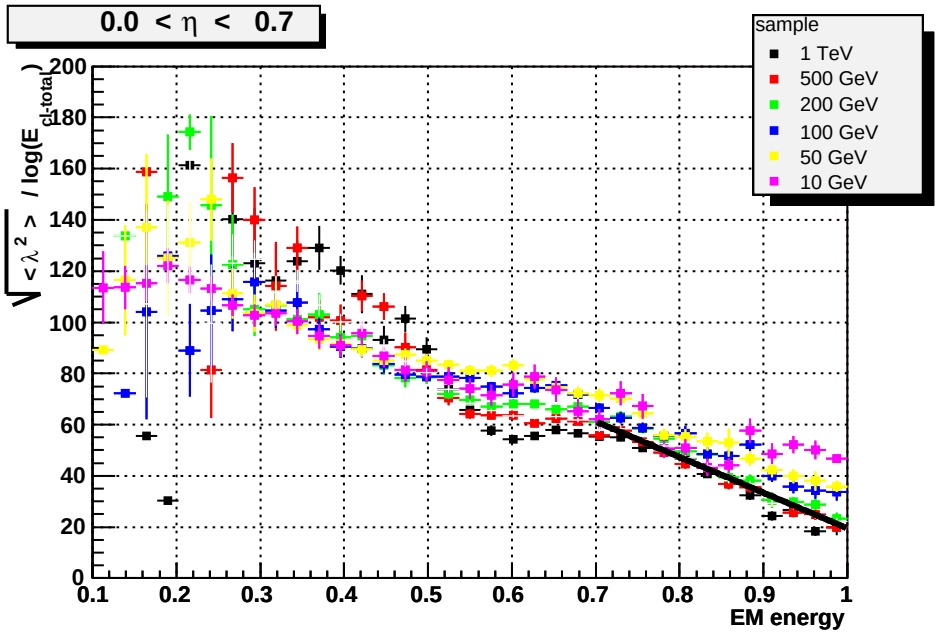
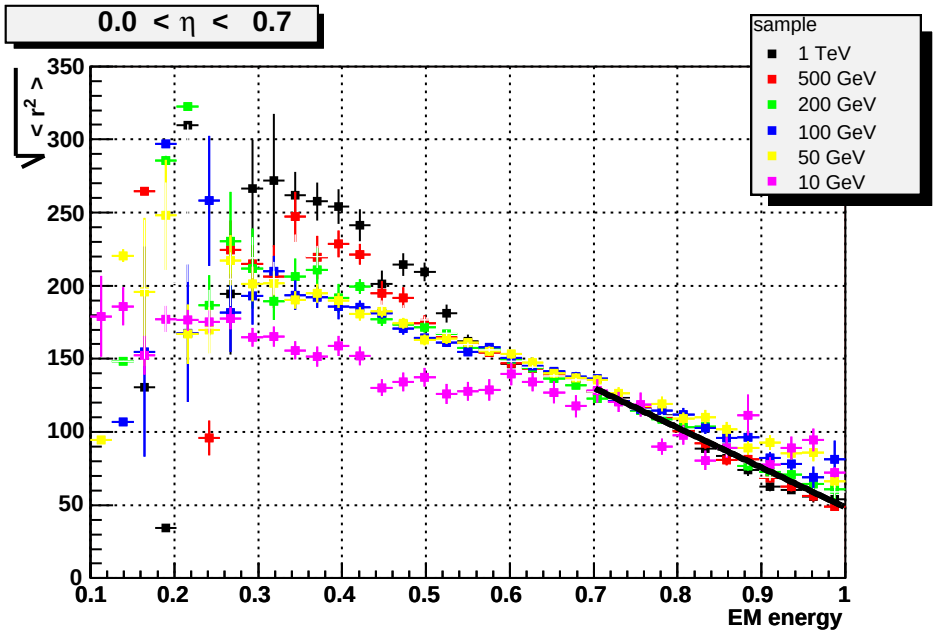
Estimation of EM component using moments for more energetic clusters

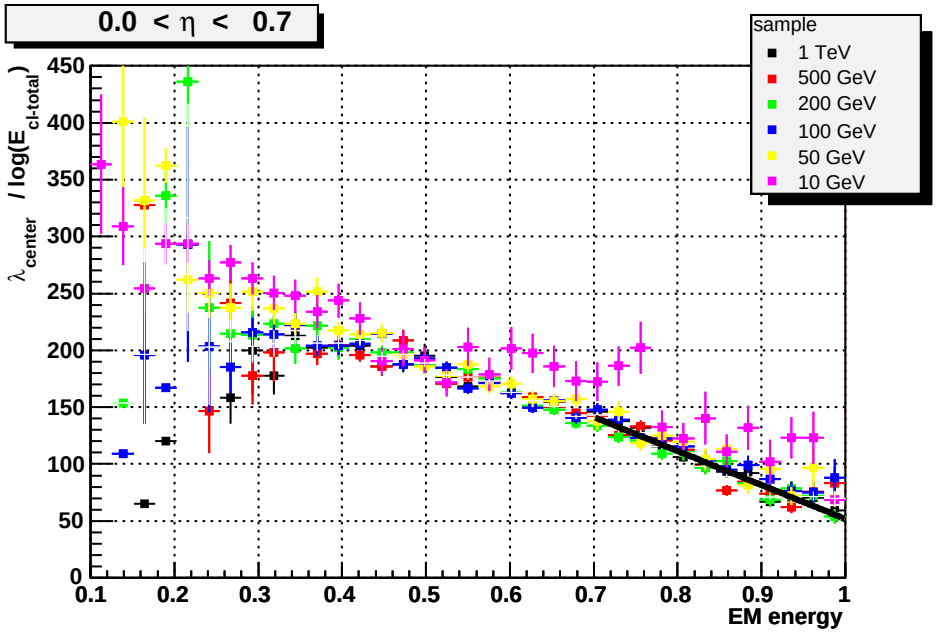
- The aim is to identify EM clusters and exclude them from weighting procedure
- All the topological moments are correlated with the electromagnetic component of the deposited energy
- I use simple linear fit to calculate the electromagnetic component of the deposited energy from topological cluster

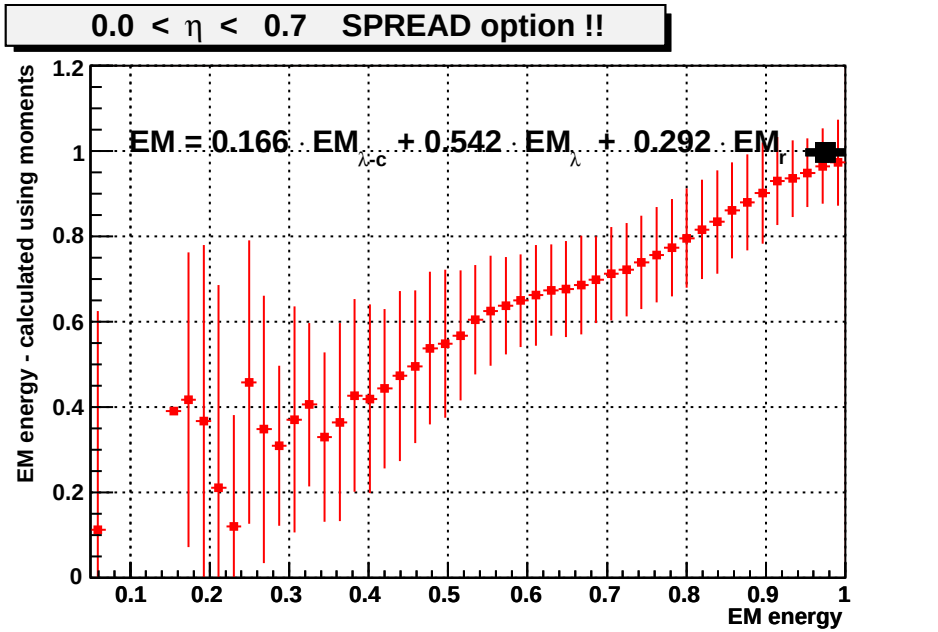
moments (i.e.I receive 3 different but strongly correlated calculated EM components) and afterwards I try to find weighted mean value of calculated EM components using MINUIT to minimize the spread (I plot calculated vs. "true" EM component - big black square are 100 GeV electrons)

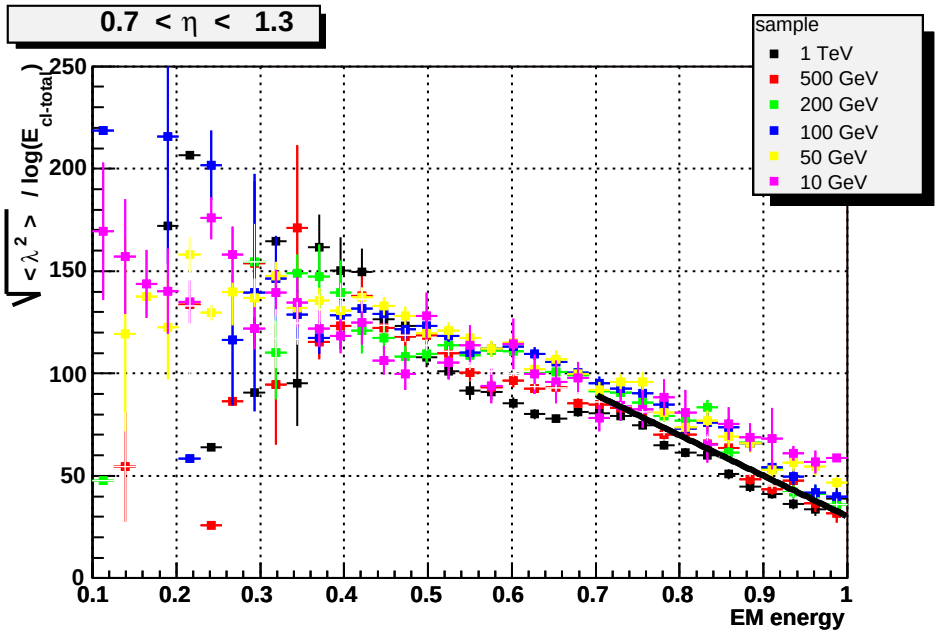
- The calorimeter is divided into 6 η bins
  - barrel 1
  - barrel 2
  - crack 1
  - encap
  - crack 2
  - forward

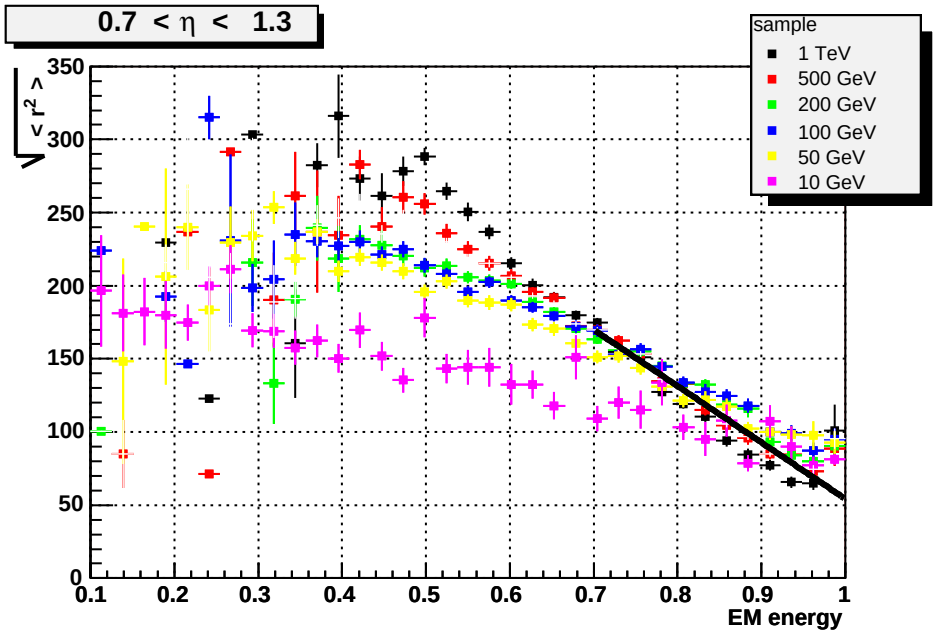

0.0 < η < 0.7
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< λ² > / log(E cl-total)
EM energy

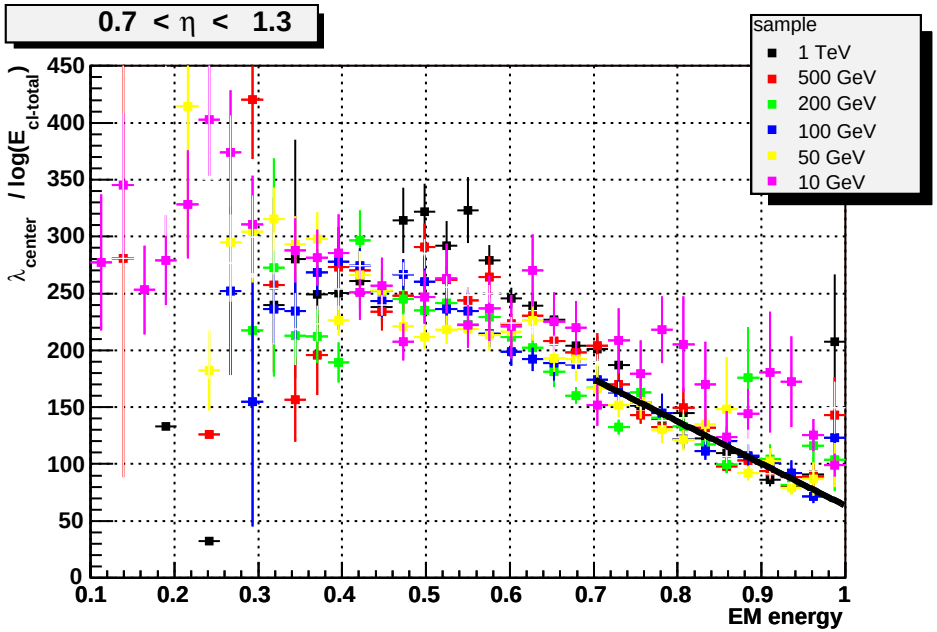

0.0 < η < 0.7
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< r² >
EM energy

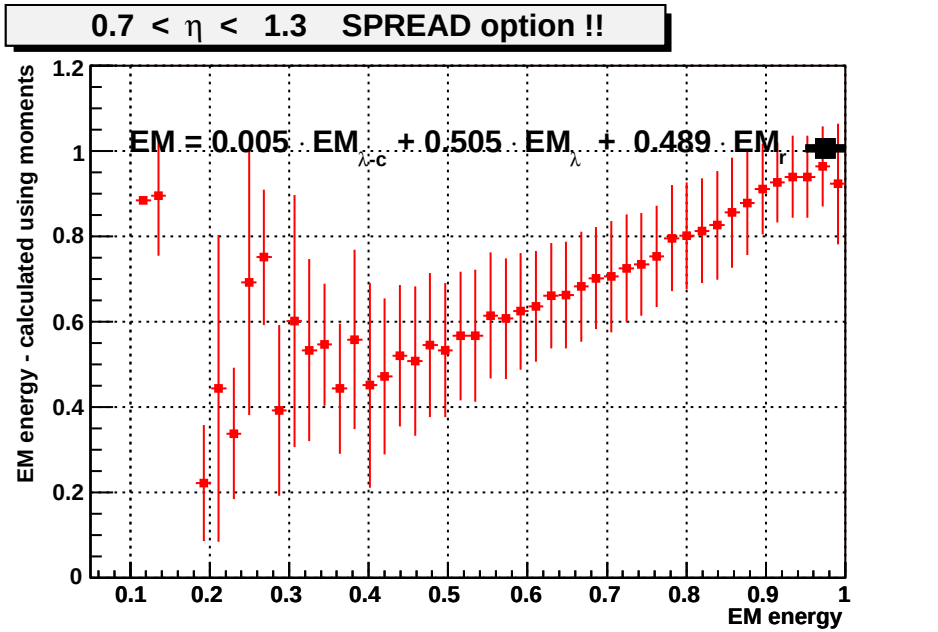

0.0 < η < 0.7
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
λ center / log(E cl-total)
EM energy

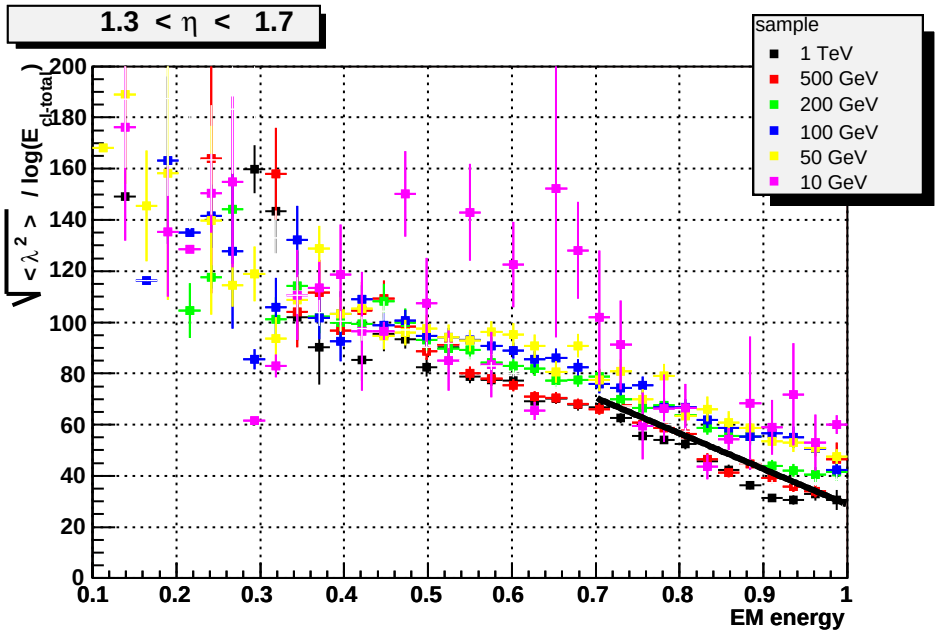

0.0 < η < 0.7 SPREAD option !!
EM = 0.166 EM λ-c + 0.542 EM λ + 0.292 EM r
EM energy - calculated using moments
EM energy

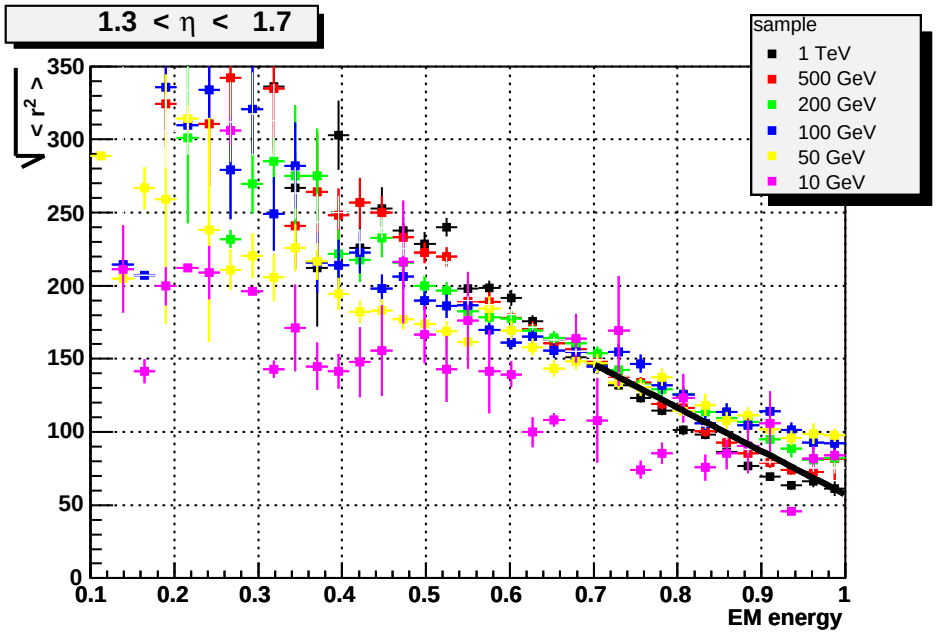

0.7 < η < 1.3
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< λ² > / log(E_cl-total)
EM energy

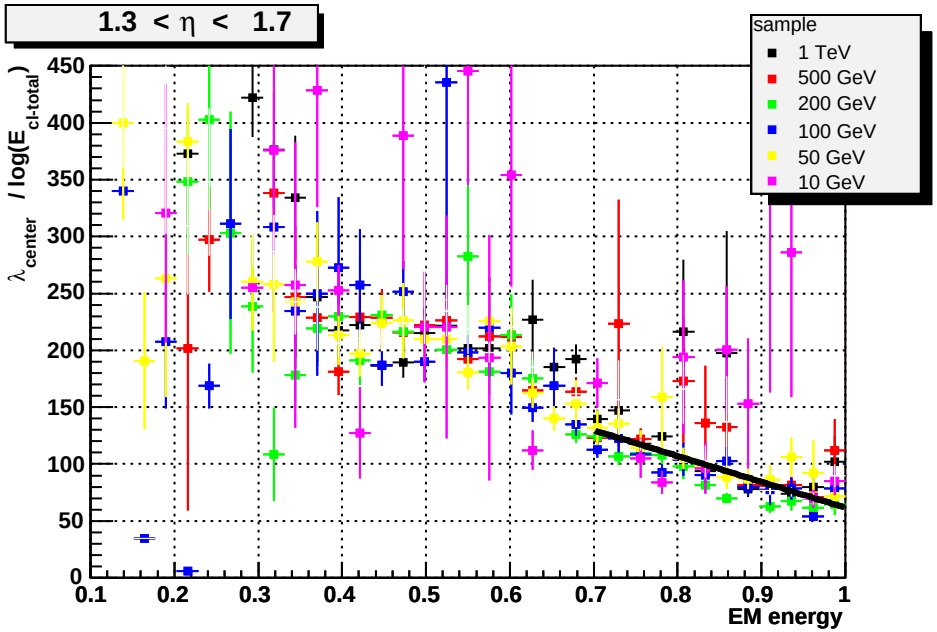

0.7 < η < 1.3
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< r² >
EM energy

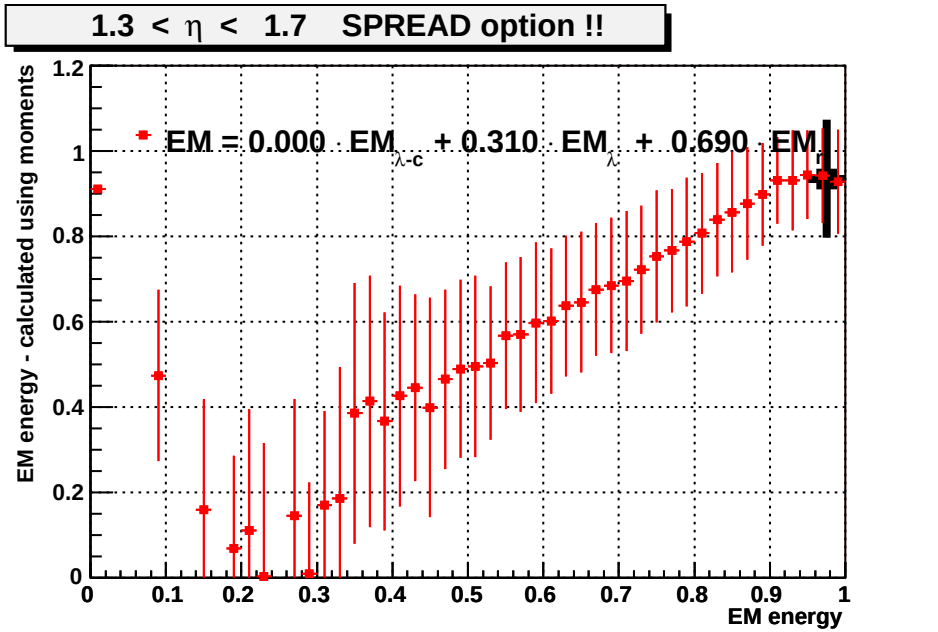

0.7 < η < 1.3
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
λ_center / log(E_cl-total)
EM energy

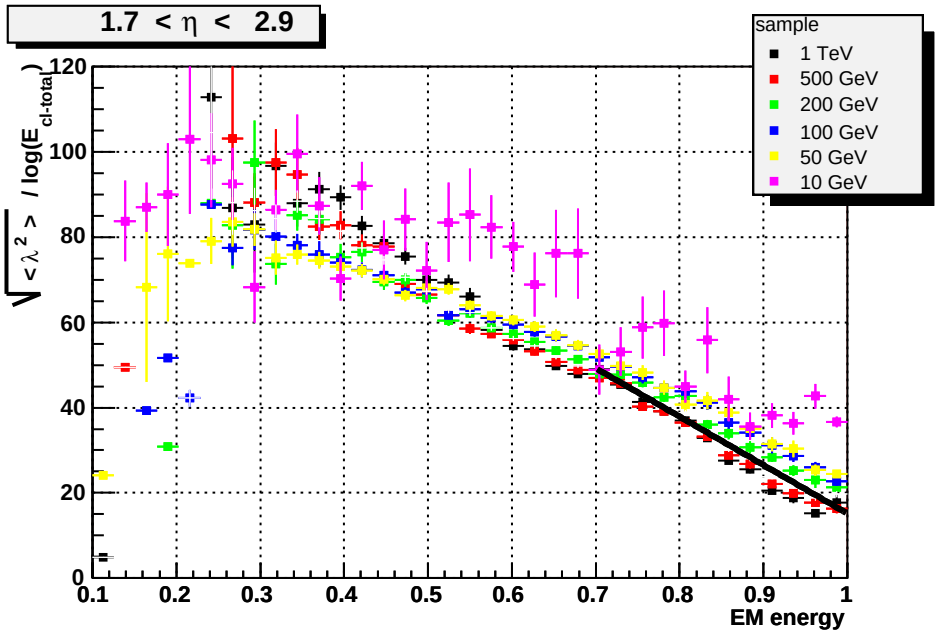

0.7 < η < 1.3 SPREAD option !!
EM = 0.005 EM_λ-c + 0.505 EM_λ + 0.489 EM_r
EM energy - calculated using moments
EM energy

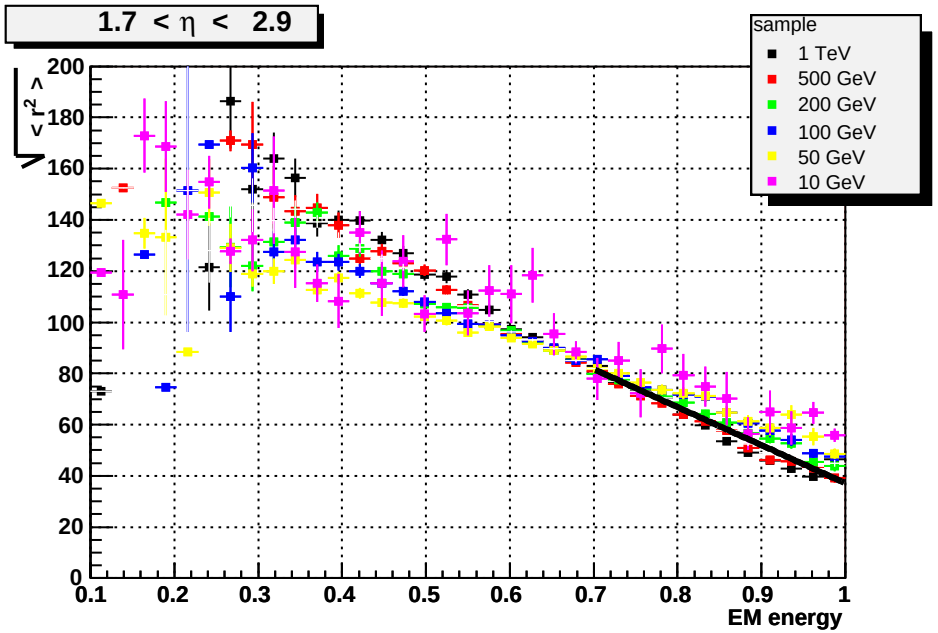

1.3 < η < 1.7
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< λ² > / log(E_cl-total)
EM energy

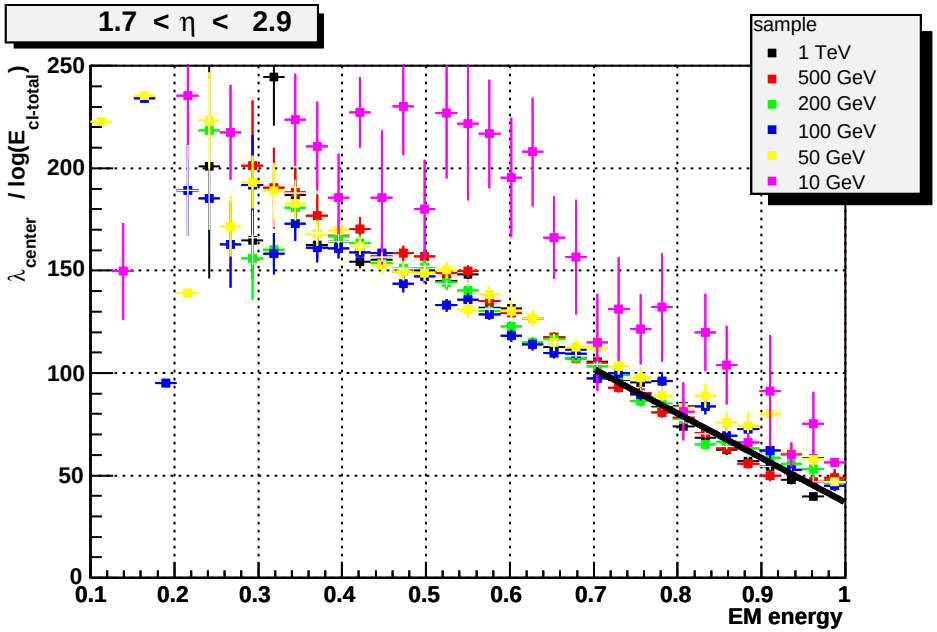

1.3 < η < 1.7
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< r² >
EM energy

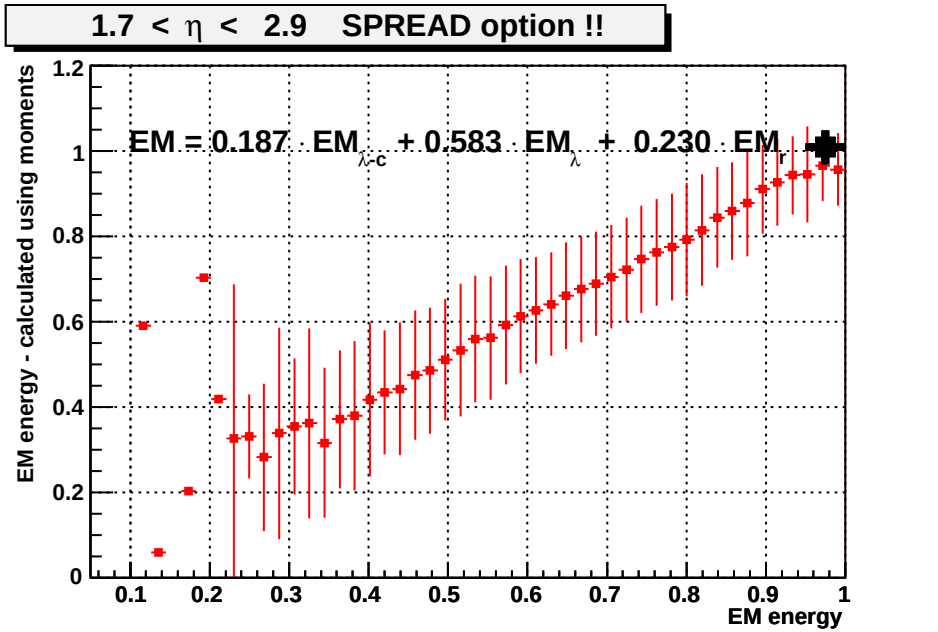

1.3 < η < 1.7
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
λ_center / log(E_cl-total)
EM energy

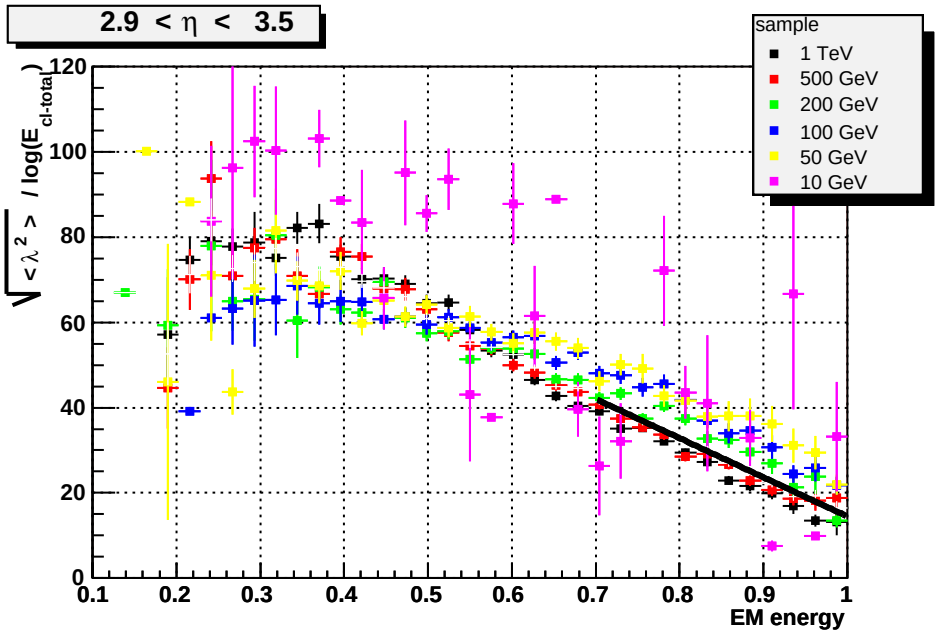

1.3 < η < 1.7 SPREAD option !!
EM = 0.000 EM_λ-c + 0.310 EM_λ + 0.690 EM_r
EM energy - calculated using moments
EM energy

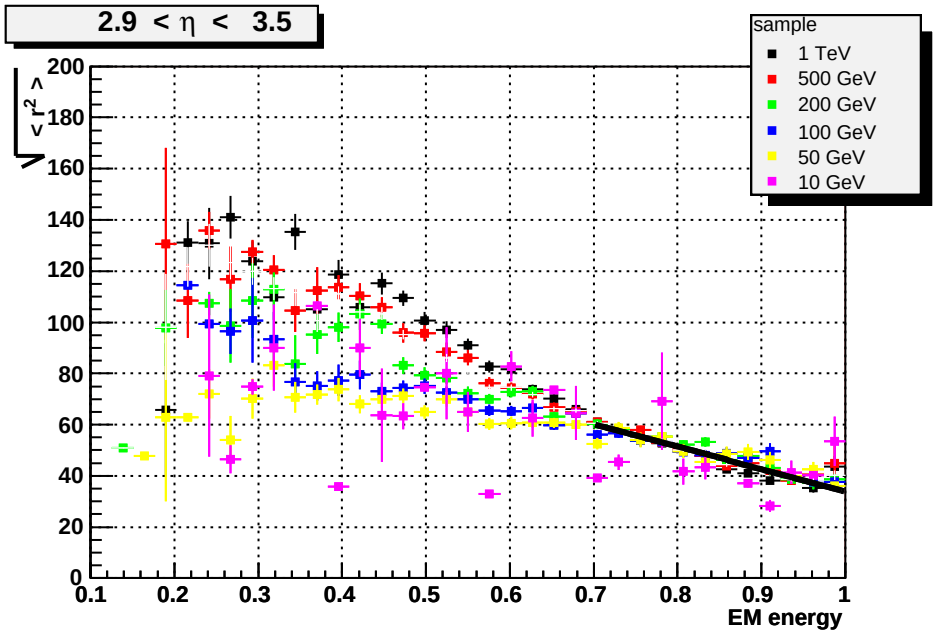

1.7 < η < 2.9
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< λ 2 > / log(E cl-total)
EM energy

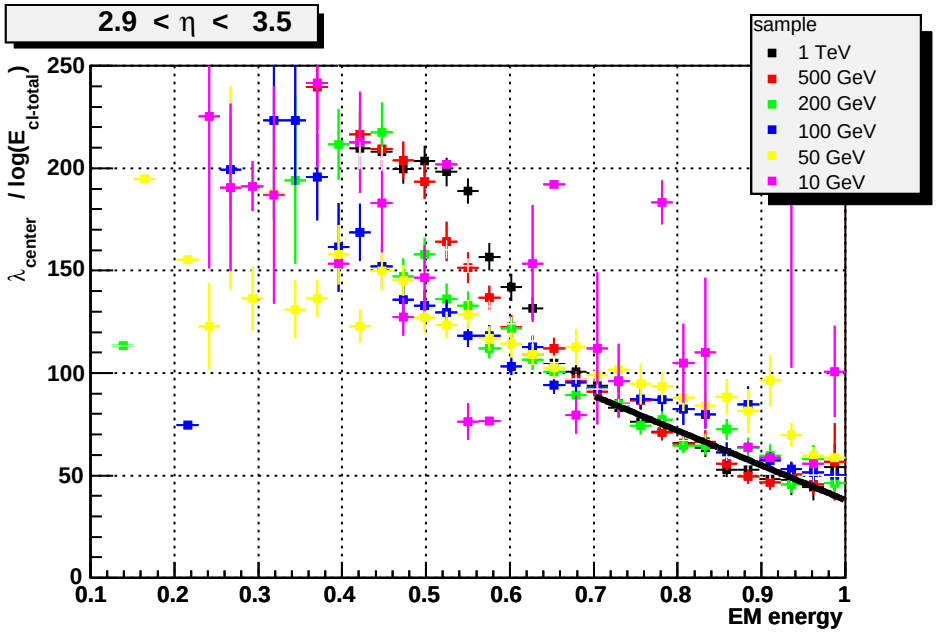

1.7 < η < 2.9
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< r2 >
EM energy

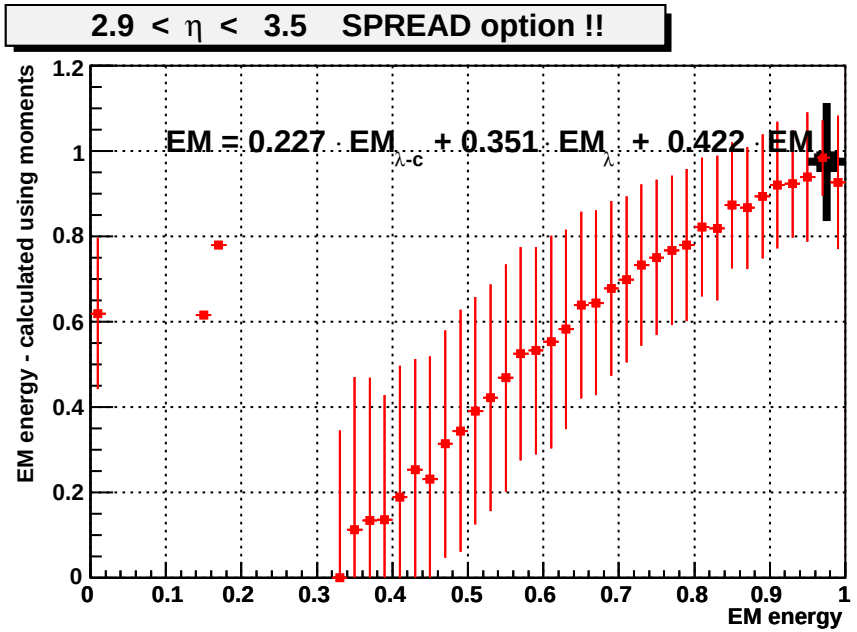

1.7 < η < 2.9
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
λcenter / log(E cl-total)
EM energy

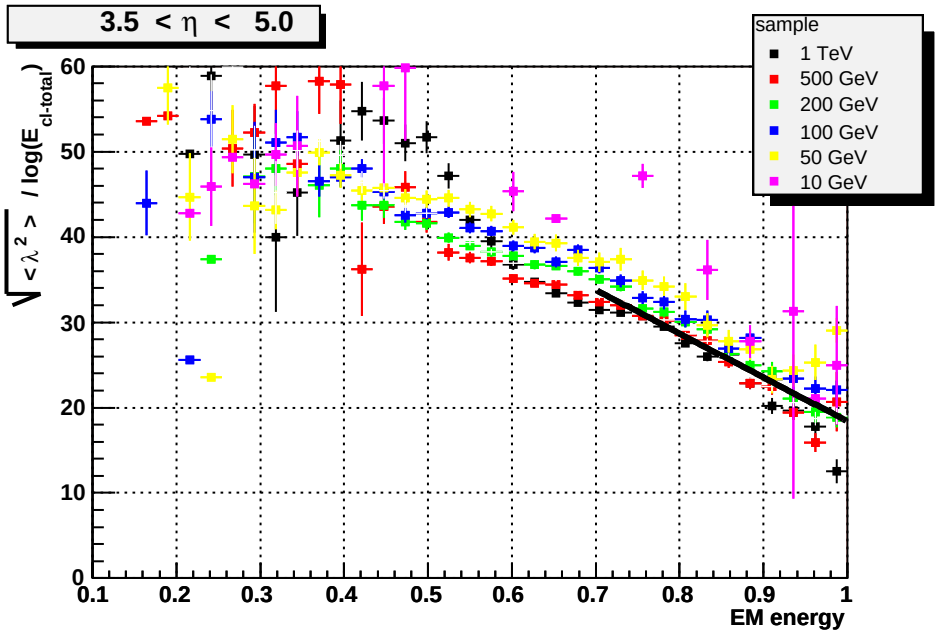

1.7 < η < 2.9 SPREAD option !!
EM = 0.187 EM λ-c + 0.583 EM λ + 0.230 EM r
EM energy - calculated using moments
EM energy

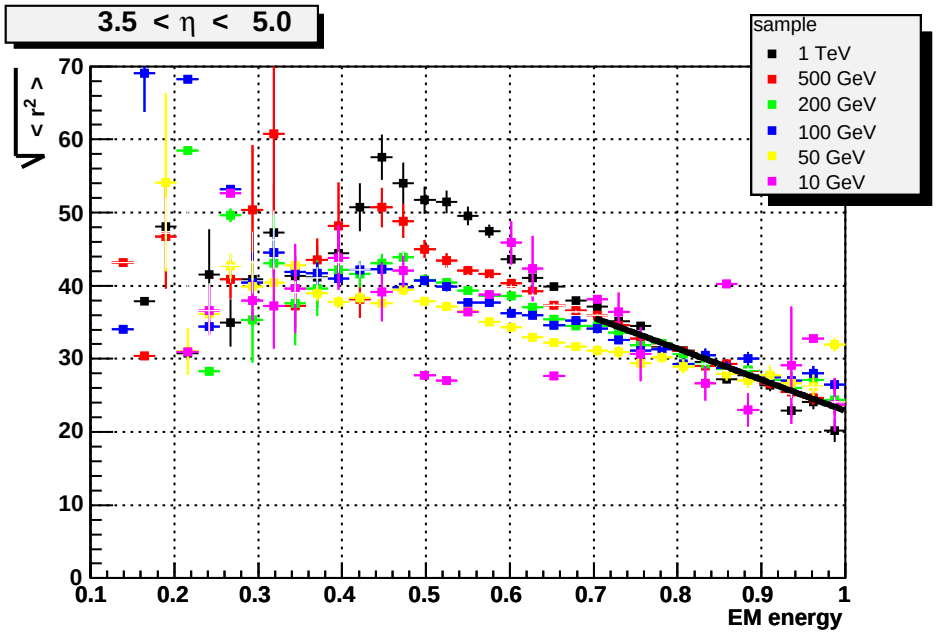

2.9 < η < 3.5
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< λ 2 > / log(E cl-total)
EM energy

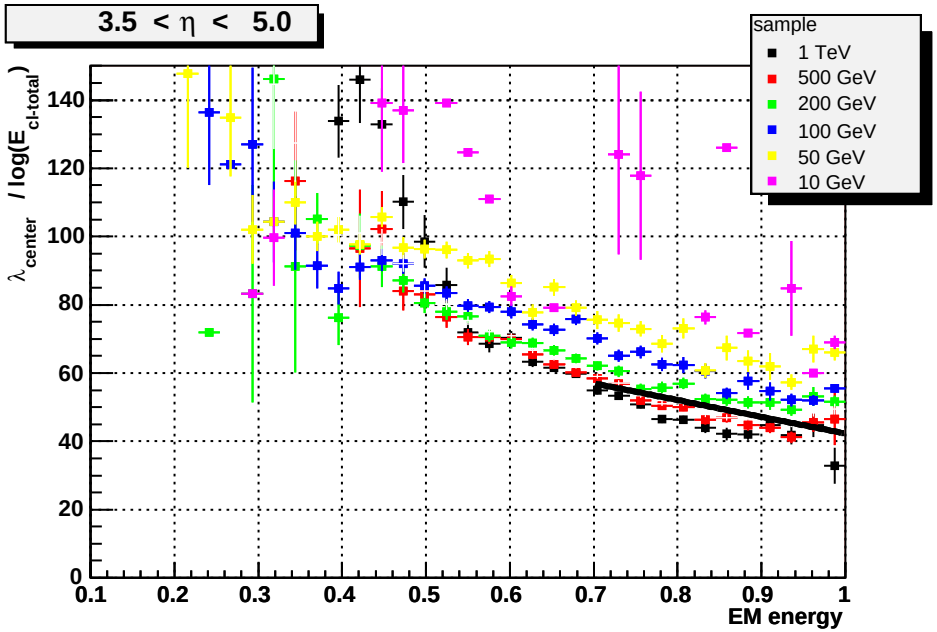

2.9 < η < 3.5
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< r2 >
EM energy

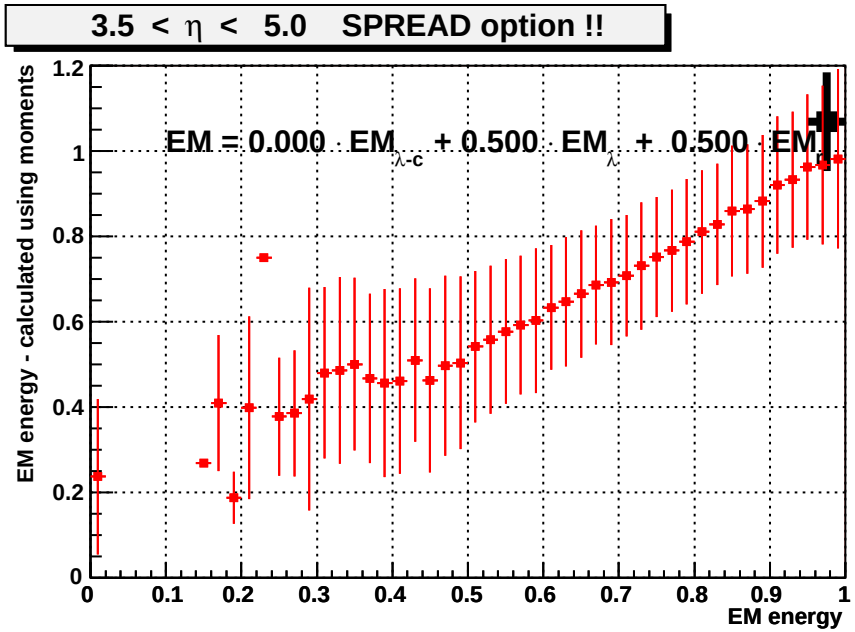

2.9 < η < 3.5
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
λcenter / log(E cl-total)
EM energy


2.9 < η < 3.5 SPREAD option !!
EM = 0.227 EM λ-c + 0.351 EM λ + 0.422 EM
EM energy - calculated using moments
EM energy

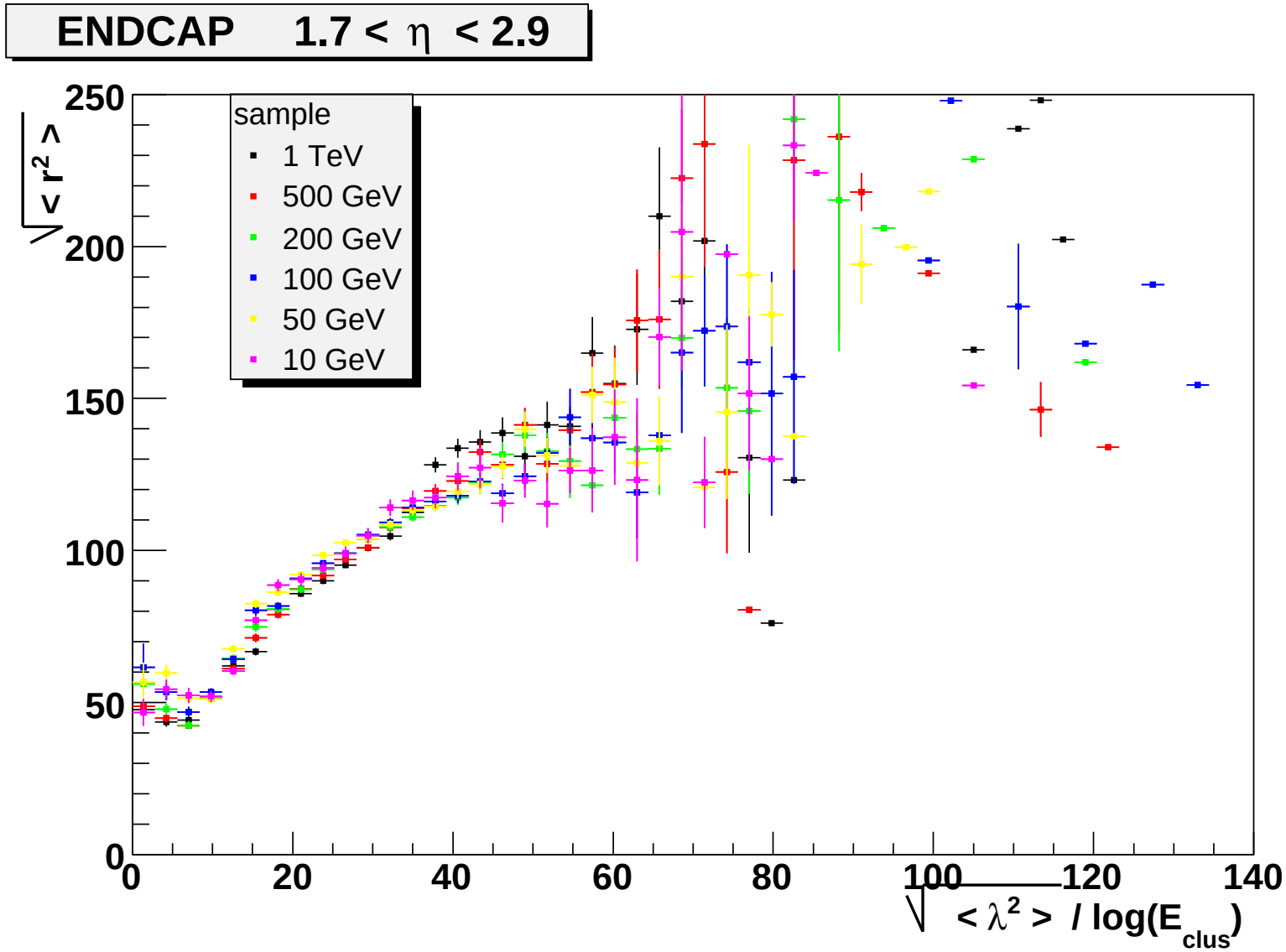

3.5 < η < 5.0
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< λ² > / log(E_cl-total)
EM energy

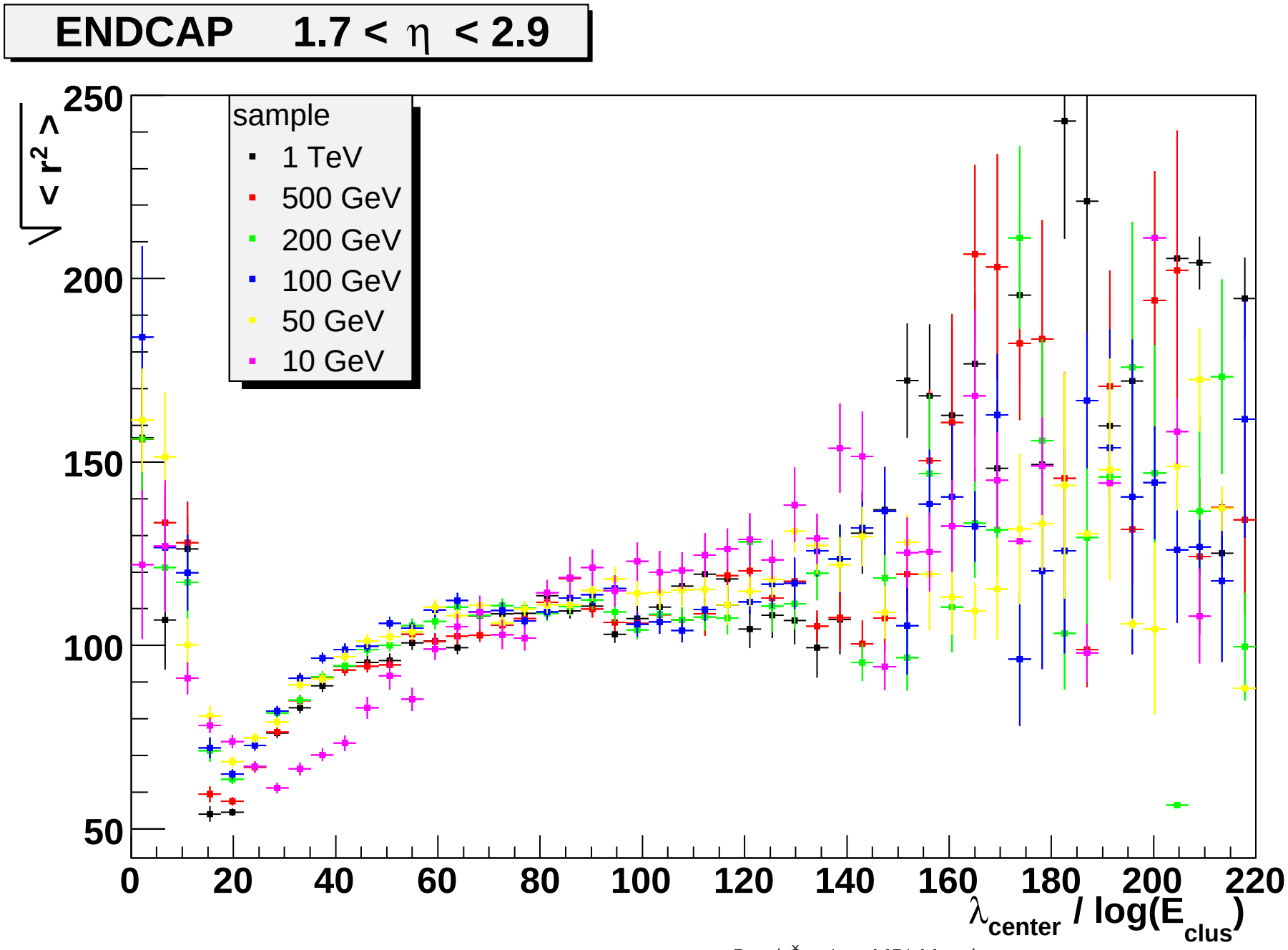

3.5 < η < 5.0
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√< r² >
EM energy

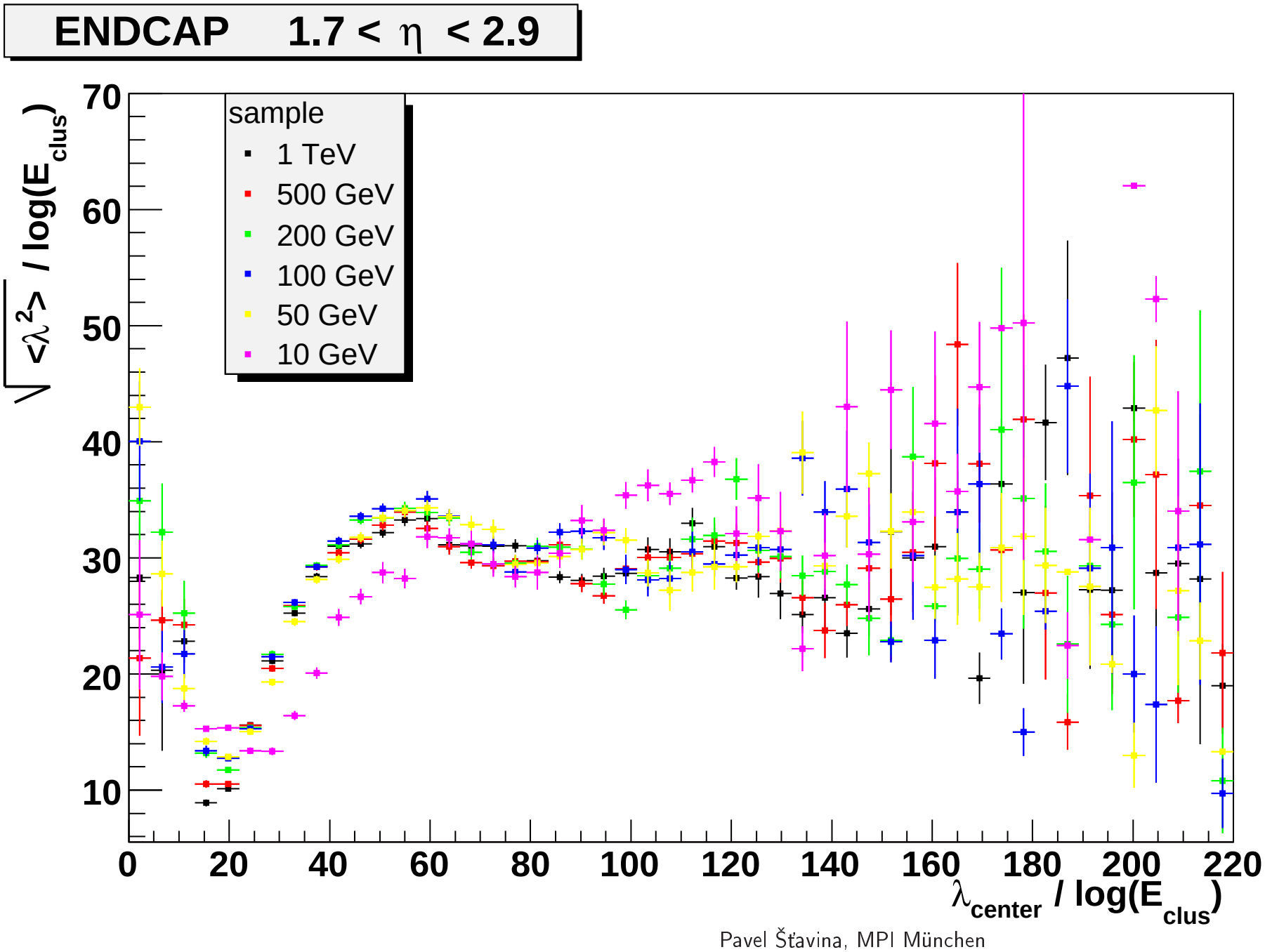

3.5 < η < 5.0
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
λ_center / log(E_cl-total)
EM energy


3.5 < η < 5.0 SPREAD option !!
EM = 0.000 EM_λ-c + 0.500 EM_λ + 0.500 EM
EM energy - calculated using moments
EM energy

Correlations - momements are strongly correlated




ENDCAP 1.7 < η < 2.9
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
√ < r² >
250
200
150
100
50
0
20
40
60
80
100
120
140
160
180
200
220
λcenter / log(Eclus)

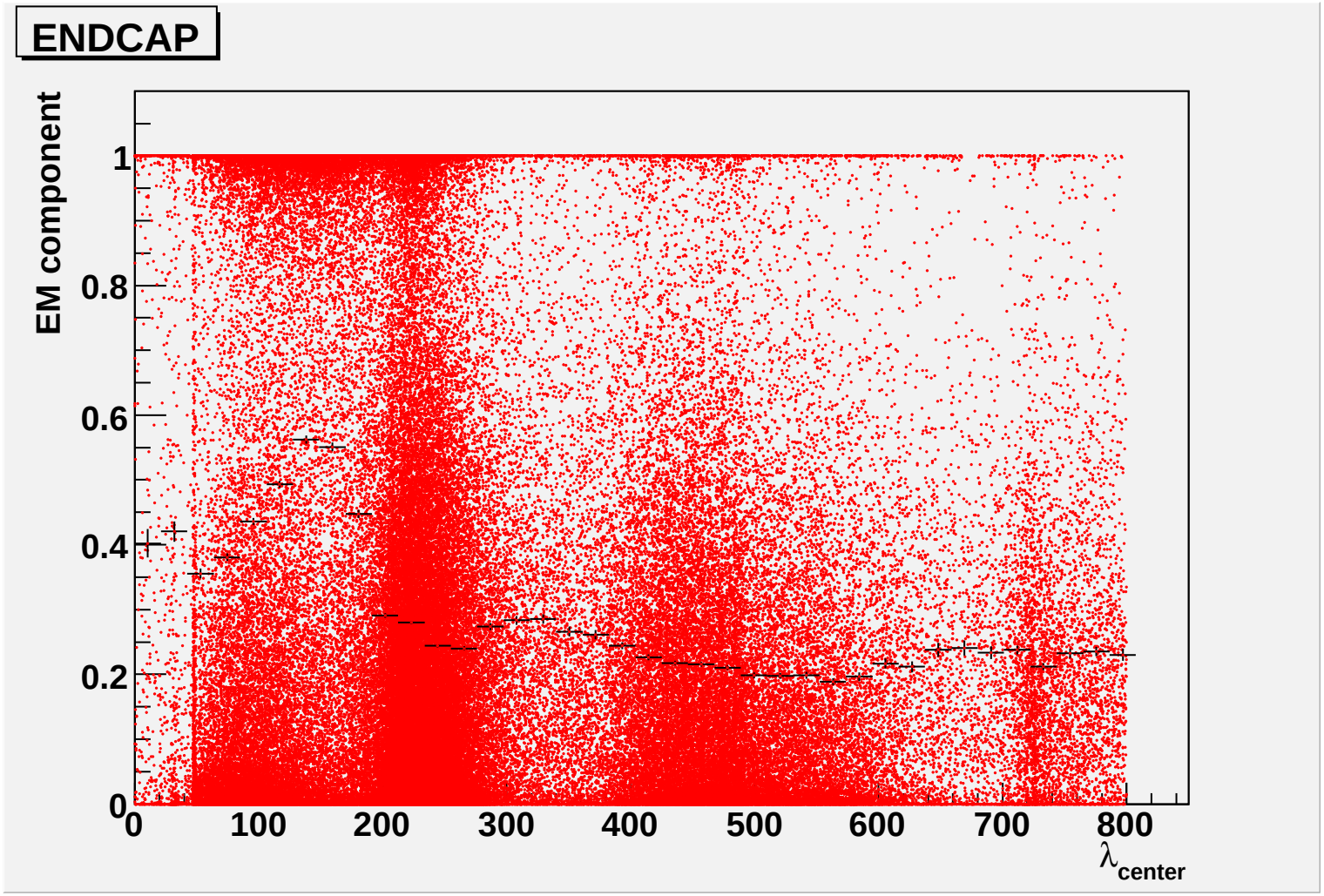

ENDCAP 1.7 < η < 2.9
sample
1 TeV
500 GeV
200 GeV
100 GeV
50 GeV
10 GeV
$\sqrt{\langle\lambda^2\rangle}$ / log(E_{clus})
λ_{center} / log(E_{clus})
0
20
40
60
80
100
120
140
160
180
200
220
10
20
30
40
50
60
70

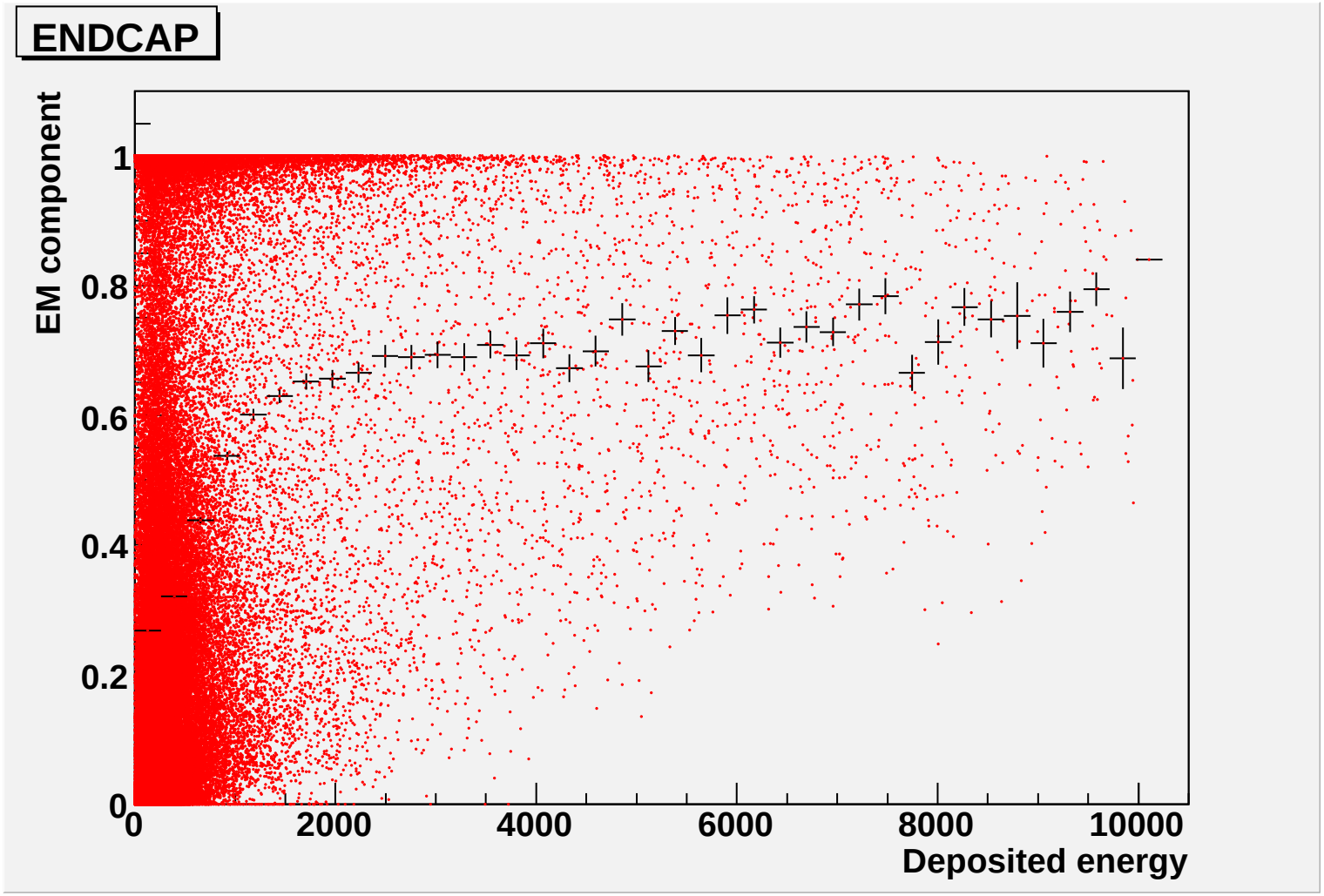
Approach for low energy clusters

- Clasification below cut fails because of granularity in
  - barrel 1
  - barrel 2
  - crack 1
  - crack 2

- Clasification for ENDCAP
  - IF cl_center_lambda > 300 => hadronic
  - ELSE IF cl_E > 1 GeV => EM
  - ELSE hadronic

- Clasification for FORWARD
  - IF cl_center_lambda > 350 => hadronic
  - ELSE IF cl_E > 1 GeV => EM
  - ELSE hadronic


ENDCAP
EM component
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
700
800
λcenter


ENDCAP
EM component
1
0.8
0.6
0.4
0.2
0
0
2000
4000
6000
8000
10000
Deposited energy