Event Reconstruction Performance Study CERN TB2022-06

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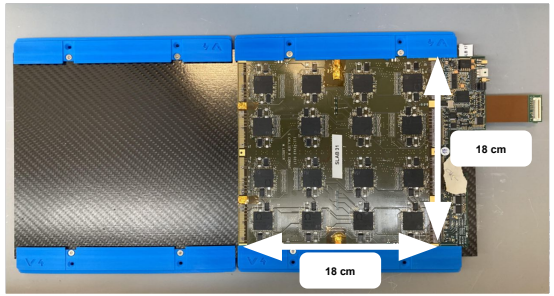
Affiliation:

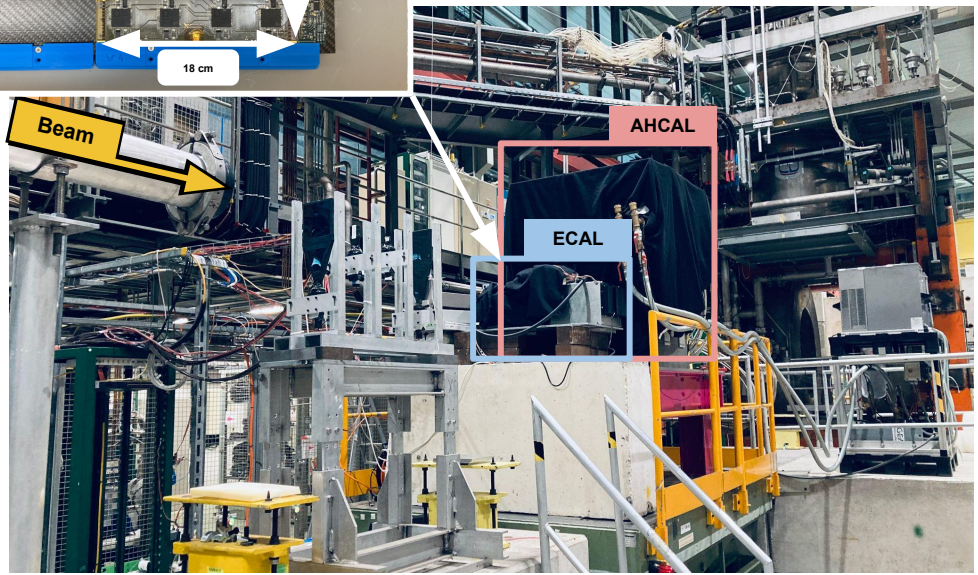
In collaboration with:

Analysis

CERN TB2022-06

- **SiW-ECAL**
  - Sensors
    - 15 layers
    - 16 chips
    - 64 channel
    - **15,360 cells**
  - Active : Silicon
    Absorb : Tungsten
- **CERN SPS Beam**
  - Energies
    - e : 10, 20, 40, 60, 80, 100, 150 GeV
    - μ : 50, 150 GeV
    - π : 10, 20, 70, 100, 150, 200 GeV





Data Samples

Data Used

- Electron Data

Energy (GeV)	Run ID
10	90320
20	90378
40	90375
60	90372
80	90367
100	90365
150	90355

MC Used

- Simulation software provided by Fabricio
  GitHub Link
- Run Setting
  - Electron beam with same energy as Data
  - Single incoming electron per event
  - Same simulated detector setup as TB2022-06
- Not uploaded to eos or anything

Simulation vs. Reconstruction

Energy	NEvents	NHits	Hits/Event
10	4999	826,350	165.303
20	4999	1,355,706	271.195
40	4999	2,164,765	433.040
60	4999	2,814,062	562.925
80	4999	3,371,195	674.374
100	4999	3,867,467	773.648
150	4999	4,903,946	980.985

Simulation

Energy	NEvents	NHits	Hits/Event
10	15120	1,813,628	119.949
20	81540	12,518,701	153.528
40	71698	16,537,826	230.660
60	47063	12,498,777	265.575
80	138585	56,395,730	406.940
100	38248	28,857,999	754.497
150	10750	10,132,062	942.517

Reconstruction

Simulation vs. Reconstruction

- **BCID merge**
  - 2-3 bcids merged to form a single event
- **Selection**
  - # Hits (shown later)
  - Filled SCAs < 13
  - Coincidents > 13
  - Hit MIP value > 1

Energy	NEvents	NHits	Hits/Event
10	15120	1,813,628	119.949
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Reconstruction

Event Display

Electron (Good)

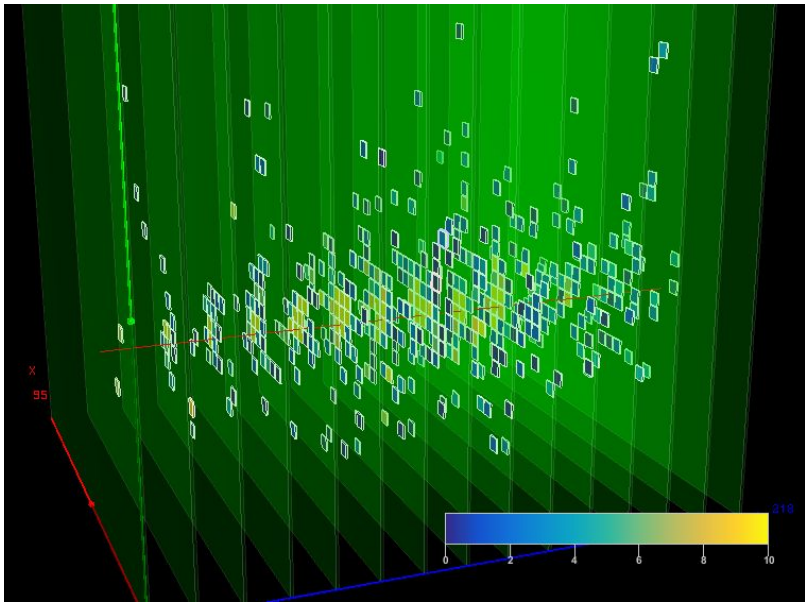


Fig. Simulation e- 40 GeV
N Hits: 458, Sum E: 2789 MIPs

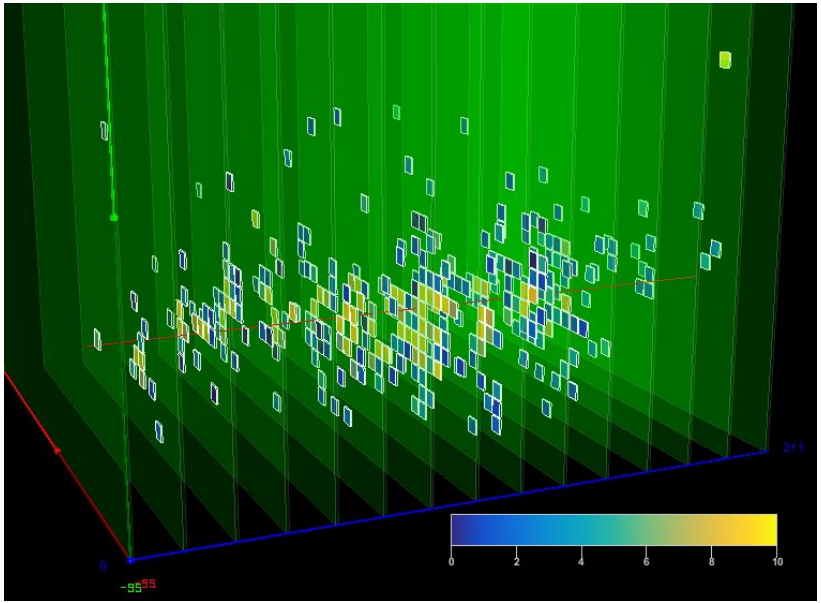


Fig. Reconstructed e- 40 GeV
N Hits: 323, Sum E: 2544 MIPs

Event Display

Simulation

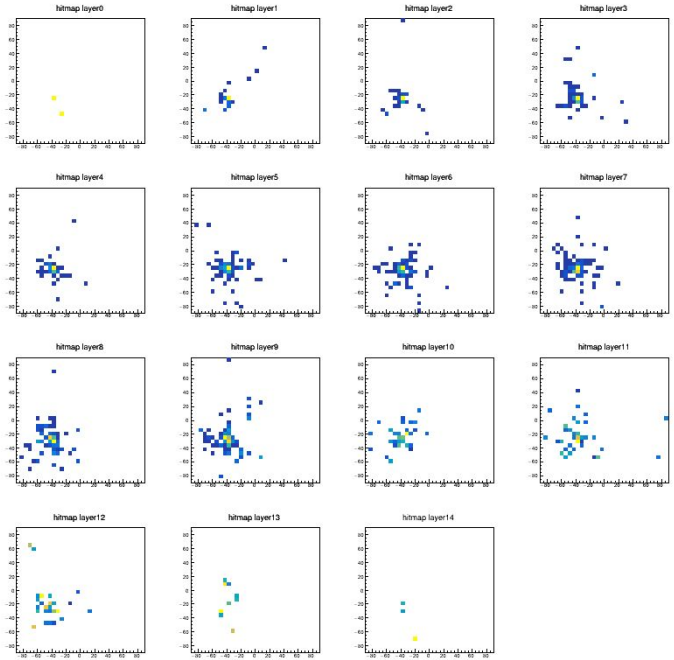


Fig. Simulation e- 40 GeV

Electron (Good)

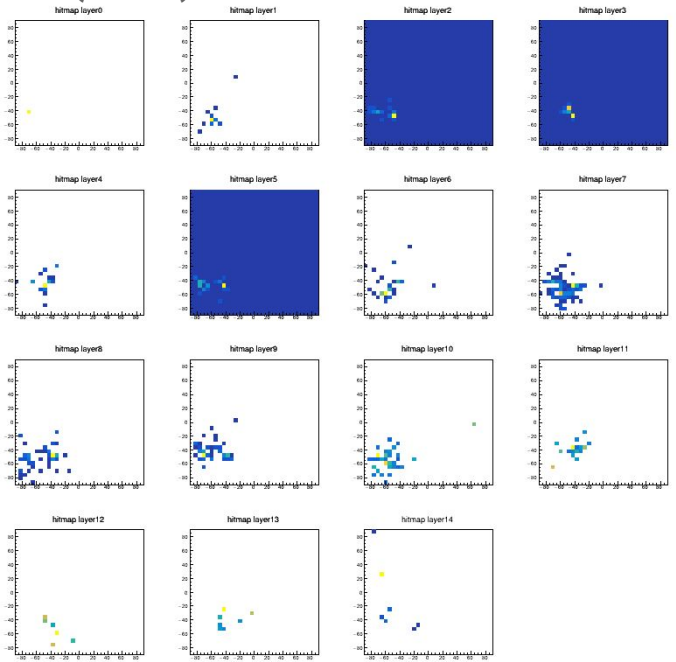


Fig. Reconstructed e- 40 GeV

Event Display

Electron (Bad)

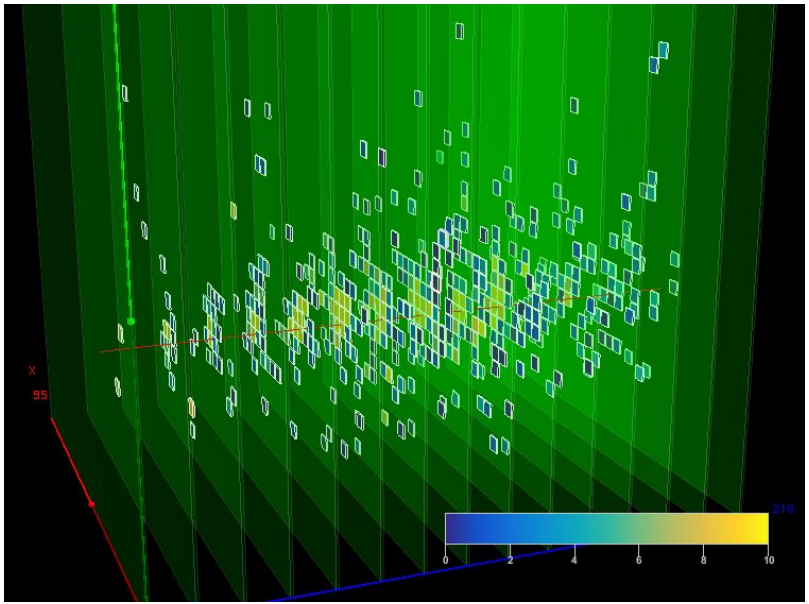


Fig. Simulation e- 40 GeV
N Hits: 458, Sum E: 2789 MIPs

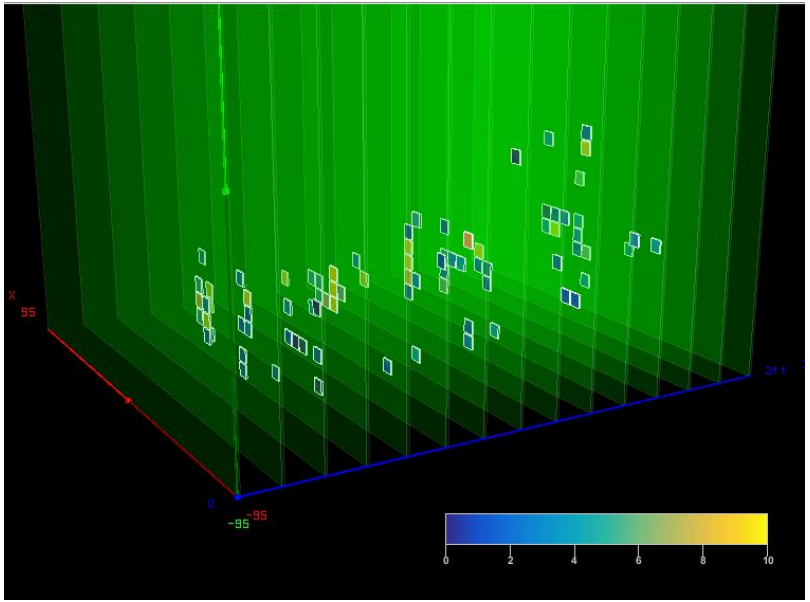


Fig. Reconstructed e- 40 GeV
N Hits: 82, Sum E: 782 MIPs

Event Display

Simulation

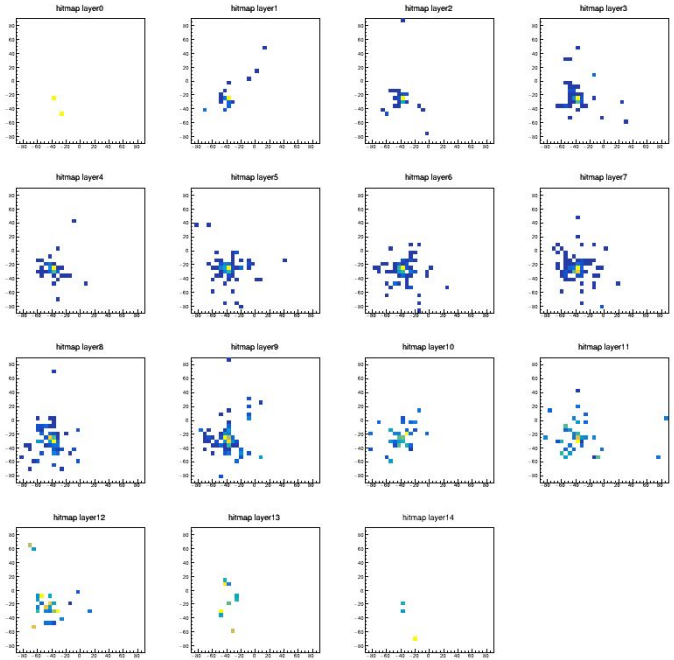


Fig. Simulation e- 40 GeV

Electron (Bad)

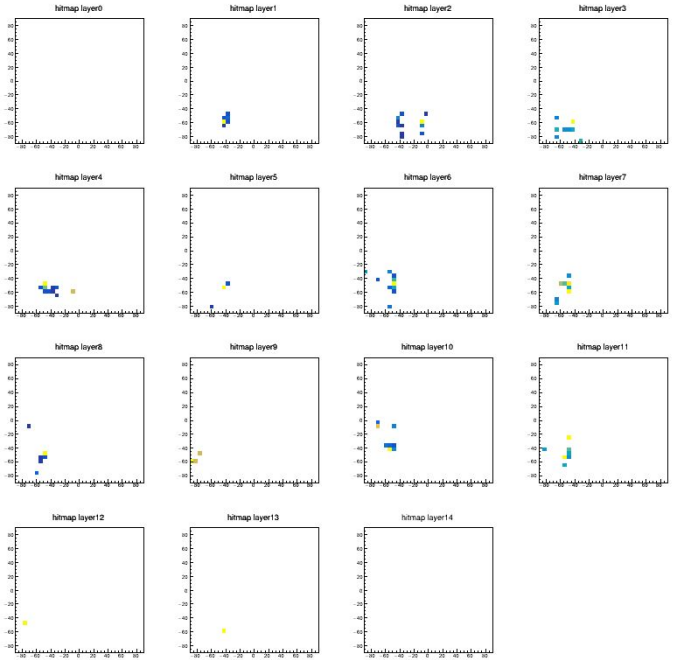
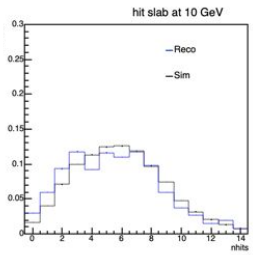
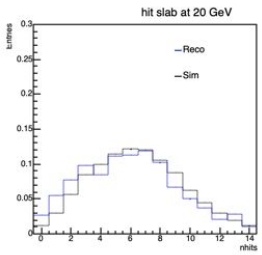
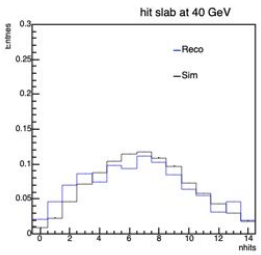


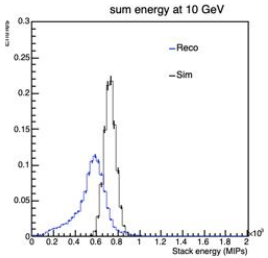
Fig. Reconstructed e- 40 GeV

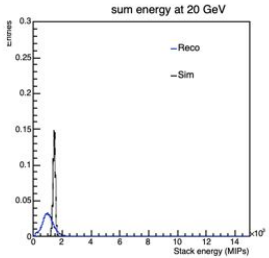
Simulation vs. Reconstruction

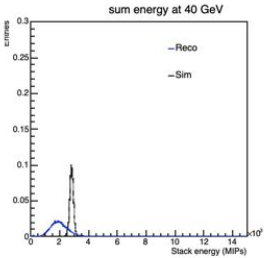


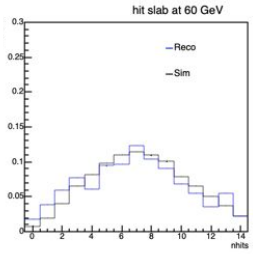


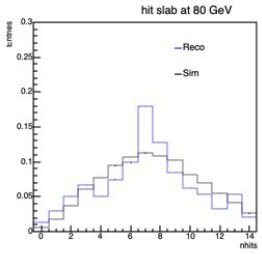


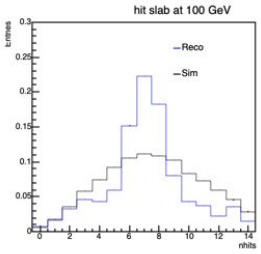


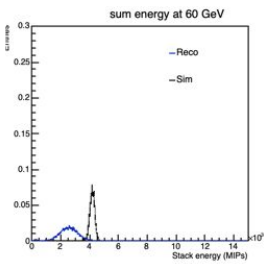


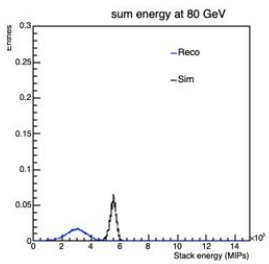


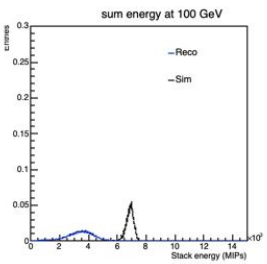


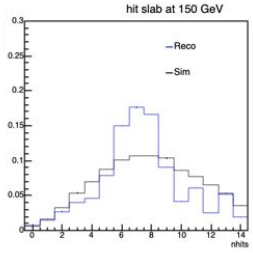


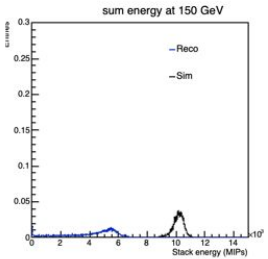






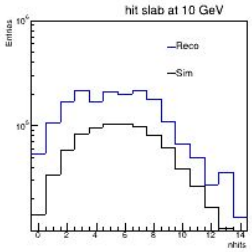


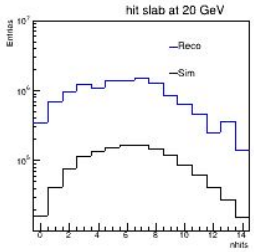


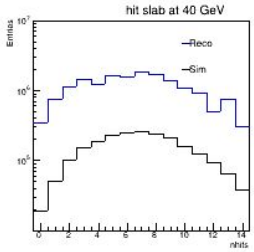


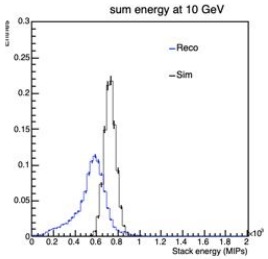
Normalized to the number of entries

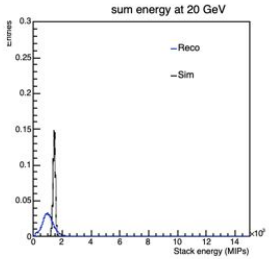
Simulation vs. Reconstruction

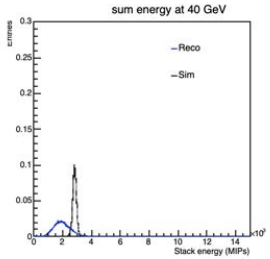


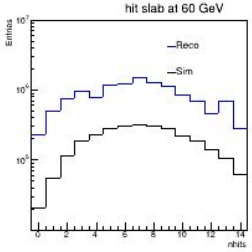


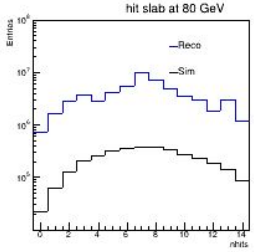


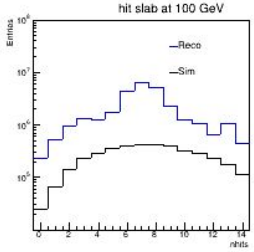


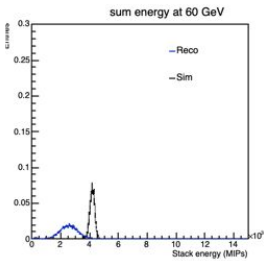


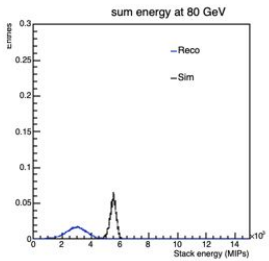


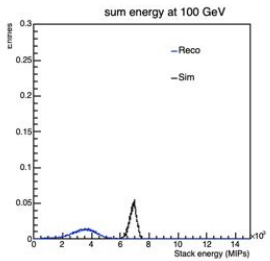


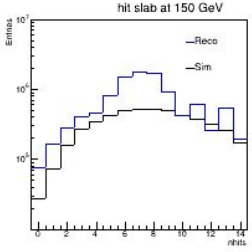


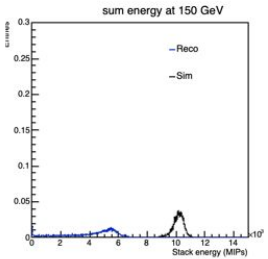






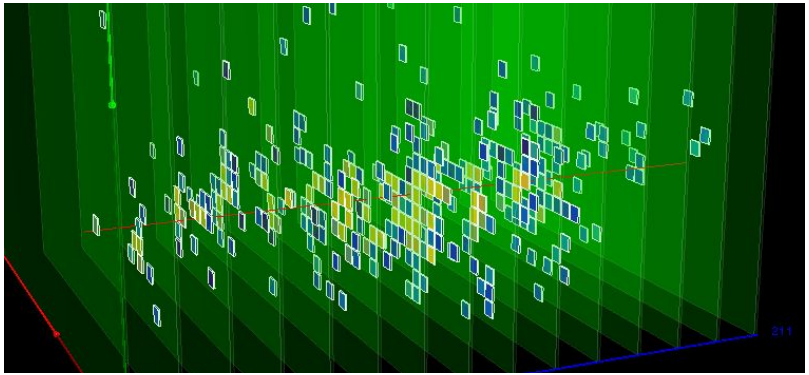




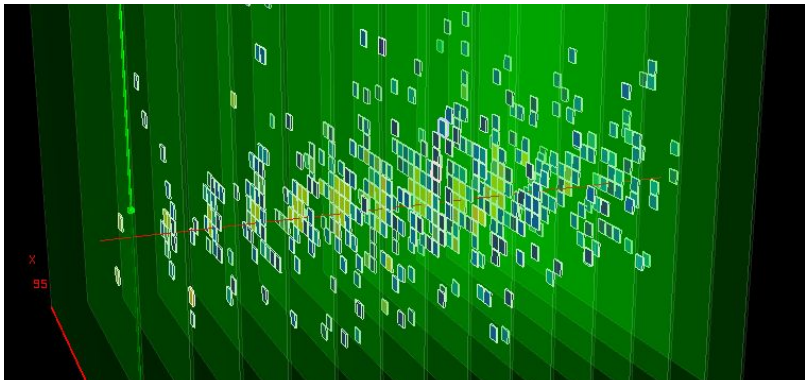


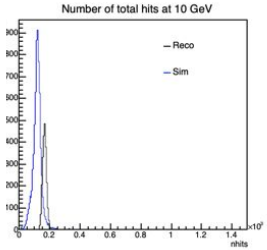
of Hits

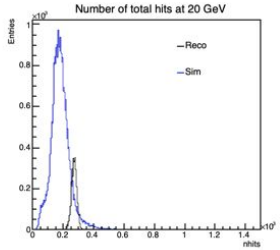
Reconstruction

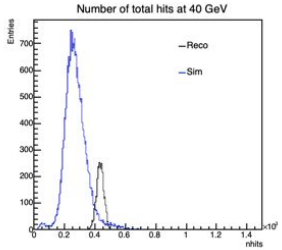


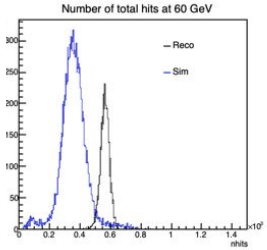
Simulation

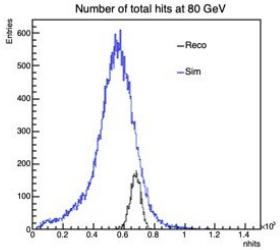


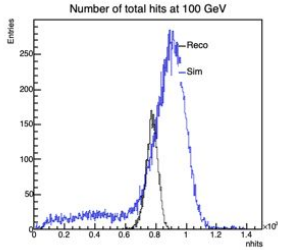


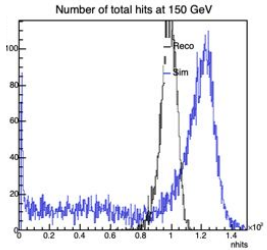




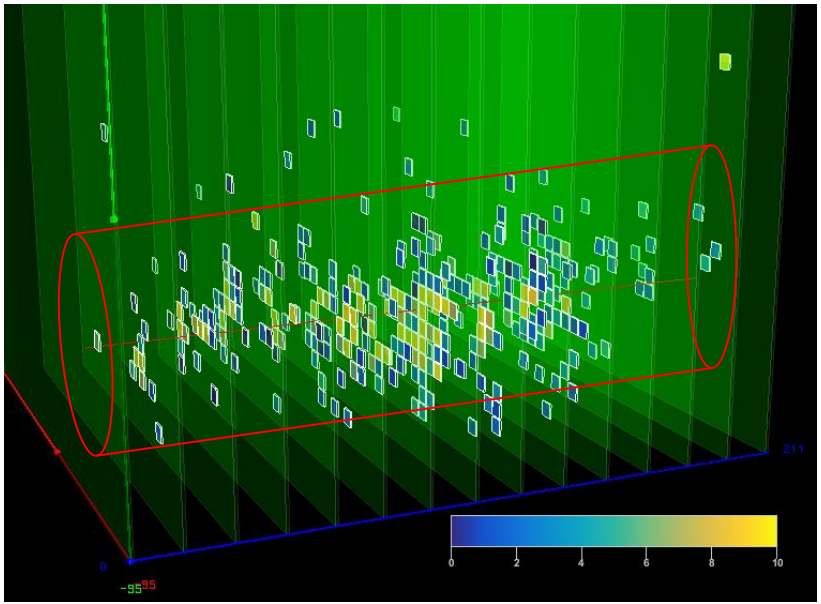


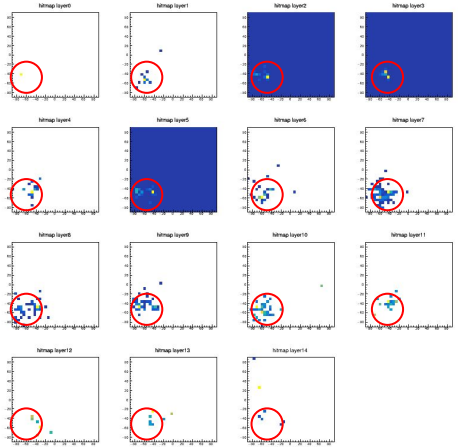






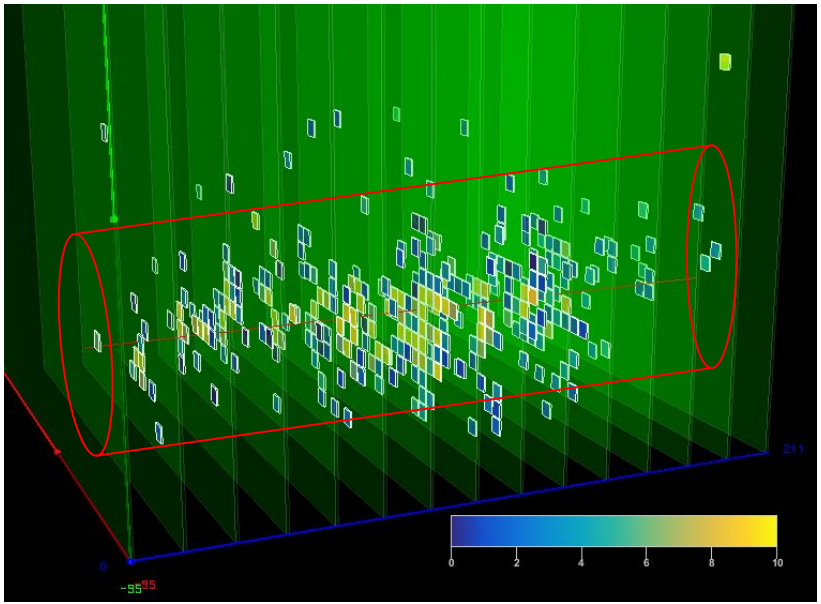
Sum Energy

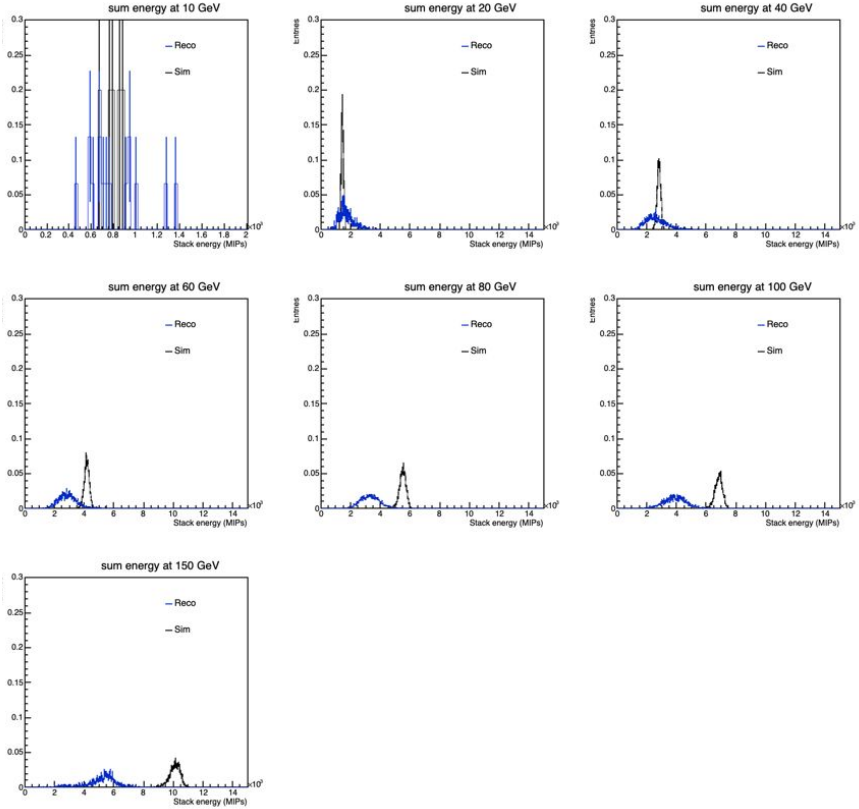




- Calculate the 2D mean and standard deviation of hits in each slab.
- Apply cuts to each parameters (±25mm radius around the beam axis)
- At least 5 slab should satisfy the cut

Sum Energy




sum energy at 10 GeV
sum energy at 20 GeV
sum energy at 40 GeV
sum energy at 60 GeV
sum energy at 80 GeV
sum energy at 100 GeV
sum energy at 150 GeV
Reco
Sim
Stack energy (MIPs)

Summary & Prospects

Summary

- CERN-TB-2022-06
- Reconstruction of energy
  - Lack in # of hits
  - Low average hit energy
  - High SCA entries
- Focus on each energies
- Can we achieve better resolution?

Prospects

- Include more BCIDs upon merger?
- Simulation with maskings
- Use of different data samples
- Work on LCIO framework
  - work with Hector
- Usage of GNN or MVA tools

(IDEAS)

General Information

Data Management

- **Test Beam Data Storage**
  - Currently under the EOS space at LXPLUS
    - Location: /eos/project-s/siw-ecal
  - also on the local disk
  - Lacks **redundancy** and **availability**
  - “Putting all eggs in a single basket”
- **GRID Storage Elements**
  - Secure and solid
  - Easy to create replica to another server
  - Compatible with the grid computation
  - Standard for data storage in HEP experiments

Data Management

- **GRID Storage Elements**
  - The storage was stopped after 2012.
  - Could we continue and renew this framework?
- **Plan**
  - Copy (not move) and upload the current raw TB data.
  - Make a replica for multiple SEs
    - IN2P3-SRM (available)
    - KEK-SRM (blocked)
    - CERN-SRM (blocked)

```
2012-01-31 12:00:37 tb-MCProduction
2011-09-21 14:48:21 tb-cern
2012-01-31 12:00:37 tb-desy
2020-06-18 08:05:02 tb-desy-siw-2012
2012-01-31 12:00:38 tb-fnal
```