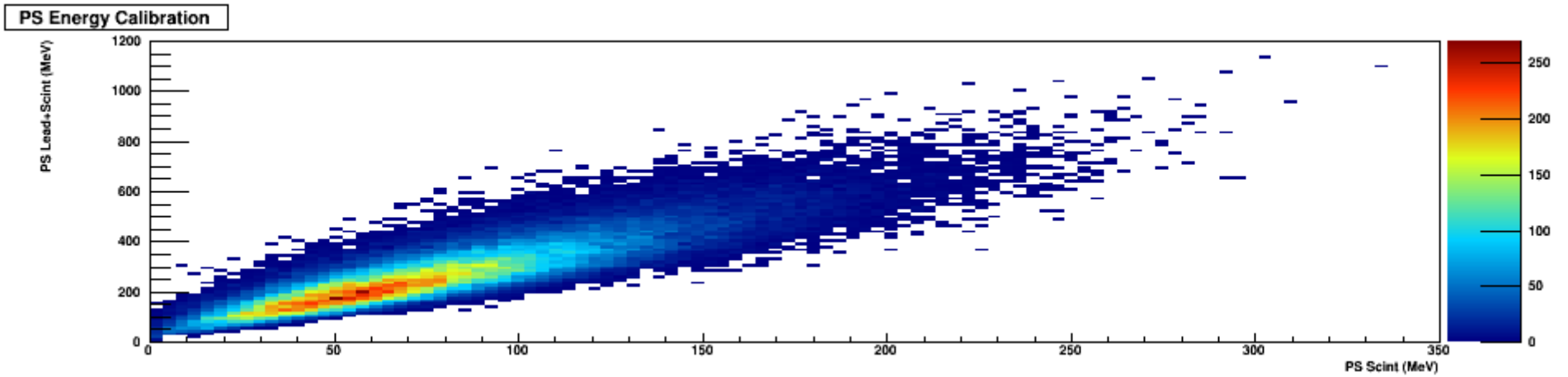
ECAL Summary 2

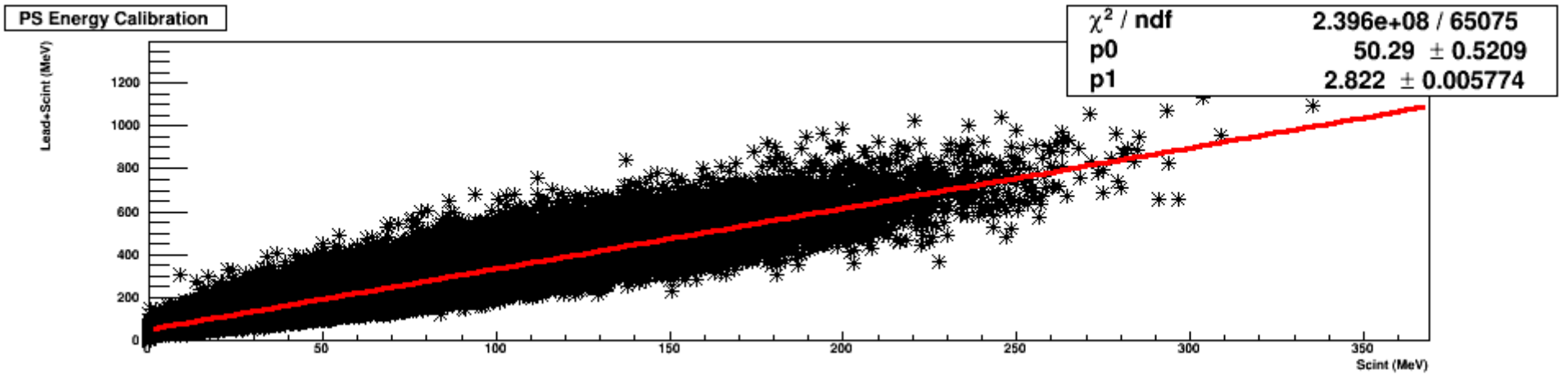
ECAL Energy Resolution and Efficiency

Update

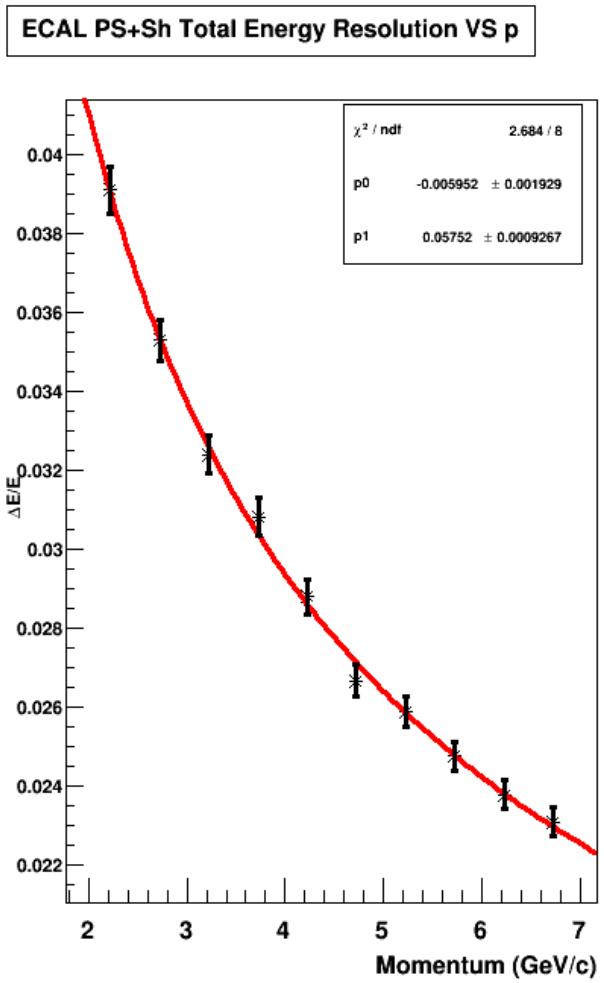
- I have been using realistic numbers for calibrated energy deposit in the PS
  - Get actual edep on the PS lead absorber
  - Get PS scint energy deposit
- I replaced this by an approximation
  - plot total energy deposit in the PS lead+scintillator vs PS scintillator to get a liner fit

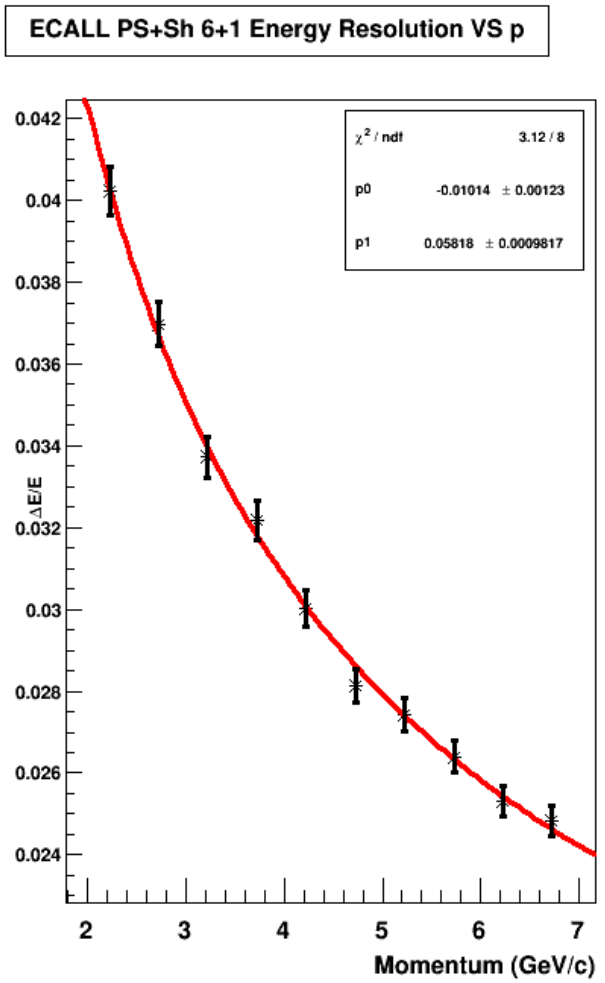
Update

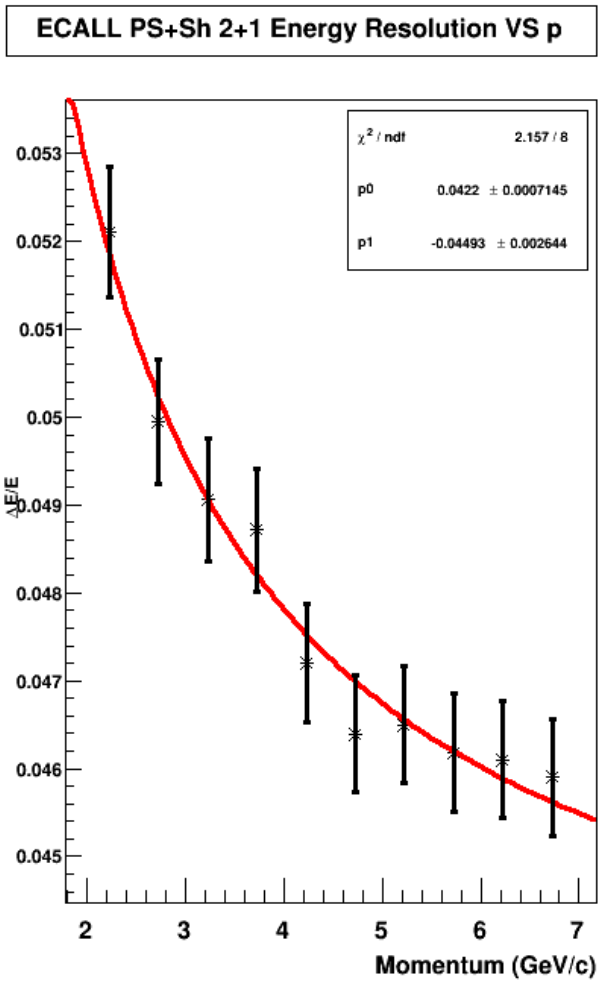

PS Energy Calibration
PS Lead+Scint (MeV)
PS Scint (MeV)


PS Energy Calibration
Lead+Scint (MeV)
Scint (MeV)
χ² / ndf 2.396e+08 / 65075
p0 50.29 ± 0.5209
p1 2.822 ± 0.005774

Intrinsic ECAL Energy Resolution : Before







Based on calibrated energy deposit in the ECAL

Intrinsic ECAL Energy Resolution : Before

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

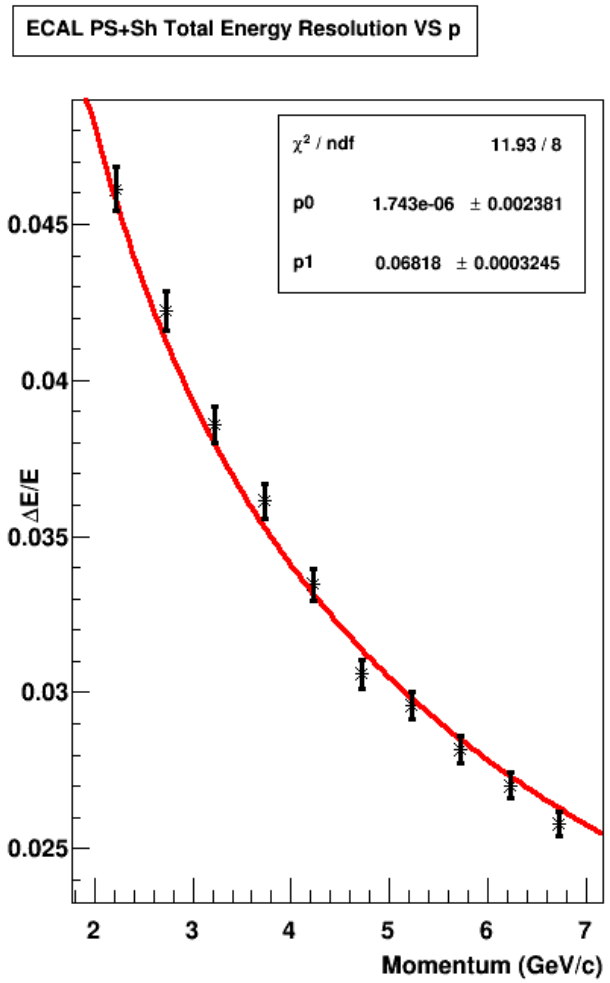
From 6+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.040	0.00059
2.73	0.037	0.00054
3.23	0.034	0.00049
3.73	0.032	0.00047
4.23	0.030	0.00044
4.73	0.028	0.00041
5.23	0.027	0.00040
5.73	0.026	0.00039
6.23	0.025	0.00037
6.73	0.025	0.00037

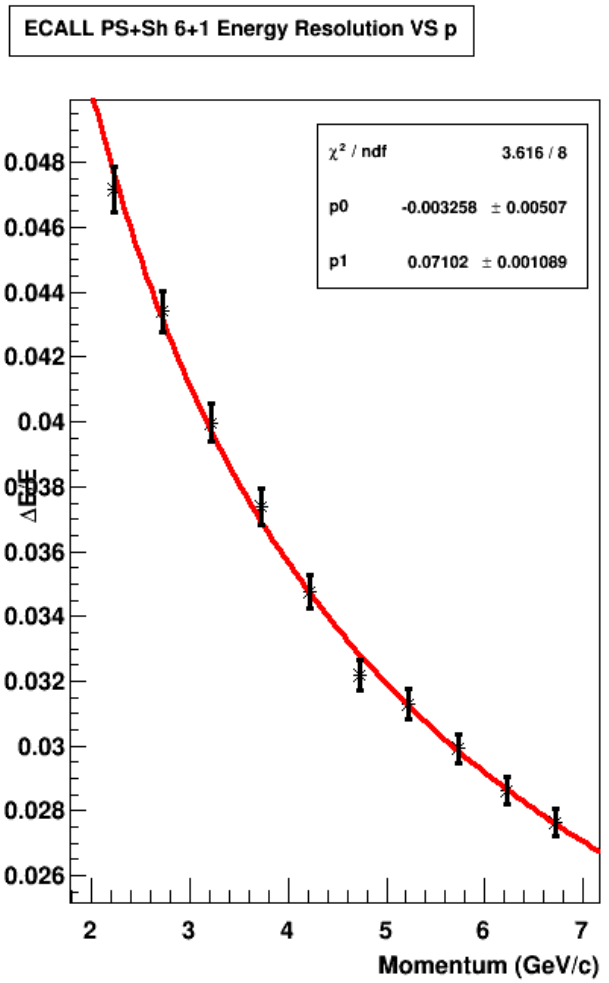
From 2+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.052	0.00075
2.73	0.050	0.00071
3.23	0.049	0.00070
3.73	0.049	0.00070
4.23	0.047	0.00067
4.73	0.047	0.00066
5.23	0.047	0.00066
5.73	0.046	0.00067
6.23	0.046	0.00067
6.73	0.046	0.00066

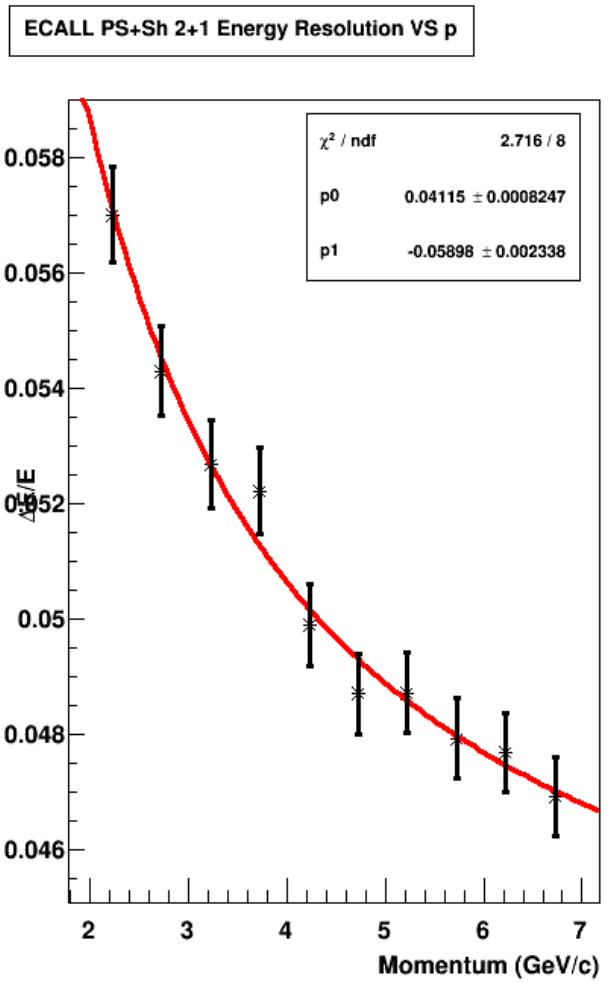
Note :

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 : After







Based on calibrated energy deposit in the ECAL

Intrinsic ECAL Energy Resolution : After

From Total Energy on ECAL		
Pf (GeV)	Res (%)	Error (%)
2.23	0.046	0.00069
2.73	0.042	0.00063
3.23	0.039	0.00058
3.73	0.036	0.00054
4.23	0.033	0.00050
4.73	0.031	0.00046
5.23	0.030	0.00044
5.73	0.028	0.00043
6.23	0.027	0.00041
6.73	0.026	0.00039

From 6+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.047	0.00070
2.73	0.043	0.00064
3.23	0.040	0.00059
3.73	0.037	0.00055
4.23	0.035	0.00051
4.73	0.032	0.00047
5.23	0.031	0.00046
5.73	0.030	0.00045
6.23	0.029	0.00042
6.73	0.028	0.00041

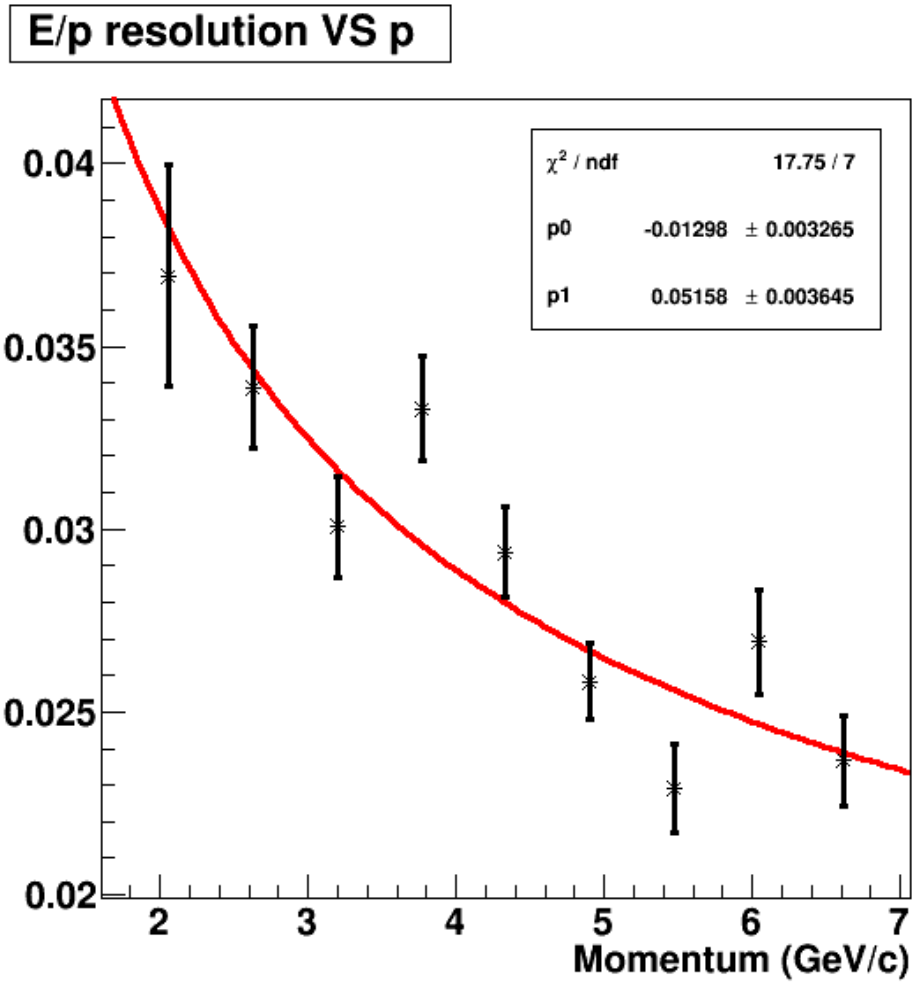
From 2+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.057	0.00082
2.73	0.054	0.00078
3.23	0.053	0.00075
3.73	0.052	0.00075
4.23	0.050	0.00071
4.73	0.049	0.00070
5.23	0.049	0.00069
5.73	0.048	0.00070
6.23	0.048	0.00069
6.73	0.047	0.00068

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.)

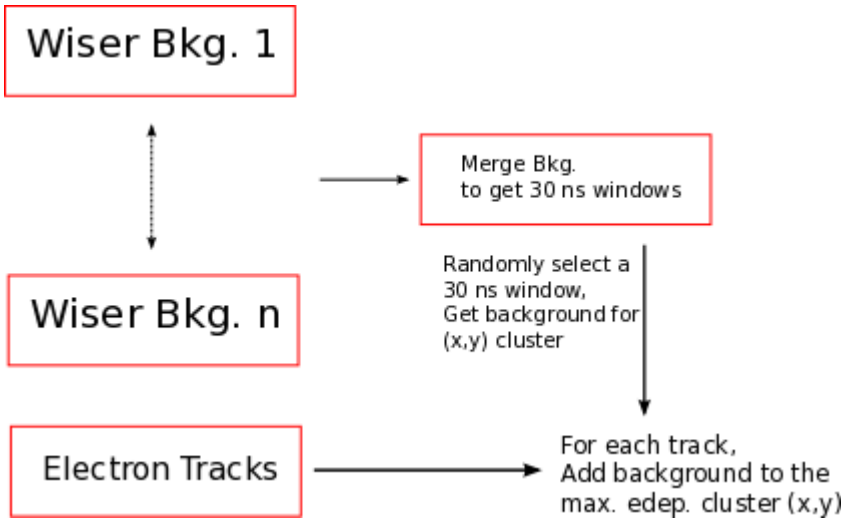
- Jin's estimation was based on ecal (ps+sh) calibrated energy deposition



Energy Resolution with Wiser Background

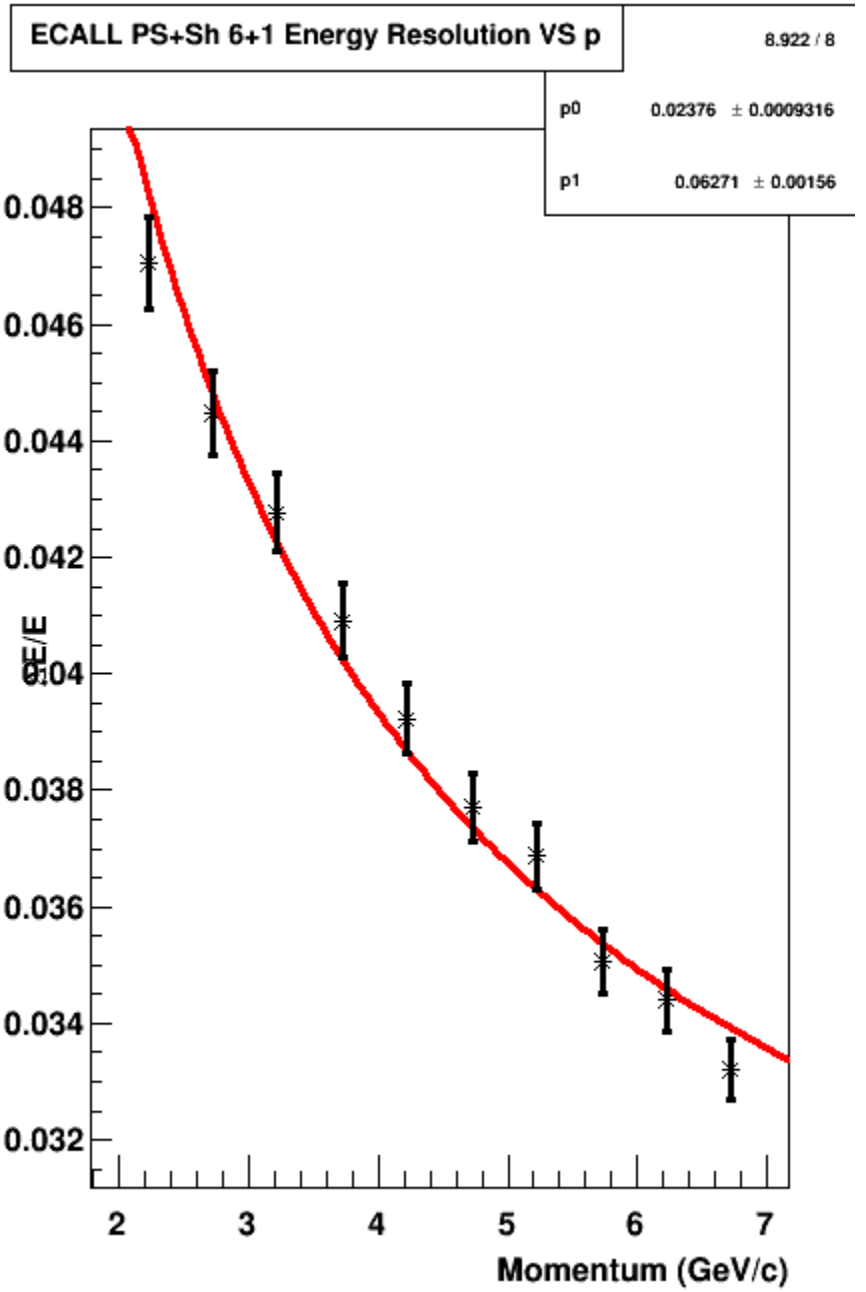
How Backgrounds are Added?

- Generate Wiser backgrounds using uniform Wiser generators
- Based on the rate , merge background in time space assuming Poisson distr.



ECAL Energy Resolution with Wiser Bkg.

From 6+1 Clusters		
Pf (GeV)	Res (%)	Error (%)
2.23	0.047	0.00079
2.73	0.044	0.00072
3.23	0.043	0.00068
3.73	0.041	0.00064
4.23	0.039	0.00061
4.73	0.038	0.00058
5.23	0.037	0.00057
5.73	0.035	0.00054
6.23	0.034	0.00053
6.73	0.033	0.00051



Summary

- Need to a better approximation for PS energy calibration
- Next : Proper efficiency study is on-going

From Previous Analysis

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

e^-

e^-

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

π^-

π^-

e^- Efficiency with PS MIP Cut

π^- Efficiency with PS MIP Cut

From preCDR

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