Progress on TB analysis

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Introduction

After achieving reasonable agreement DATA/MC for SPS TB data, try to extract resolution with help of simulation

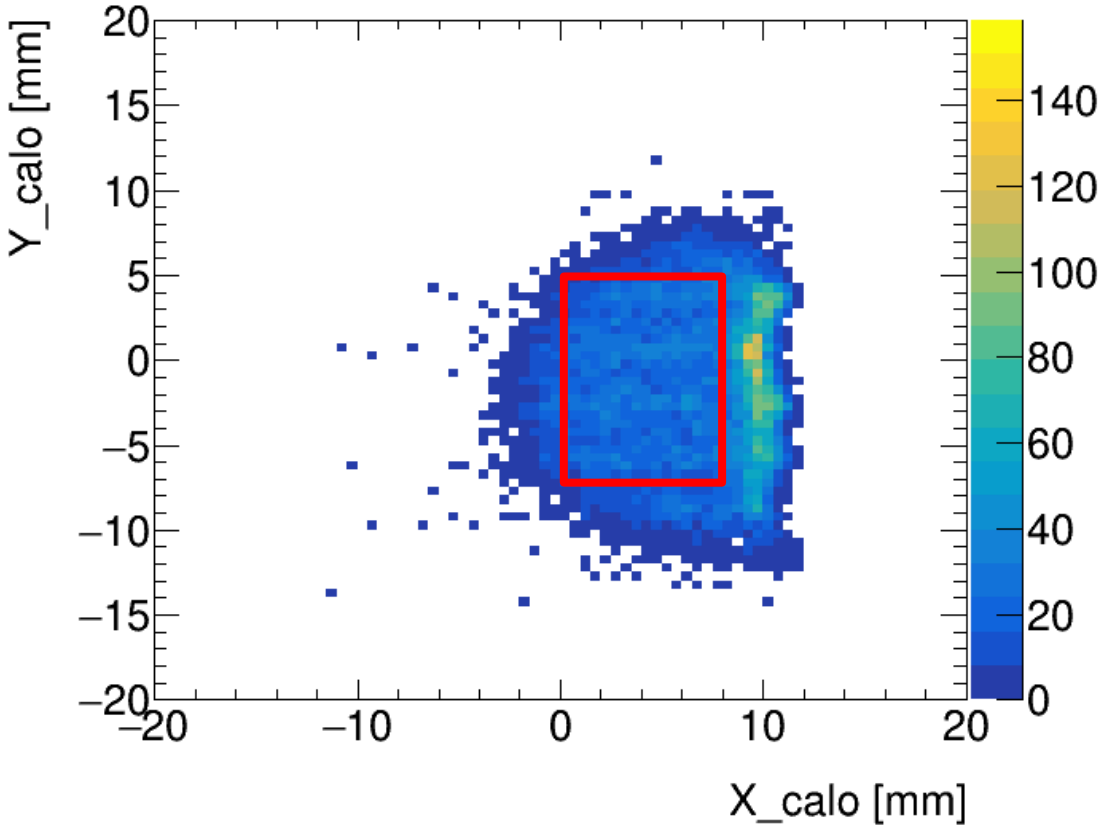
- Define algorithm for extracting energy measurement on single 20 GeV run without preshower
- For runs with preshower: select events with only 1 mip in preshower, and calculate linearity and resolution

  Only three energies workable: 10,20 and 30 GeV
- Compare with MC

Procedure

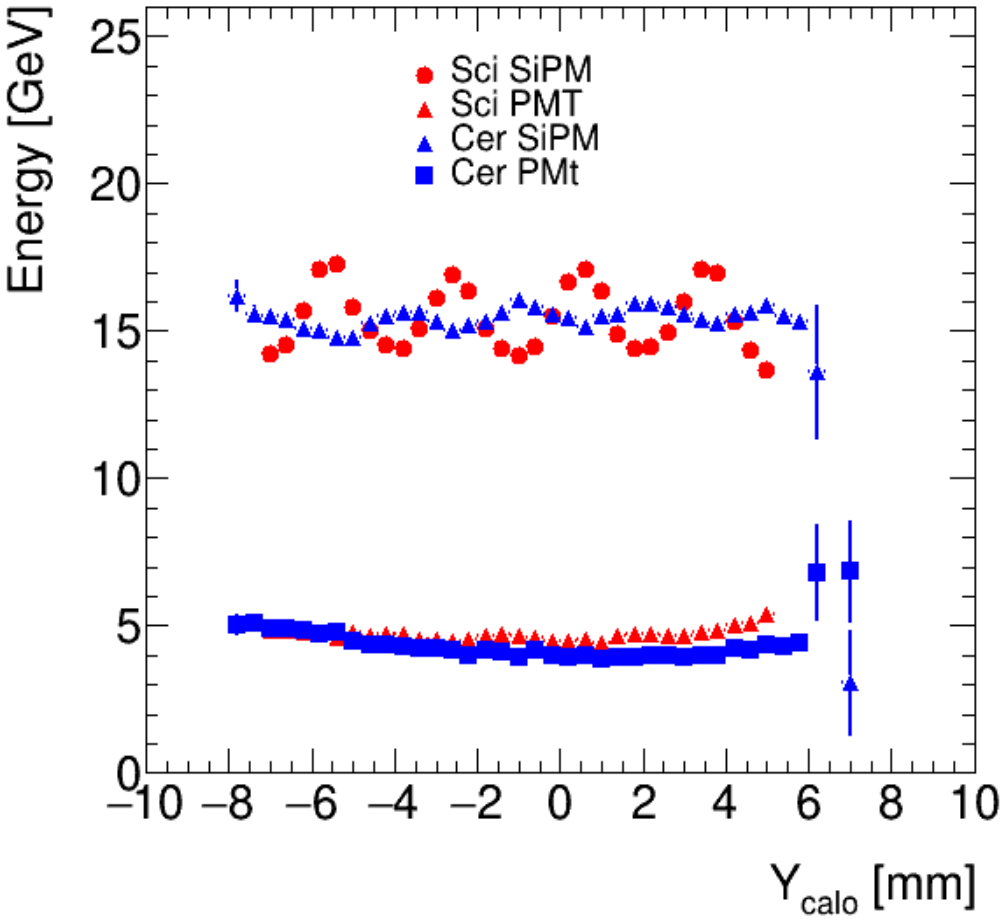
- Perform equalisation on run without preshower (20 GeV)
- Define fiducial based on sci barycenter in SiPMs
- For that fiducial calculate 3 numbers in MC
  - Energy in cell 0 (E_0)
  - Energy in surrounding 8 cells ($E_{(1,8)}$)
  - Leakage fraction f_{leak}
- Scale sum of energy in SiPM to E_0 (Sci and Cer separately)
- Same for sum energy in PMTs to $E_{(1,8)}$
- Divide the two performance regions:
  - In each region scale sum of Sci and Cer to E_0
  - Add PMT energy and scale by f_{leak}
- Use factors thus calculated for all energies

Fiducial



Ratio of energy deposition in cell 0 to total depends on the fiducial beam spot, so first step is fiducial

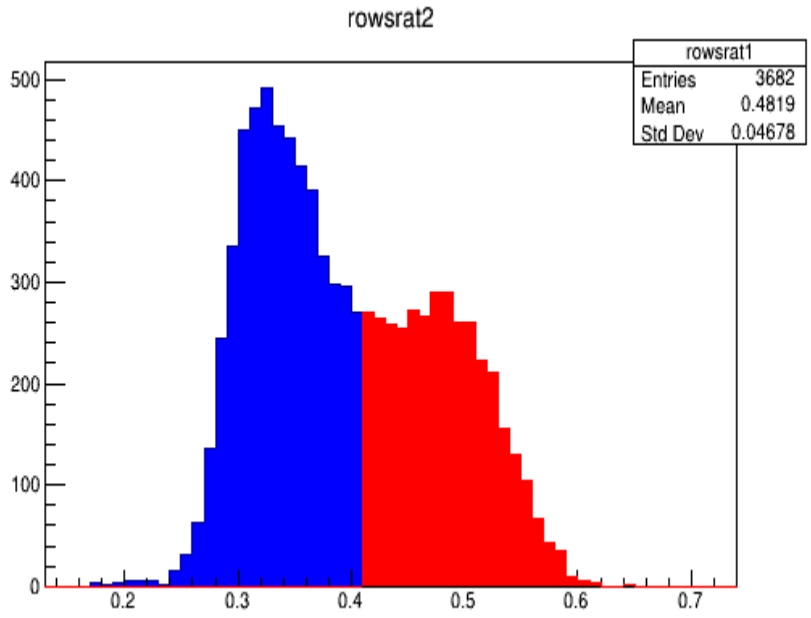
Variation of response



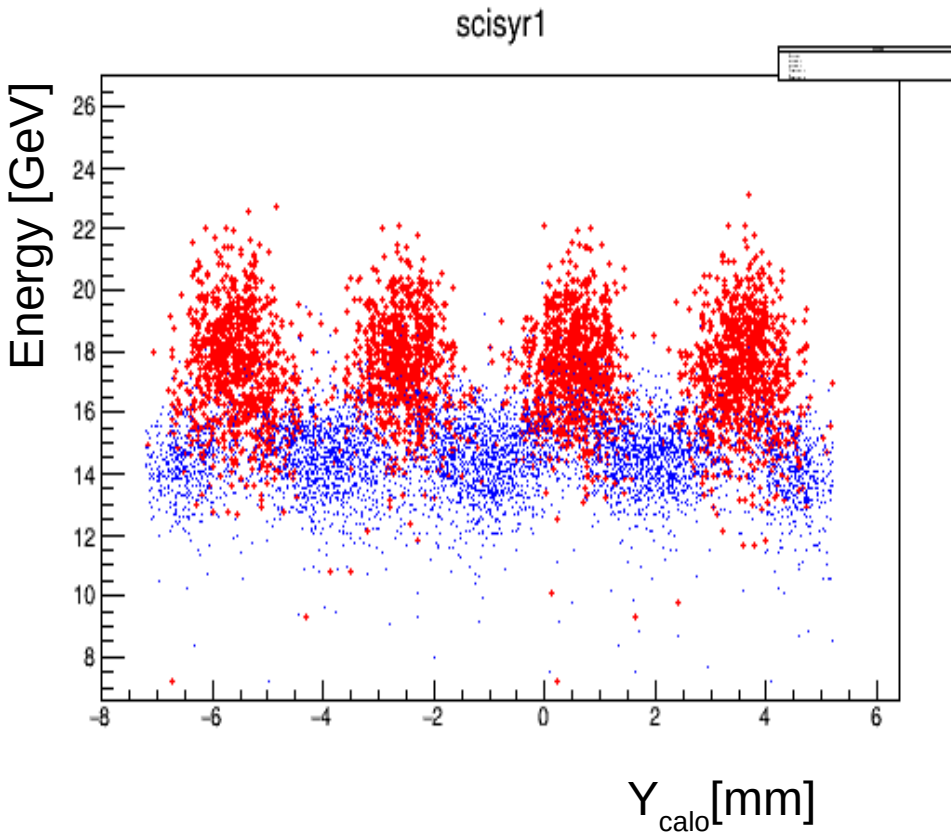
Periodic structure in Y in SiPM
Phase of Sci opposite to phase of Cer, but amplitude very different
→ only partial cancellation when summing them
No such structure in PMT

Need first to correct for variation in SiPM summing Cer and Sci, and then sum PMTs

Region definition



E^{row}_{max}/Etot



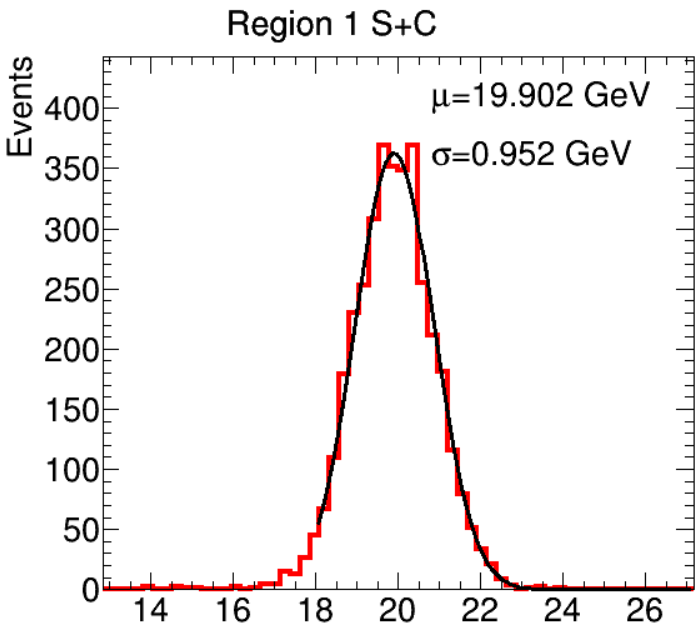
Y_{calo}[mm]

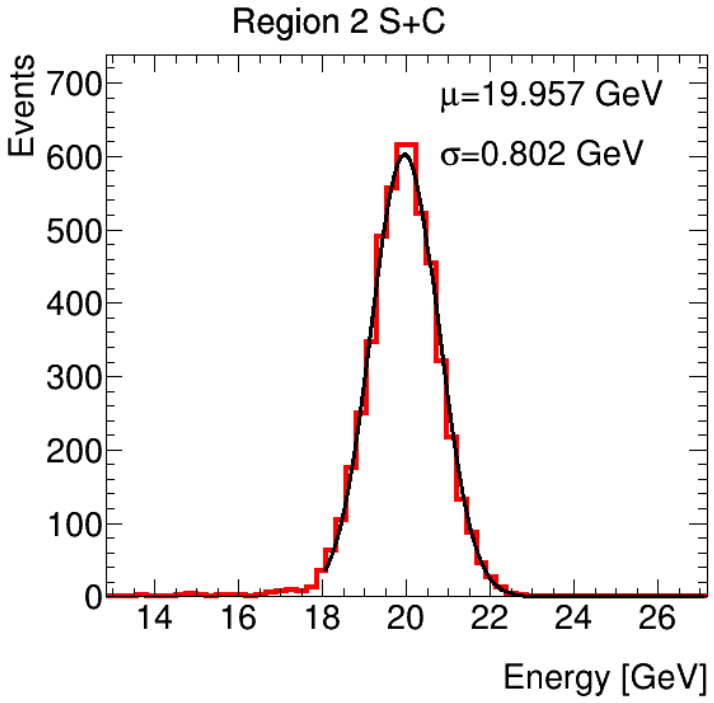
Calculate the ratio of the energy in the hottest scintillator row to the total energy

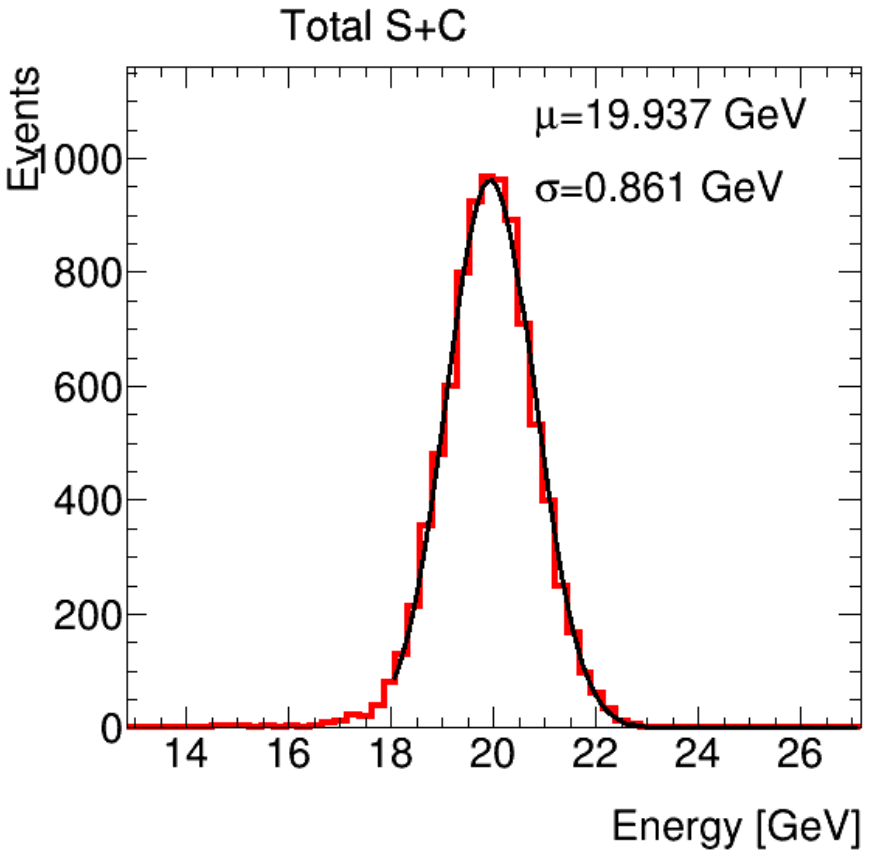
A cut at 0.41 separates well two regions of response

Resolution run 695

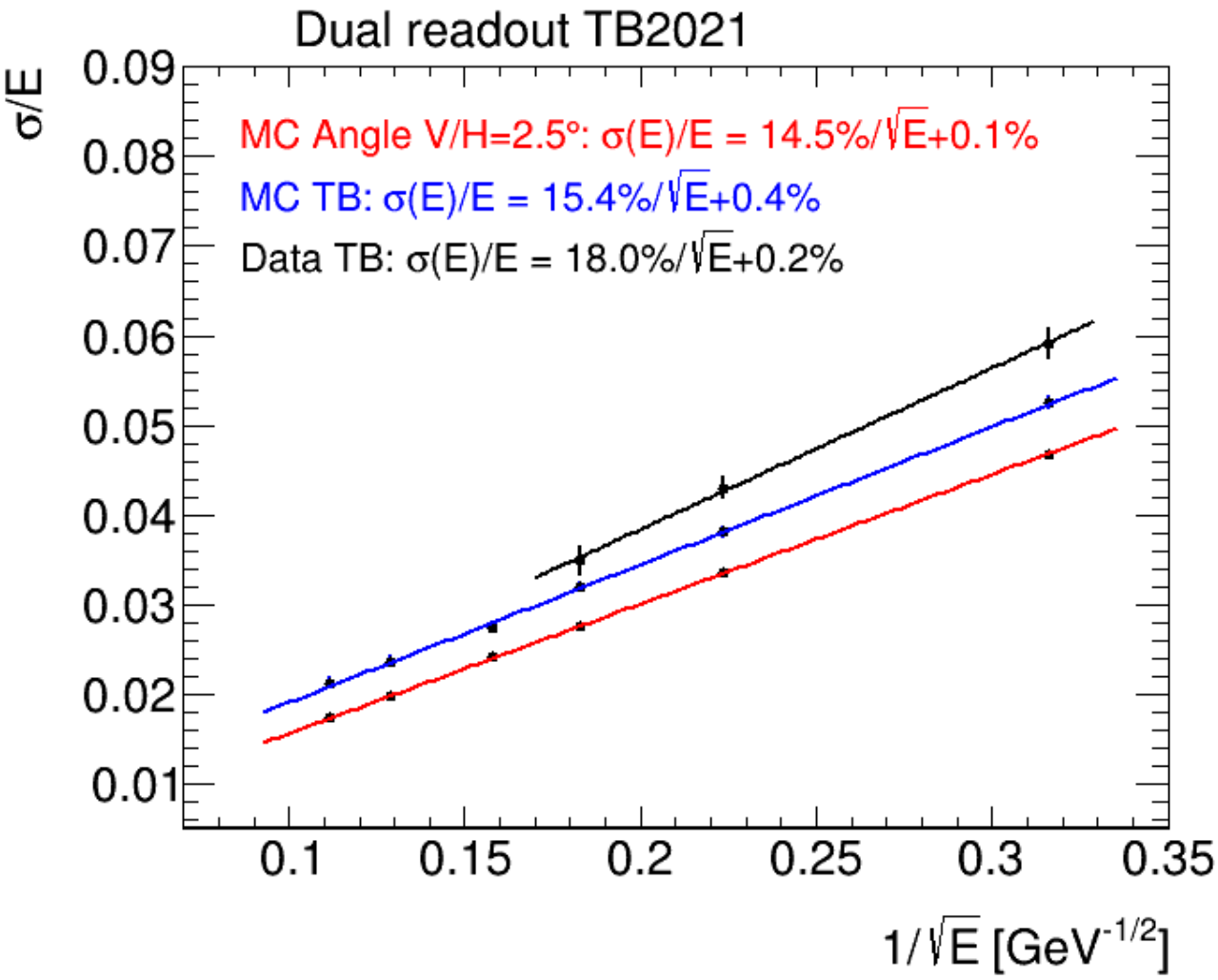
20 GeV No PS





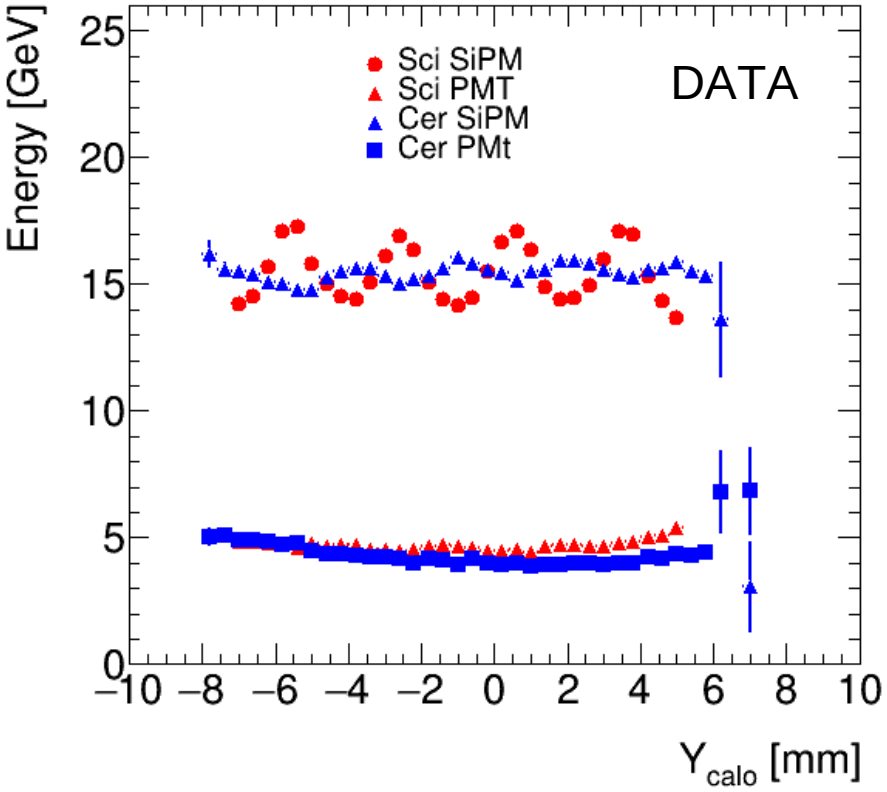


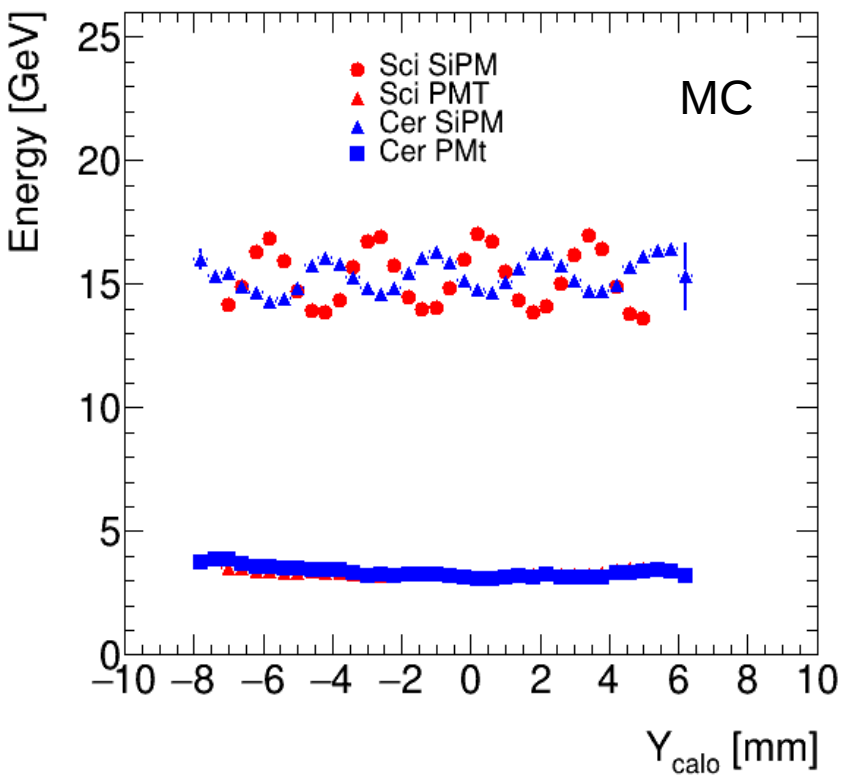
Results



MC yields better resolution than data

Variation in MC





Amplitude variation well reproduced for Scintillator

For Cerenkov much smaller variation in data → when summing

Sci+Cer MC is much more stable than data

Conclusions

First attempt at extracting resolution for events with only 1 mip in preshower, based on

- MC driven normalisation factors at 20 GeV
- 2-region separation on 20 GeV no PS run

18%/sqrt(E) resolution on tree available energy point

MonteCarlo has better performance

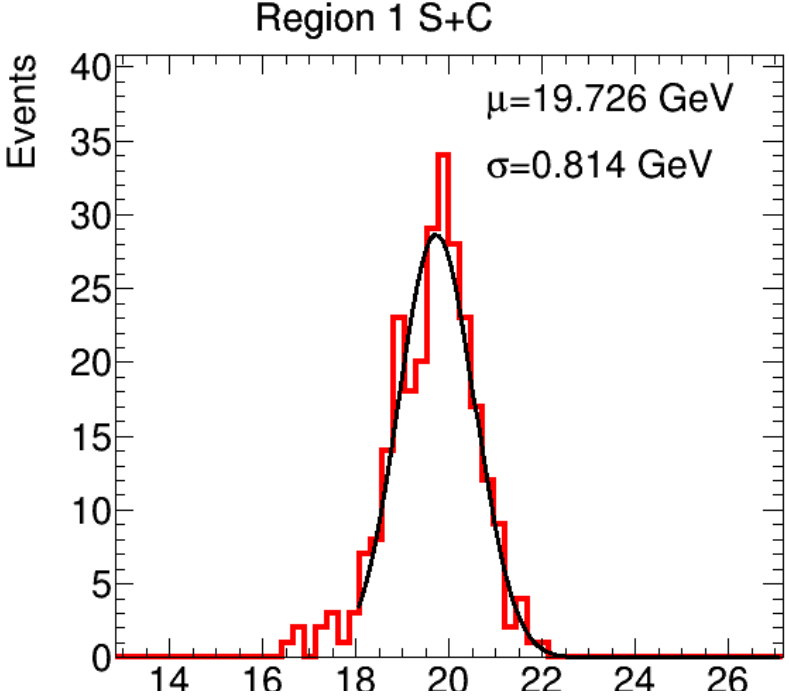
Next steps,

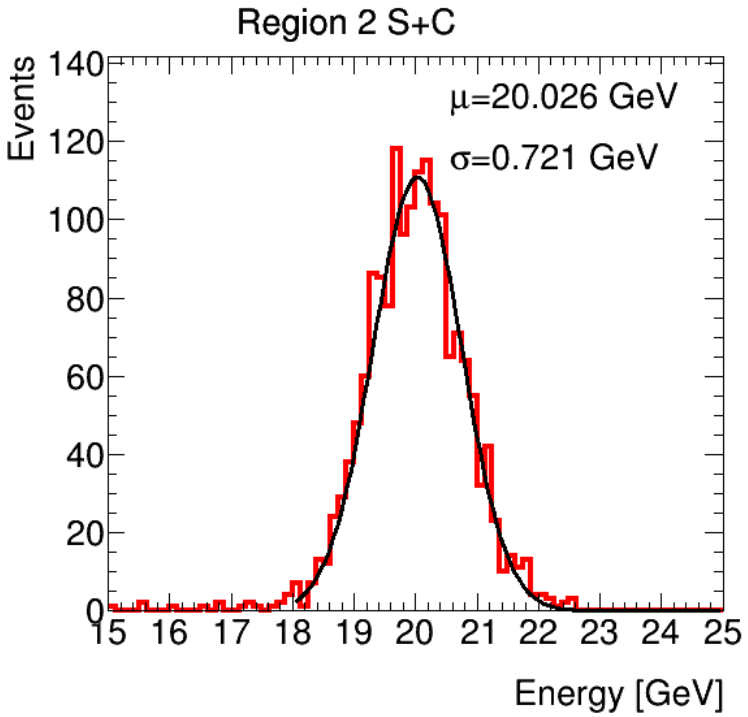
- try to improve performance by fully correctingfor modulation in response
- Try to understand why better performnce in MC

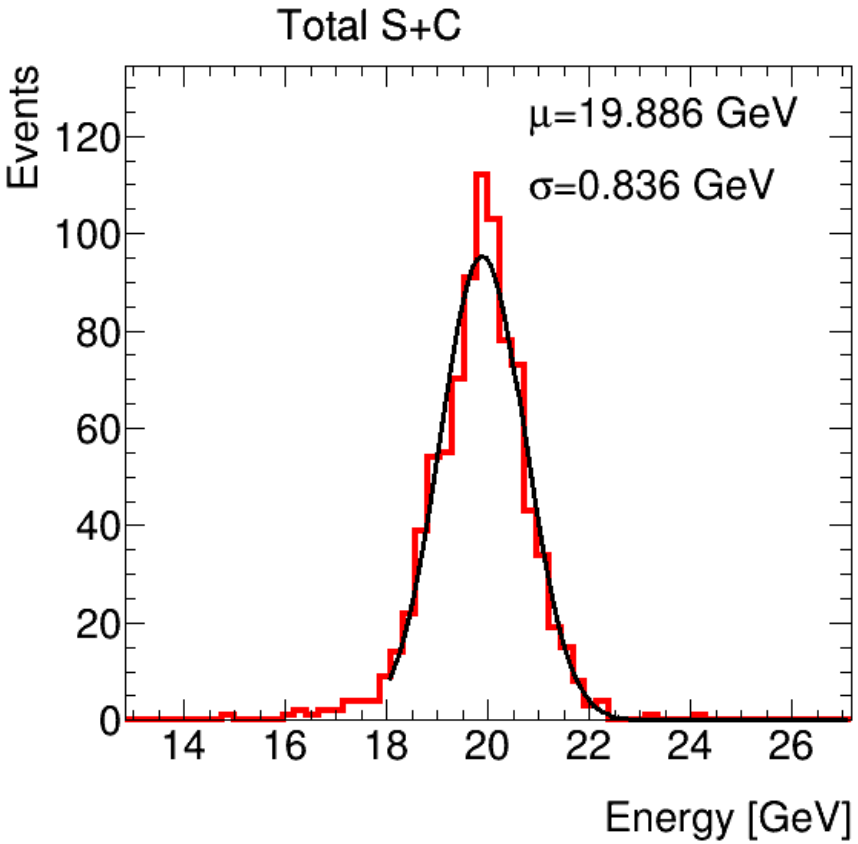
Backup

Resolution run 694

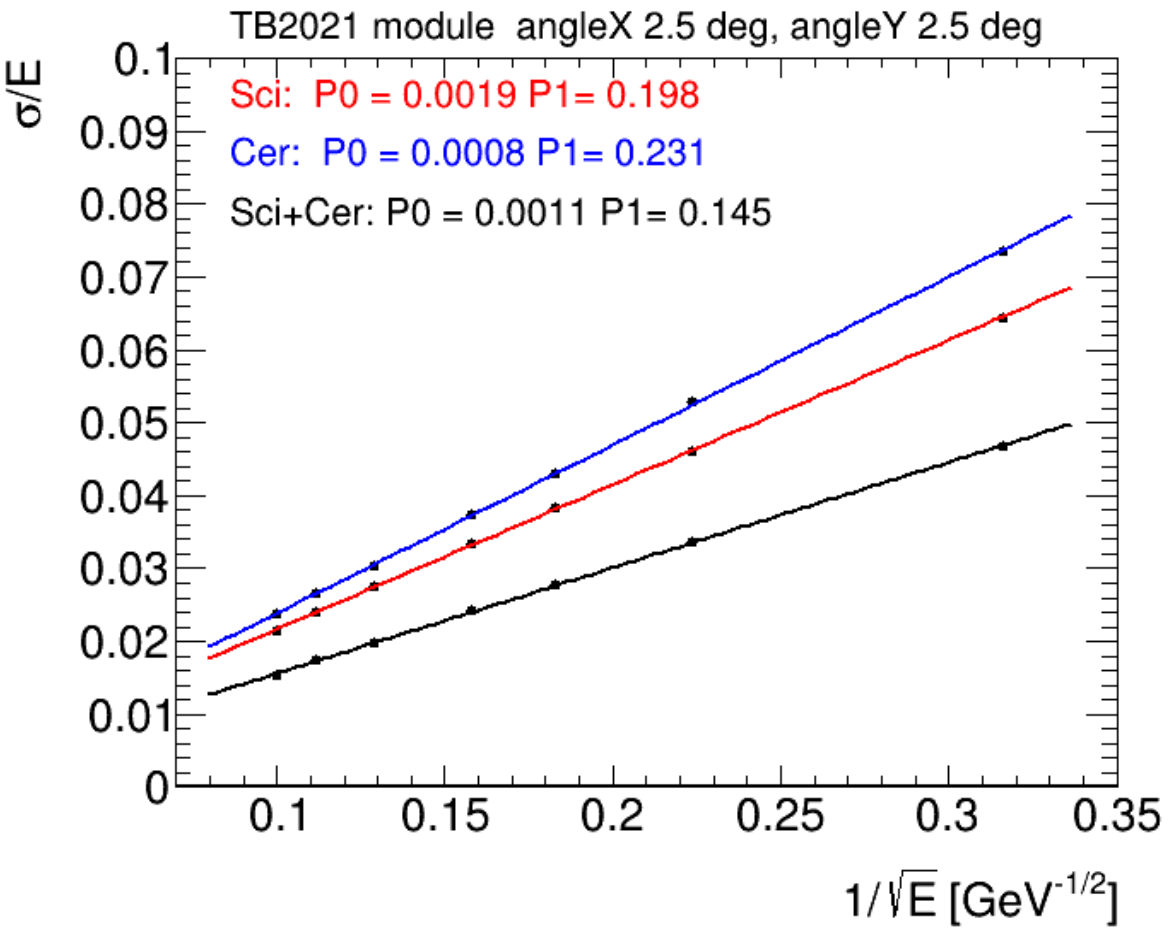
20 GeV PS 1 mip







EM resolution for TB2021 simulation with rotated calo



xrot=2.5 degrees

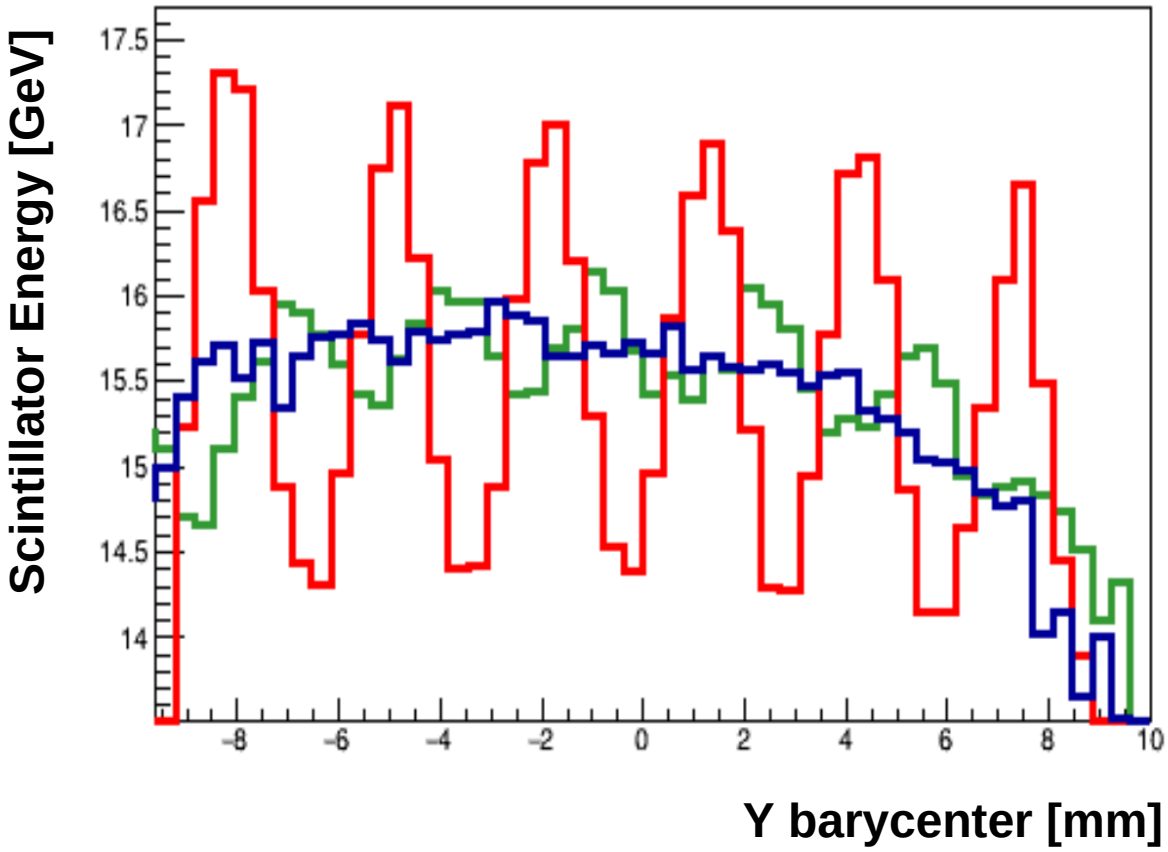
yrot=2.5 degrees

An EM resolution of 14.5%/sqrt(E) should be achievable with TB2021 module if all instrumental effects can be mastered

Definition of optimal beam angle in TB

On simulation:

angular scan round x and y axis looking for minimum angle in two directions yielding no modulation of response in x and y direction



xrot:

0 degrees

1.5 degrees

2.5 degrees