Simulating the tail catcher on a full detector model

- Outline:
  - New geometry model including a tail catcher
  - Details on calibration
  - Effects of the tail catcher on energy resolutions

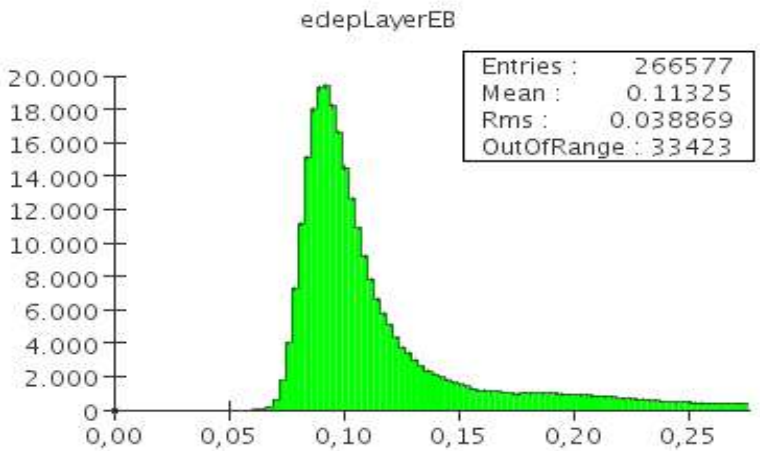
Justifying the Tail Catcher

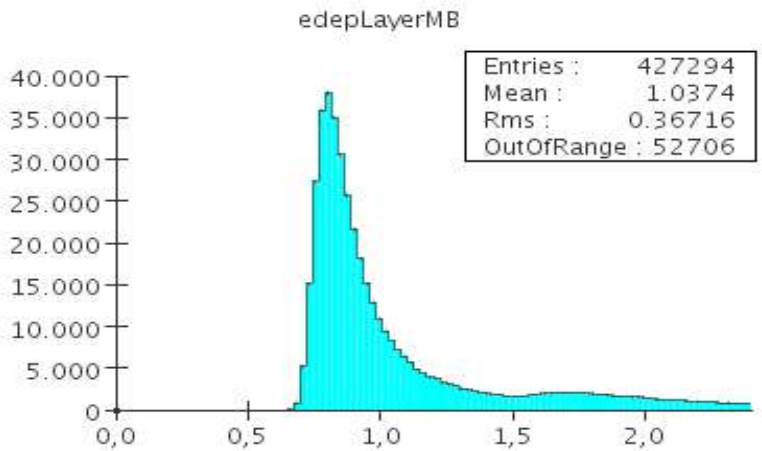
- Suggested by Sasha+Vishnu
- Look at hadronic shower containment in HCal, how much energy survives coil and reaches first layers of Muon System
- Effects on energy resolution of single-particles and single-jets
- Plan of action:
  - Look at single-jets from physics events: "single-jet events" event filtering: filter out everything but a single-jet from real events
  - Detector simulation: replace muon system with a fine tail catcher

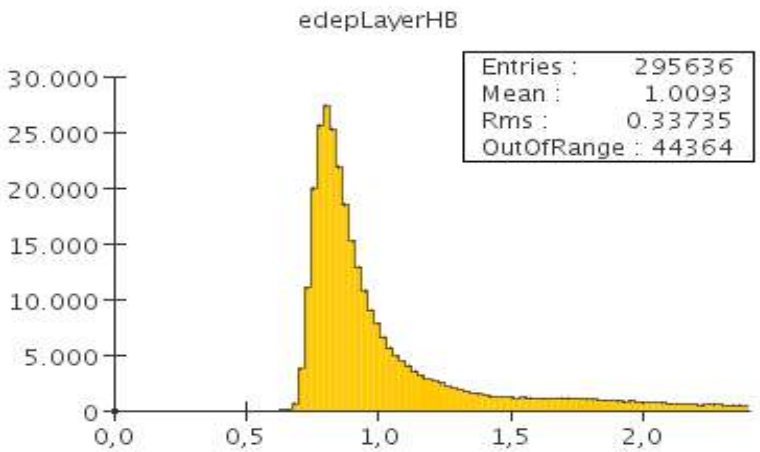
Simulating the tail catcher on a full detetor model

- New detector model: sidaug05_tcmt
  - sidaug05: projective SiW ECal, SS/RPC HCal and muon system.
    Muon layers are 5cm Fe + 0.64cm RPC + 0.86cm air
  - sidaug05_tcmt: non-projective 0.5x0.5(cm^2) Ecal, 1x1 SS/Scint Hcal and 3x3 SS/Scint TCMT
    tail catcher layers are 2cm SS + 0.5cm scint + 0.3cm air
  - Several single-particle samples simulated
    muons, photons, charged pions, neutrons, Klongs. Under way: b- and c-jets.

Details on calibration procedure







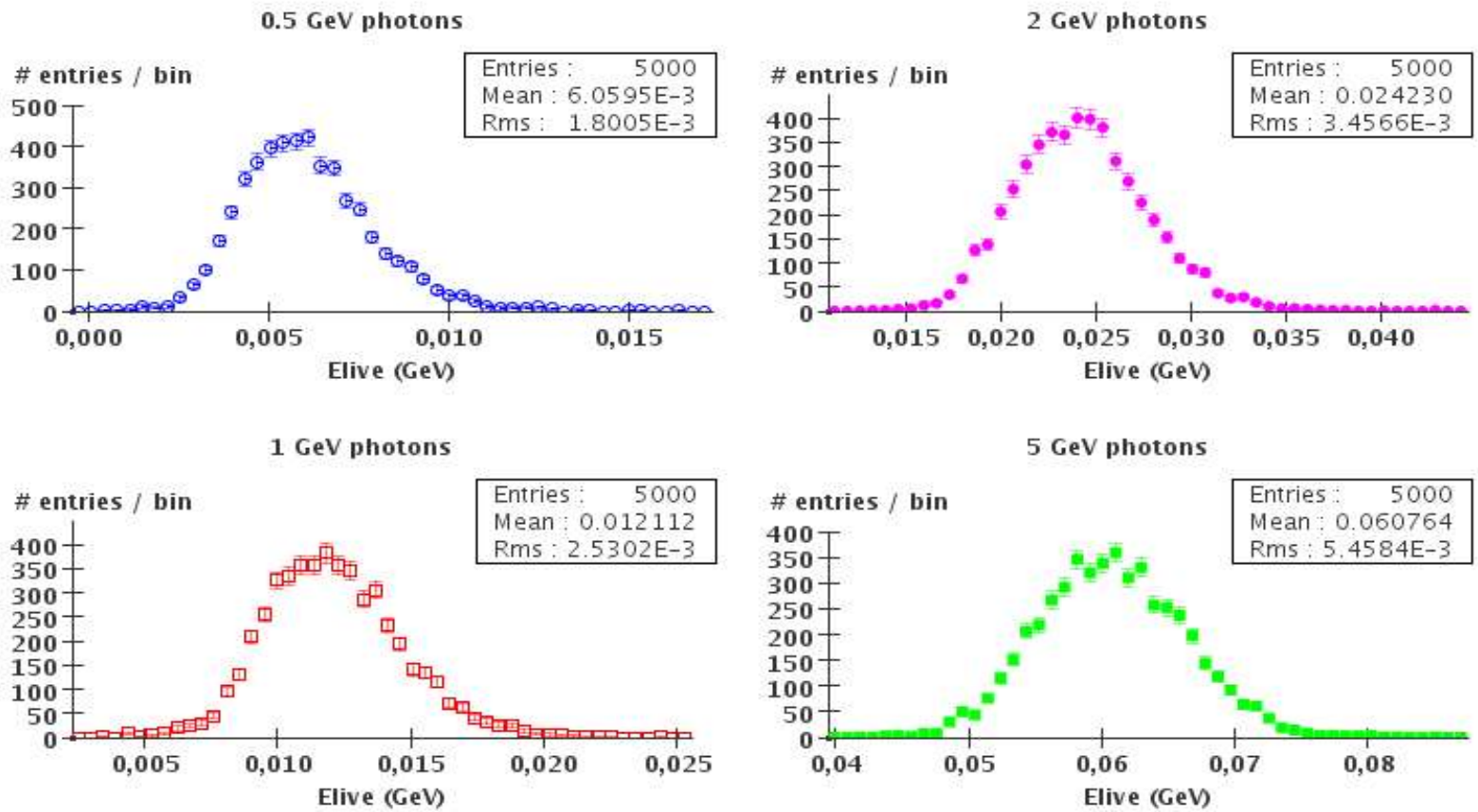
For 100 GeV muons on sidaug05_tcmt, mip peaks are:

Ecal: 0.092 MeV

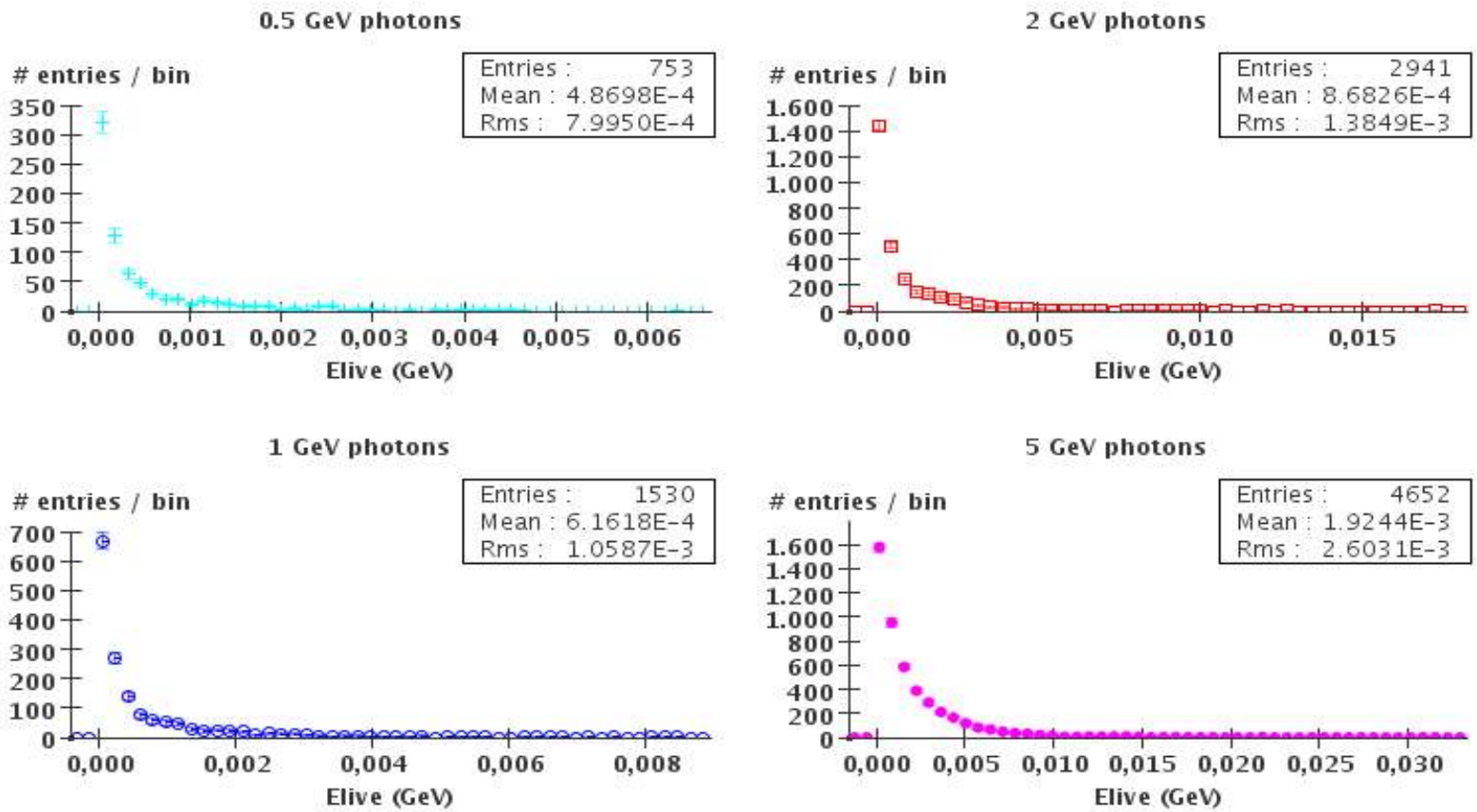
Hcal, TCMT: 0.80 MeV

Energy thresholds at ¼ MIP

Photons: live energy in ECal



Photons: live energy in HCal



If gaussian fits don't work, use mean and RMS from histogram

Ecal calibration

SamplingFractionsUsingGammaOnly - OpenOffice.org Calc

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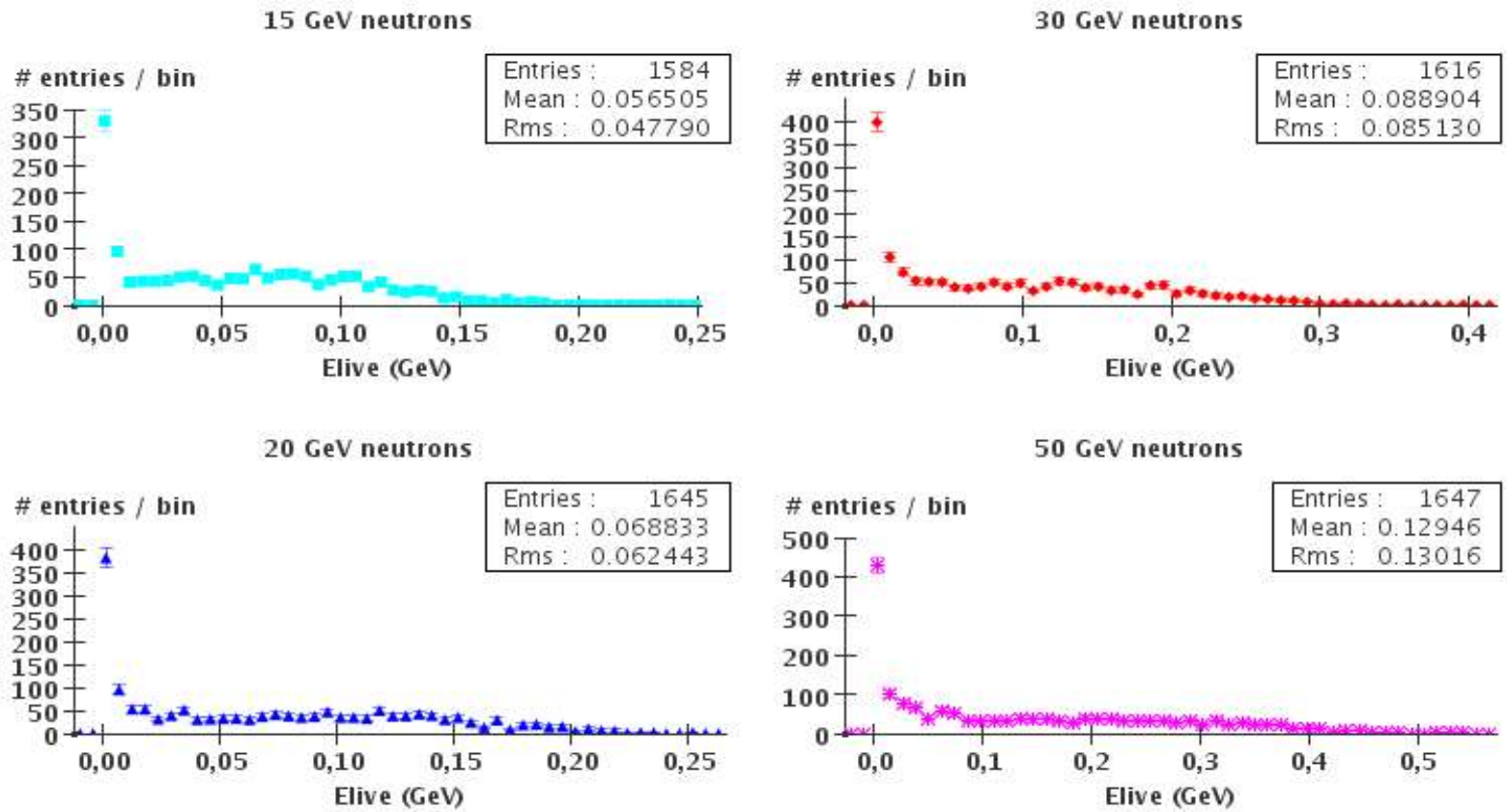
Luxi Sans 10

C16 =(G12*D12-F12*H12)/(E12*D12-H12*H12)

	A	B	C	D	E	F	G	H
1								
2	Yi	Ei	Hi	Ei*Ei	Hi*Hi	Ei*Yi	Hi*Yi	Ei*Hi
3	0.5	0,006060	0.00048698	0,000037	0,0000000	0,000000	0,000000	0,000000
4	1	0,012112	0,000616	0,000147	0,0000004	0,012112	0,000616	0,000007
5	2	0,024230	0,000868	0,000587	0,0000008	0,048460	0,001737	0,000021
6	5	0,060764	0,001924	0,003692	0,0000037	0,303820	0,009622	0,000117
7	10	0,121280	0,004677	0,014709	0,0000219	1,212800	0,046765	0,000567
8	20	0,241710	0,012578	0,058424	0,0001582	4,834200	0,251560	0,003040
9	50	0,600590	0,044306	0,360708	0,0019630	30,029500	2,215300	0,026610
10	100	1,192100	0,116890	1,421102	0,0136633	119,210000	11,689000	0,139345
11								
12		2,258846	0,181859	1,859406	0,015811	155,650892	14,214600	0,169707
13								
14								
15		Alfa=	81,325829		1/alpha=	0,012296		
16		Beta=	26,122351		1/beta=	0,038281		
17		Alfa=	81,325829					
18								

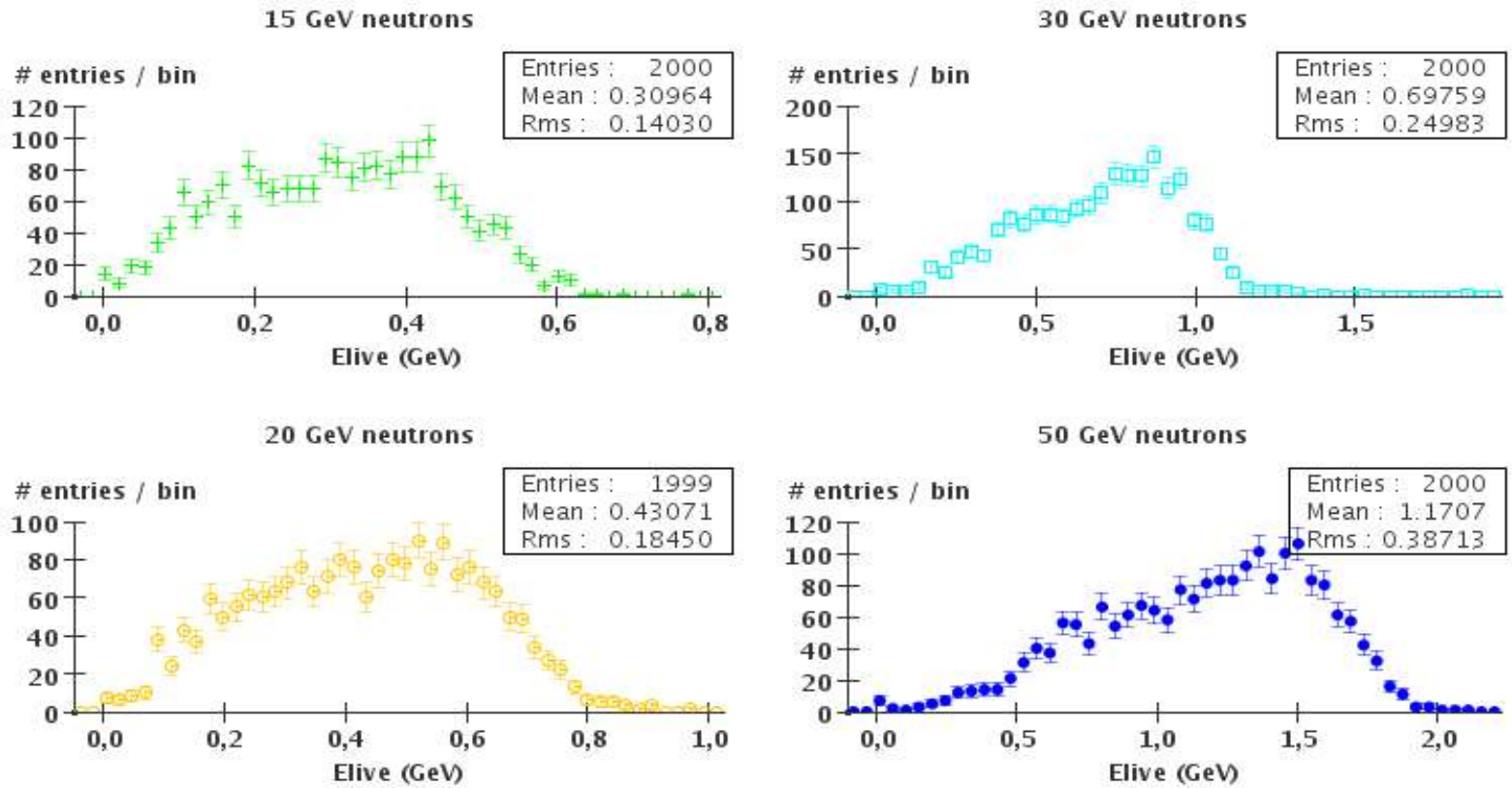
Ecal sampling fraction

Neutrons: live energy in ECal



Should require no interaction in Ecal ?

Neutrons: live energy in HCal



Should require no interaction in Ecal ?

HCal calibration (neutrons)

SamplingFractionsUsingGammaOnly - OpenOffice.org Calc

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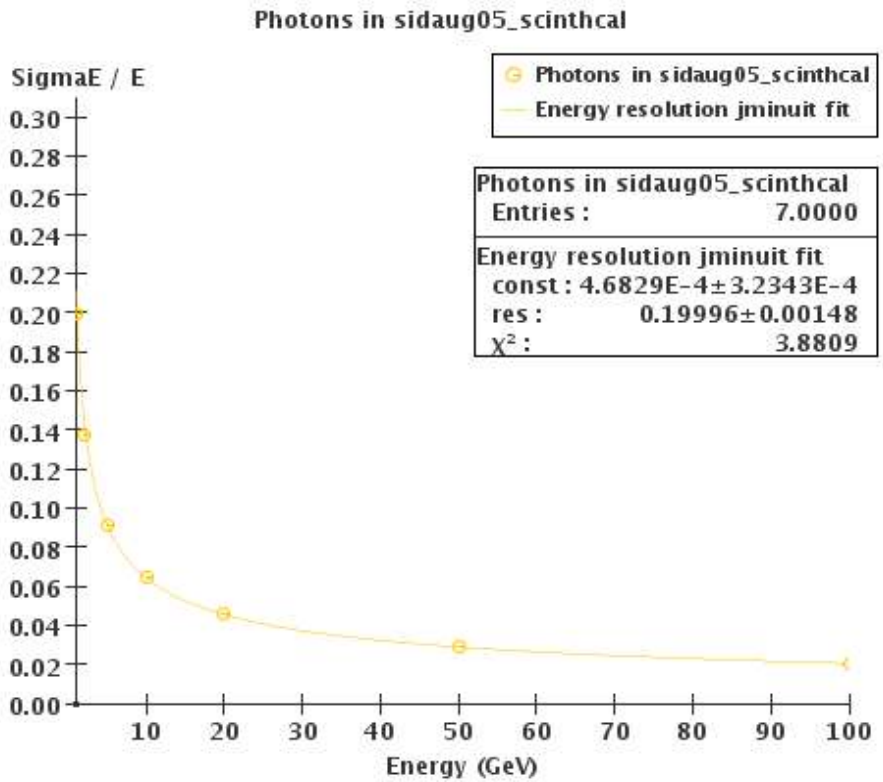
Luxi Sans 10

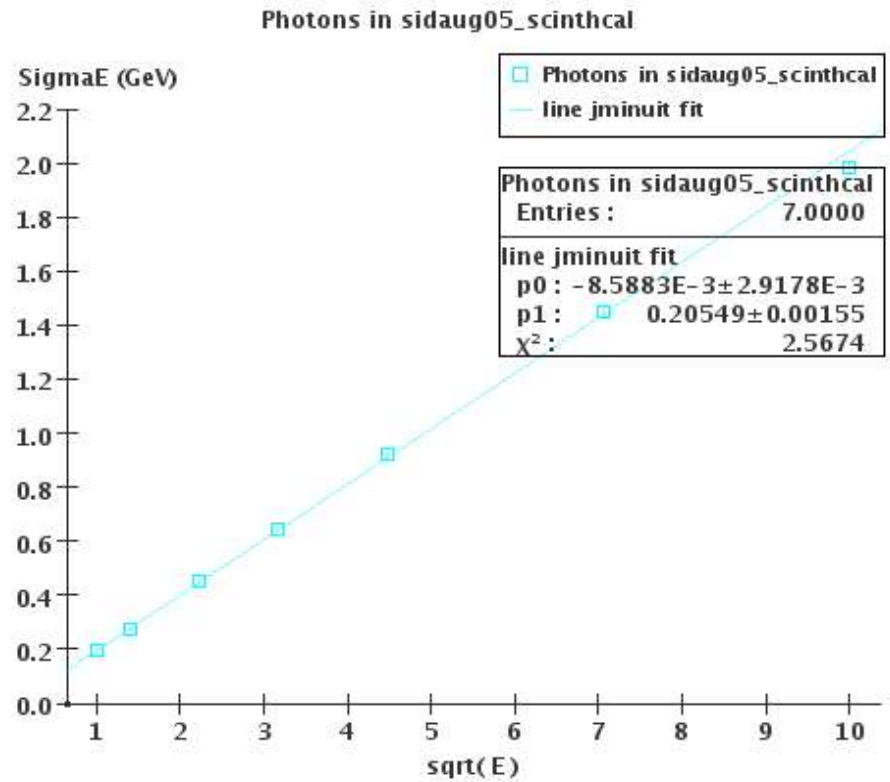
C16 =(G12-C15*H12)/E12

	A	B	C	D	E	F	G	H
1								
2	Yi	Ei	Hi	Ei*Ei	Hi*Hi	Ei*Yi	Hi*Yi	Ei*Hi
3	2	0,018107	0,027844	0,000000	0,0007753	0,036214	0,055688	0,000504
4	3	0,022325	0,044853	0,000328	0,0020118	0,066975	0,134559	0,001001
5	5	0,030277	0,084753	0,000498	0,0071831	0,151385	0,423765	0,002566
6	10	0,042803	0,192880	0,000917	0,0372027	0,428030	1,928800	0,008256
7	15	0,056505	0,309640	0,001832	0,0958769	0,847575	4,644600	0,017496
8	20	0,068833	0,430710	0,003193	0,1855111	1,376660	8,614200	0,029647
9	30	0,088904	0,697590	0,000917	0,4866318	2,667120	20,927700	0,062019
10	50	0,129460	1,170700	0,016760	1,3705385	6,473000	58,535000	0,151559
11								
12		0,457214	2,958970	0,024444	2,185731	12,046959	95,264312	0,273048
13								
14								
15		Alfa=	81,325829	(fixed!)	1/alpha=	0,012296		
16		Beta=	33,425177		1/beta=	0,029918		
17								
18								

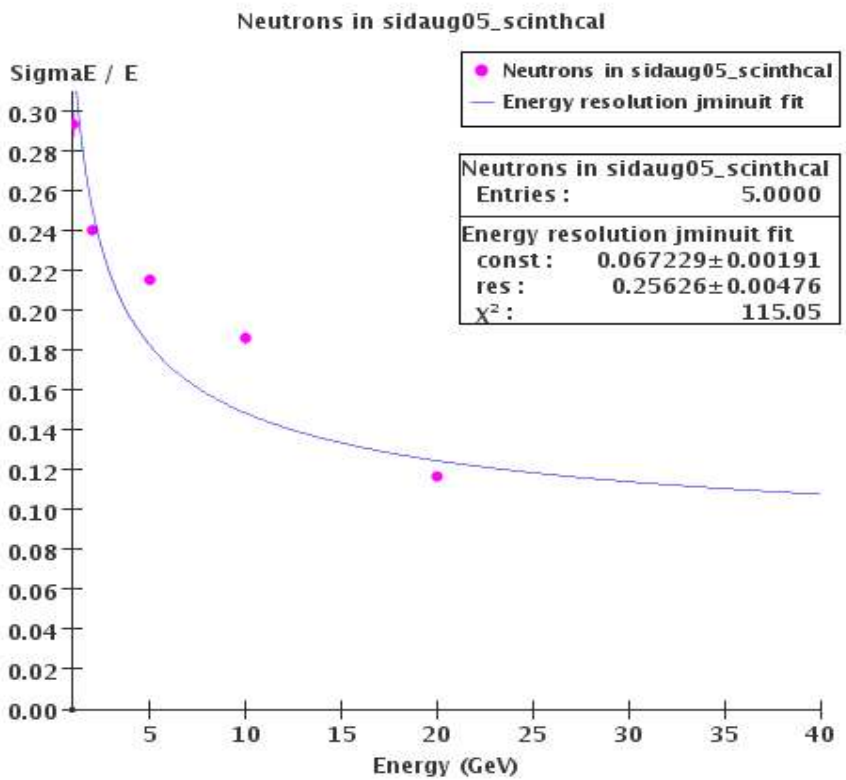
HCal sampling fraction

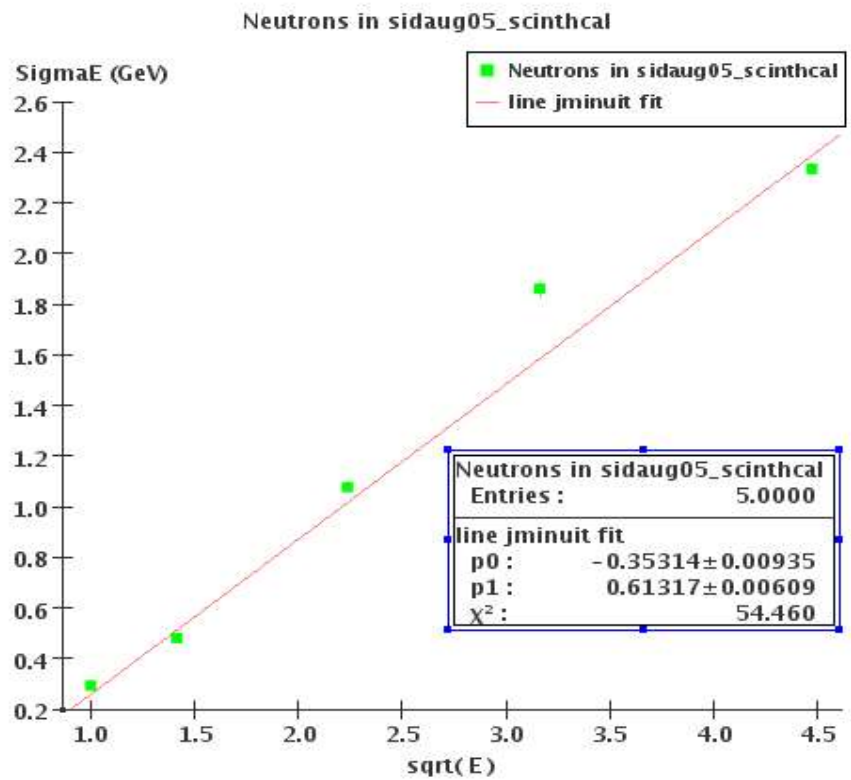
Photon resolution (ECal)



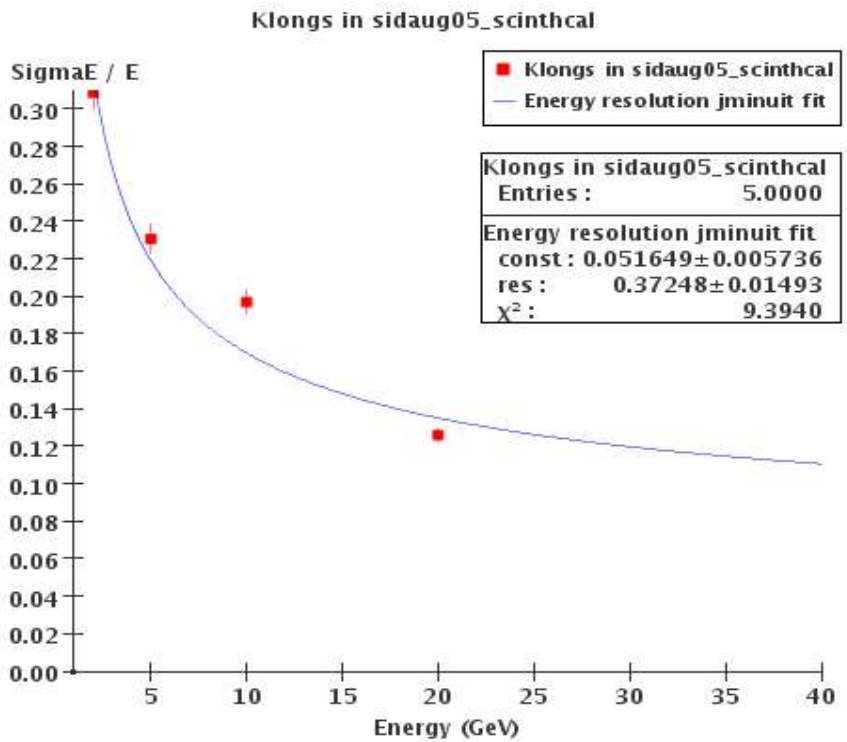


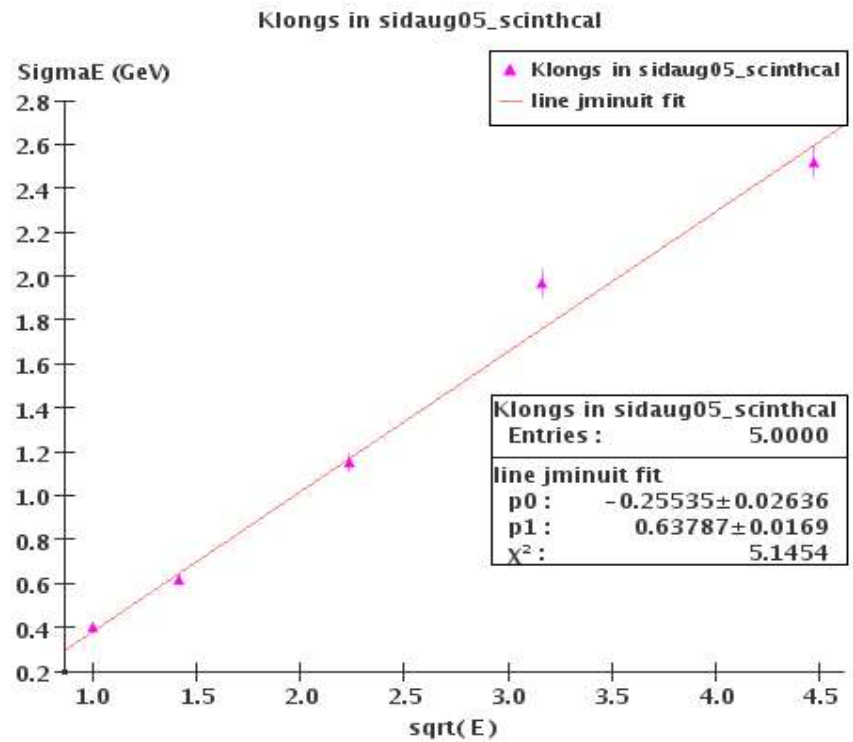
Neutrons (Hcal resolution)



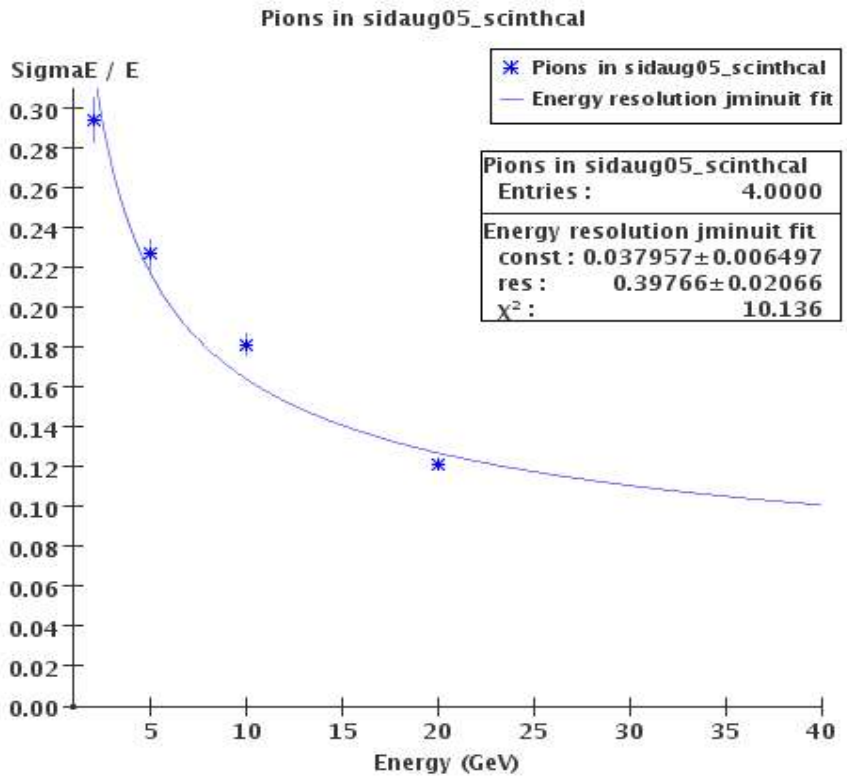


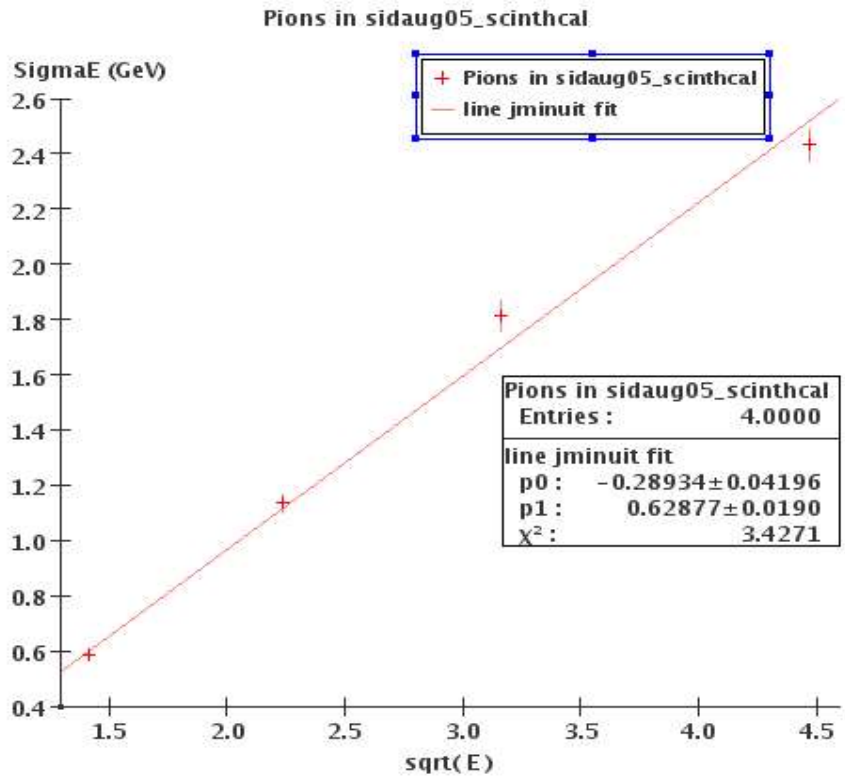
Klongs (Hcal resolution)





Pions


Pions in sidaug05_scinthcal
SigmaE / E
Pions in sidaug05_scinthcal
Energy resolution jminuit fit
Pions in sidaug05_scinthcal
Entries : 4.0000
Energy resolution jminuit fit
const : 0.037957±0.006497
res : 0.39766±0.02066
χ² : 10.136
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
5
10
15
20
25
30
35
40
Energy (GeV)


Pions in sidaug05_scinthcal
SigmaE (GeV)
Pions in sidaug05_scinthcal
line jminuit fit
Pions in sidaug05_scinthcal
Entries : 4.0000
line jminuit fit
p0 : -0.28934±0.04196
p1 : 0.62877±0.0190
χ² : 3.4271
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
1.5
2.0
2.5
3.0
3.5
4.0
4.5
sqrt(E)

Next steps

- Energy resolution plots for single particles in sidaug05_tcmt
- Look at b- or c-quark single-jet events
- Refine/improve calibration procedure?