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Energy Reconstruction at Low Energy: Update

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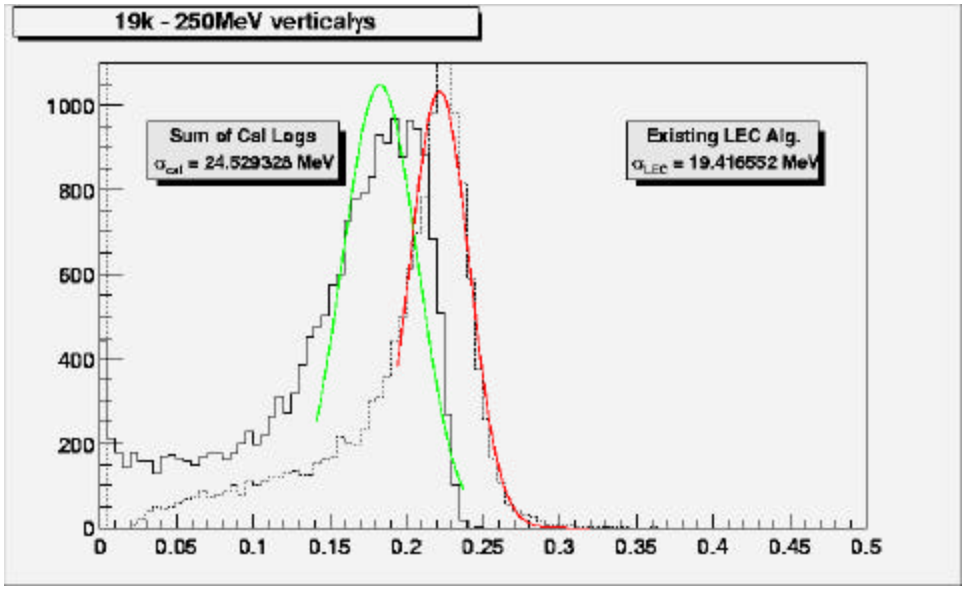
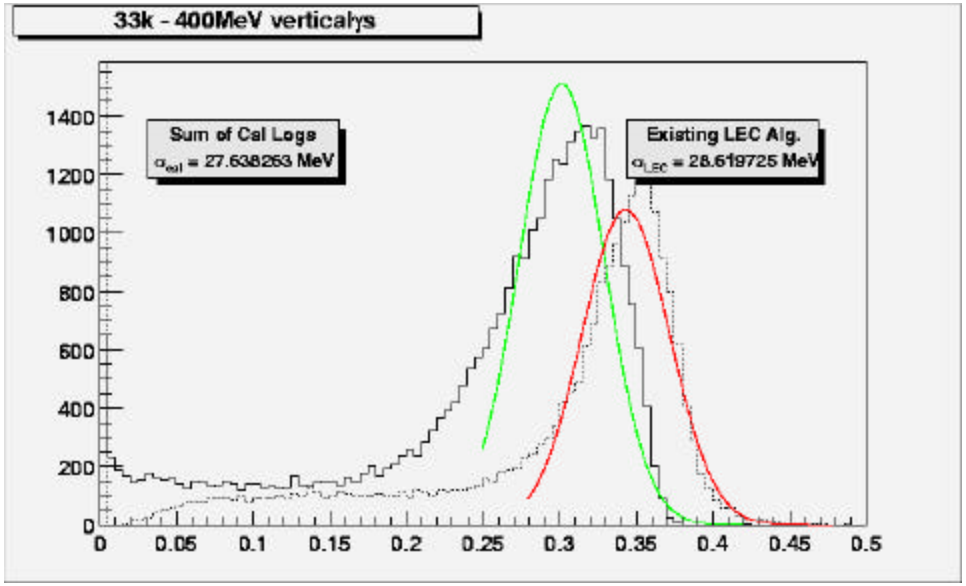
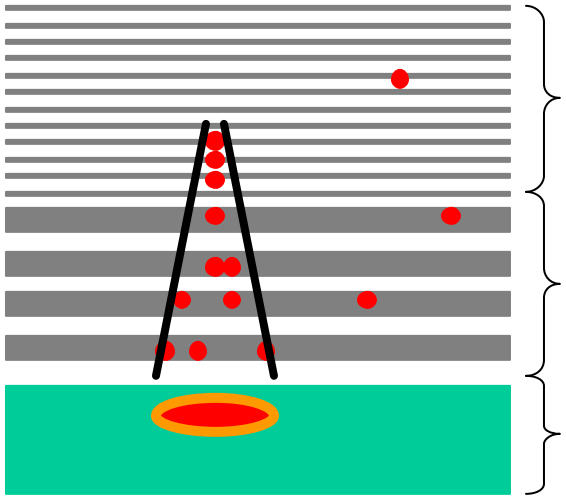




Issue: Up to Eg =~400MeV the loss of information due to the dispersion of energy in the tracker (~1Xo) significantly deteriotes the Calorimeter energy measurement

The method, well established within existing Algorithms is to use the tracker as a sampling calorimeter

Form a cone with a opening angle 3½ times that of the MS-angle around the track and count the number of hits in the silicon through the tracker



Information available:

- **N_{hits} in the upper 12 layers (within cone)**
- **The number of layers below the conversion**
- **N_{hits} in the lower 4 layers (within cone)**
- **The number of layers below the conversion**
- **Energy measured in the Calorimeter**

Task:

To find an improved parameterisation of the energy lost in the tracker from the digitized data available

Method:

Generate many sets of data for a range of energy and angle

Search for an optimal parameterisation of the energy loss in the tracker

Update from previous report:

Unpopular ‘ bias ’ removed

Data sets have been generated over a range of energies to try to average-out the energy dependance of the fitted parameters

Changed to use a likelihood (rather than least-squares)
- removing the tacit assumption of gaussian errors

Detail:

The likelihood is formed

$$L = \prod_{N_{events}} f(D|\Theta)$$

where D is the data set and ? is the parameter set

for the function f, an analytic approximation to a Landau distribution is used

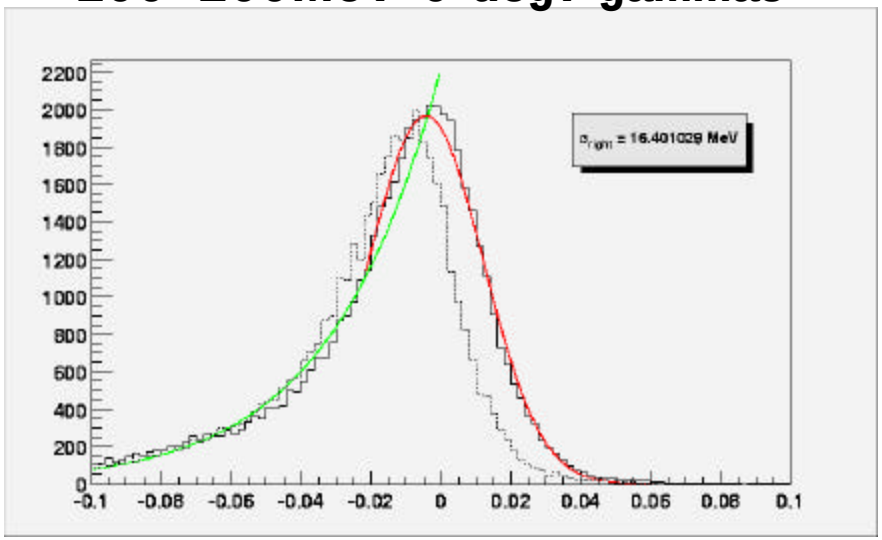
$$f = \sqrt{\frac{e^{(-S-e^{-S})}}{2p}} \qquad S = R(E - \hat{E})$$

$$E = \frac{(a \cdot H_U + b \cdot H_L + g_U \cdot N_U + g_L \cdot N_L)}{\cos(q_{gamma})} + E_{Cal}$$

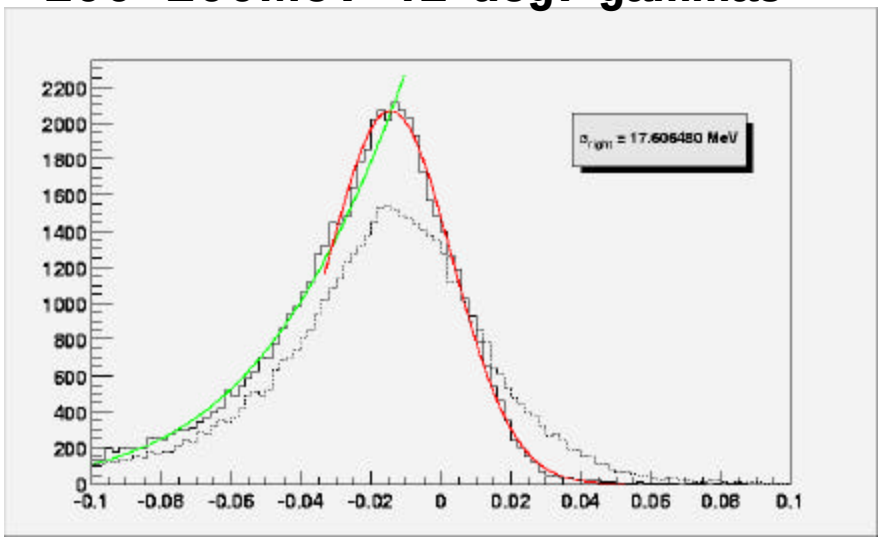
The minimisation has 6 parameters: R,Ê,a,ß,$?_U$,$?_L$.

Result of the minimisation come with mixed success:

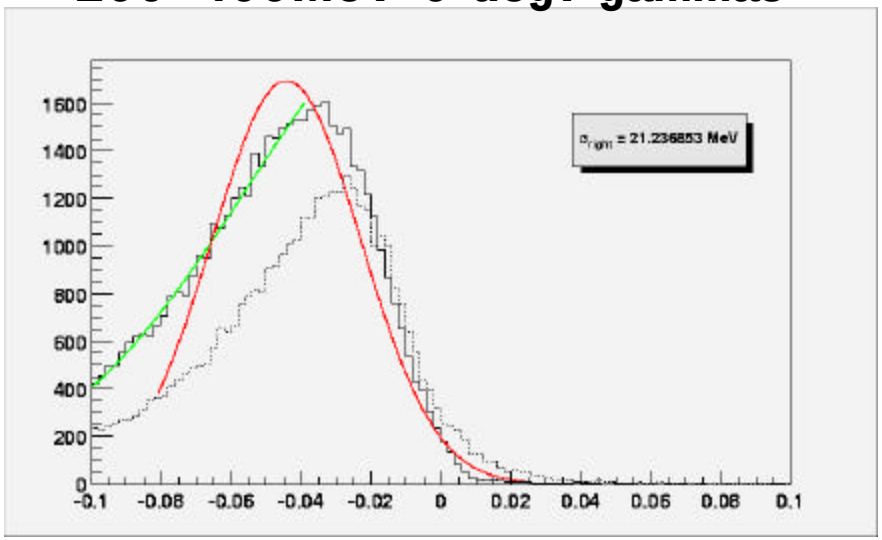
100-200MeV 0 deg. gammas



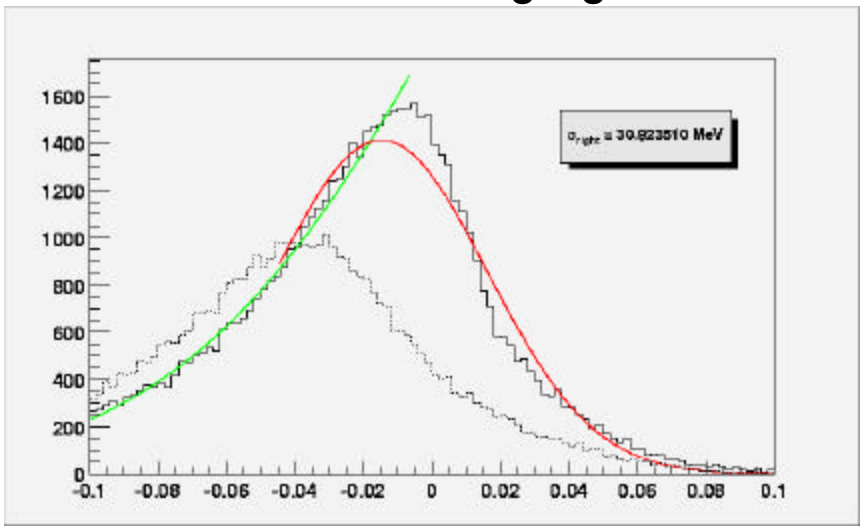
100-200MeV 41 deg. gammas



200-400MeV 0 deg. gammas



200-400MeV 41 deg. gammas



Observations:

Low energy reconstruction couls enjoy a little improvement by having the existing parameterisation (or variant) include a dependence on the gamma incident angle

More improvement must be sought from allowing the paramaterisation to include an energy dependence.

However, attempts to build an iterative energy estimation with the parameters (a,ß,?..) themselves dependent on the current energy measurement is not converging reliably (at the moment)

Next Steps:

The failure of the iteration needs to be undertstood