The result of low energy beam data in semi-digital hadron calorimeter

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Outline

- Introduction to low energy beam data

- Event selection

    - Muon rejection

    - Electron background check & rejection

- resolution

- Conclusion

Low energy beam data analysis

- Data samples were taken at PS, May 2015

- Energy : 3, 4, 5, 6, 7, 8, 9, 10, 11

- Contamination : muons , electrons(since using electron eliminator in test beam period, the electron contamination is negligible except 3-5GeV samples)
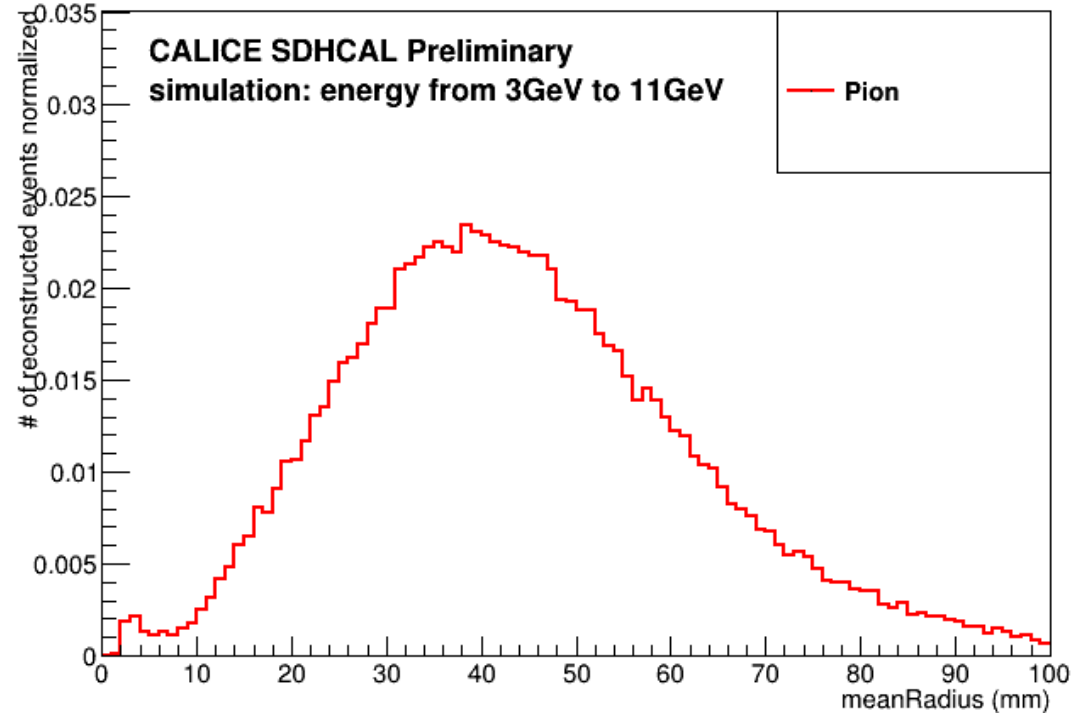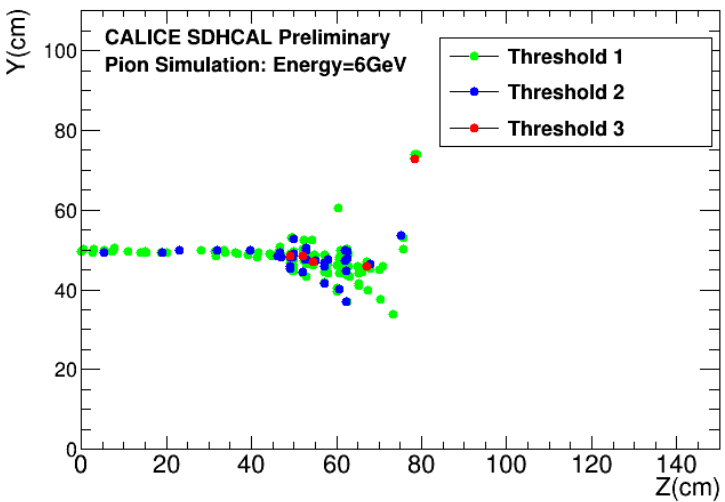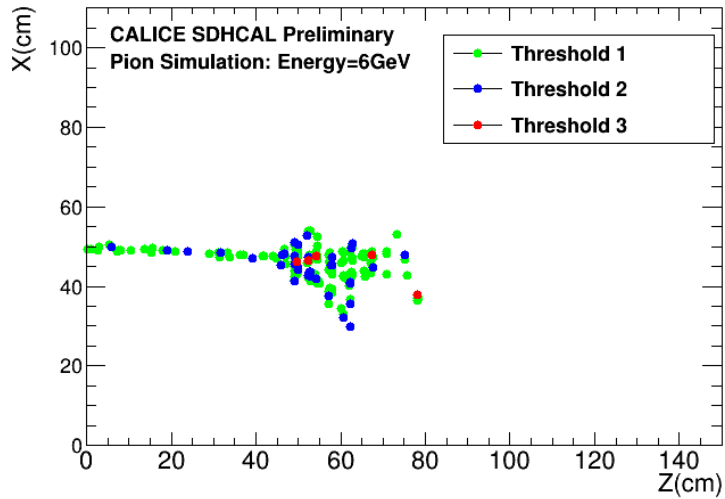
- Simulation: FTF_BIC , geant4.9.6

Muon background rejection

MeanRadius of muon track
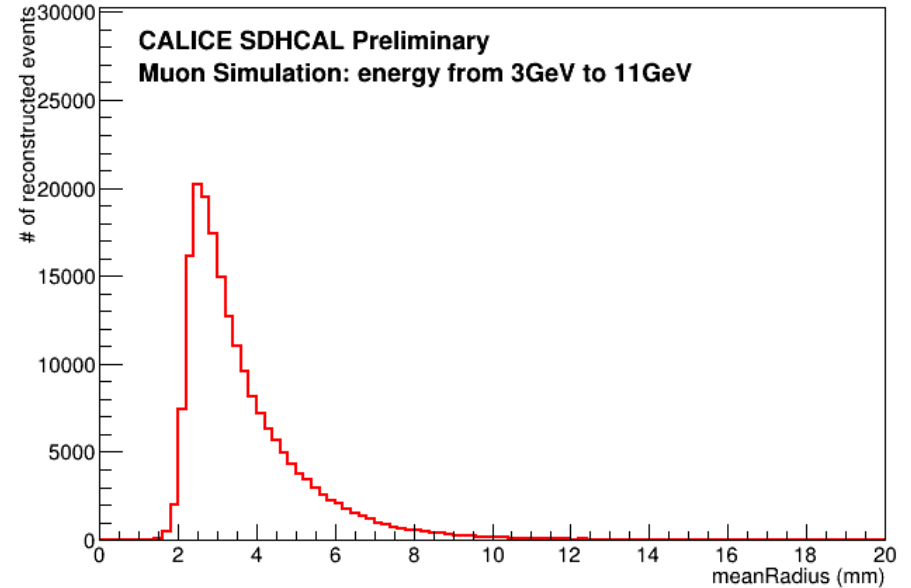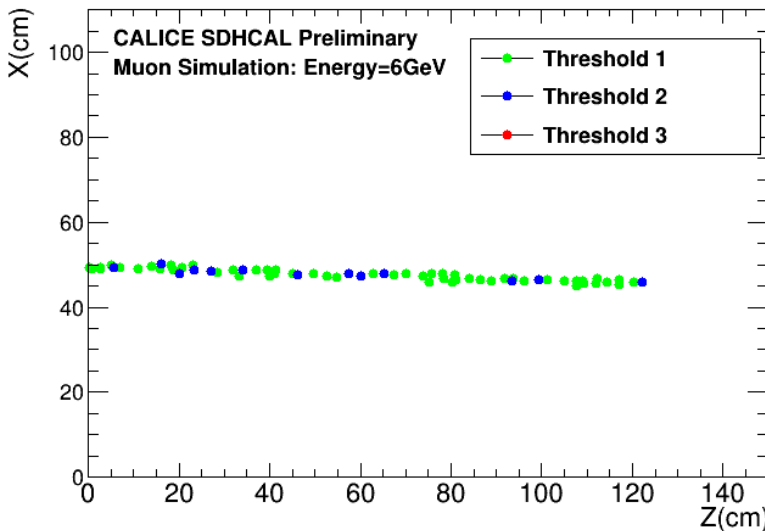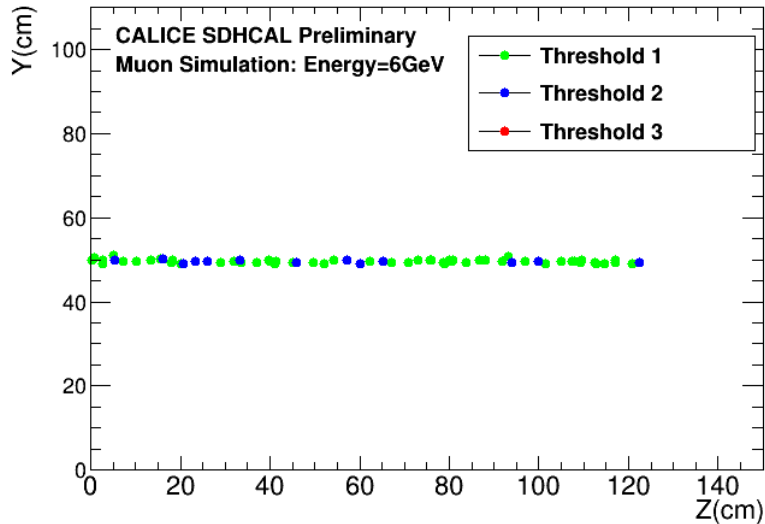
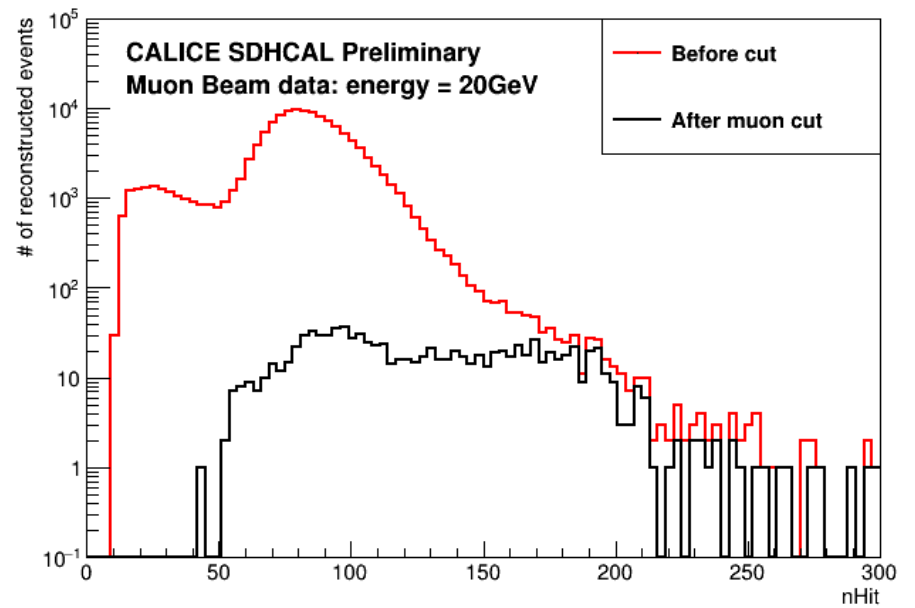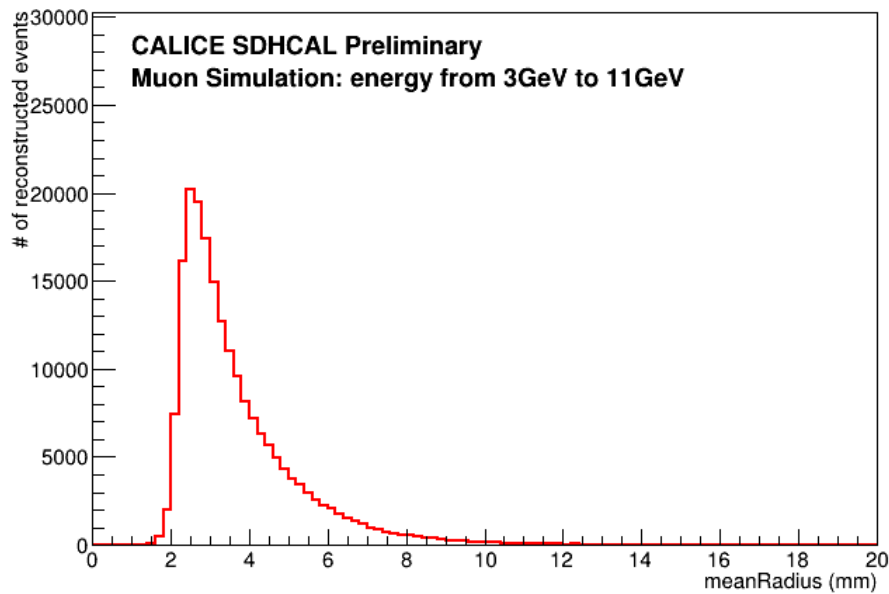The shower radius is very small < 15mm(≈1.5pad size)

MeanRadius of pion shower

Larger shower radius than muon

Event selection:muon rejection
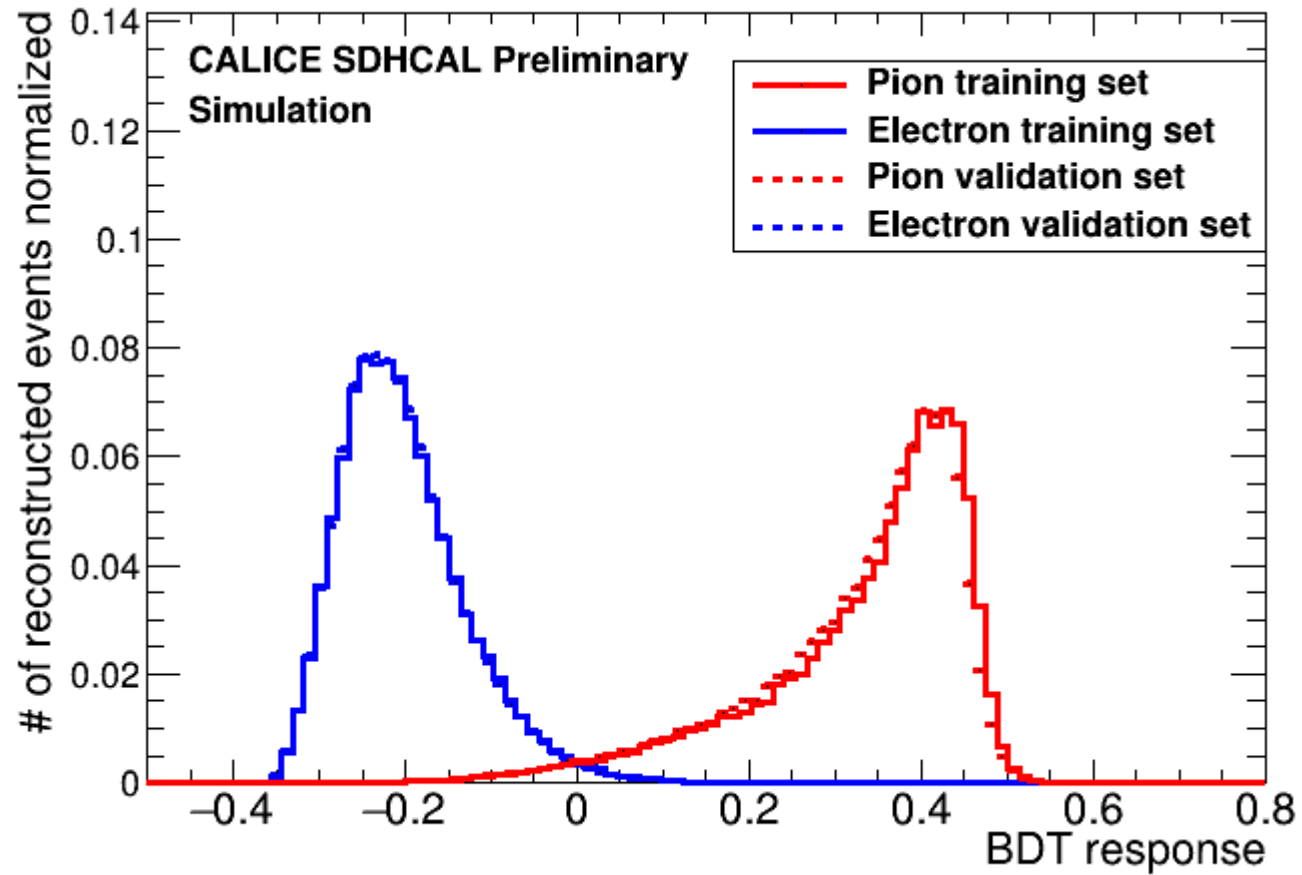
MeanRadius > 15mm

Muon beam data validation
99% background rejection rate
achieved

Electron background

- Method: BDT

- Training set:
  - Electron 1-12GeV, 10000 events per GeV
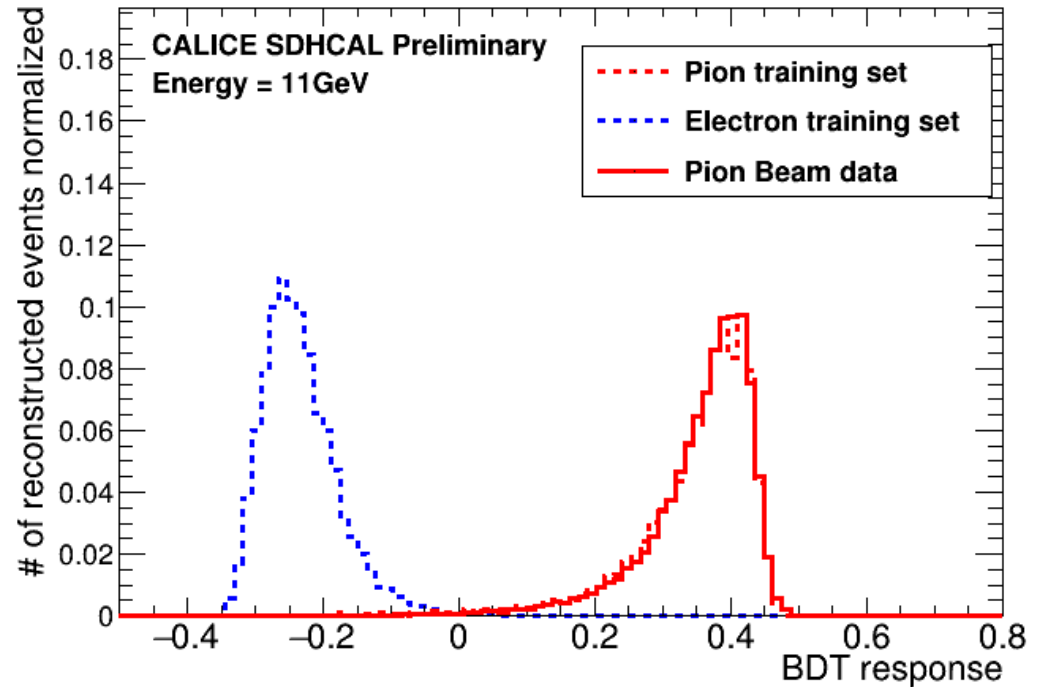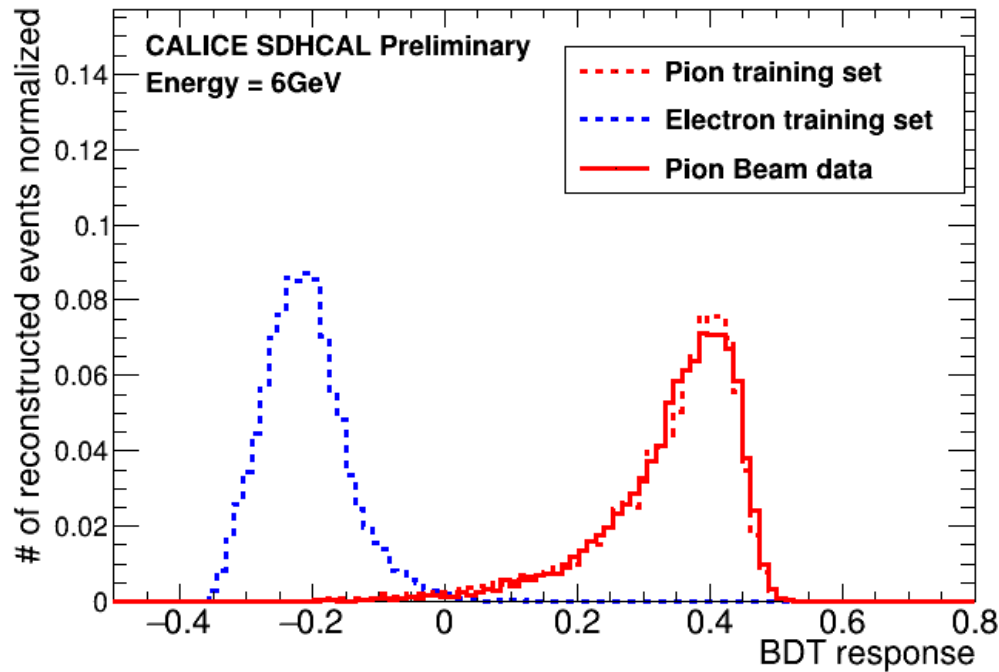 - Pion 1-12GeV, 10000 events per GeV
- Test set: the same size

- Input variables:nTrack, nCluster, radius, nHit/nLayer, density,
- nHit3/nLayer, nShower layer/nLayer, nHough/nHit

Model Performance

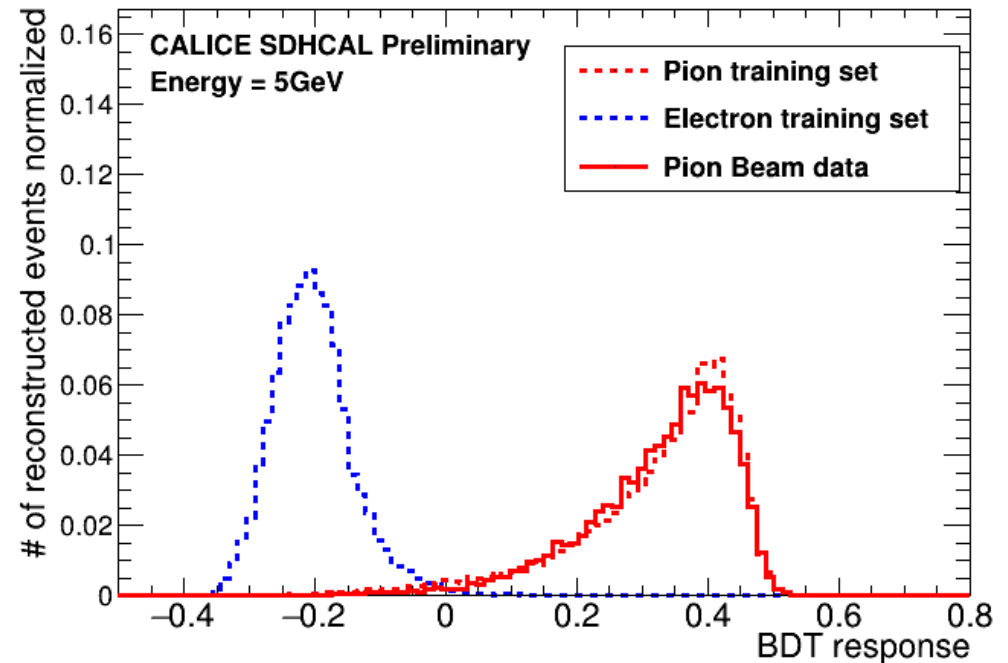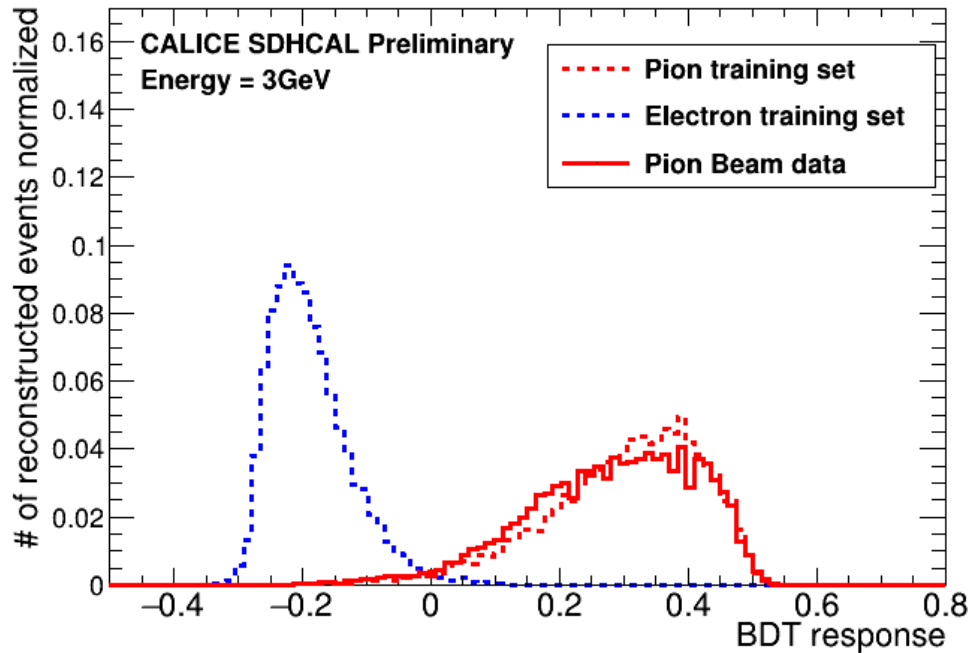

The model is reliable

Pion beam validation for 6-11GeV

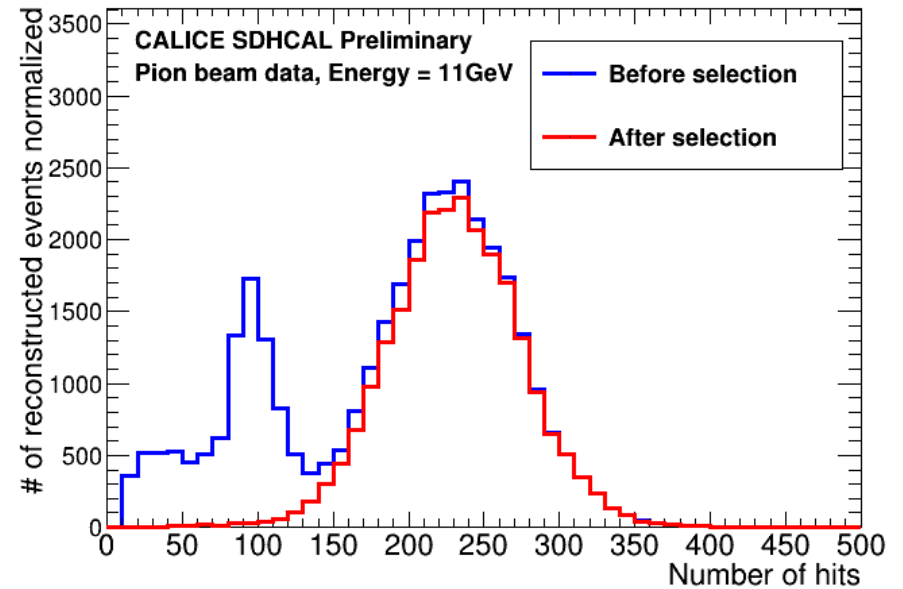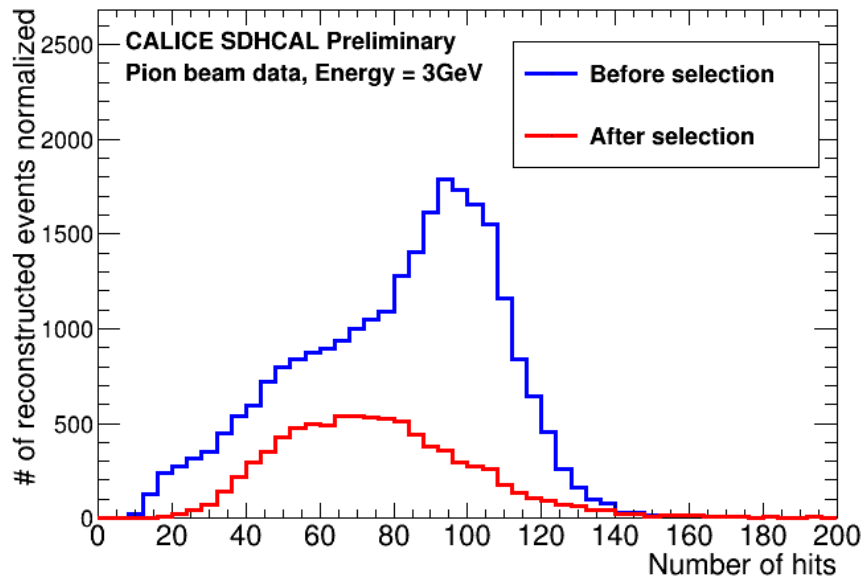We know there is no electron for 6-11GeV pion beam. These two results confirm it.

The model reliable.
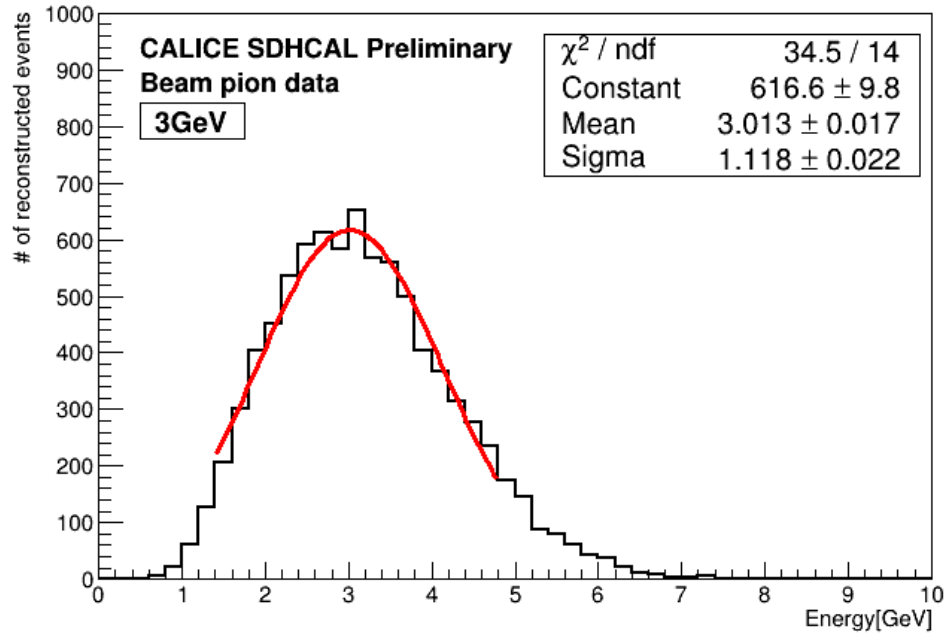
Electron check for pion beam 3-5GeV

The electron contamination is negligible. Applying BDT value cut > 0.0 is enough to reject electron-like events

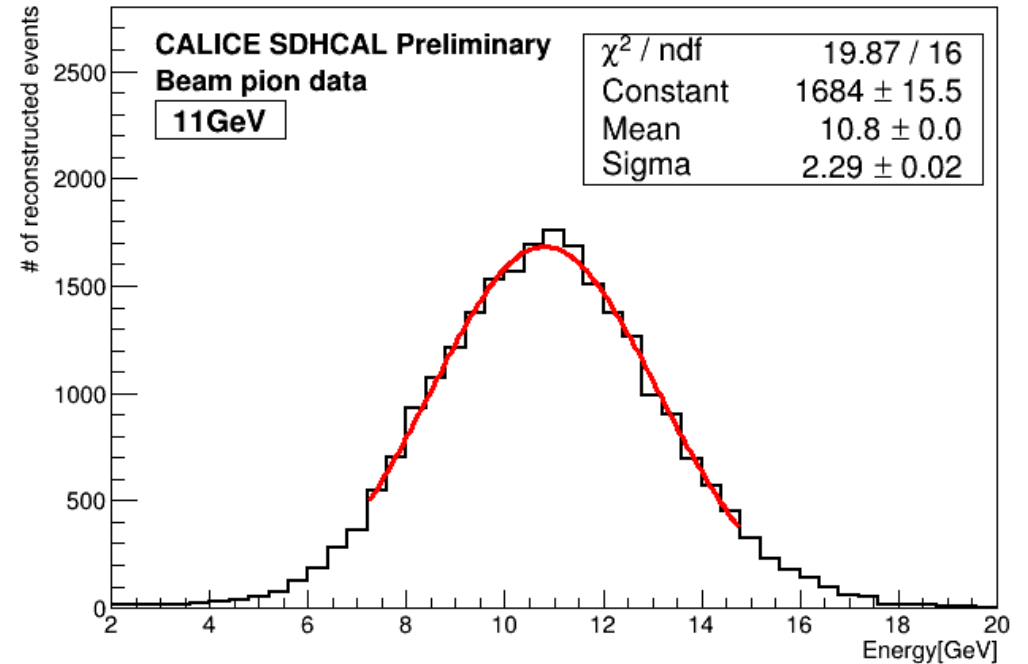# Apply the muon rejection and electron rejection

The number of hits before and after selection
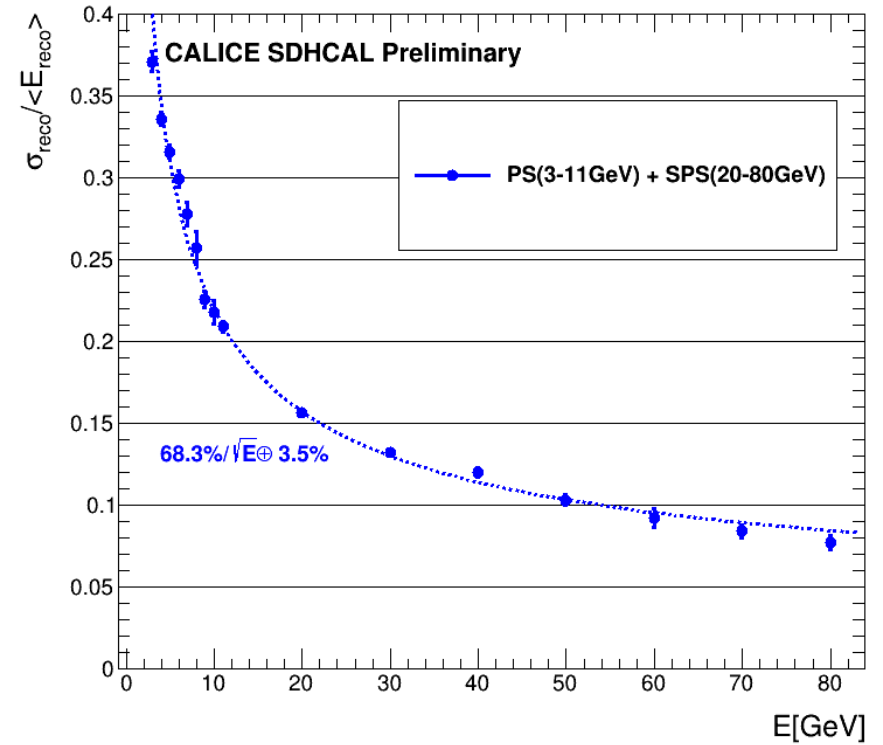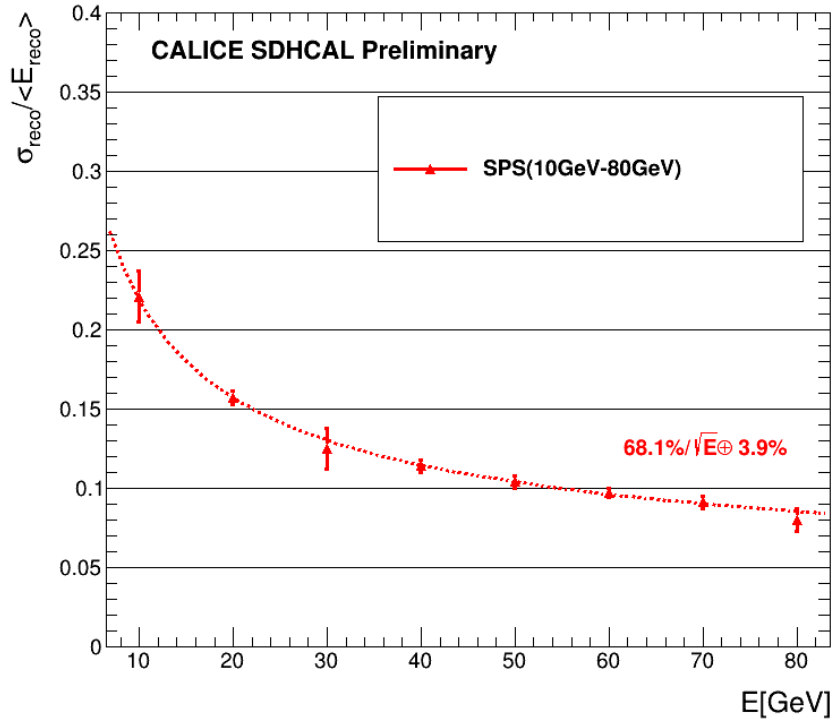
Energy reconstruction

Fitting range 1.65σ

Fitting range 1.65σ

resolution

Good agreement with SPS data taken at 2015 October

Conclusions & Next

- The cut based on MeanRadius can easily remove the muon background

- The BDT model is robust and it can separate electron and pion of low energy beam data

- The resolution of low energy beam data has a good agreement with SPS data.

- Continue to write the analysis note