Update on calorimeter reconstruction

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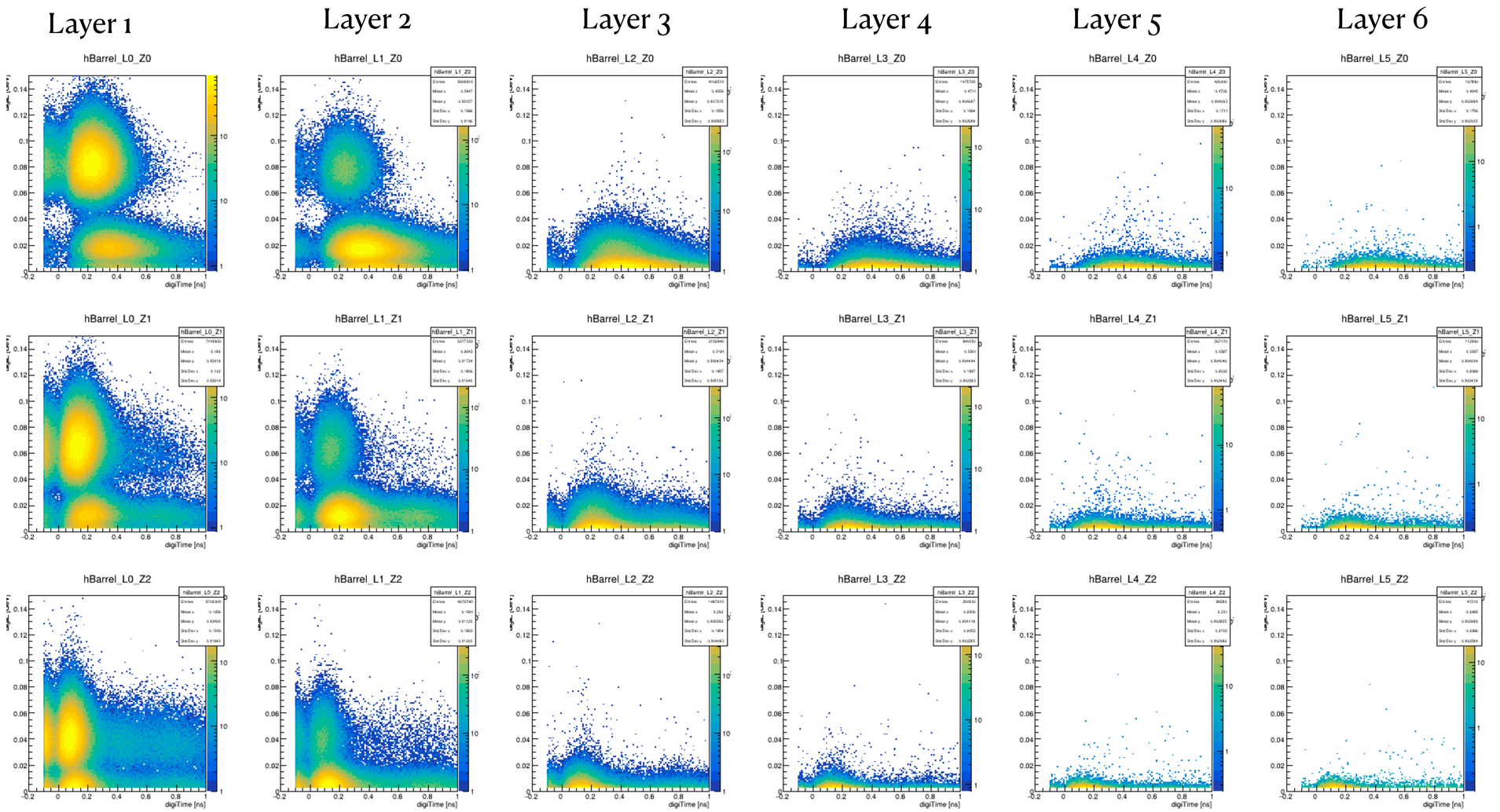
Recap √s=10 TeV BIB in CRILIN EM calorimeter

- Trimmed with **[-0.1 , 25]ns** time window.
- Study based on DigiHit: x axis **arrival time [ns]**, y axis **energy [GeV]**.
- Each layer of **CRILIN** divided in 3 region in z of equal width.



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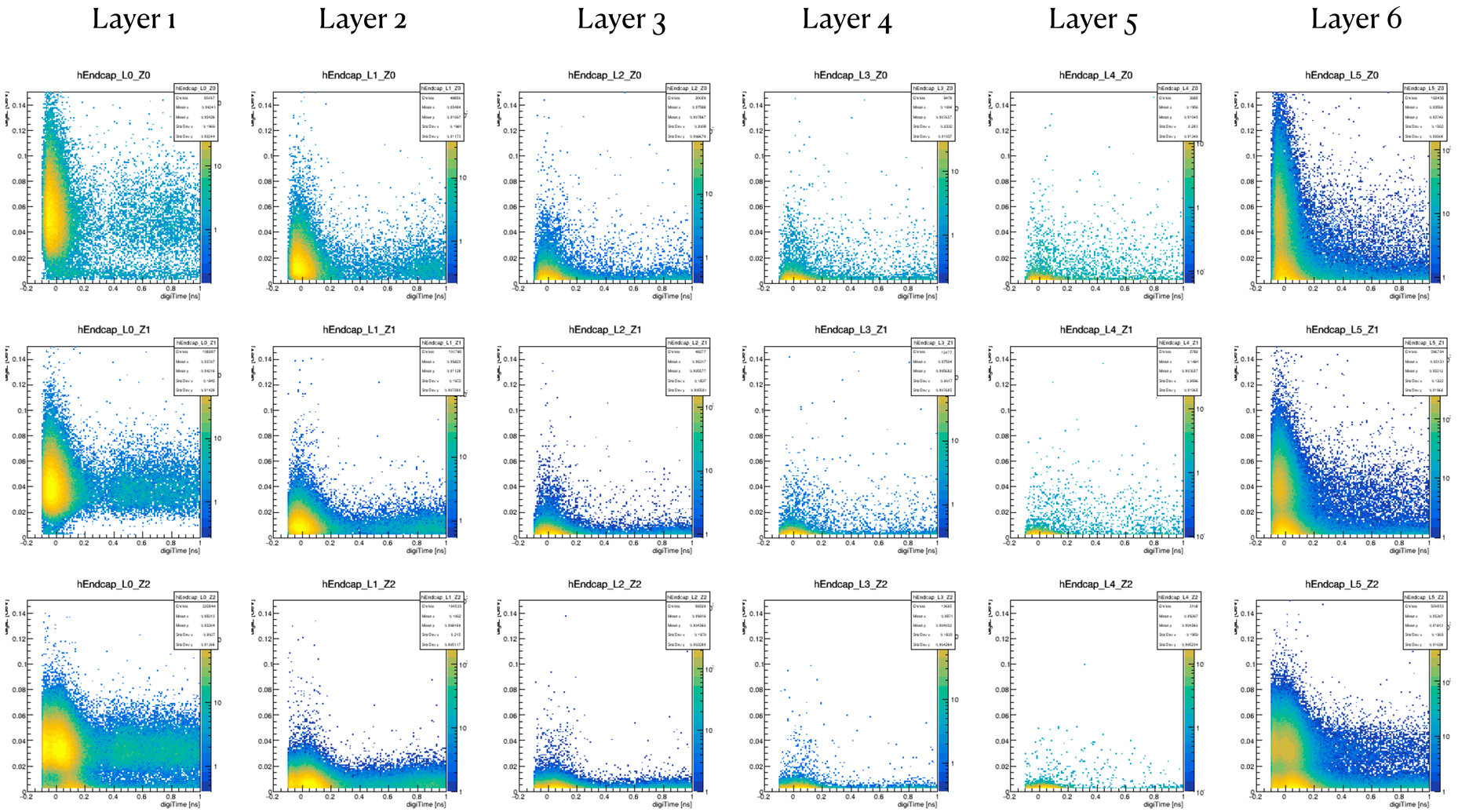
- Trimmed with **[-0.1 , 25]ns** time window.
- Study based on DigiHit: x axis **arrival time [ns]**, y axis **energy [GeV]**.
- Each layer of **CRILIN** divided in 3 circular region (R) of equal width.



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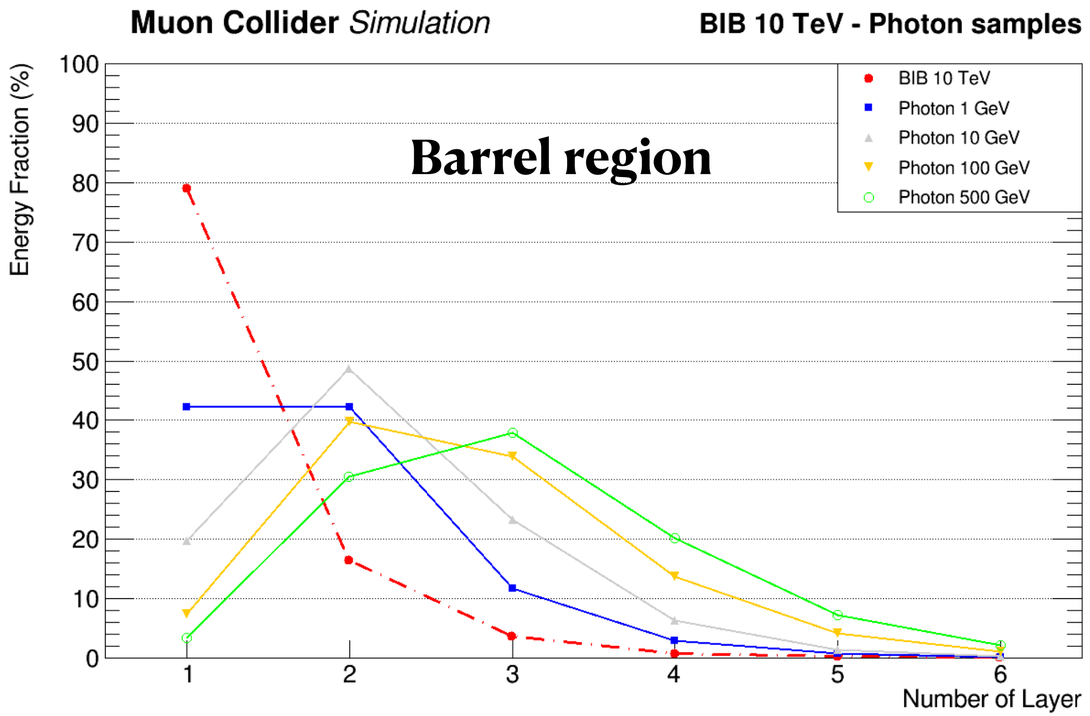
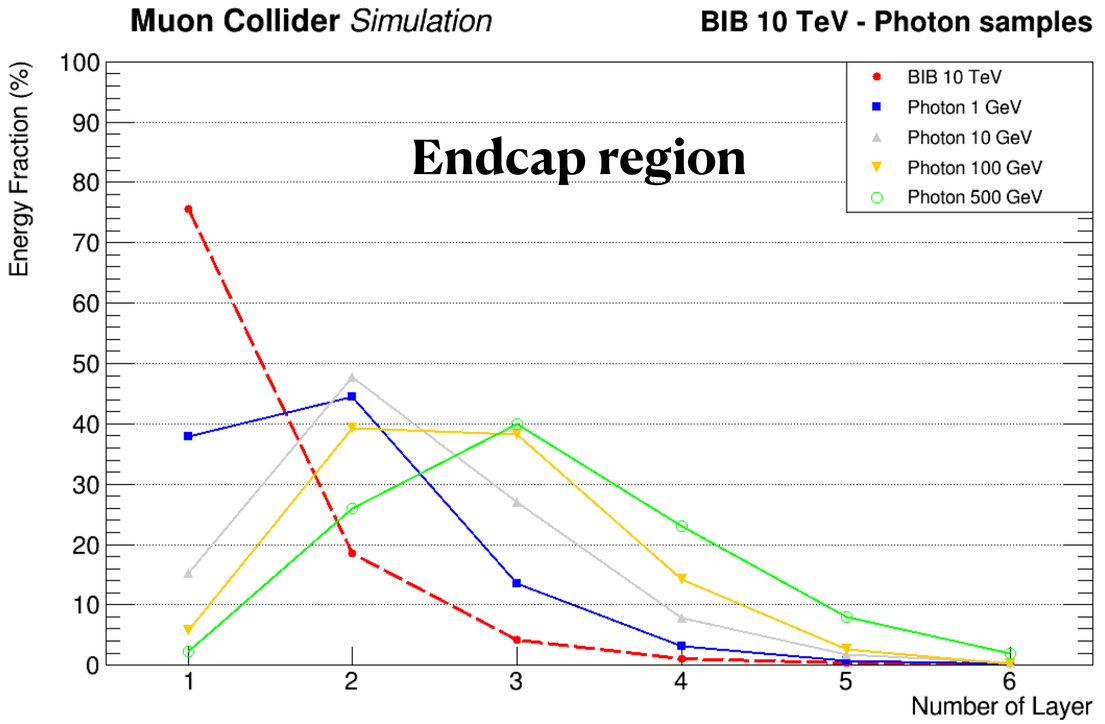




BIB: release most of the energy in the **first layer of CRILIN**.

BIB mitigation strategy in ECAL

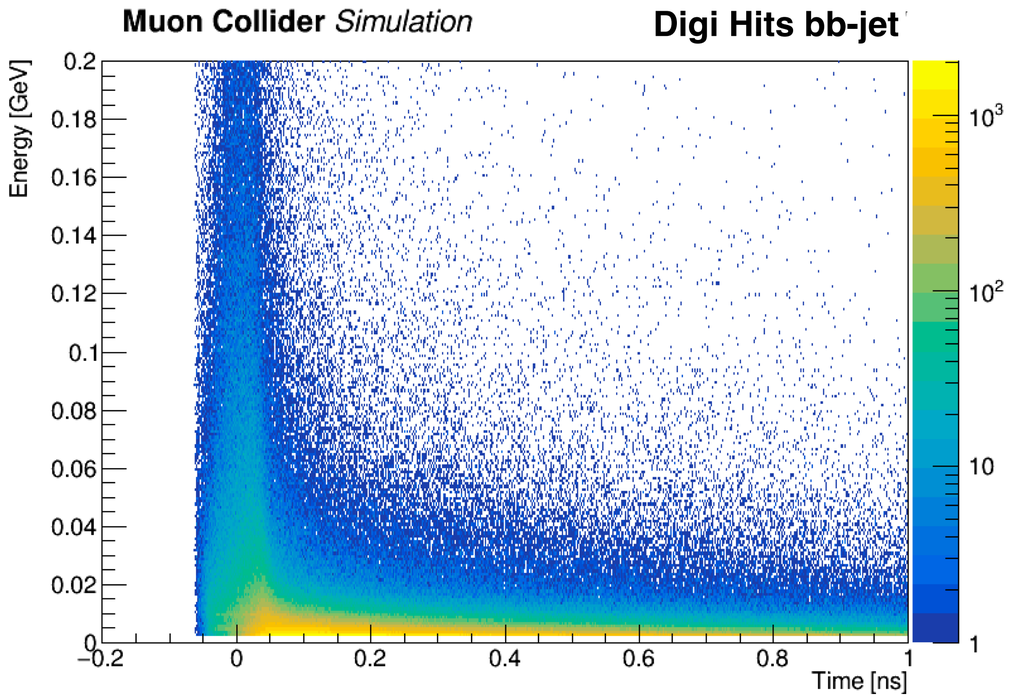
- Implement **energy thresholds** to cut off low energy BIB hits.
- Define **acquisition time windows** to cut off the out-of-time portion of the BIB and preserve the signal.

→ Optimized for each layer and single sub-region of the layer.

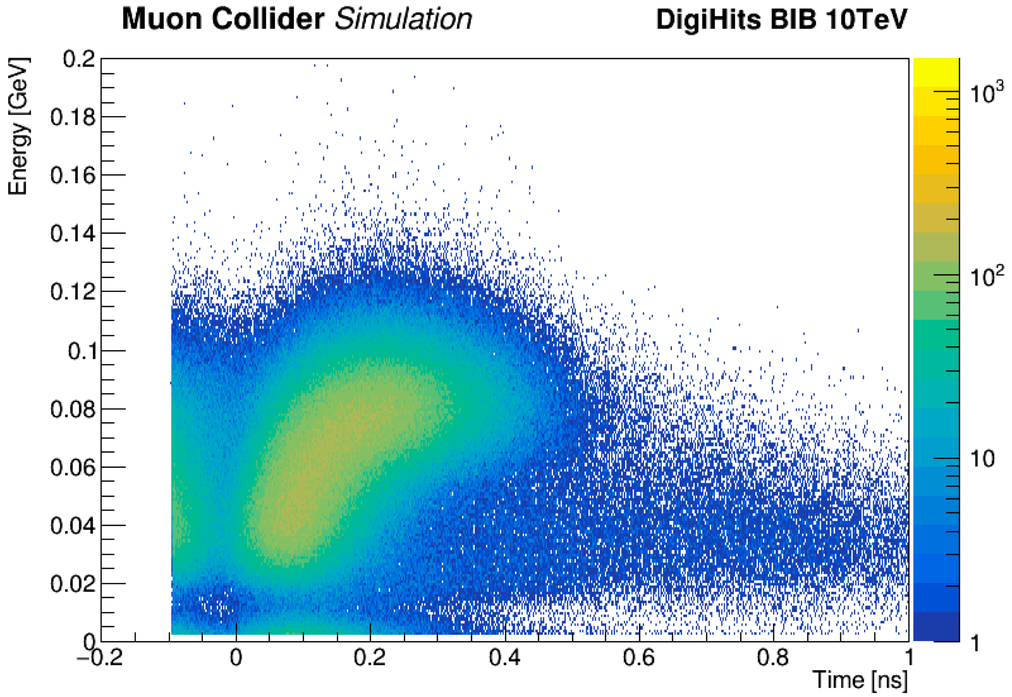
- It is necessary to study in detail both **single-particle signals** (electrons and photons) and also **jets**.
- I started studying samples of bb and cc di-jets with invariant mass between [0, 100] GeV.

Arrival time - energy distributions in CRILIN: layer 1

bb-dijet sample



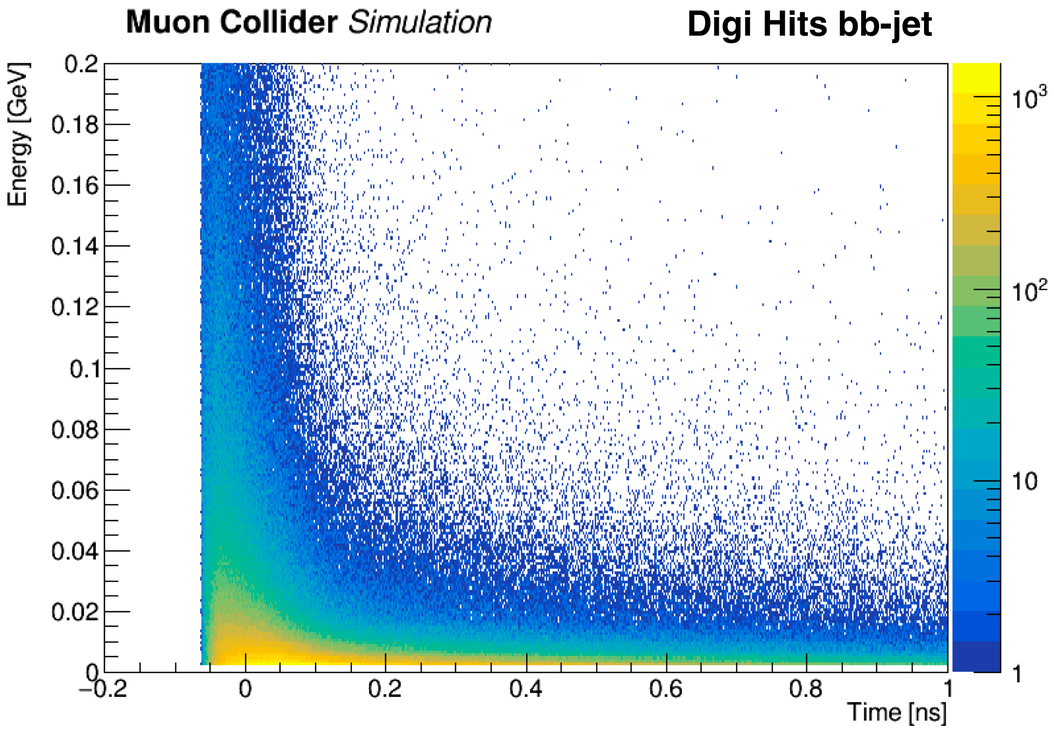
BIB sample



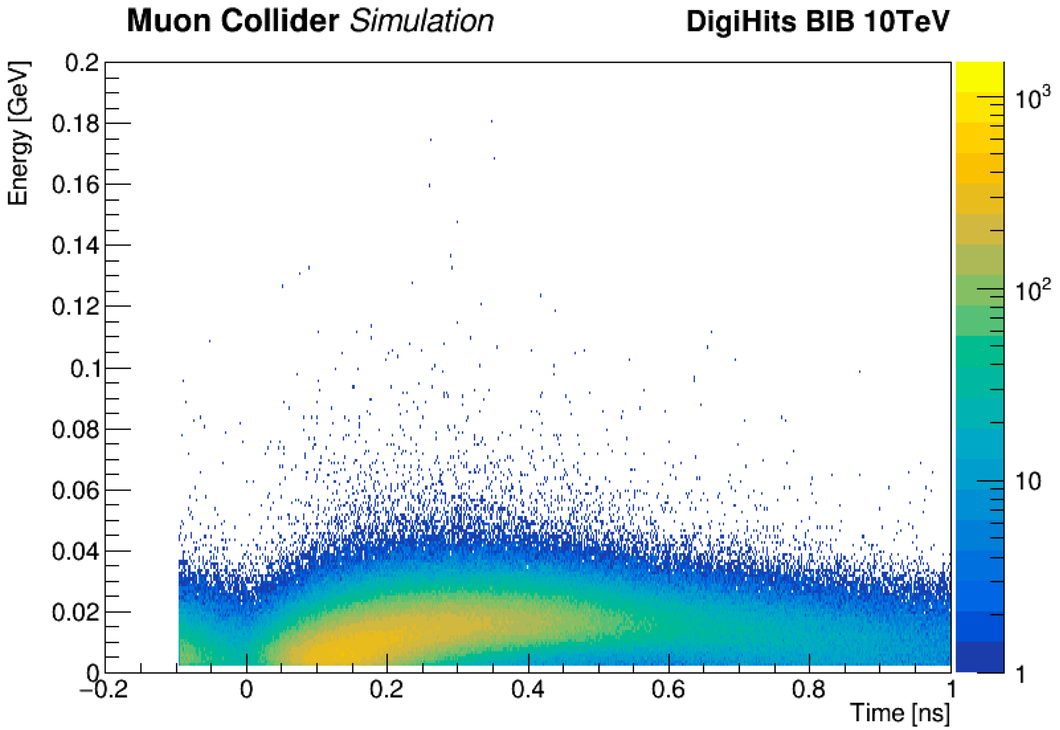
- Broader time distribution than observed from single-photon samples
- Large number of low energy hits

Arrival time - energy distributions in CRILIN: layer 2

bb-dijet sample



BIB sample



Next steps on the jet studies

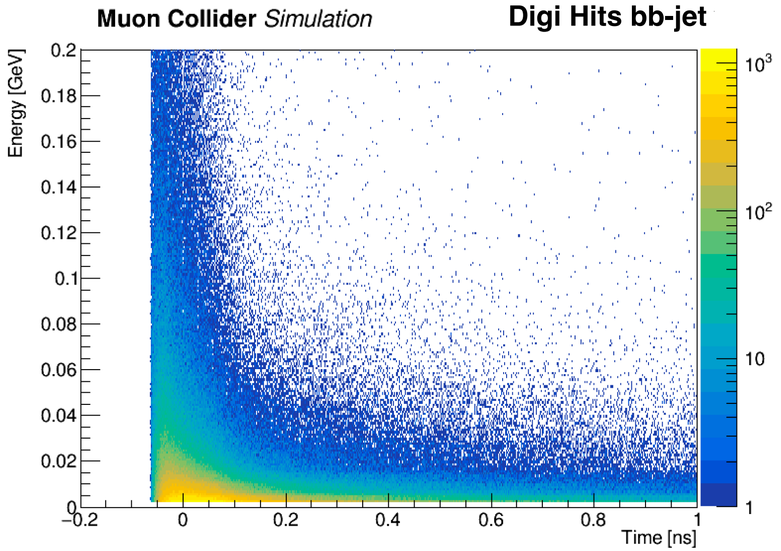
- Study of jet reconstruction performance with MUSIC_V1 geometry (initially without BIB overlay).
- Optimization of energy thresholds and time acquisition windows as a function of the CRILIN layer.
- Verify the performance of CRILIN with the BIB at $\sqrt{s}$=10 TeV and the sample tagging efficiency between b and c jets samples.

Towards a more realistic digitizer

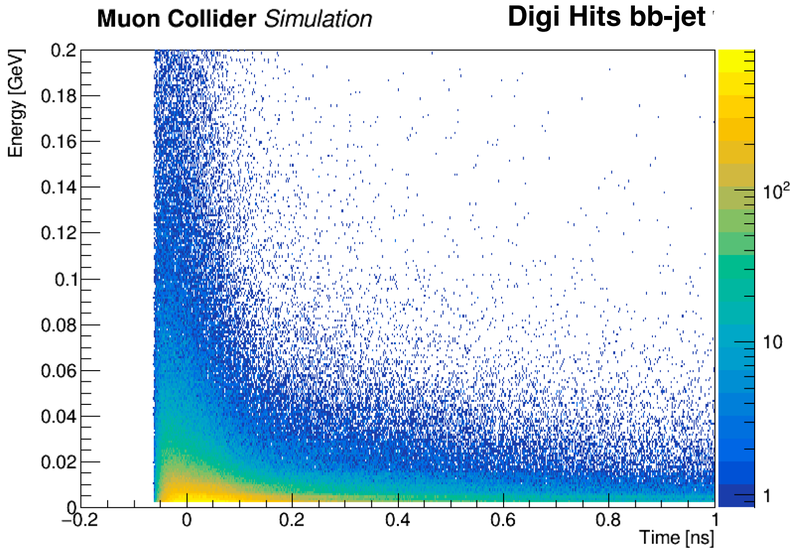
- Recap of previous upgrades:
  - Parametric charge collection efficiency (vs integration time)
  - Configurable t-E selection on DigiHits by region and layer
- Until now: no real “trigger”, first hit in a cell defined the DigiHit timestamp (unrealistic, very low energy early hits should not define the timestamp value)
- Upgrade:
  - Signal “max voltage” assumed linear with charge integral ($V_0 \sim kC$, here $k=1$)
  - Account for signal pileup modeling the waveform as $V(t)=V_0\, e^{-t/\tau}$
  - Tails from before-trigger signal enter the charge integral
  - Configurable trigger level
  - Configurable “blind time” (time before which no trigger can happen)

Backup

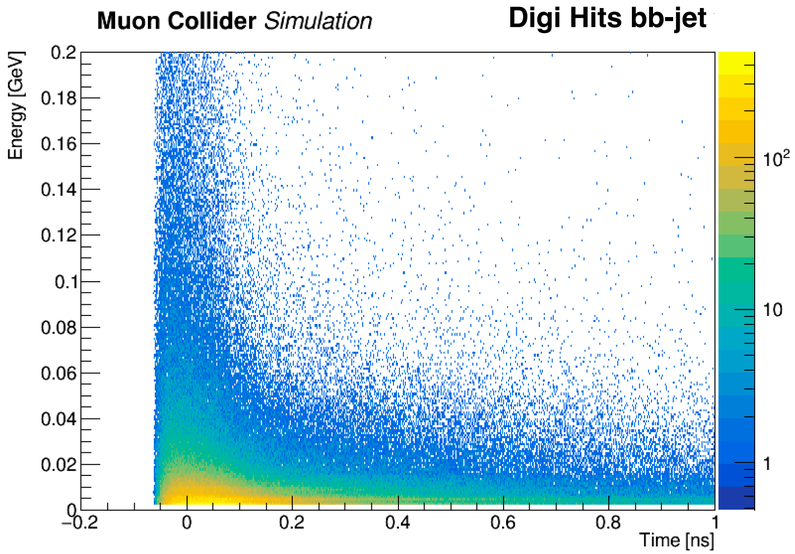
Layer 3



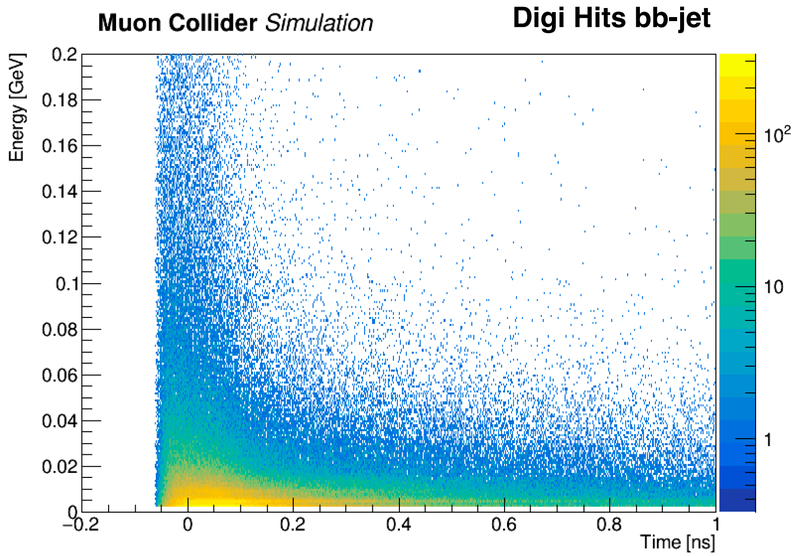
Layer 4

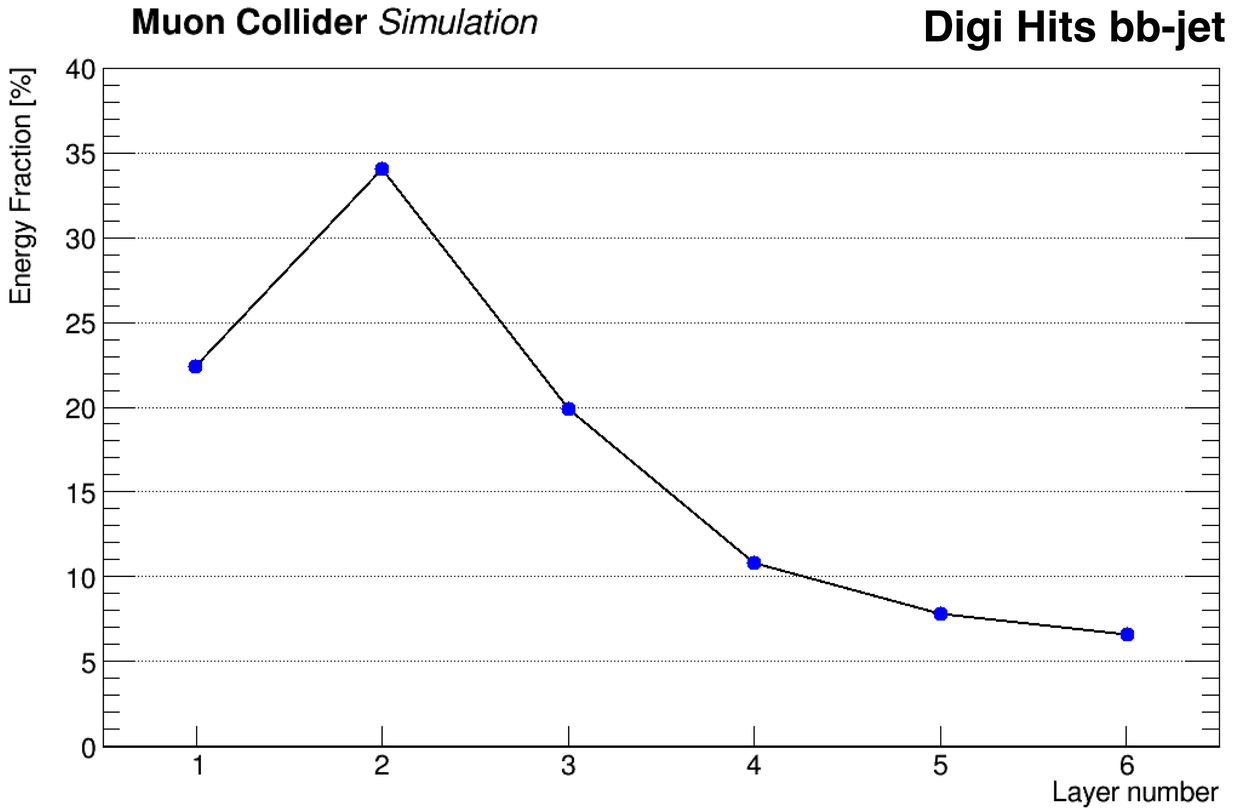


Layer 5



Layer 6




Muon Collider Simulation
Digi Hits bb-jet
Energy Fraction [%]
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
Layer number