume
  - reflector dead volume
  - PCB board
  - copper radiator ...
- StripSplittiong method works well
- difference of JER between SiECAL and ScECAL remains

Jet energy resolution vs. jet energy



Difference of JER between ScECAL and SiEAL exists

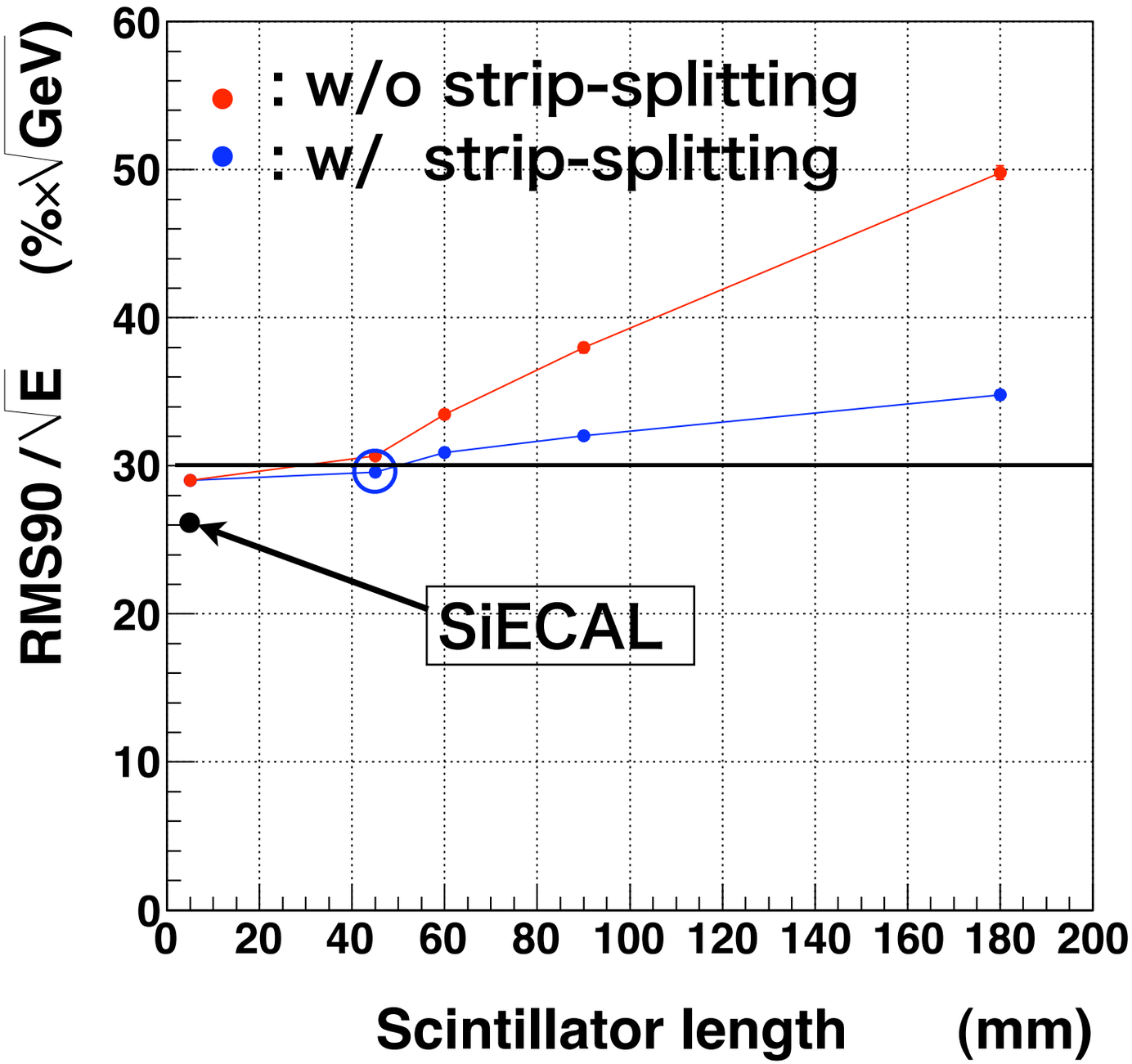
The behavior of ScECAL is similar to that of SiECAL in LOI

There is a difference of layer structure between ScECAL and SiECAL: SiECAL has fine layers in 1st - 20th layers

Similar layer structure for ScECAL was tested ▶ no effect

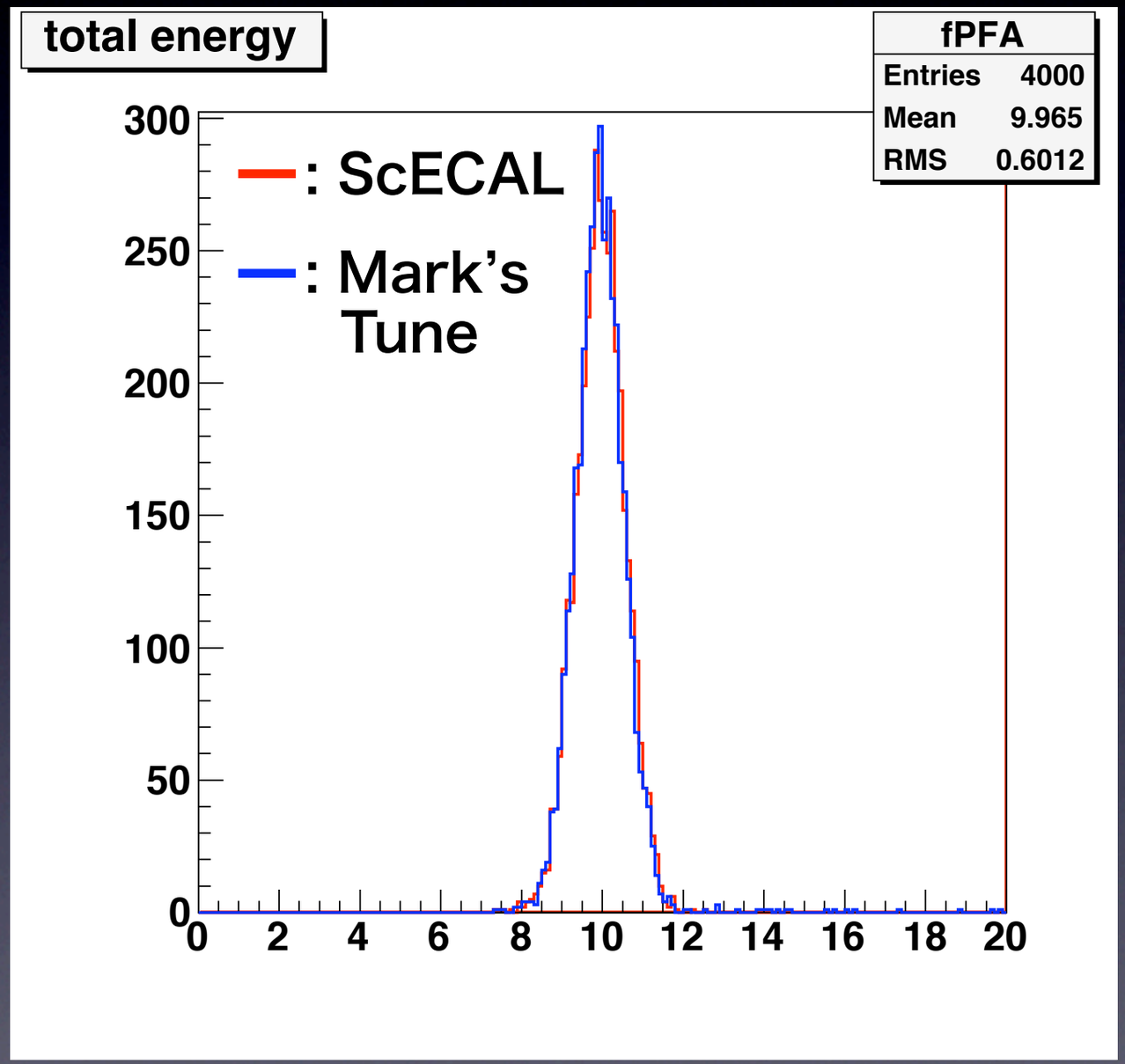
need fine tuning for PFA

Length dependence of JER 45 GeV after tuned by author of PandoraPFA



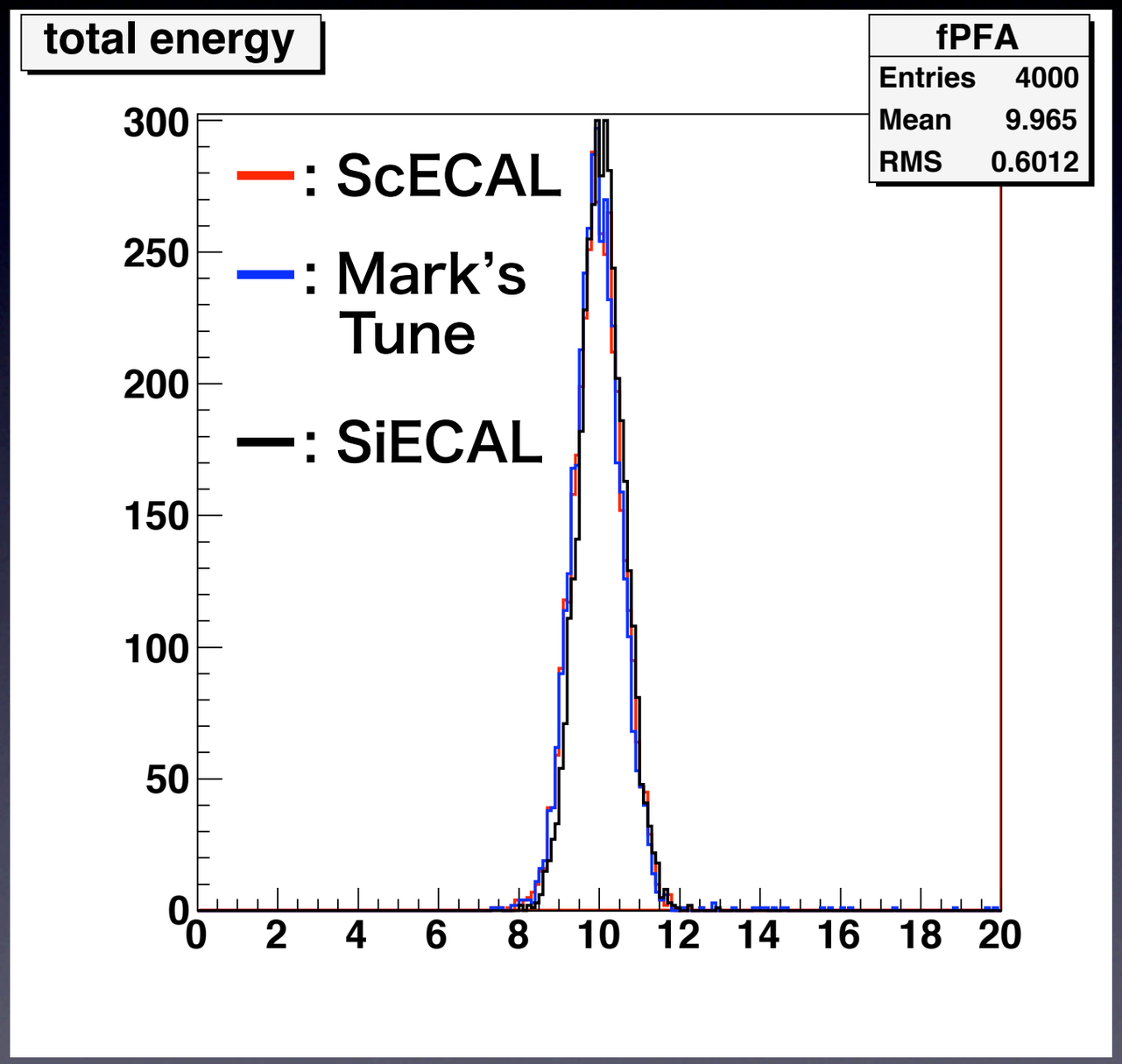
- PandoraPFA parameters for ScECAL45x5mm² were Tuned by Mark Thomson.
- Sc45x5mm²StripECAL achieves to have JER/√E less than 30%.

Energy resolution of 10 GeV photon



- One photon energy resolution is similar between default analysis and M.Thomson's. This is a starting point
- RMS90
  0.488±0.06 (Default)
  0.479±0.06 (Mark's)
- Because energy resolution of one photon events does not require separation capability, Similar energy resolution is not surprising thing

Energy resolution of 10 GeV photon



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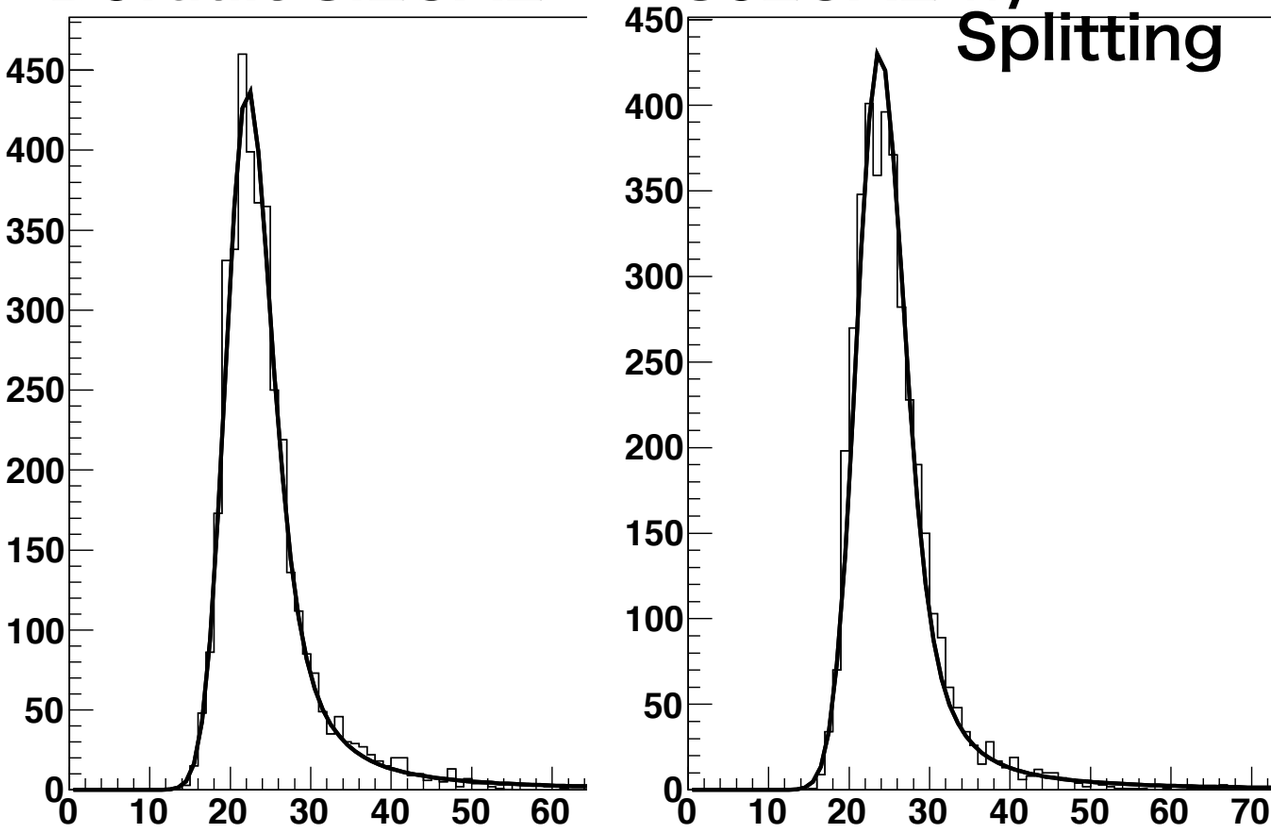
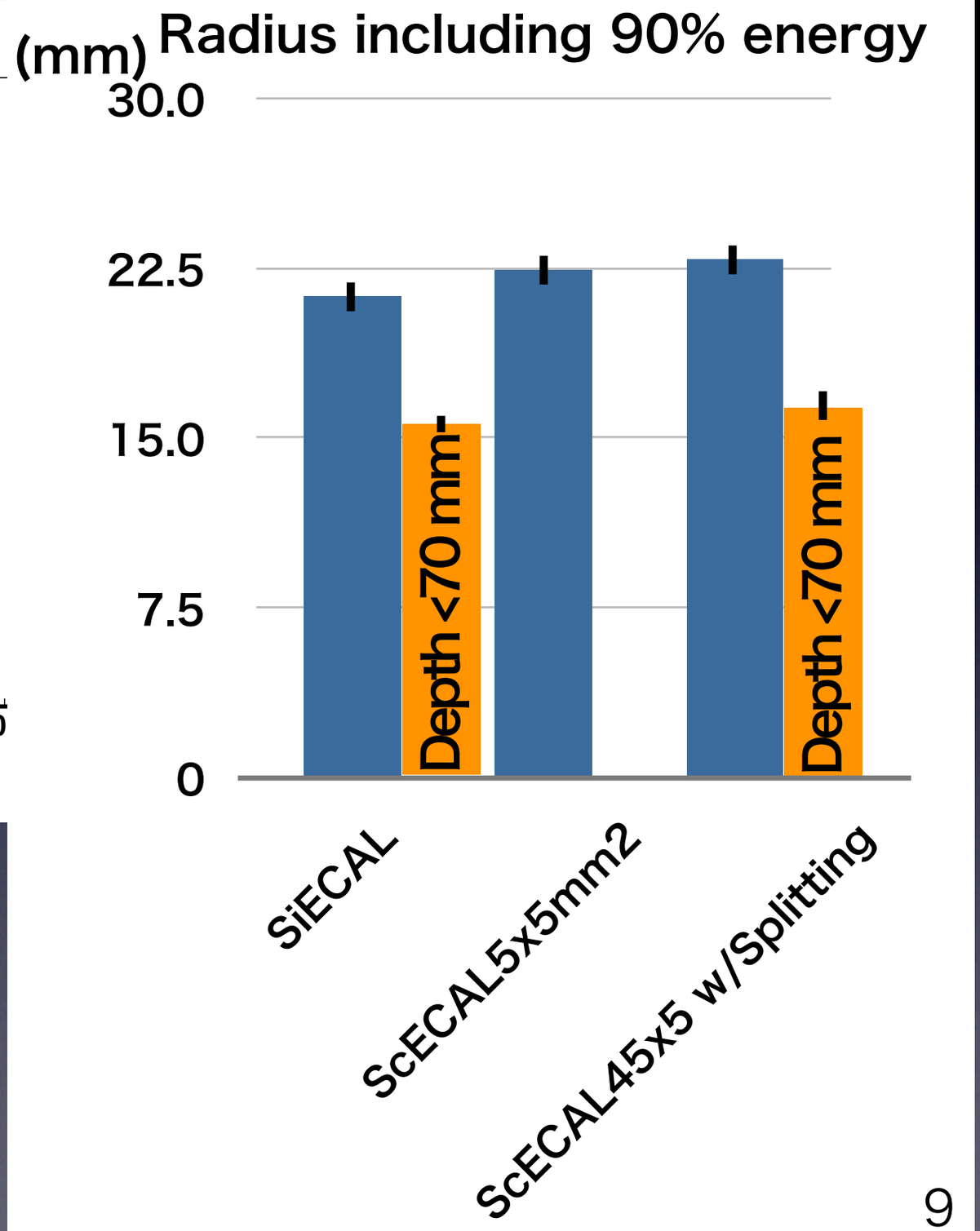
- RMS90
  0.488±0.06 (Default)
  0.479±0.06 (Mark's)
- Because energy resolution of one photon events does not require separation capability, Similar energy resolution is not surprising thing
- SiECAL also has almost similar energy resolution
- RMS90
  0.471±0.05 (SiECAL)

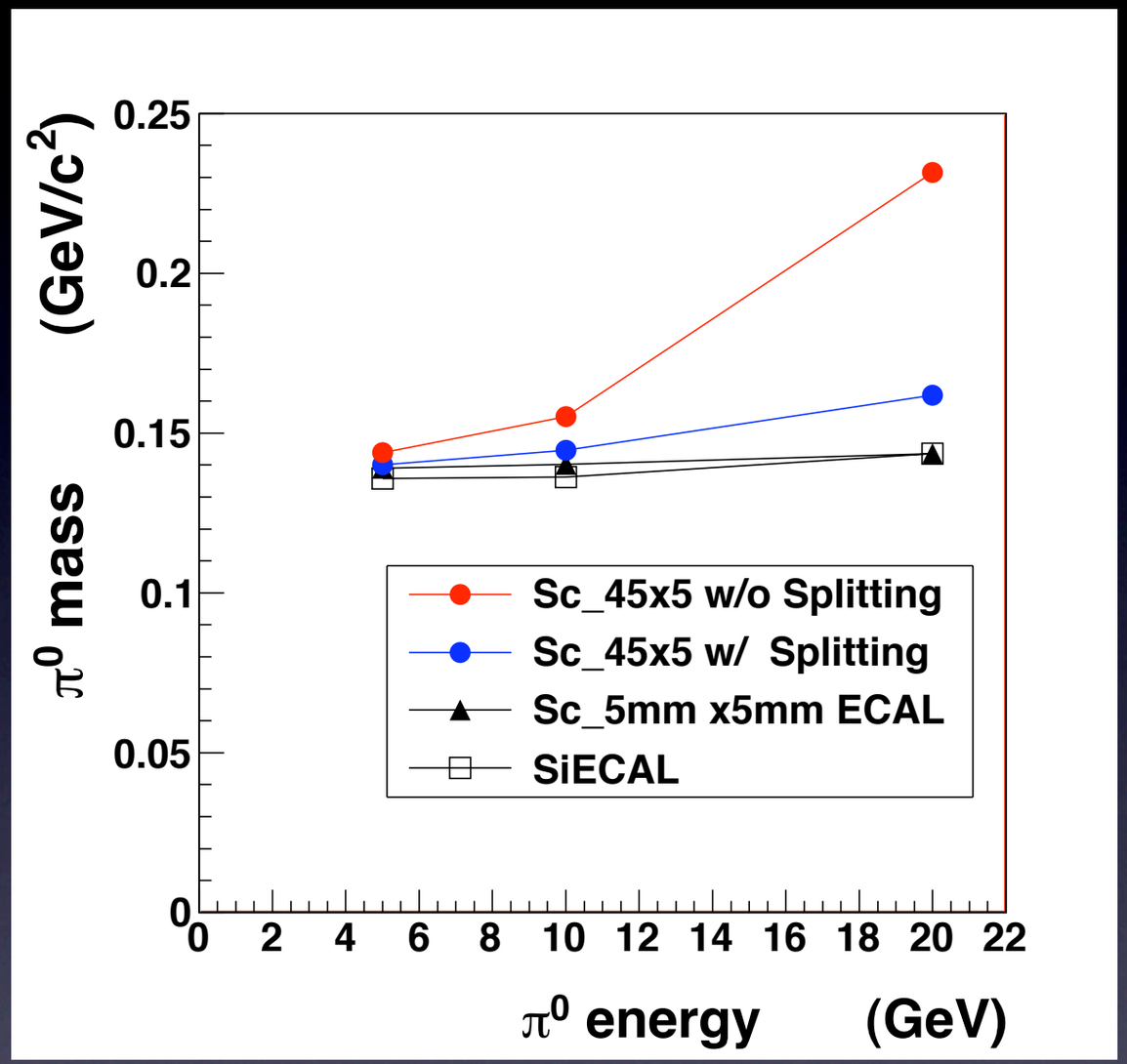
Radius of 10 GeV photon in ECAL

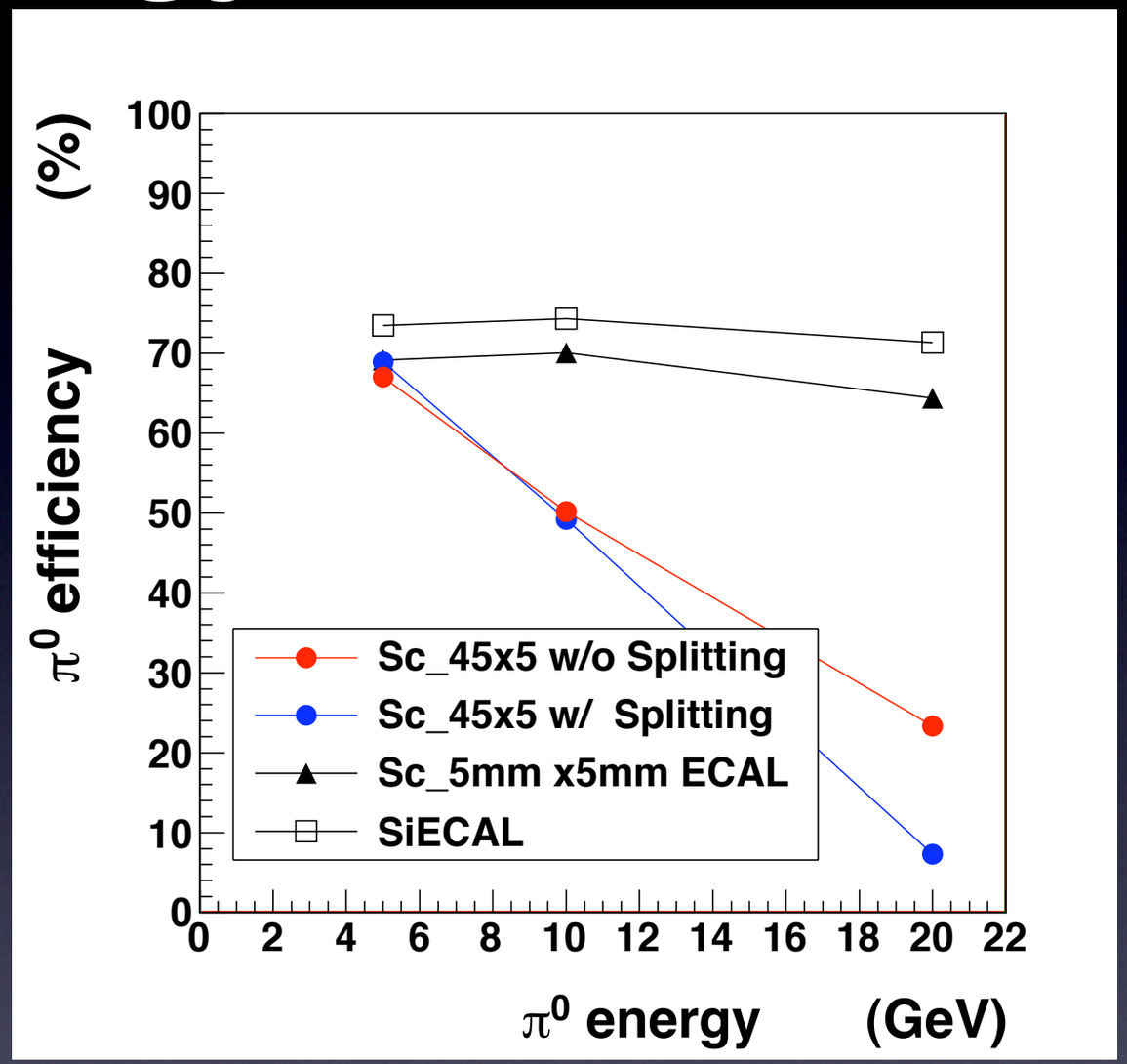




-MPV of Landau-gaussian fit to cluster radius including 90% energy is not so different between SiECAL and ScECAL

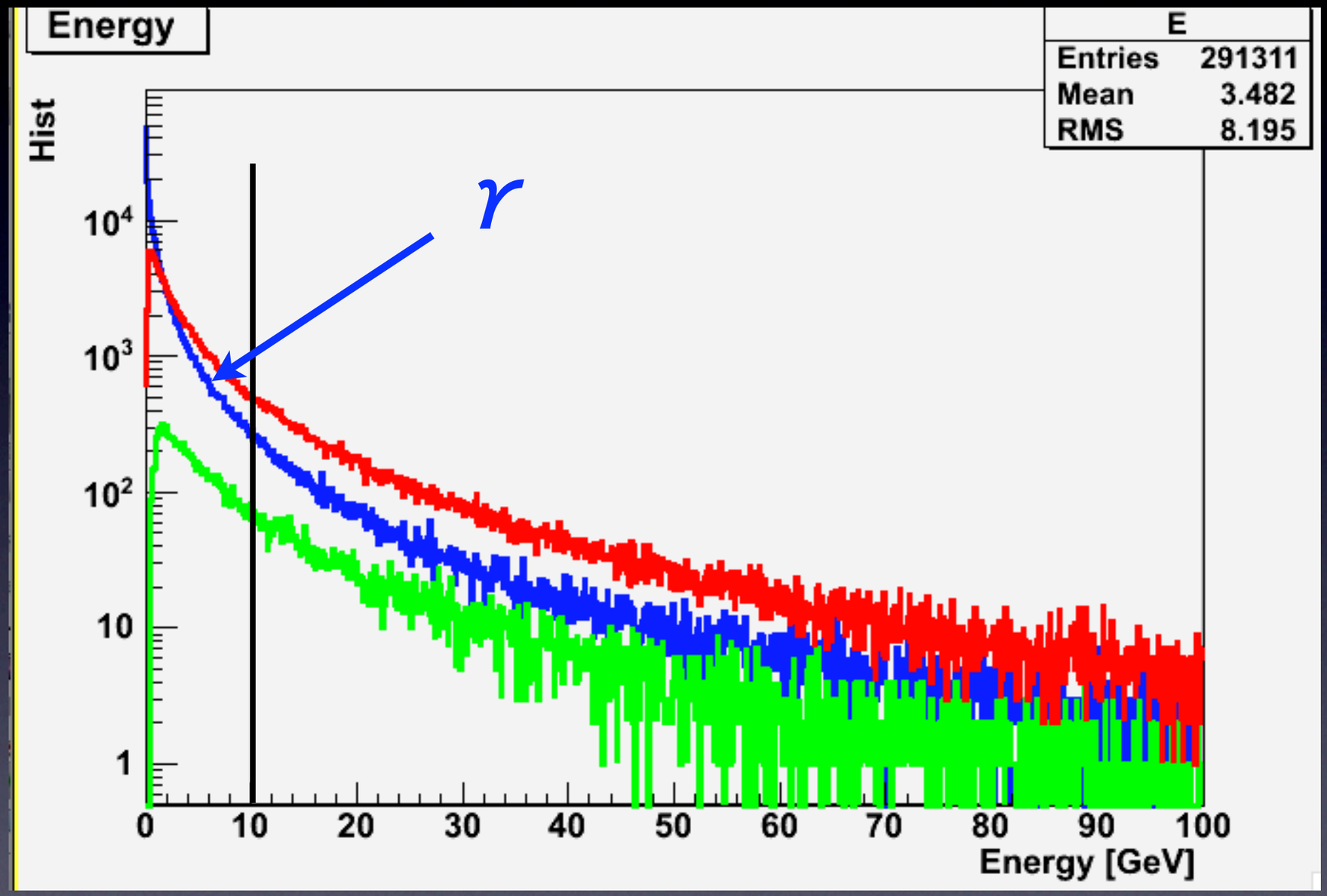
π^0 mass and π^0 recon.efficiency vs. π^0 energy





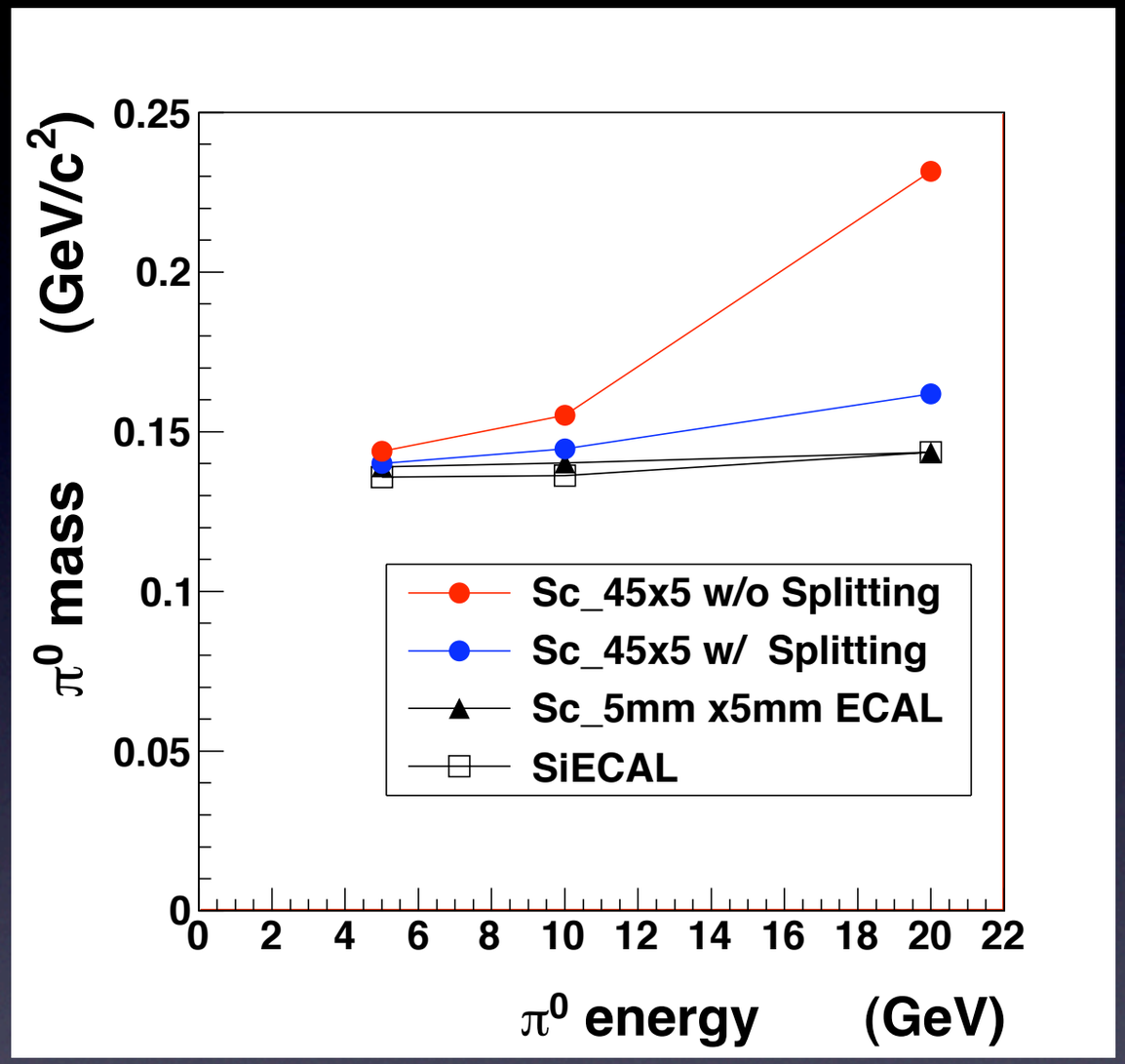
- Reconstructed π^0 mass using strip-Splitting method looks reasonable.
- Efficiency degrades with higher energy.
- Sc5x5squareECAL has reasonable efficiency ▶ This does not explain the difference of JER between SiECAL and ScECAL
- Need tune photon separation for strip-Splitting method.

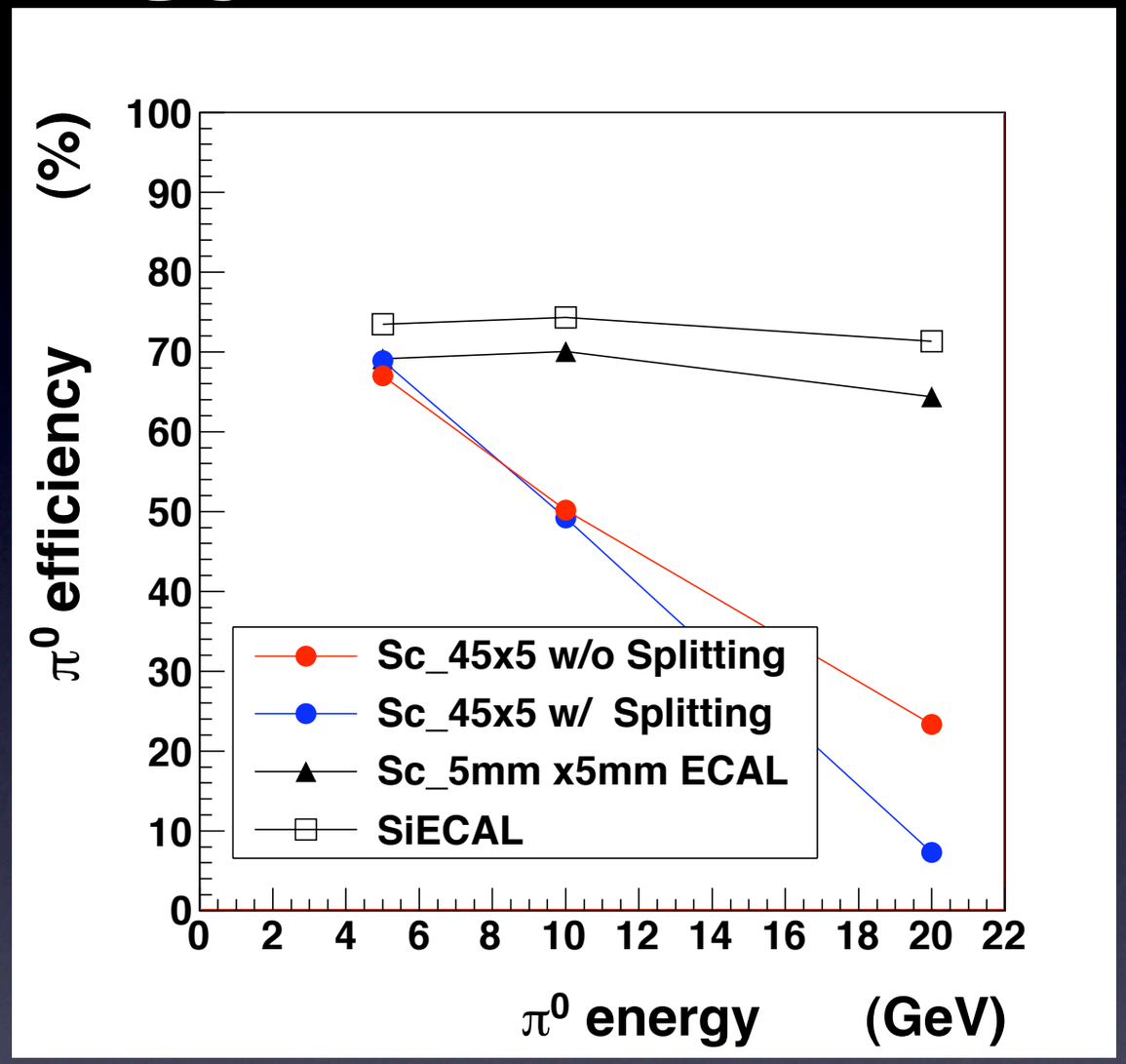
Energy of particles in 1.5 TeV Jet



- Energy of photons is dominated by less than 10 GeV

π^0 mass and π^0 recon.efficiency vs. π^0 energy





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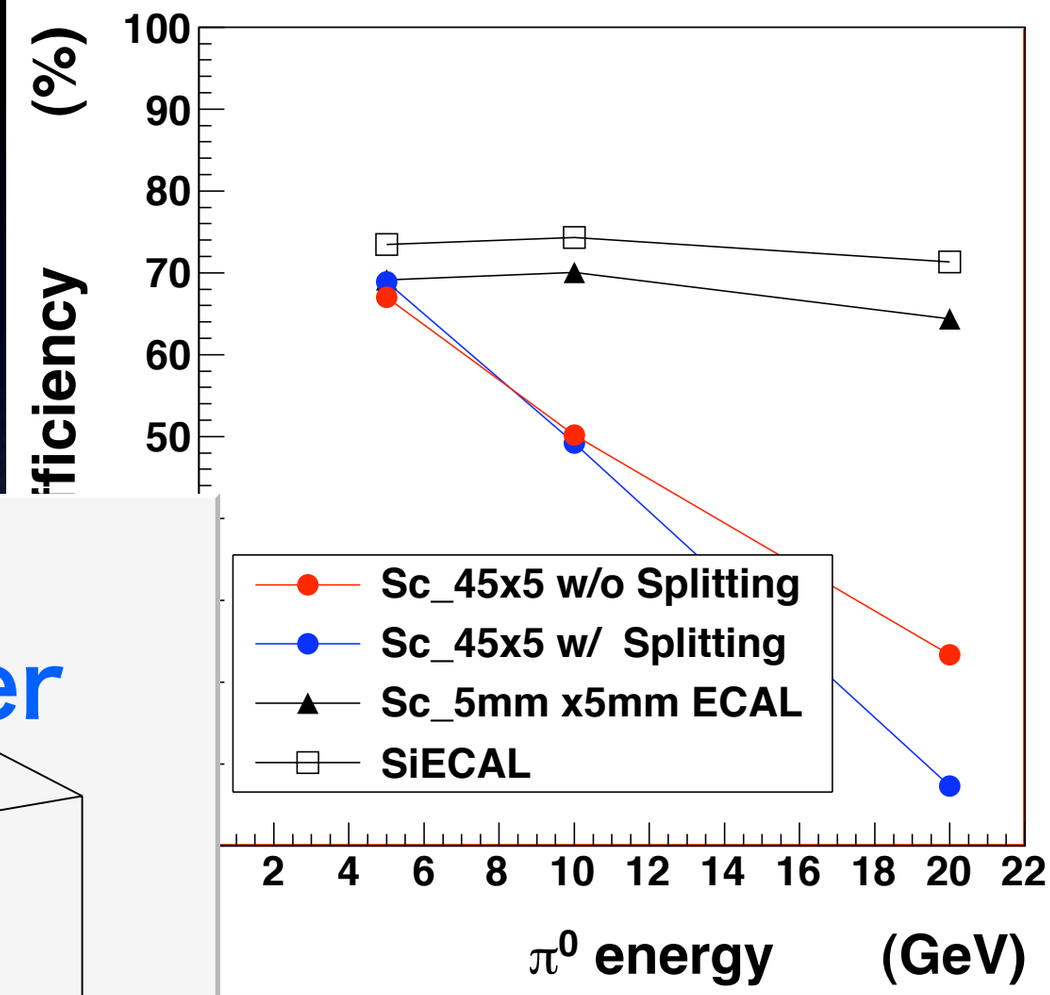
π^0 mass and π^0 recon.efficiency vs. π^0 energy

Case:
Merged in one cluster



- R… plitting method looks r…
- E… gy.
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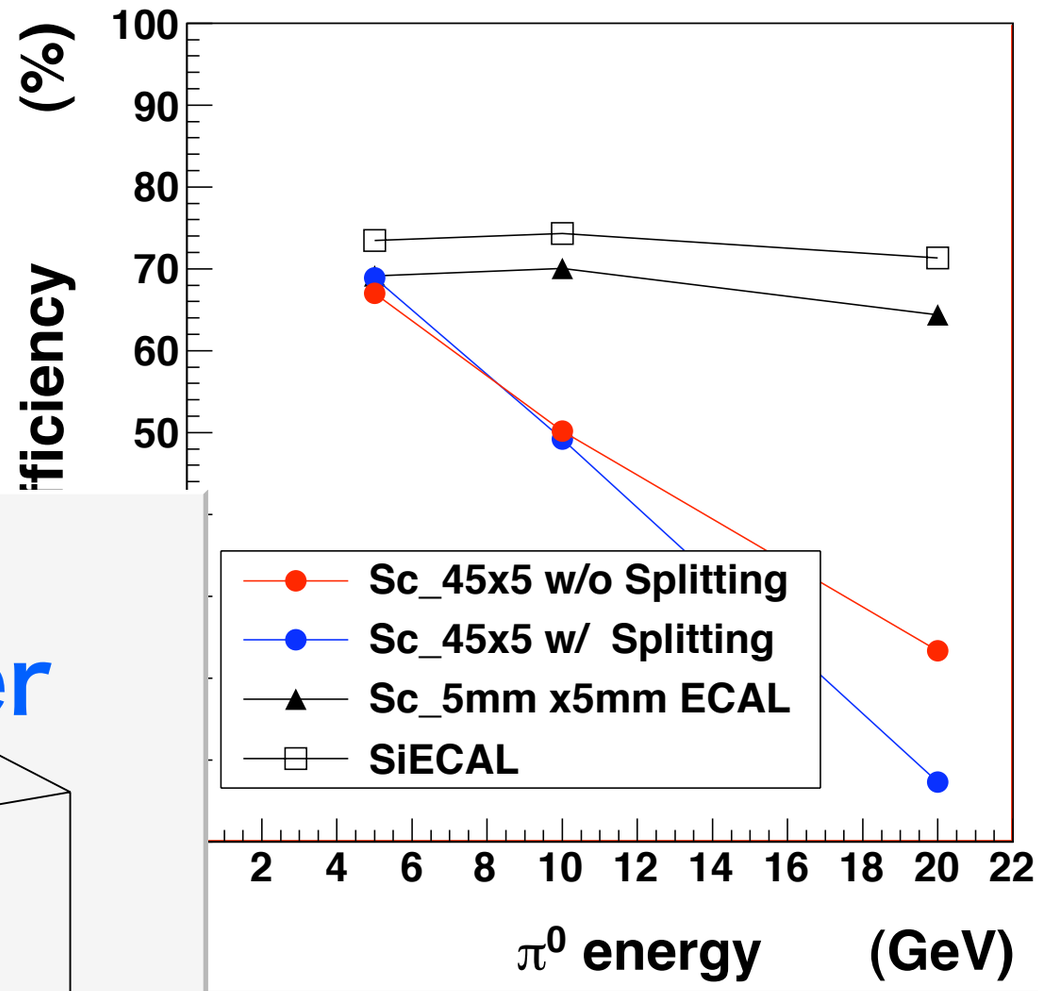
π^0 mass and π^0 recon.efficiency vs. π^0 energy



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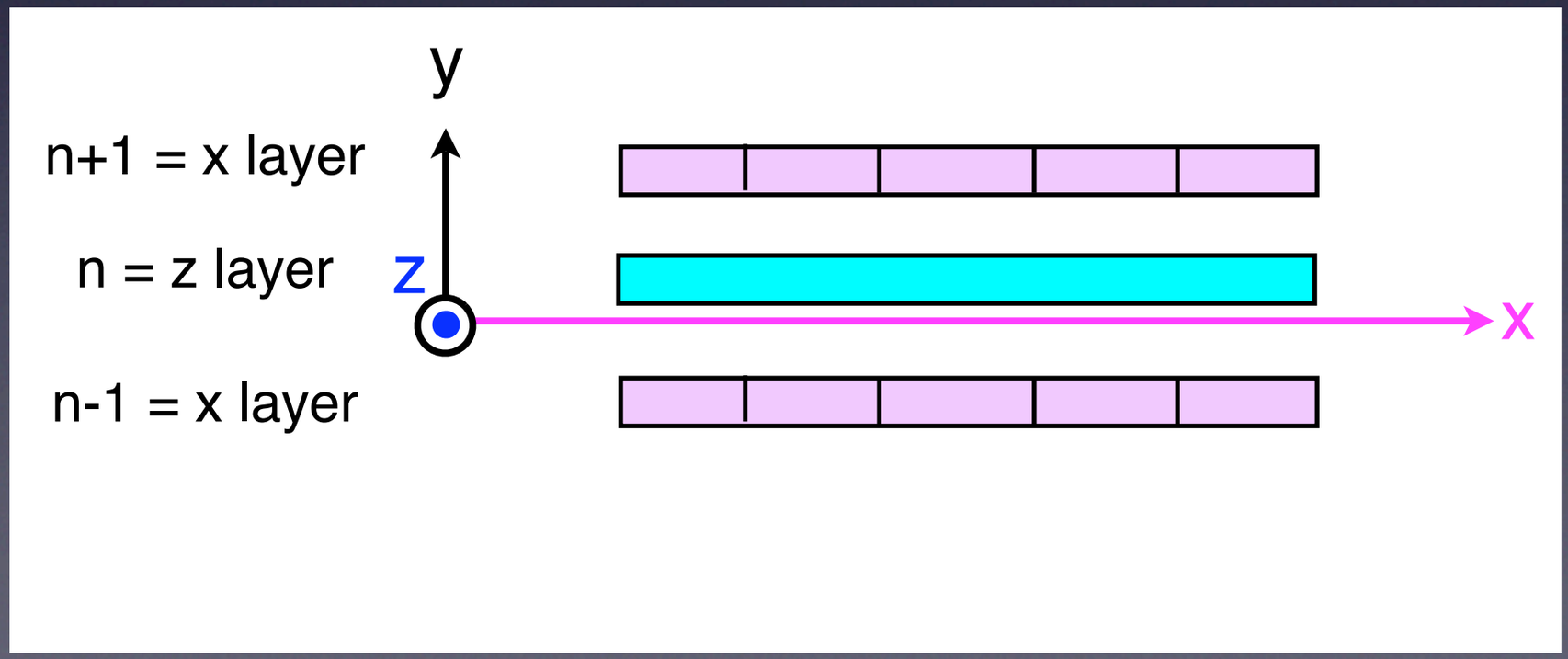
Summary

- Strip-Splitting method was devised last year.
- With Strip-Splitting method ScECAL with 45x5 mm scintillator strip achieved less than 30% of JER/√E for 45 GeV jet.
- Still not arrived at SiECAL resolution.
- Basic energy resolutions for one photon events is almost similar for ScECAL and SiECAL.
- Some rooms are there for improvement of cluster separation.
- Difference of performance between SiECAL and ScECAL should be removed with fine tuning of PandoraPFA. Event by event study
- Implement StripSplitting method in Calice-soft
- Hybrid ECAL and Strip AHCAL

back up

Strip-splitting method

1. Assume that n-th is an z-layer (fine segmentation in z direction), while n±1 layers are x-layers (fine segmentation in x direction).
2. Split each strip in n-th layer into virtual square cells.
3. Energy deposit in n-th layer
4. is distributed in virtual square cells according to the energy deposits in adjacent (n-1)th and (n+1)th layers.
5. The position and energy of virtual square cells are fed into PandoraPFA.



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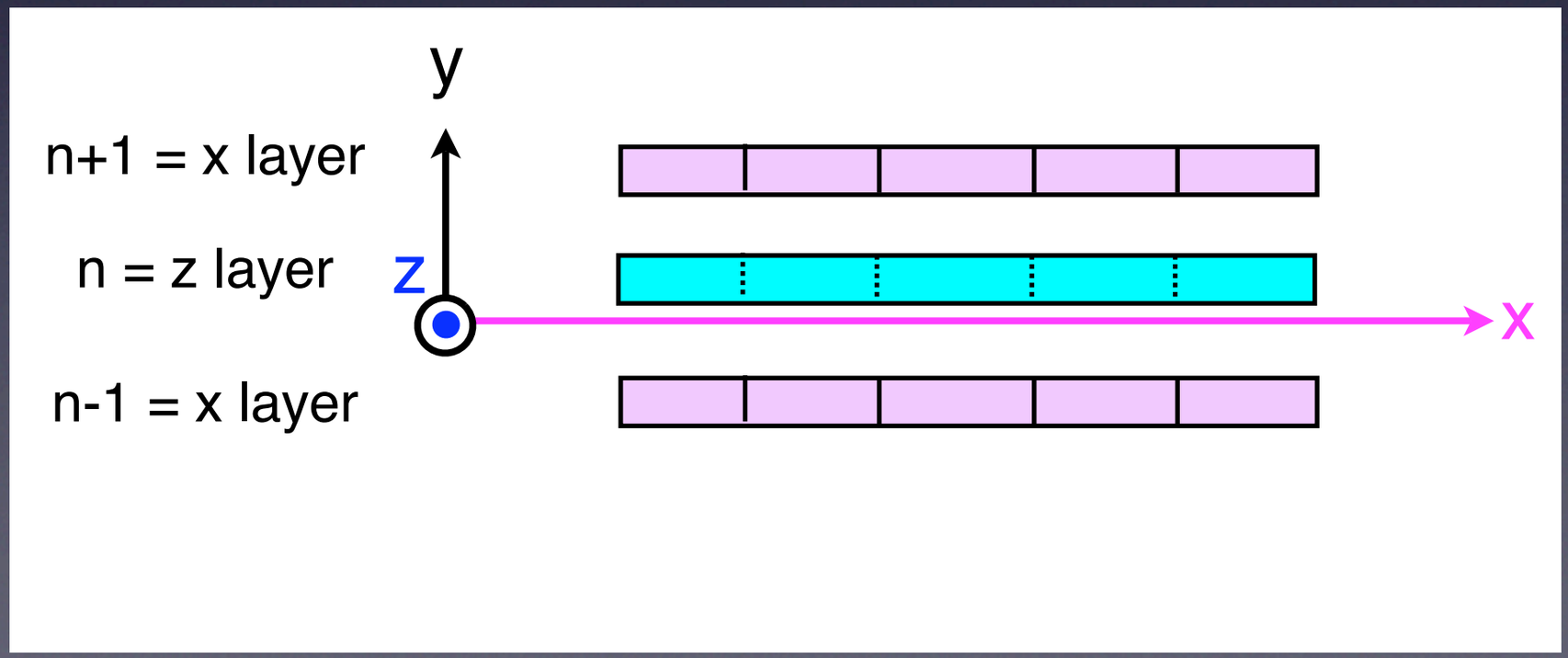

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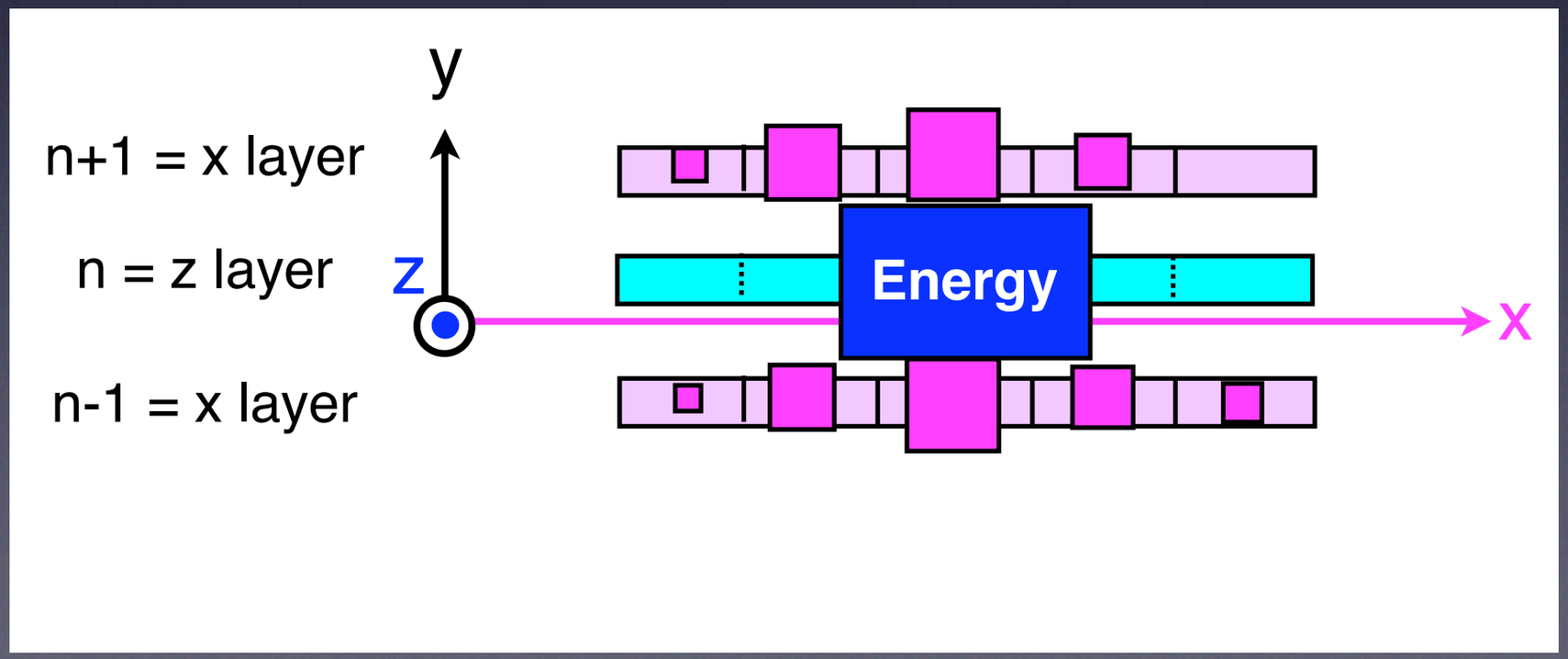

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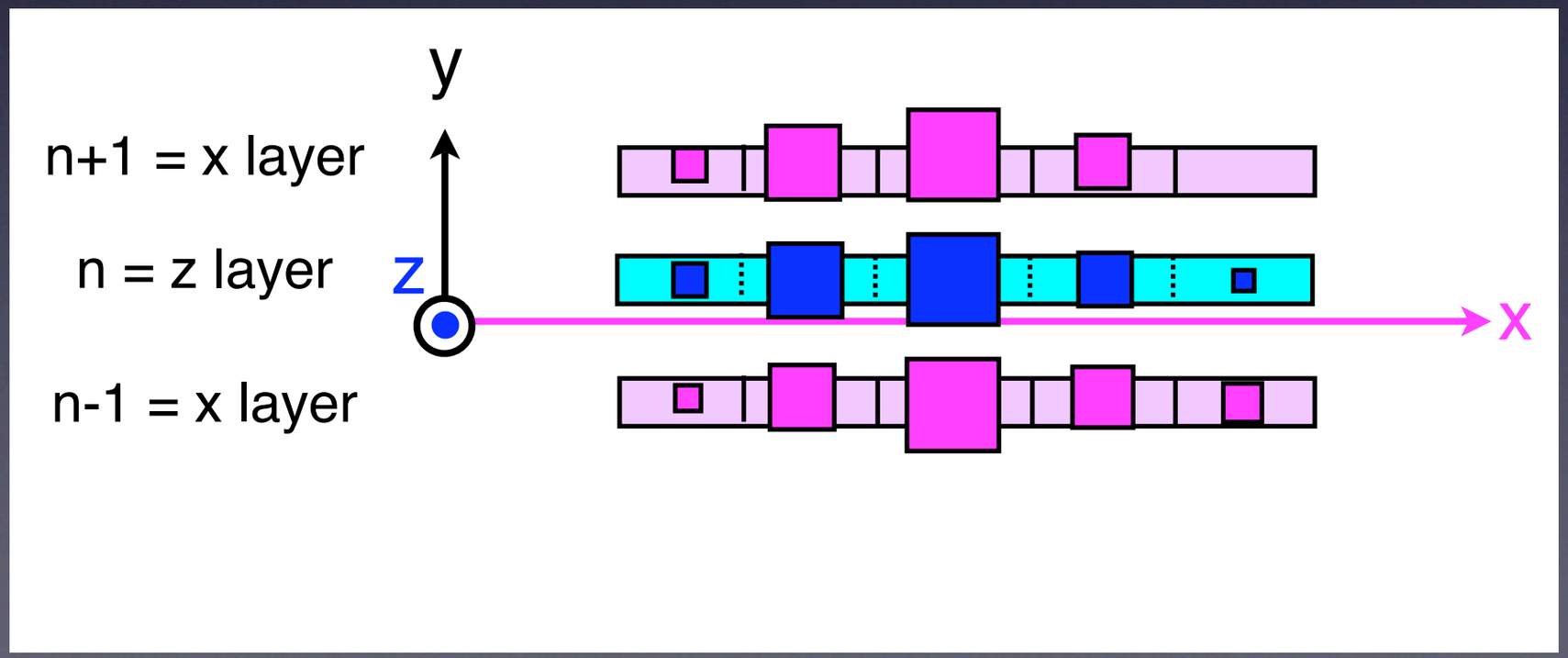

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