EMCal Testbeam Analysis Update 7/19

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- New fitting procedure
- Analysis of energy response by hodoscope cut
- Resolution with added 1/E term in fit

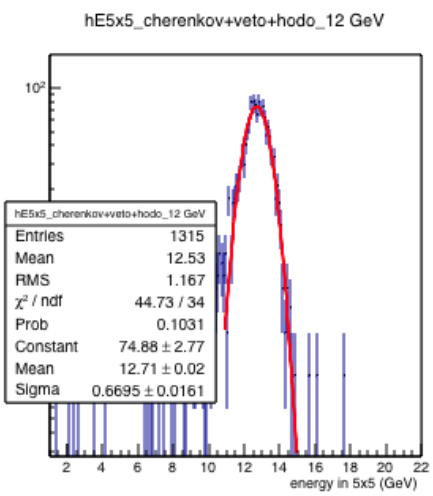
Runs Used

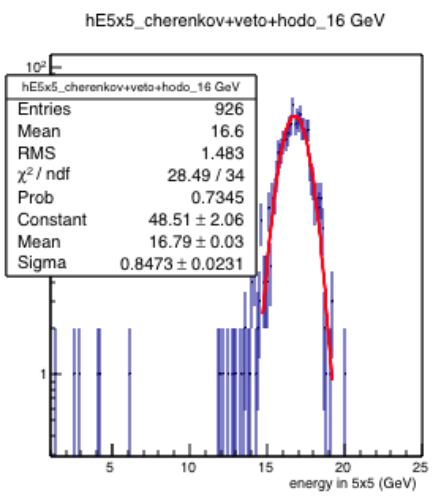
Energy	Run Number
1 GeV	2298
2 GeV	2268
3 GeV	2260
4 GeV	2253
6 GeV	2247
8 GeV	2295
12 GeV	2276
16 GeV	2280

Production used: Production_0428_MIP_set2_Cosmic

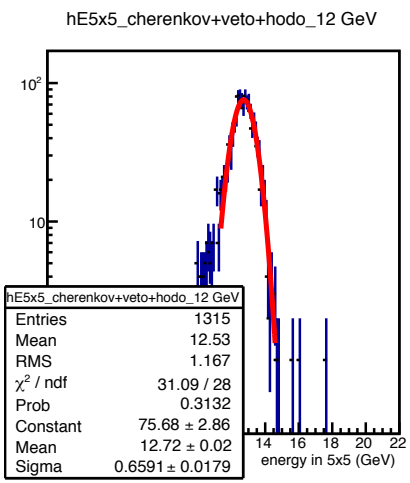
New Fitting of 5 by 5 Energy Distribution plots

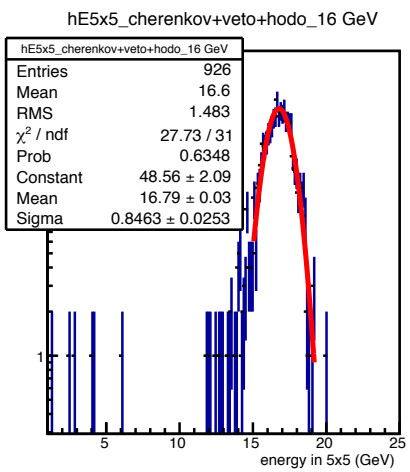
- Previously we were fitting by setting a specific fit range for each plot
- Now: fit once and use fit parameters to automatically create fit range
- New fit range is: mean-2*sigma to mean+2.8*sigma
  where mean is fit parameter 1 from original fit and sigma is fit parameter 2





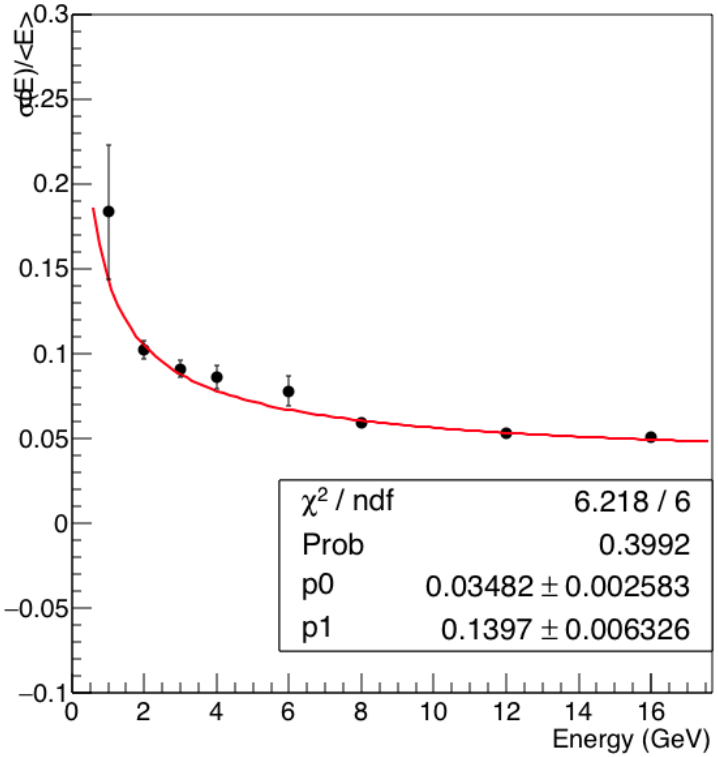
Old Fits



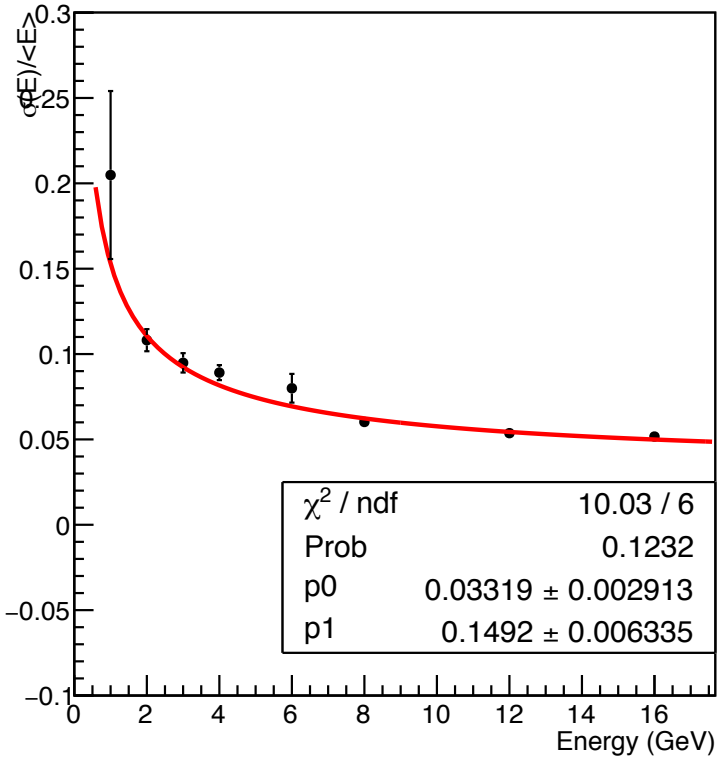


New Fits

New Fitting



Old Fits



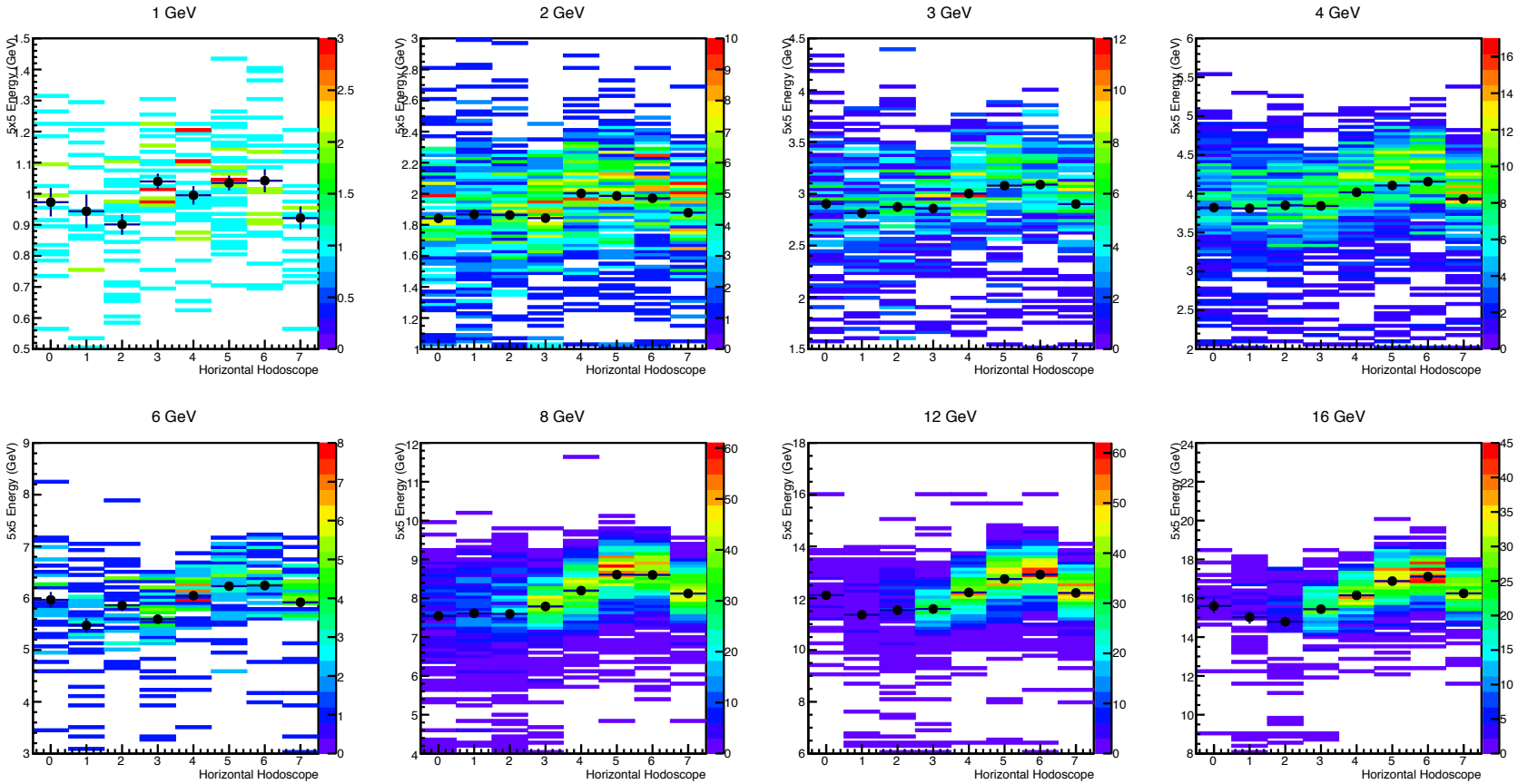
New Fits

Hodoscope Analysis

- Looked at energy response across EMCal by varying the horizontal and vertical hodoscope cuts on data
- Motivation: want to use data from center rather than edges of light guides where the energy response will be greater

Hodoscope Analysis

Energy across vertical hodoscope finger 3, varying horizontal hodoscope position

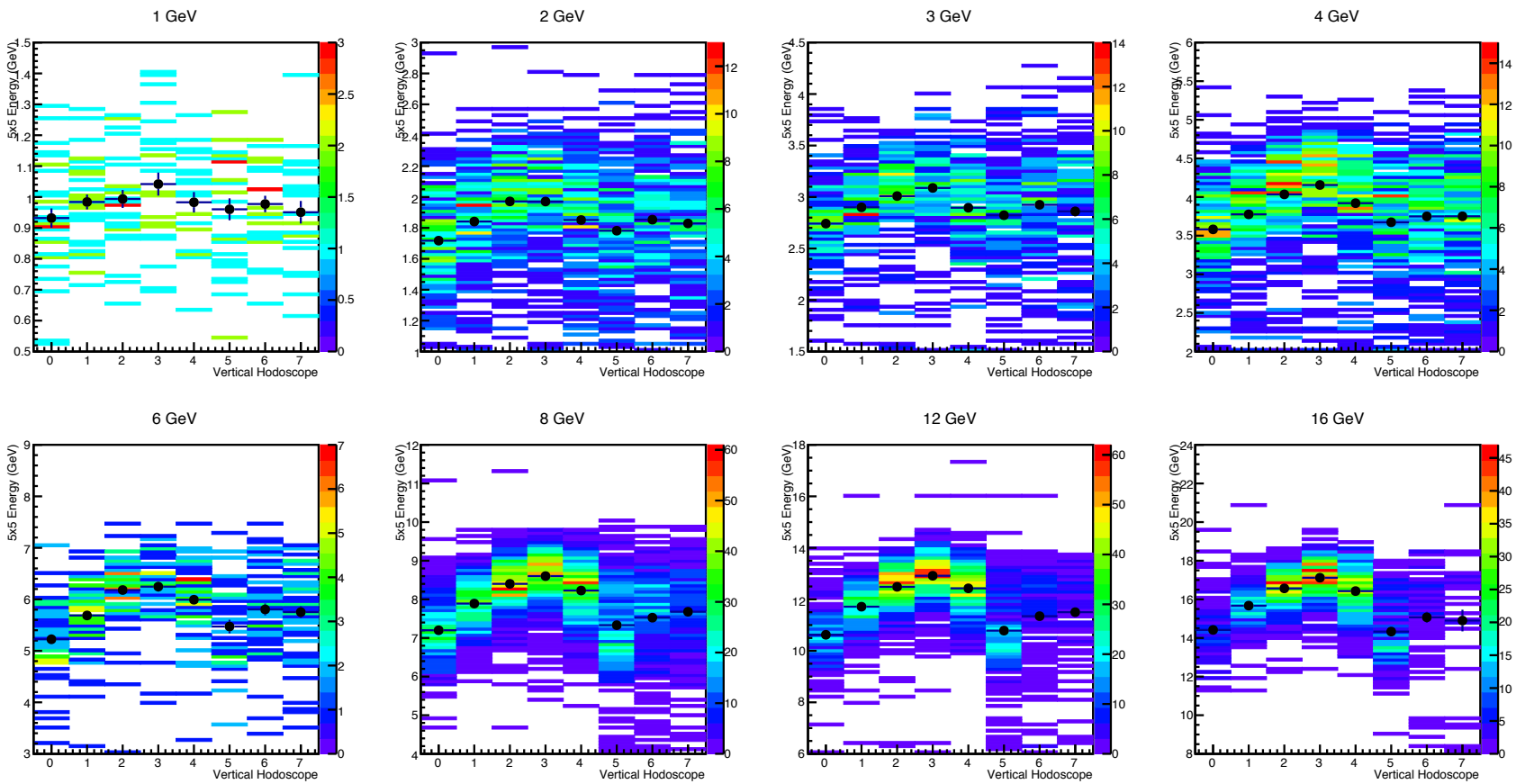


5 by 5 energy after cuts:

- Cherenkov: abs(C2_inner_t + C2_outer_t) > 100
- Veto: Veto1_t < 15 || Veto2_t < 15 || Veto3_t < 15 || Veto4_t < 15
- Vertical hodoscope: abs(Vert_HODO_R3_t) > 30
- Horizontal hodoscope cut varies along x axis

Hodoscope Analysis

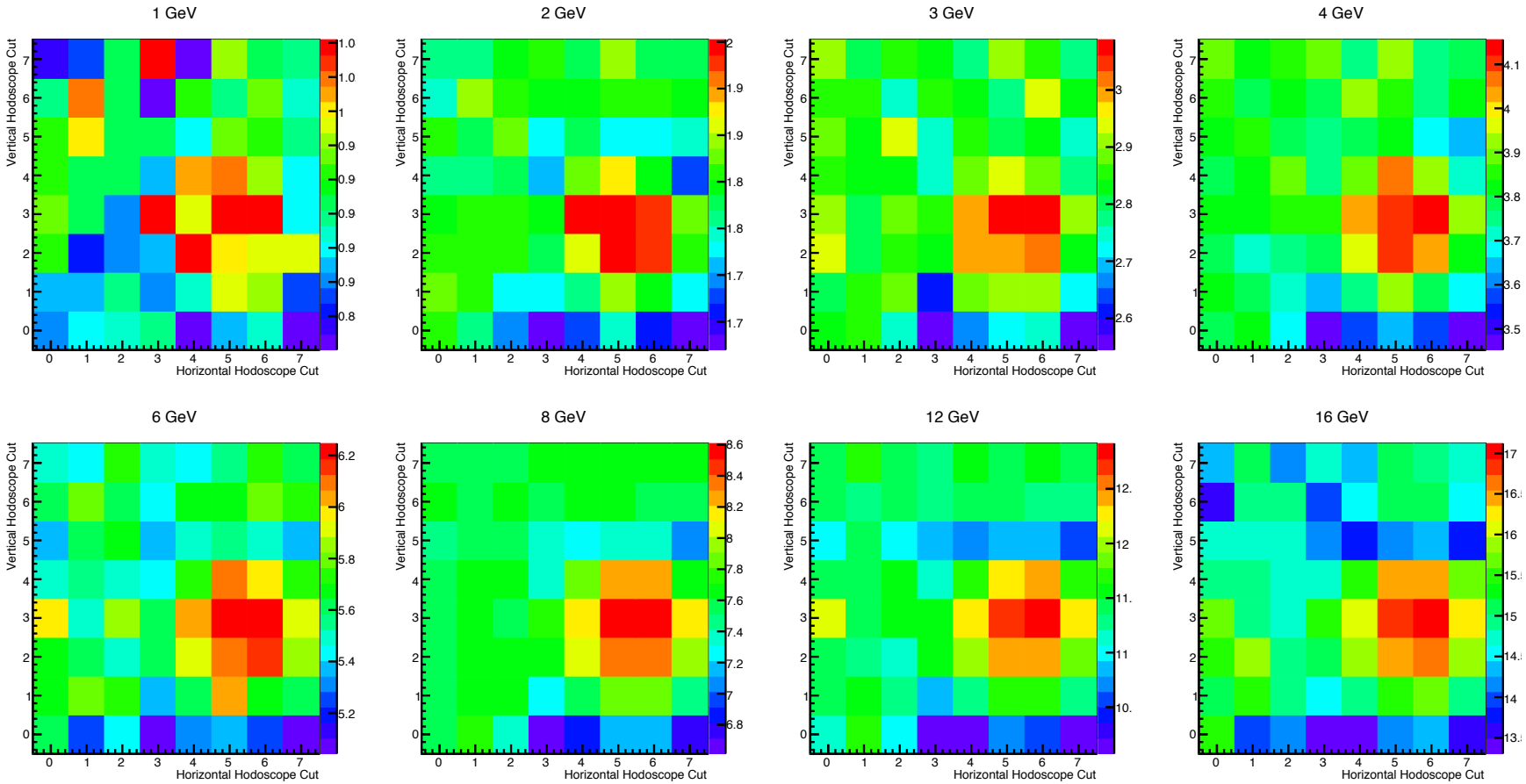
Energy across horizontal hodoscope finger 6, varying vertical hodoscope position



5 by 5 energy after cuts:

- Cherenkov: abs(C2_inner_t + C2_outer_t) > 100
- Veto: Veto1_t < 15 || Veto2_t < 15 || Veto3_t < 15 || Veto4_t < 15
- Horizontal hodoscope: abs(Horz_HODO_R6_t) > 30
- Vertical hodoscope cut varies along x axis

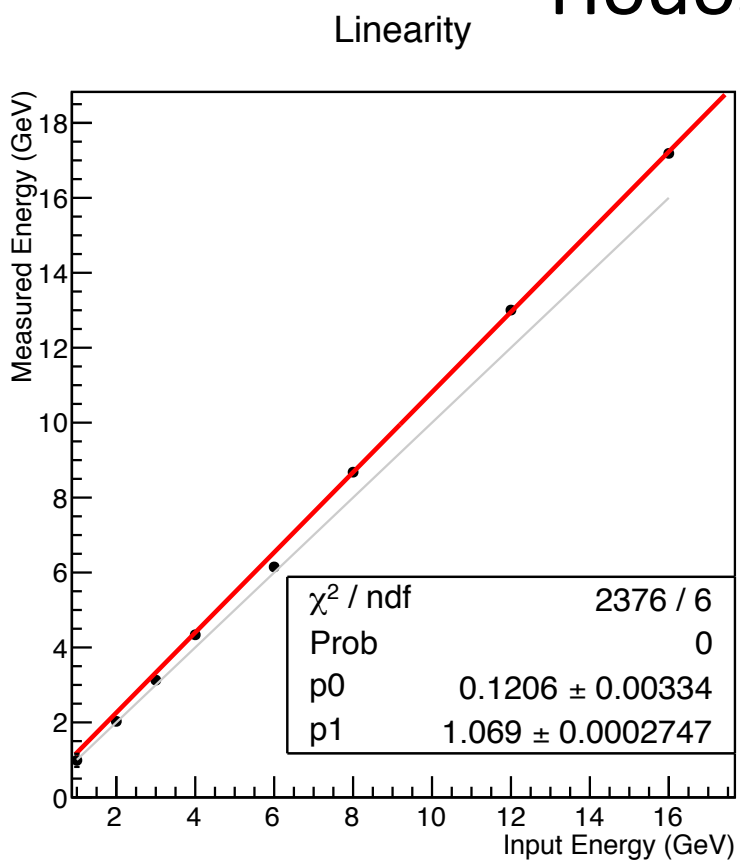
Hodoscope Analysis

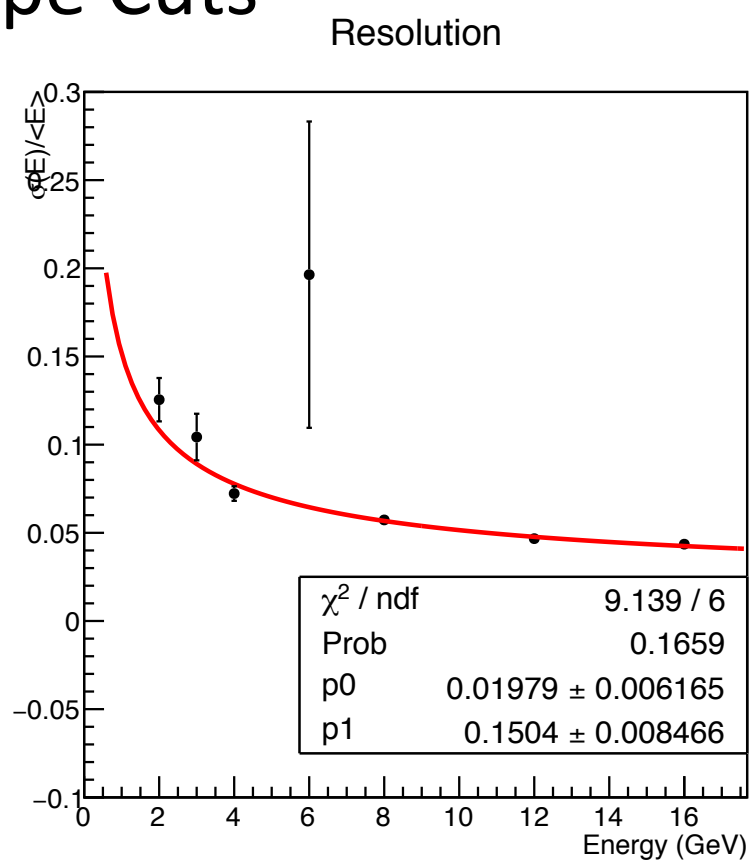


Mean 5 by 5 energy for each pair of vertical and horizontal hodoscope cuts with:

- Cherenkov: abs(C2_inner_t + C2_outer_t) > 100
- Veto: Veto1_t < 15 || Veto2_t < 15 || Veto3_t < 15 || Veto4_t < 15

Resolution and Linearity with New Hodoscope Cuts



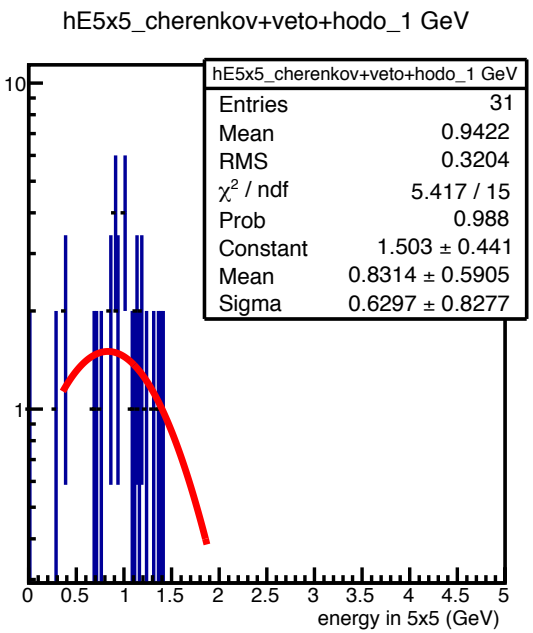


Cuts:

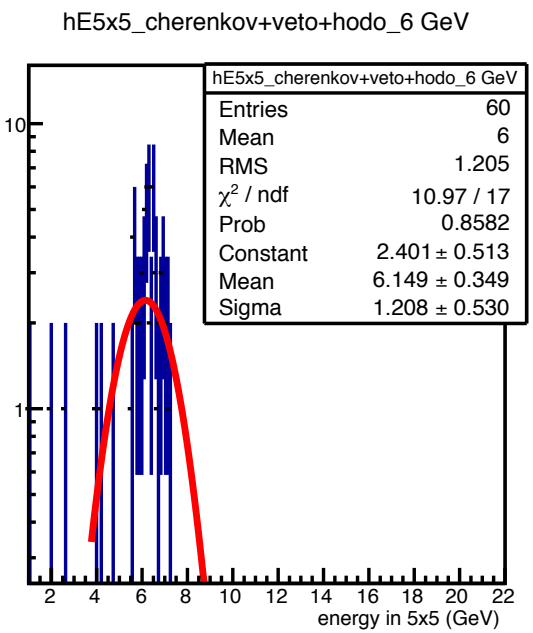
- Cherenkov: abs(C2_inner_t + C2_outer_t) > 100
- Veto: Veto1_t < 15 || Veto2_t < 15 || Veto3_t < 15 || Veto4_t < 15
- Horizontal hodoscope: abs(Horz_HODO_**R6**_t) > 30
- Vertical hodoscope: abs(Vert_HODO_**R3**_t) > 30

Bad statistics for 1 and 6 GeV points (1 GeV point missing)

Resolution and Linearity with New Hodoscope Cuts



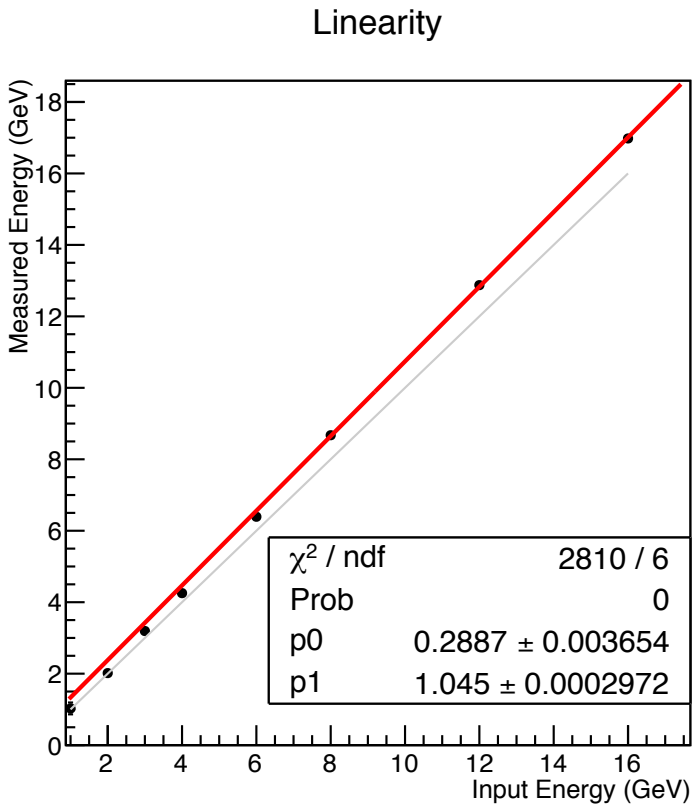
1 GeV

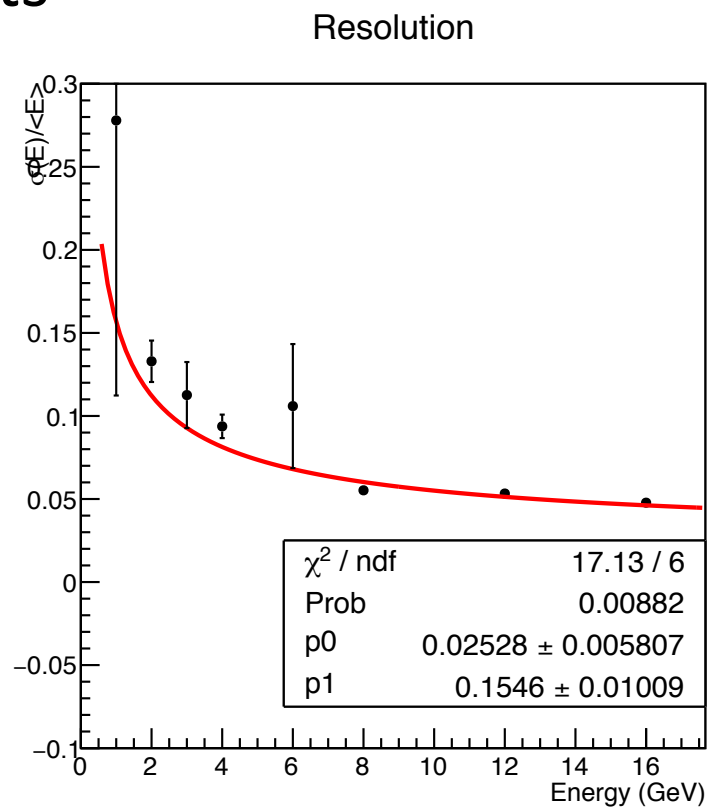


6 GeV

- Low statistics + new fitting
- New fitting works well for higher statistics, but not for lower statistics

Resolution and Linearity with New Hodoscope Cuts



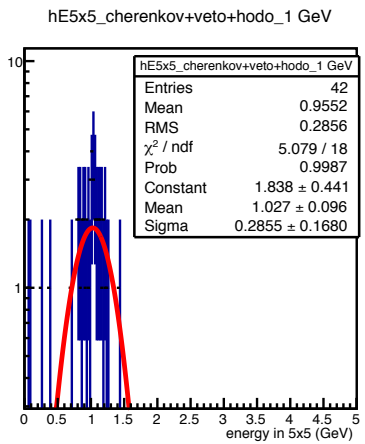


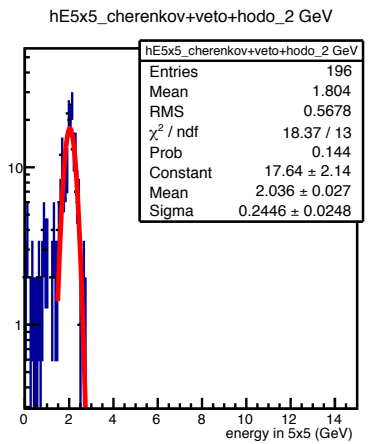
Similar low statistics issues

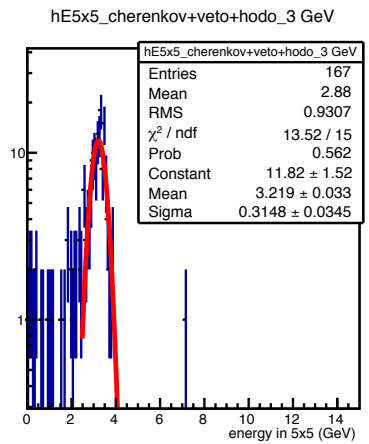
Cuts:

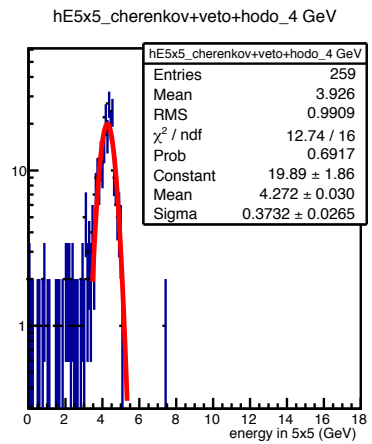
- Cherenkov: abs(C2_inner_t + C2_outer_t) > 100
- Veto: Veto1_t < 15 || Veto2_t < 15 || Veto3_t < 15 || Veto4_t < 15
- Horizontal hodoscope: abs(Horz_HODO_**R5**_t) > 30
- Vertical hodoscope: abs(Vert_HODO_**R3**_t) > 30

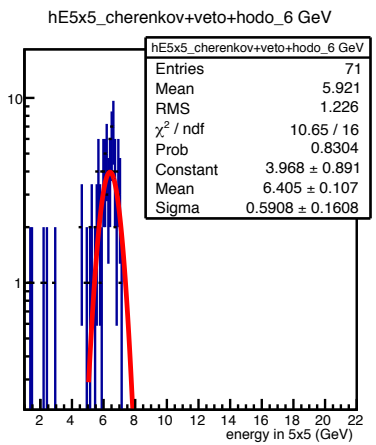
Resolution and Linearity with New Hodoscope Cuts

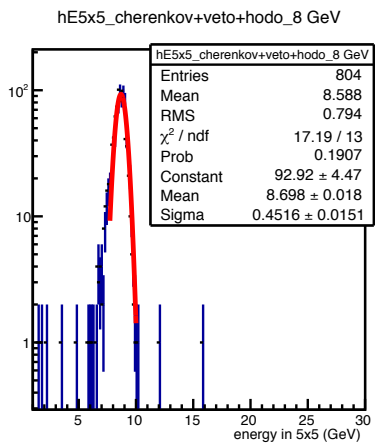


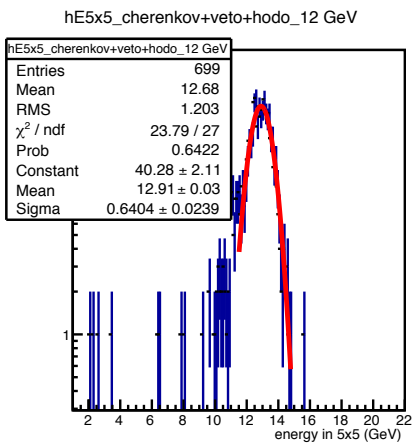


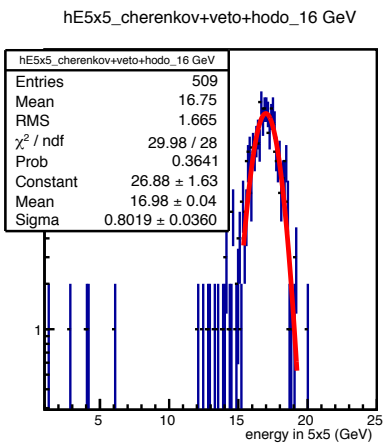








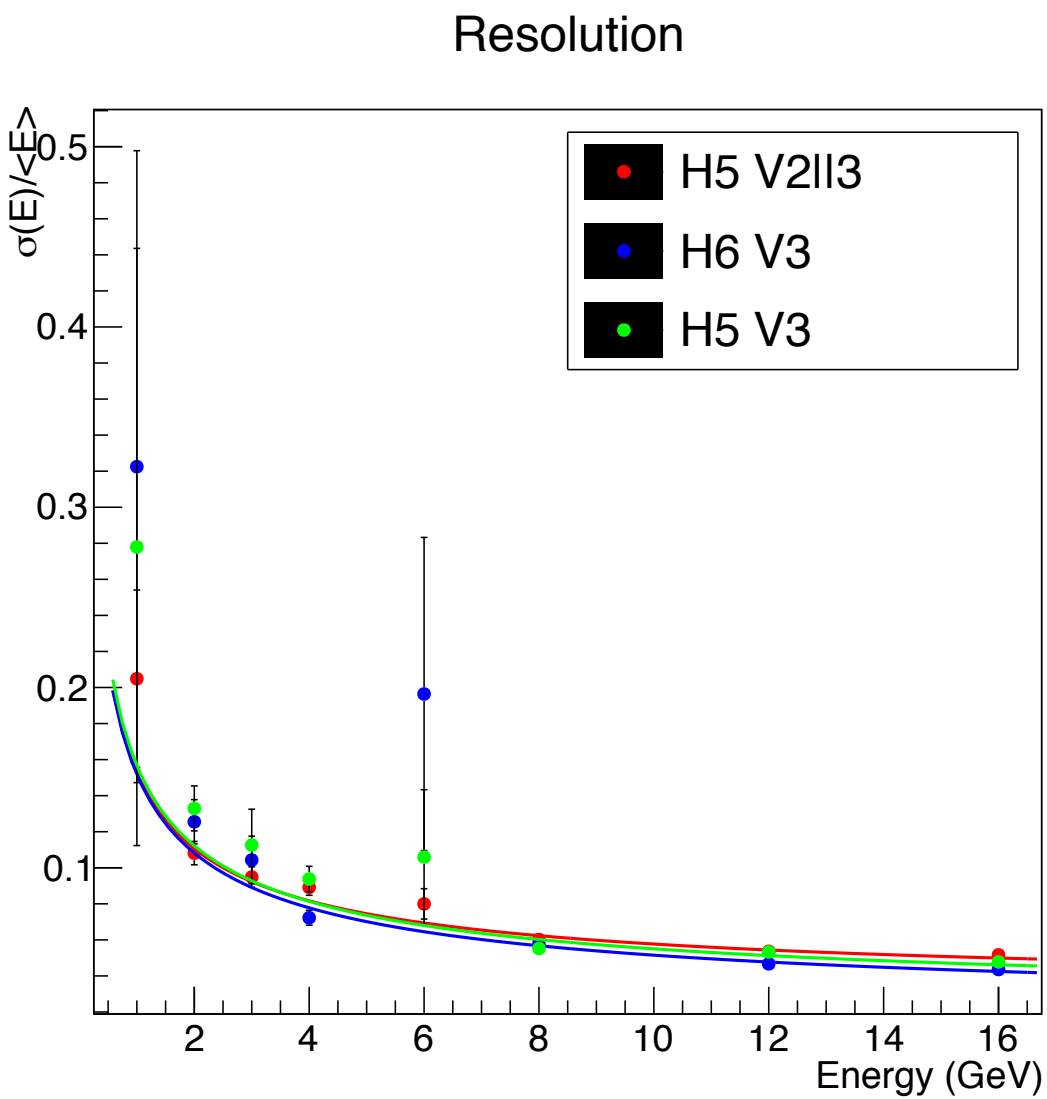




Cuts:

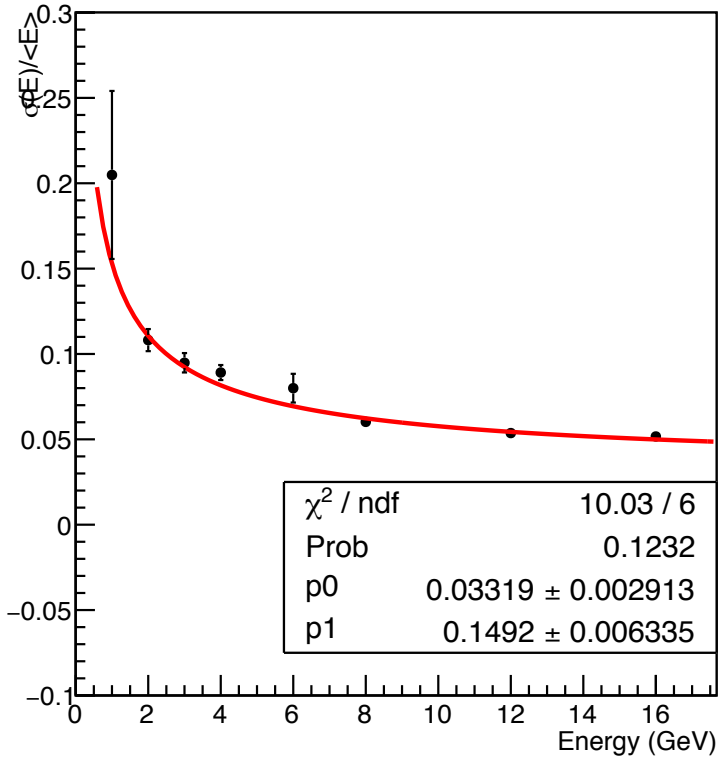
- Cherenkov: abs(C2_inner_t + C2_outer_t) > 100
- Veto: Veto1_t < 15 || Veto2_t < 15 || Veto3_t < 15 || Veto4_t < 15
- Horizontal hodoscope: abs(Horz_HODO_**R5**_t) > 30
- Vertical hodoscope: abs(Vert_HODO_**R3**_t) > 30

Resolutions for Different Hodoscope Cuts

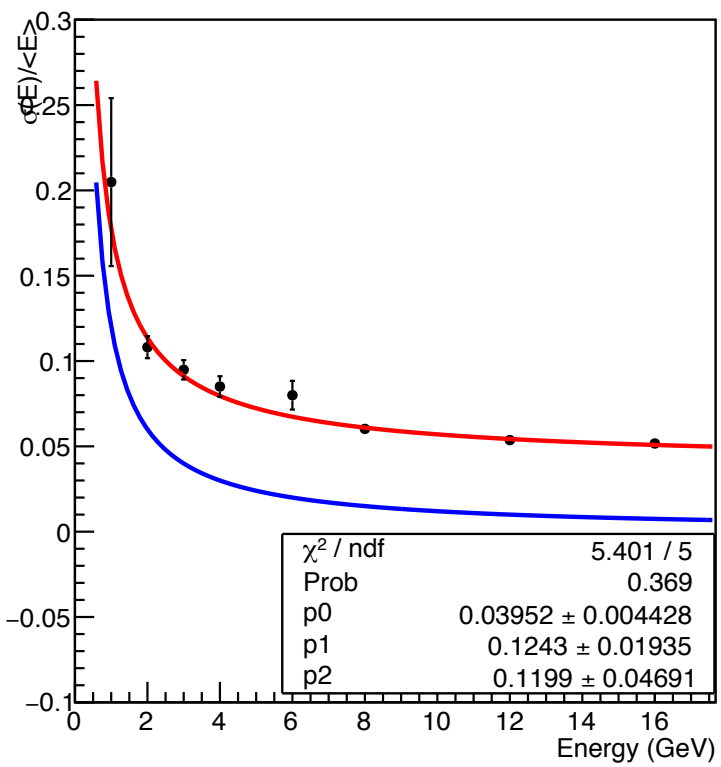


Horizontal Hodoscope	Vertical Hodoscope	Resolution
5	2||3	0.1492
6	3	0.1504
5	3	0.1546

Resolution with 1/E term in fit



Usual fit



Fit with 1/E term

To Do:

- Try to optimize fit range
- To increase statistics we will look at the fits for each run number to try to combine data from multiple runs for 1, 2, 3, 4, and 6 GeV

Energy	Run Numbers (Number of Events)
1 GeV	2297(19k), 2298* (46k)
2 GeV	2265(72k), 2266(69k), 2267(127k), 2268* (195k)
3 GeV	2260* (130k), 2261(135k), 2262(50k)
4 GeV	2253*, 2254, 2255
6 GeV	2243, 2244, 2245, 2246, 2247*

*runs we have been using