ECAL Summary

ECAL Energy Resolution and Efficiency

Input Flat Distribution
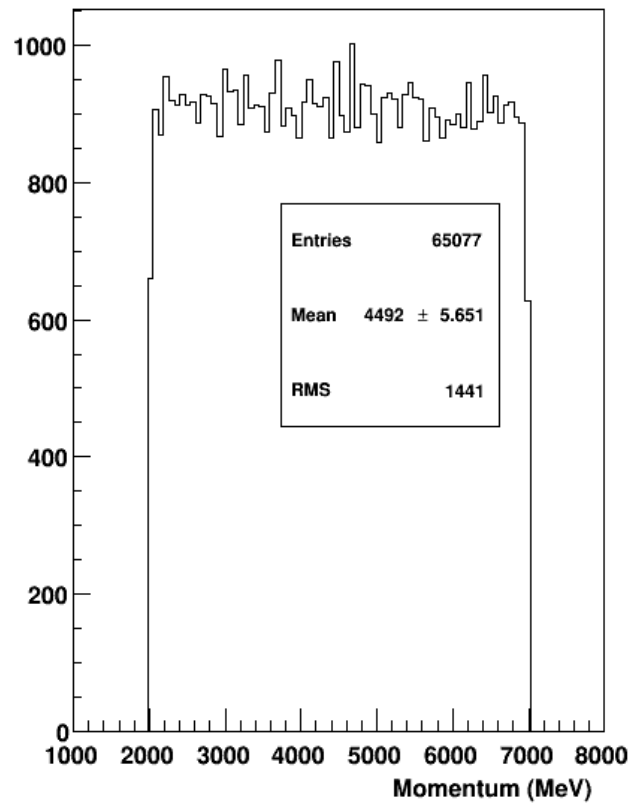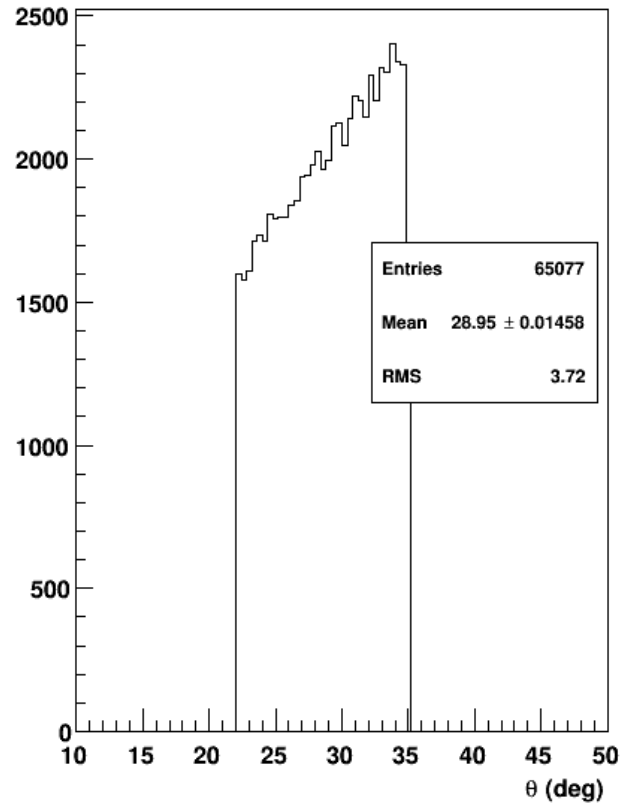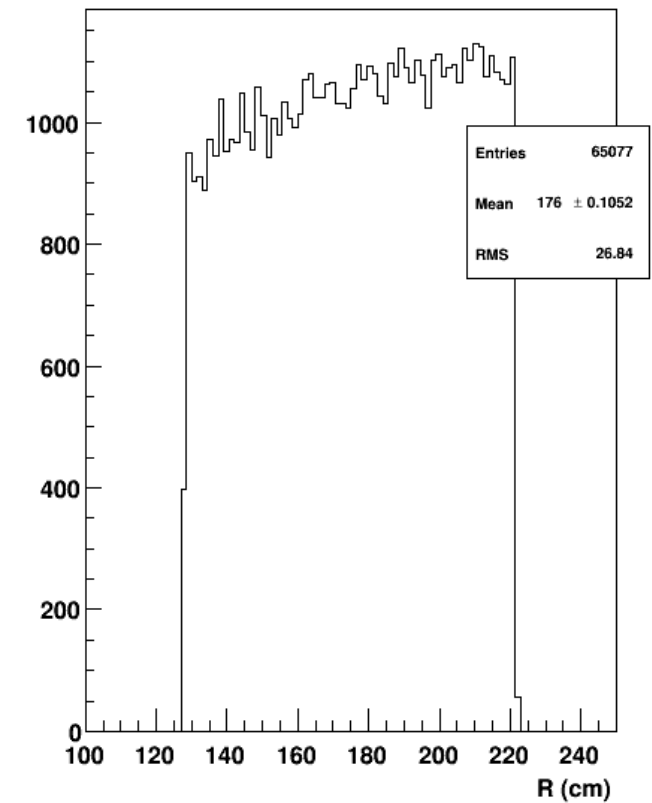
edep over P$_f$ Ratio in Shower
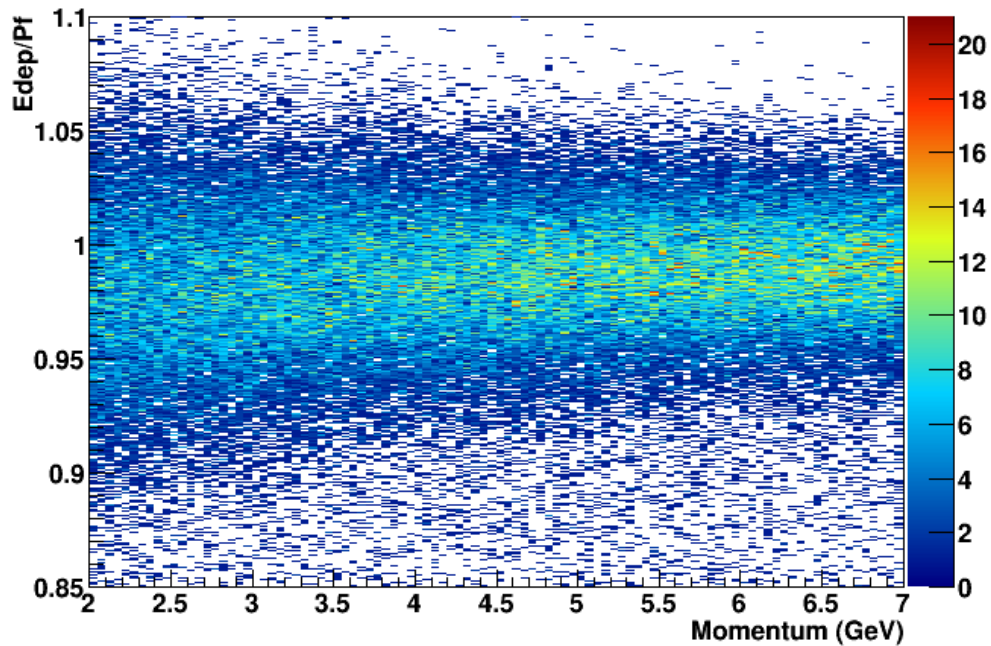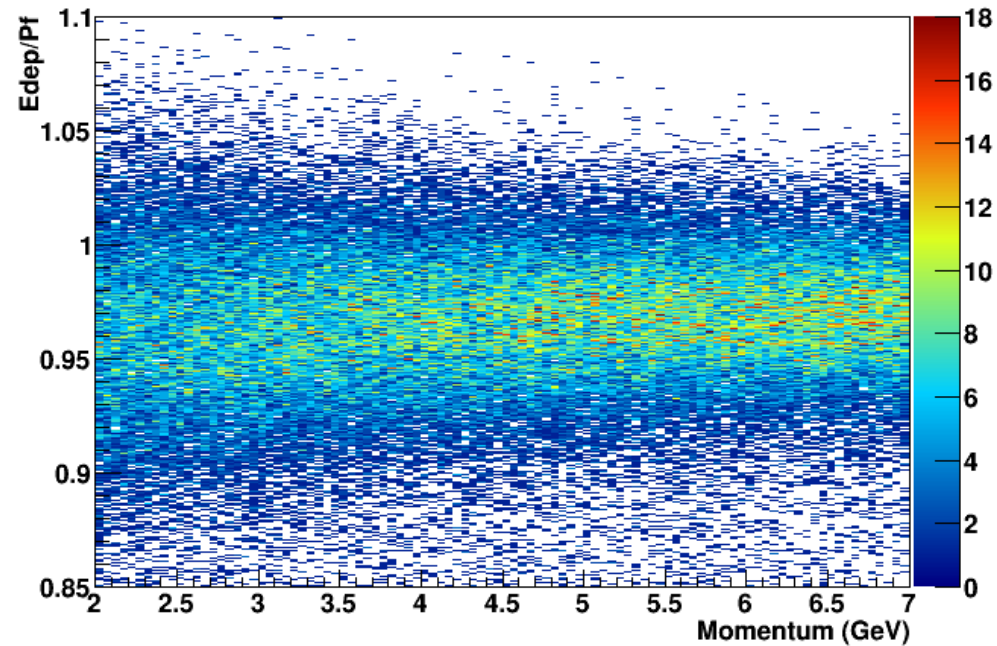
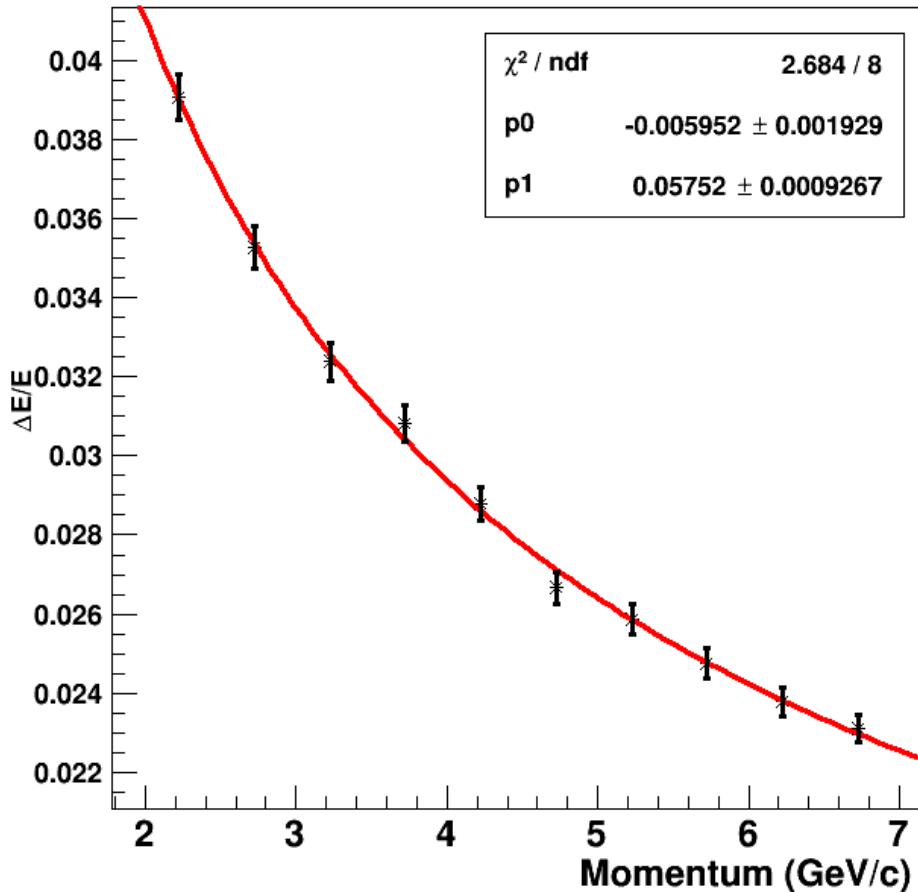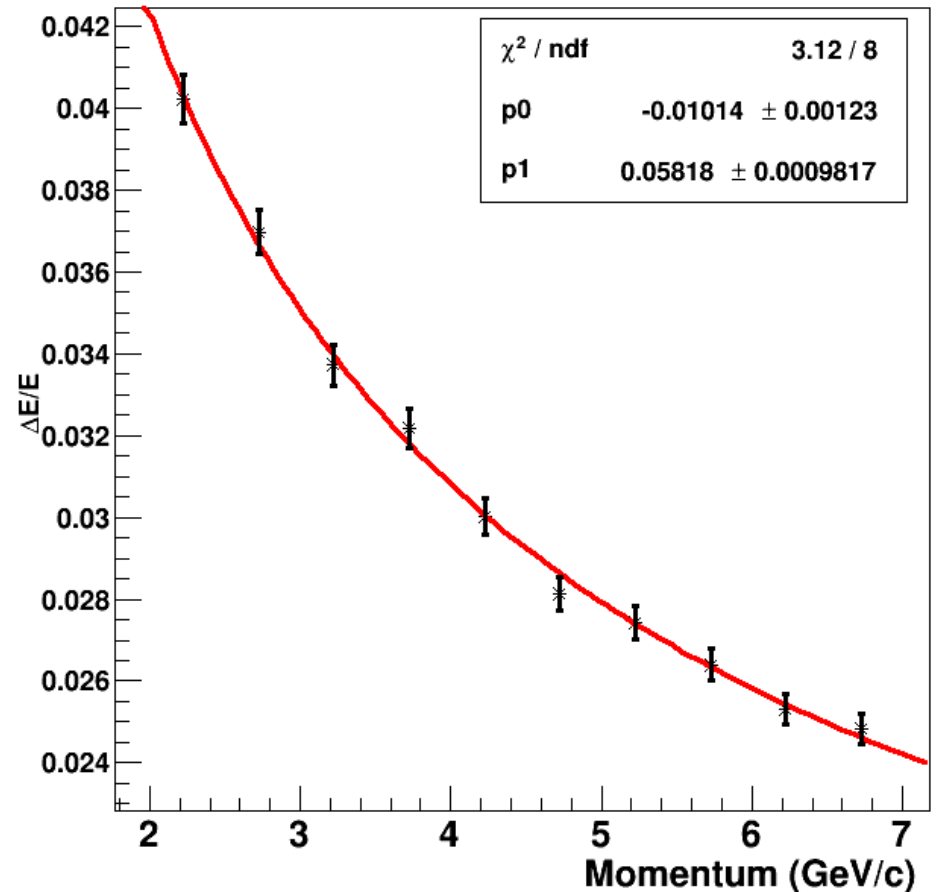- Pre-Shower lead and scintillator are included in the simulation
- Edep is the total calibrated energy in the PS + Sh
- Pf is the incident electron momentum

Intrinsic ECAL Energy Resolution

Based on calibrated energy deposit in the ECAL

Shower Energy Resolution

From Total Energy on ECAL		
Pf (GeV)	Res (%)	Error (%)
2.23	0.039	0.00058
2.73	0.035	0.00053
3.23	0.032	0.00048
3.73	0.031	0.00046
4.23	0.029	0.00043
4.73	0.027	0.00040
5.23	0.026	0.00039
5.73	0.025	0.00038
6.23	0.024	0.00036
6.73	0.023	0.00035

From 6+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.040	0.00059
2.73	0.037	0.00054
3.23	0.034	0.00049
3.73	0.032	0.00047
4.23	0.030	0.00044
4.73	0.028	0.00041
5.23	0.027	0.00040
5.73	0.026	0.00039
6.23	0.025	0.00037
6.73	0.025	0.00037

Note :

The main difference between total energy based energy resolution and 6+1 cluster based energy resolution is the constant term is larger when 6+1 clusters are considered.

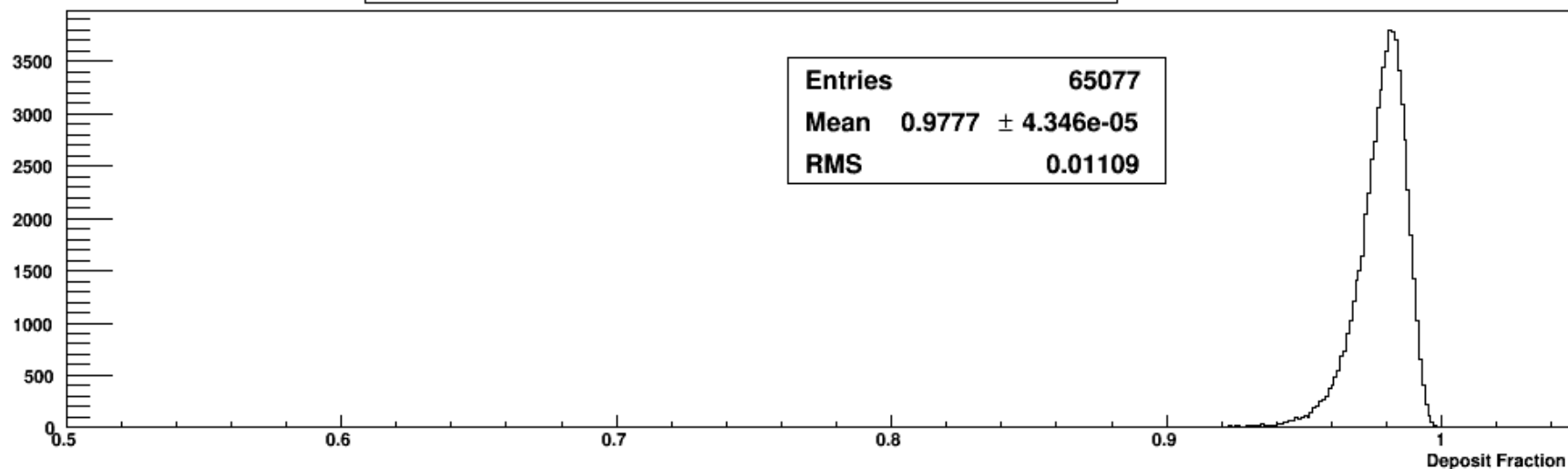# Jin's Energy Resolution (with No Phot. Elec.)

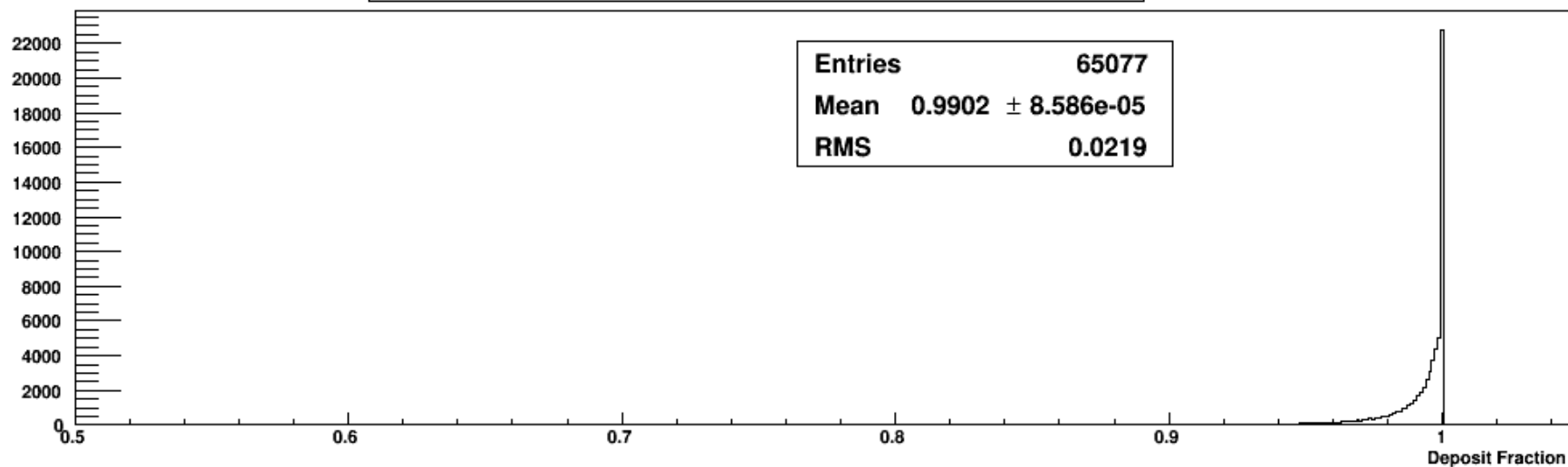- Jin's estimation was based on ecal (ps+sh) calibrated energy deposition

E/p resolution VS p

χ^2 / ndf   17.75 / 7

p0   -0.01298 ± 0.003265

p1   0.05158 ± 0.003645
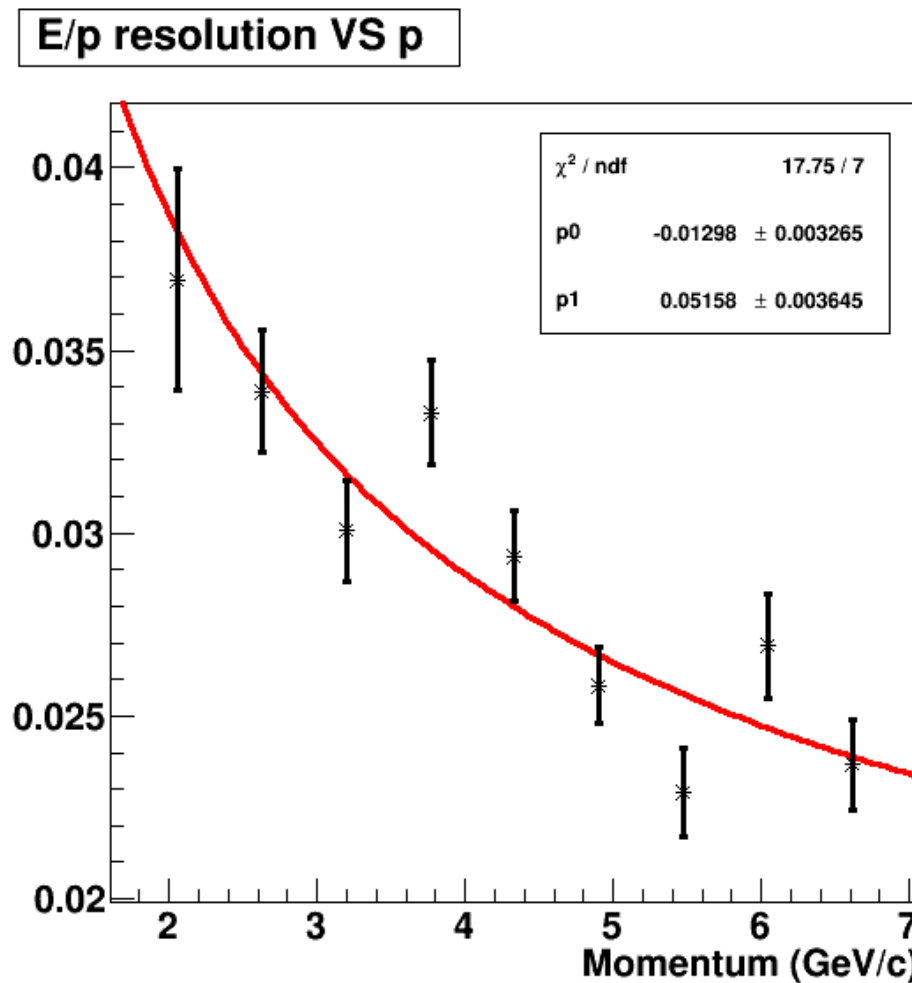
Energy Loss in Max 6+1 Clusters

Rakitha Beminiwattha

Energy Deposit Fraction :
Shower 6+1 Clusters

Shower 6+1 Cluster Edep Fraction (Edep_6p1/Edep_Total)

Entries	65077
Mean	0.9777 ± 4.346e-05
RMS	0.01109

Deposit Fraction

Pre-Shower 6+1 Cluster Edep Fraction (Edep_6p1/Edep_Total)

Entries	65077
Mean	0.9902 ± 8.586e-05
RMS	0.0219

Deposit Fraction

Energy Deposit Fraction :
Shower 6+1 Clusters

Shower 6+1 Cluster Edep Fraction (Edep_6p1/Edep_Total)

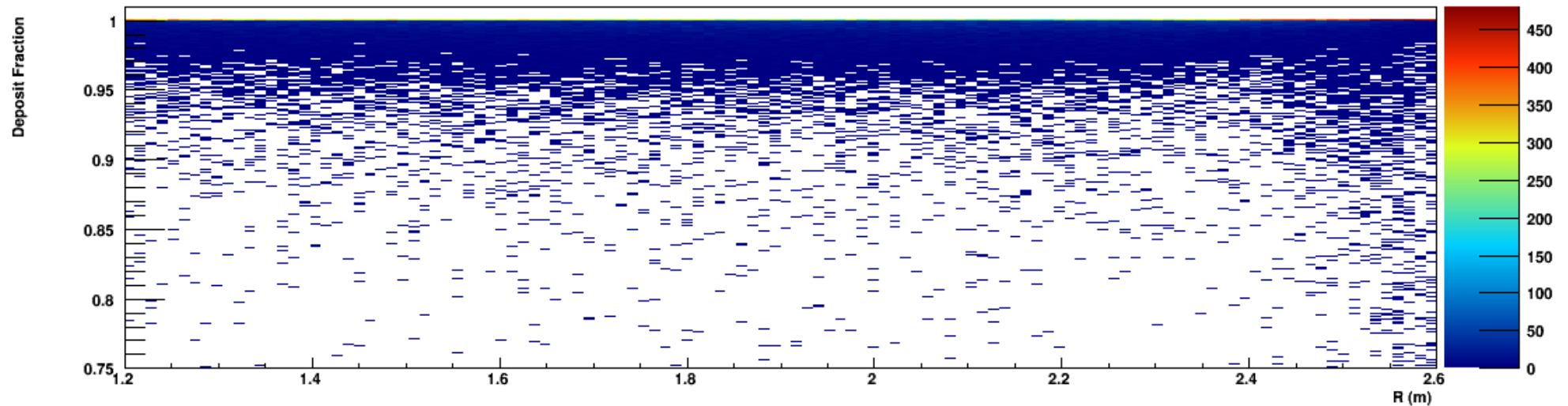| Entries	65077
Mean	0.9777 ± 4.346e-05
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Deposit Fraction

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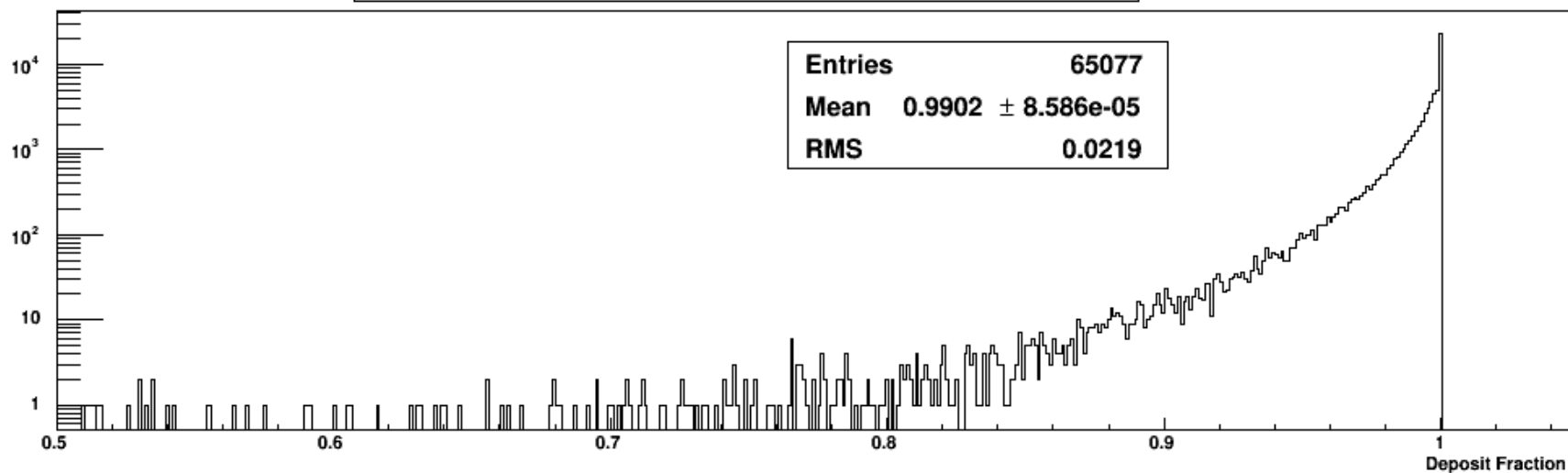
Deposit Fraction

Energy Deposit Fraction :
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Pre-Shower 6+1 Cluster Edep Fraction (Edep_6p1/Edep_Total)

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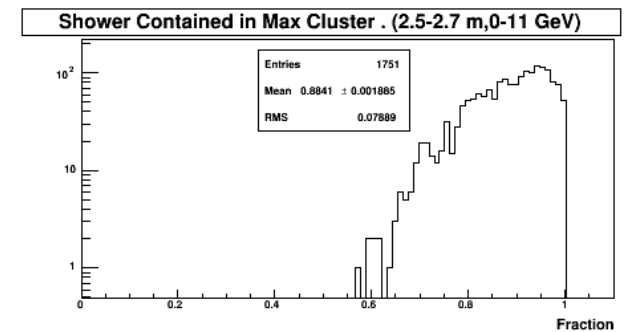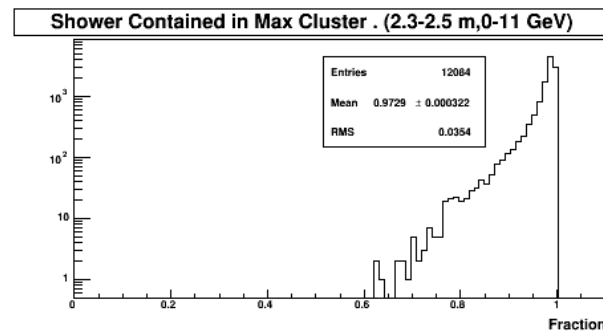

Shower 6+1 Cluster Edep Fraction (Edep_6p1/Edep_Total)
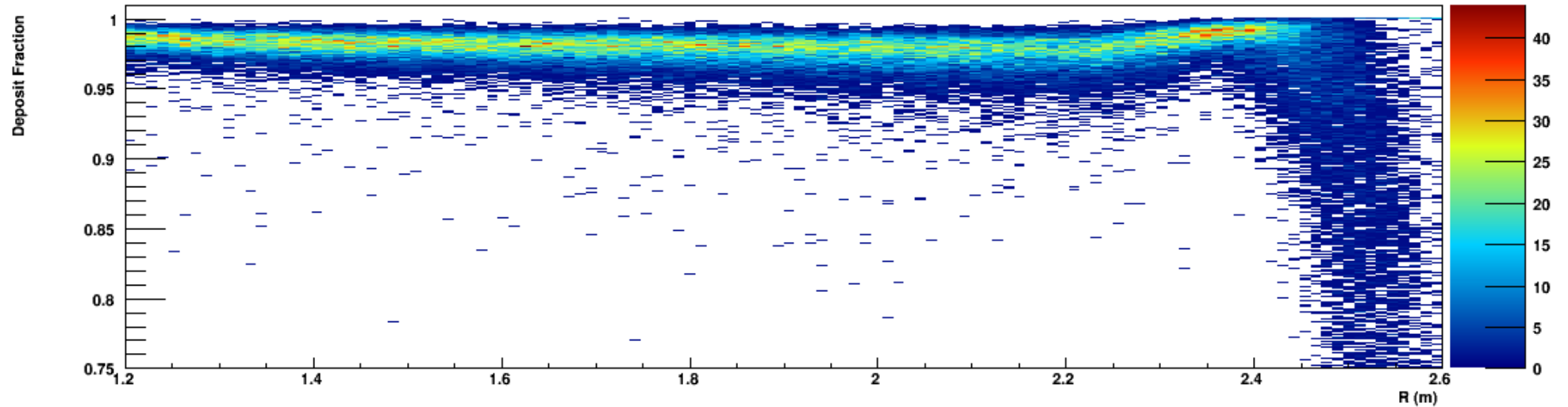
Pre-Shower 6+1 Cluster Edep Fraction (Edep_6p1/Edep_Total)
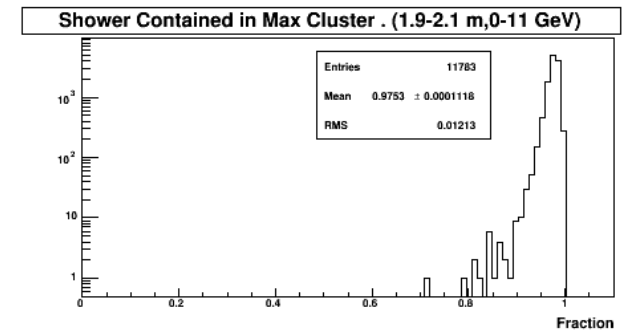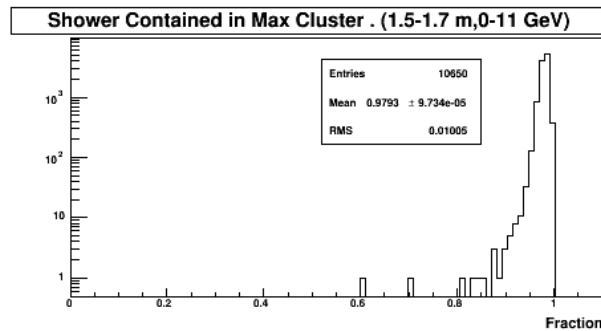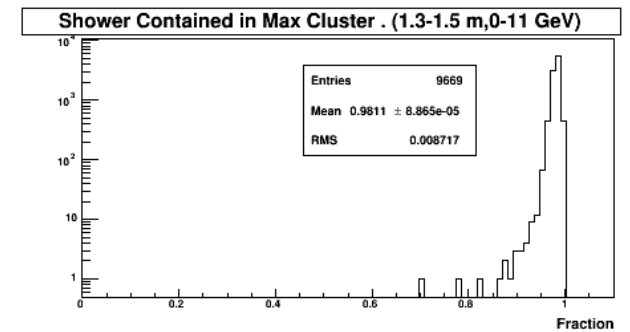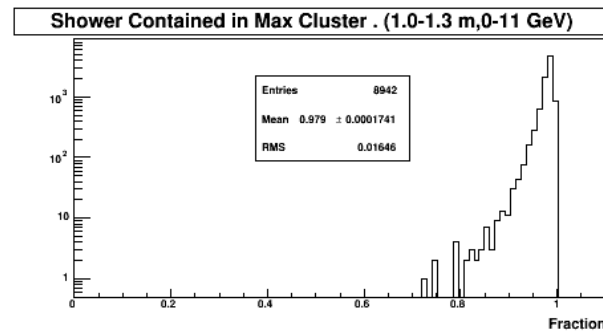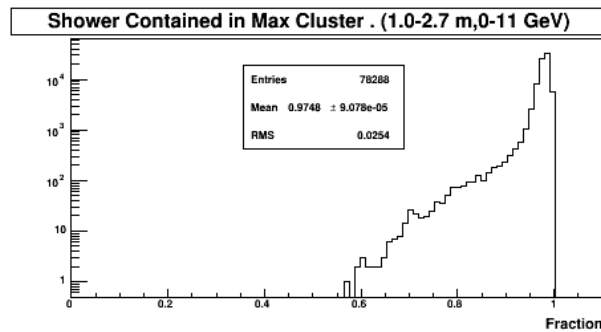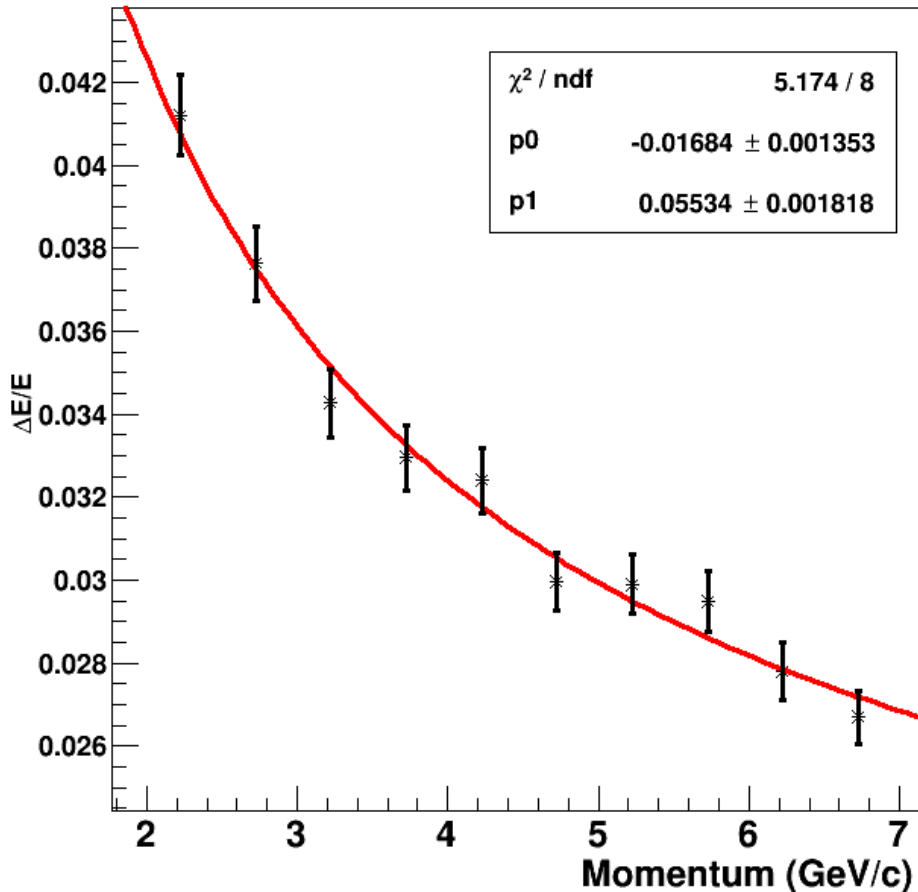
Energy Deposit Fraction in R bins : Shower 6+1 Clusters

- The 6+1 cluster energy deposit fraction in all momenta and all radii are shown here

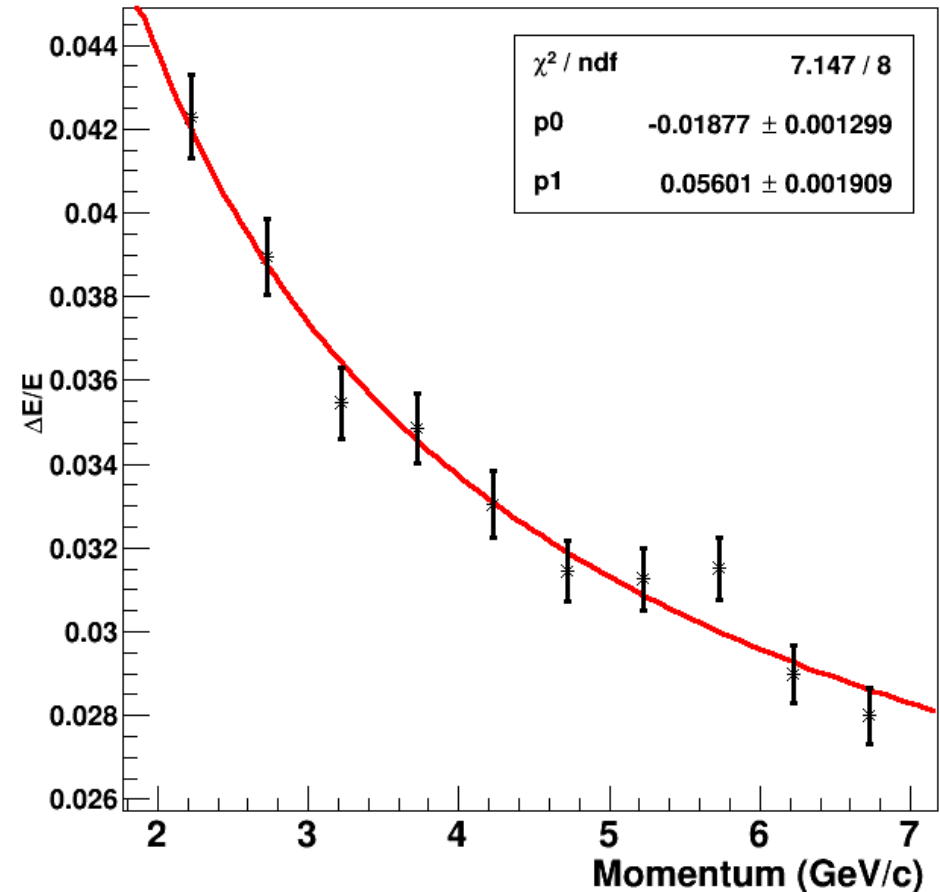- The energy loss increases for radii above 2.3 m

ECAL Energy Resolution : R 1.0 – 1.5 m
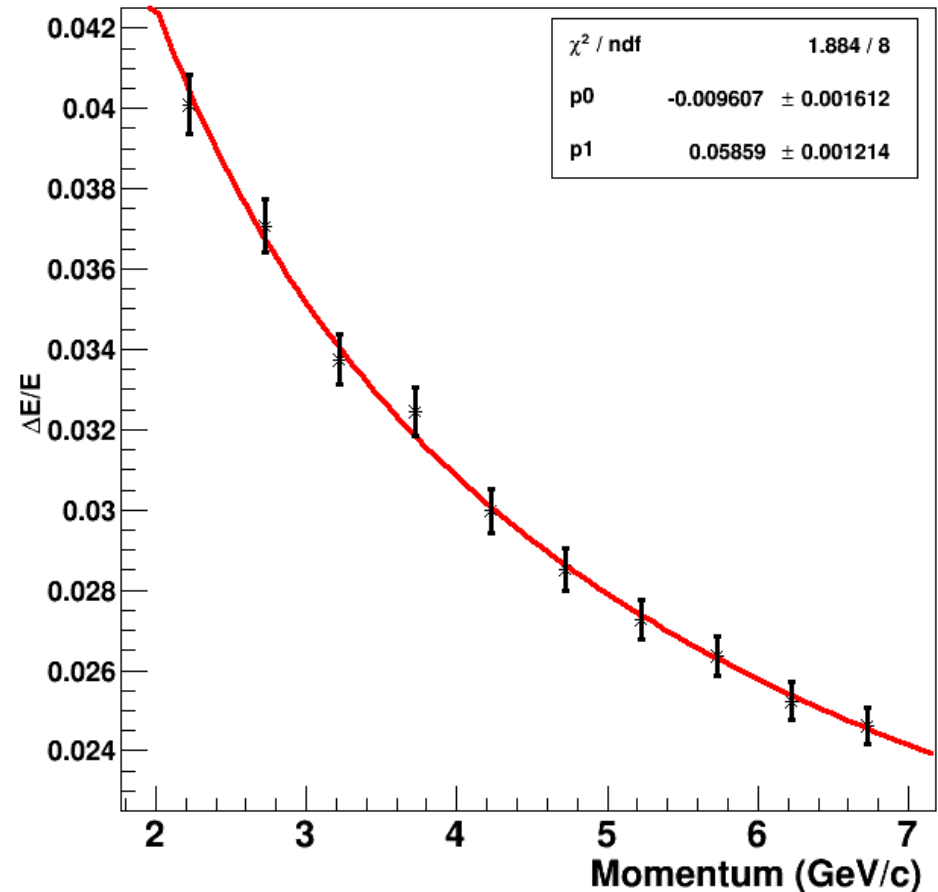
Based on calibrated energy deposit in the ECAL
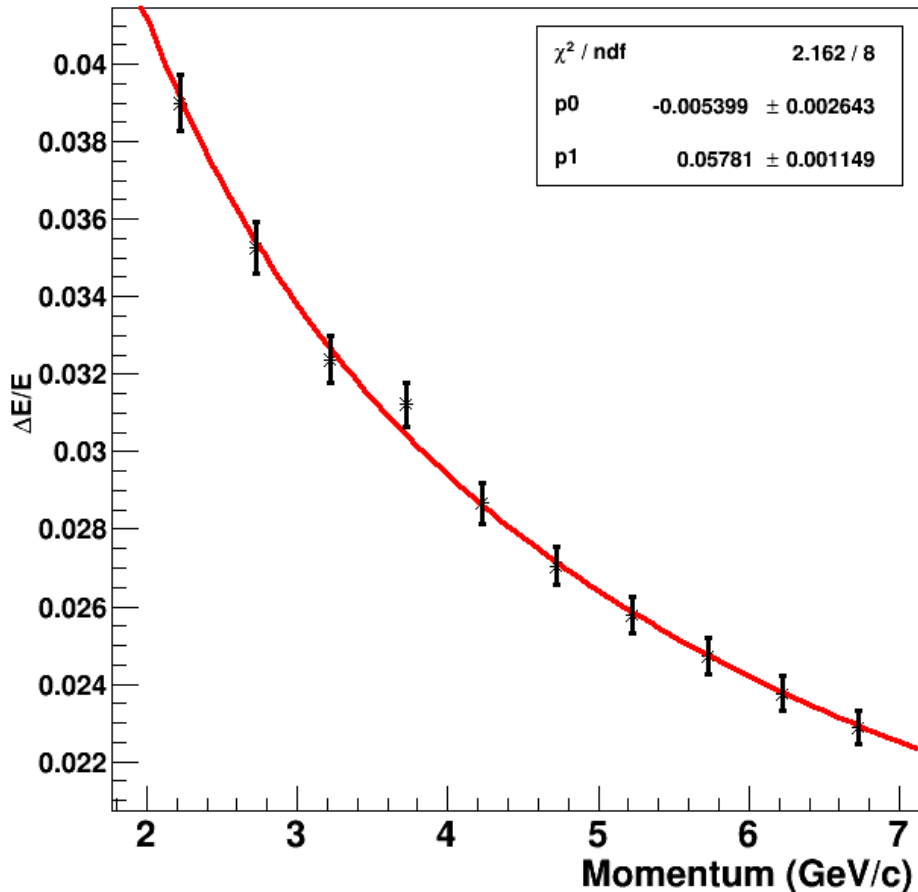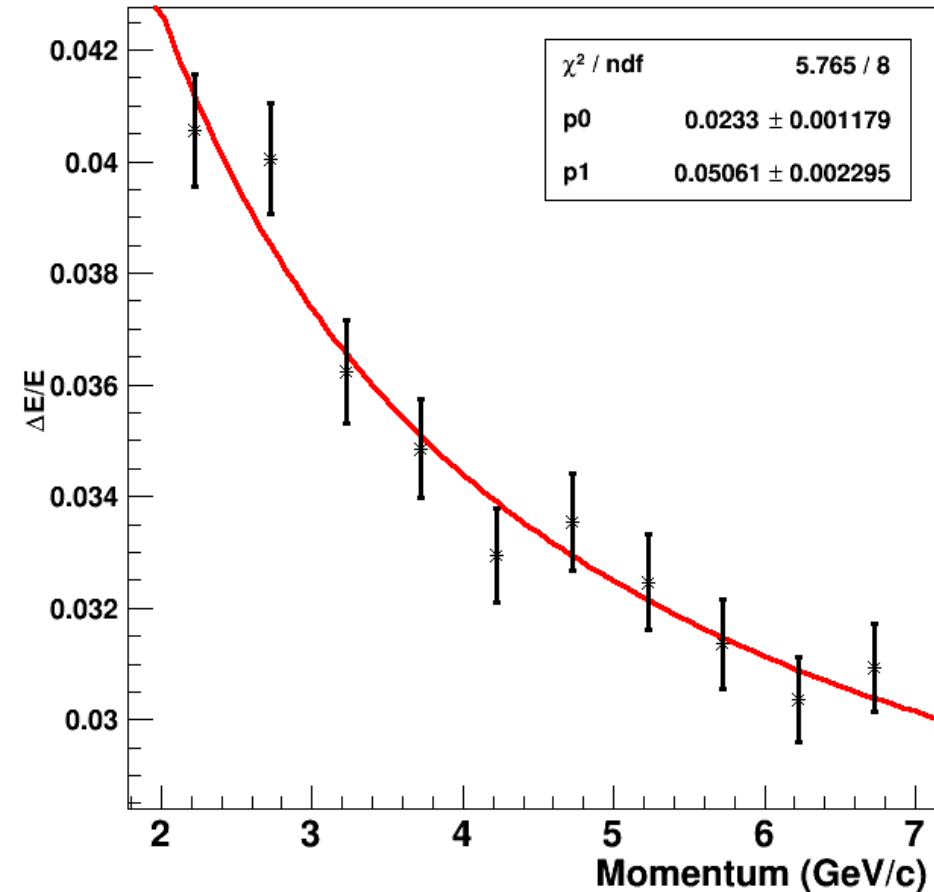
ECAL Energy Resolution : R 1.5 – 2.1 m

Based on calibrated energy deposit in the ECAL

ECAL Energy Resolution : R 2.1 – 2.4 m

Based on calibrated energy deposit in the ECAL
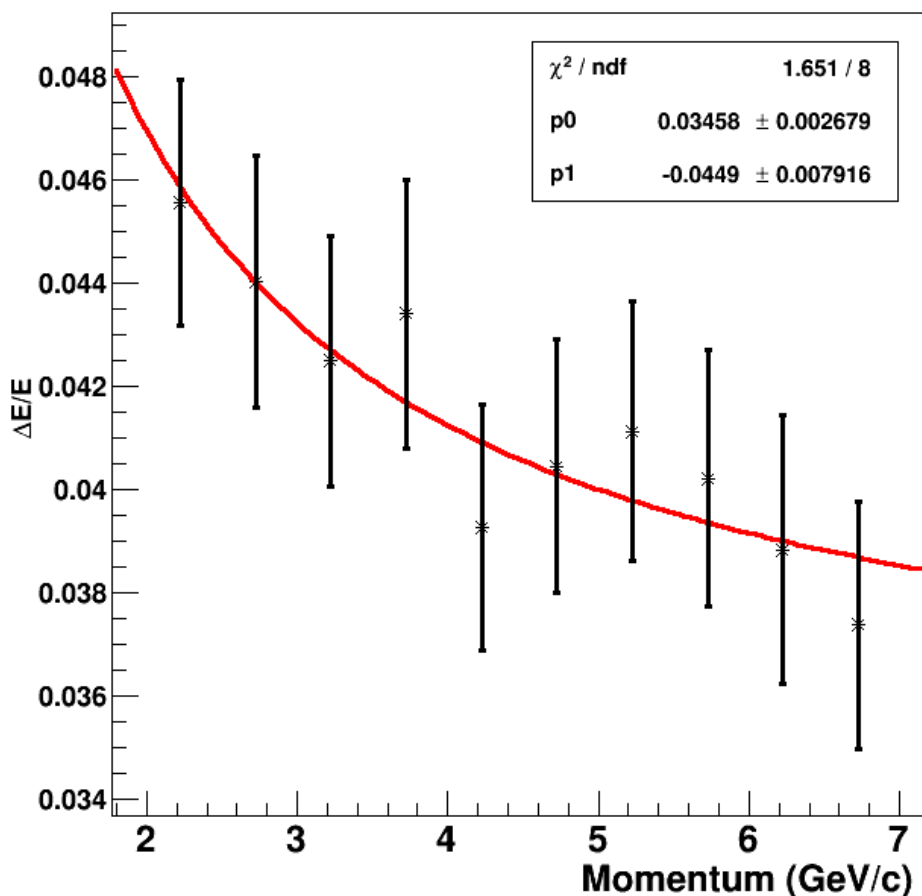
ECAL Energy Resolution : R 2.4 – 2.7 m
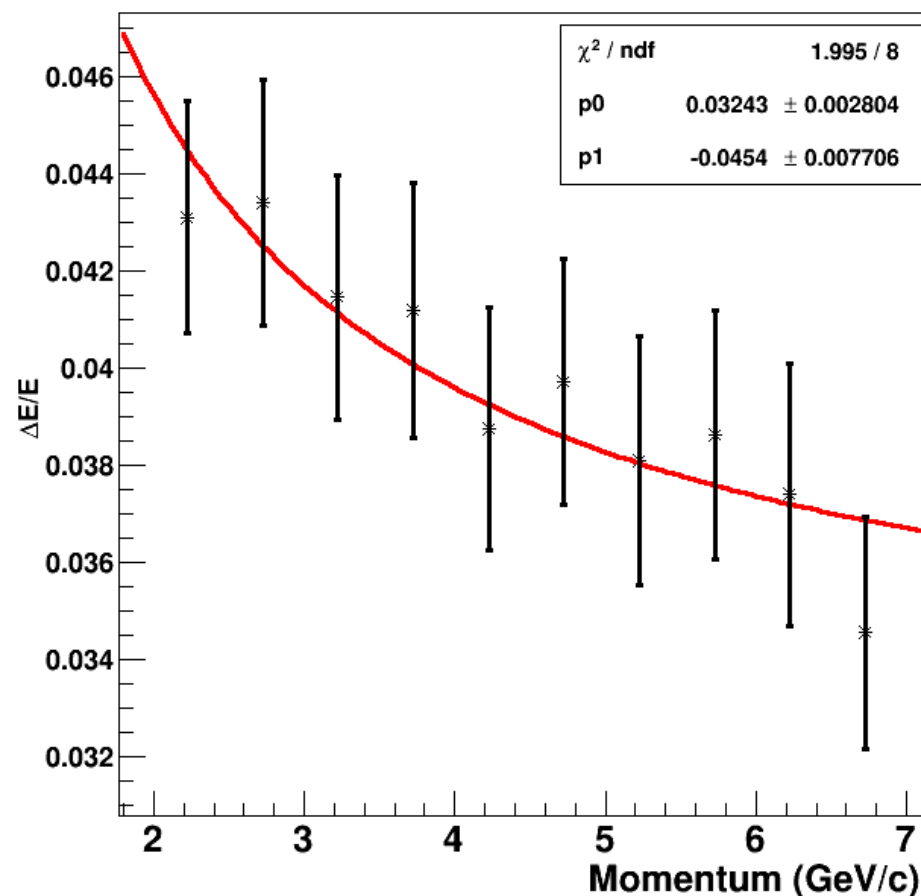
Based on calibrated energy deposit in the ECAL

ECAL PID Efficiency

e$^-$ Calibrated Energy over Pf Ratio

Shower 6+1 cluster Edep over P

Entries	92067
Mean	0.9672 ± 0.0001089
RMS	0.03305
χ^2 / ndf	1453 / 56
Constant	1.161e+04 ± 5.140e+01
Mean	0.9678 ± 0.0001
Sigma	0.03115 ± 0.00009

Calibrated PS+Sh 6+1 Edep over P with efficiency (2.5 sigma)cut

Entries	88629
Mean	0.9678 ± 9.732e-05
RMS	0.02897
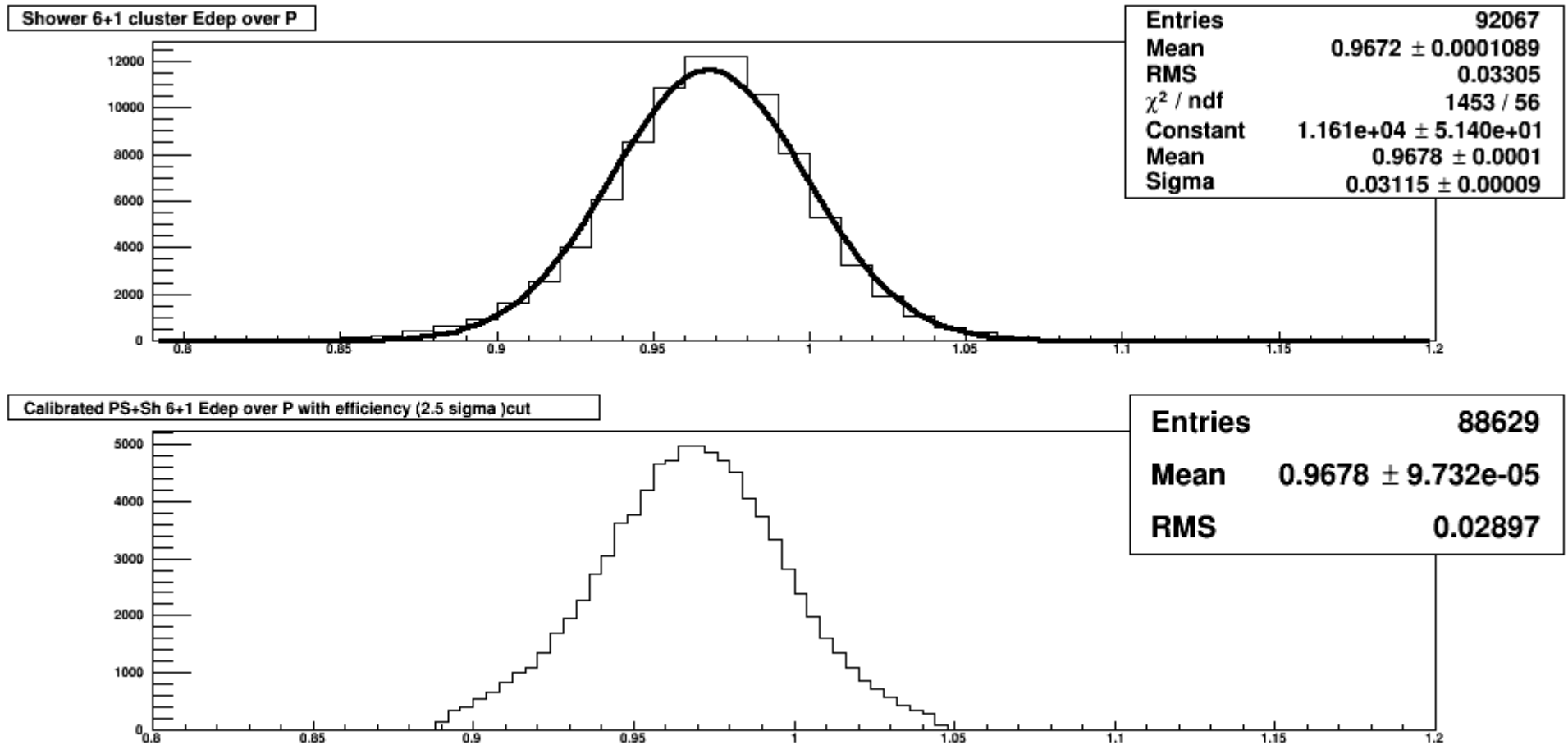
- A 2.5 σ cut applied to select e$^-$ events
- Ratio of above cut selected e$^-$ over total e$^-$ events is the ECAL efficiency

MIP Cut on the Pre-Shower

- Electron deposit energy in the PS differently compared to pions

- Due to Pions act like a MIP most of the time PS cut just above a MIP can reject pions
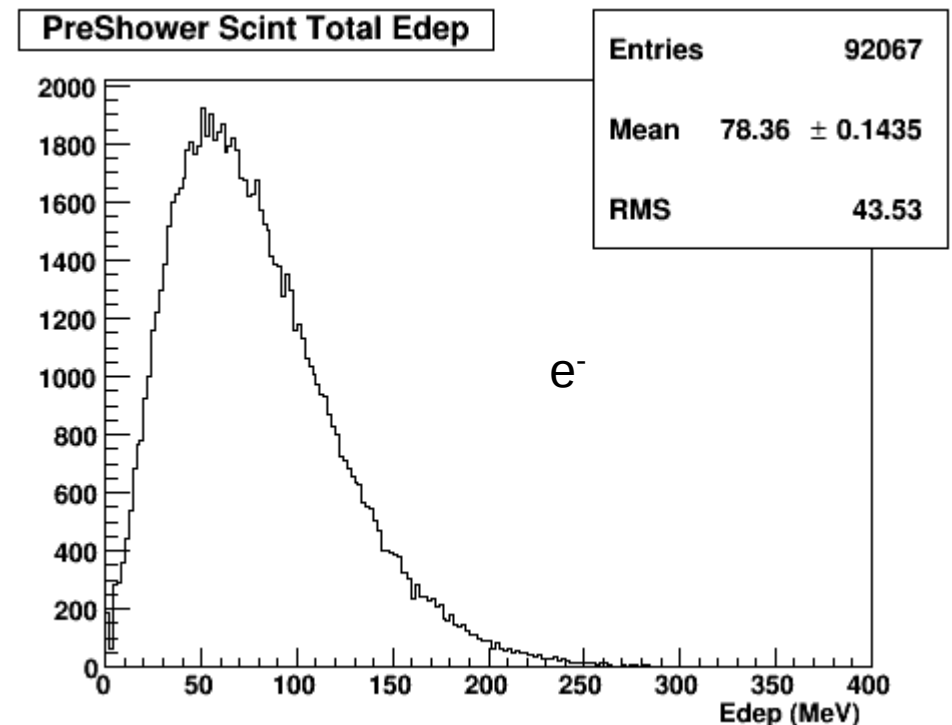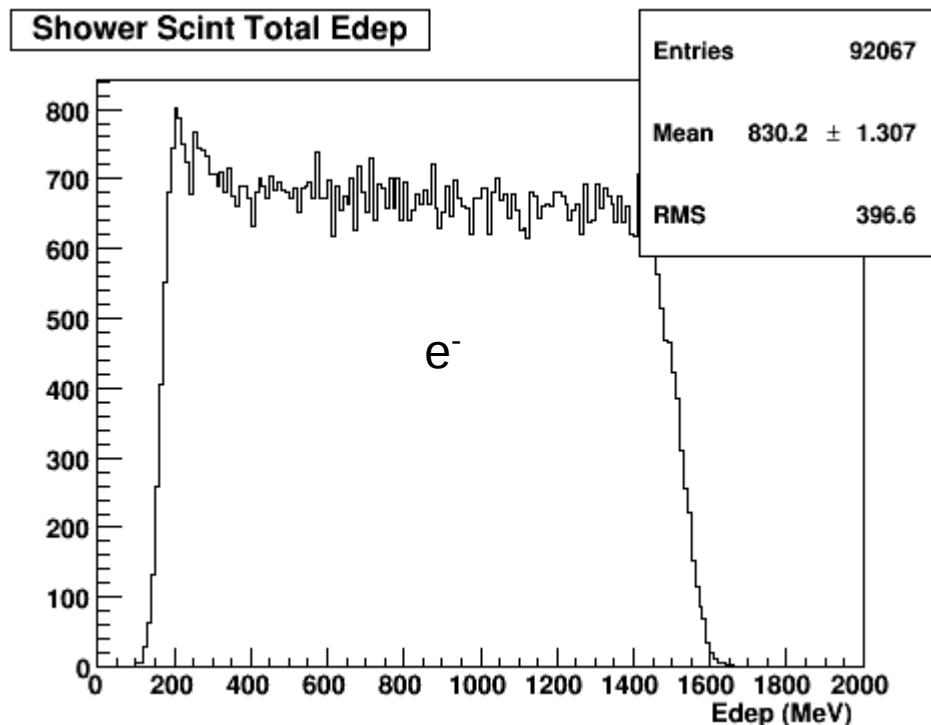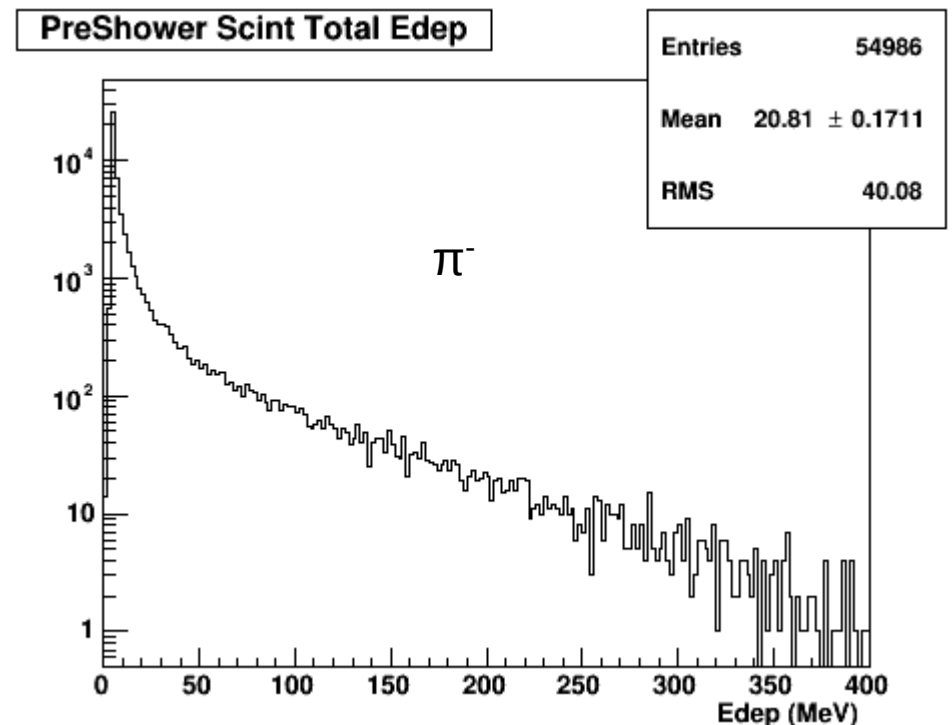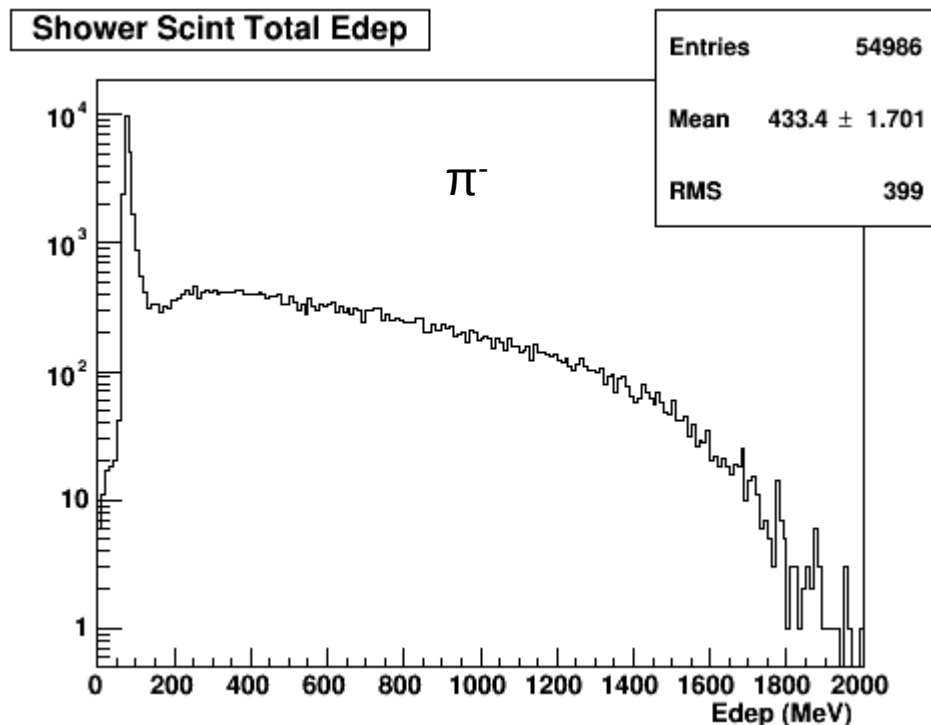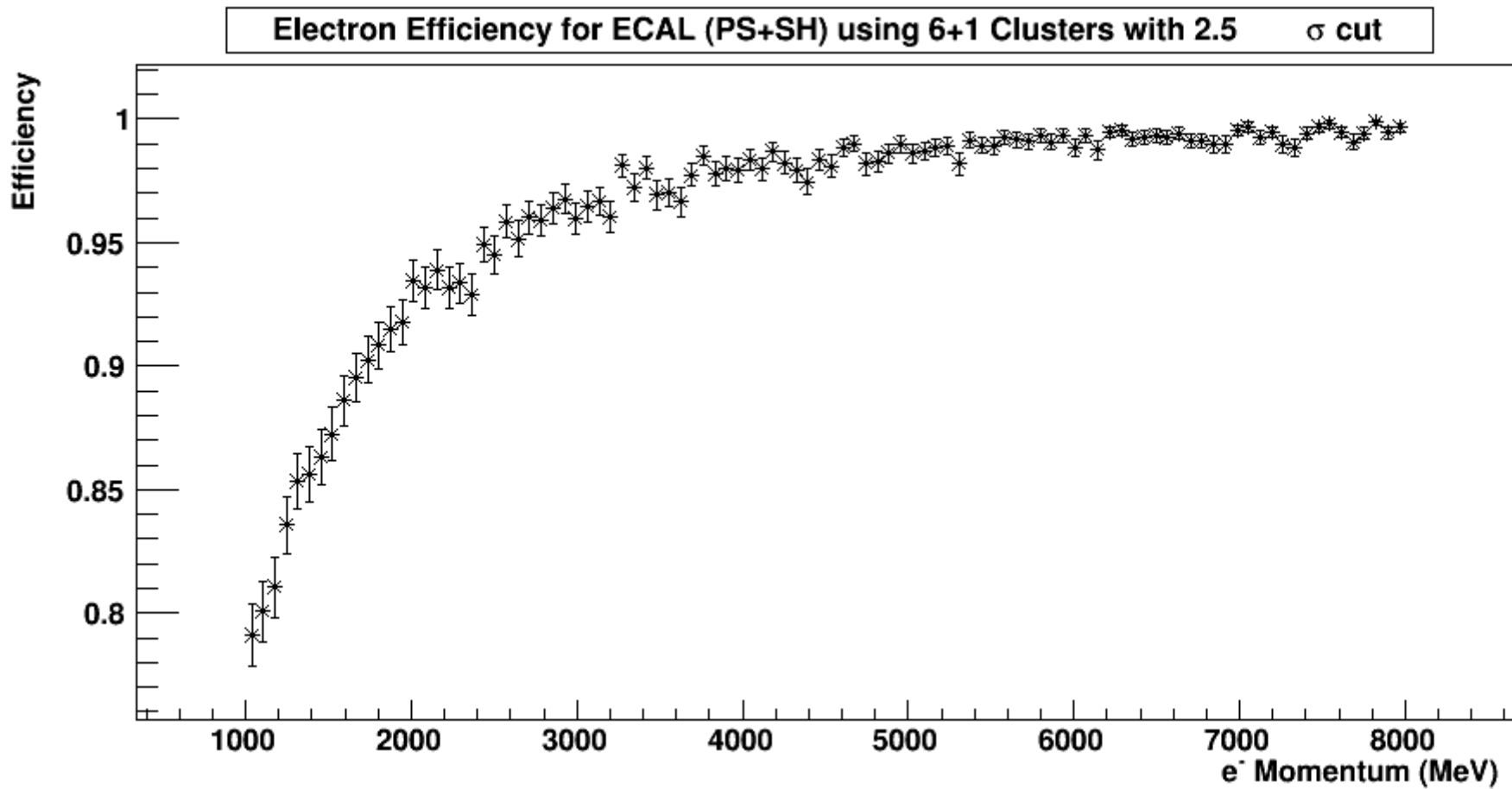
MIP Cut on the Pre-Shower

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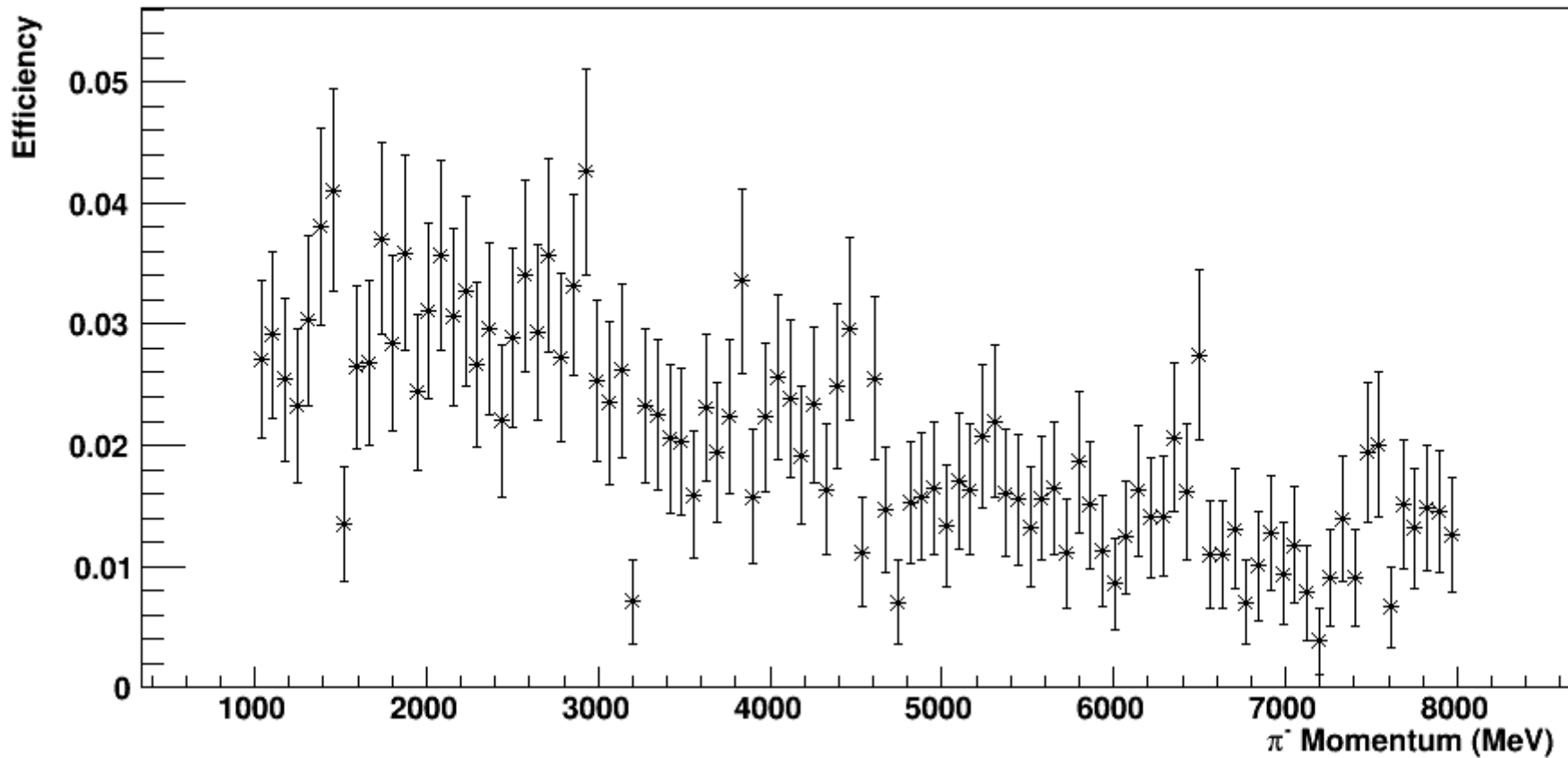- Apply a MIP cut to select edep greater than MIP
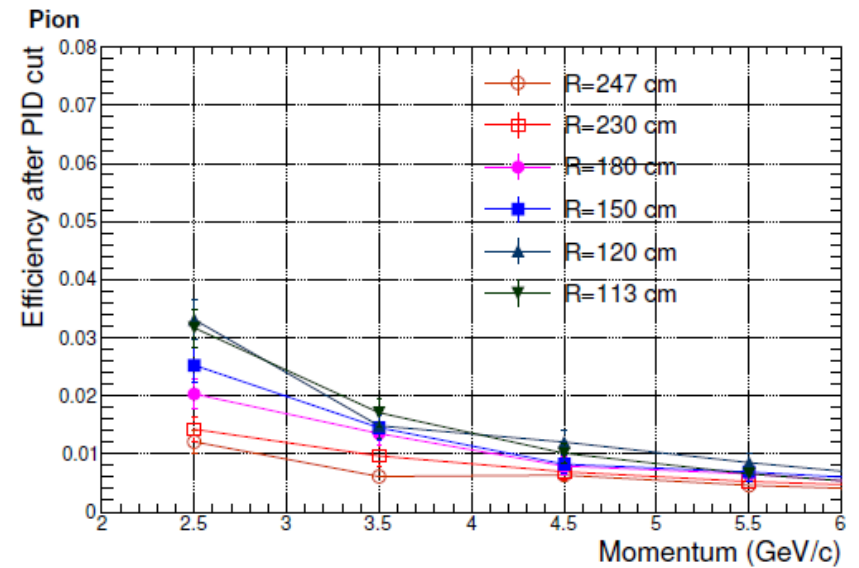 - MIP cut is to 9 MeV

e⁻ Efficiency with PS MIP Cut
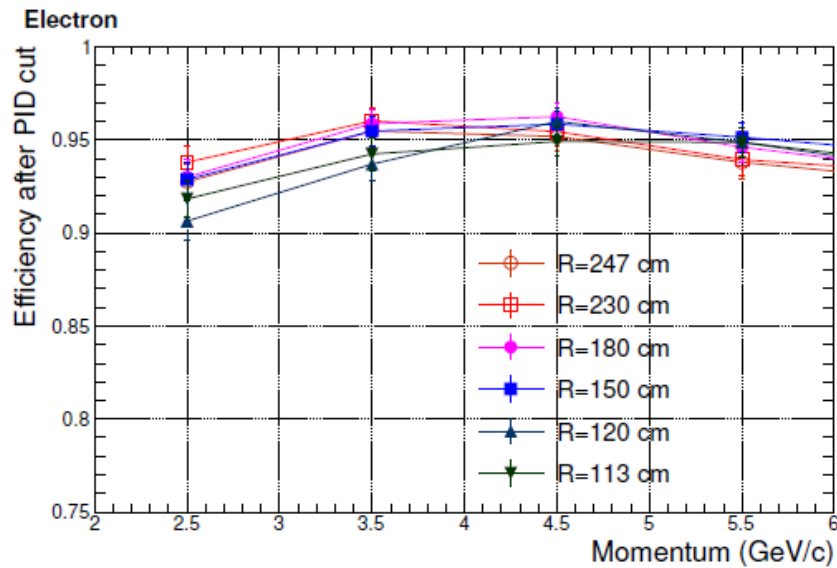

Electron Efficiency for ECAL (PS+SH) using 6+1 Clusters with 2.5 σ cut

π⁻ Efficiency with PS MIP Cut
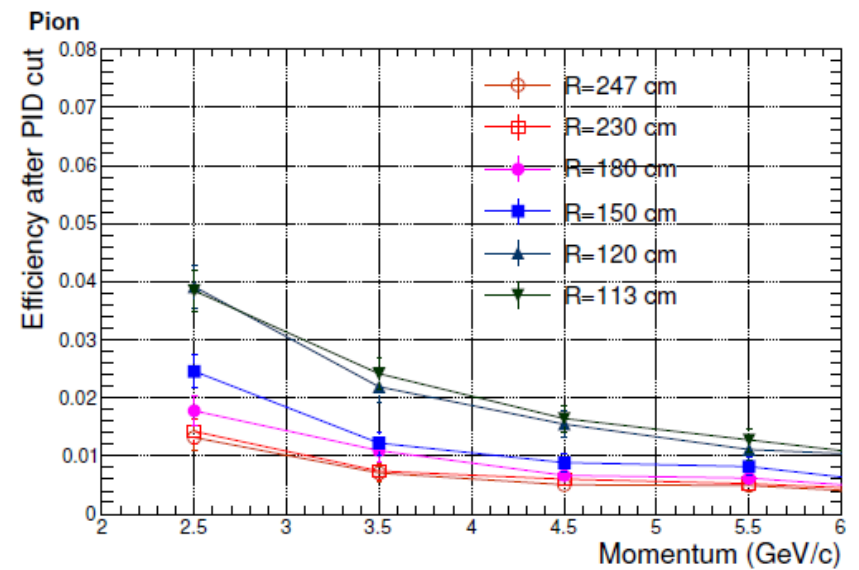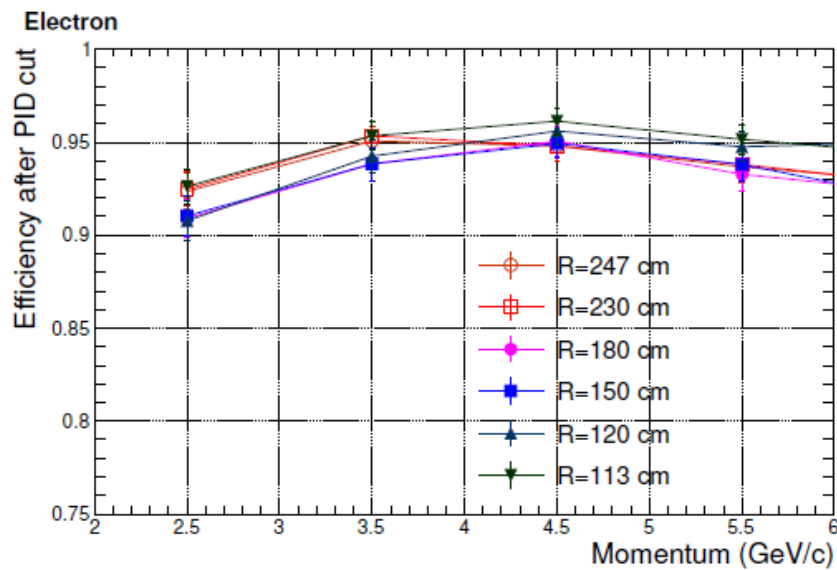

Pion Efficiency for ECAL (PS+SH) using 6+1 Clusters with 2.5 σ cut

From preCDR

(a) lower-radiation azimuthal region

Summary

- Energy resolution agrees with Jin's original analysis within 1 %

- PID efficiency agrees well with the preCDR

- There is some loss when going from total ECAL to max 6+1 cluster in the Shower

  - For over 98% of the electron events the energy loss is about 5%

  - Maximum energy loss is about 20% but such events are statistically insignificant

  - The Energy loss is dominated in the large radius region

- Energy loss when going from total ECAL to max 6+1 cluster is negligible in the Pre-Shower