

BCAL Energy Resolutions

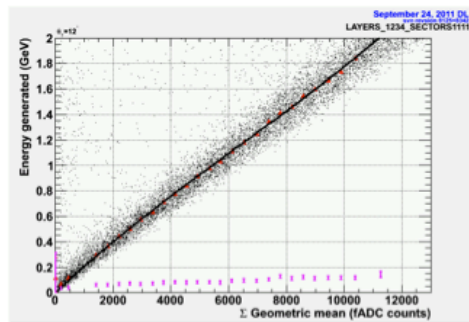
David Lawrence JLab

Oct. 3, 2011

Slide from last week ...

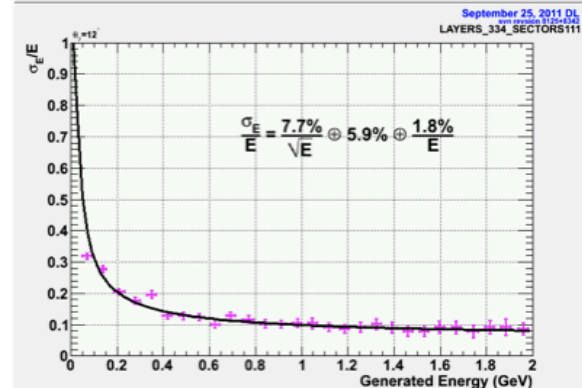
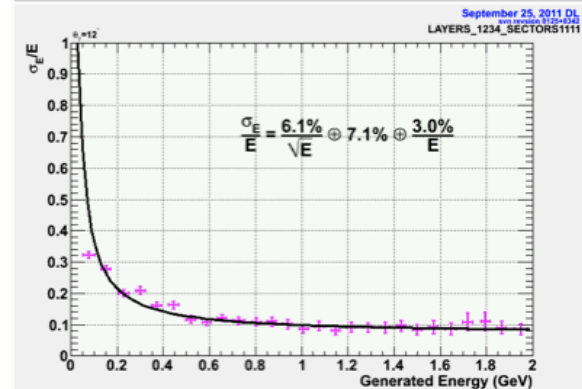
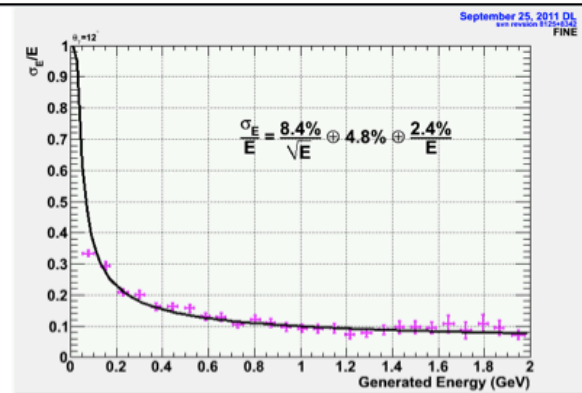
Energy Resolution

Energy resolution calibrated using reconstructed and generated values.

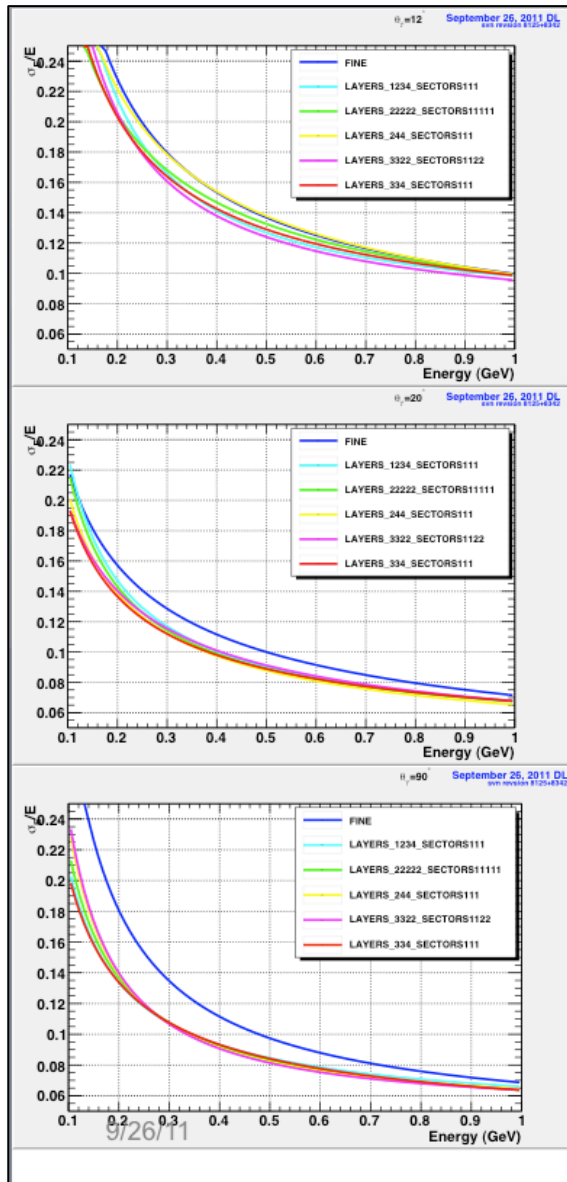


- Calibration done independently for each segmentation scheme and each angle
- Fit to 3rd order polynomial
- Energy resolution largely independent of segmentation scheme
 - Sampling fluctuations and photo-statistics dominate (see 6/17/2011 talk)

9/26/11



Slide from last week ... $\frac{\sigma}{E} = \frac{A}{\sqrt{E}} \oplus B \oplus \frac{C}{E}$



Energy Resolution

$\theta=12^\circ$	A	B	C
FINE	8.4%	4.8%	2.4%
1234	6.1%	7.1%	3.0%
334	7.7%	5.9%	1.8%

$\theta=20^\circ$	A	B	C
FINE	7.0%	1.4%	0.0%
1234	5.4%	3.8%	1.5%
334	5.6%	3.7%	0.8%

$\theta=90^\circ$	A	B	C
FINE	5.1%	3.7%	2.7%
1234	4.7%	4.4%	1.4%
334	5.1%	3.6%	1.2%

Investigating floor term

Turn off most stochastic effects in simulation to investigate origin of large floor terms

Turned off:

- Dark Hits
- Photo-statistics
- Sampling fluctuations
- SiPM Time jitter

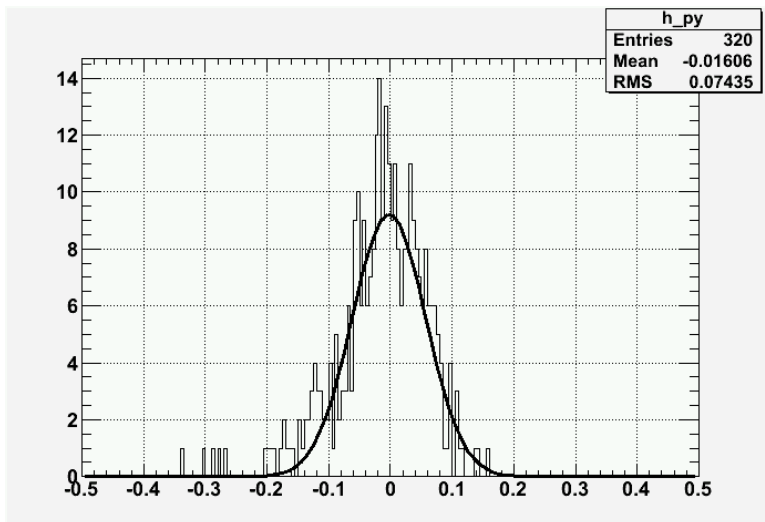
Asymmetric Gaussian:

Same mean and amplitude, different σ 's on left and right sides

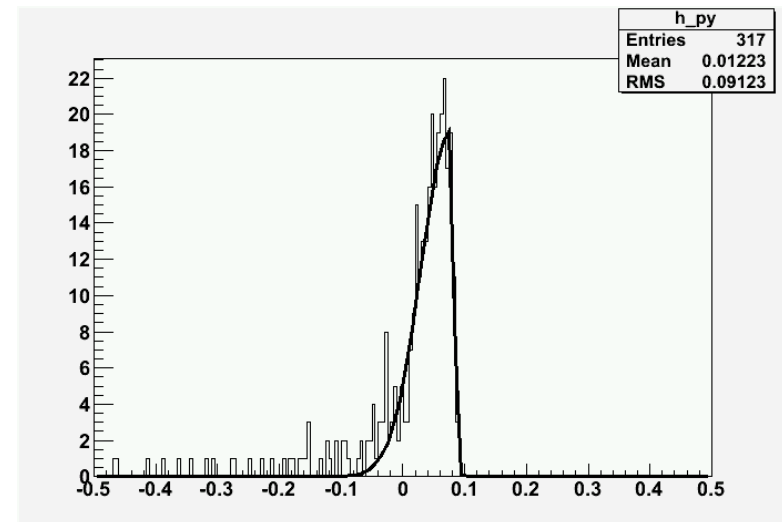
$$\sigma_{tot}^2 = \frac{\sigma_1^3 + \sigma_2^3}{\sigma_1 + \sigma_2}$$

$$\Delta\sigma_{tot} = \frac{3(\sigma_1^2\Delta\sigma_1 + \sigma_2^2\Delta\sigma_2) - \sigma_{tot}^2(\Delta\sigma_1 + \Delta\sigma_2)}{2\sigma_{tot}(\sigma_1 + \sigma_2)}$$

Example of energy residual fit to symmetric Gaussian.



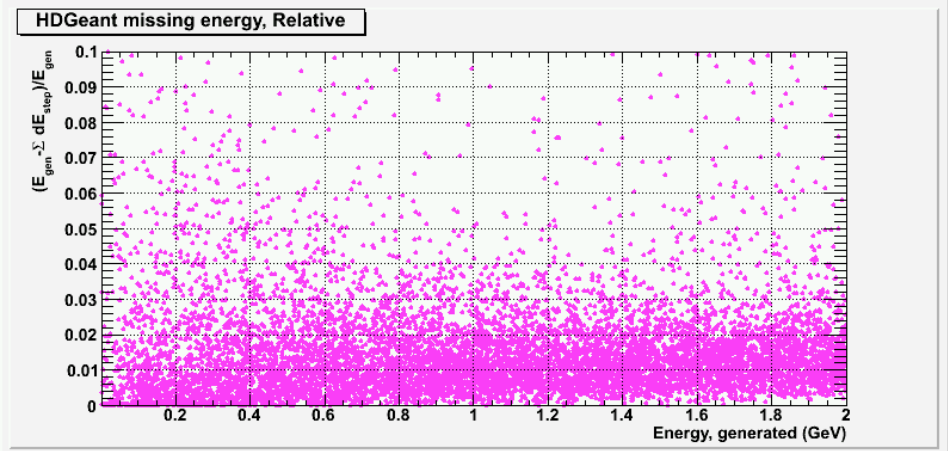
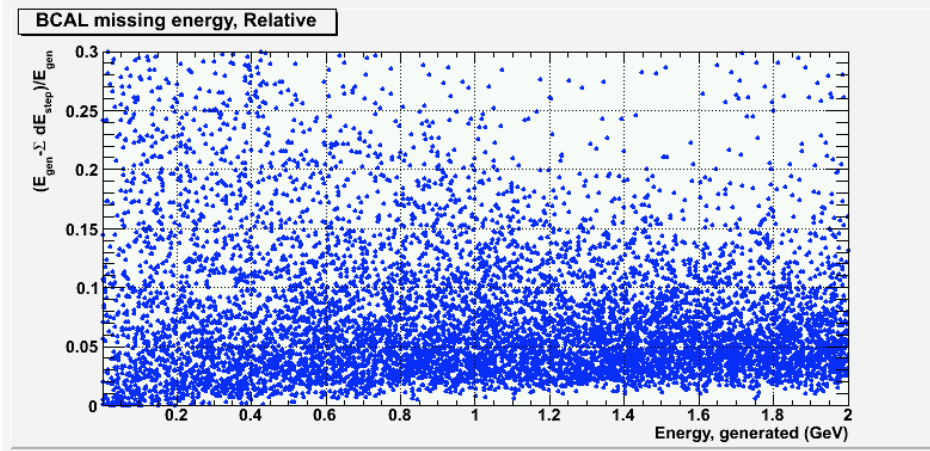
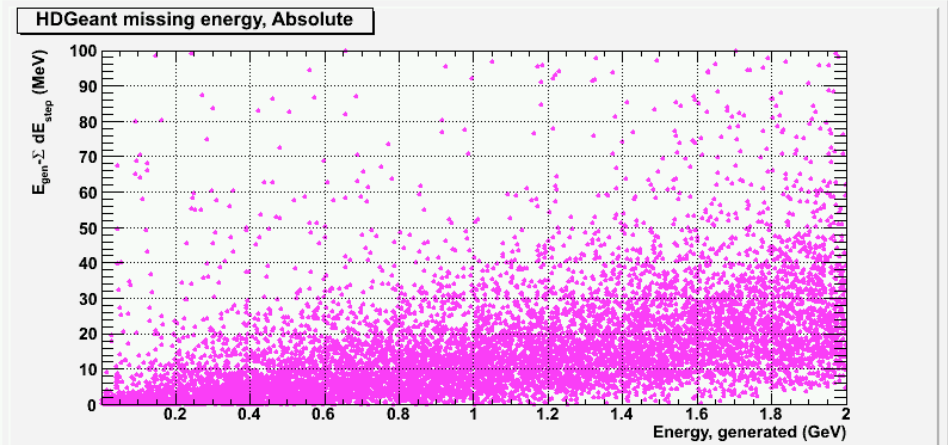
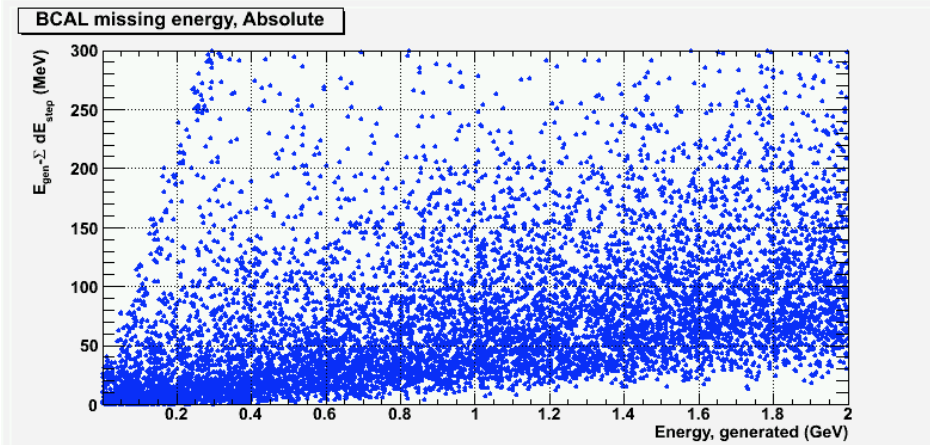
Example of energy residual fit to asymmetric Gaussian. Energy calibration causes shift to values greater than zero.



Missing Energy

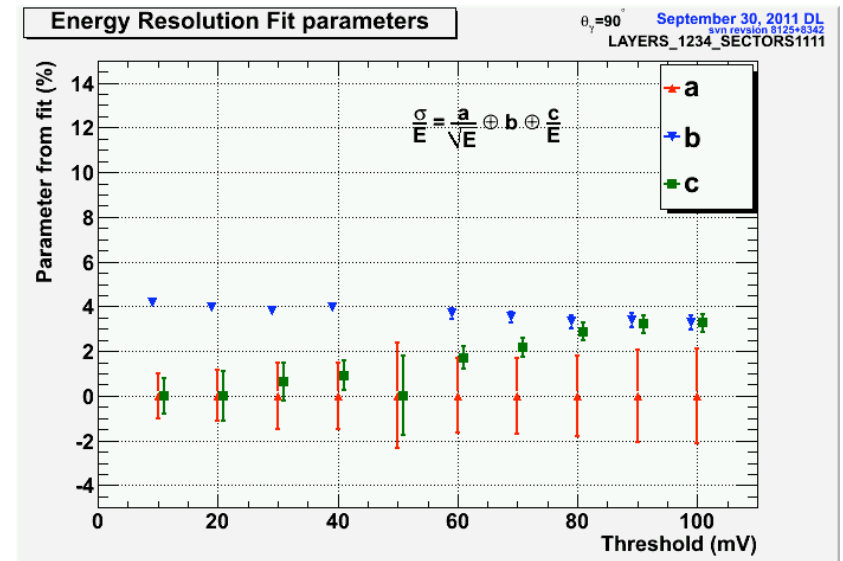
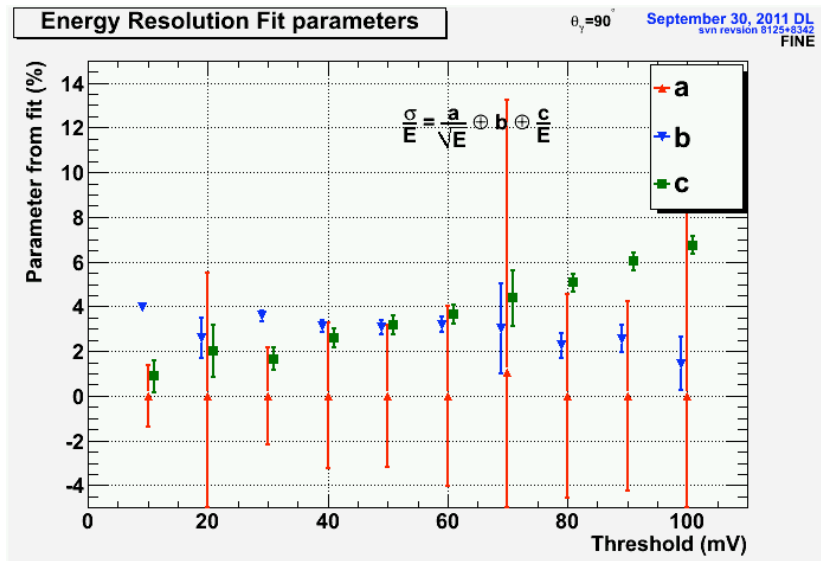
BCAL loses energy due to leakage and/or pre-shower

GEANT loses energy due ???



Total energy missed by BCAL is around 5%, of which, around 1%-1.5% is missed by gustep/DESTEP altogether

Fit parameters vs. threshold



With most processes turned off, parameter dependence on threshold can be observed.

Threshold is connected with $1/E$ term.

Floor term (“b”) of a few percent still exists, largely independent of threshold.

