Single electron energy reconstruction with implementation of the pulse shape

Jan 28 (Tue)
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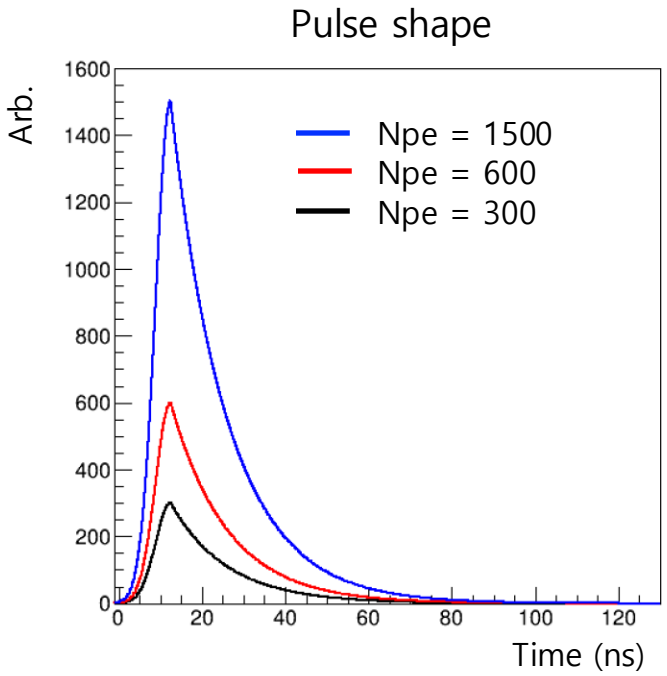
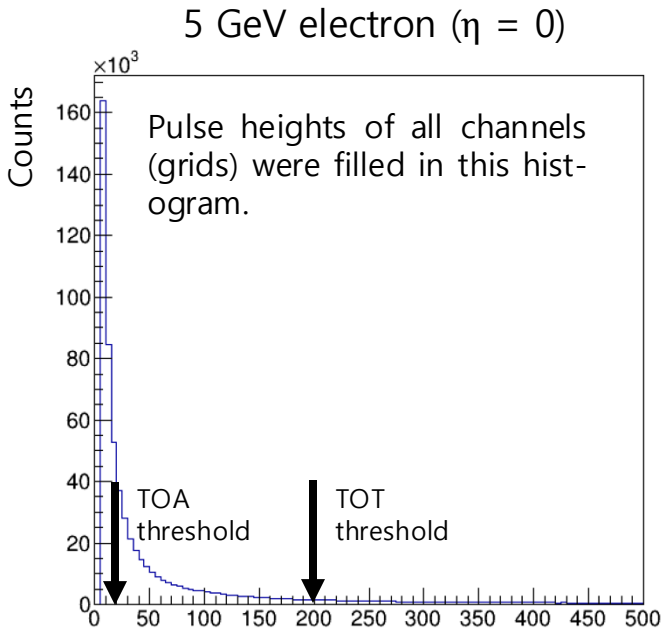
Assumption remind



- The rising and falling shapes are preserved regardless of the Npe (number of photo-electrons).
- The y-axis unit must be a relative one. it was assumed that if there was A Npe, the pulse height was also A.

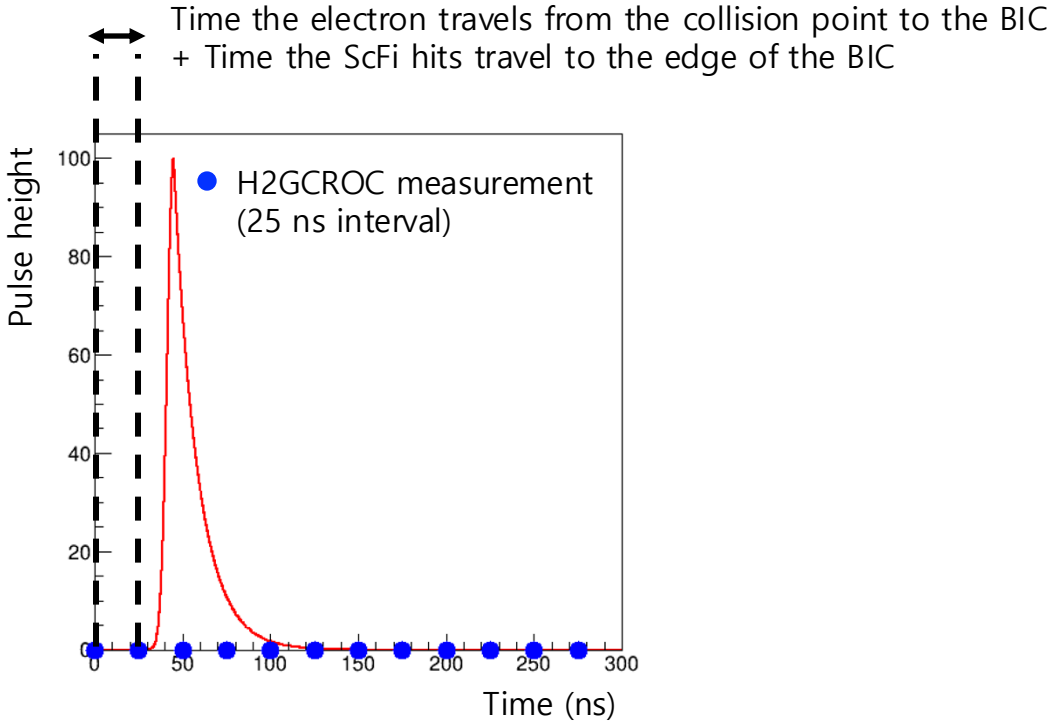
TOA and TOT thresholds



(Already attenuated, Poisson-smeared and threshold-applied)

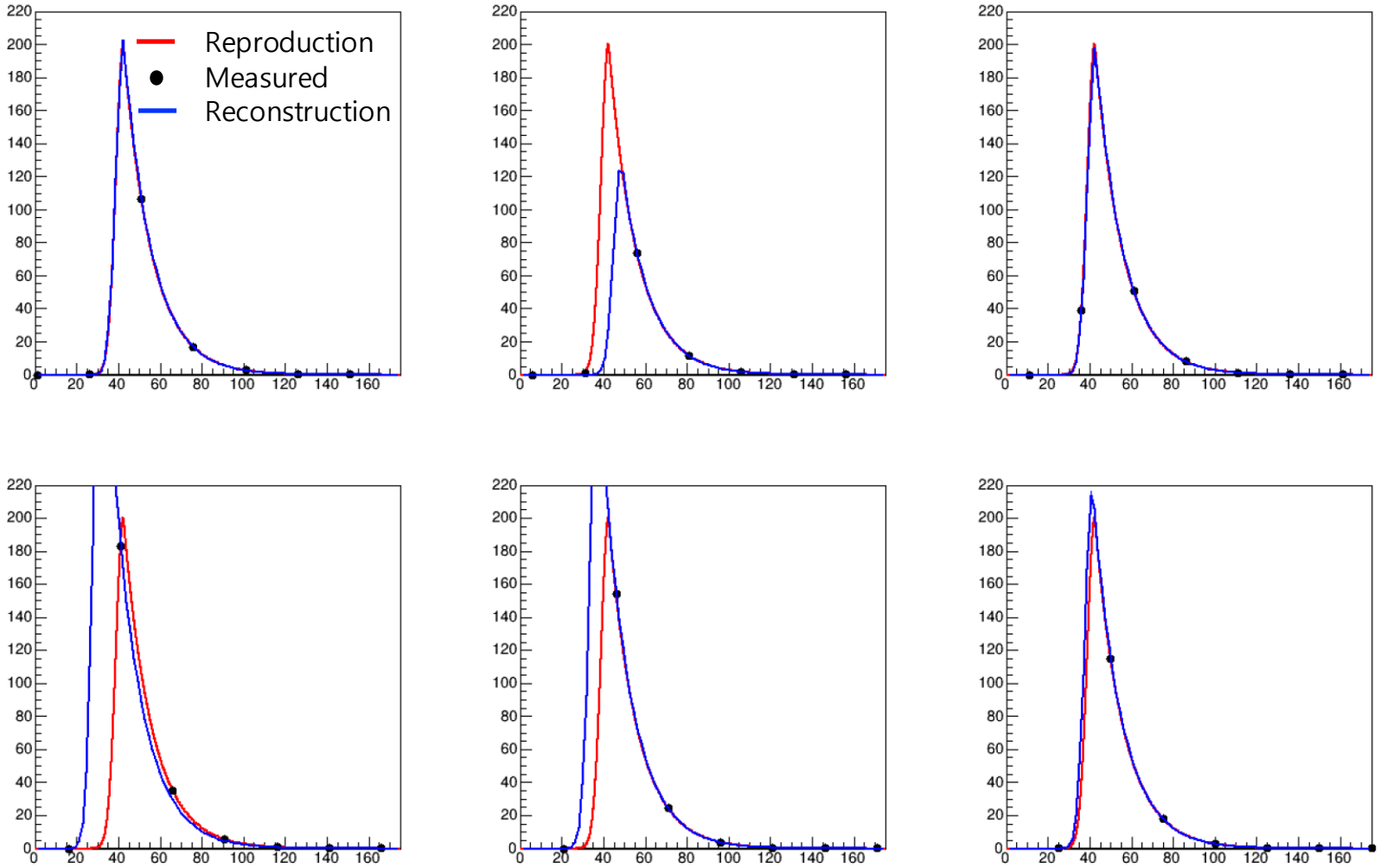
- In this report, the TOA and TOT thresholds were set to 20 and 200, respectively.
- We can study the BIC performances with different TOA and TOT thresholds and optimize them later.

Reproduce the pulse shapes and measurements



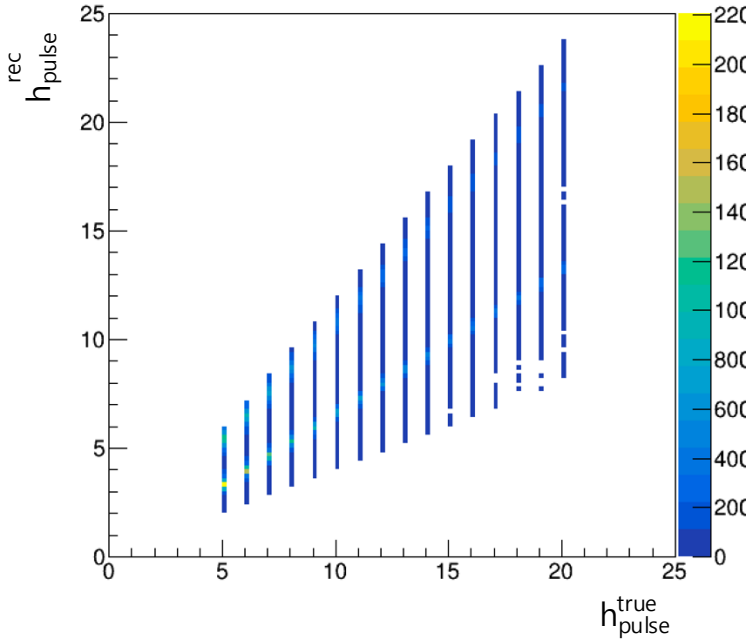
- The pulse shape was implemented considering the times the electron and ScFi hits were traveling. It was assumed that the speed of the ScFi hit was 160 mm/ns.
- It was also assumed that the H2GCROC started the measurement at the same time the electron was generated (0 sec in the above plot).
- Now, we'll reconstruct the pulse shape differently depending on the pulse height (h_{pulse}) with respect to the TOA and TOT thresholds.

Remind ($h_{pulse} \leq$ TOA thr)



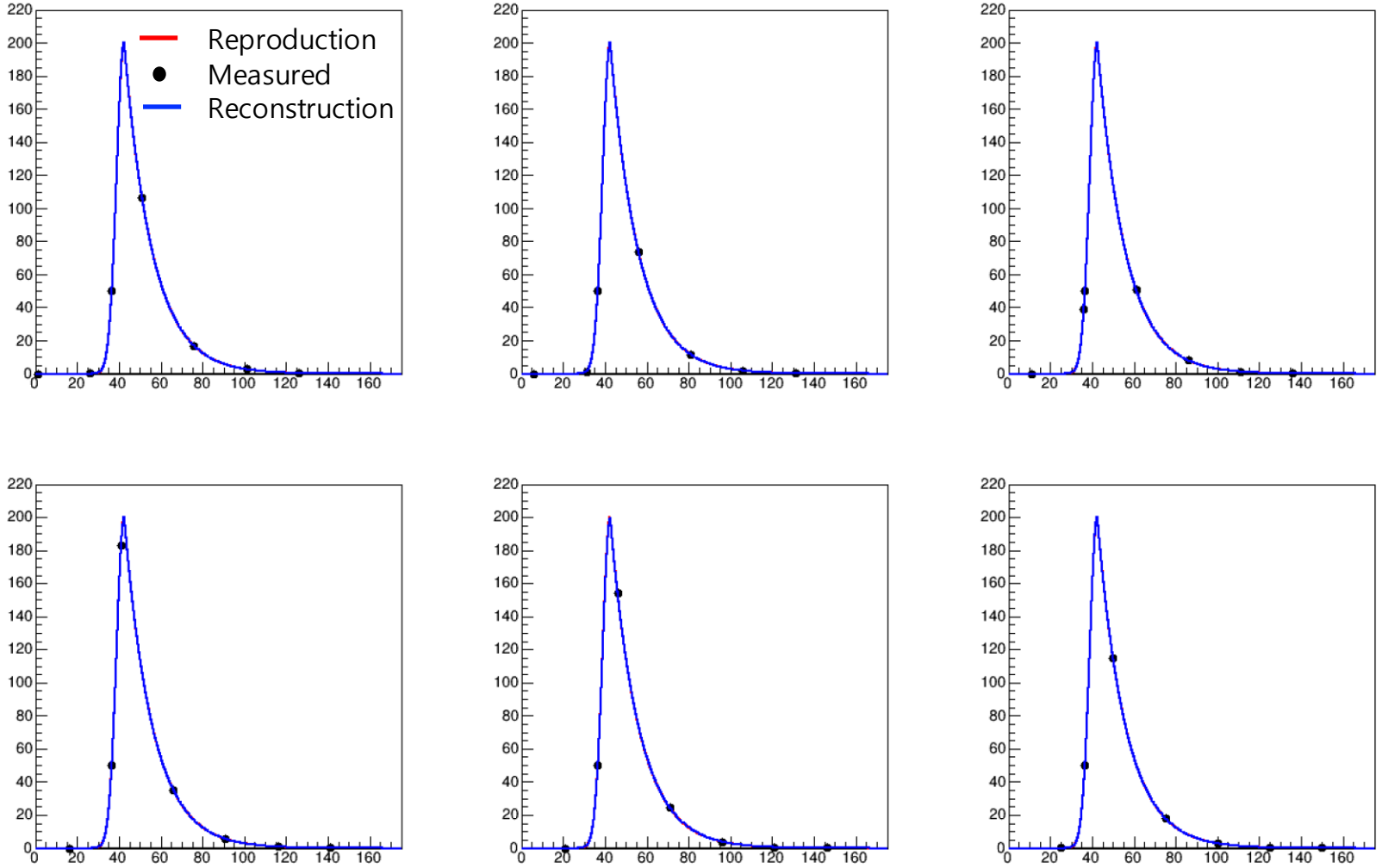
- If we have the ADC information only, it is hard to reconstruct the pulse shape.
- Sum of the measured ADCs was used to reconstruct the h_{pulse}.

Npe estimation ($h_{pulse} \leq$ TOA thr)



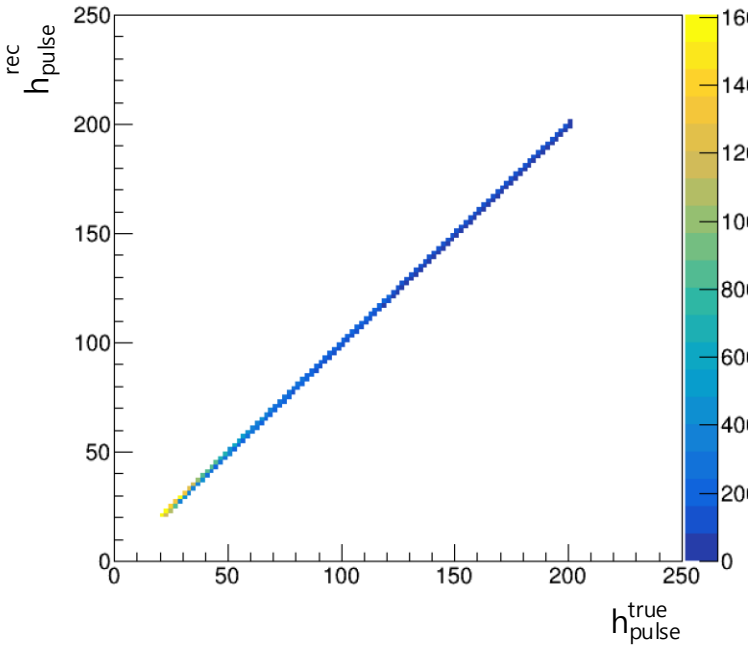
- The resolution should be bad, but it won't have much effect on the total resolution because this pulse height range is quite small compared to the other ranges, which are TOA thr $< h_{pulse} \leq$ TOT thr and TOT thr $< h_{pulse}$.

Remind (TOA thr < h_{pulse} ≤ TOT thr)



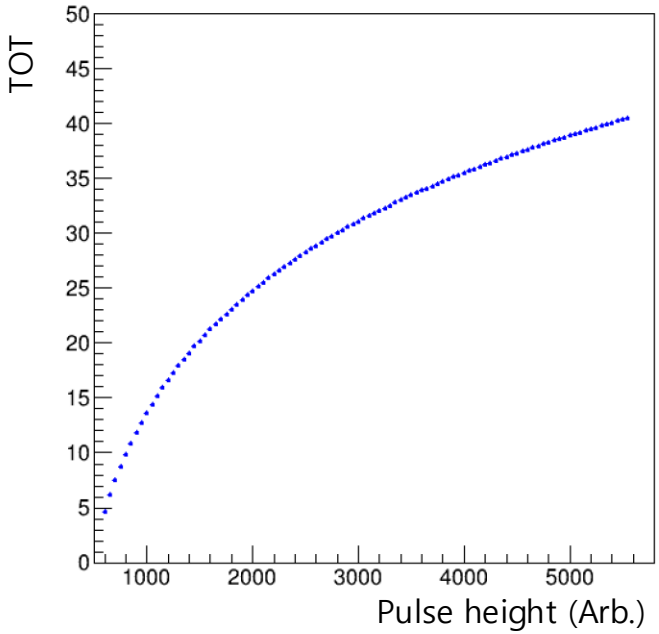
- If we use both ADC and TOA information, we can reconstruct the pulse shape quite well.

Npe estimation (TOA thr $< h_{pulse} \leq$ TOT thr)



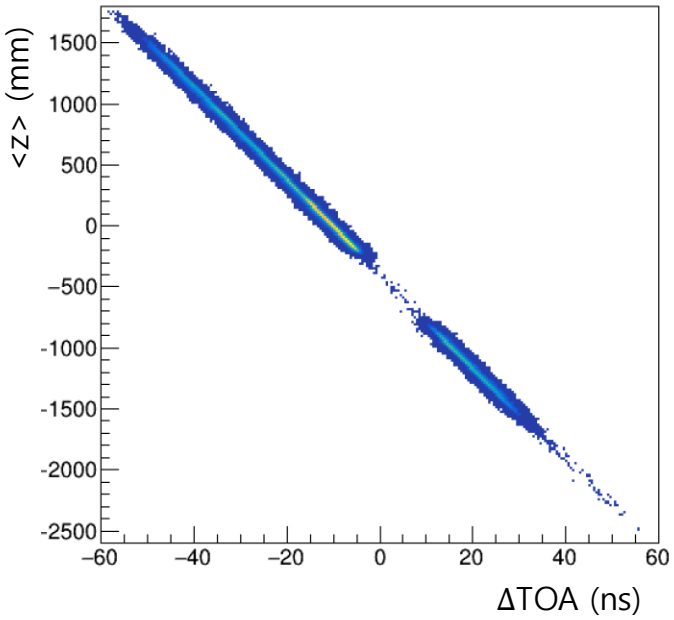
- If we use both ADC and TOA information, we can reconstruct the pulse height quite well as expected.
- The resolution should depend on how precisely the H2GCROC measures the ADC values (will be considered later).

Remind (TOT thr < h_{pulse})



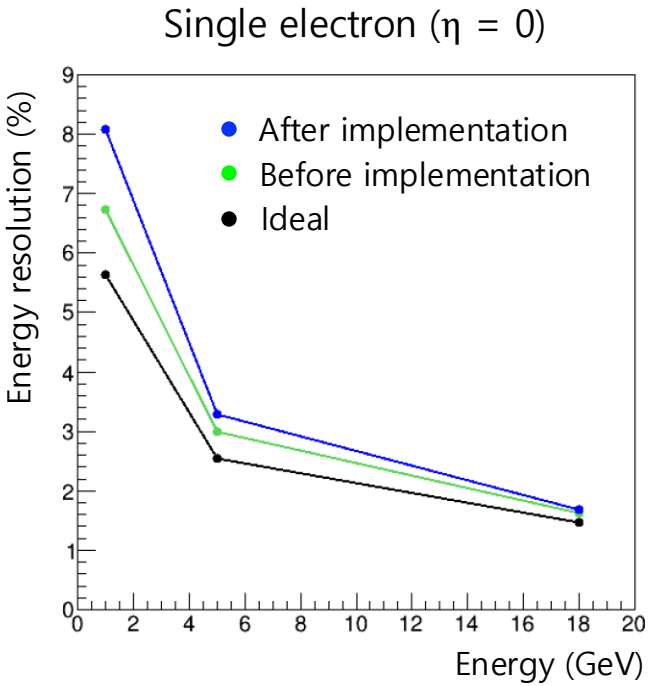
- If TOT is measured, the pulse height can be 1 vs. 1 matched from it. It was assumed that the pulse heights were exactly reconstructed in this range.
- The resolution should depend on how precisely the H2GCROC measures the TOT values (will be considered later).

Attenuation correction



- The attenuation correction was done using energy-weighted z (<z>), which was evaluated by ΔTOA.
- For 5 GeV electron data sets (-1.2<η<-0.8, -0.2<η<0.2, 0.2<η<0.8, and 0.8<η<1.2) were used to extract the relation between <z> and ΔTOA.
- If one of the TOA values were absent, an average correction value was used.

Energy resolution comparison



- Whether this result is reasonable is being cross-checked.
- The feasibility of the energy splitting will be studied with this level of pulse shape implementation. Afterwards, more realistic factors will be added to estimate the feasibility practically.