

# Reconstruction of Topoclusters with Pileup

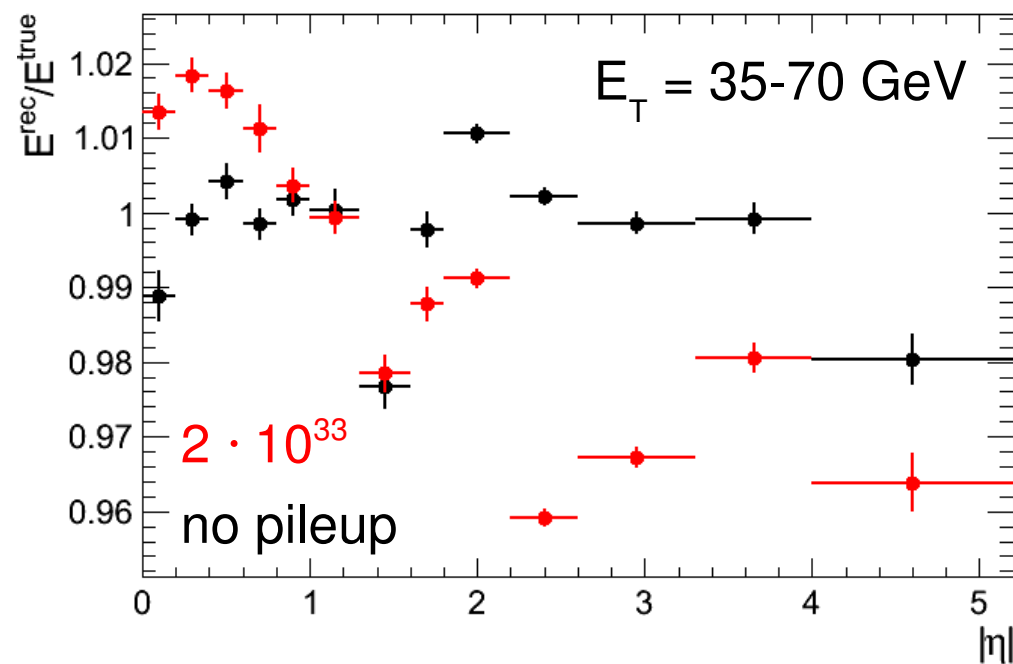
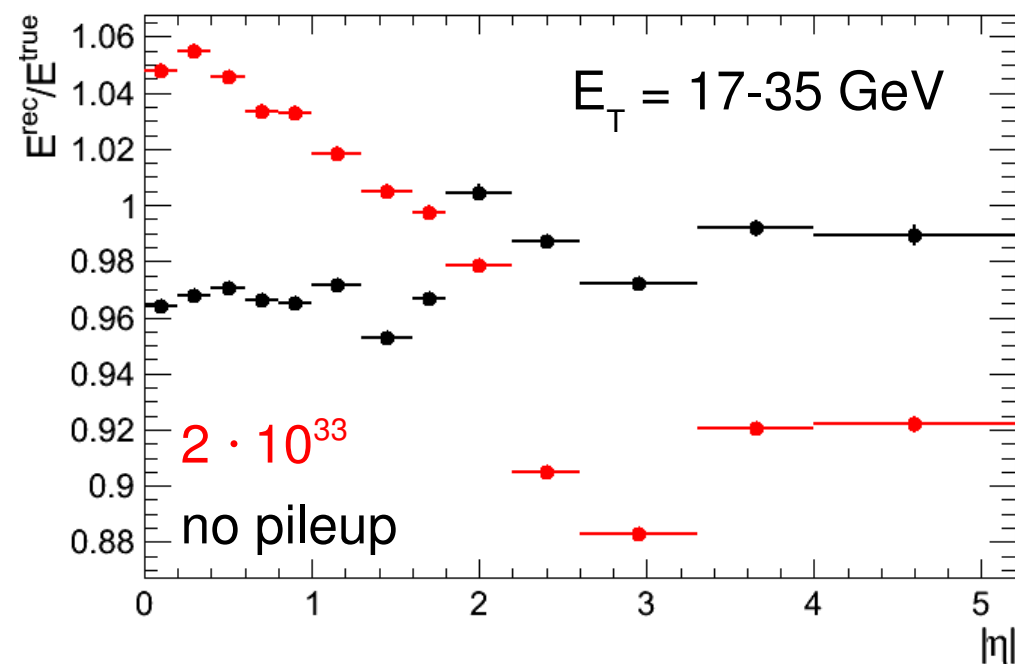
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# Jet Response vs $\eta$

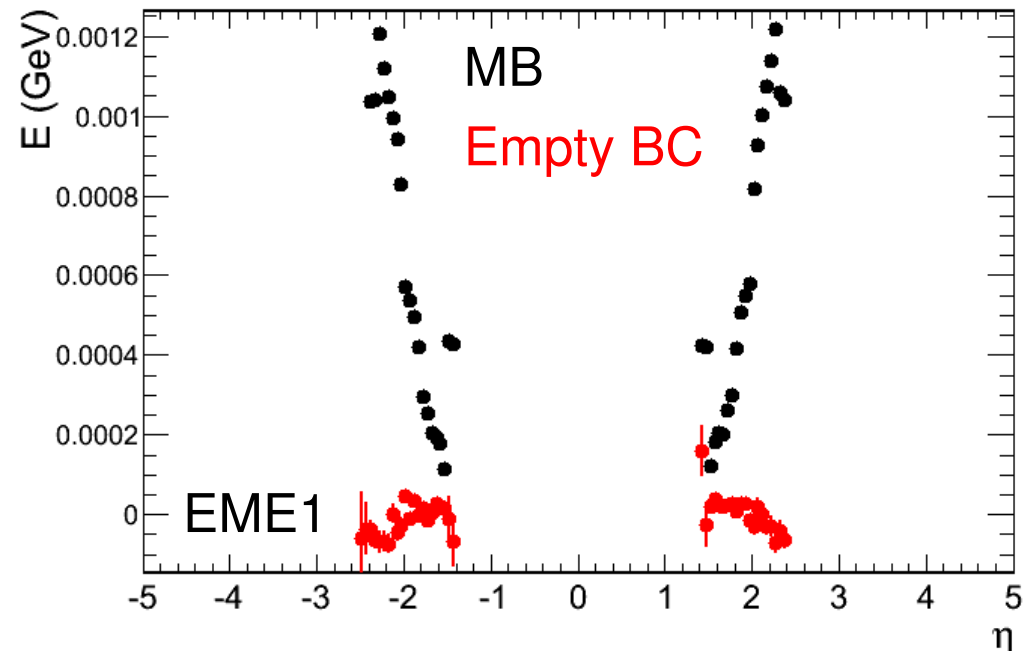
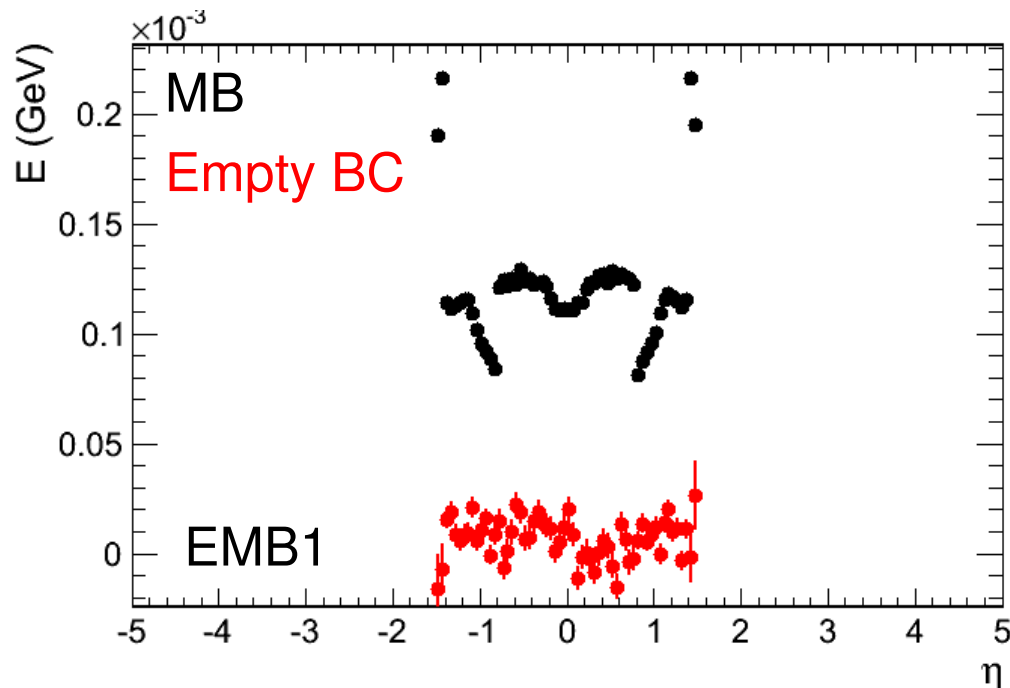
QCD dijets (J3), Cone4H1TopoJets



- Is the bias in the presence of pileup ( $\sim 15\%$  Variation in J1 bin) caused by the clustering?
- Can it be understood and reduced by changing the clustering parameters?

# Average energy in minimum bias data

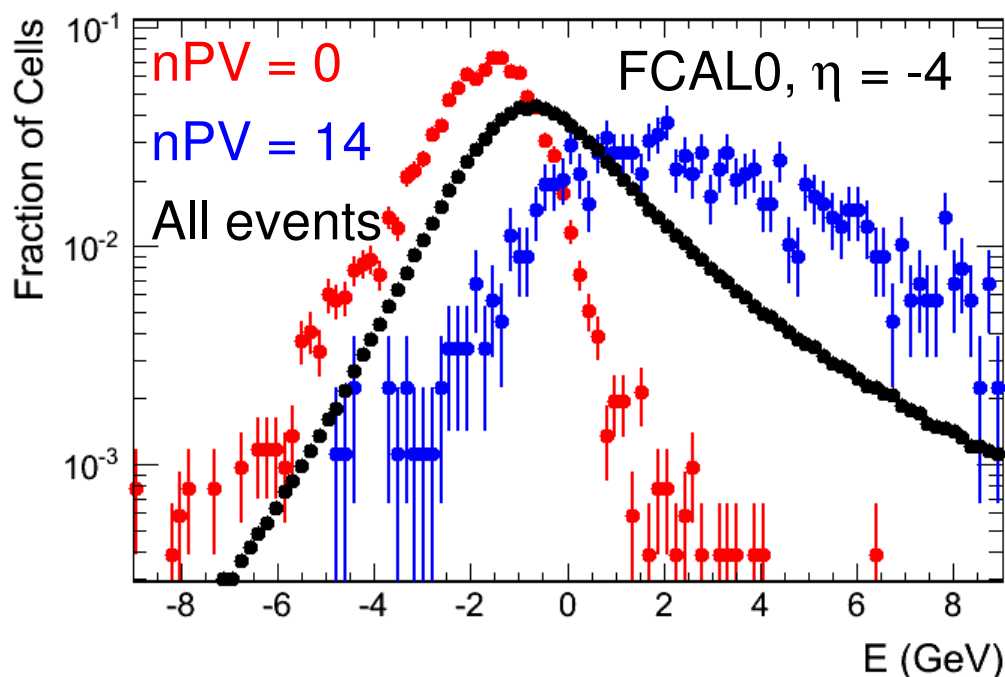
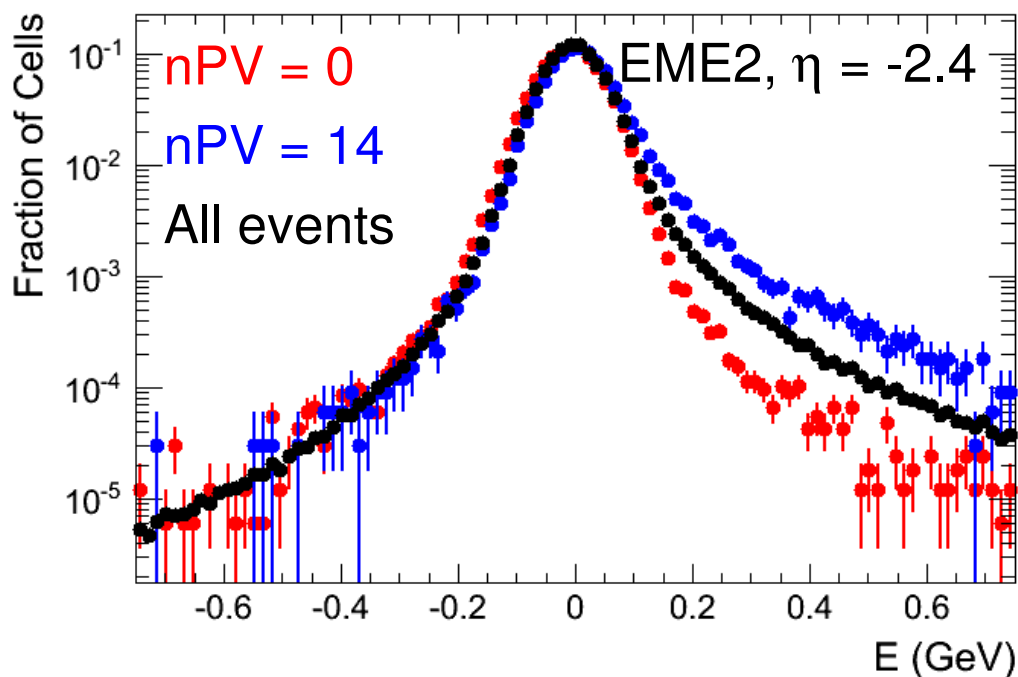
- Average cell energy expected to be 0 in minimum bias data
  - ◆ No bias on large signals
  - ◆ How are noise and small signals affected by noise suppression?
- Use a dataset that contains only noise and pileup
  - ◆ mc08 minimum bias is really “minimum bias plus one event in BC0”\*
  - ◆ Compare with “empty bunch crossings with pileup” ( $2 \cdot 10^{33}$ , 25ns):



\*Guillaume's conjecture

# Cell energy distributions

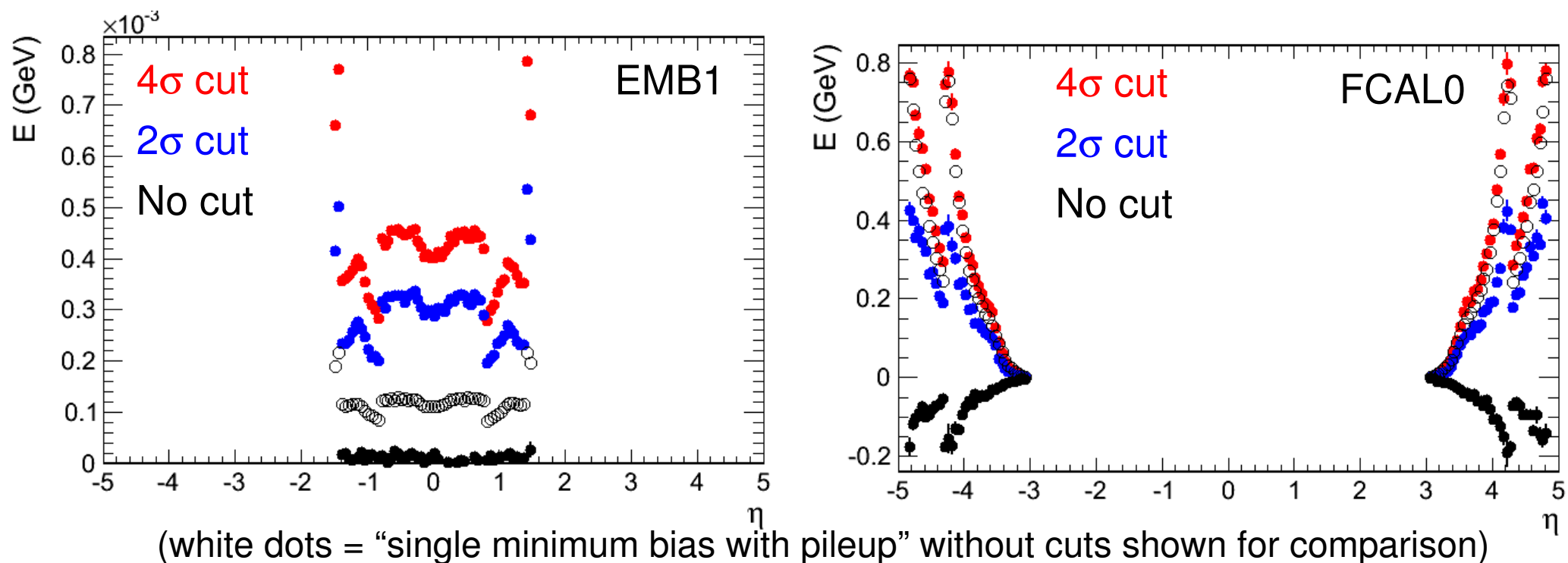
- Cell energy distributions in minimum bias data are not Gaussian



- Out-of-time contribution observed in events without interactions
  - ▶ Mostly symmetric with Gaussian core, negative tails in layers with short pulse lengths (e.g. FCAL)
- In-time pileup adds very low  $E_T$  signal

# Effect of symmetric cuts on noise

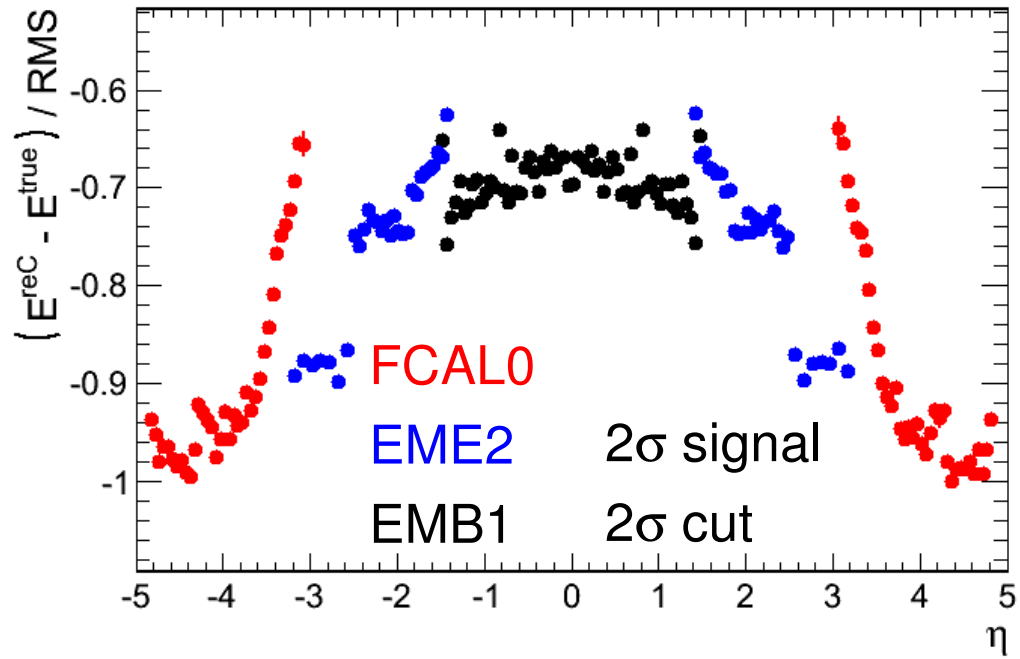
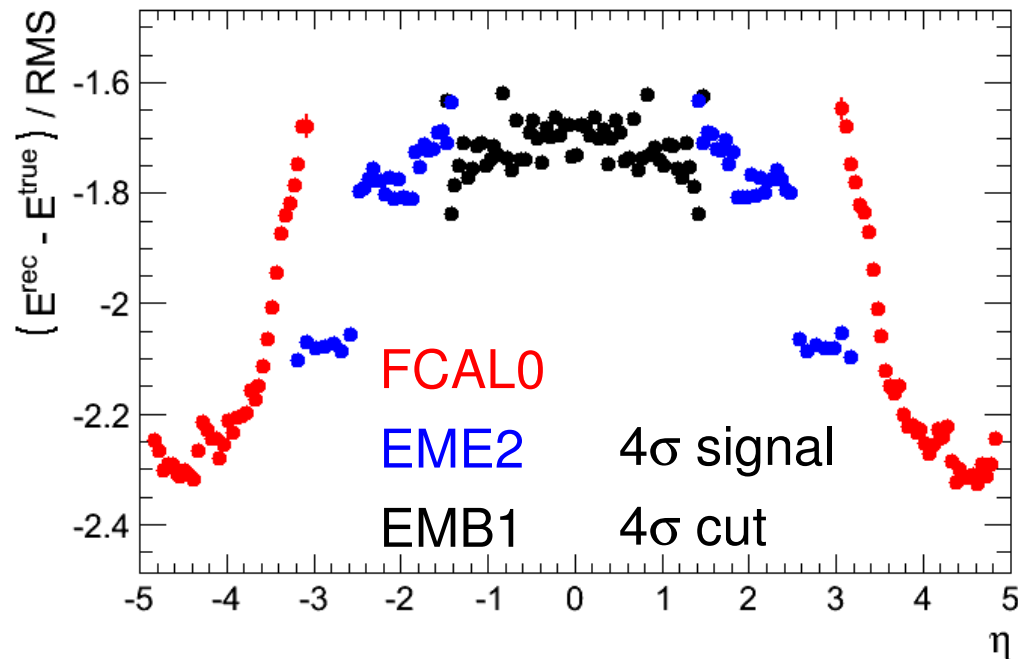
- Cuts are symmetric
  - ◆ Pure noise cancels if its distribution is symmetric



- Noise does not cancel in the presence of pileup
- Shift of average energy caused by cuts similar to the shift caused by adding a minimum bias event
- Effect is larger (relatively) in the central detector region

# Effect of symmetric cuts on small signals

- “Inject” a signal to cells and observe response



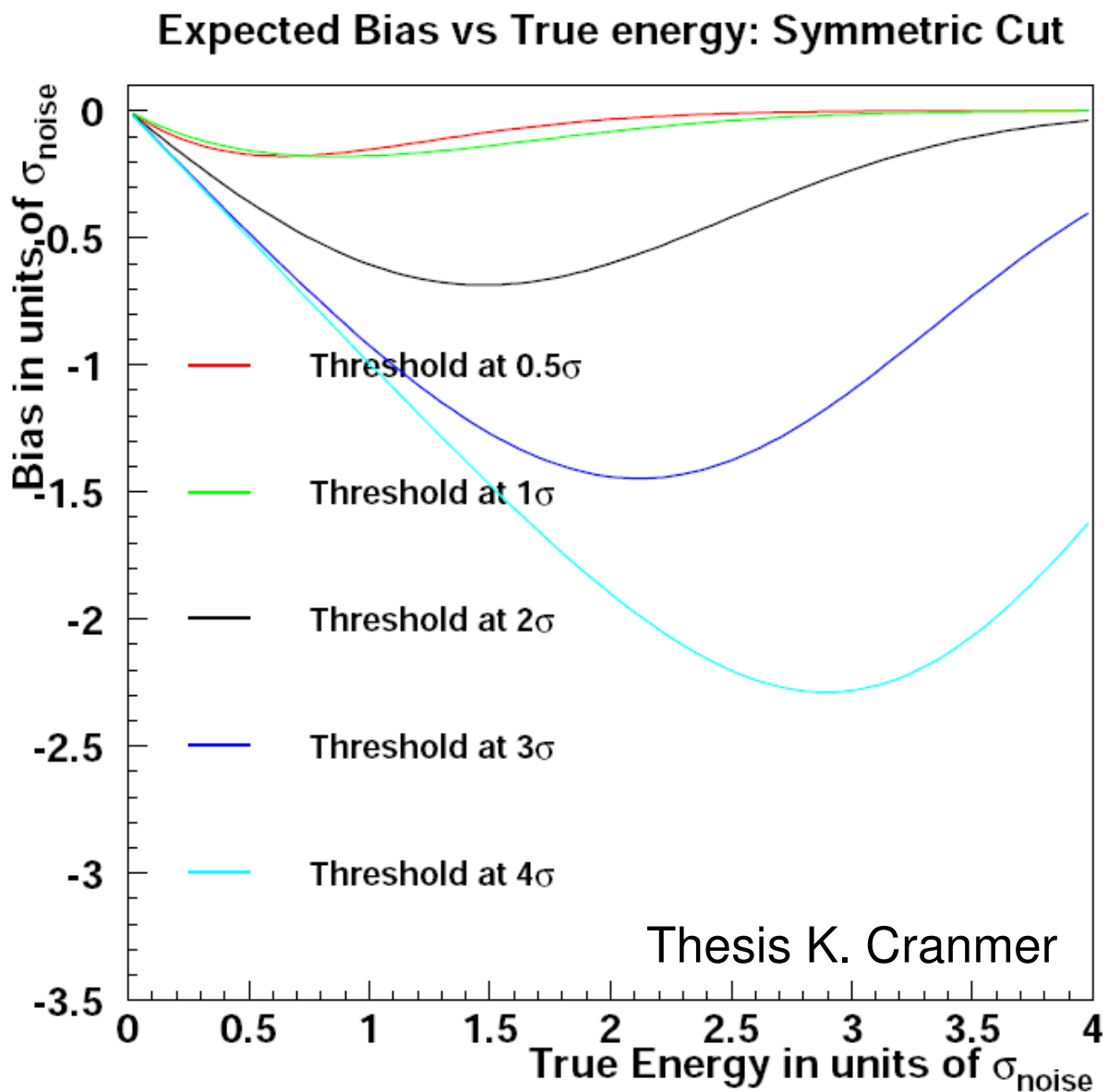
- Bias in the central region close to expectation for Gaussian noise
- Significant deviations in forward regions
  - ♦ Is it possible to define cuts that result in a uniform bias?
- Plan: Study response of the clustering to added signal clusters

P.S.: Switch to “empty bunch crossings + pileup” for mc09?

Backup

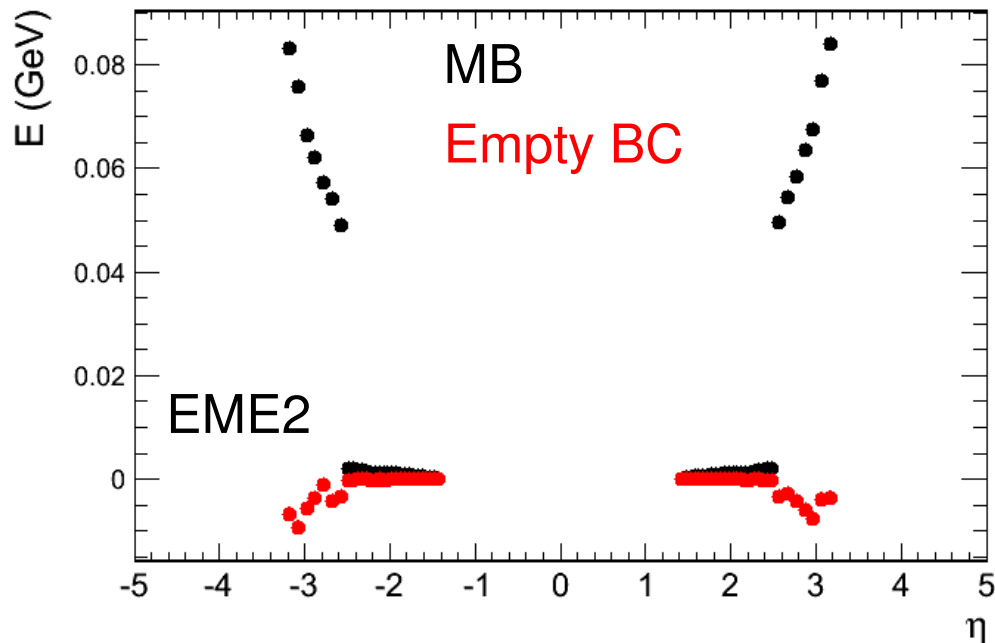
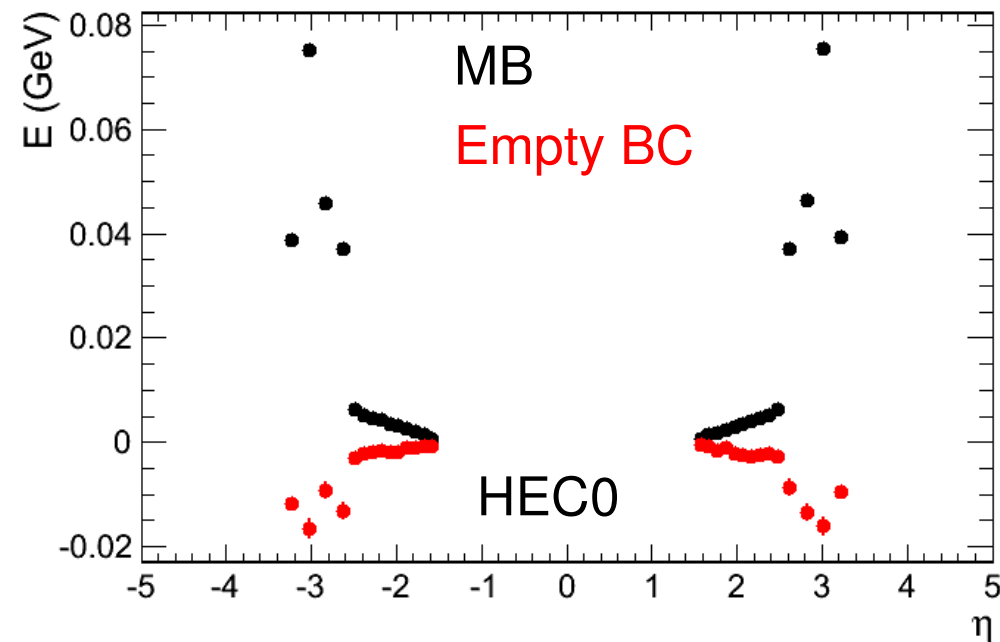
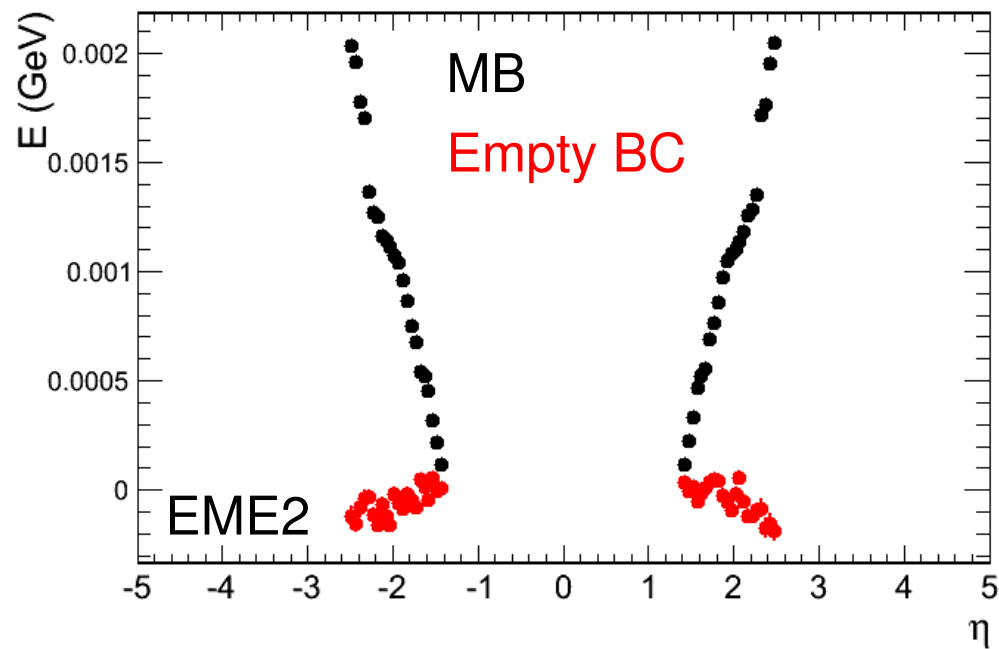
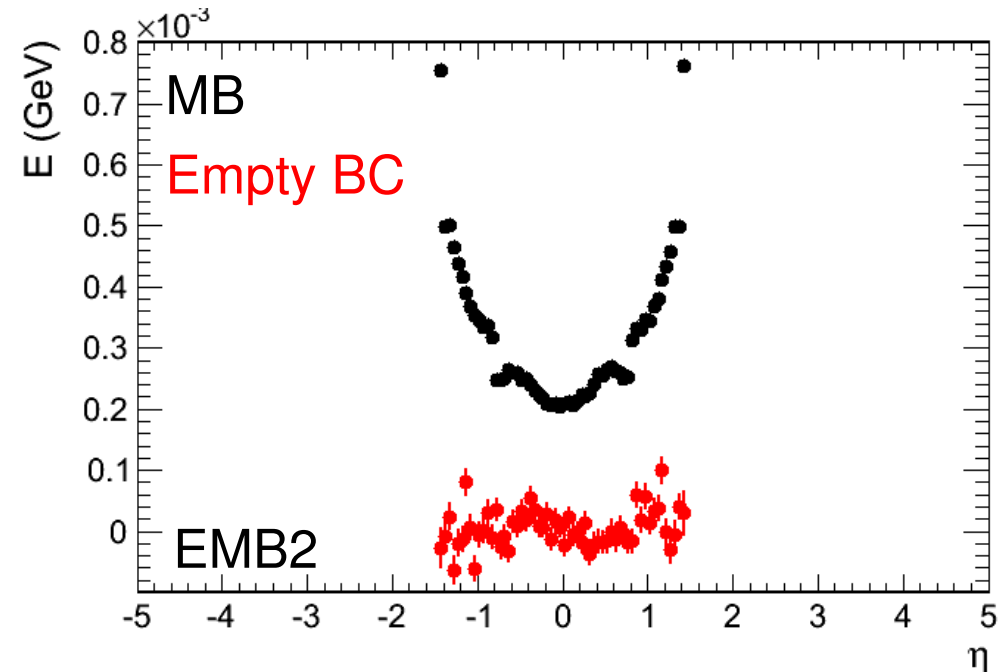
# Bias on small signals for a Gaussian noise distribution

- Expected bias for the case of symmetric cuts and a Gaussian noise distribution
- Values for 4/4, 2/2 very close to shifts observed in EM barrel ( $\rightarrow$  slide 5)

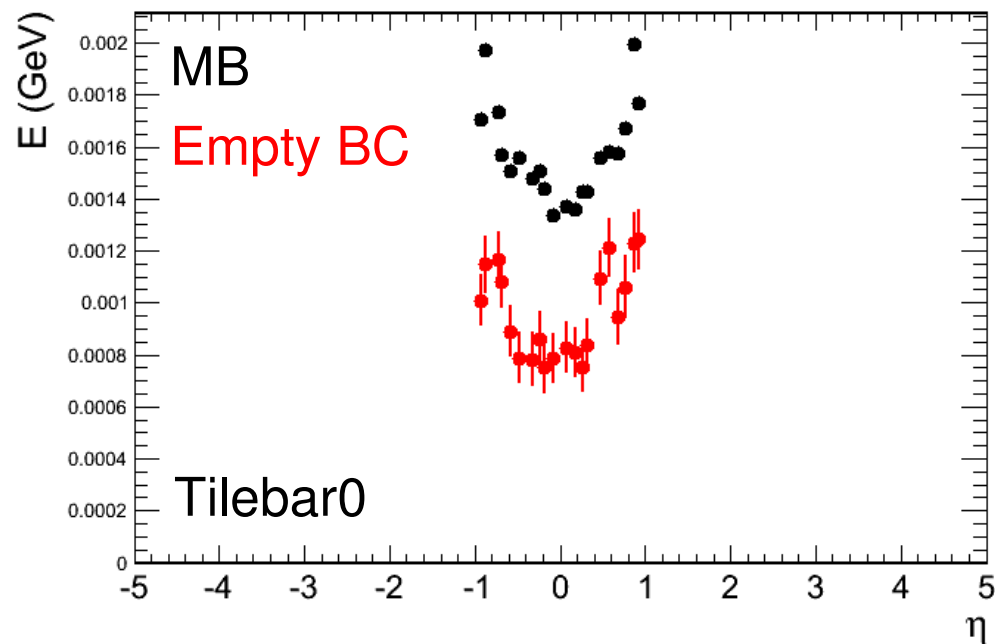
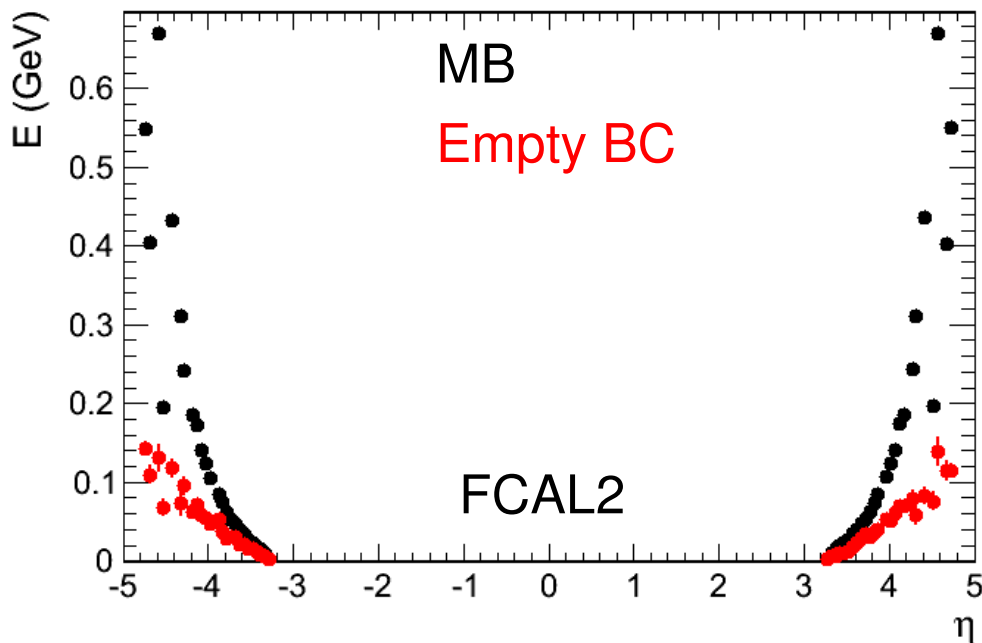
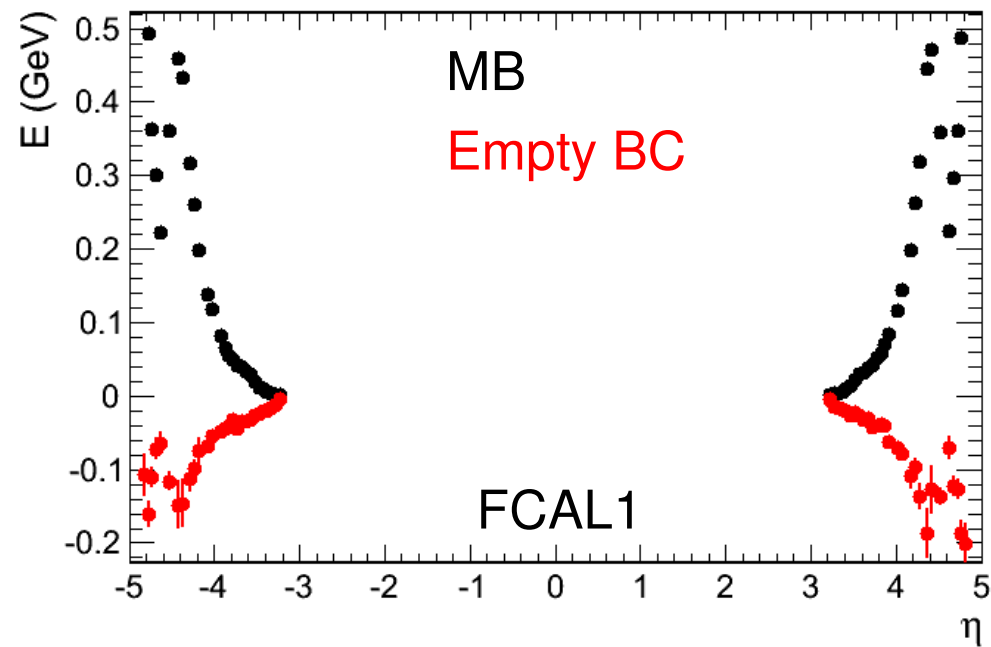
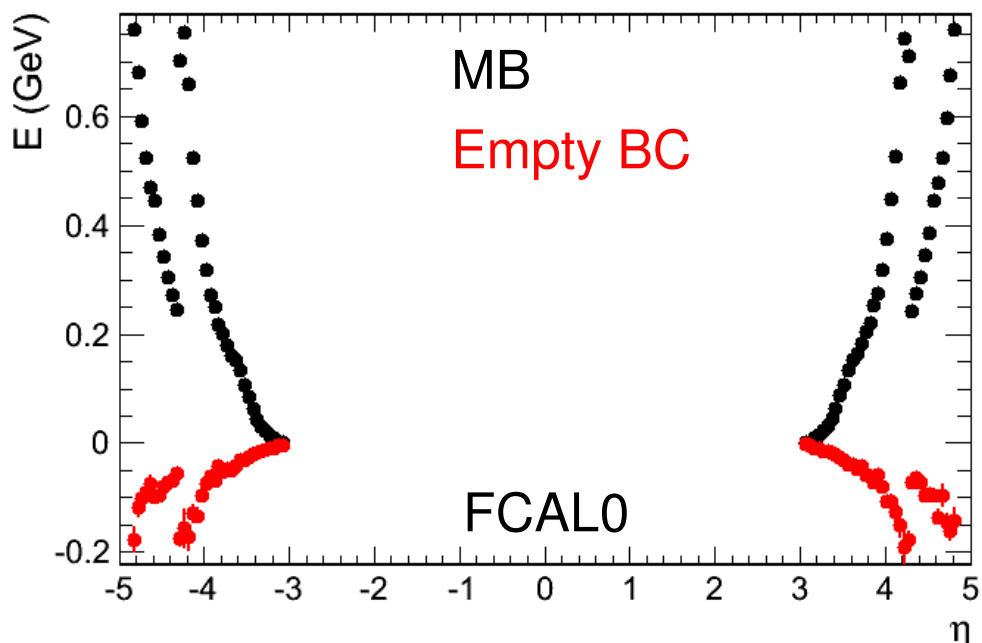




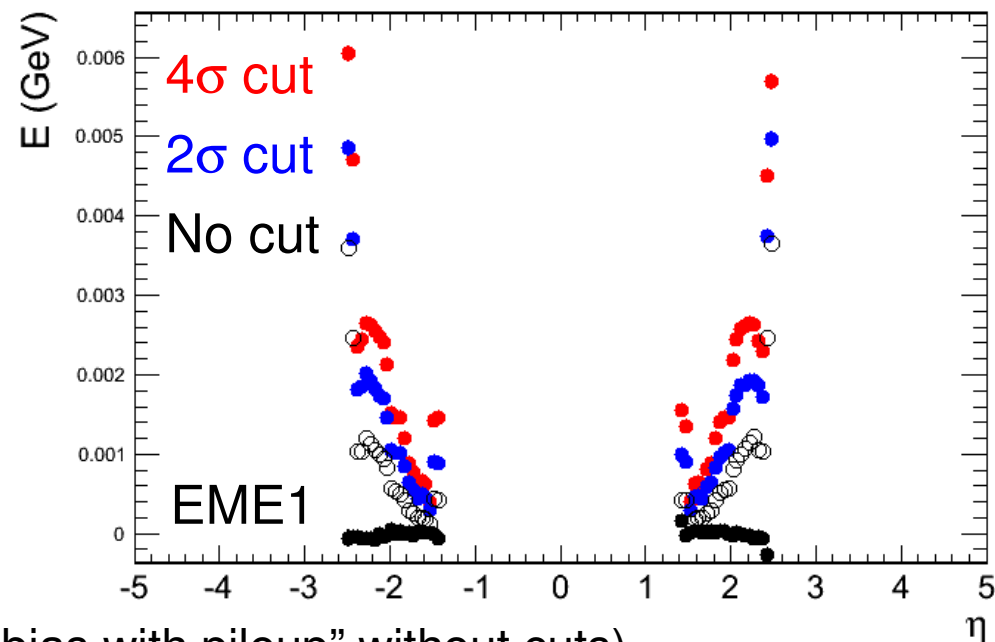
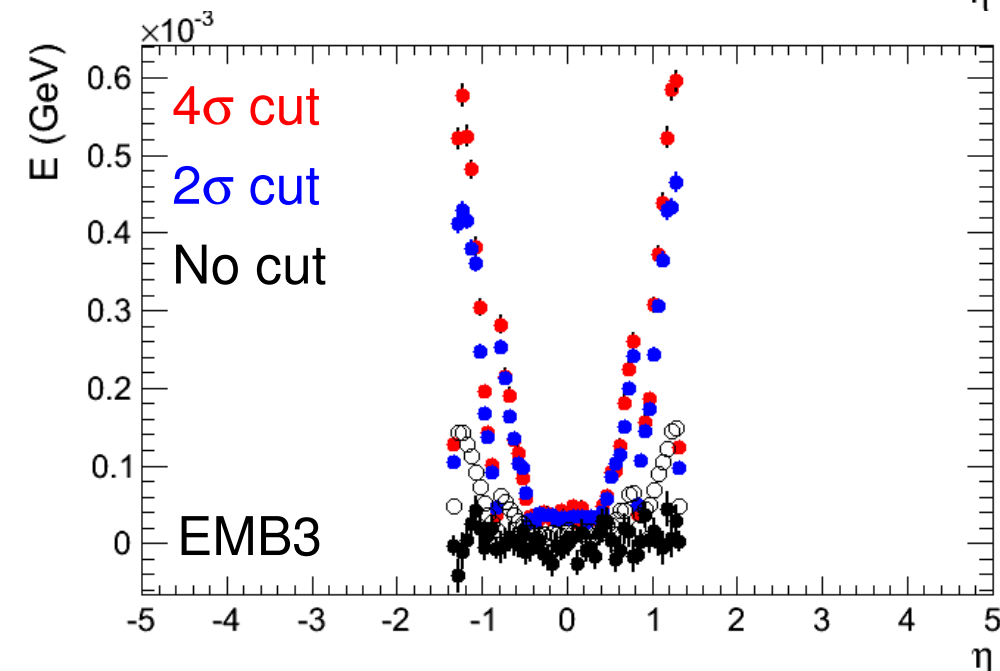
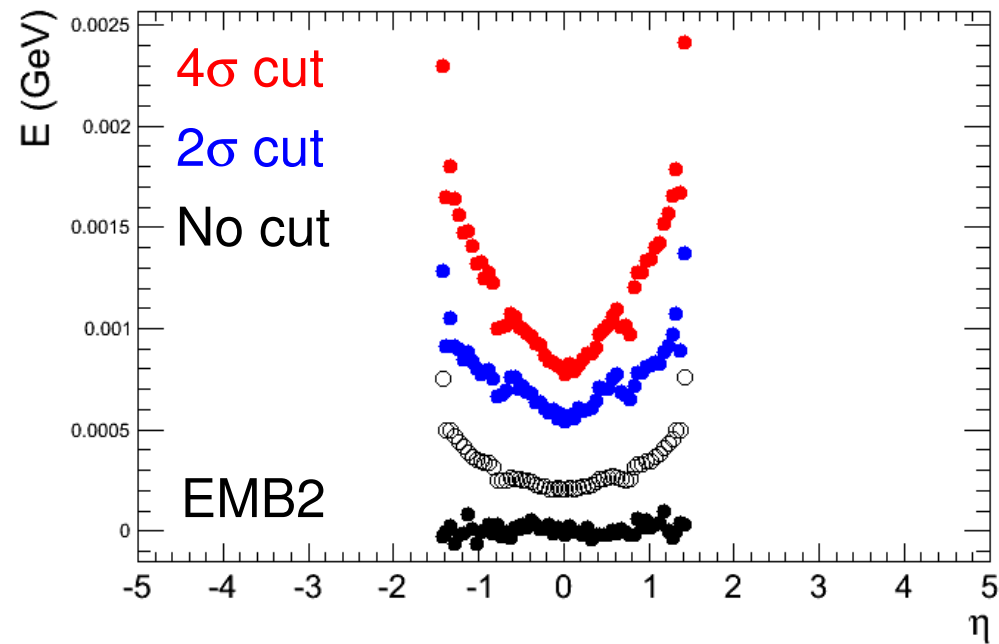
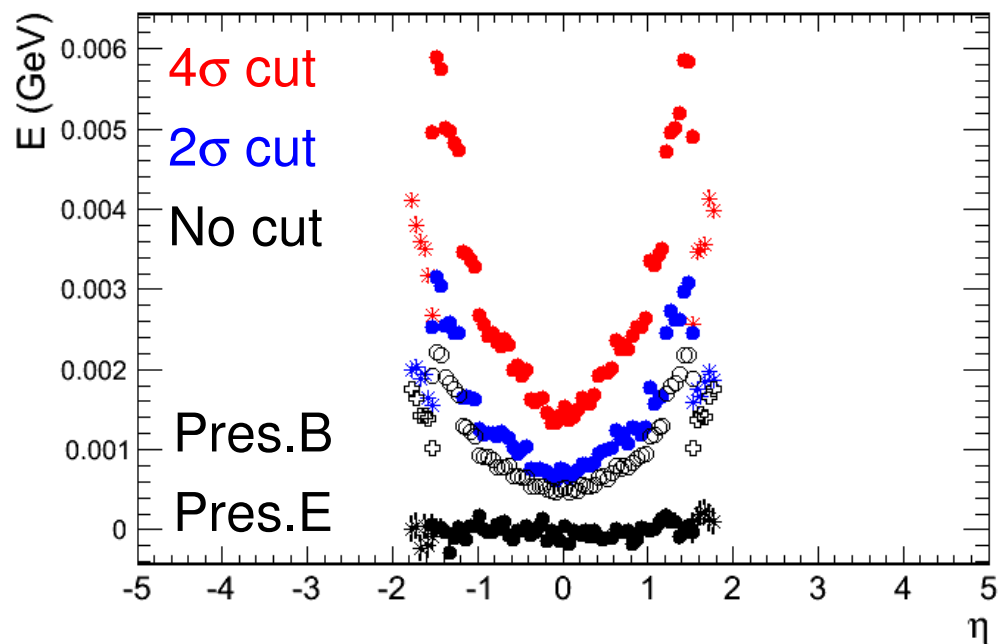
# Average Energy in Different Calorimeter Layers



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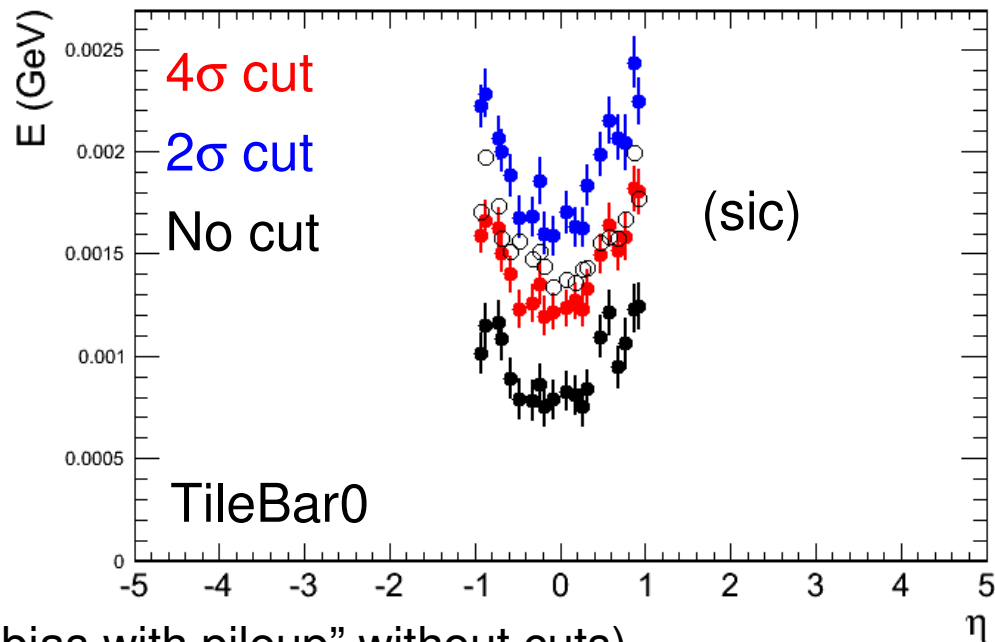
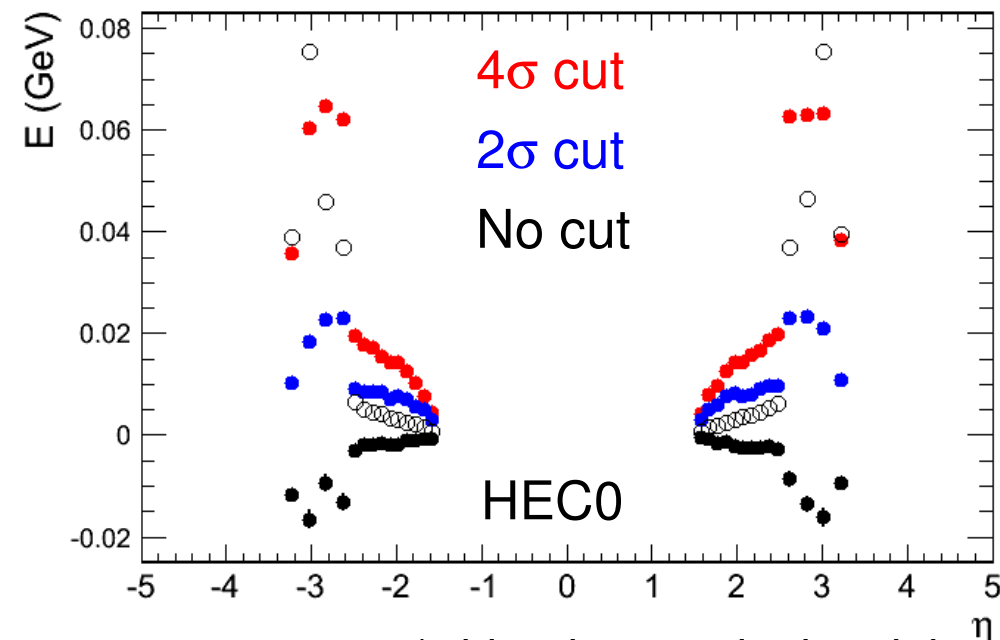
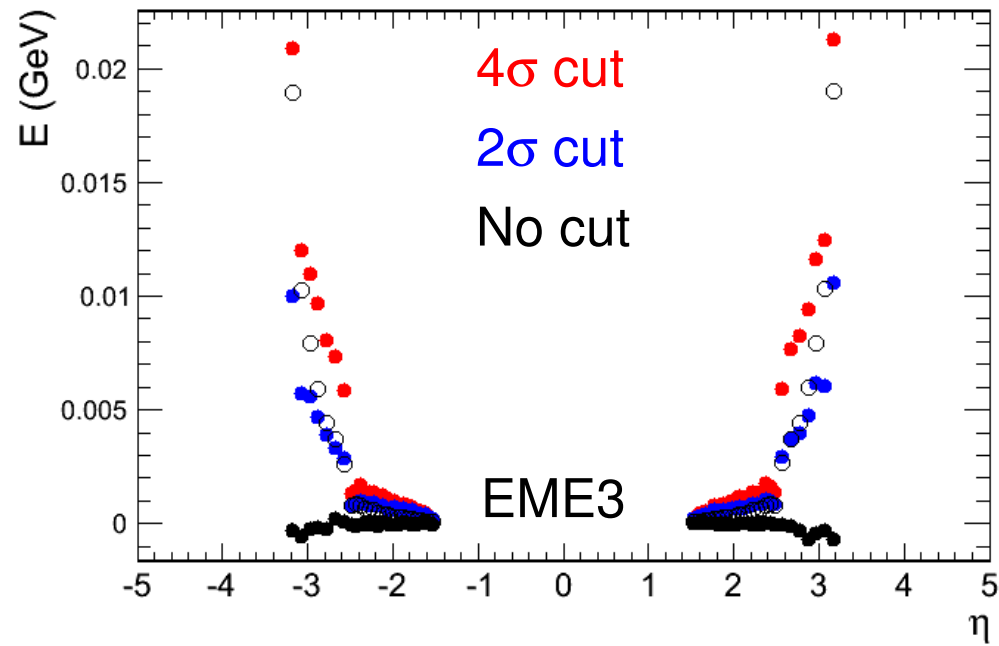
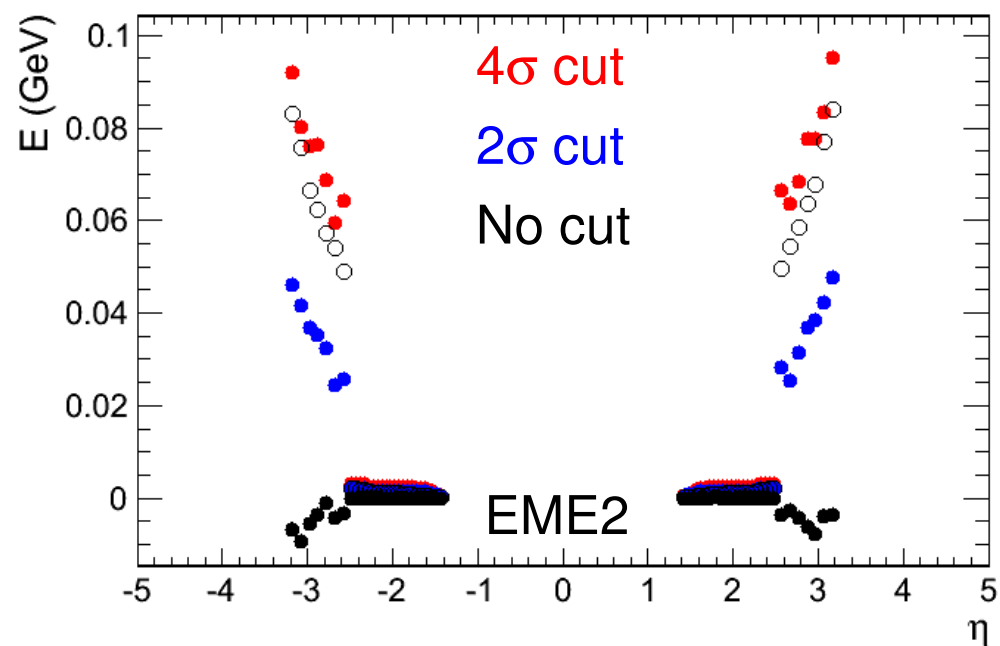


# Average Energy after symmetric cuts



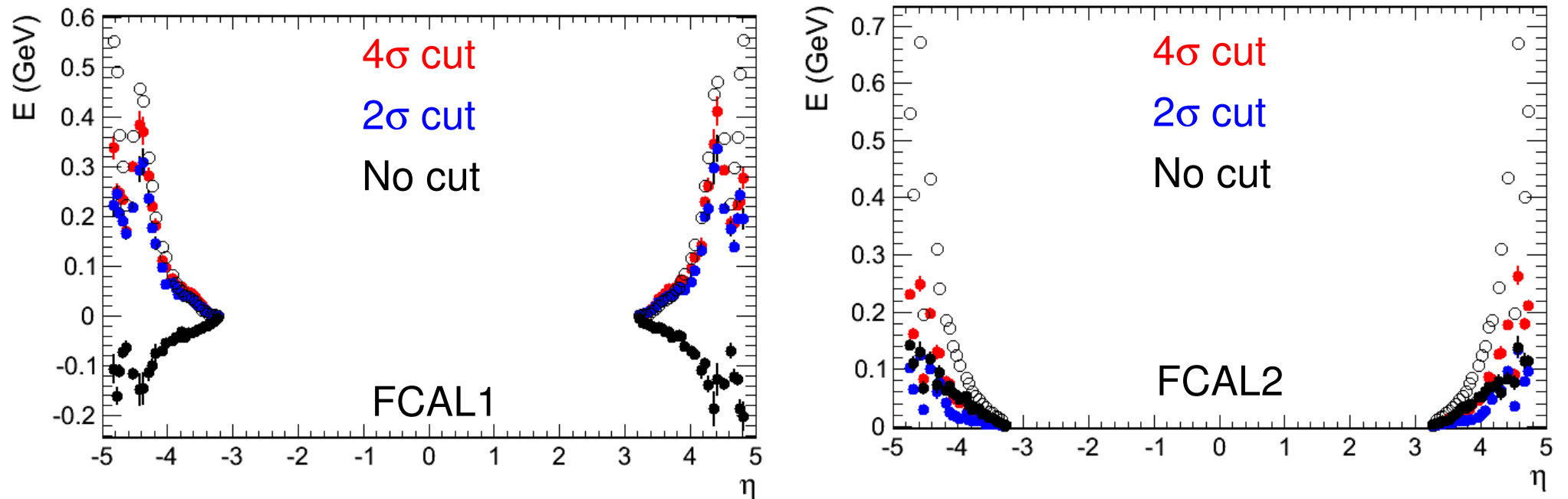
(white dots = "single minimum bias with pileup" without cuts)

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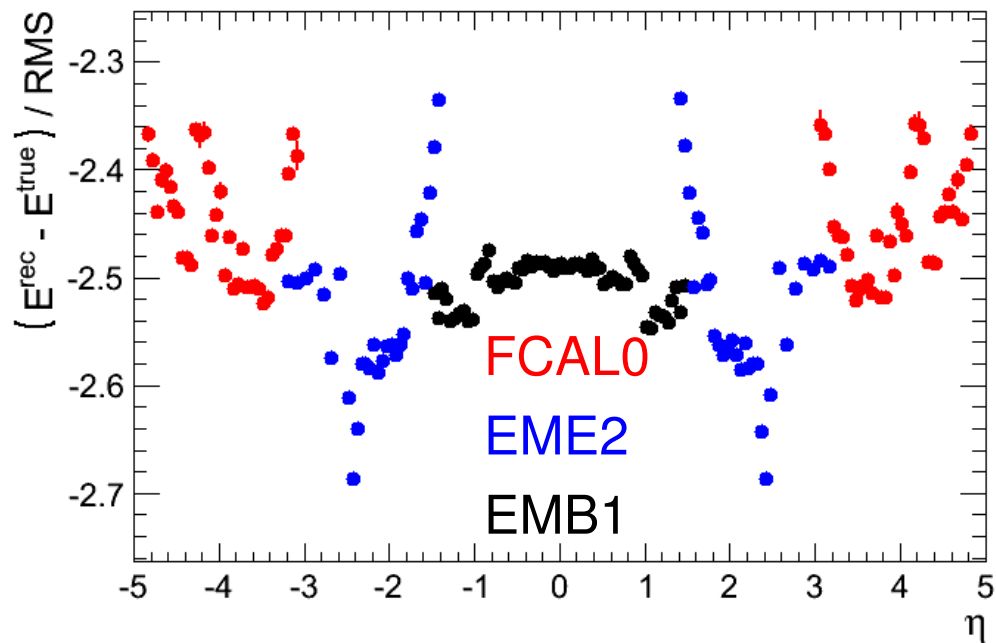
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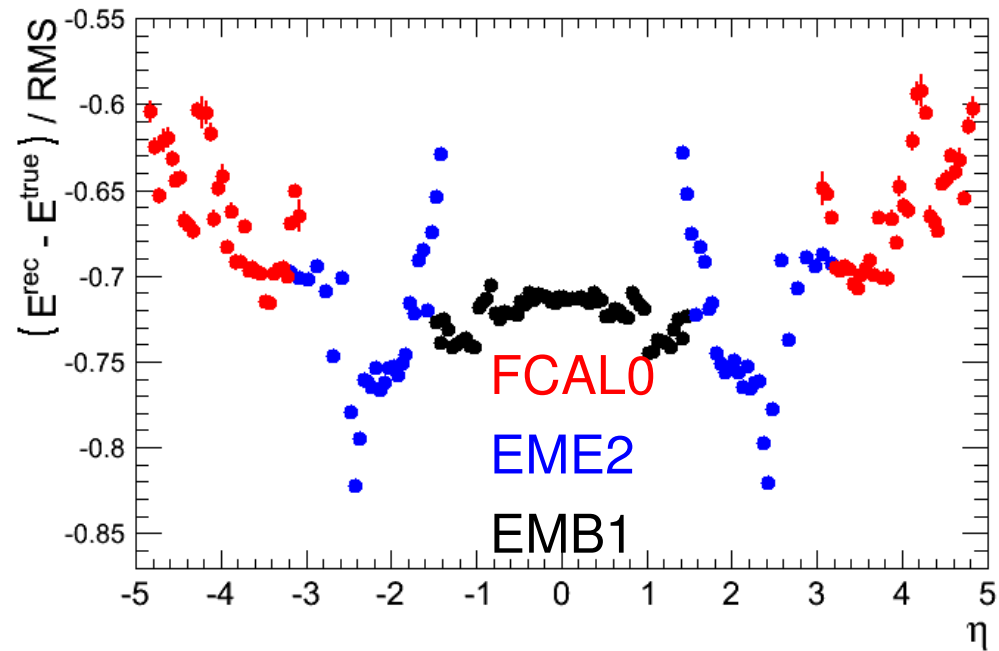
(white dots = “single minimum bias with pileup” without cuts)

# Bias for small signals after symmetric cuts

$3\sigma$  signal  
 $4\sigma$  cut

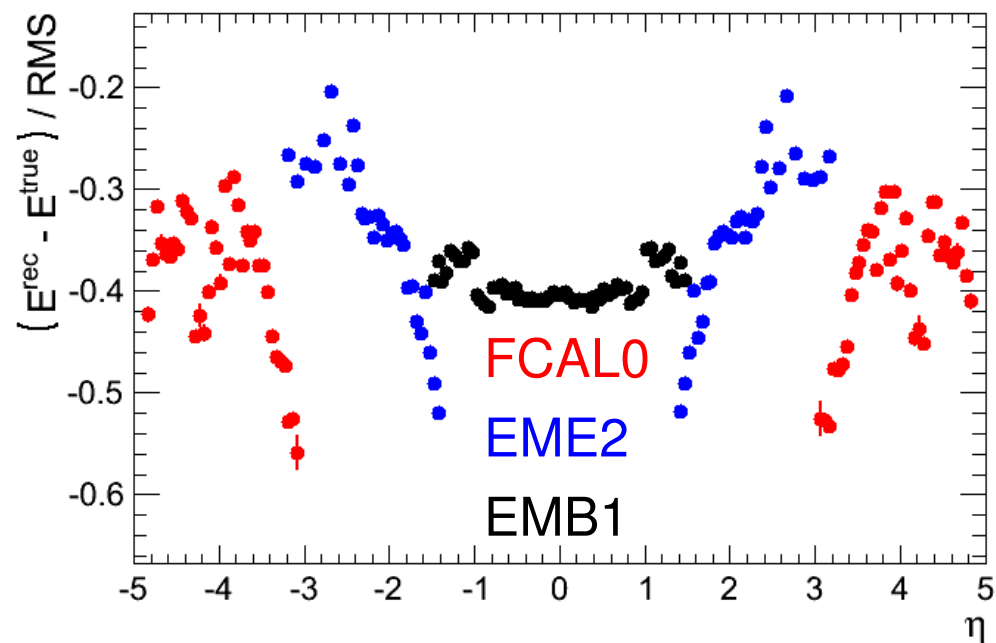


$1\sigma$  signal  
 $2\sigma$  cut



# Bias for small signals after symmetric cuts

5 $\sigma$  signal  
4 $\sigma$  cut



3 $\sigma$  signal  
2 $\sigma$  cut

