Simulation of BCAL Timing

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Motivation

* Reproduce the “effects” we saw in BCAL timing

* Check the possible systematics in Z-position reconstruction

Simulation

* 48 BCAL modules in GEANT-3

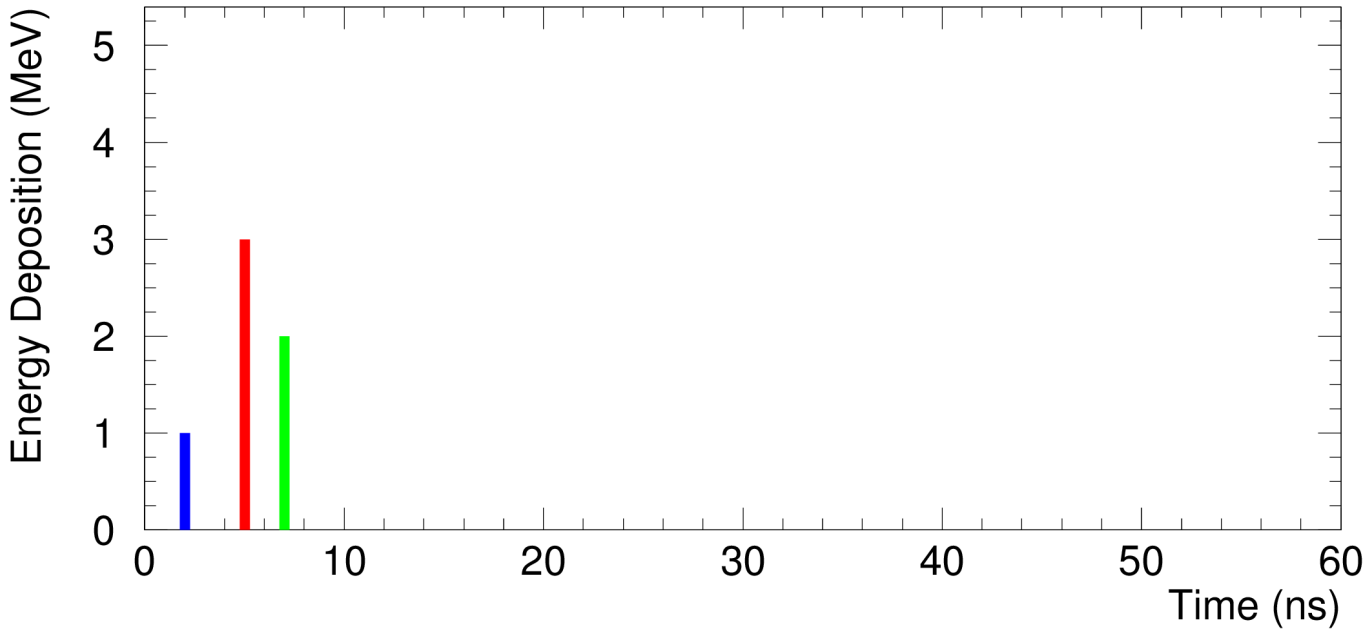
* Fine-structure model of BCAL

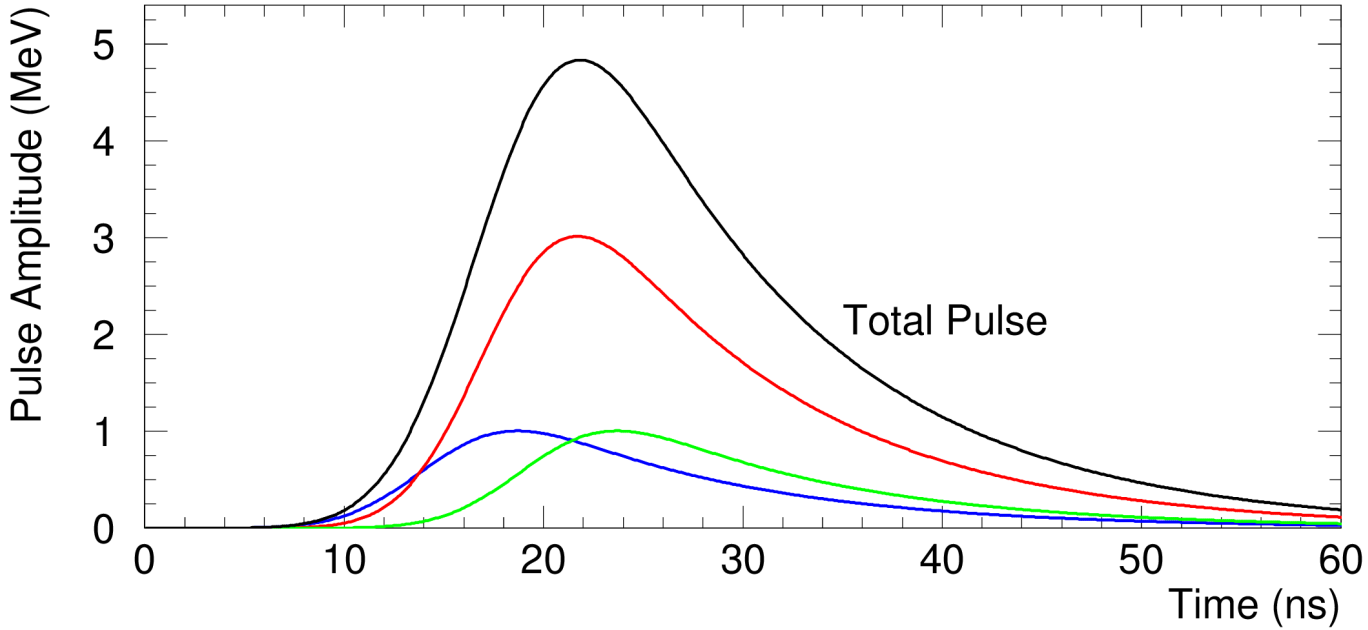
* Fixed-momentum particles from the center of the target

* Uniform seed on Φ and Z

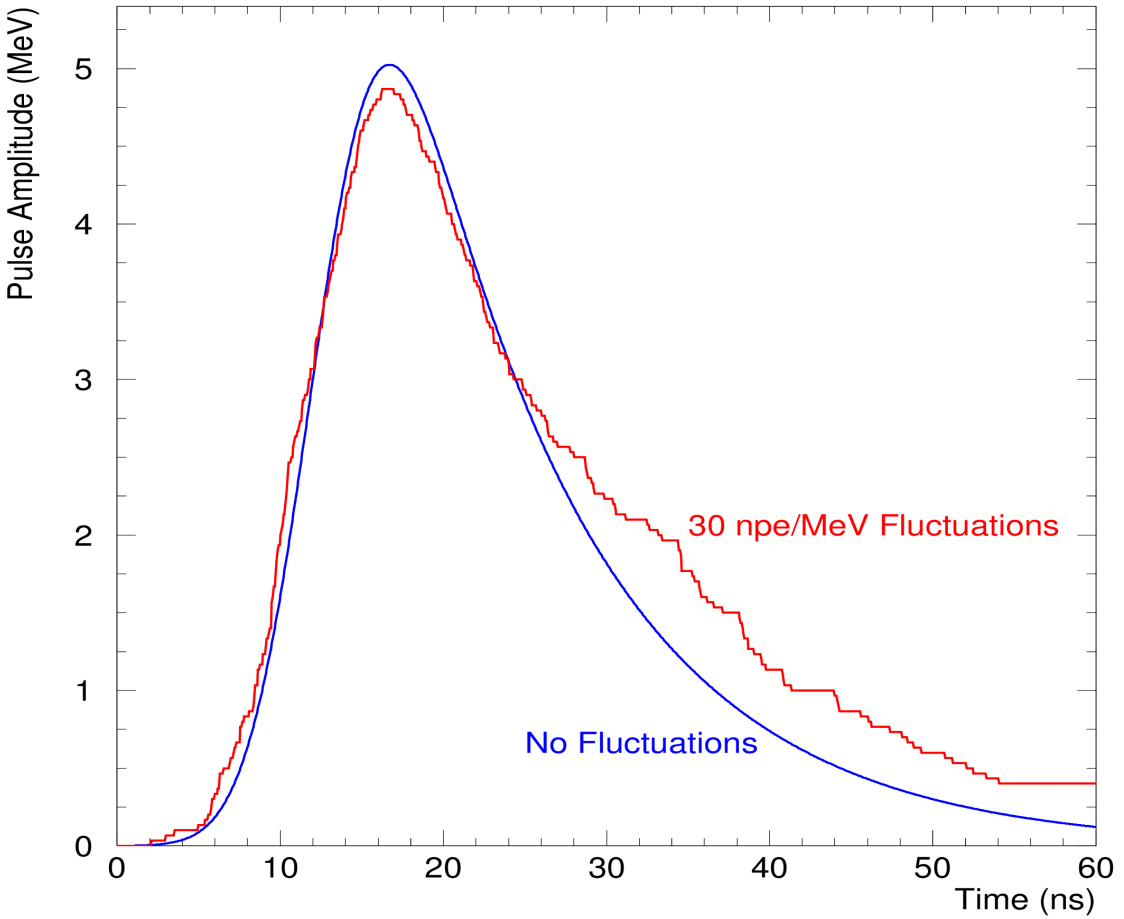
* Effective velocity of the light propagation through the BCAL was assumed as 16.75 cm/ns

Timing in the Simulation





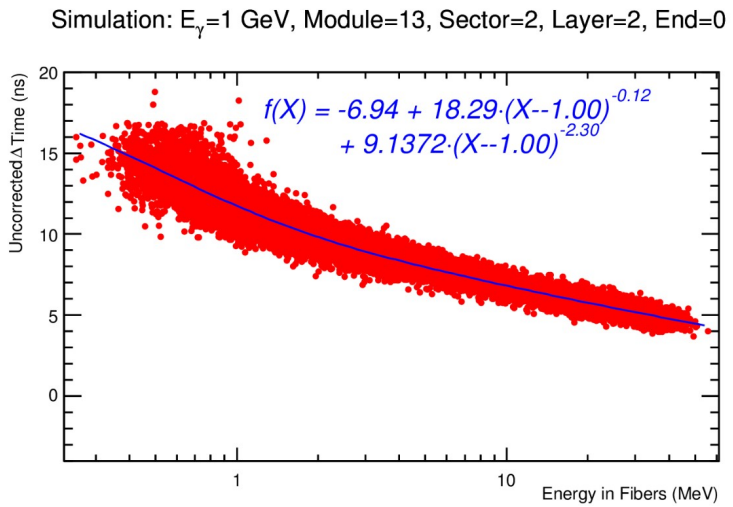
Fluctuations

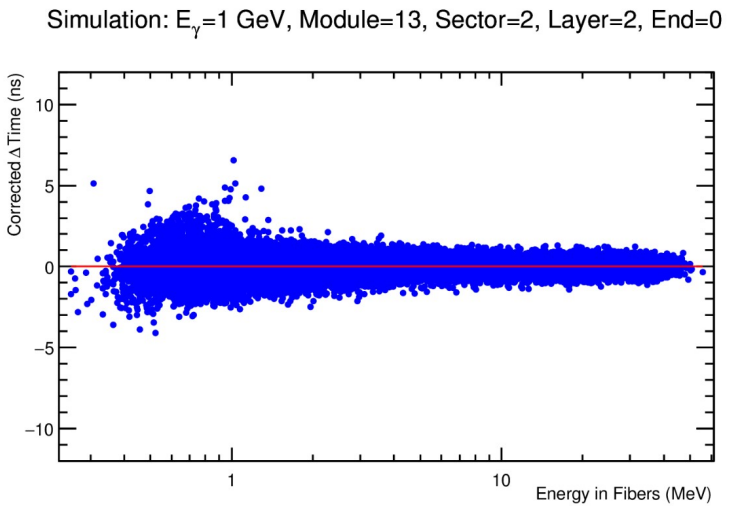


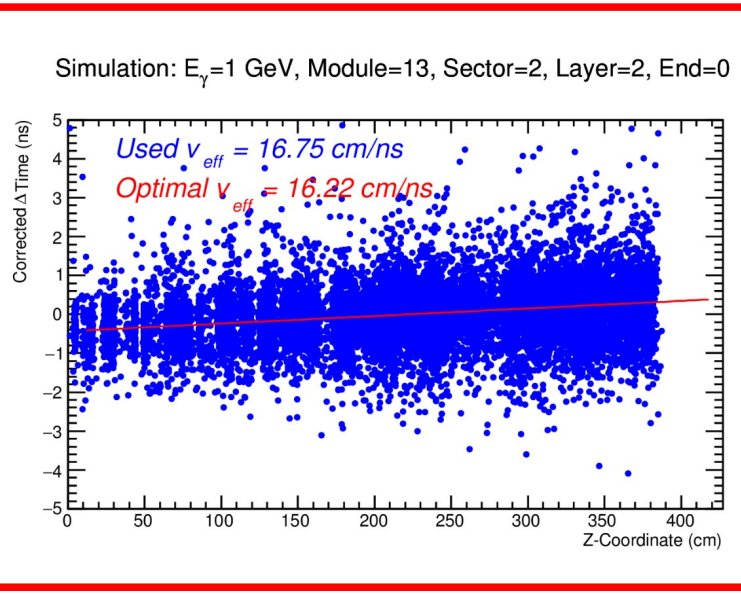
Conversion factor was measured with cosmics in 2010

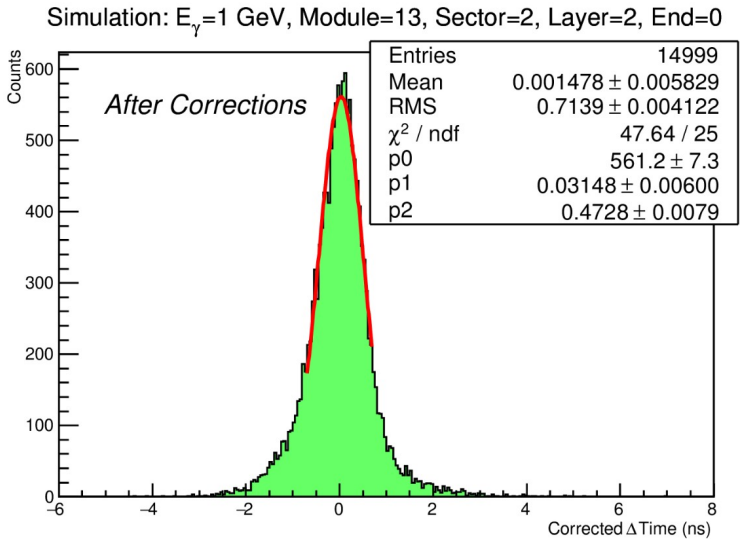
Crossing oh the threshold -> “Raw” Time

Calibration (iteration #1)

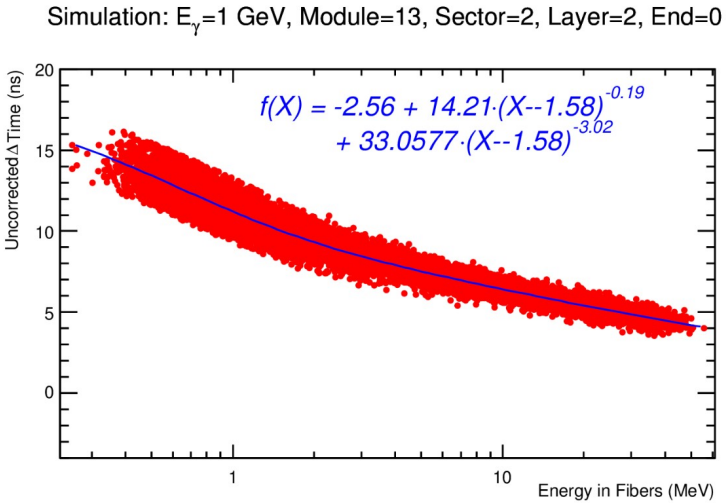


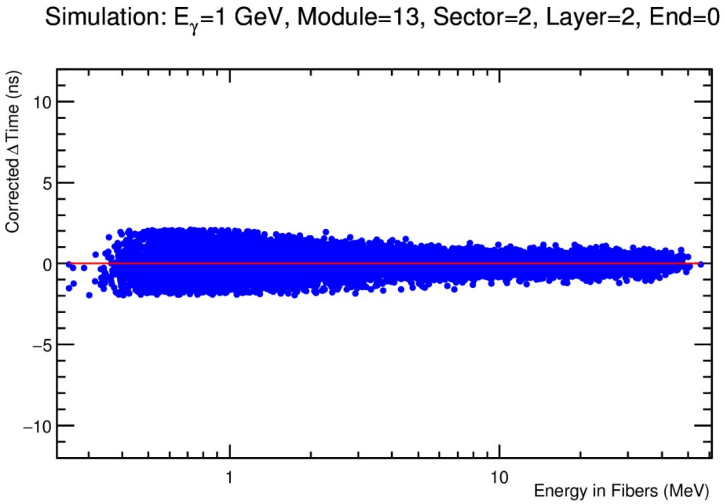


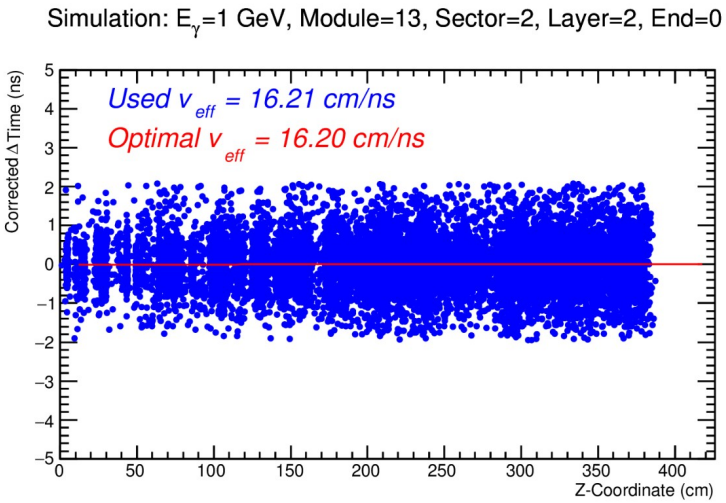


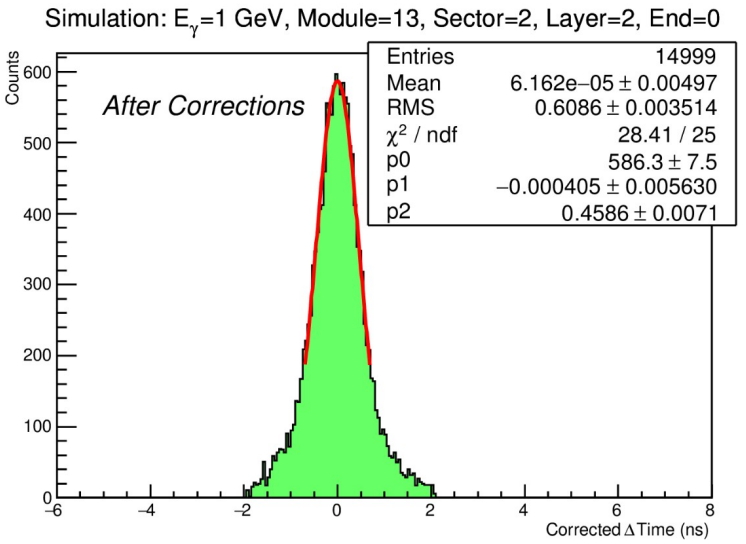


Calibration (final iteration)



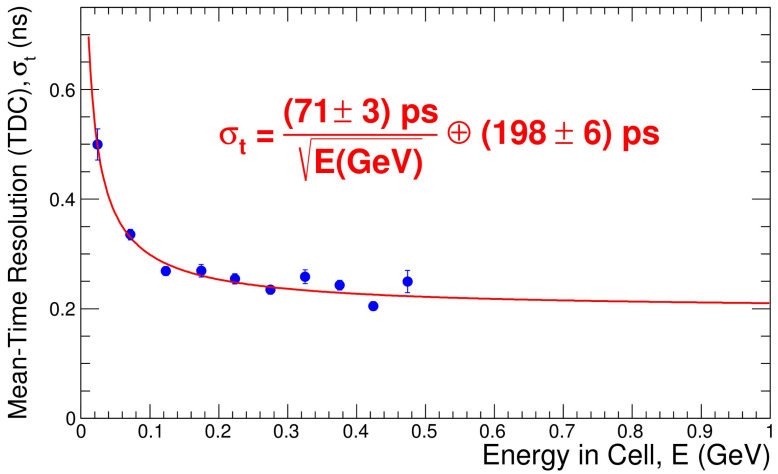




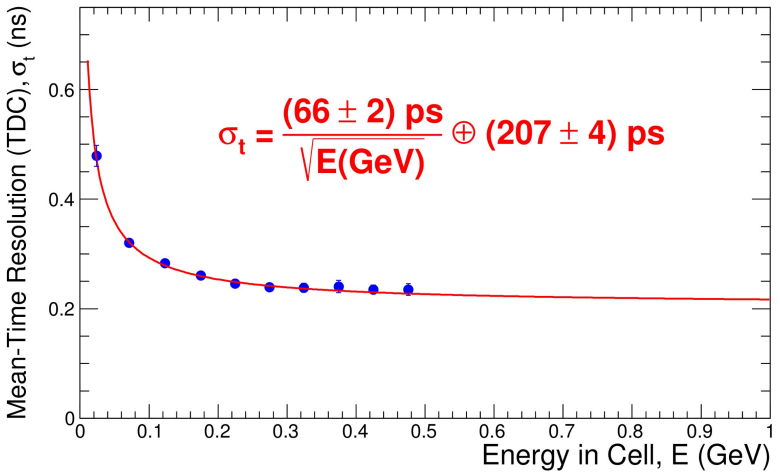


Resolution from Simulation

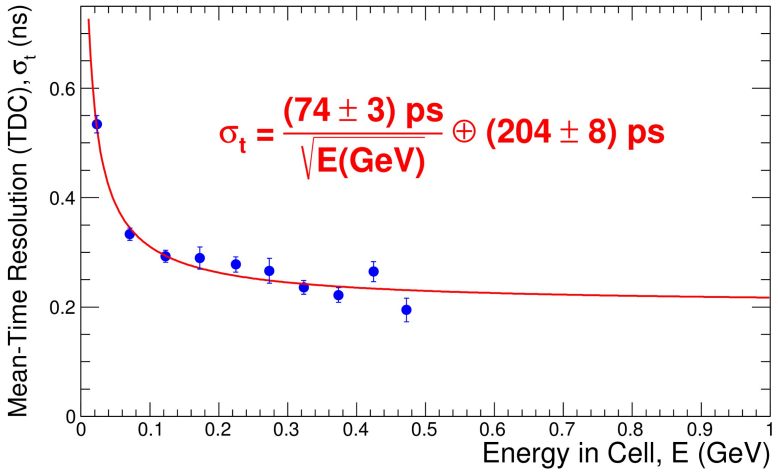
Photon Showers in BCAL: Layer 1



Photon Showers in BCAL: Layer 2

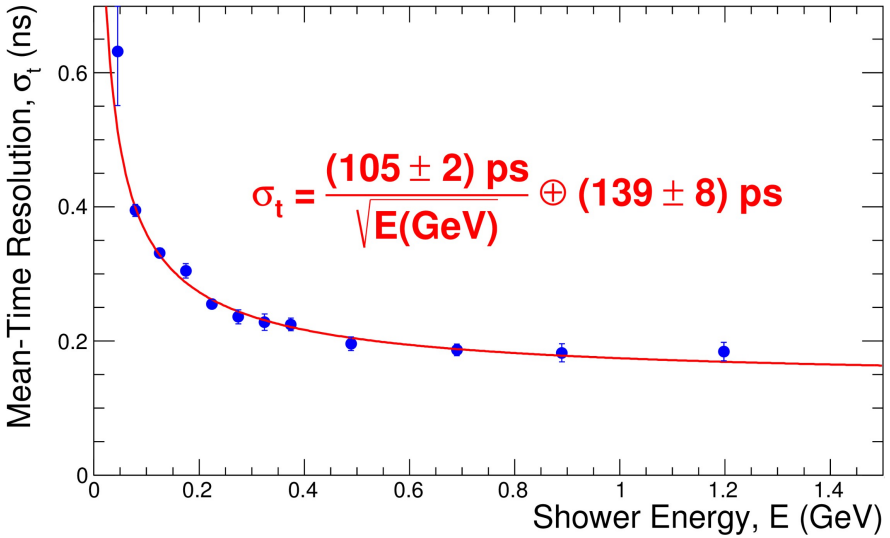


Photon Showers in BCAL: Layer 3



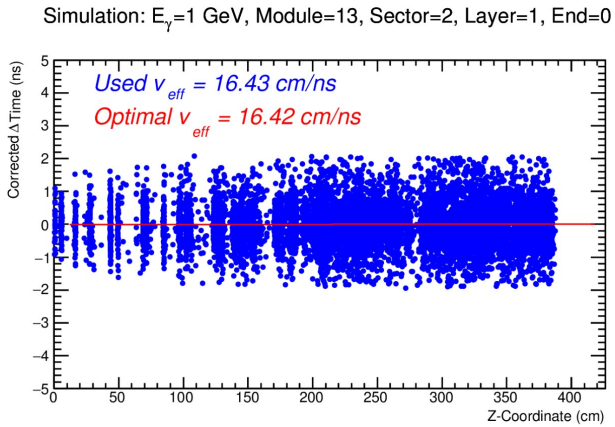
DATA

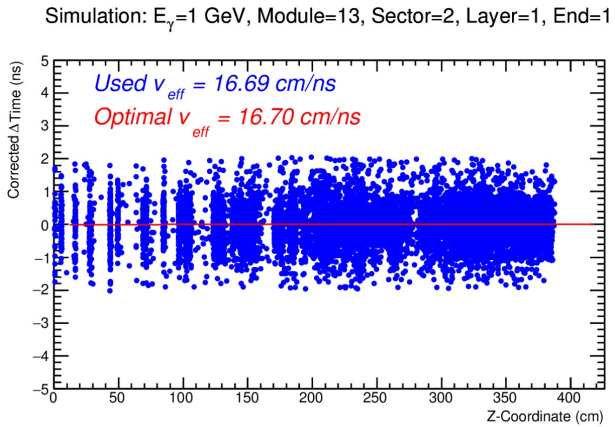
Photon Showers in BCAL (Run 10913)



Effective Velocities from Simulation

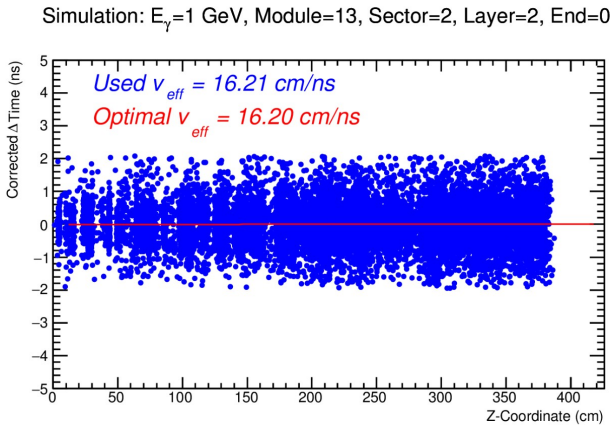
Layer 1

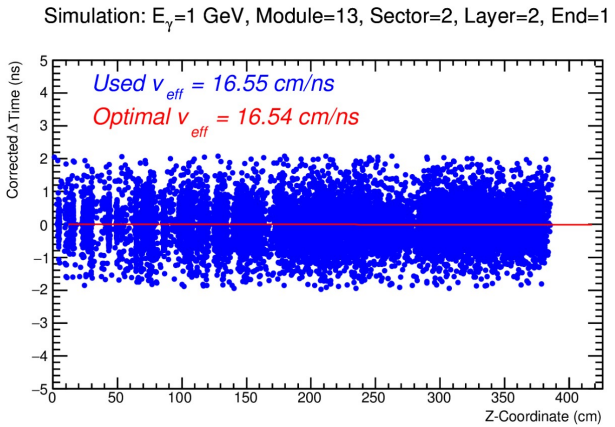




$V_D - V_U = 0.28$ cm/ns

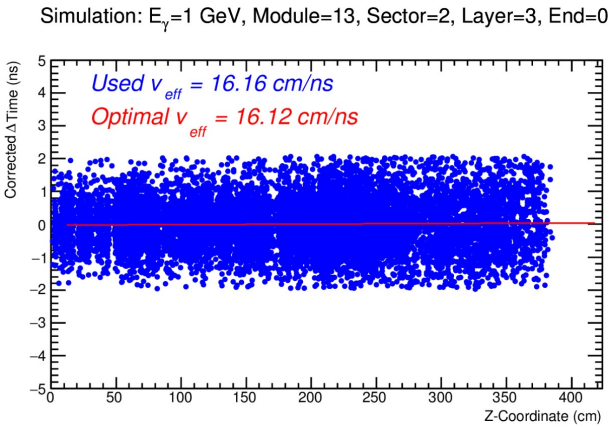
Layer 2

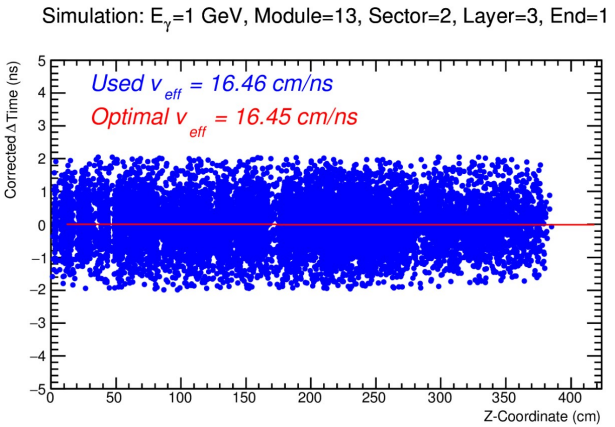




$V_D - V_U = 0.34$ cm/ns

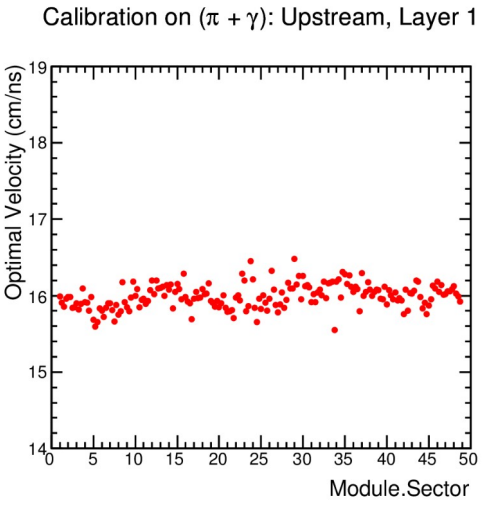
Layer 3

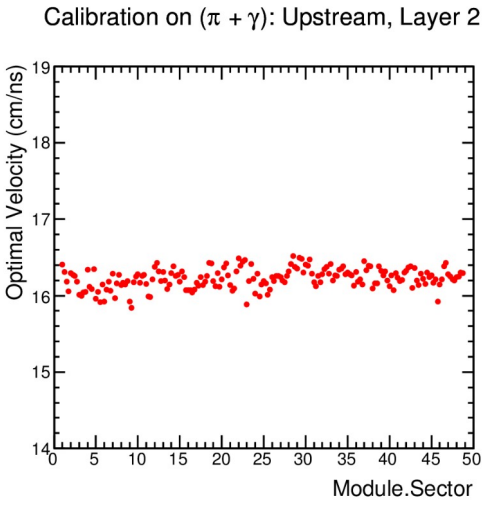


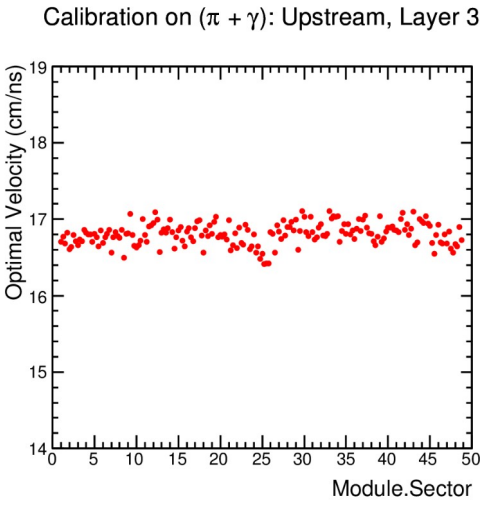


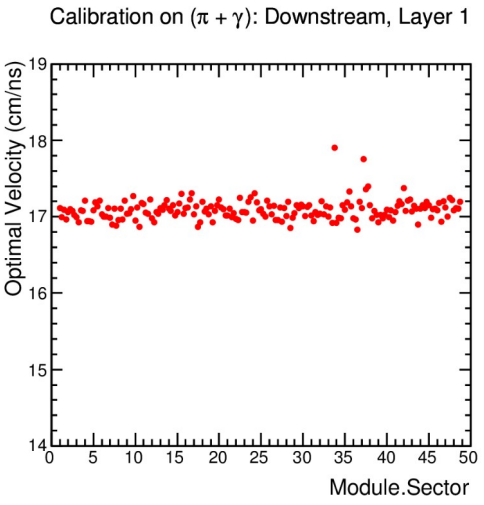
$V_D - V_U = 0.33$ cm/ns

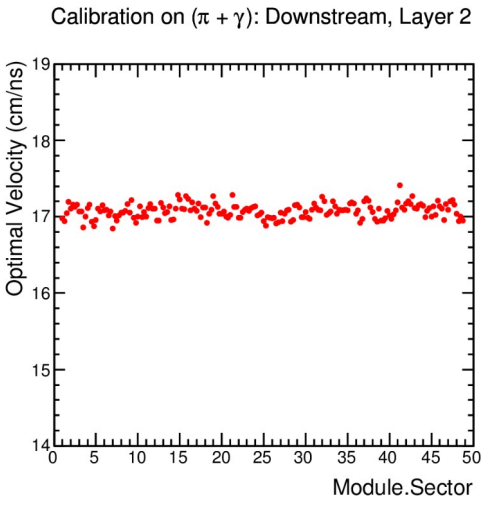
Effective Velocities from Data

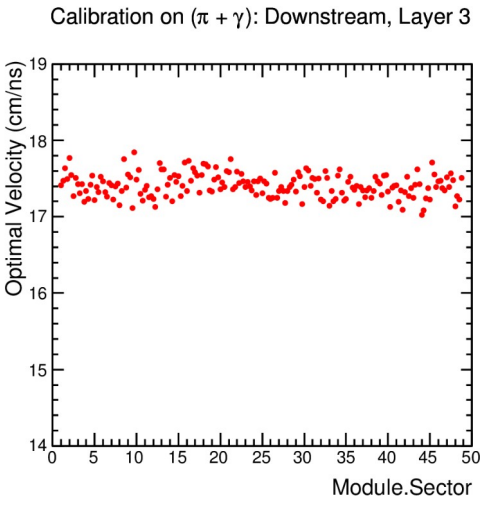




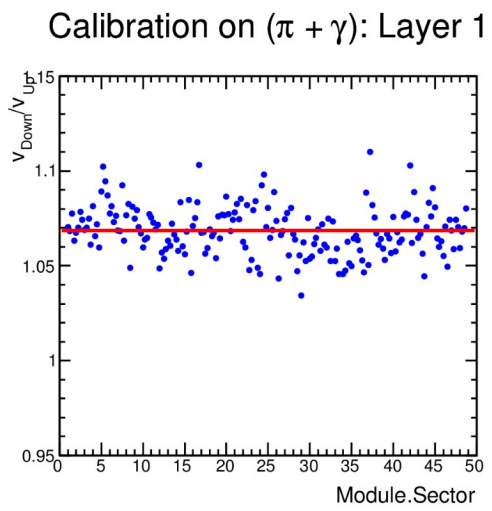


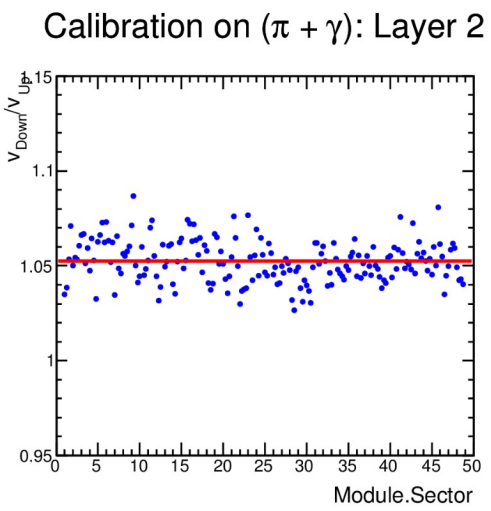


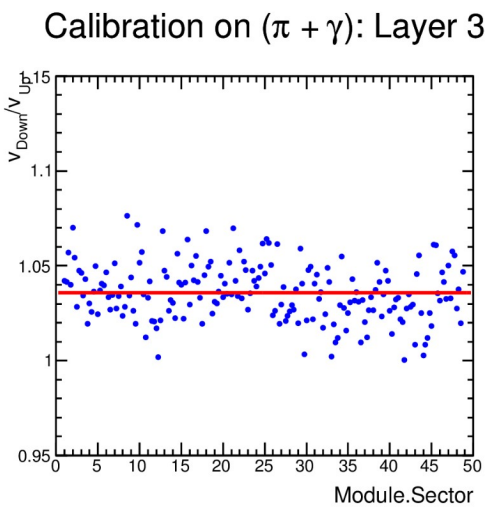


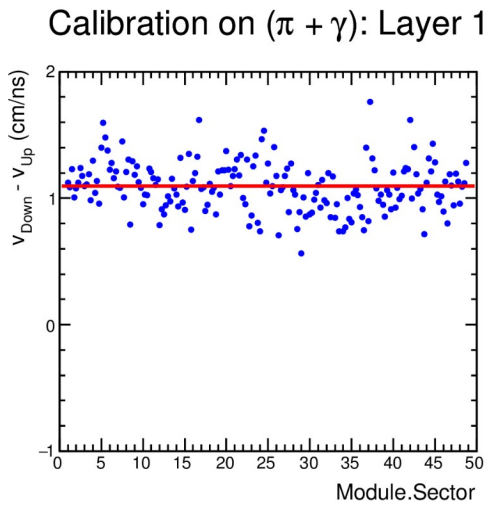


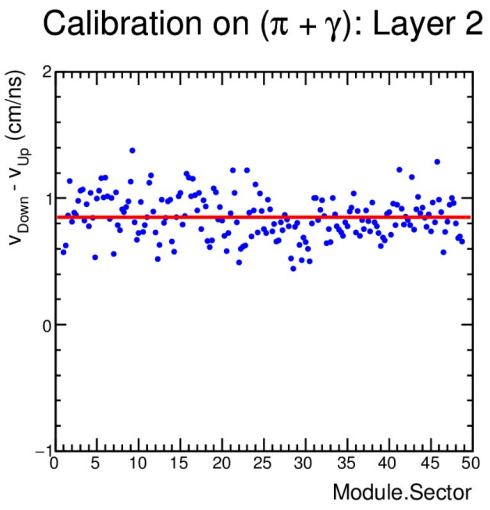
Effective Velocities from Data

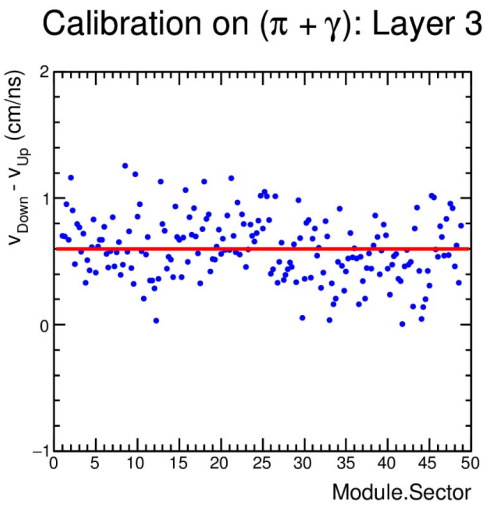




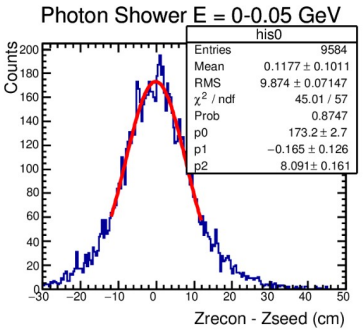


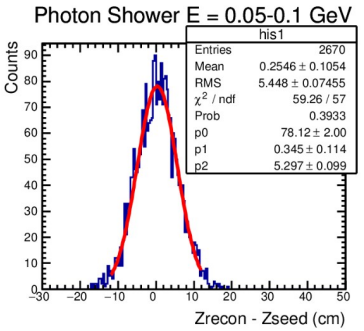


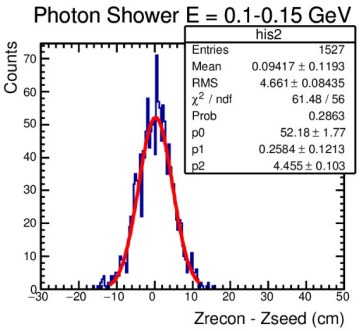


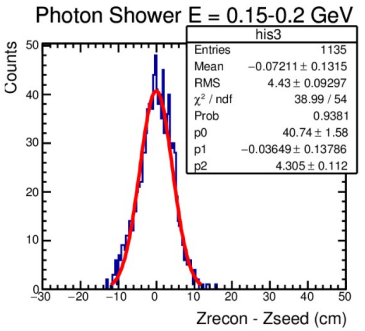


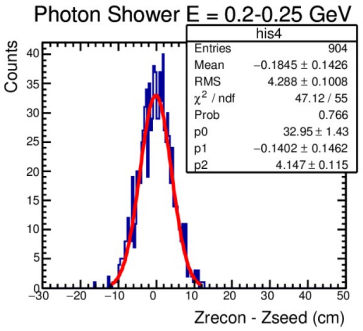
“Reconstructed” Z vs Thrown Z

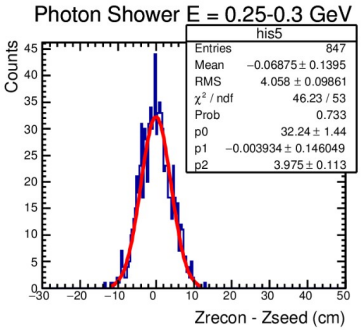


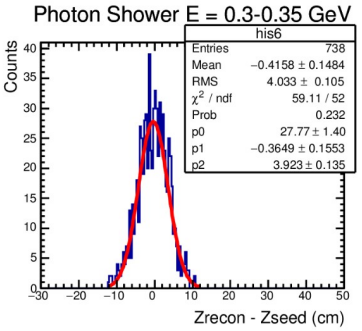


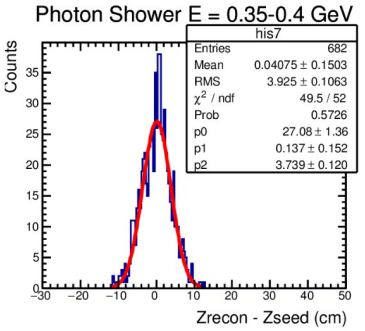


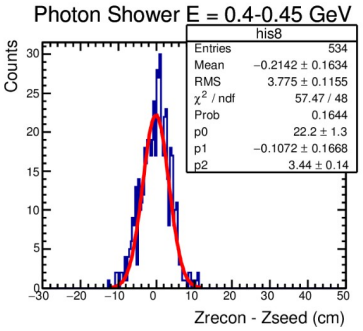


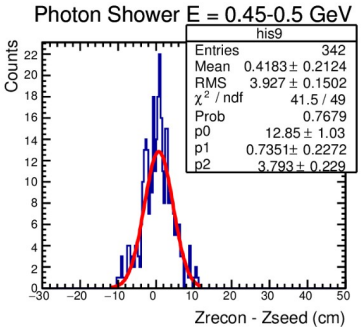


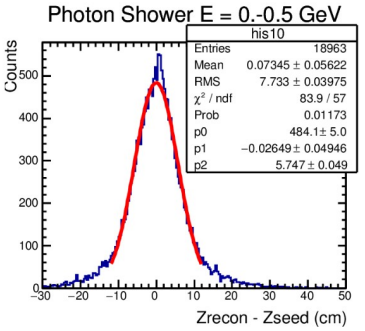






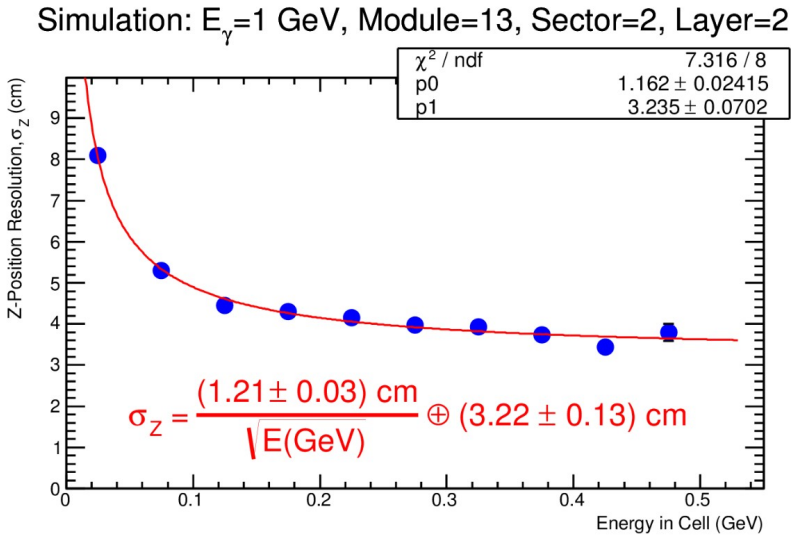


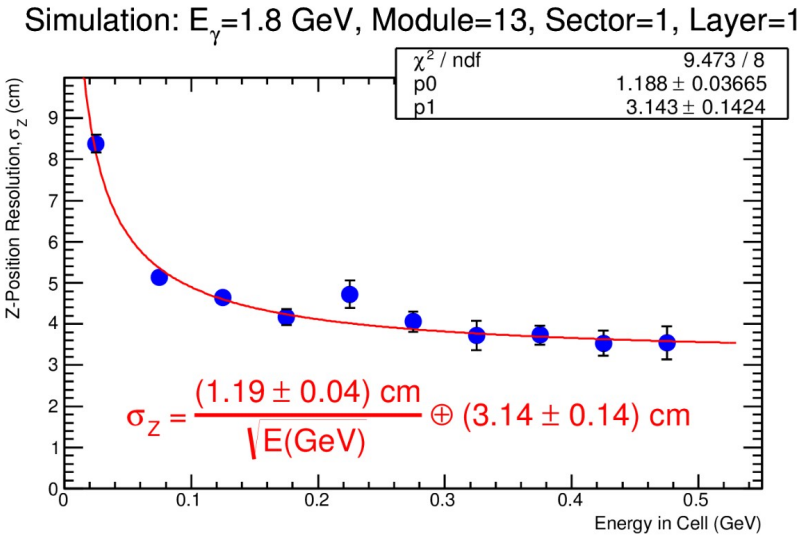


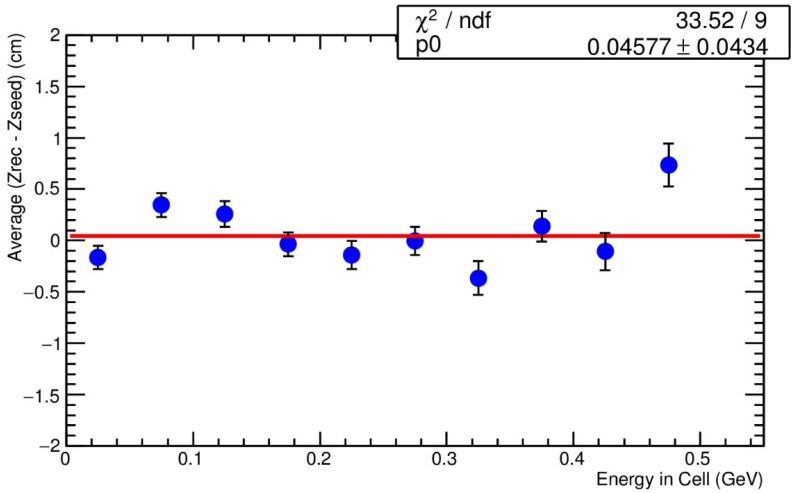


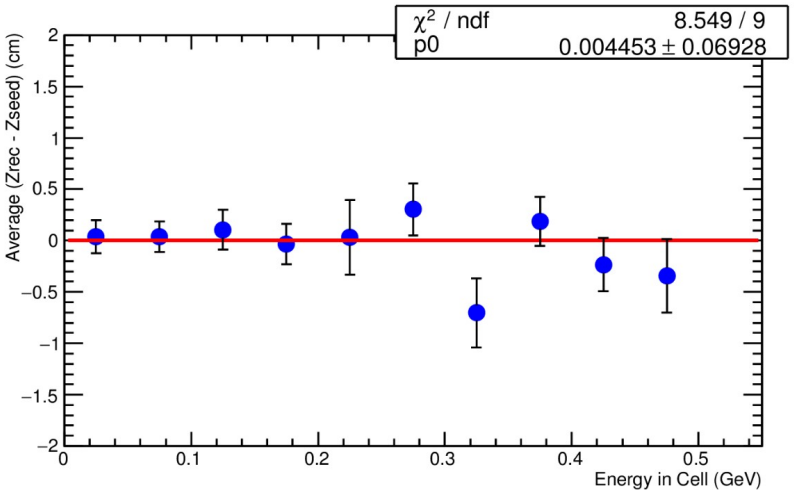
Sum

“Reconstructed” Z vs Thrown Z

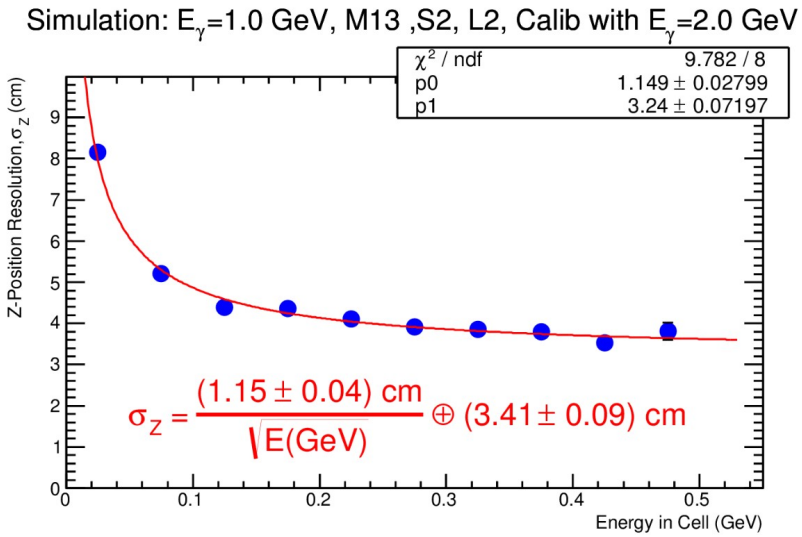


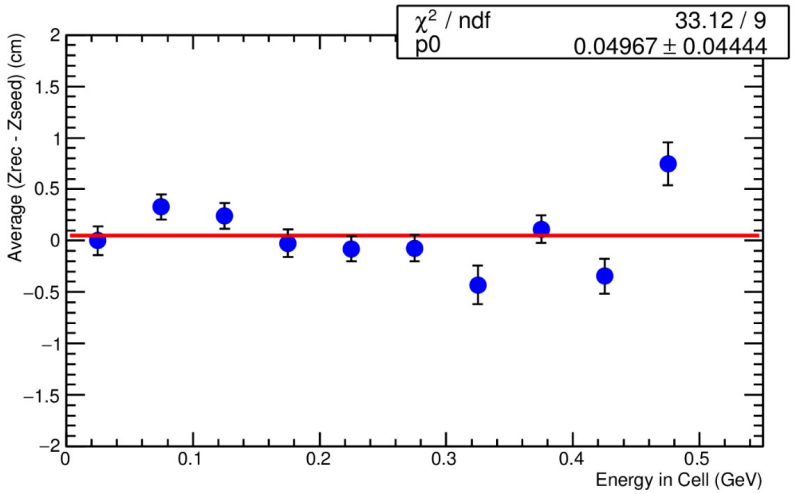




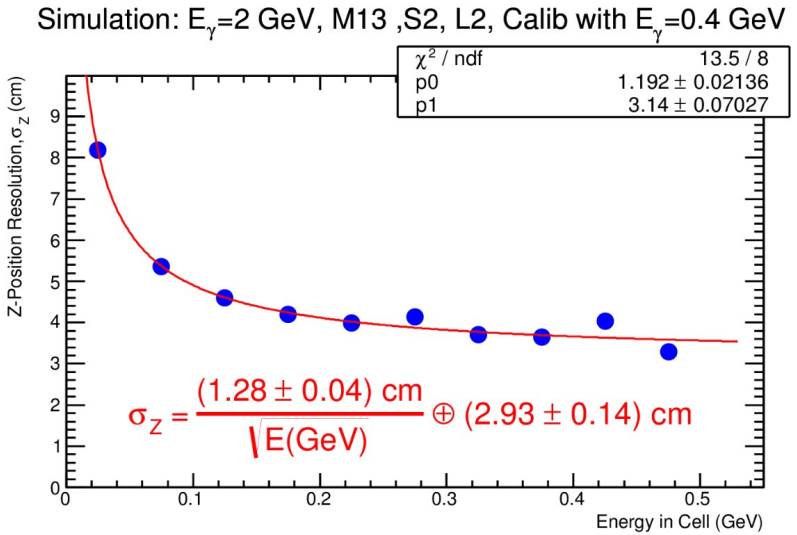


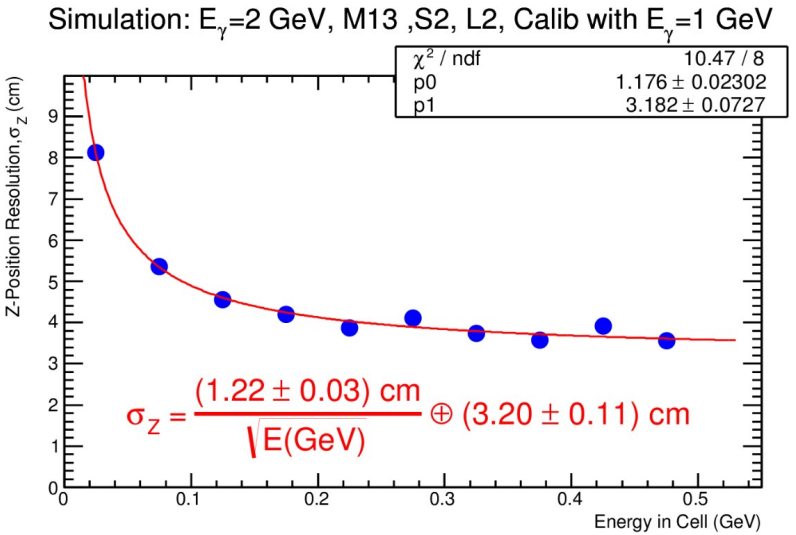
Calibration Stability

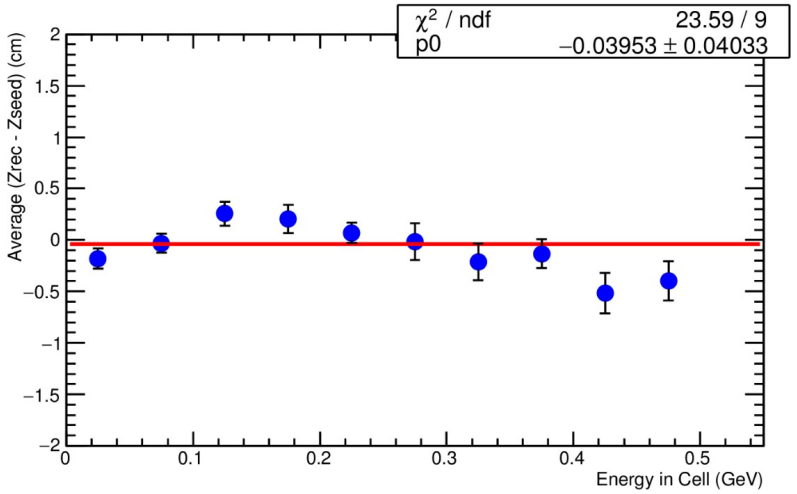


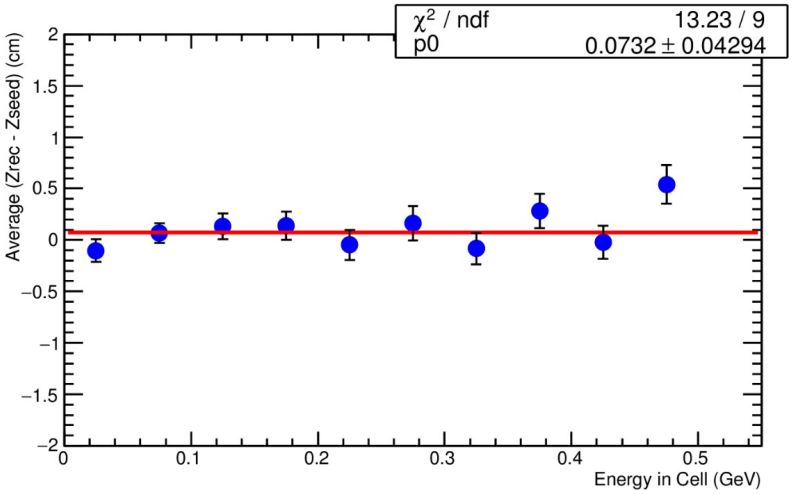


Calibration Stability









Conclusions

* With realistic assumptions, we can reproduce (in general) BCAL time resolution

* Comparison with the data suggests that the volume of the energy deposition in the shower is not the only cause of the “two-velocity” effect in BCAL

* The systematics in the Z-reconstruction is small (consistent with zero)

* In this simulation model (!), the timing calibration on gamma is stable (viz., only one calibration set can be used for the reliable Z-reconstruction of the gamma shower)