Physics object reconstruction performance with MUSIC detector

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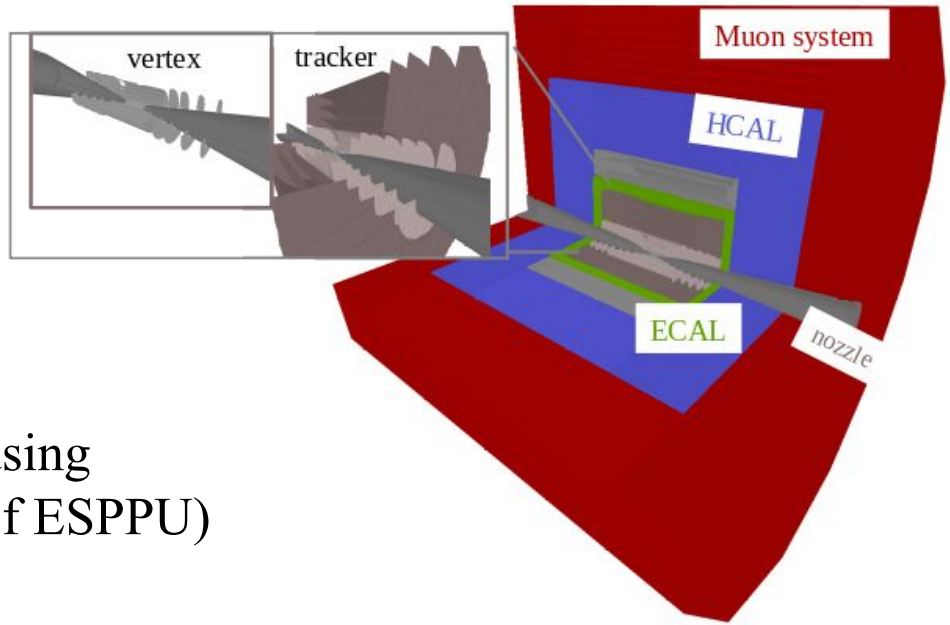
Overview

- Converging on performance on several physics objects

- Optimisation ongoing for some sub-detectors:
  - Tracker
  - ECAL
- Evaluation of performance on several physics objects:
  - Muons (tracks)
  - Photons / electrons
  - Jets
- Performance evaluation done using BIB (from last lattice version of ESPPU) + Incoherent Pairs (IPs)

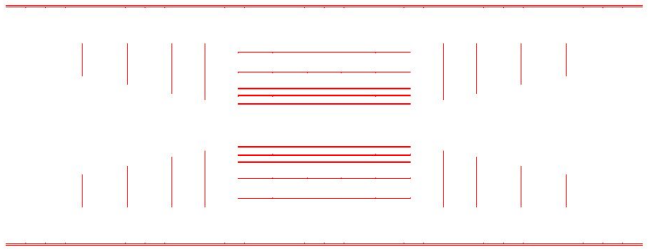


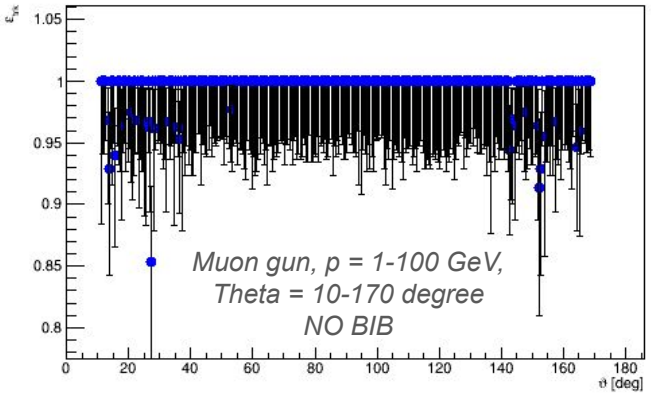
Tracker

- 5 layers are kept in the VXD barrel

- To get faster seeding procedure with BIB+IPs, we removed first layer from seeding
  - No important loss in reco efficiency

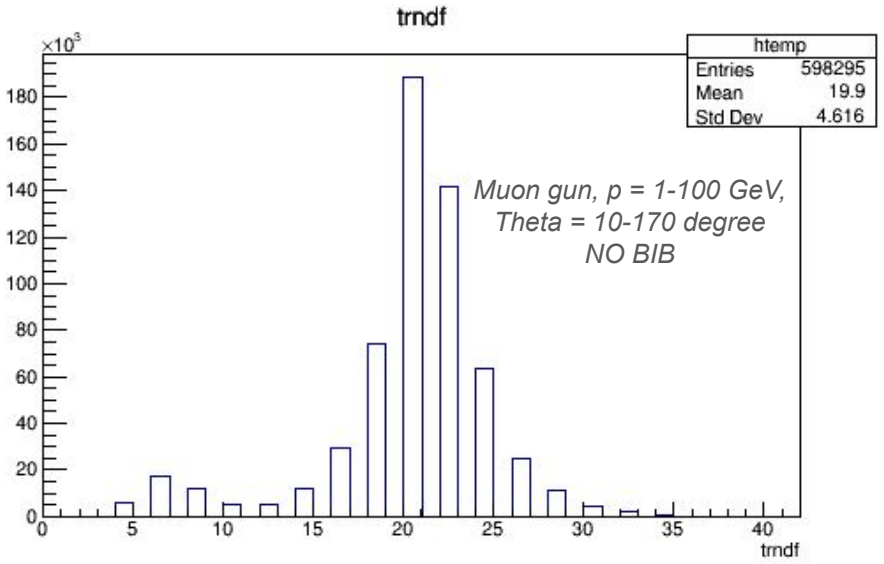
- After seeding and track reconstruction steps, roughly 900k tracks per event are present (BIB+IPs)
  - For seeding, we have tried some binnings in z, no evident advantage





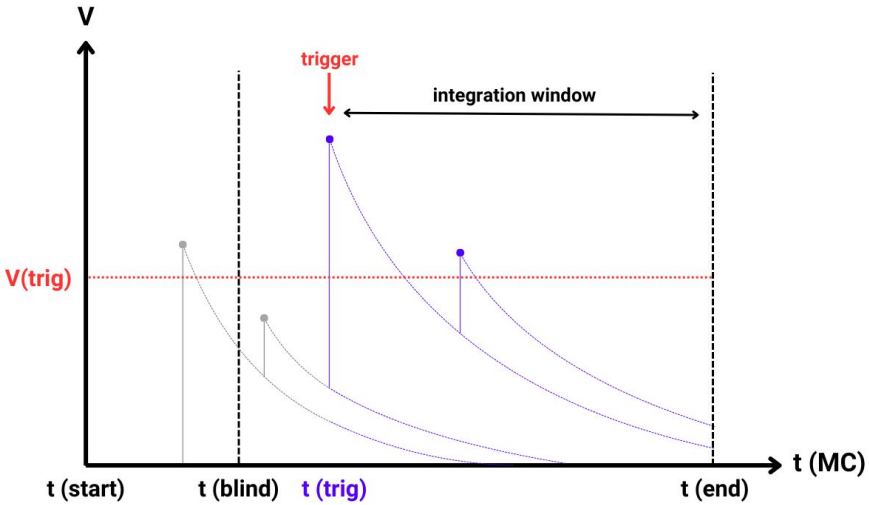
Tracker

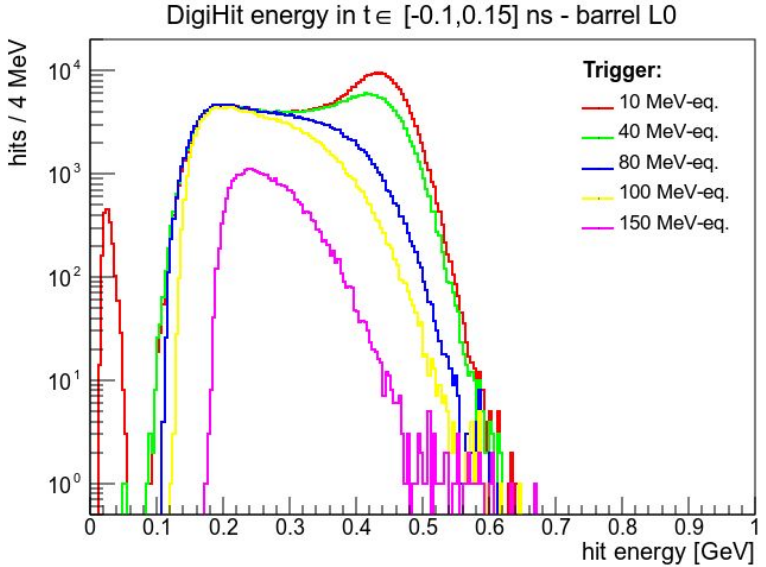
- Decided to apply a cut on `trndf`, as it impacts the most
  - E.g., for `trndf>17`, we keep just ~2k tracks per event on average (signal+BIB+IPs)
- This cut can be tuned to accommodate different requirements from different analyses
- **Evaluation with BIB+IPs is ongoing**



ECAL (photons/electrons)

- The final geometry accounts for 6 layers of CRILIN calorimeter
- Lots of work by Carlo and Leonardo to finalize:
  - Implementation of trigger at digitiser level





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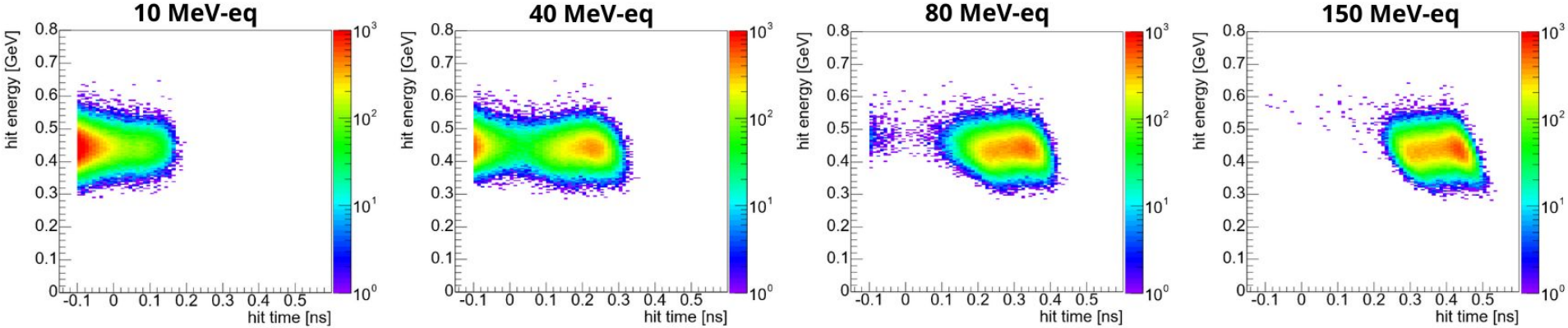
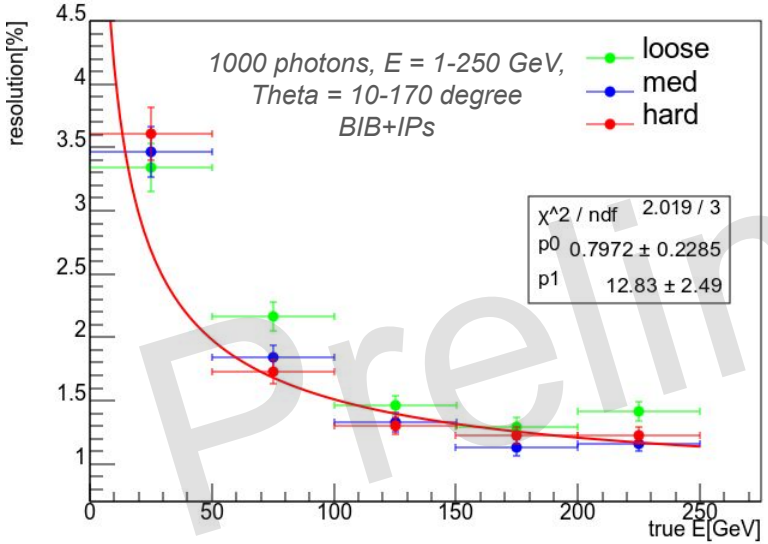
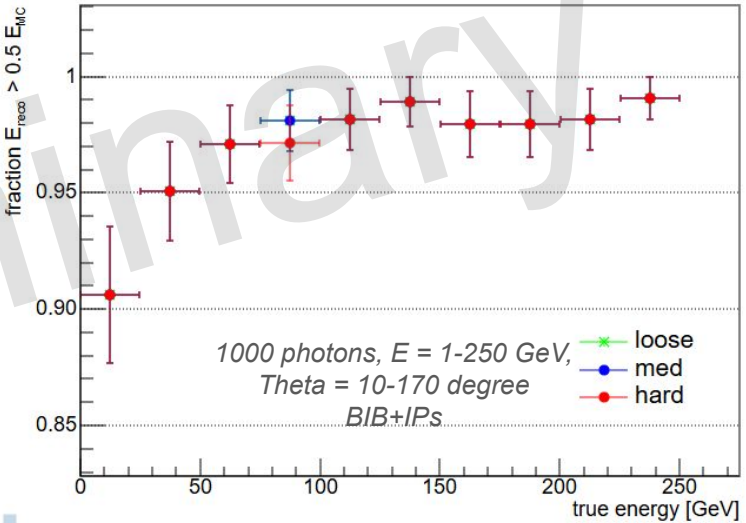


ECAL (photons/electrons)

- The final geometry accounts for 6 layers of CRILIN calorimeter
- Lots of work by Carlo and Leonardo to finalize:
  - Implementation of trigger at digitiser level
  - Configuration of trigger and evaluation performance
    - **Different configurations under testing**

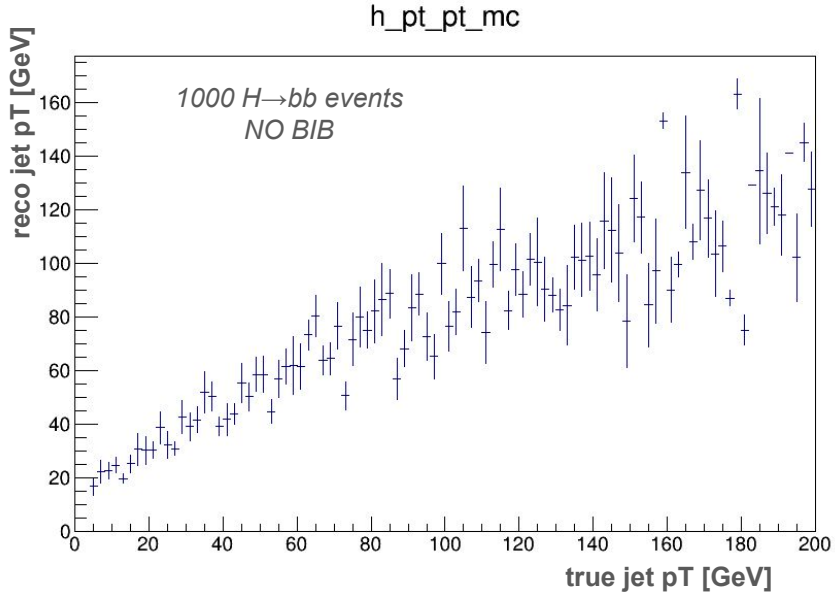
Able to reach a resolution of the order of ~13%/sqrt(E)

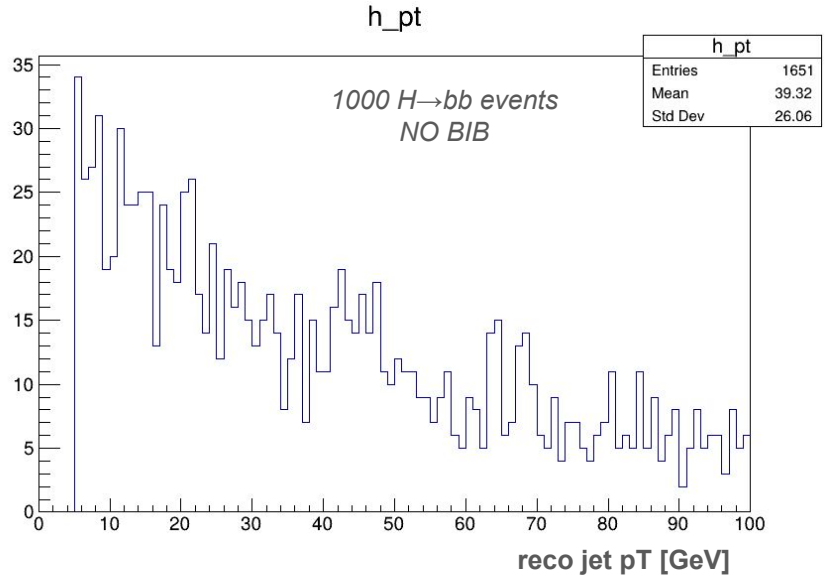




Jets

- After optimisation of tracker and ECAL, we can move to jet
- We have already simulated samples of
  - H→bb @ 10 TeV using Whizard
  - bb dijet samples using Pythia8

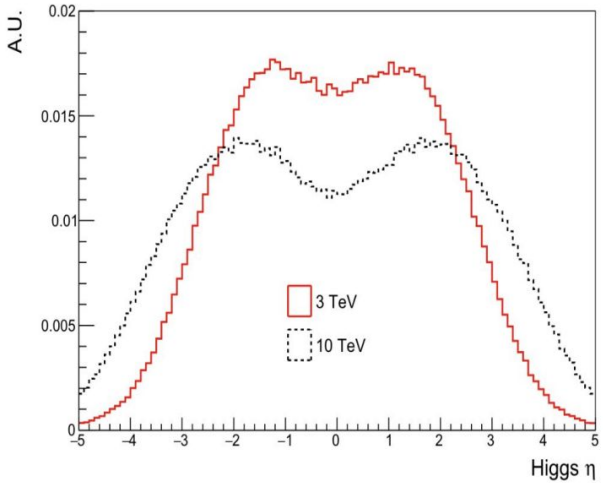




Jets

- From some preliminary estimates, we get $\varepsilon_{reco} = 29\%$
  - In the 3 TeV case, we had $\varepsilon_{reco} = 39\%$
  - It seems that the difference is mainly due to difference in acceptance

- The plan is quite straightforward:
  - Reconstruct jets with BIB+IPs overlay
  - Apply cuts on track reconstruction and calo digitisation
  - Perform the same analysis as for the 3 TeV case



Conclusions

- Each sub-detector has been optimized (at least at first order)
  - From these preliminary studies, it seems that
    - We can manage both tracker and ECAL occupancy with BIB+IPs
    - We can reach similar performance to 3 TeV case

- We are now preparing the pipeline to produce all performance studies and plots