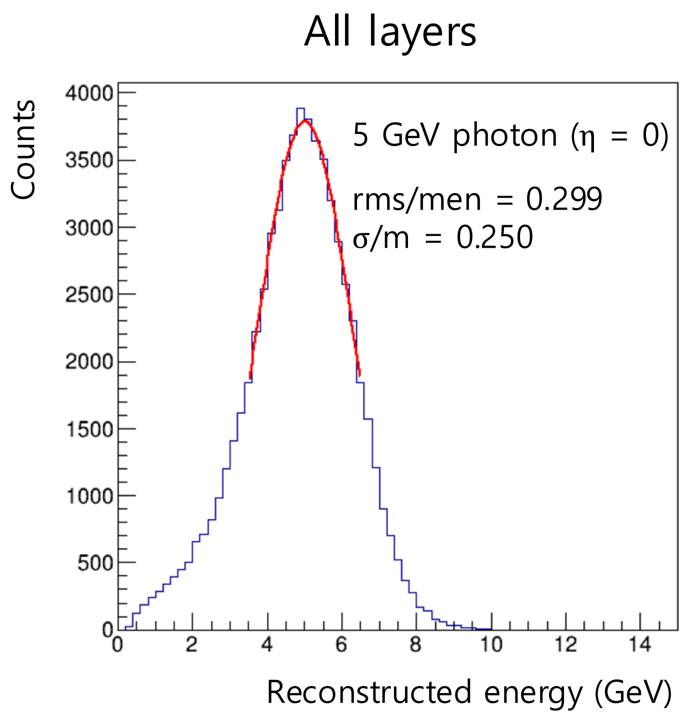
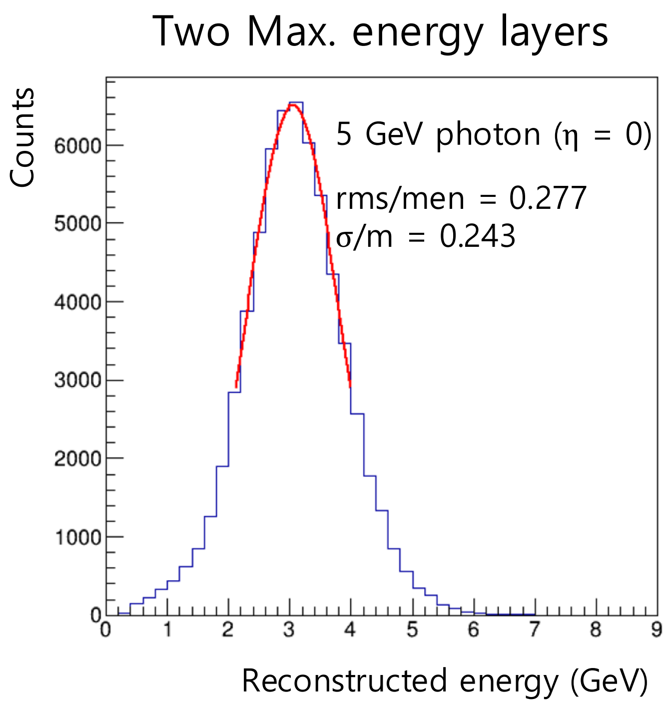
Energy splitting when using ScFi layers info and when using imaging layers info

Oct 1 (Tue)

Minho Kim

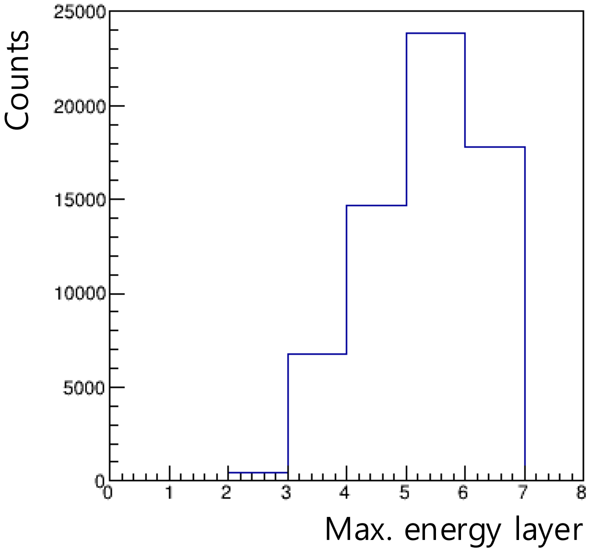
What information will be used from the imaging layer



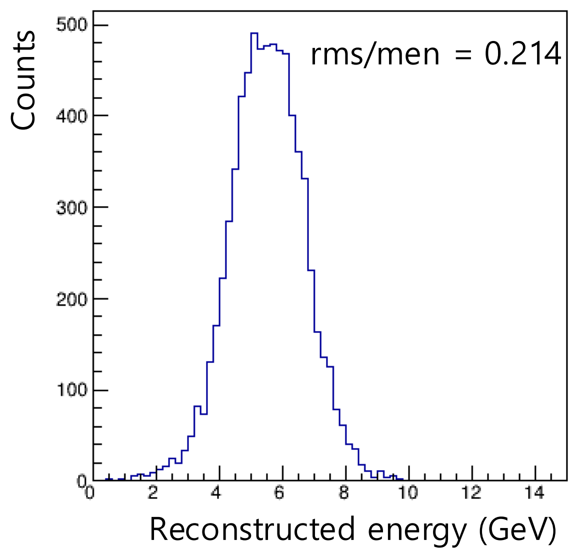


- For 5 GeV photons, the resolution is better when two Max. energy layers are used.
- This means the two Max. energy layers algorithm generally represents the 5 GeV photon at $\eta = 0$ better than all layers.

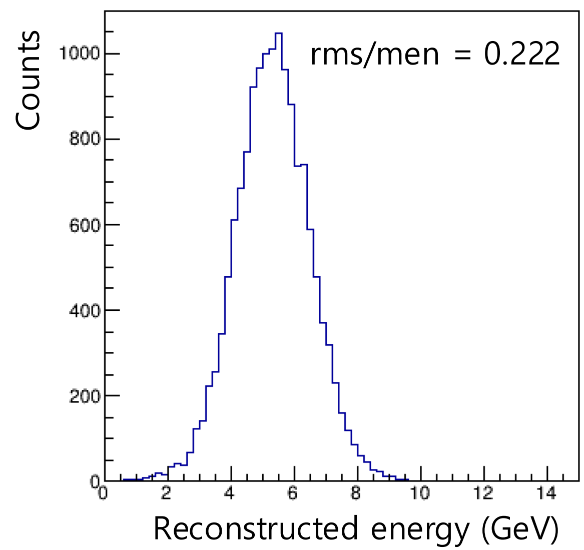
When all layers are used



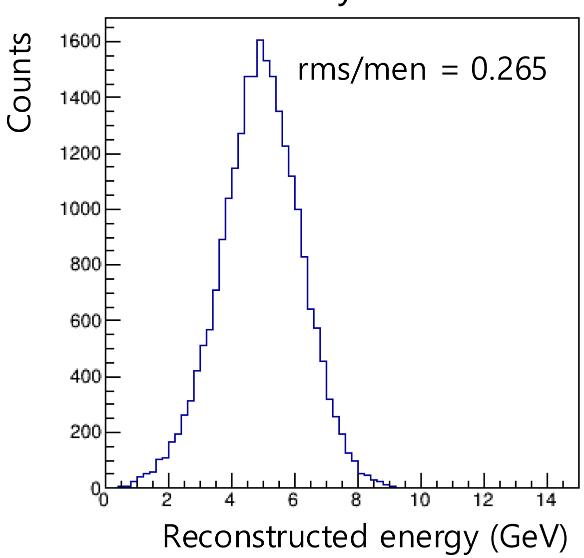
Max. layer ≤ 3



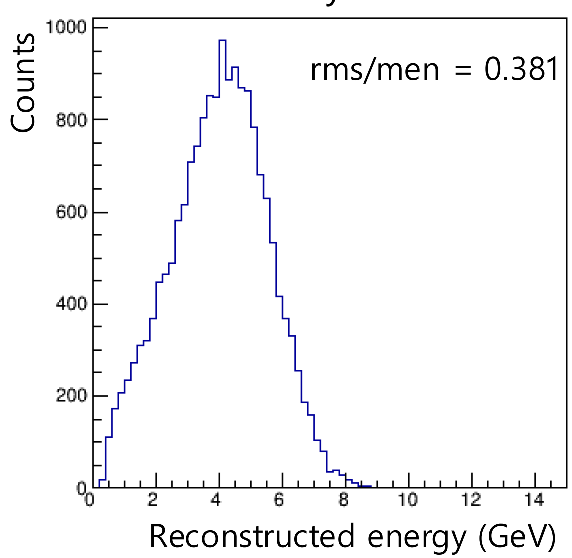
Max. layer = 4



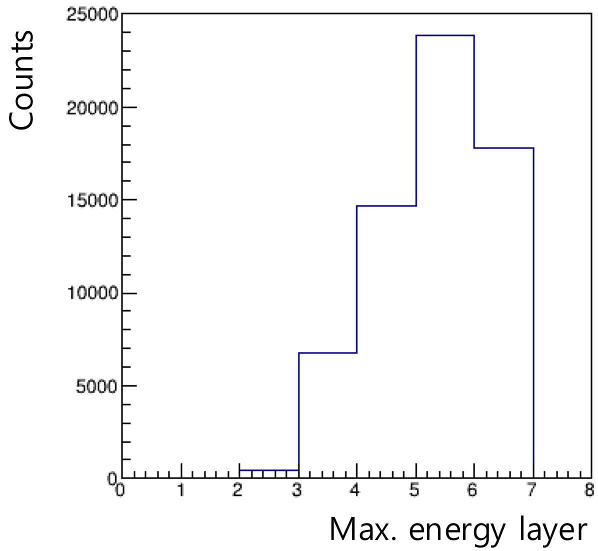
Max. layer = 5

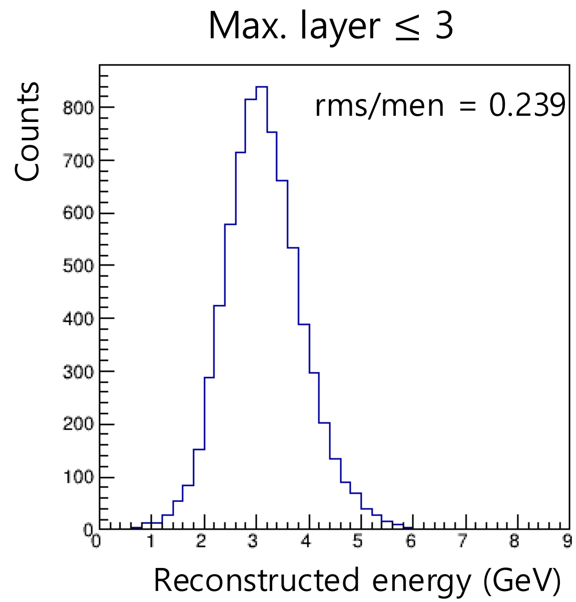


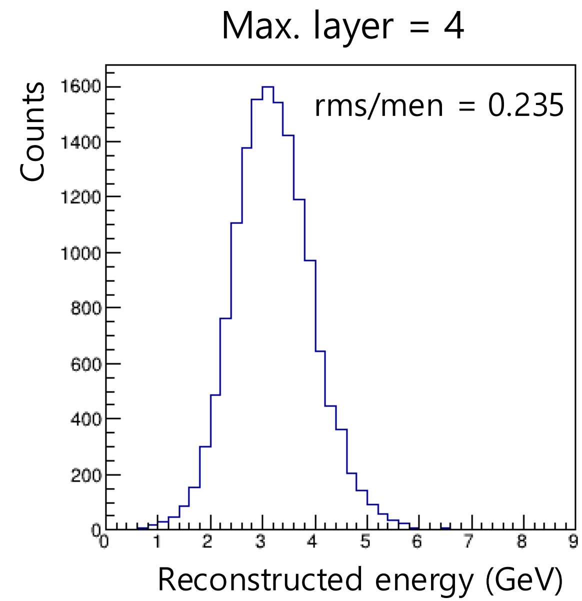
Max. layer = 6

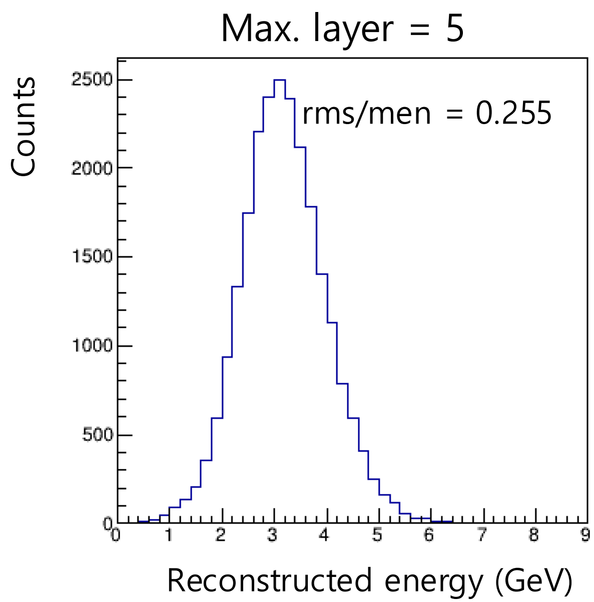


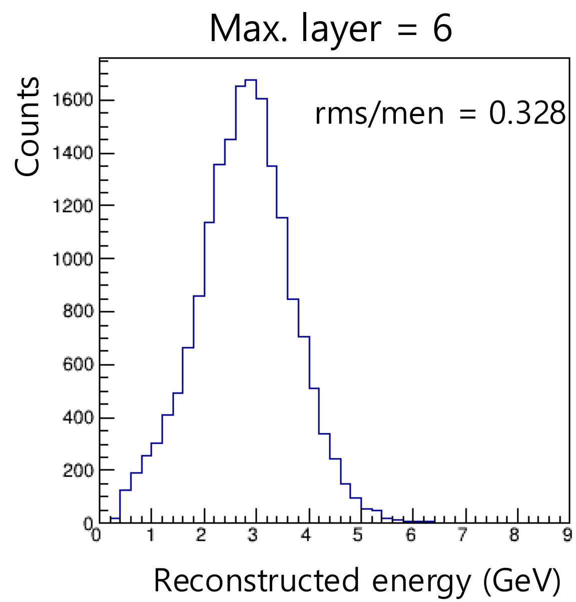
When two Max. energy layers are used



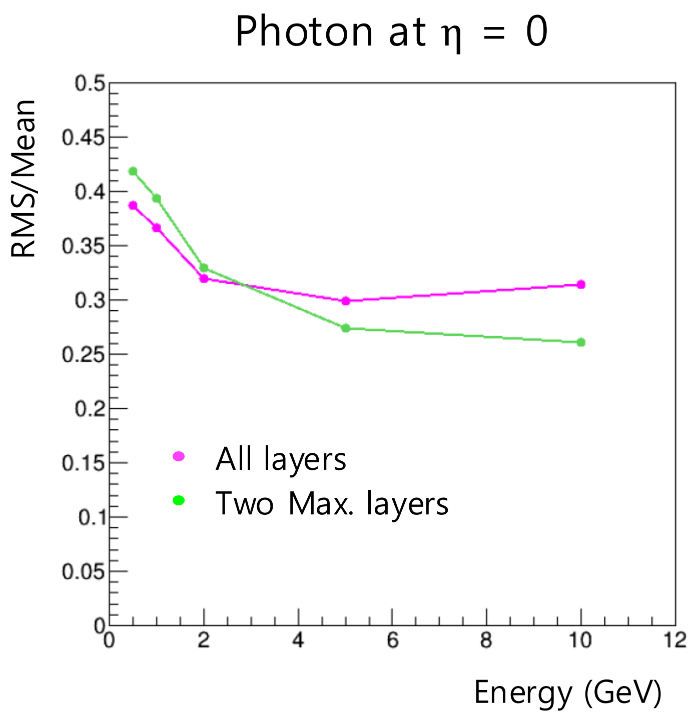


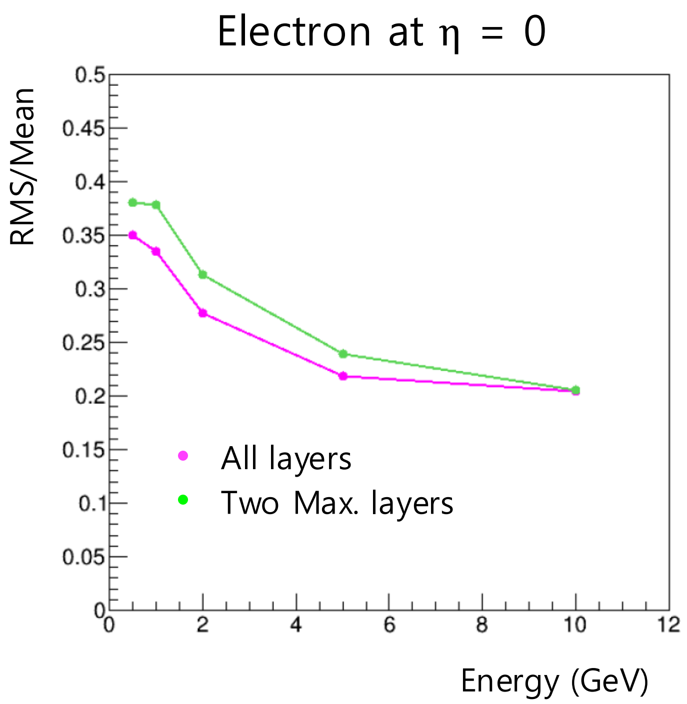






RMS/Mean as a function of energy





- For photons, the "All layers" is better for low energy only.
- For electrons, the kinematic range where the "All layers" shows a better performance is wider than photons because the shower max position is located more forward.

Energy splitting

1 GeV (500 events)

E_scfi_{1GeV} E_imag_{1GeV}

2 GeV (500 events)

E_scfi_{2GeV} E_imag_{2GeV}

$E_{sum} = E\_scfi_{1GeV} + E\_scfi_{2GeV}$

$R_A = E\_imag_{1GeV}$

$R_B = E\_imag_{2GeV}$

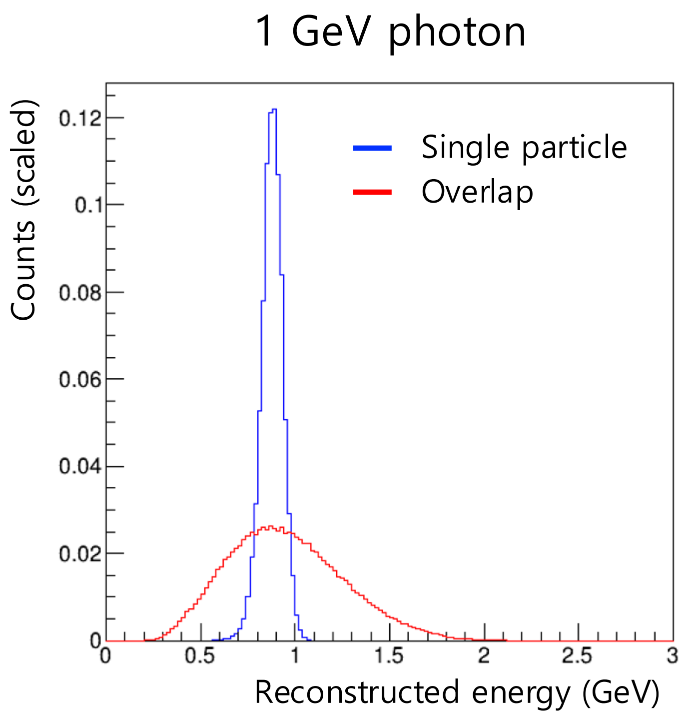
$1\ GeV = E_{sum}[R_A/(R_A+R_B)]$

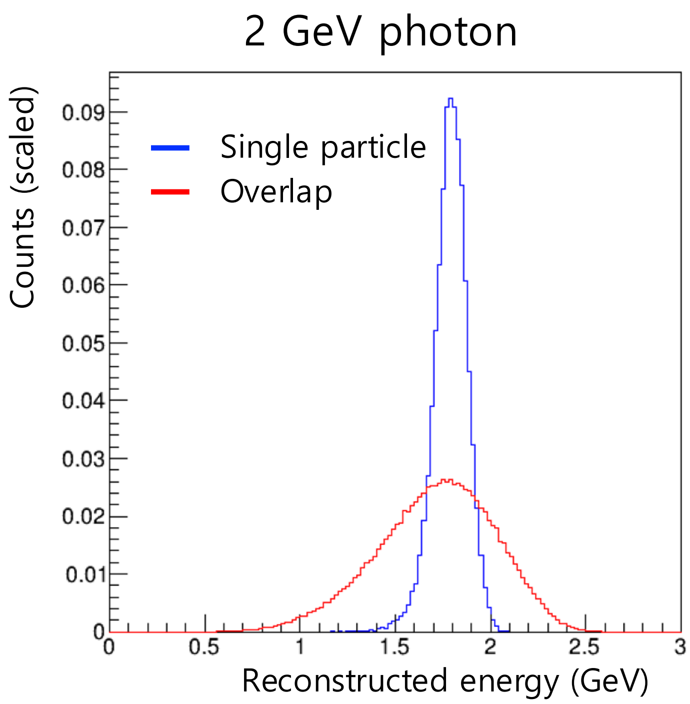
$2\ GeV = E_{sum}[R_A/(R_A+R_B)]$

- The two samples are the ones where photons were generated at $\eta = 0$, but it was assumed that they hit the same sector.

- The above calculation was done for each event of each sample (500 x 500 combinations).

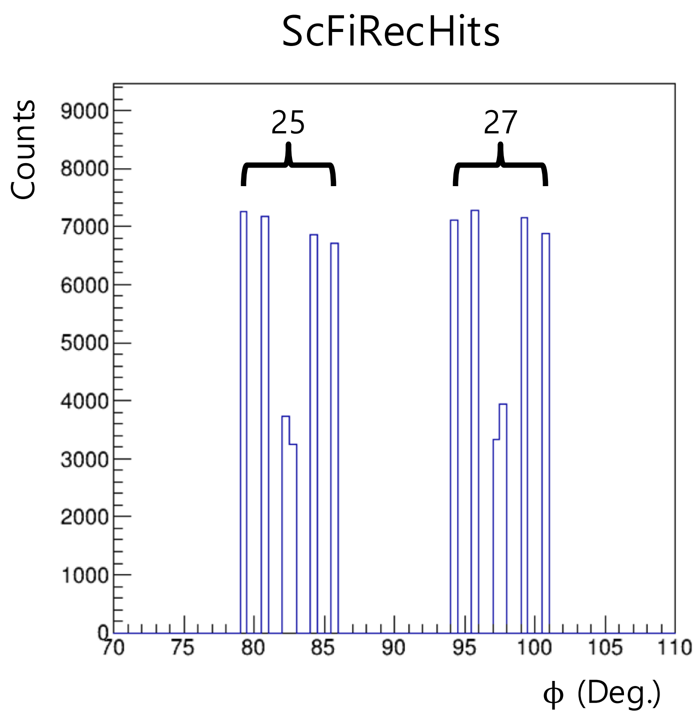
Energy splitting

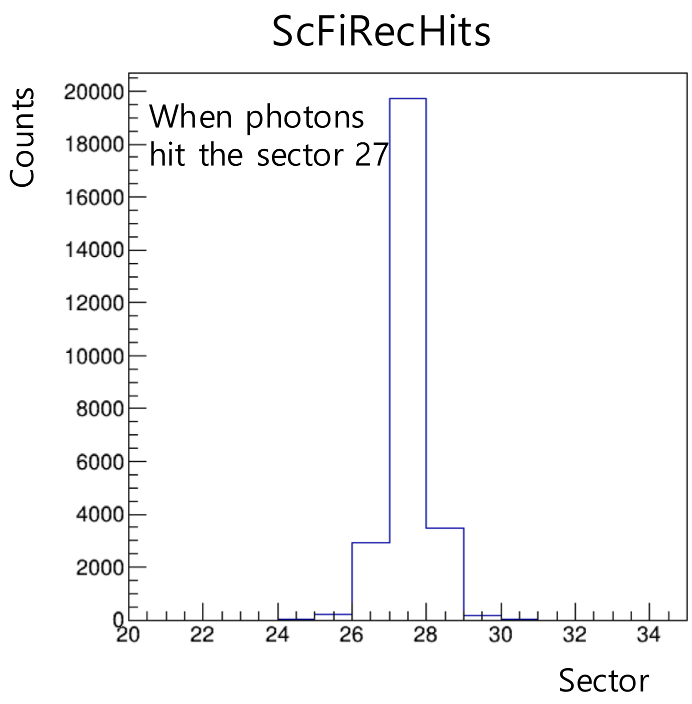




- The extracted energy resolution is much worse when only the imaging layer information is used.
- How the resolution can be more improved when the two particles hit the same sector will be studied.

Energy splitting using the ScFi layer information





- Each sector has a ϕ interval of 7.5 Deg. It was assumed that a particle hit the sector "n" if the ϕ sits within the range of (<ϕ>-3, <ϕ>+3) Deg.

- Three sectors (23, 24, and 25 for the photons that hit sector 25, and 27, 28, and 29 for photons hit sector 27) were used to represent each particle energy.

Energy splitting

1 GeV (500 events)

A23 A24 A25 ⋯ A29

2 GeV (500 events)

B23 B24 B25 ⋯ B29

$E_{sum} = (A23 + \cdots + A29) + (B23 + \cdots + B29)$

$R_A = (A23 + A24 + A25) + (B23 + B24 + B25)$

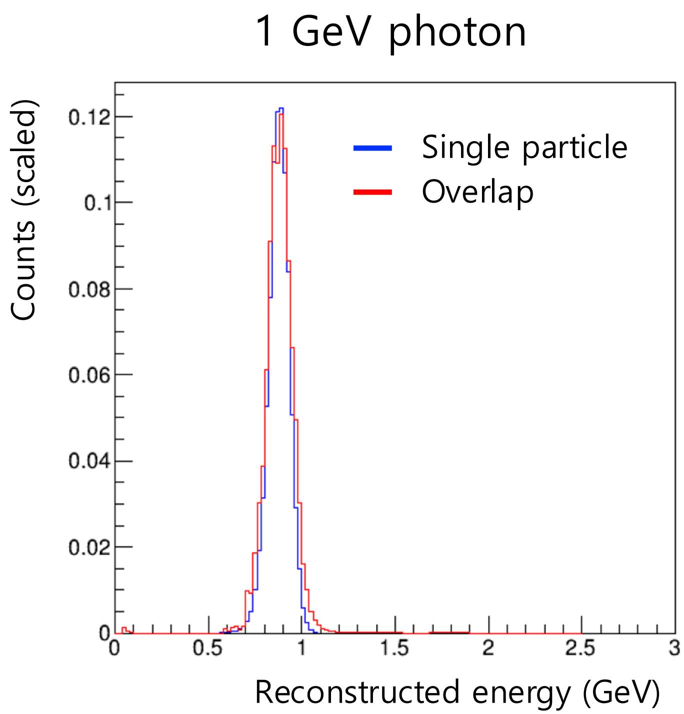
$R_B = (A27 + A28 + A29) + (B27 + B28 + B29)$

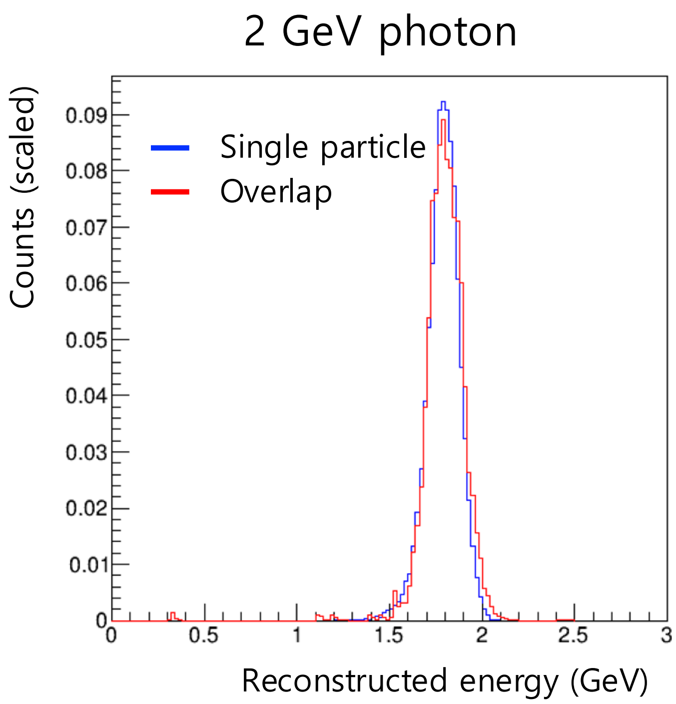
$1\ GeV = E_{sum}[R_A/(R_A+R_B)]$

$2\ GeV = E_{sum}[R_A/(R_A+R_B)]$

- The above calculation was done for each event of each sample (500 x 500 combinations).

Energy splitting





- When one photon hits a sector and another photon hits the next next sector, the extracted energy resolution is almost the same with the single particle reconstruction.

- Energy splitting performance when two particles hit the neighboring sectors will also be studied.

Plan

- How to improve the energy splitting when the two particles hit the same sector will be studied.
- The best imaging layer configuration from the energy splitting's point of view will be studied.
- The energy splitting when two particles hit the neighboring sectors will be studied.
- The sampling fraction at EICrecon will be updated.