Digital RPC-HCAL slice test studies

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Outline

- **General**
- **MST clustering and resolution studies**
- **Some results**

General

- **· event selection**

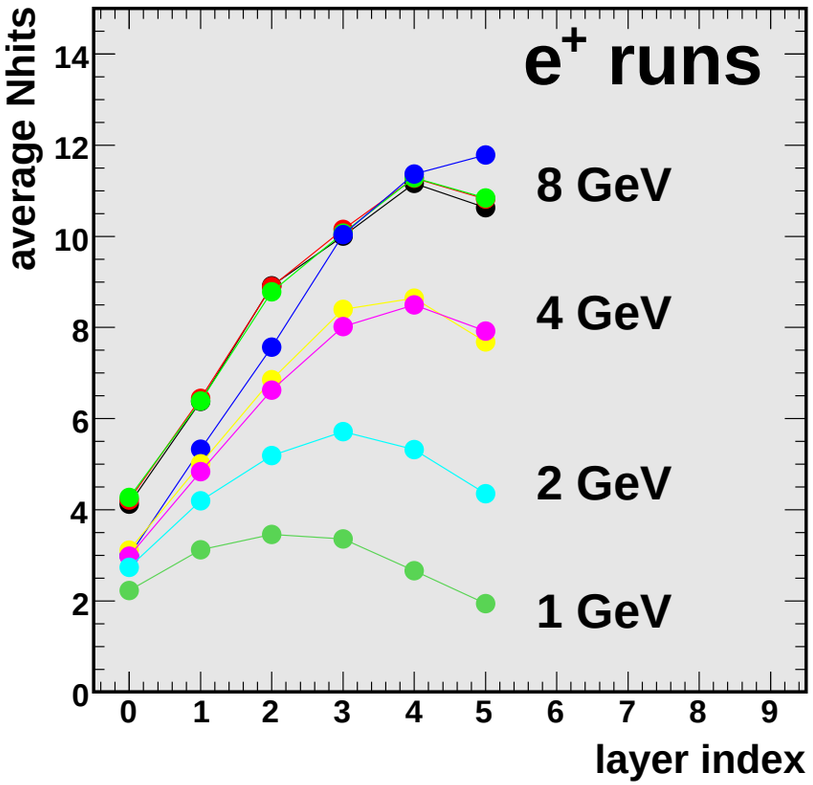
  : no event selection, no corrections,
  only a very first look into the data from the "slice test"

  : study with the e^+ runs,
  consider only the signal recorded from the first 6 chambers

- **· runs under study**

E(GeV)	e^+ run	# of events
8	240 241 242 254	39060
4	258 260	13192
2	262	8636
1	270	12097

Shower longitudinal profile



showers are not well contained (but shower maxima are)

MST clustering and resolution studies

(Minimal Spanning Tree)

- **· digital/semidigital performance**

  : intrigued by the results shown at LCWS07 (see talk by D.Chakraborty) wrt semidigital treatment of Si/W ECAL+ scint.HCAL+TCMT (improved combined energy resolution)

  : try to investigate whether "topological considerations" can improve the performance of a calorimeter compared to pure digital response

  : for a start, study Si/W ECAL hits, possibly go further to include scint.HCAL+TCMT.

- **· digital RPC-HCAL**

  : preliminary studies with "slice test" data

MST Clustering – Main steps

►. **metric**

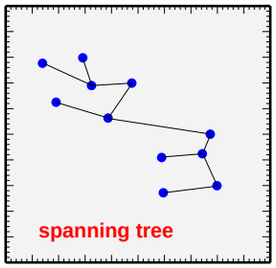
define a metric	:	metric defines configuration space
	:	not necessarily euclidean
fill distance matrix	:	lower triangular N^2 matrix

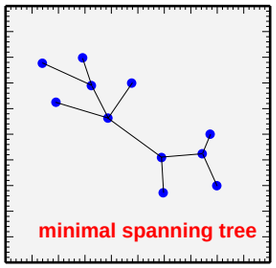
►. **MST**

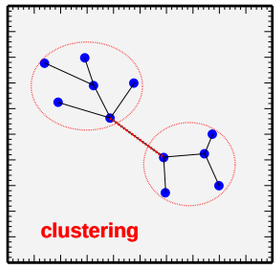
construct the MST	:	apply Prim's algorithm

►. **clustering**

set cut	:	"proximity" bound between nodes belonging to the same cluster
find clusters	:	single linkage cluster analysis
	:	i.e. go through MST and cut branches with length above cut







MST clustering and resolution studies

- · possible metrics to study

euclidean distance $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2}$

scaled euclidean distance $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (\frac{R_M}{X_0})^2 (z_i - z_j)^2}$

or generally $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + A \cdot (z_i - z_j)^N}$

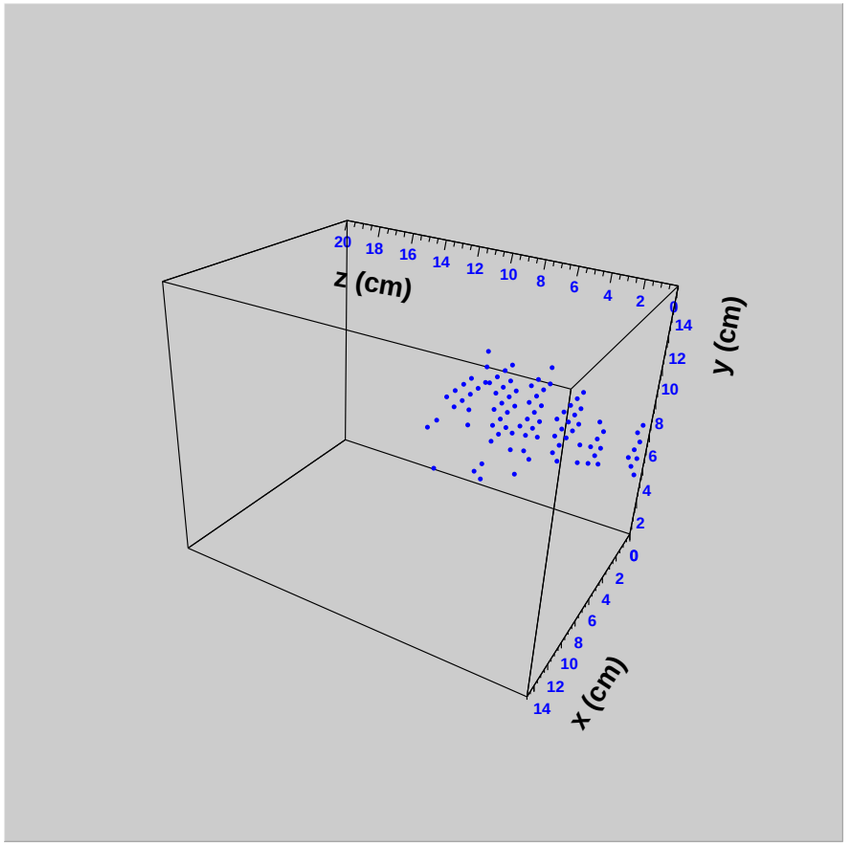
angular distance $d_{ij} = acos \frac{x_i x_j + y_i y_j + z_i z_j}{\sqrt{x_i^2 + y_i^2 + z_i^2} \sqrt{x_j^2 + y_j^2 + z_j^2}}$

etc ...

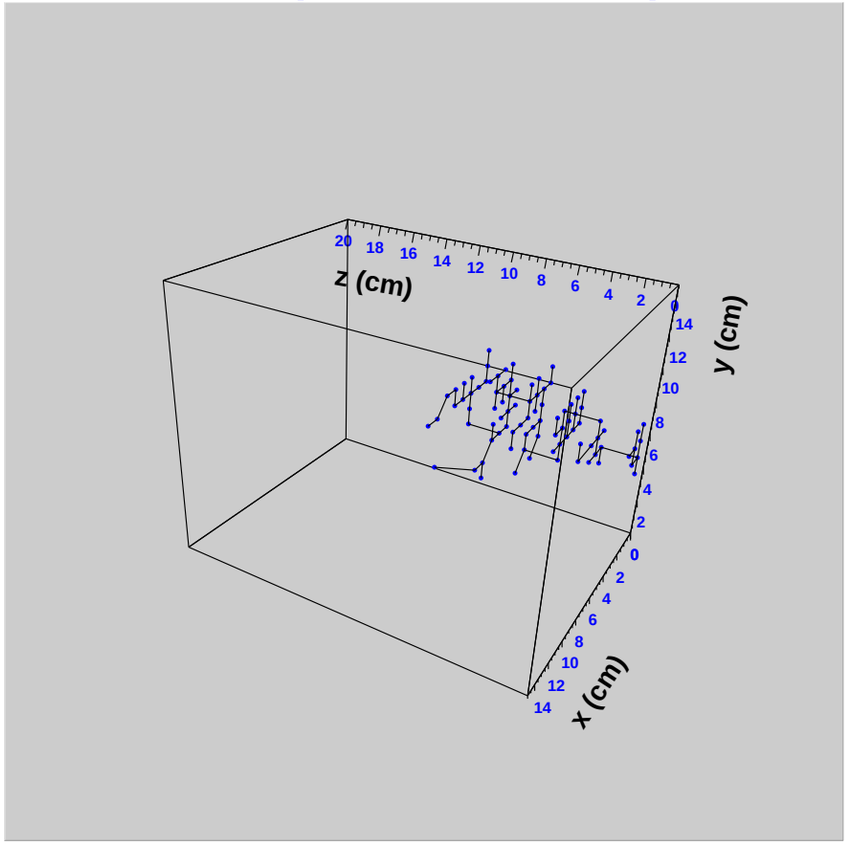
- · show next some plots with euclidean metric

MST example

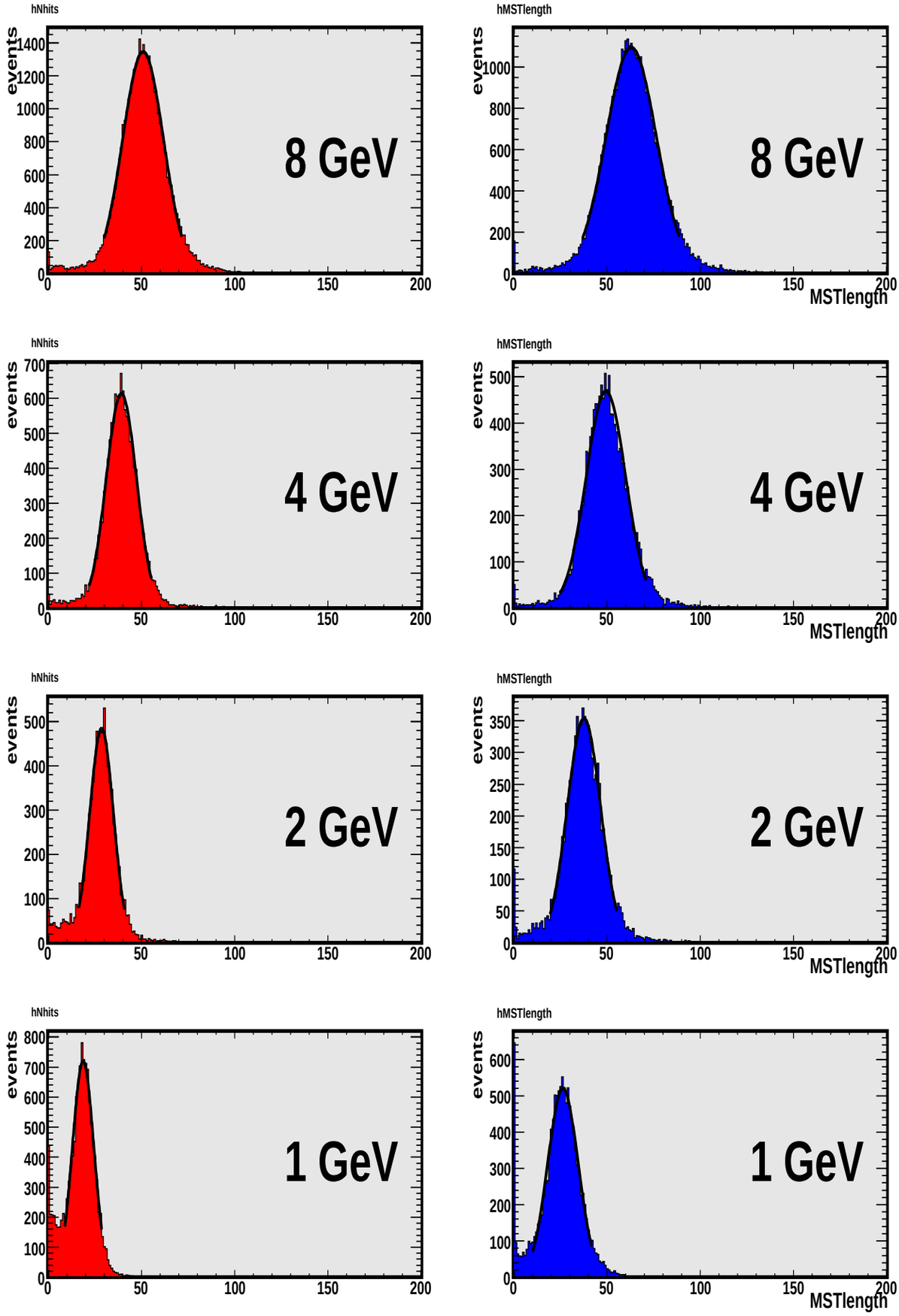
shower hits (e^+ 8 GeV)



MST (euclidean metric)

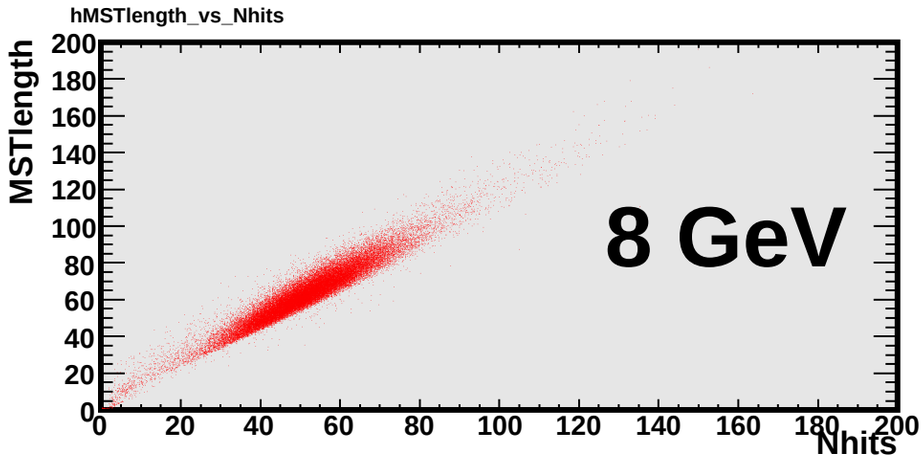


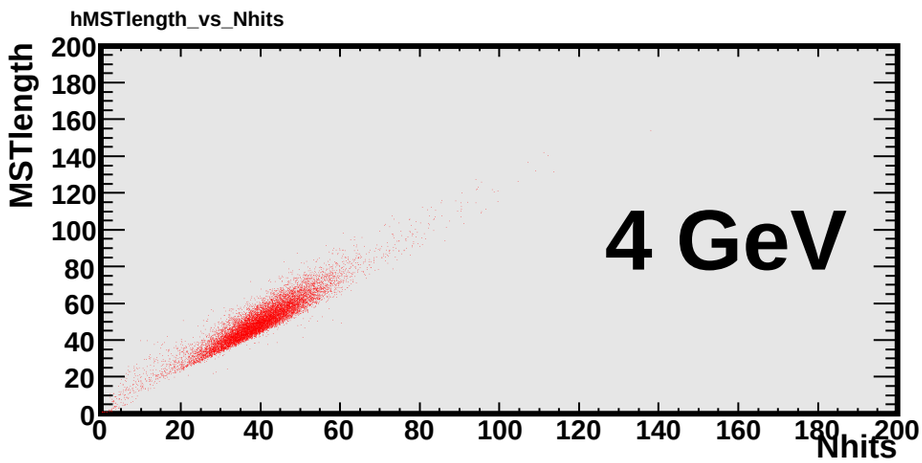
Nhits, MSTlength

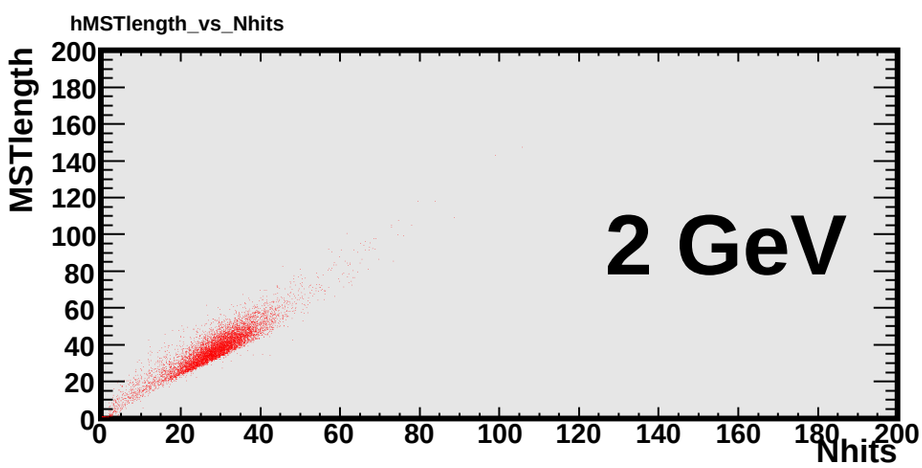


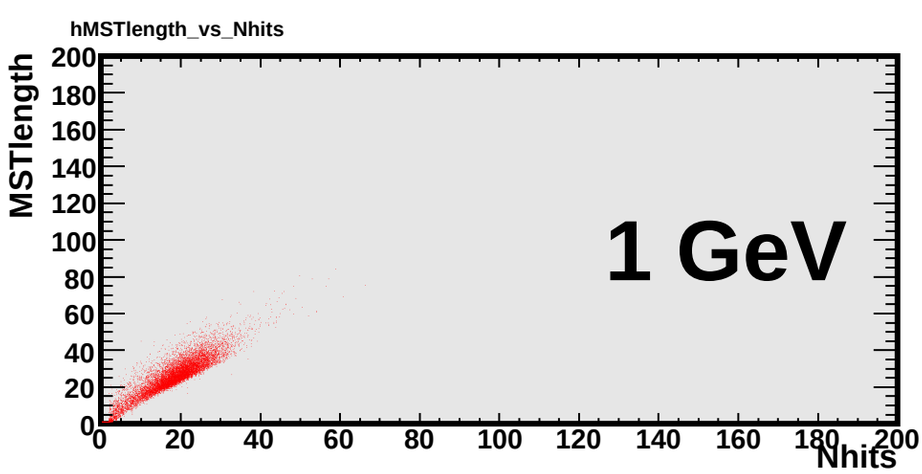
Nhits **MSTlength**

MSTlength vs Nhits

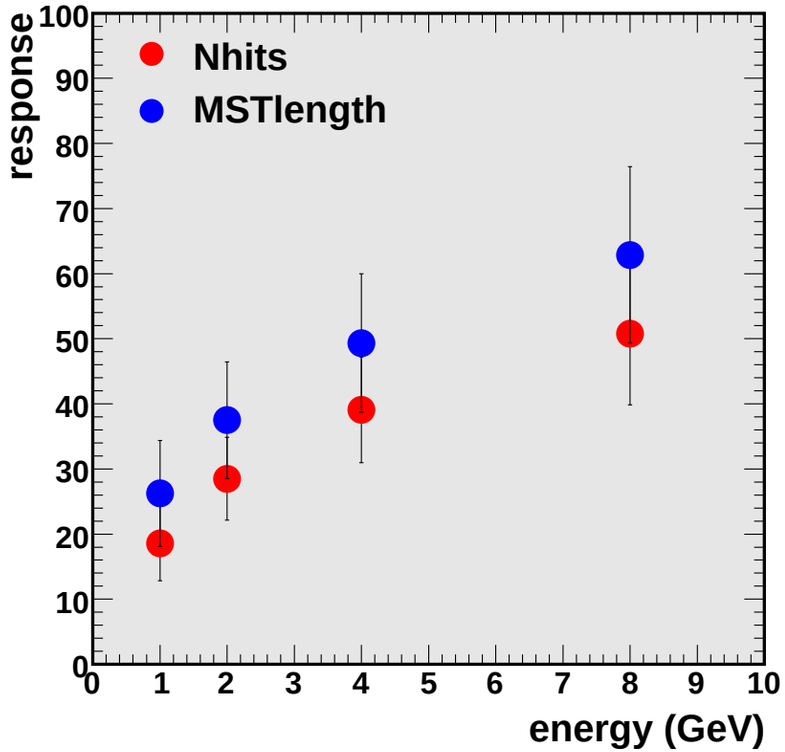


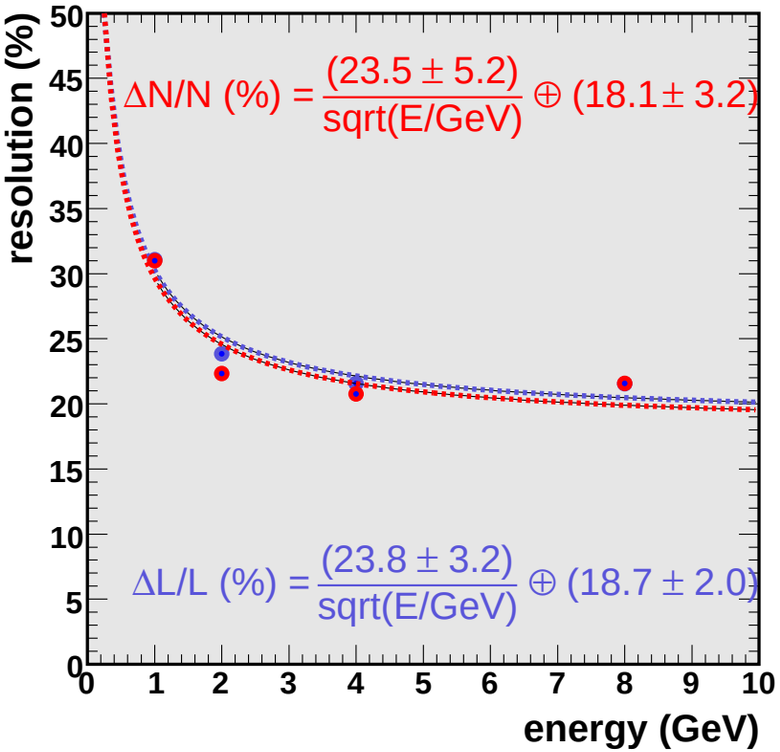






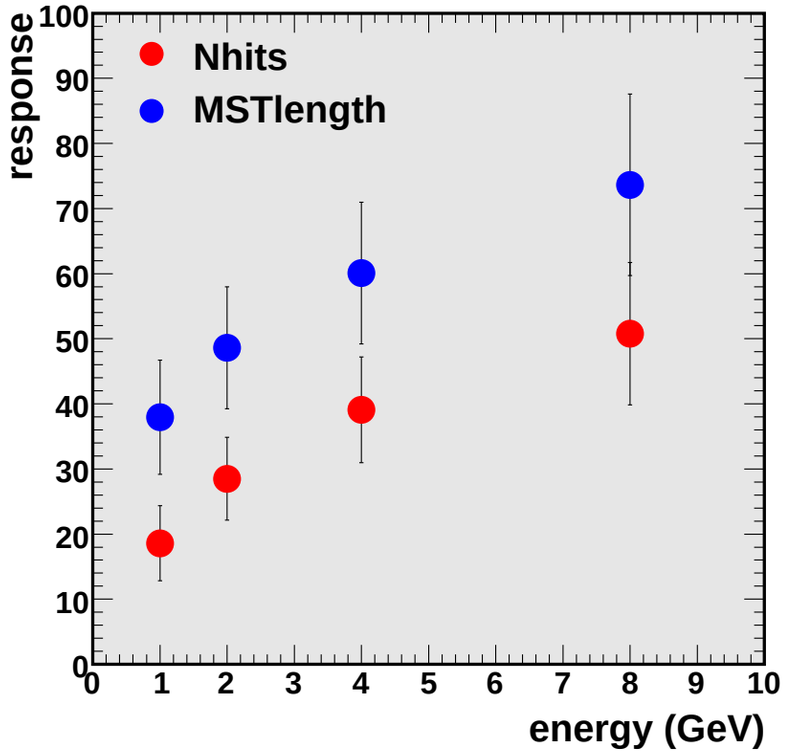
Response & resolution

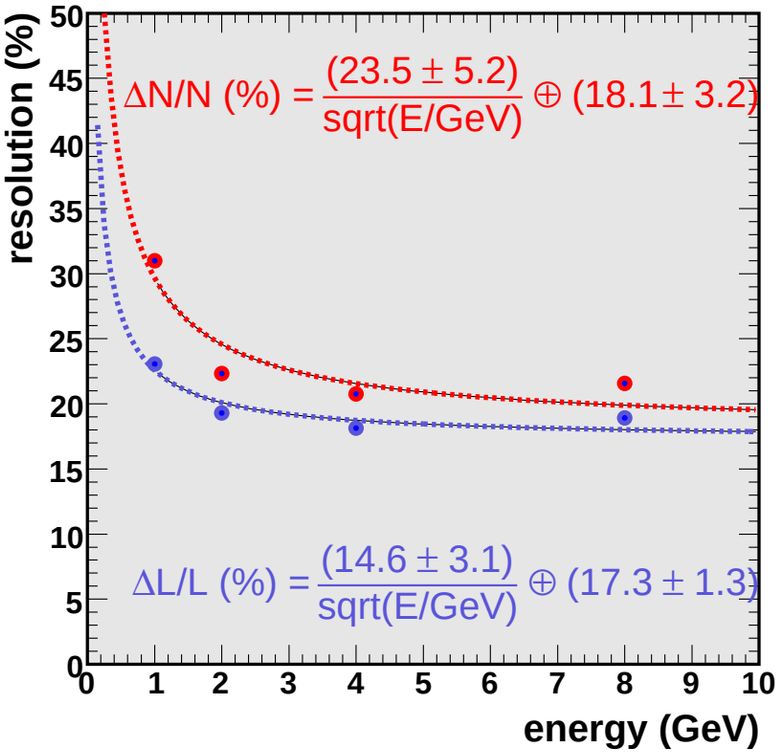




(metric is $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2}$**)**

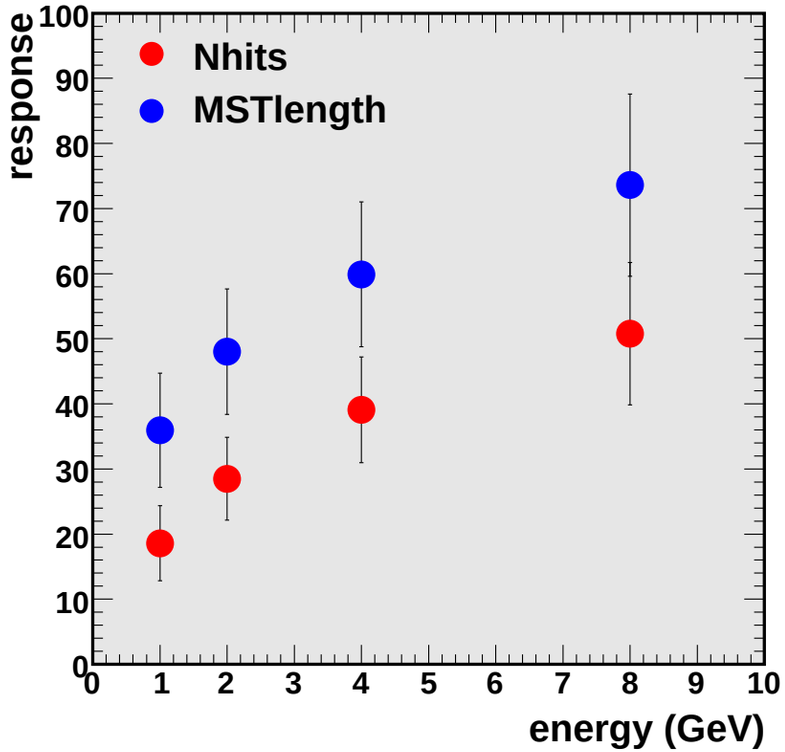
Response & resolution

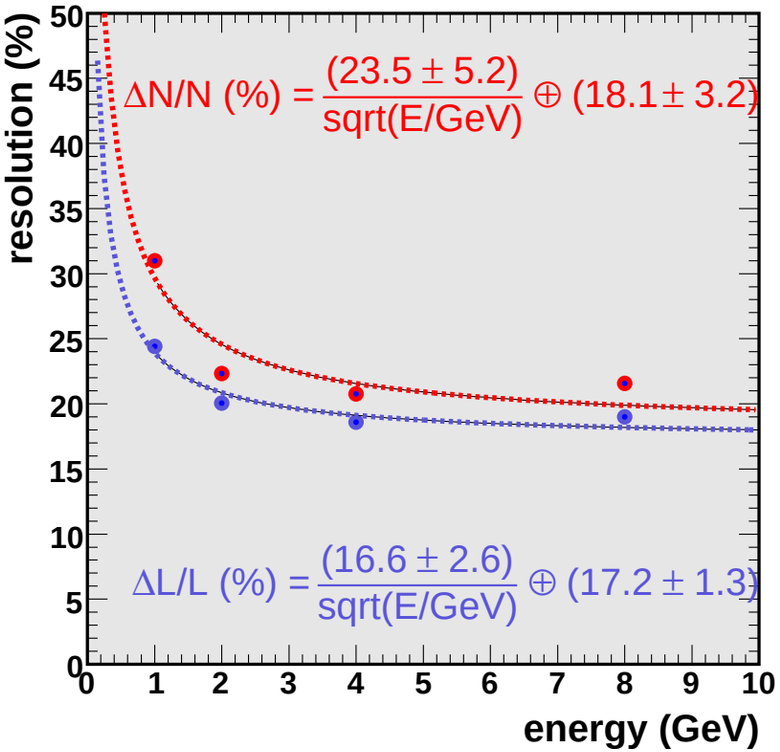




(metric is $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^4}$**)**

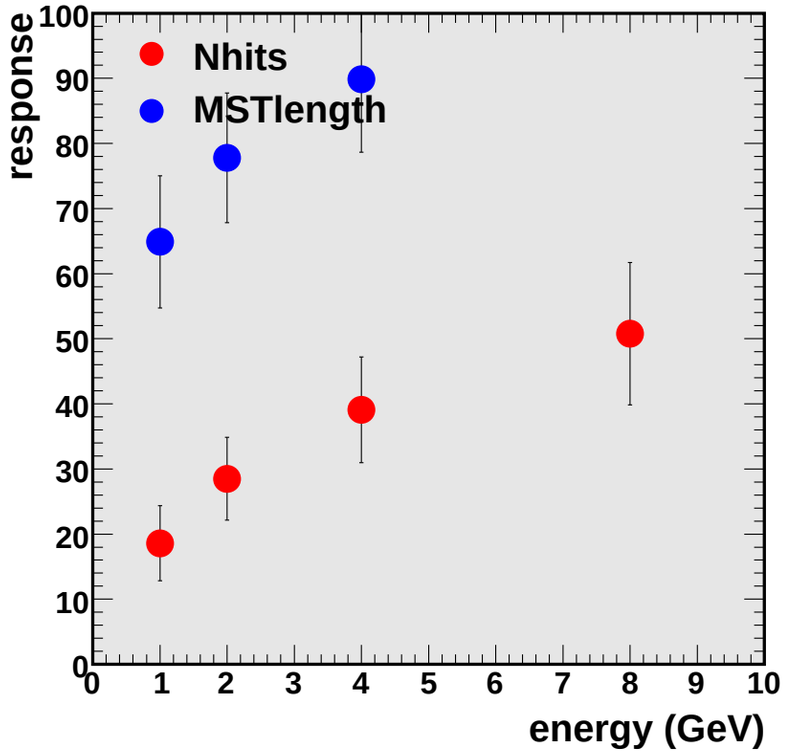
Response & resolution

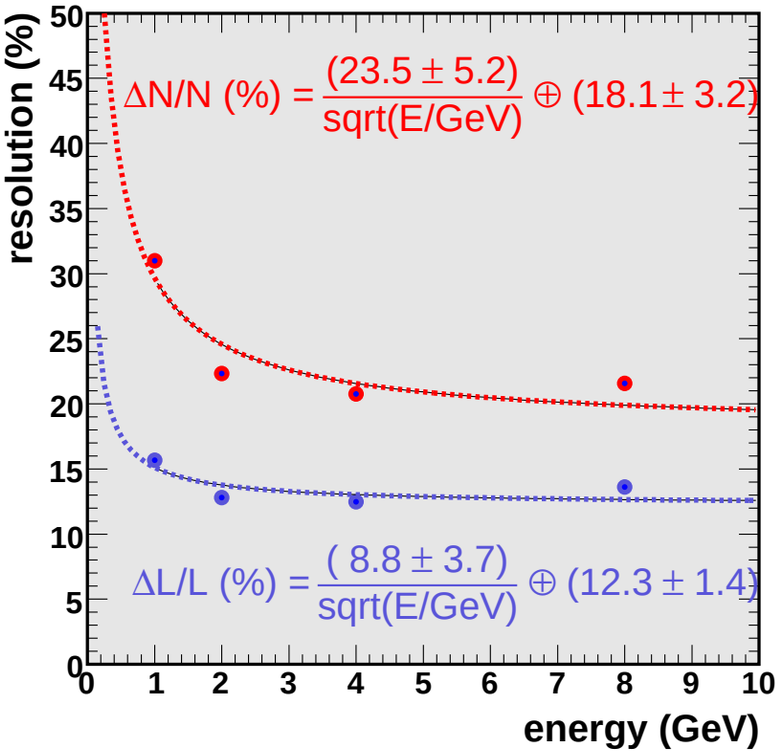




(metric is $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (2 \cdot (z_i - z_j))^2}$**)**

Response & resolution





(metric is $d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (5 \cdot (z_i - z_j))^2}$**)**