Simulation Framework

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Argonne National Laboratory

BIC System Testing Meeting
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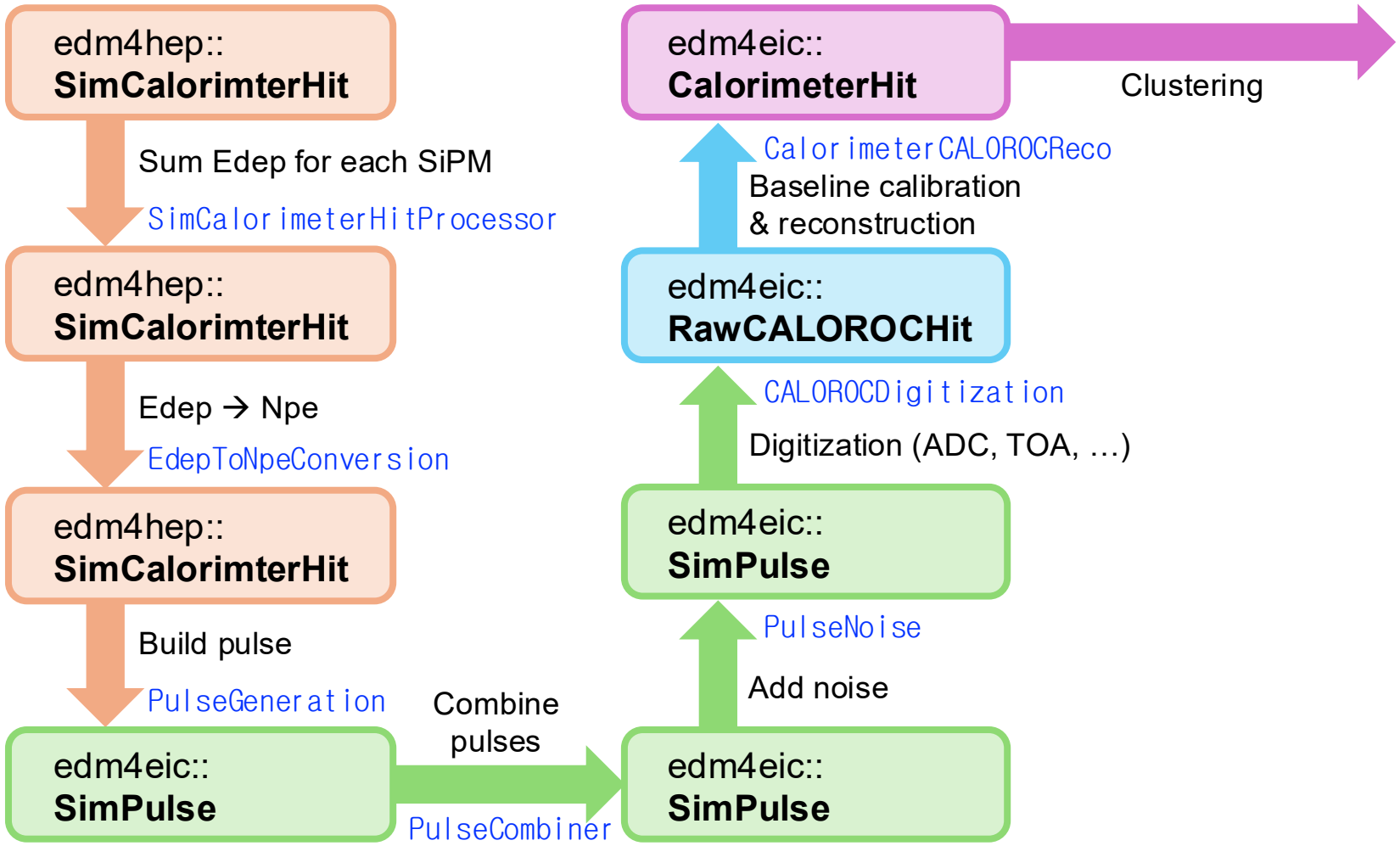
Argonne NATIONAL LABORATORY

ScFi Digitization/Reconstruction Chain



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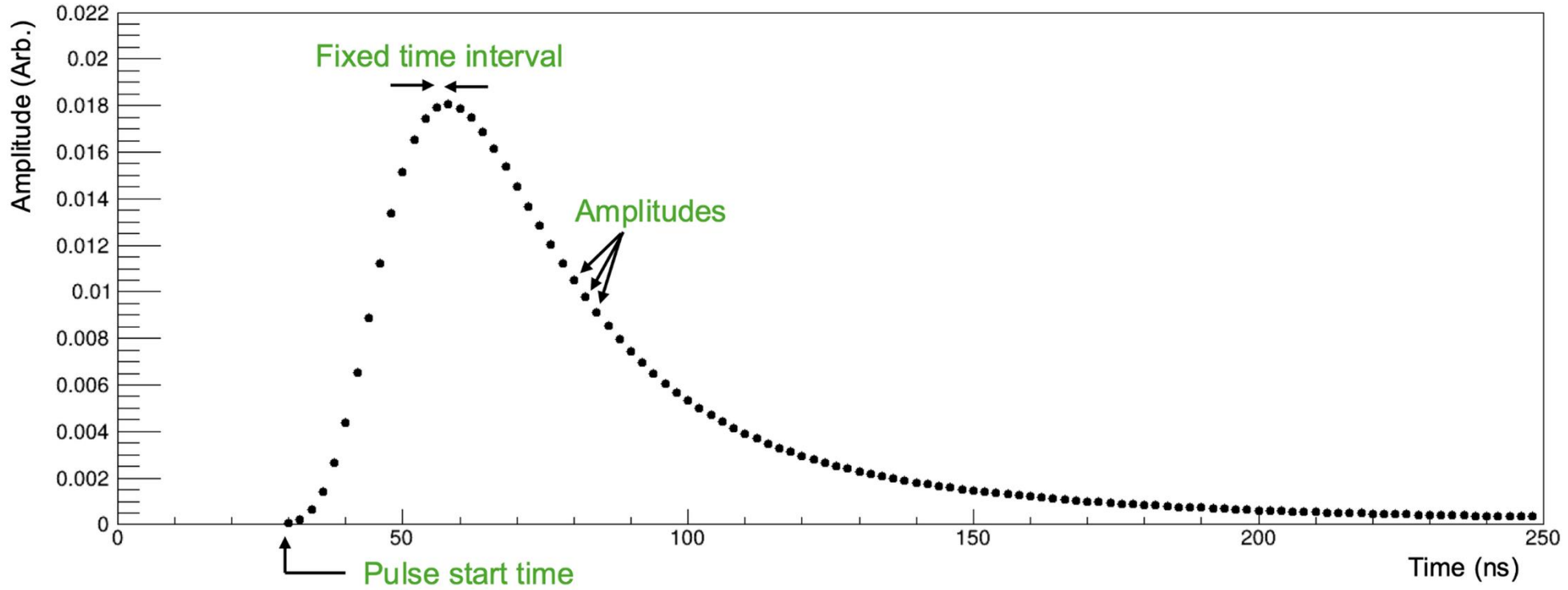

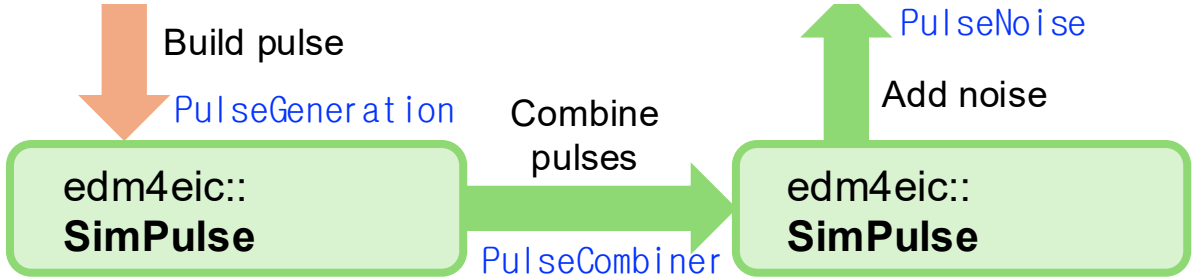

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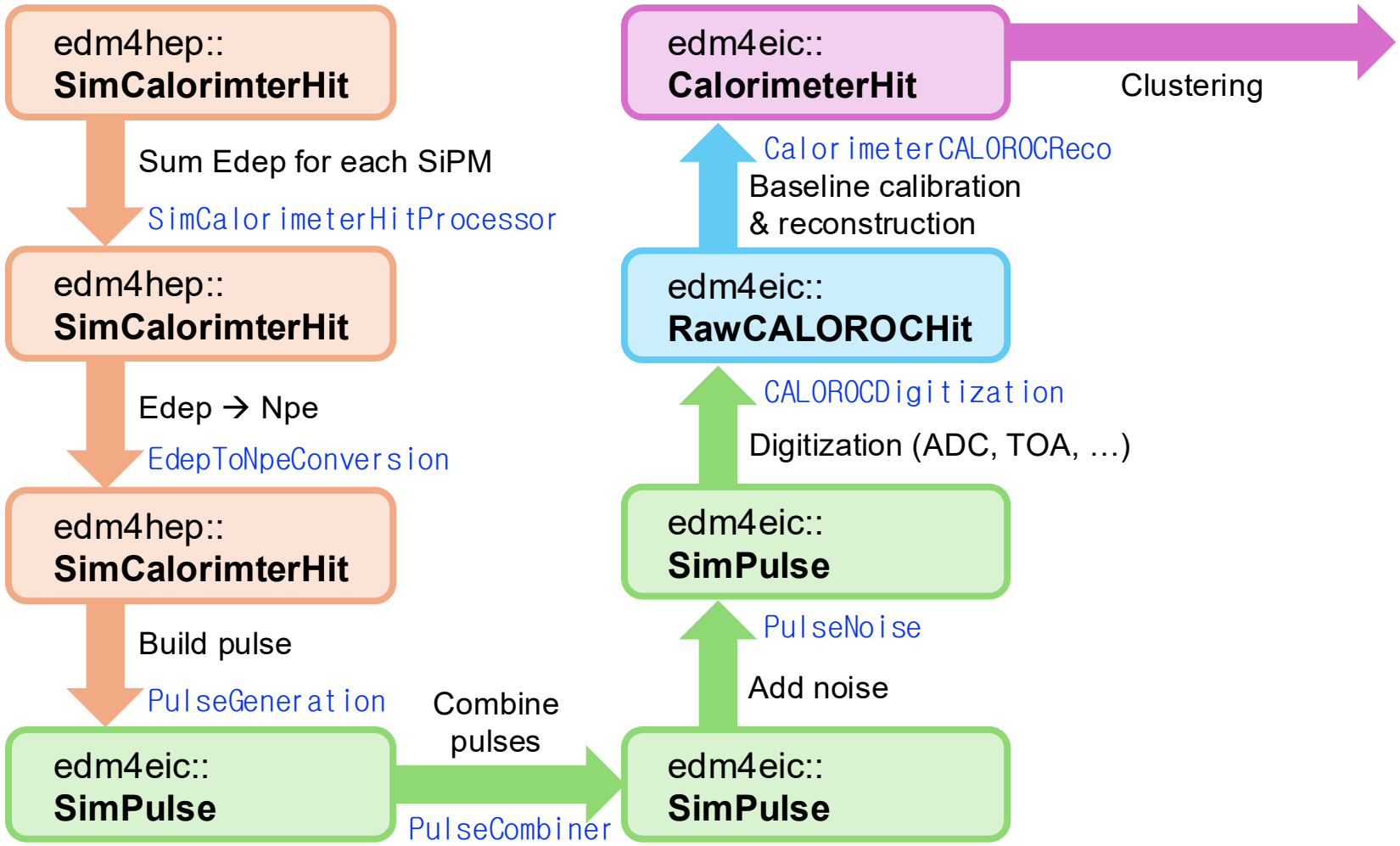
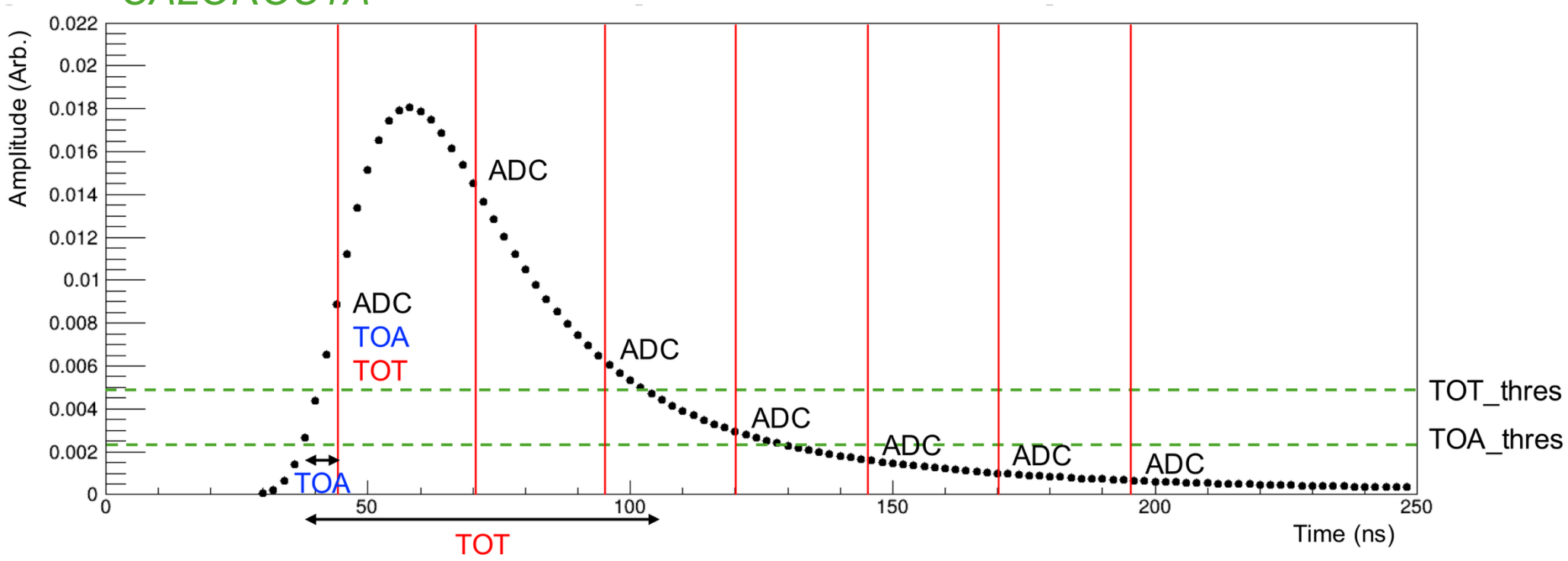
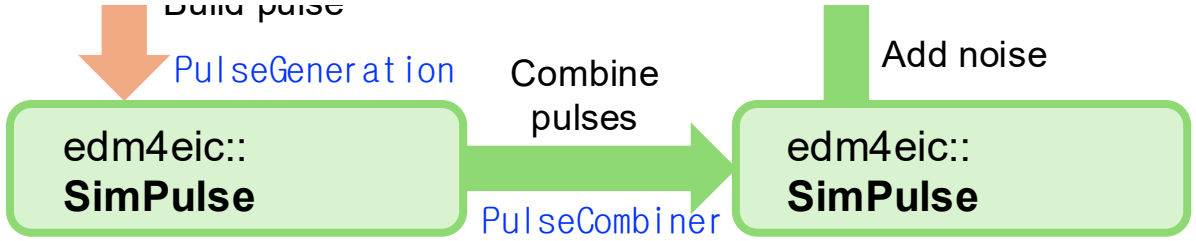


ScFi Digitization/Reconstruction Chain

CALOROC1A





ScFi Digitization/Reconstruction Chain

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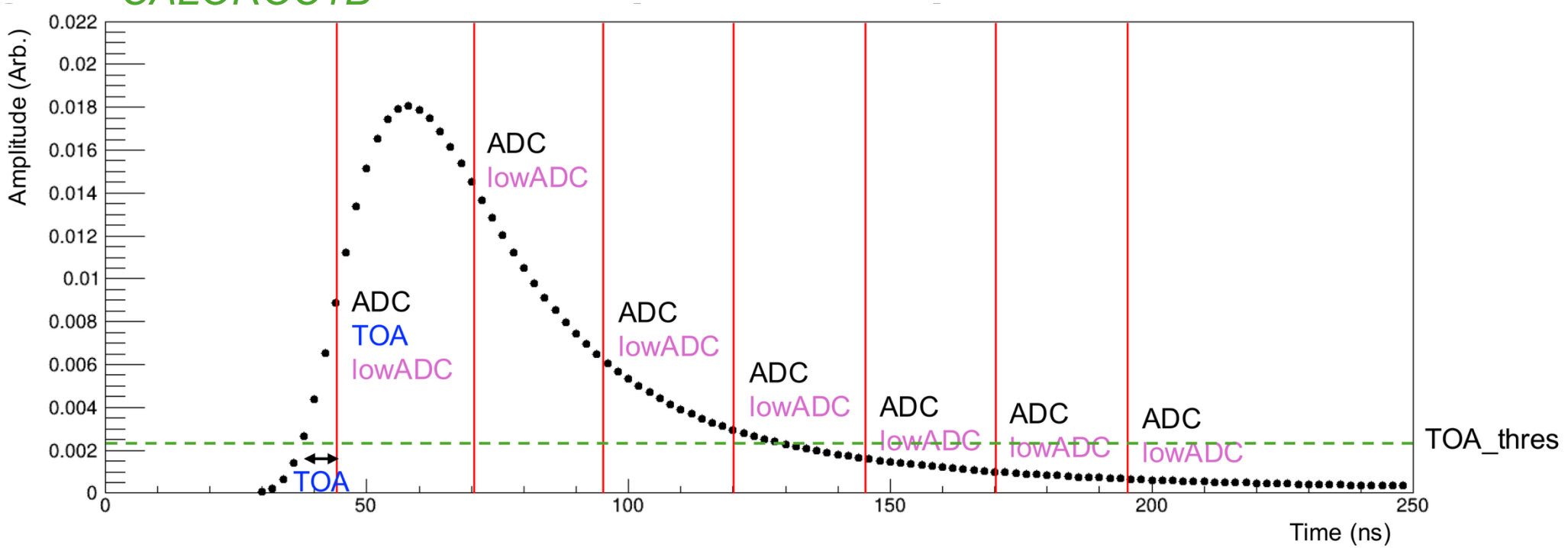
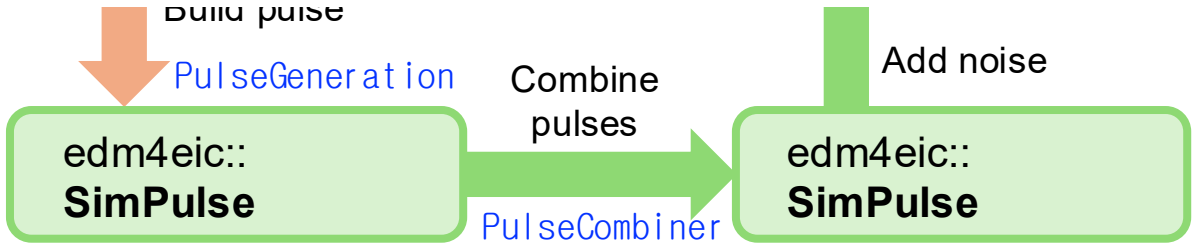
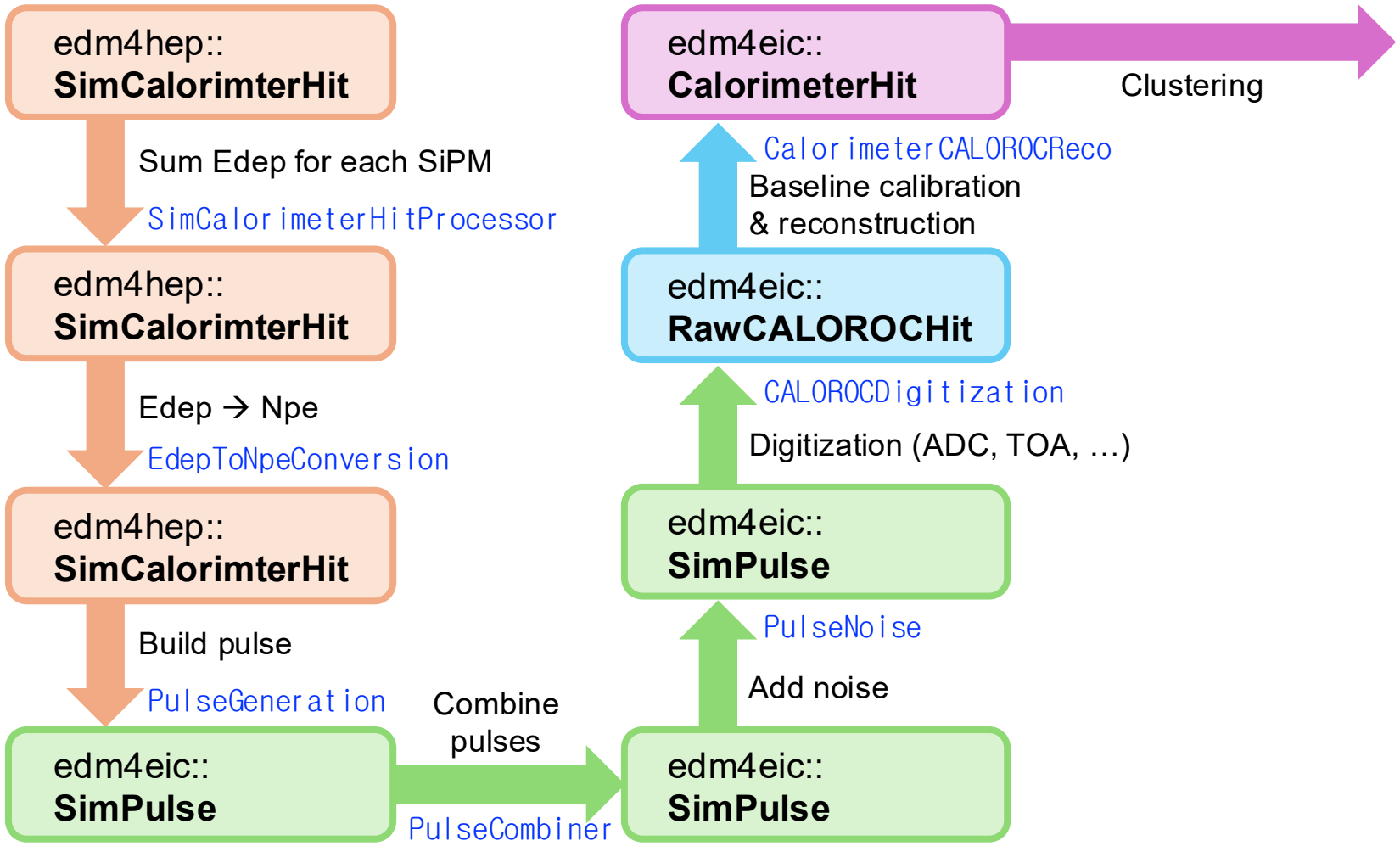




ScFi Digitization/Reconstruction Chain



ScFi Digitization/Reconstruction Chain

edm4hep::
SimCalorimterHit

Sum Edep for each SiPM

SimCalorimeterHitProcessor

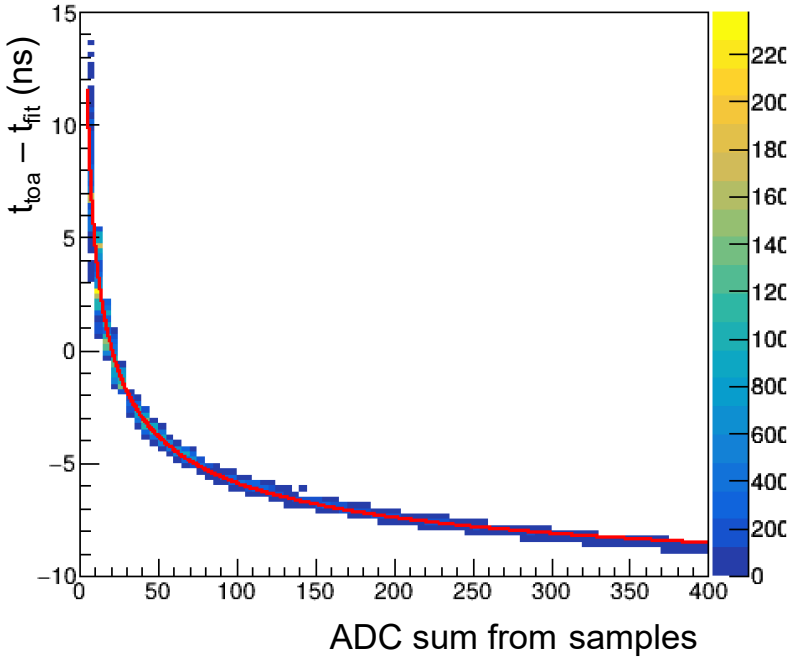
edm4hep::

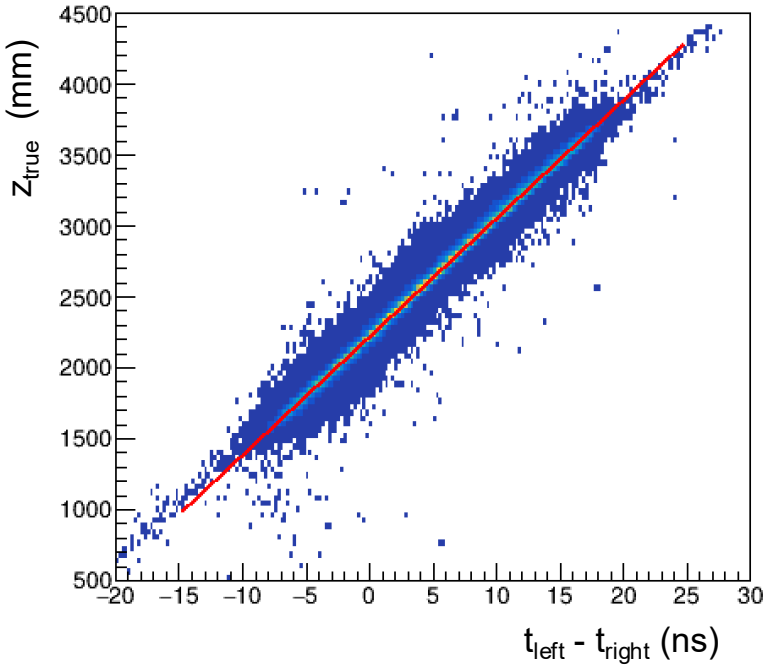
edm4eic::
CalorimeterHit

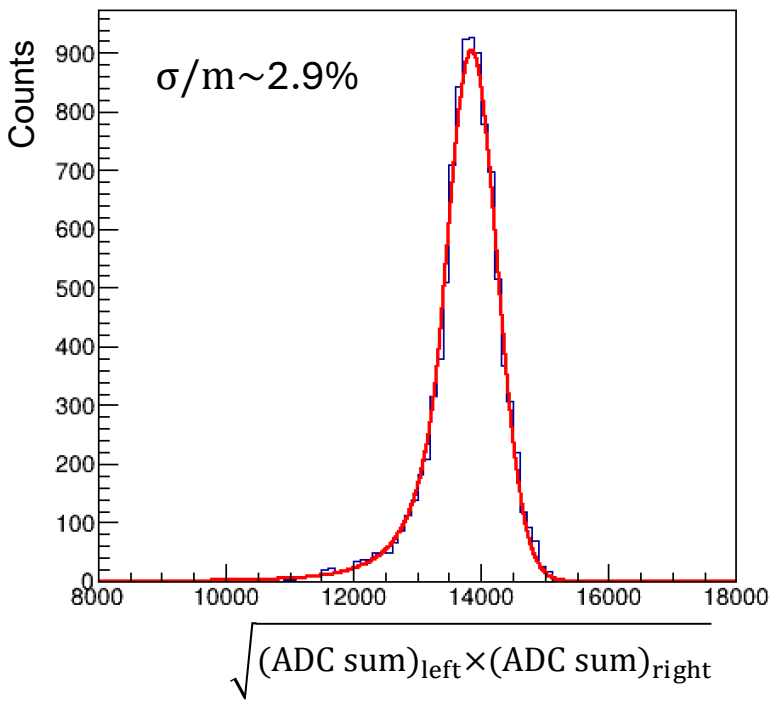
Clustering

CalorimeterCALOROCReco
Baseline calibration
& reconstruction

edm4eic::

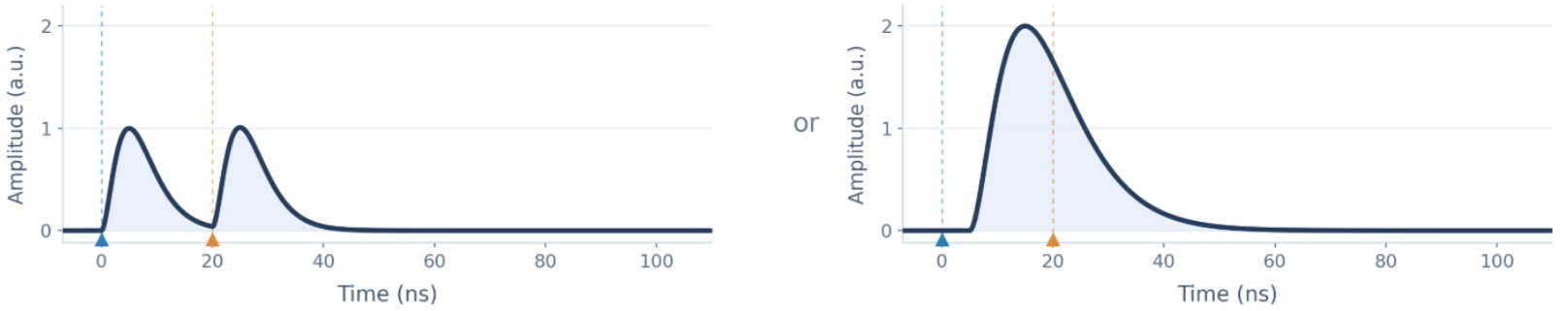






Feedback between Hardware and Simulation

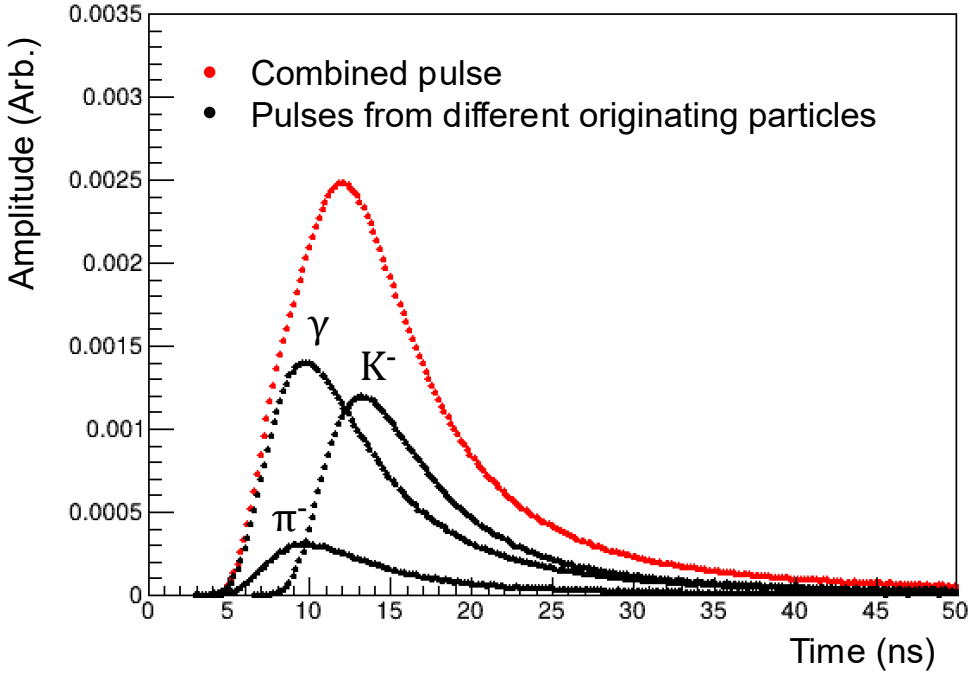
- For simulation, we would like to refer to the following information from beam tests and hardware development.
  - Single pulse shape
    - Can the rise time and tail of the pulse be controlled independently?
    - How much does noise distort the pulse shape?
  - Pulse overlap
    - What does the pulse look like when two signals arrive with a given time separation?



- From simulation, we can study the detector performance depending on pulse shape, readout parameter, etc.

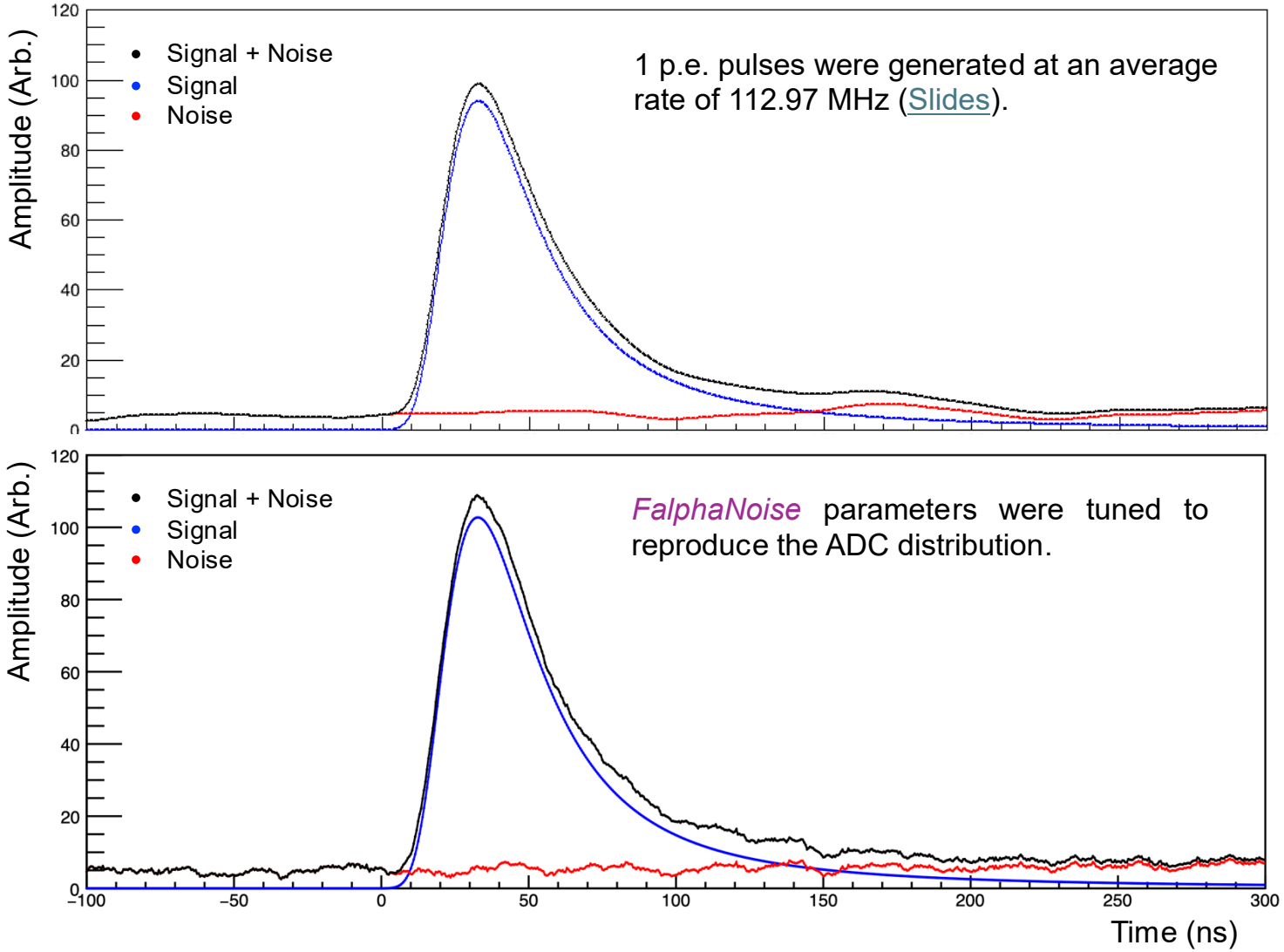
Backup

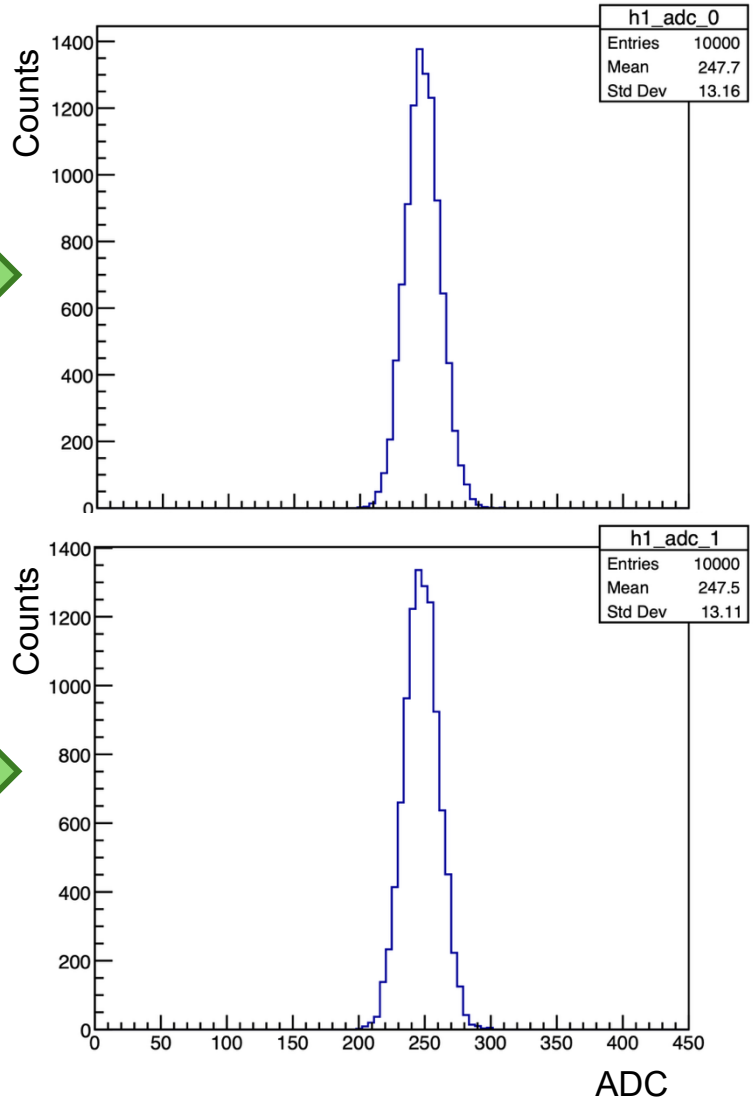
PulseCombiner



- If there is more than one pulse at a SiPM, `PulseCombiner` combines them by adding the amplitudes.

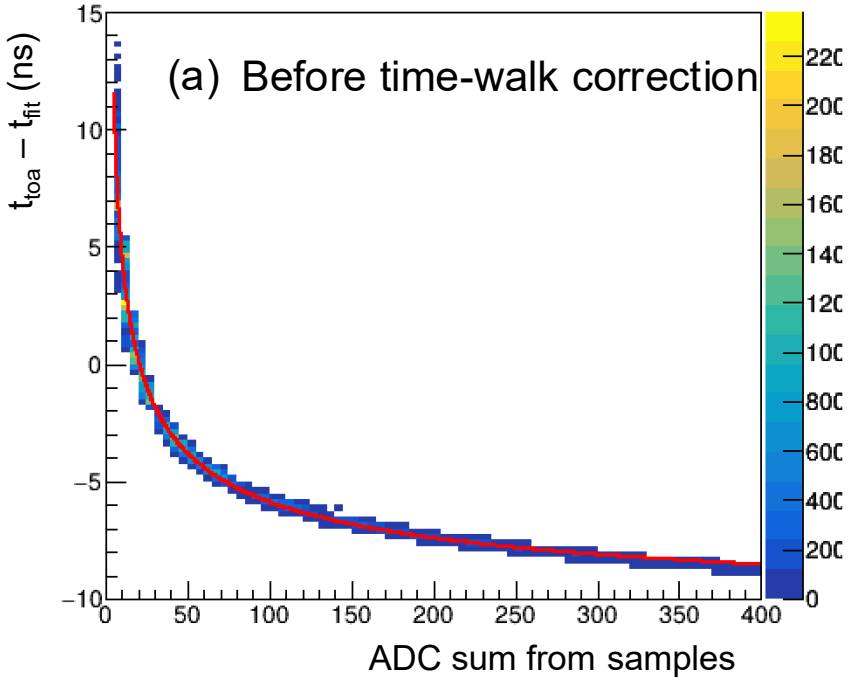
PulseNoise

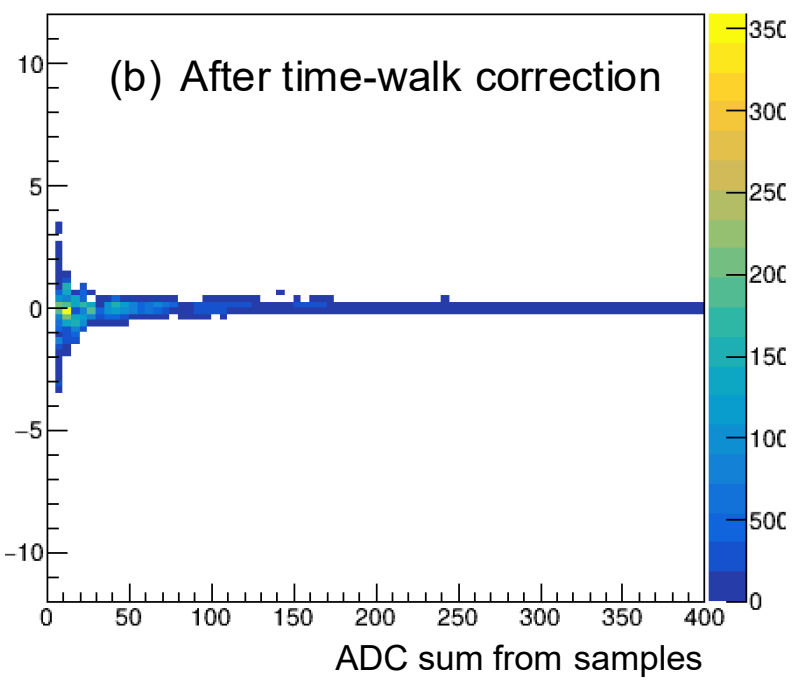


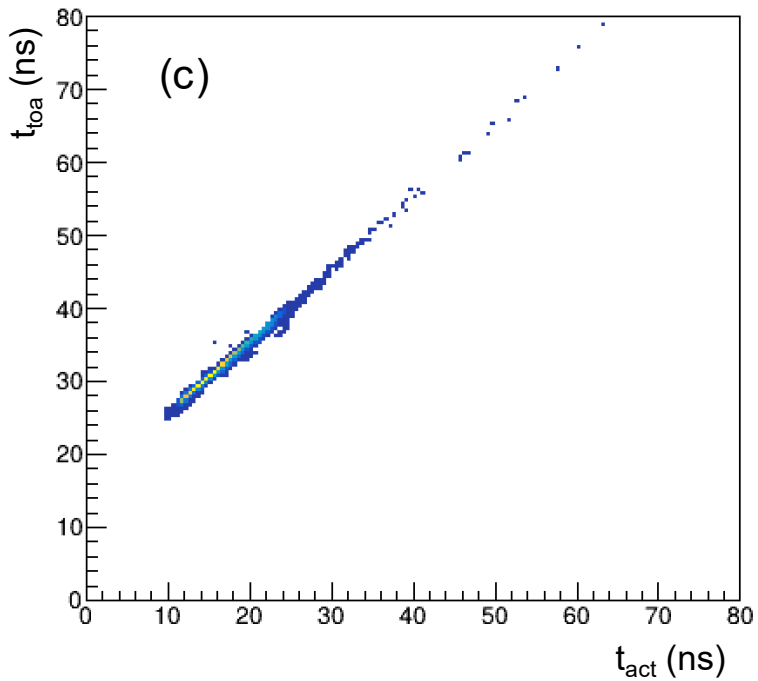


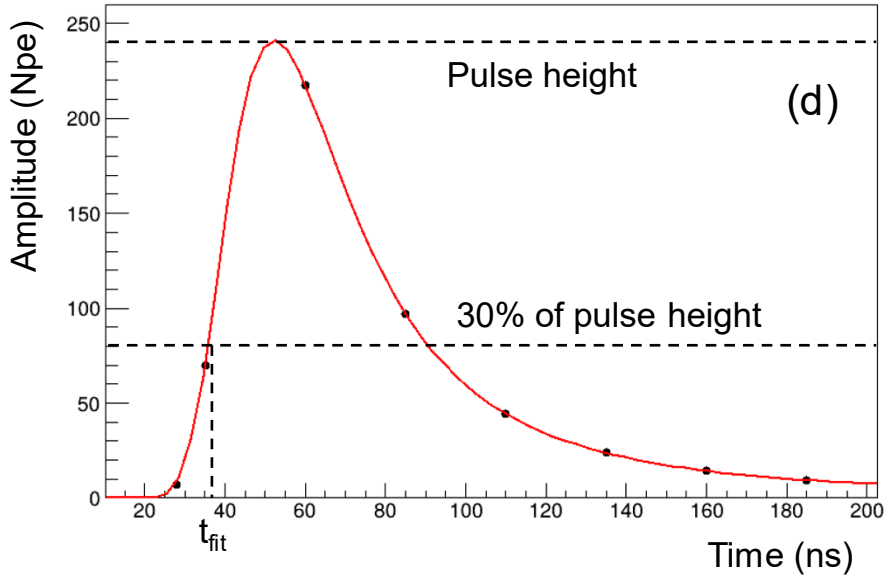
- However, for the detector and physics performance studies, the important quantity we extract from the pulse is the ADC value, not the pulse shape.

Validation & Performance Studies



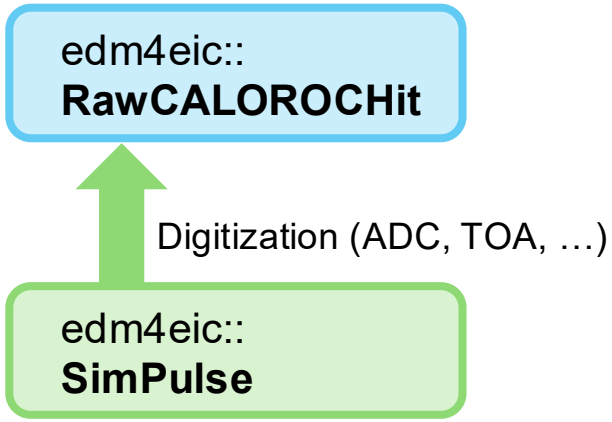


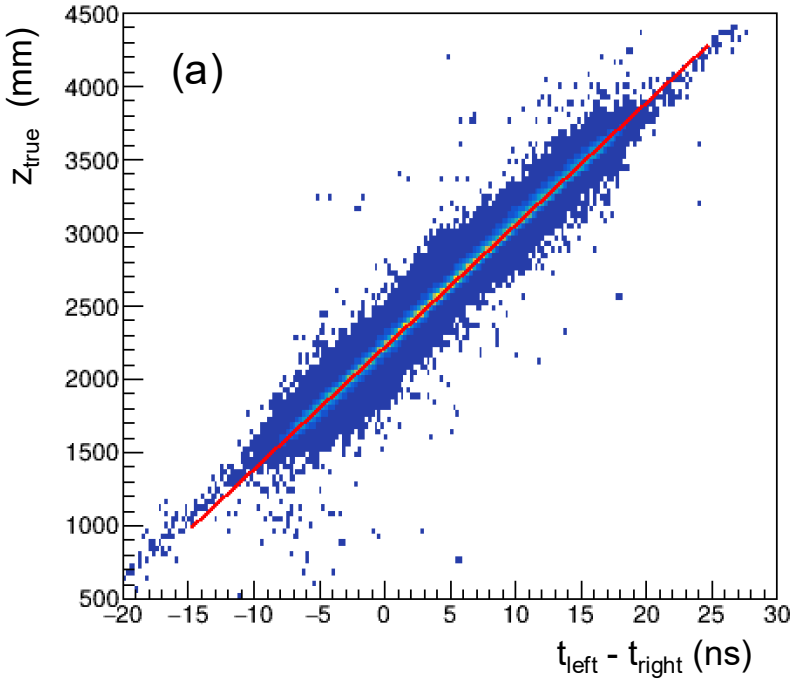


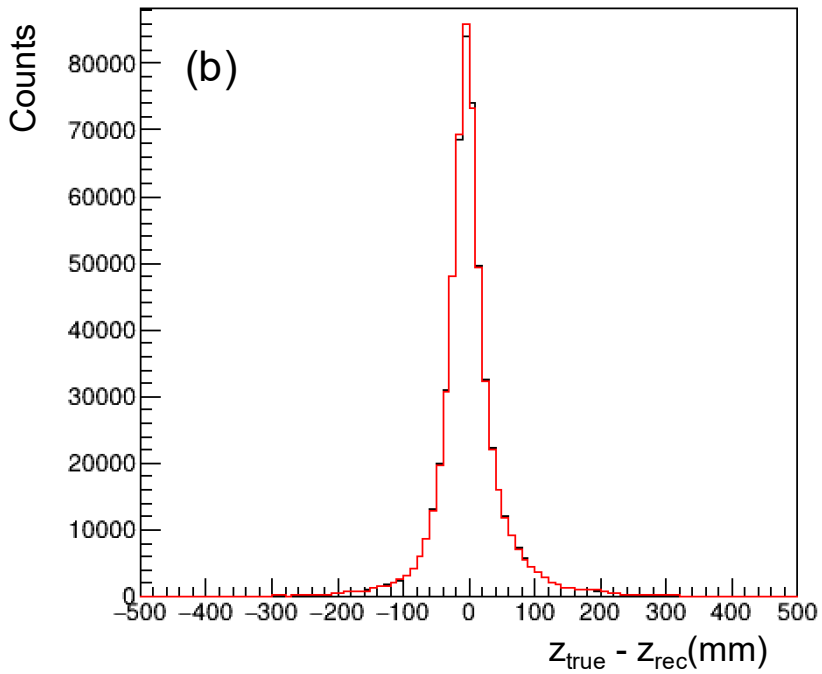


- (d): To perform the time-walk correction, the pulse was reproduced by fitting the amplitudes and the time at 30% of the pulse height was used as the reference timing.
- (a), (b), (c): After the time-walk correction, t_{toa} represents the t_{act} well.

Validation & Performance Studies

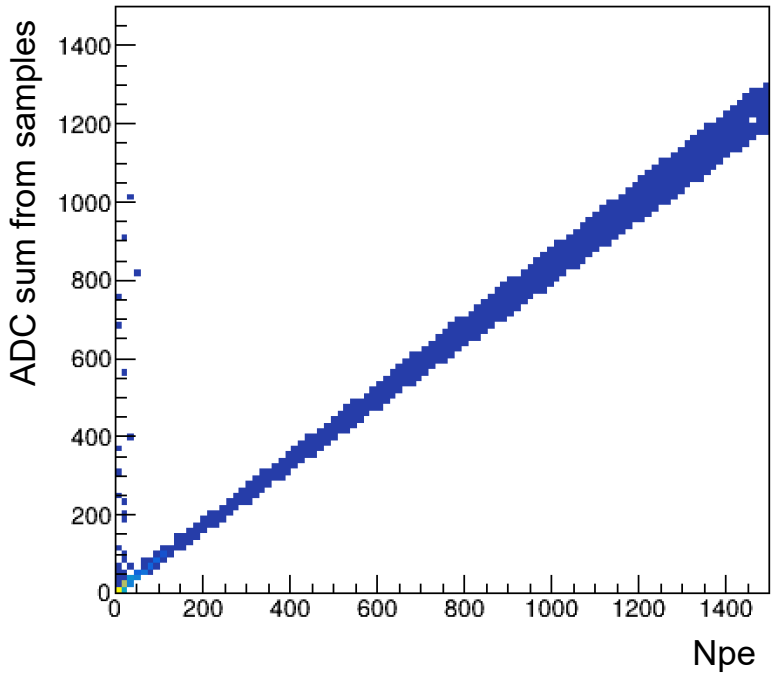


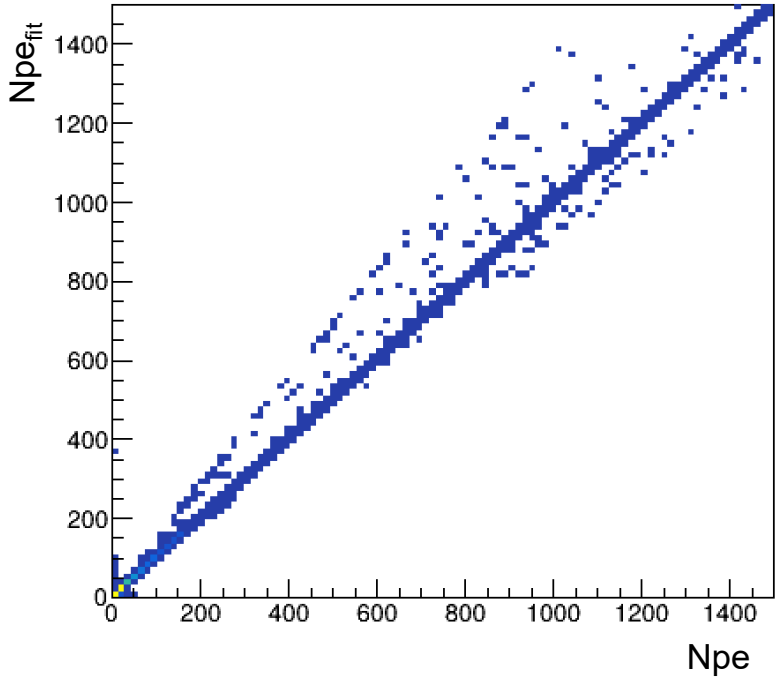




- We need z position to perform the attenuation correction and it can be reconstructed using the time difference between the left and right SiPMs.
- Without considering noise, we expect the z resolution about 40 mm (FWHM).

Validation & Performance Studies





- Both the ADC sum and the reconstructed pulse height can be used as an energy proxy to reconstruct the energy, but the pulse height should be the better choice.
- More detailed studies on the ADC and fitting are necessary.