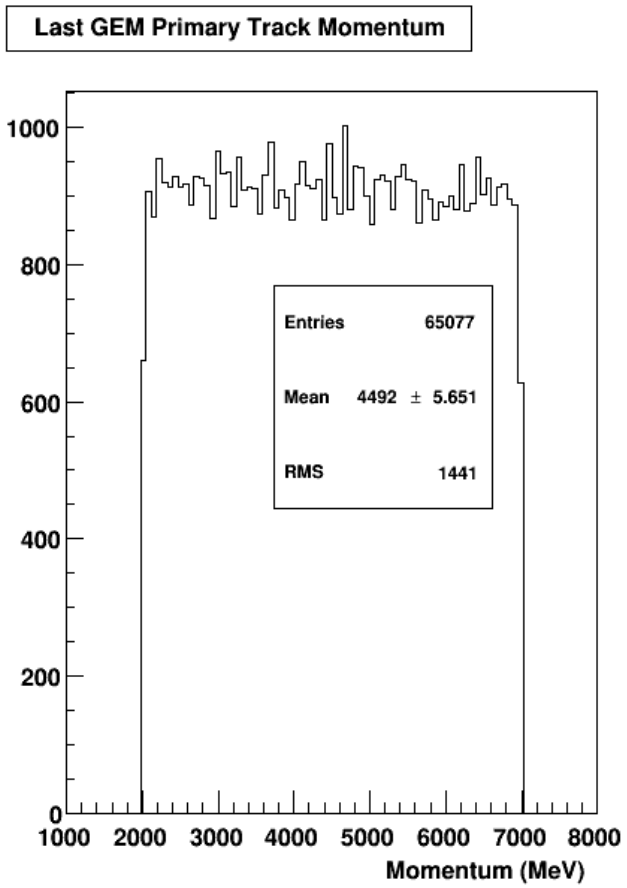
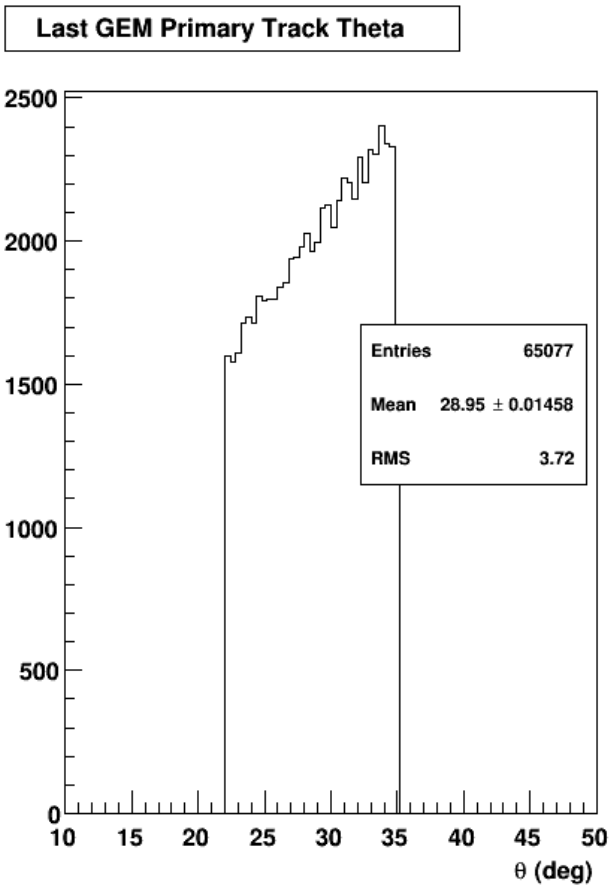
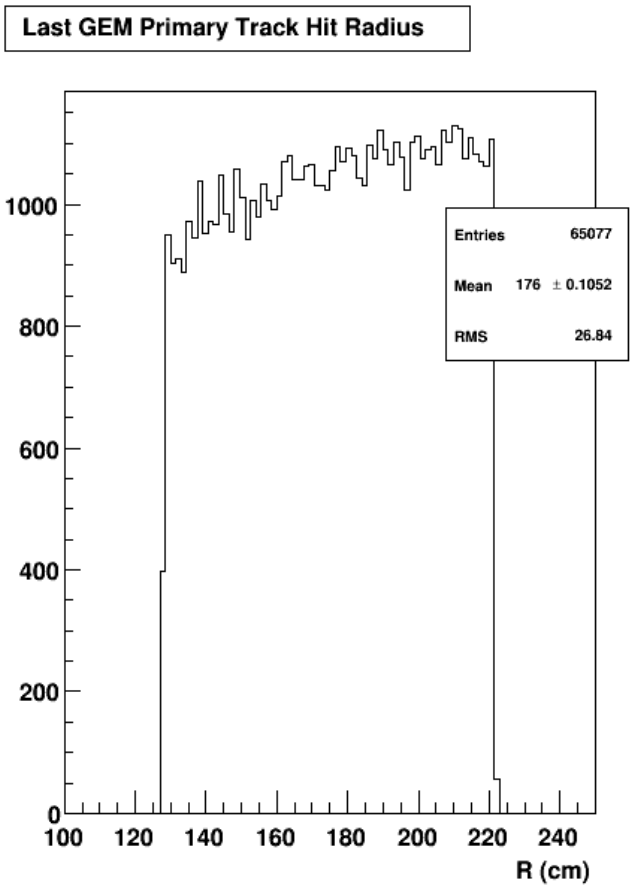
ECAL Summary

ECAL Energy Resolution and Efficiency

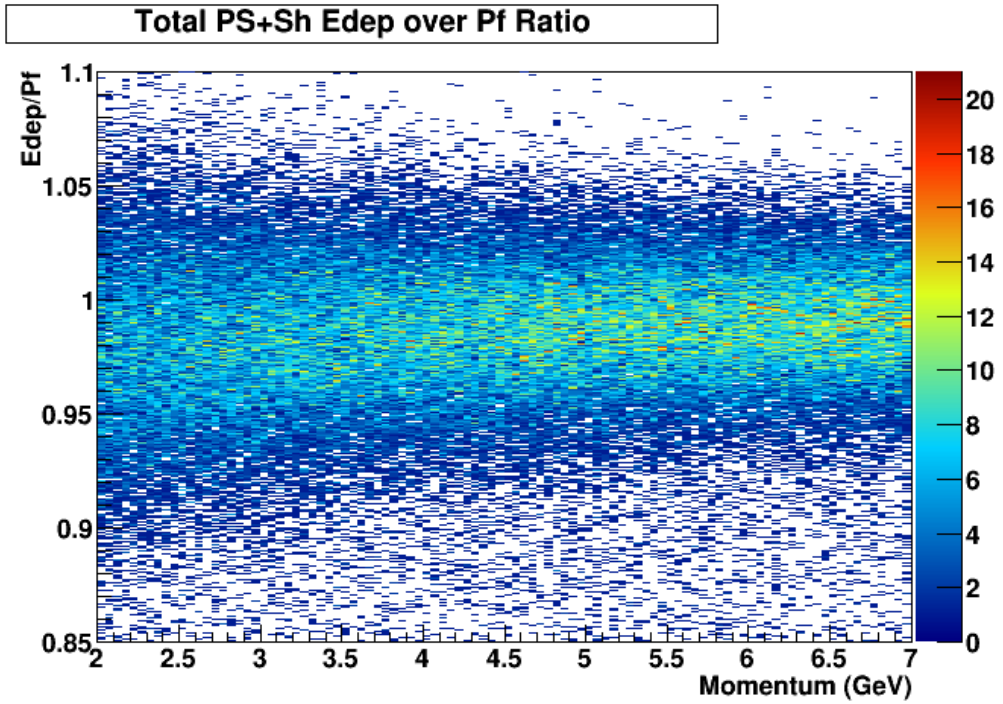
Input Flat Distribution

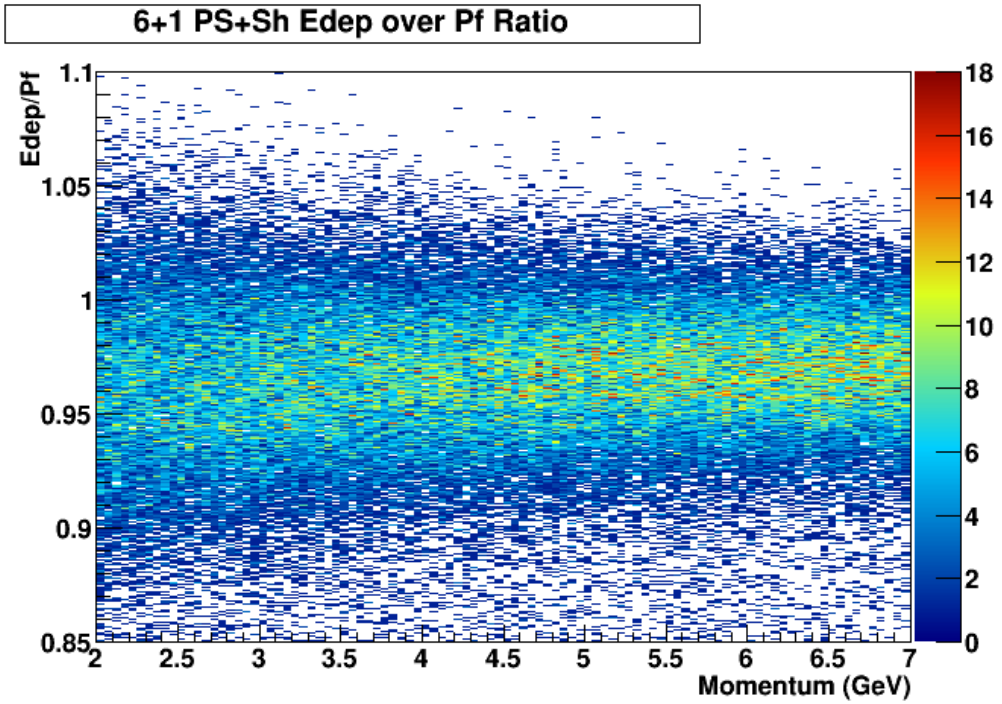






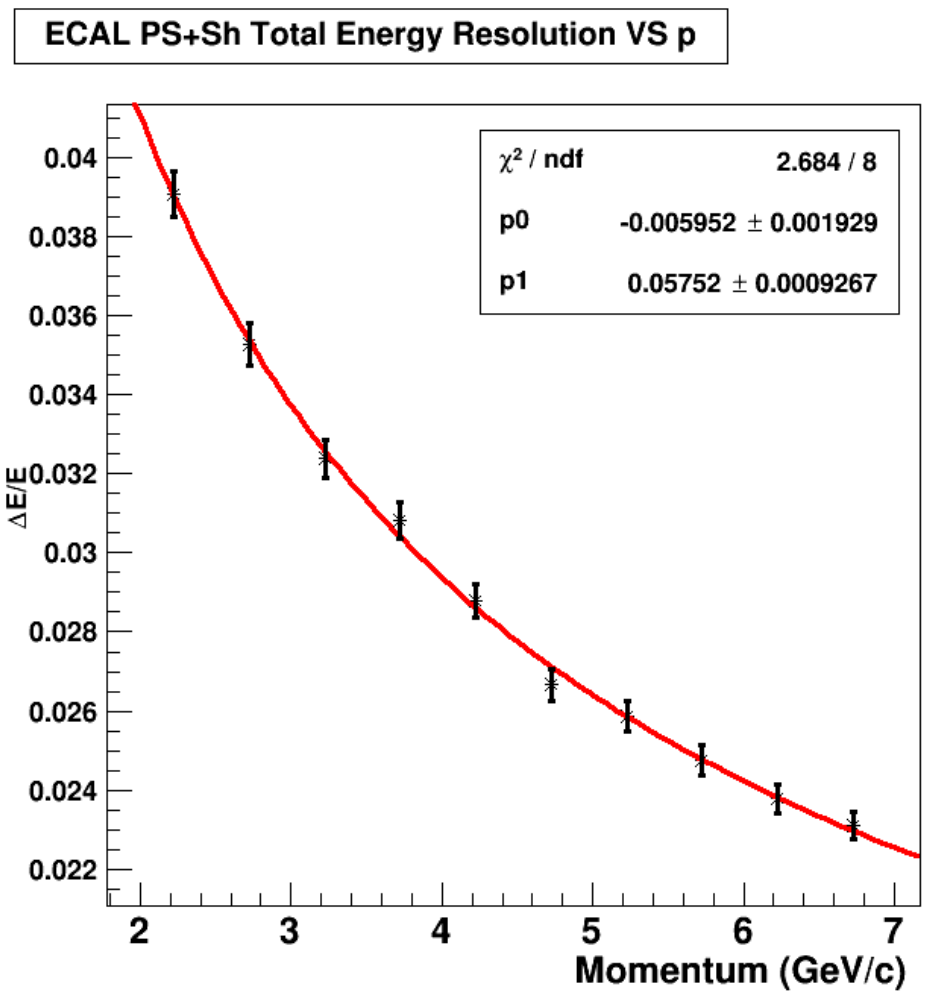
edep over P_f Ratio in Shower

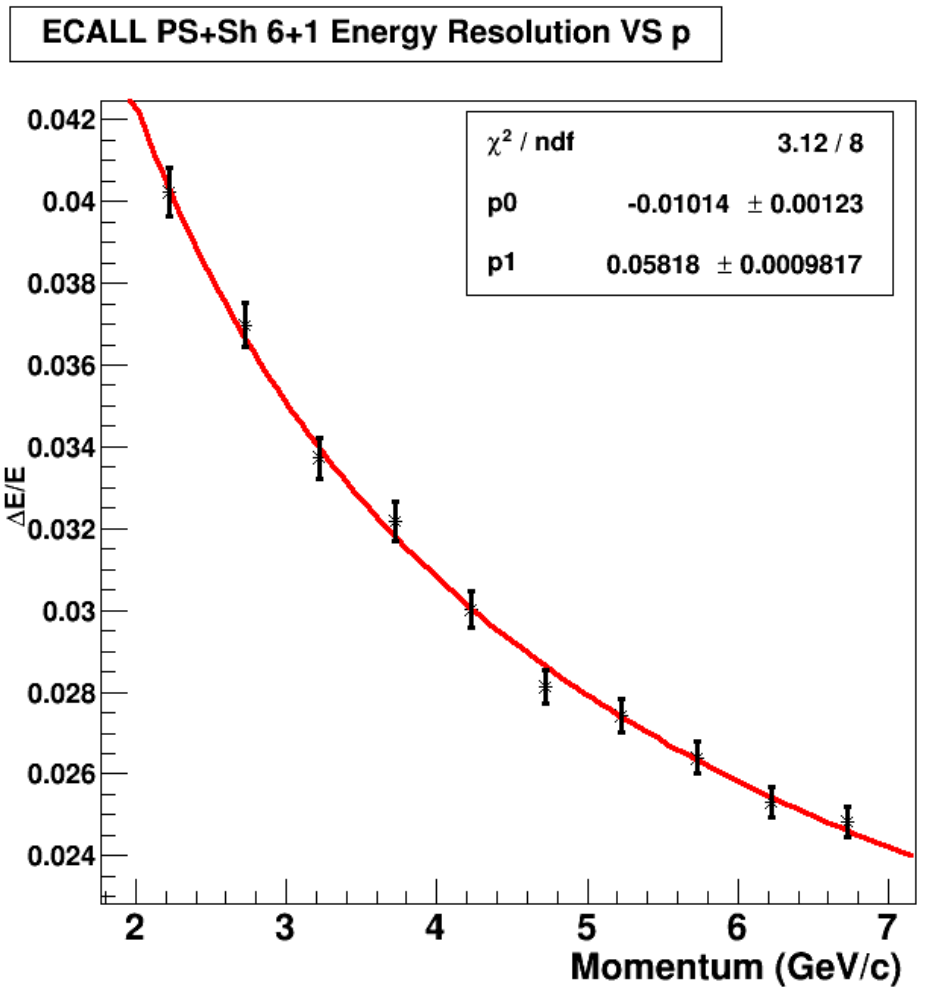




- Pre-Shower lead and scintillator are included in the simulation
- Edep is the total calibrated energy in the PS + Sh
- Pf is the incident electron momentum

Intrinsic ECAL Energy Resolution





Based on calibrated energy deposit in the ECAL

Shower Energy Resolution

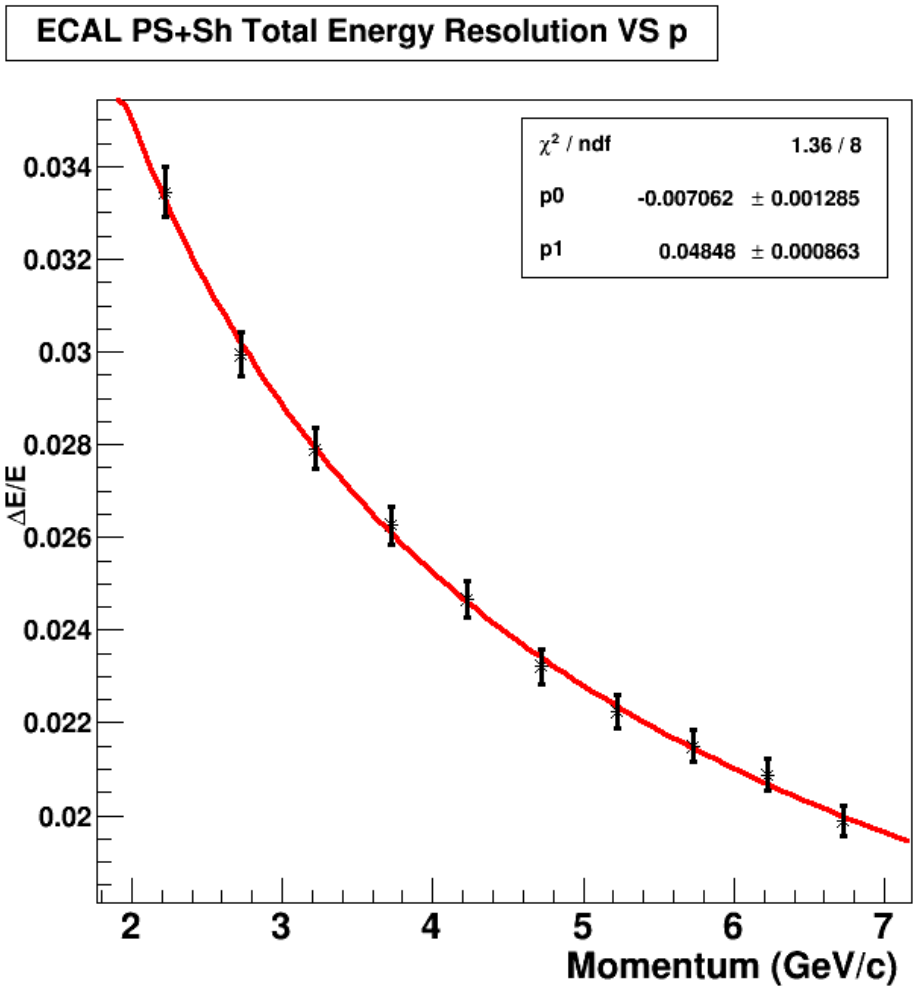
From Total Energy on ECAL		
Pf (GeV)	Res (%)	Error (%)
2.23	0.039	0.00058
2.73	0.035	0.00053
3.23	0.032	0.00048
3.73	0.031	0.00046
4.23	0.029	0.00043
4.73	0.027	0.00040
5.23	0.026	0.00039
5.73	0.025	0.00038
6.23	0.024	0.00036
6.73	0.023	0.00035

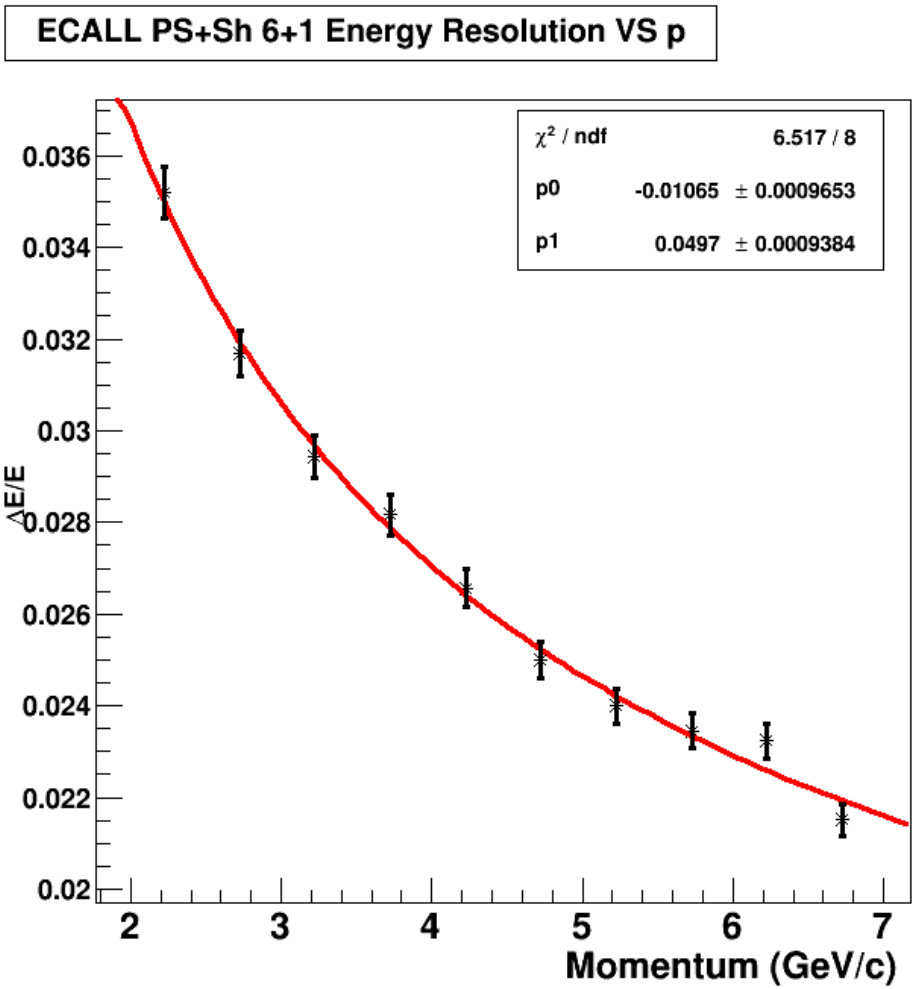
From 6+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.040	0.00059
2.73	0.037	0.00054
3.23	0.034	0.00049
3.73	0.032	0.00047
4.23	0.030	0.00044
4.73	0.028	0.00041
5.23	0.027	0.00040
5.73	0.026	0.00039
6.23	0.025	0.00037
6.73	0.025	0.00037

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.

Intrinsic ECAL Energy Resolution with double the layers





Increased the no. of layers by halving lead and scint. thickness

Shower Energy Resolution with double the layers

From Total Energy on ECAL		
Pf (GeV)	Res (%)	Error (%)
2.23	0.033	0.00053
2.73	0.030	0.00048
3.23	0.028	0.00045
3.73	0.026	0.00042
4.23	0.025	0.00039
4.73	0.023	0.00037
5.23	0.022	0.00036
5.73	0.022	0.00035
6.23	0.021	0.00034
6.73	0.020	0.00032

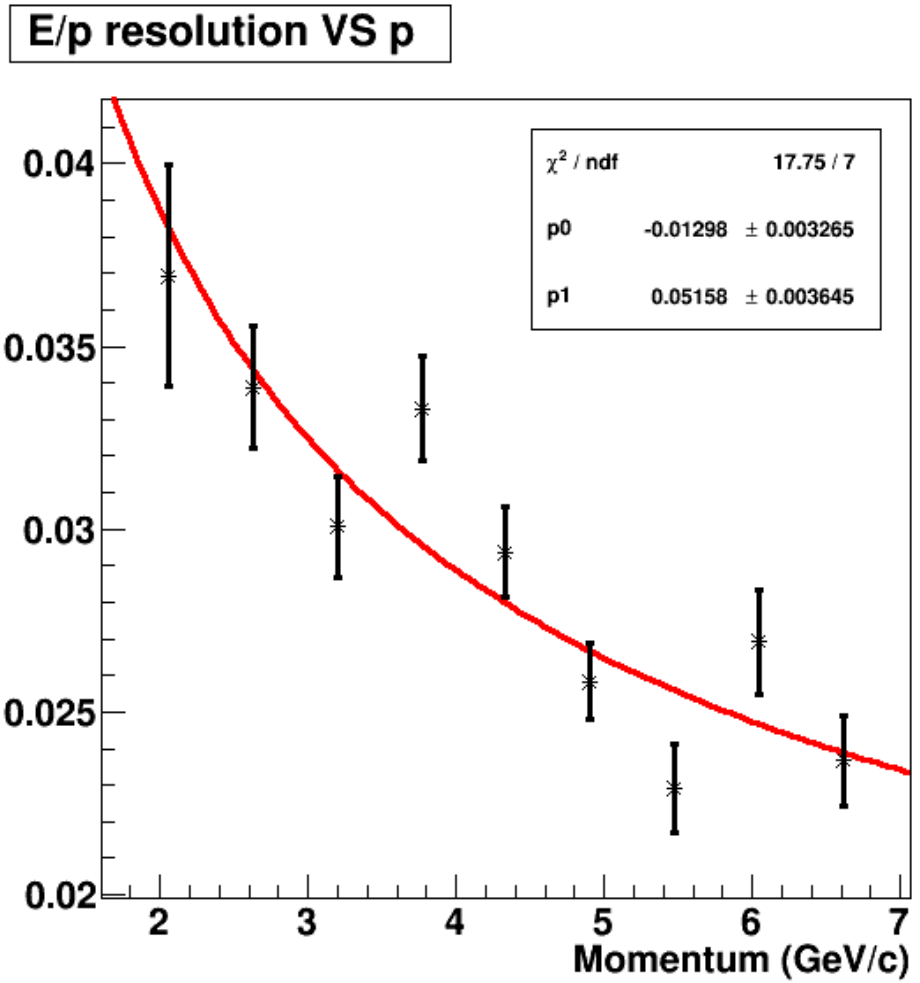
From 6+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.035	0.00055
2.73	0.032	0.00049
3.23	0.029	0.00046
3.73	0.028	0.00044
4.23	0.027	0.00042
4.73	0.025	0.00040
5.23	0.024	0.00038
5.73	0.023	0.00037
6.23	0.023	0.00037
6.73	0.022	0.00034

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.

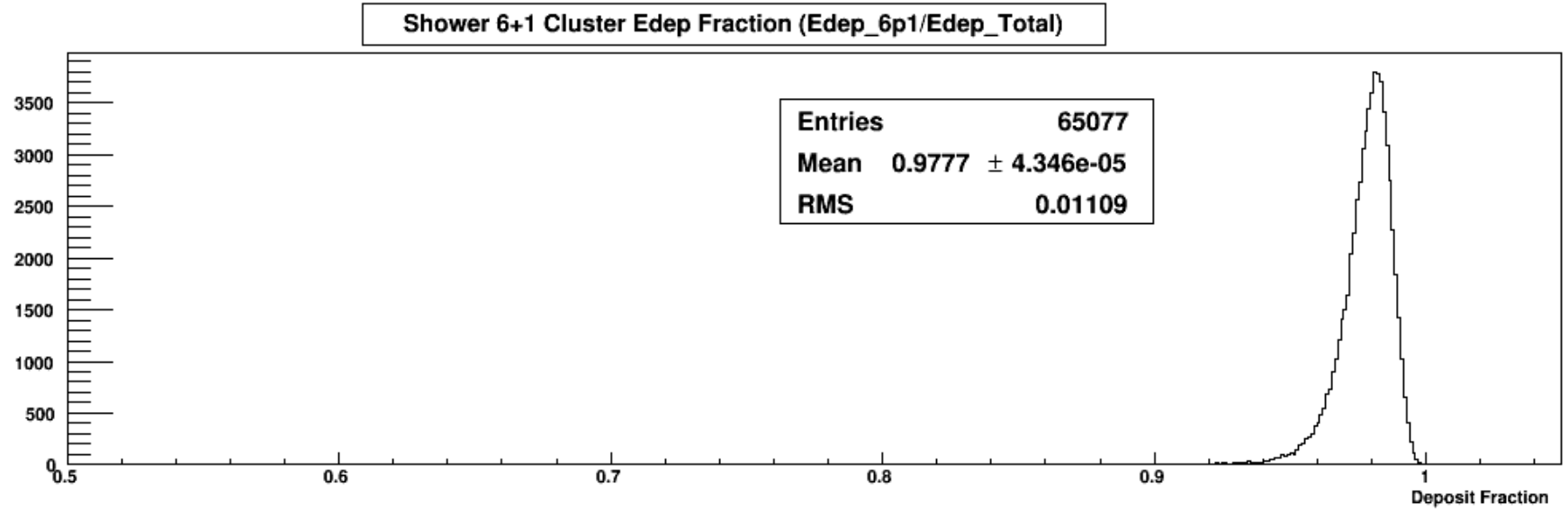
Jin's Energy Resolution (with No Phot. Elec.)

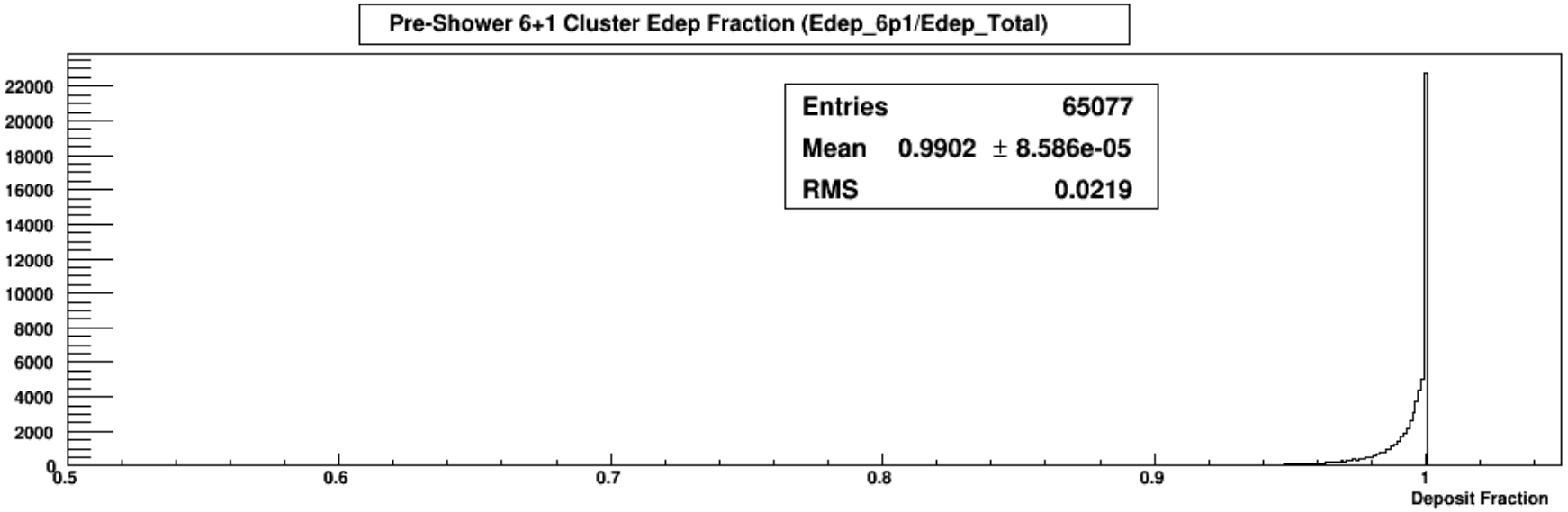
- Jin's estimation was based on ecal (ps+sh) calibrated energy deposition



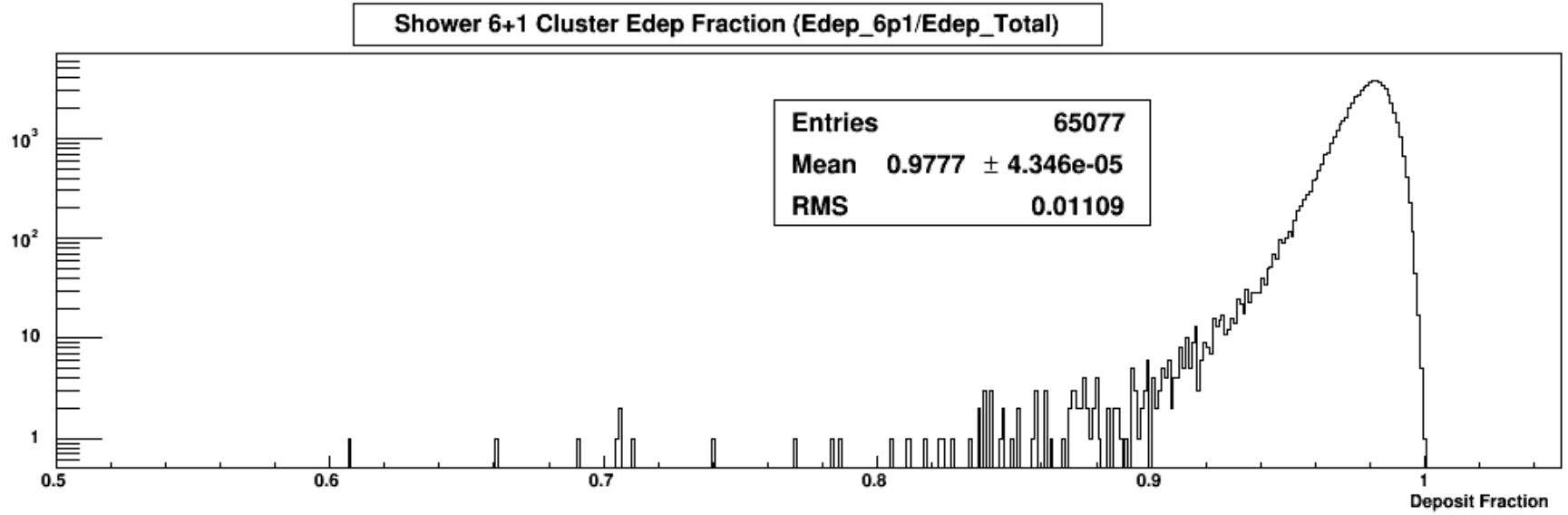
Energy Loss in Max 6+1 Clusters

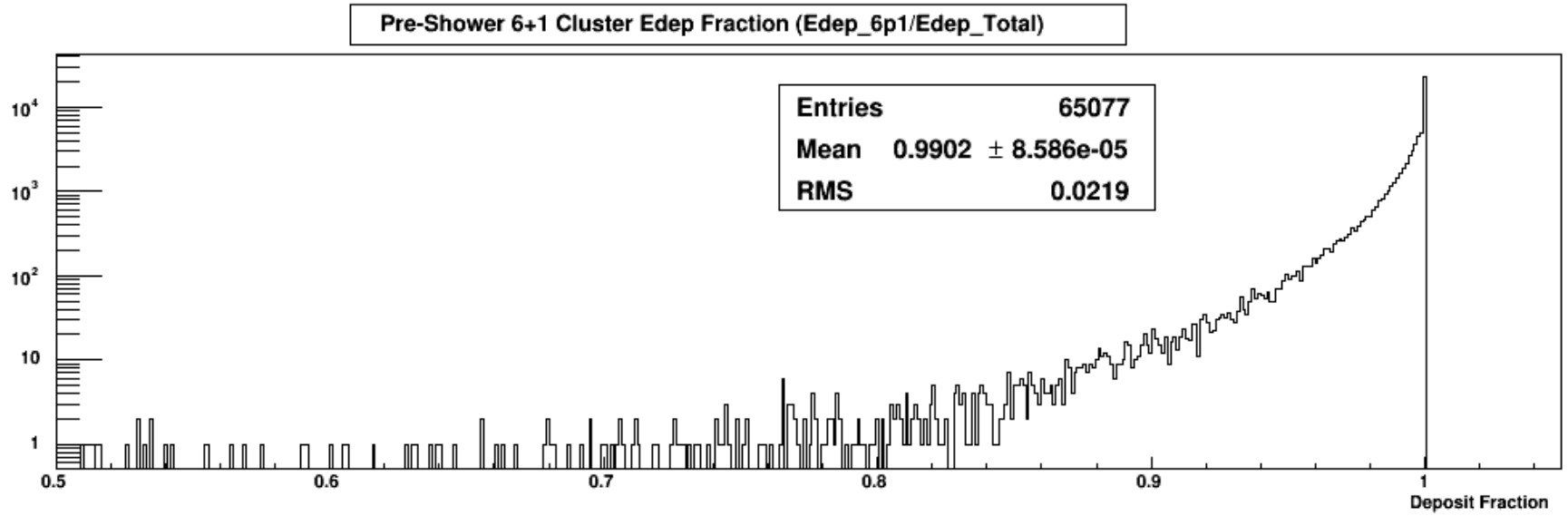
Energy Deposit Fraction : Shower 6+1 Clusters



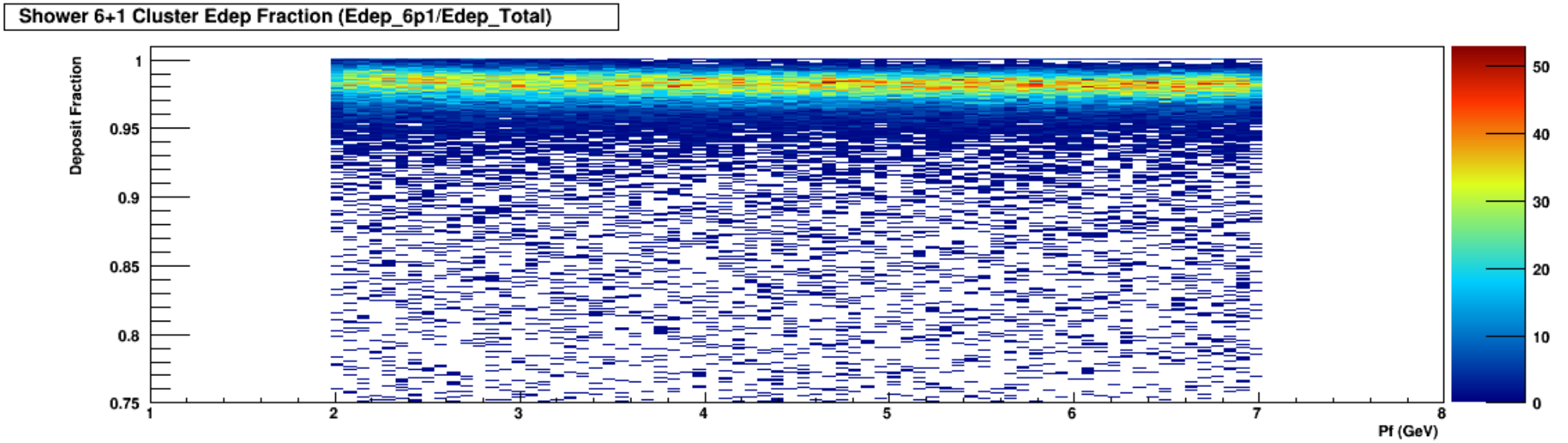


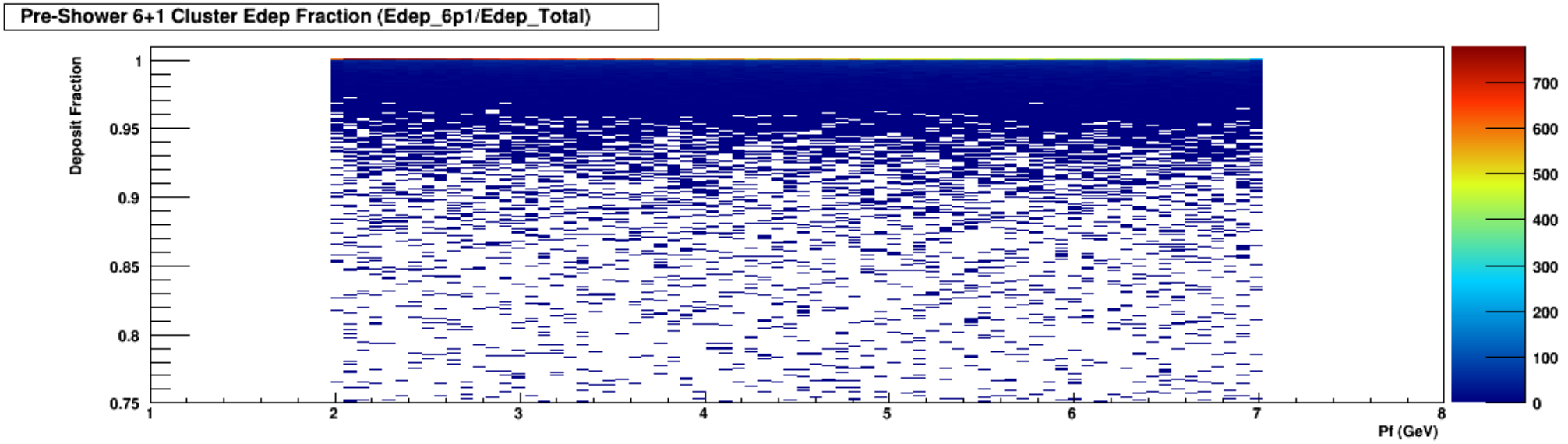
Energy Deposit Fraction : Shower 6+1 Clusters



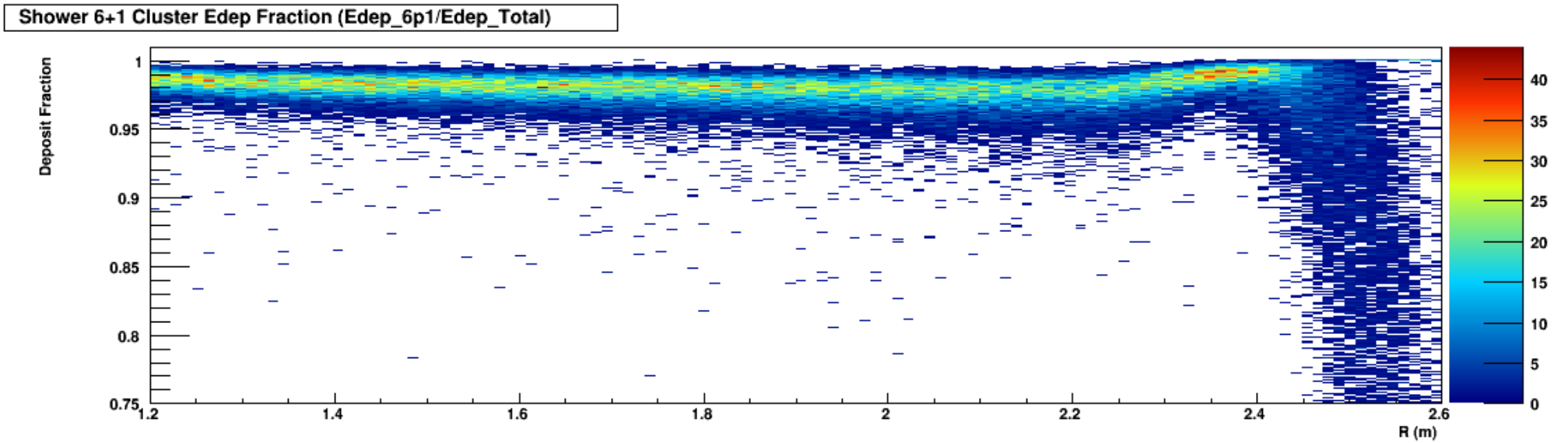


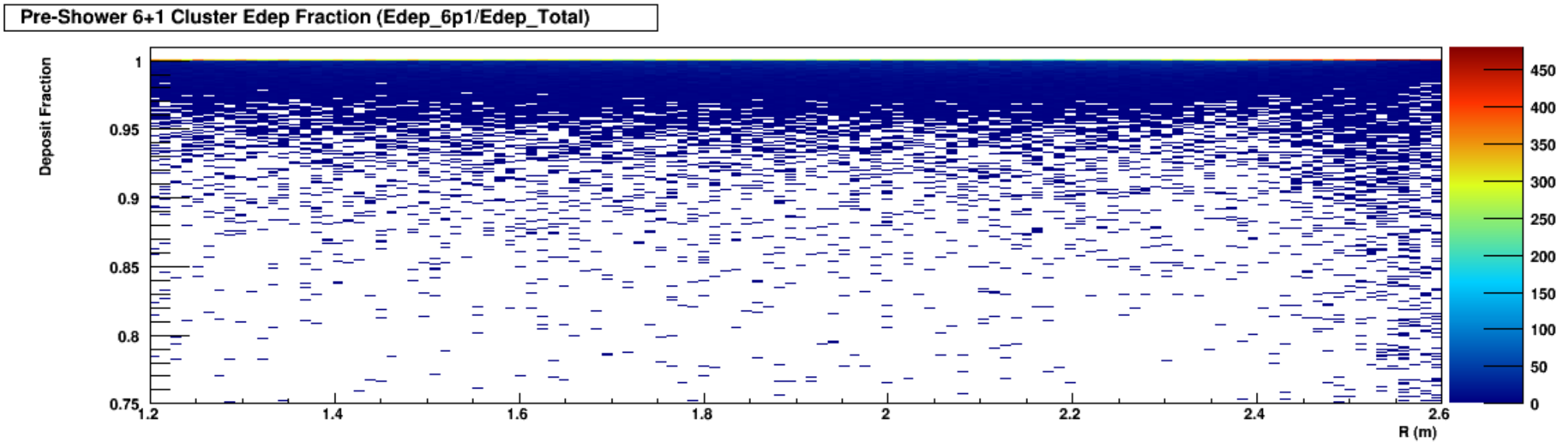
Energy Deposit Fraction : Shower 6+1 Clusters





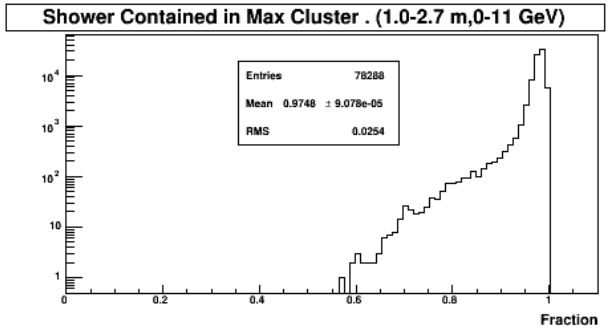
Energy Deposit Fraction : Shower 6+1 Clusters

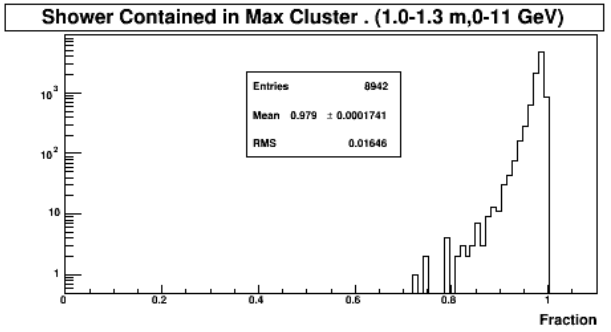


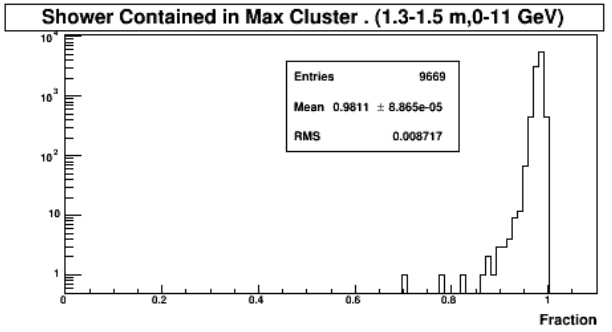


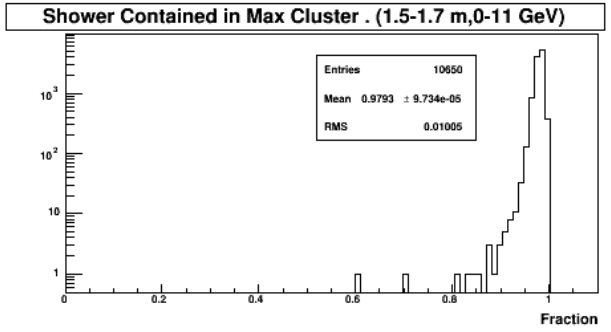
Energy Deposit Fraction in R bins : Shower 6+1 Clusters

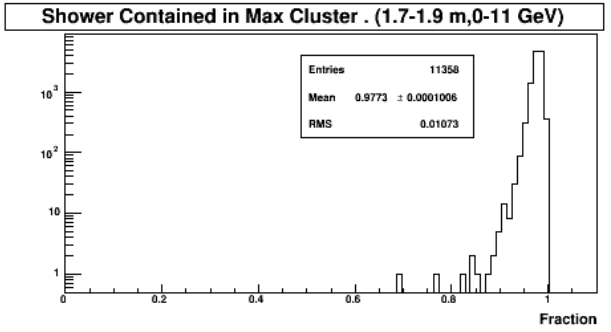
- The 6+1 cluster energy deposit fraction in all momenta and all radii are shown here
- The energy loss increases for radii above 2.3 m

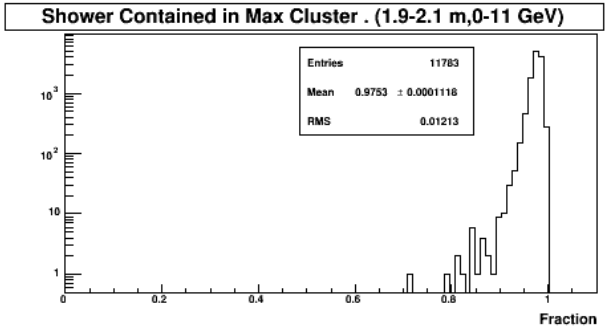


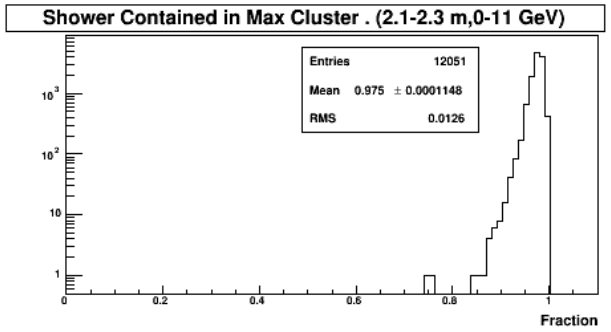


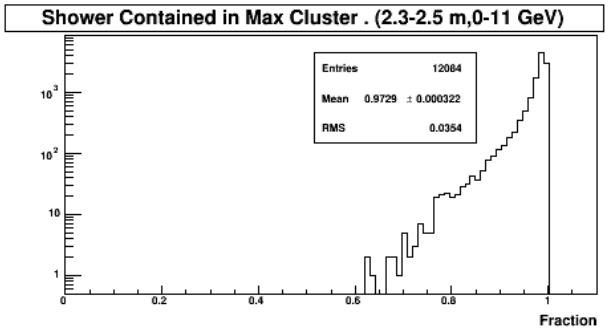


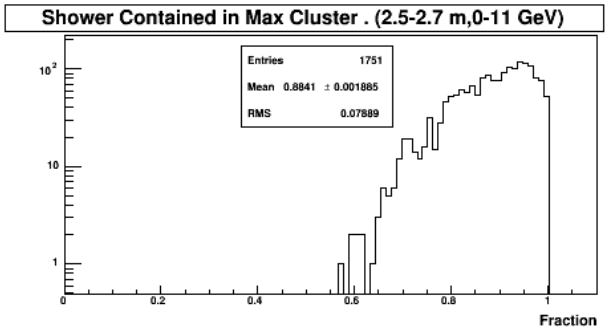




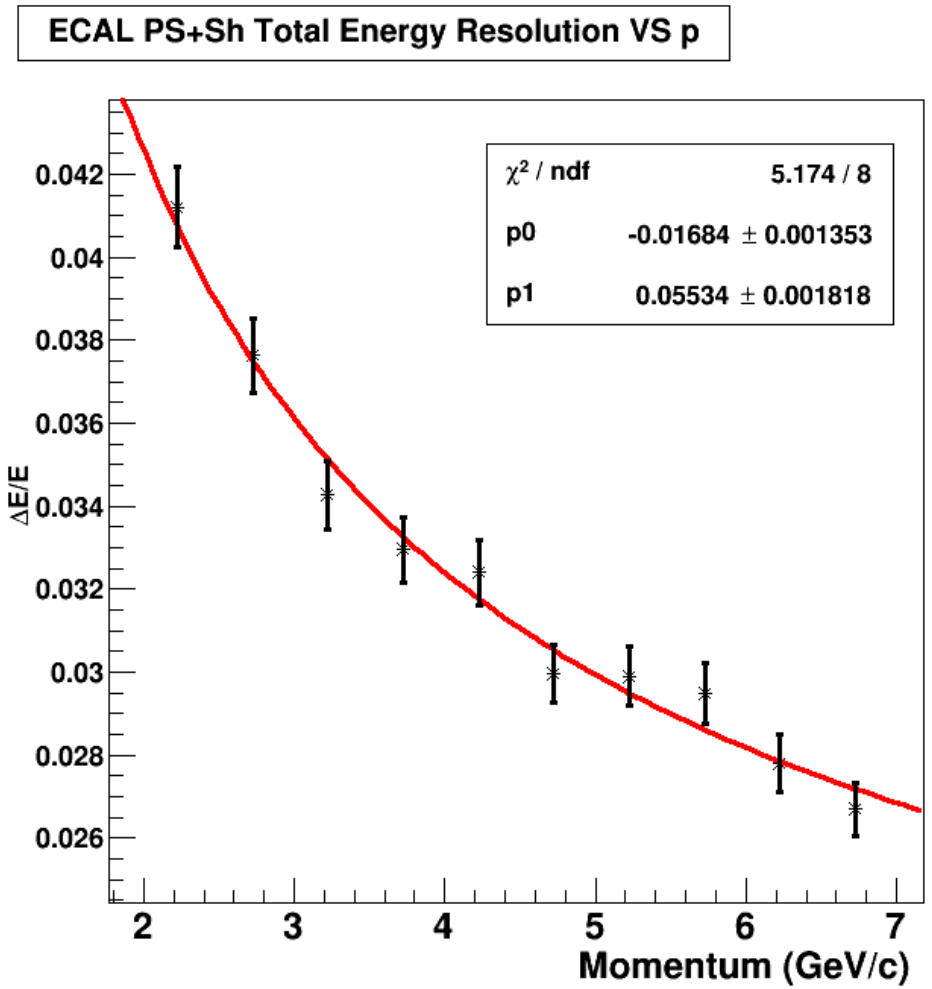


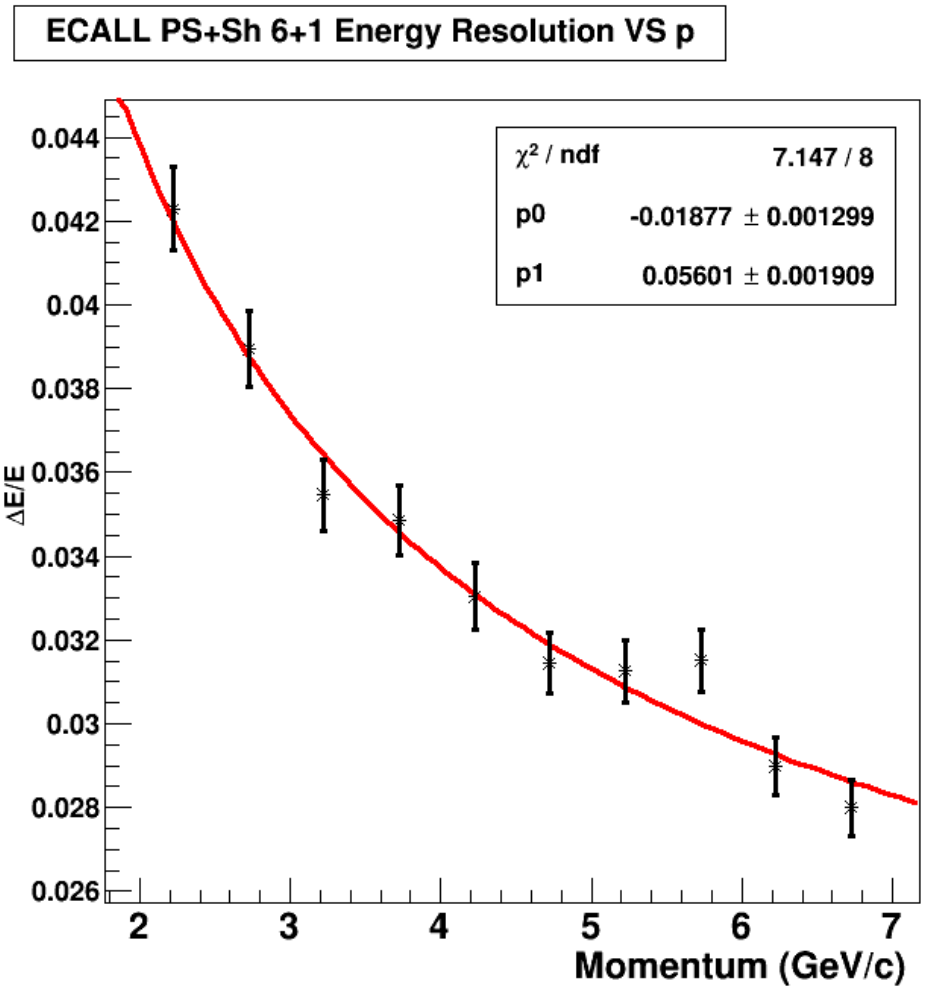






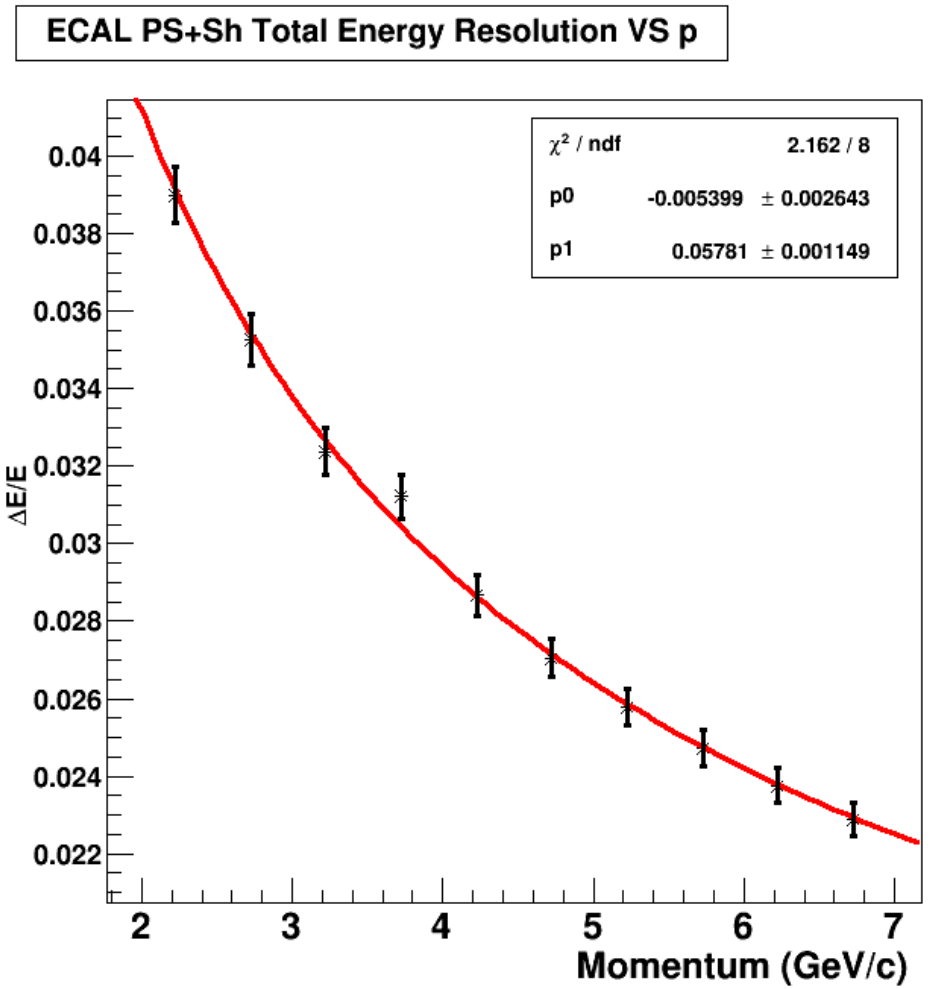
ECAL Energy Resolution : R 1.0 – 1.5 m

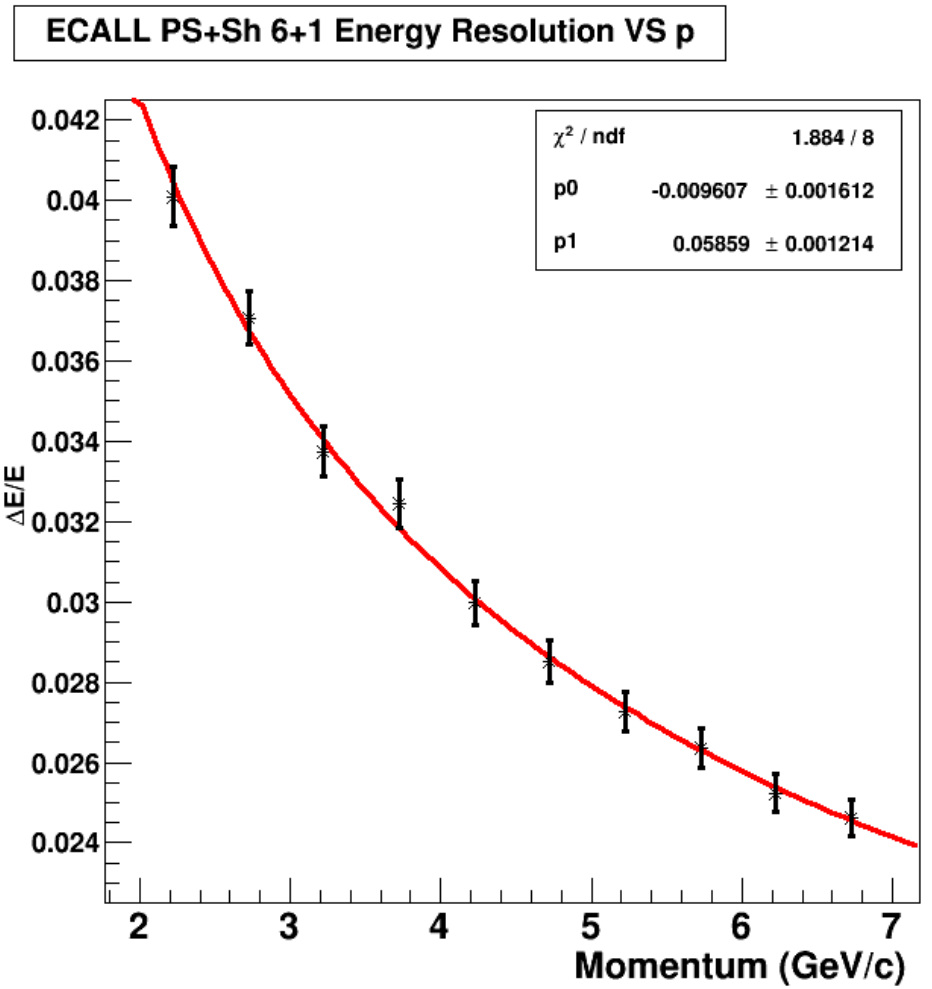




Based on calibrated energy deposit in the ECAL

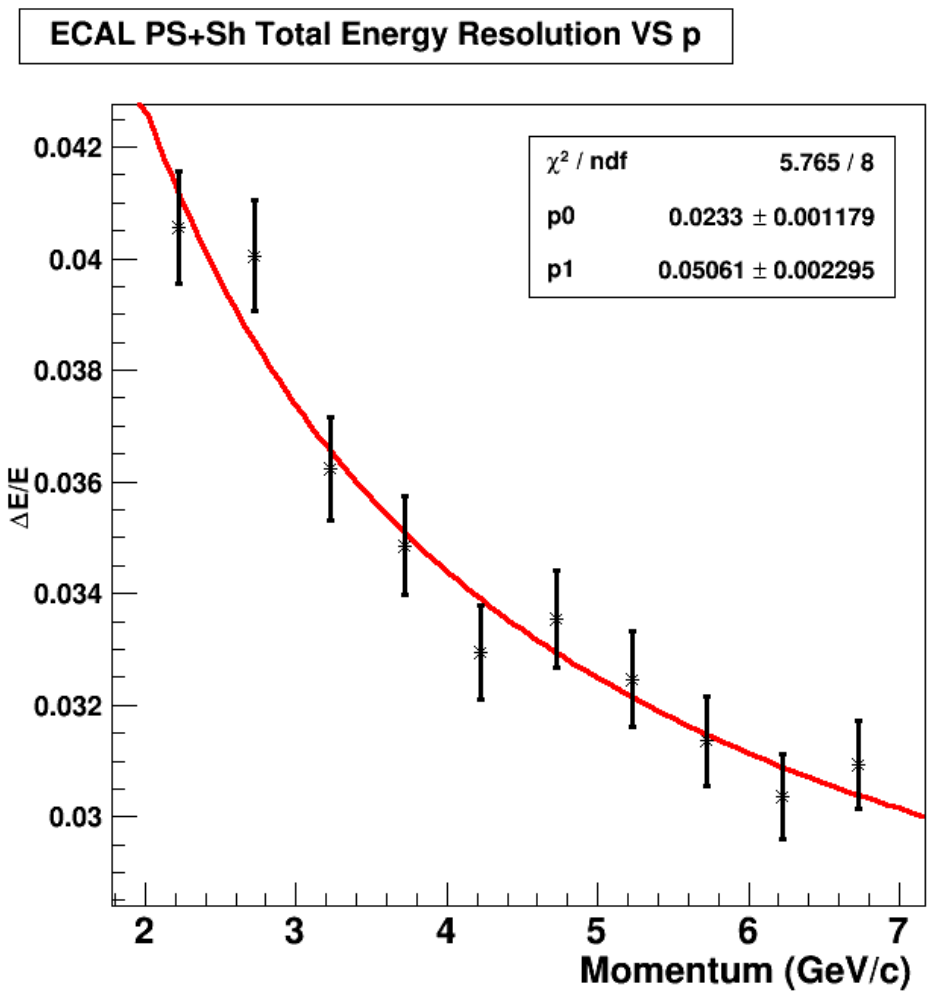
ECAL Energy Resolution : R 1.5 – 2.1 m

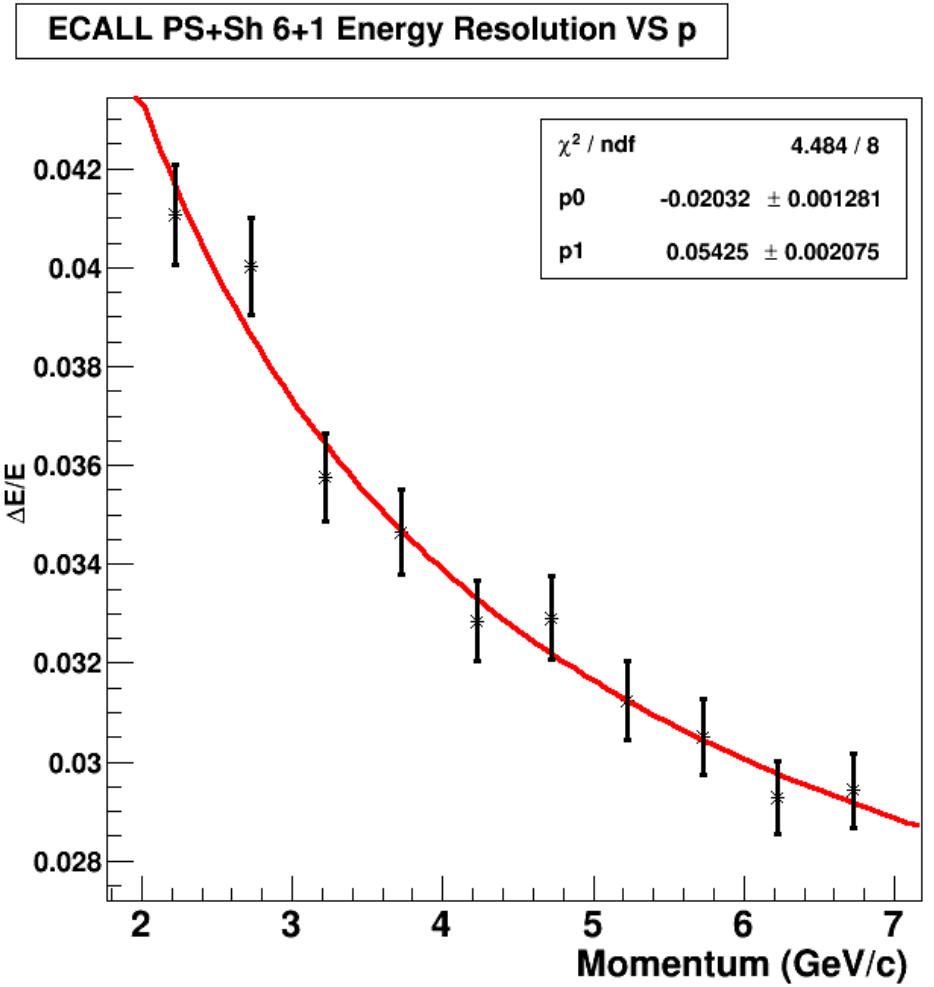




Based on calibrated energy deposit in the ECAL

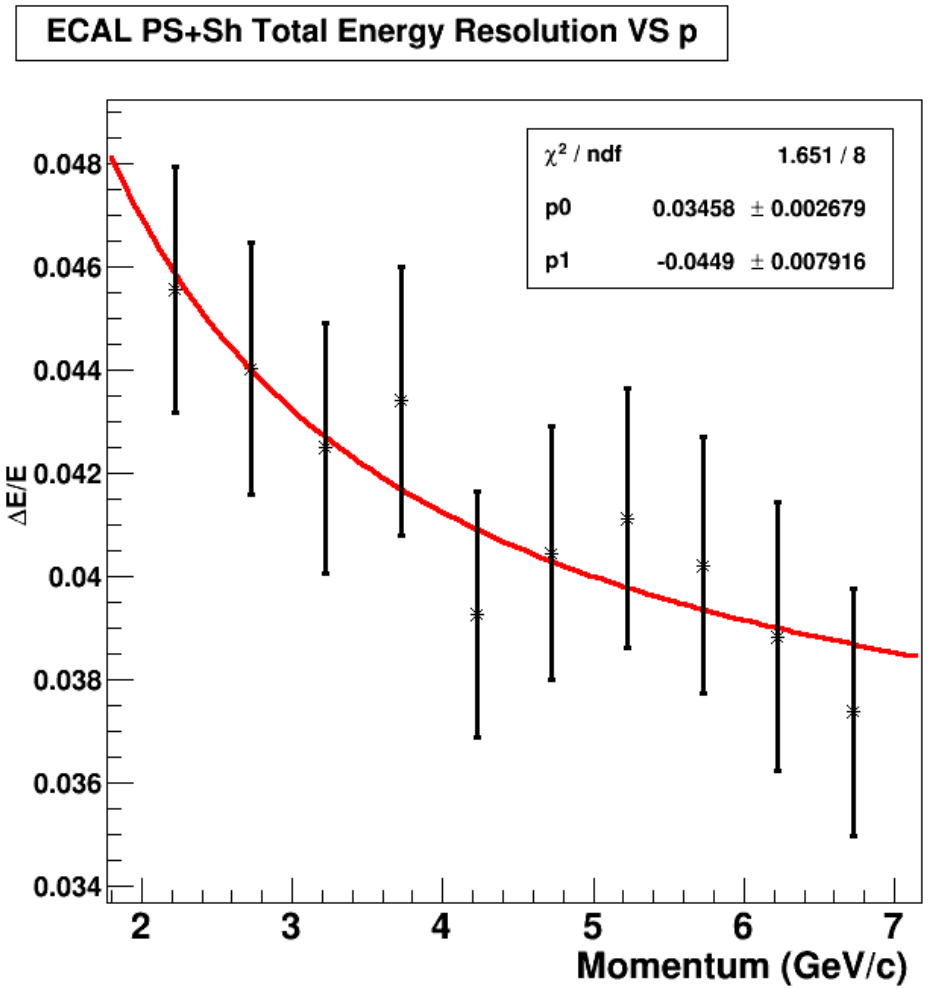
ECAL Energy Resolution : R 2.1 – 2.4 m

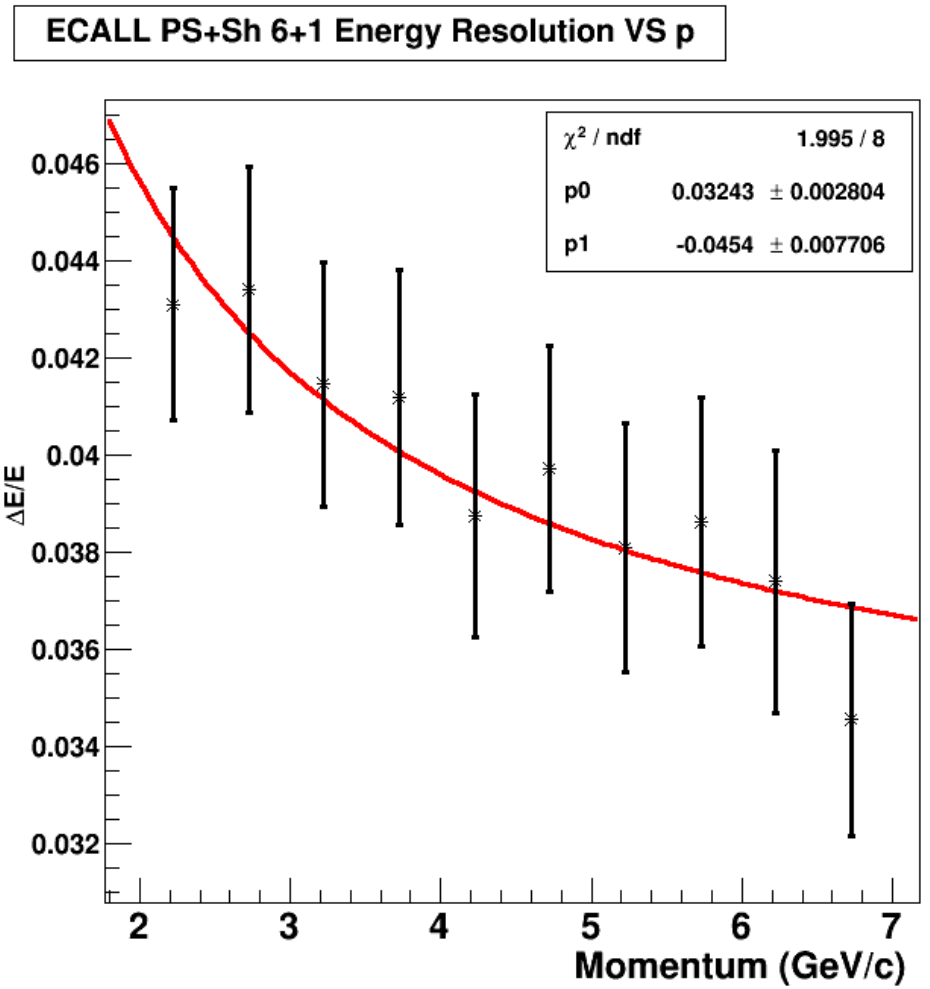




Based on calibrated energy deposit in the ECAL

ECAL Energy Resolution : R 2.4 – 2.7 m

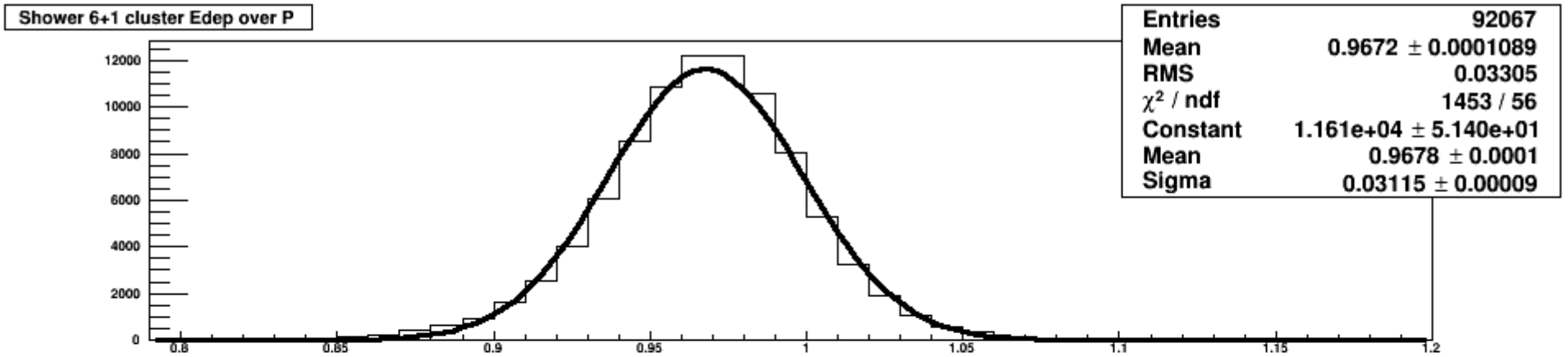


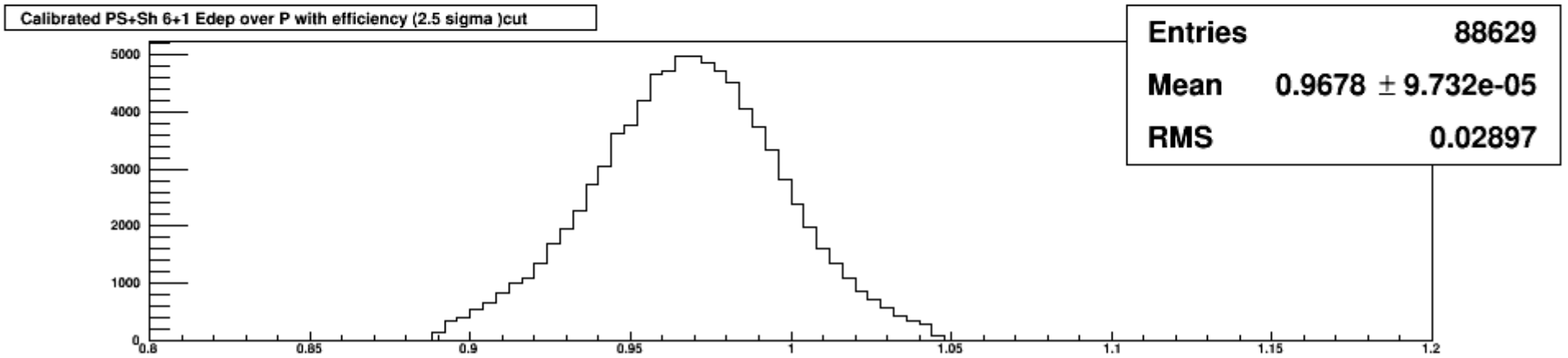


Based on calibrated energy deposit in the ECAL

ECAL PID Efficiency

e^- Calibrated Energy over Pf Ratio

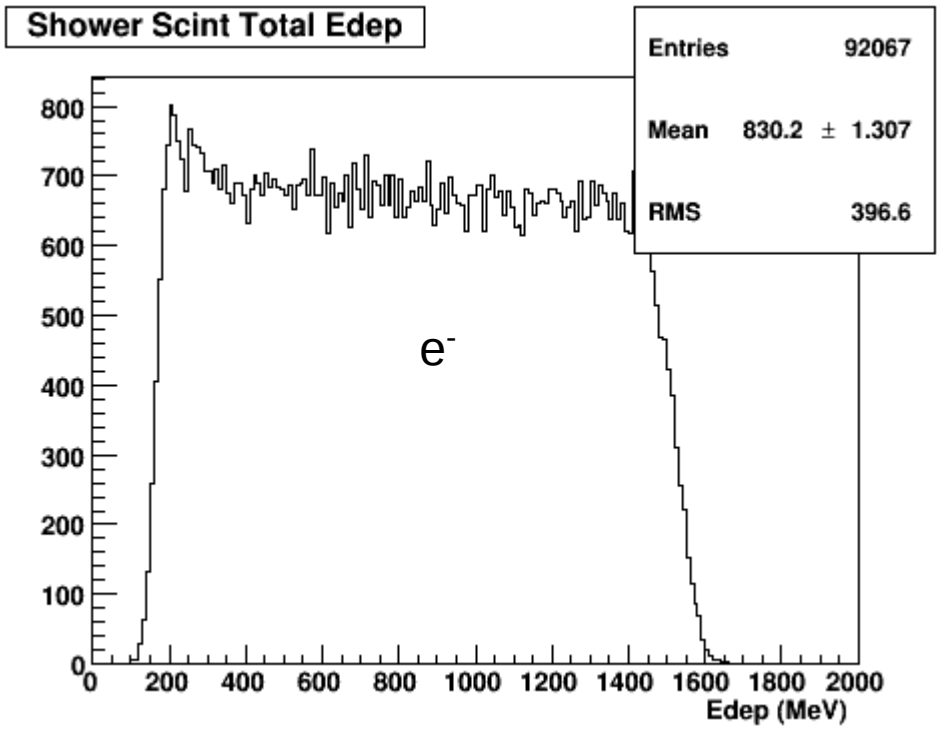


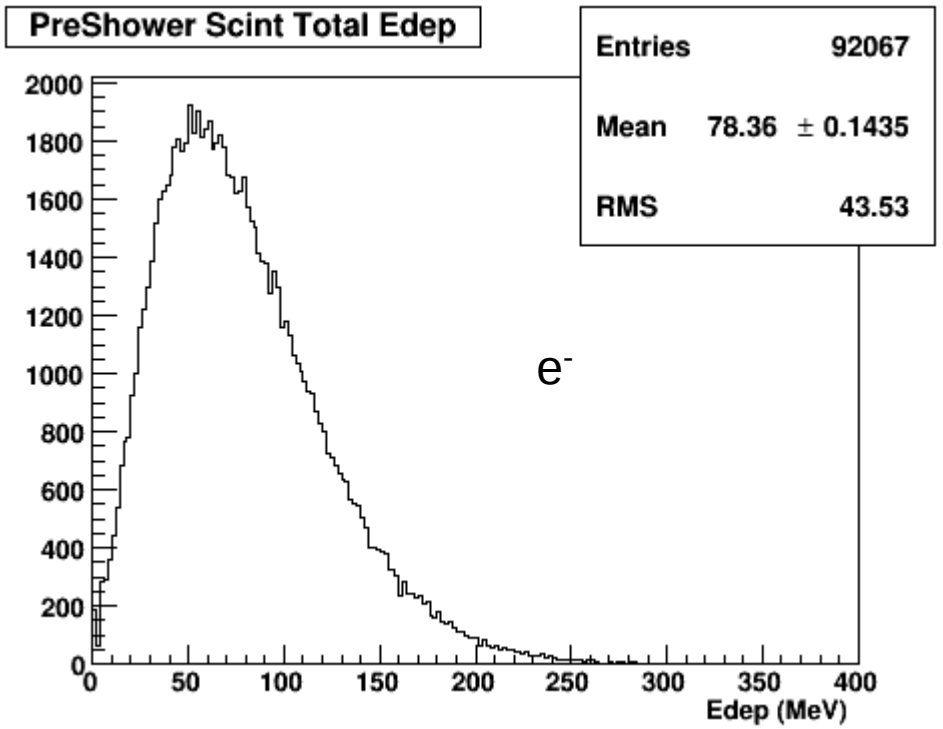


- A 2.5 σ cut applied to select e^- events
- Ratio of above cut selected e^- over total e^- events is the ECAL efficiency

MIP Cut on the Pre-Shower

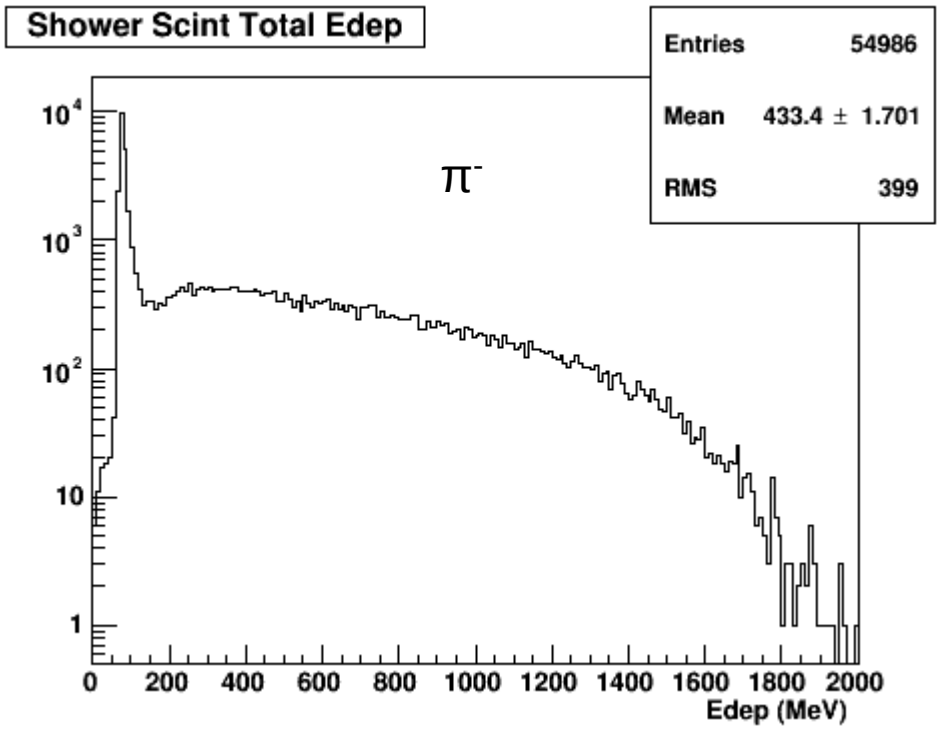
- Electron deposit energy in the PS differently compared to pions
- Due to Pions act like a MIP most of the time PS cut just above a MIP can reject pions

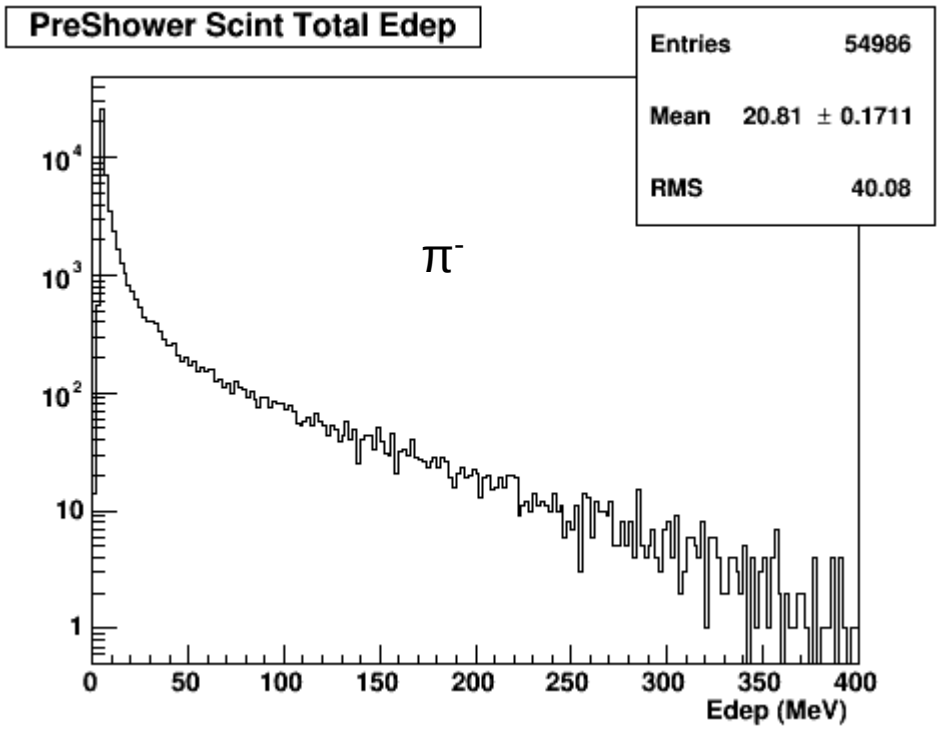




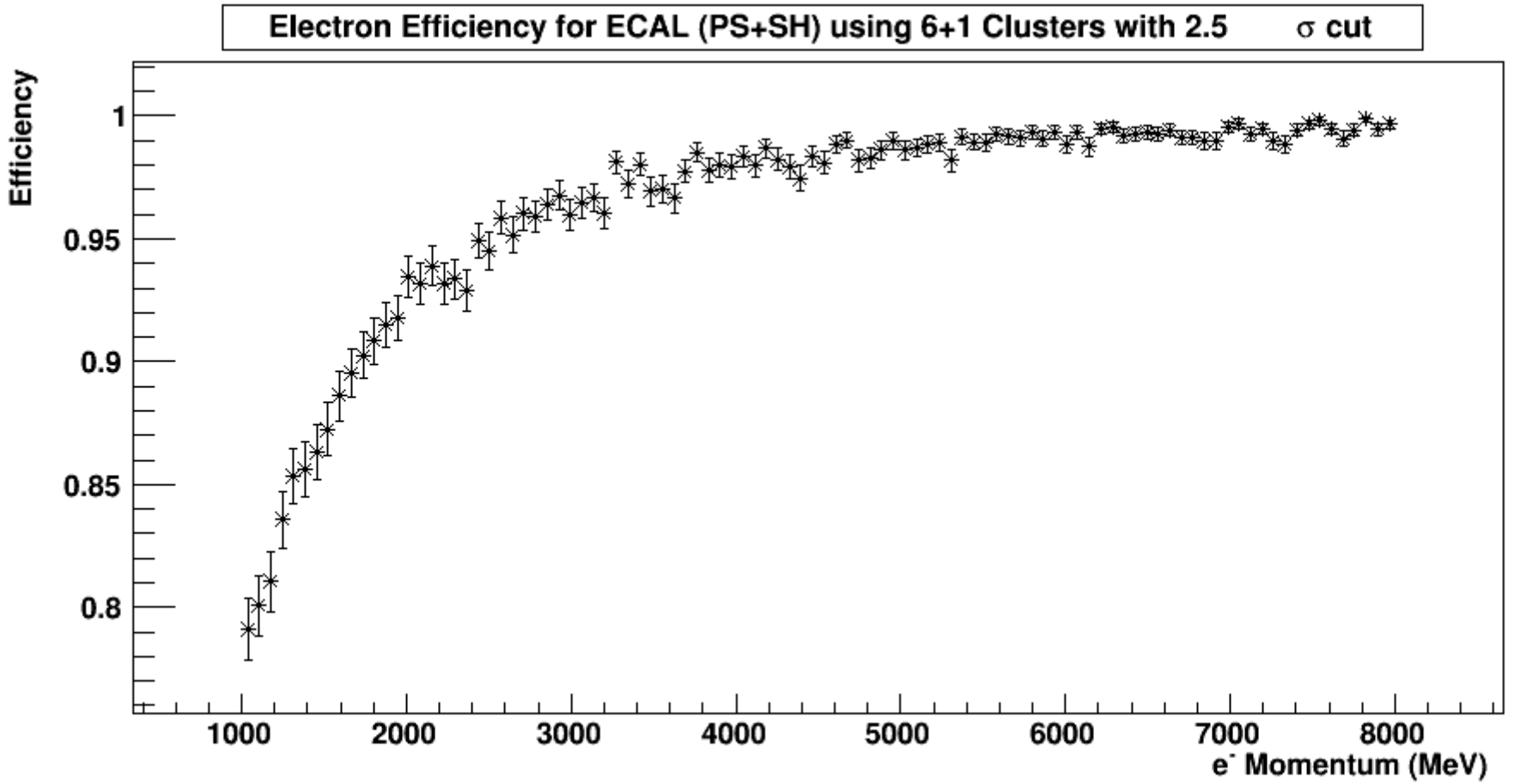
MIP Cut on the Pre-Shower

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

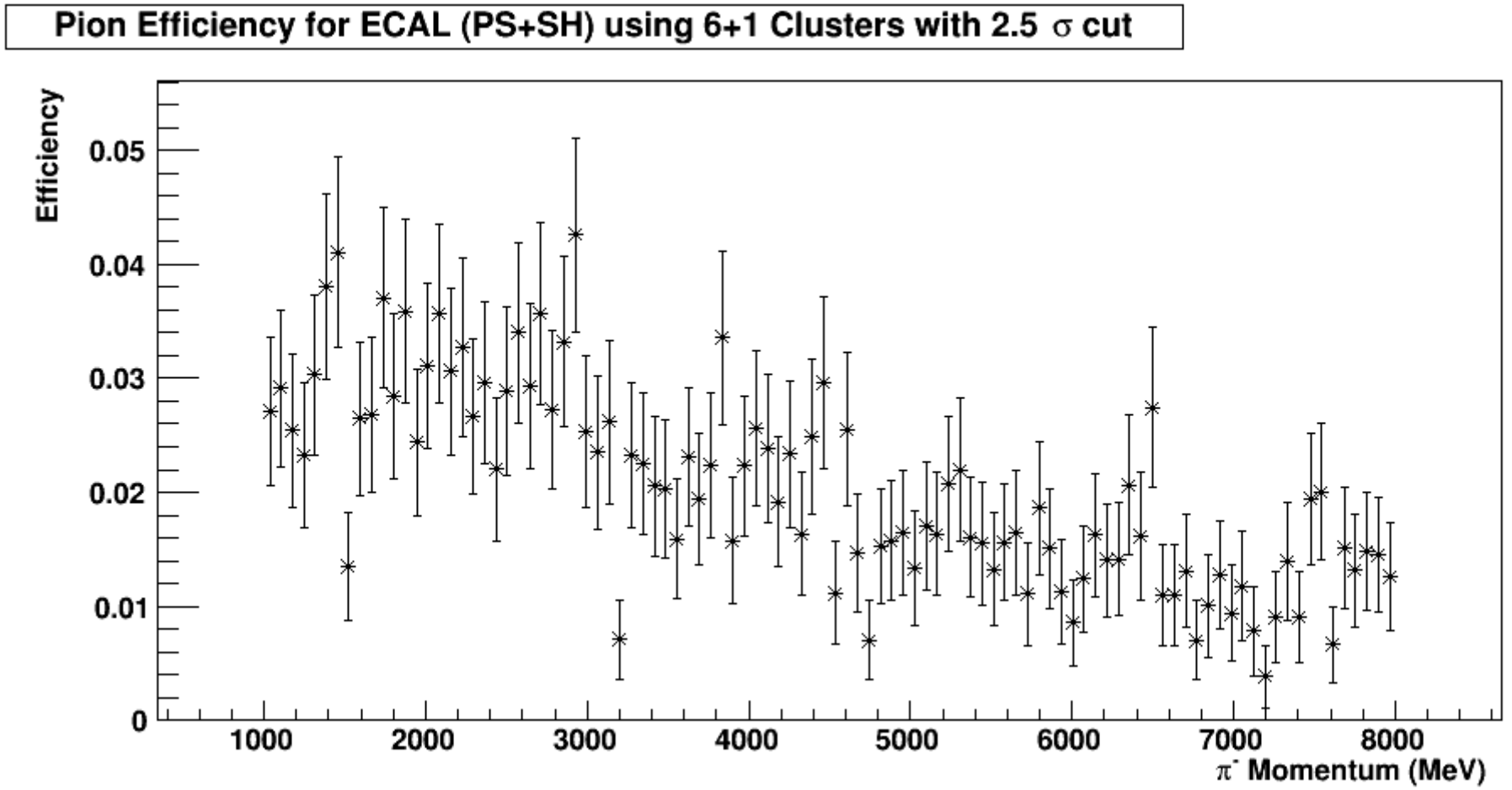




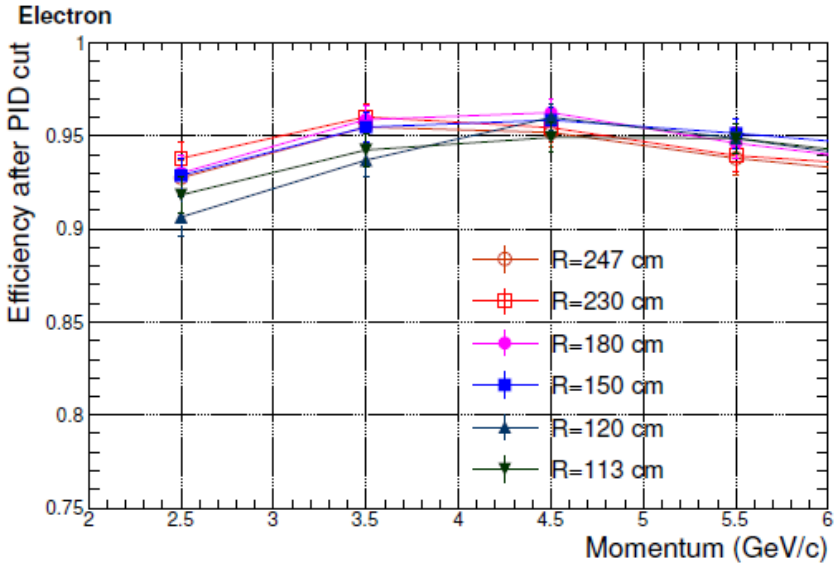
e^- Efficiency with PS MIP Cut

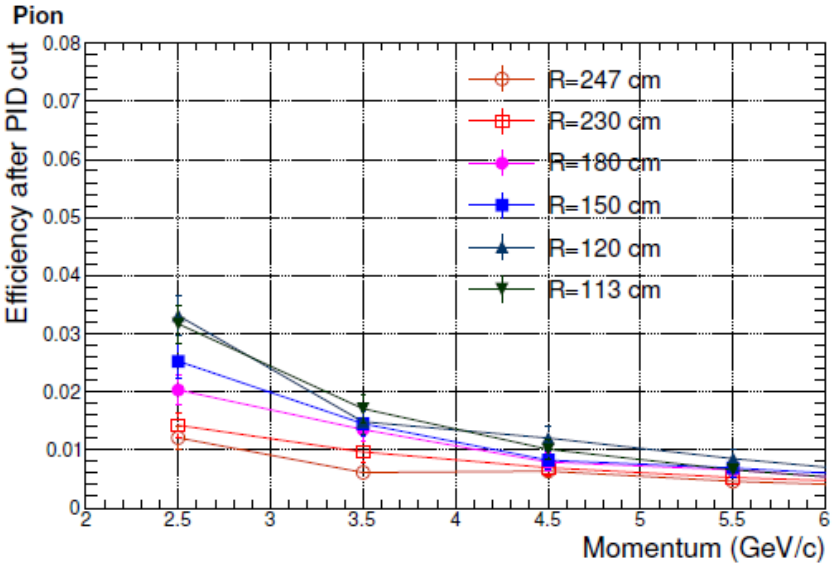


π^- Efficiency with PS MIP Cut

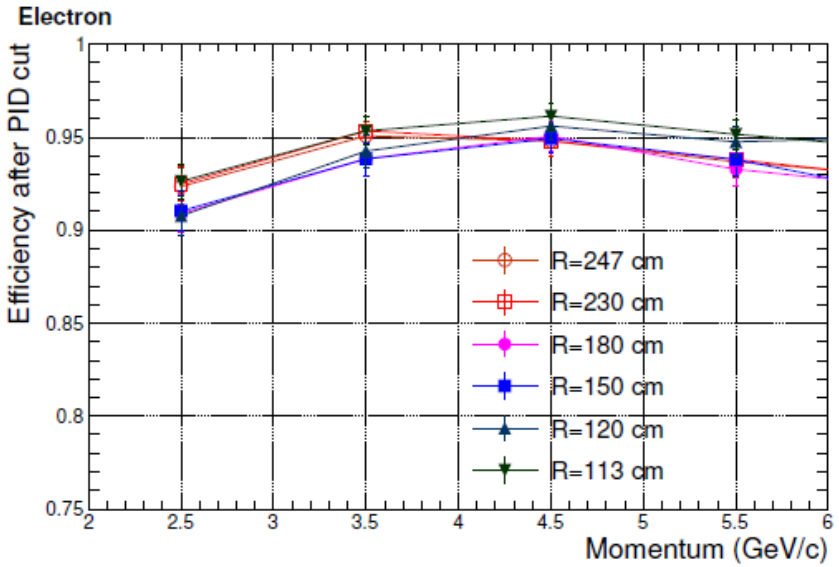


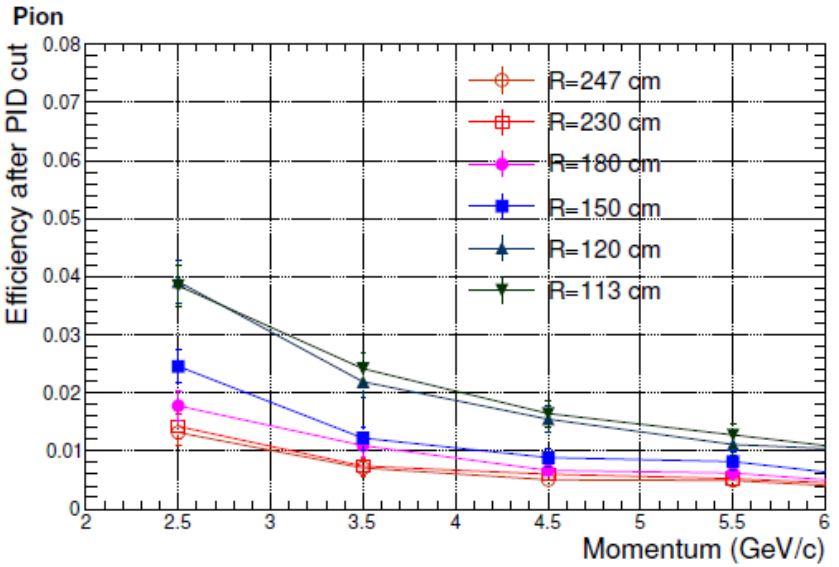
From preCDR





(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