BCAL Simulation

David Lawrence JLab

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Code Modifications

The following modifications were made in this special area of the repository:

https://halldsvn.jlab.org/repos/trunk/home/davidl/Studies/2011.06.03.bcal_calib

Changes will be merged into main trunk at a later time.

- Changed Al base plate from 1” to 8mm
- Added Poisson sampling to number of photo-electrons generated due to energy deposition in *mcsmear*
- Replaced energy calibration procedure with table lookup rather than parameterized function

Original Calibration Procedure

$$E_{corr} = A \cdot E_{\gamma}^{1+\epsilon} + B$$ From Blake's Thesis eq. 6.7

Here, Ecorr is what is also called Eraw in the code, the uncorrected energy sum taken from adding up energy in all cells which had double ended readout. Leakage and thresholds will make Eraw less than the true value of E.

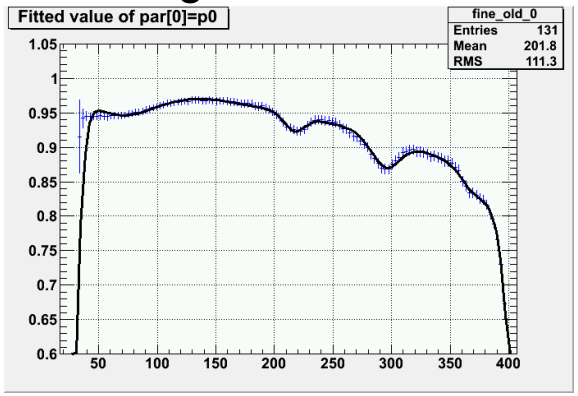
The original calibration procedure fit the ratio of Ecorr to Egen, the generated photon energy.

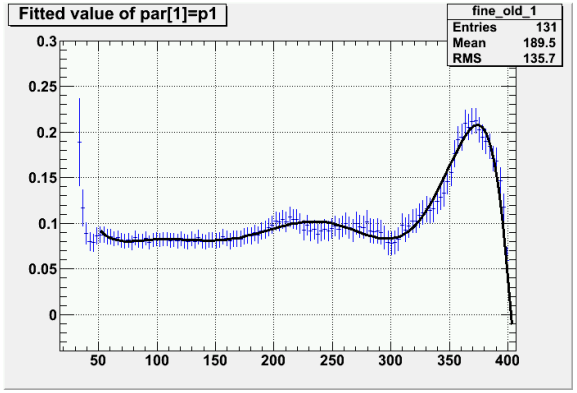
- This was done for slices of z_entry
- Each parameter was fit to a 3rd order poly as a function of z_entry
- z_entry was calculated by projecting to the inner surface of the BCAL assuming the photon came from the center of the target
- The value of B was not included (i.e. fixed at zero)
- No accounting for leakage from the end was made

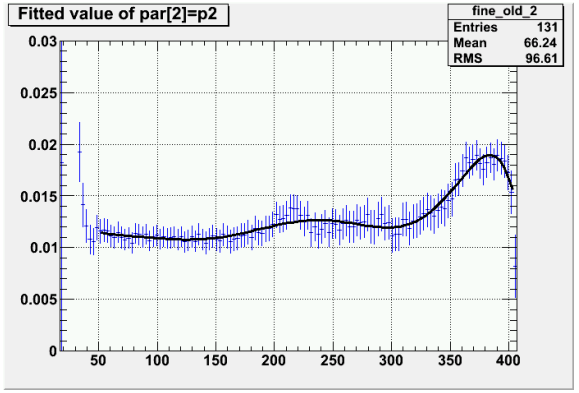
Fit Parameters

KLOE Algorithm

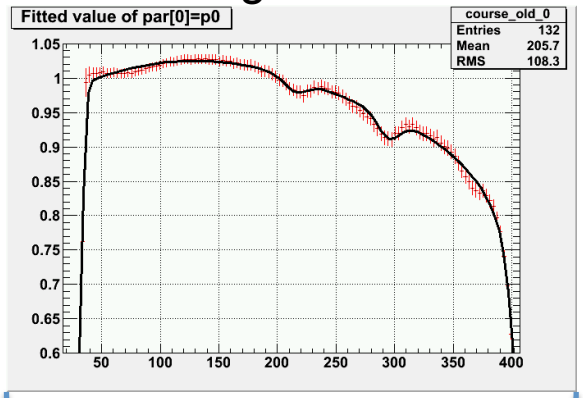
Fine segmentation

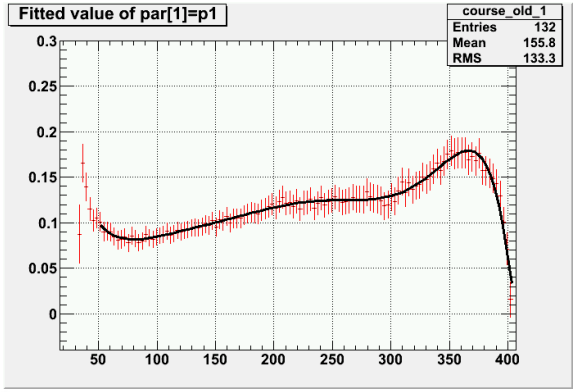


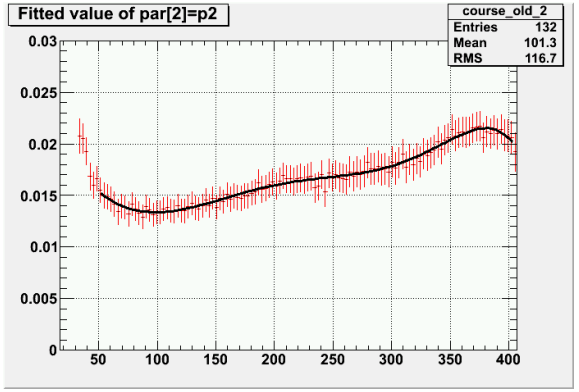




Course segmentation







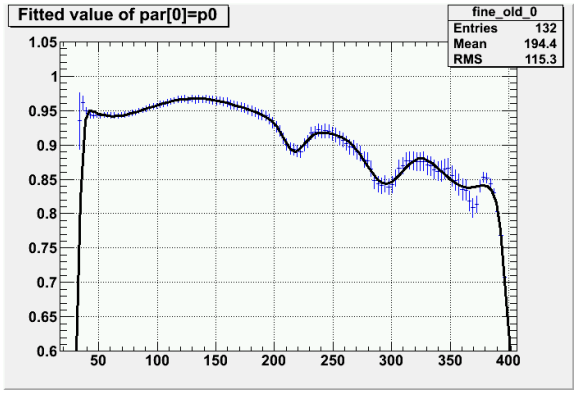
Fit to 21 parameter function with 4 parameters allowed to float

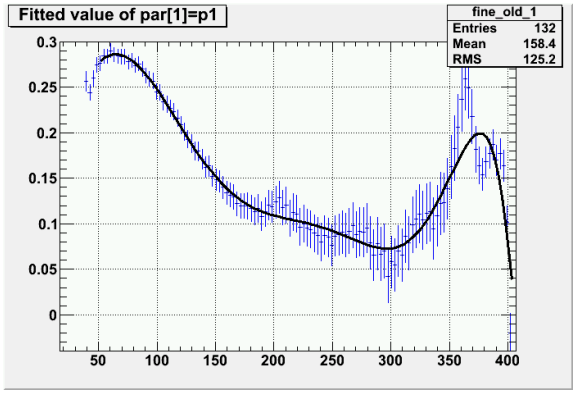
Fit to 8th order polynomial

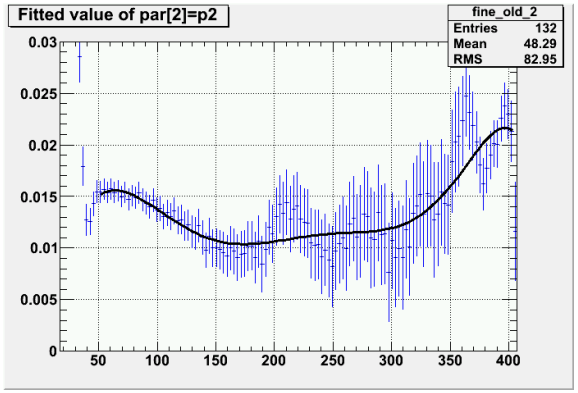
Fit Parameters

Matt's Algorithm (under development)

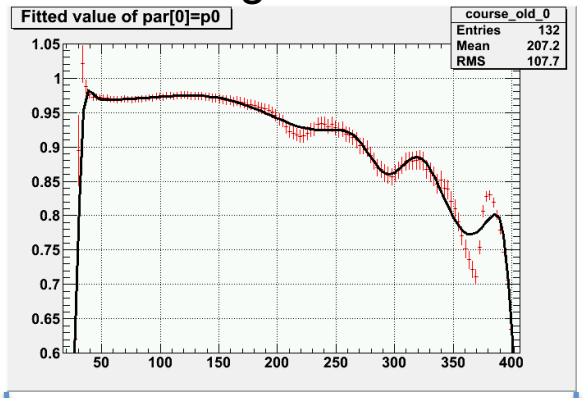
Fine segmentation

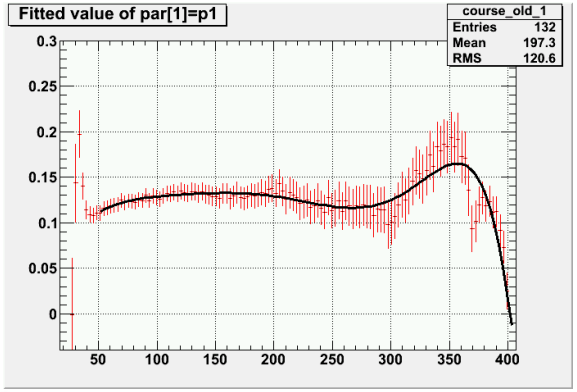


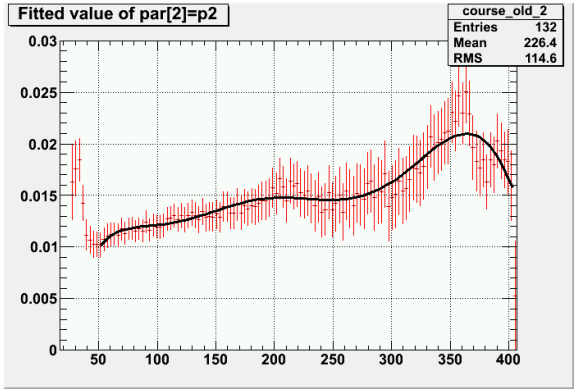




Course segmentation







Fit to 21 parameter function with 4 parameters allowed to float

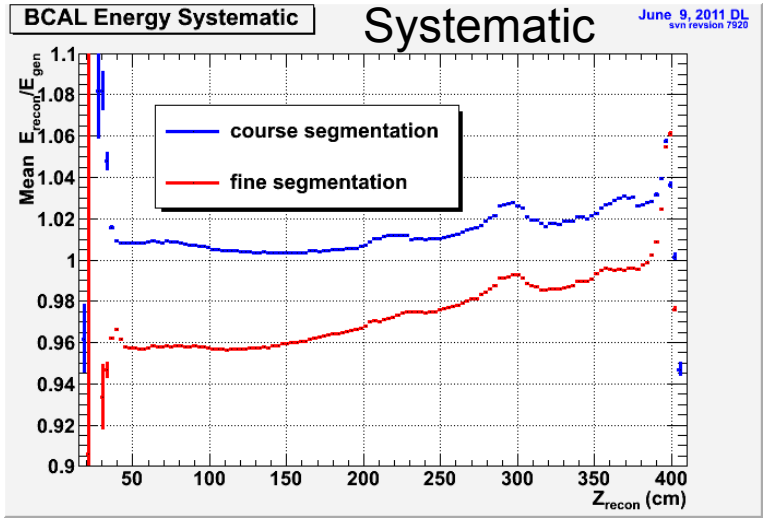
Fit to 8th order polynomial

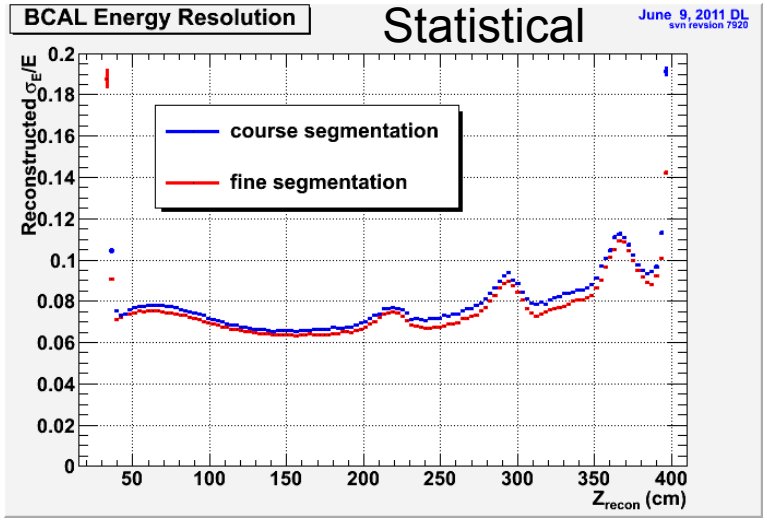
Resolutions ?

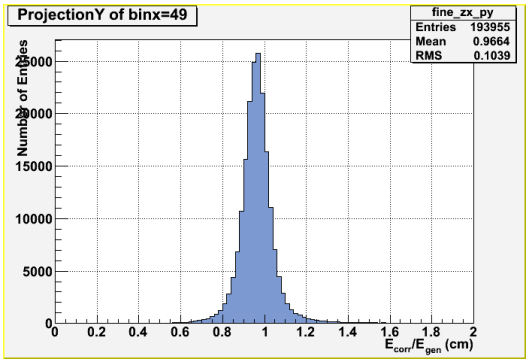
These were obtained by fitting z-slices of the Ecorr/Egen distributions (Ecorr is calibrated, reconstructed energy).

0.0 <= Eγ <= 2.0 GeV

10º <= θ <= 110º *(logarithmic distribution)*



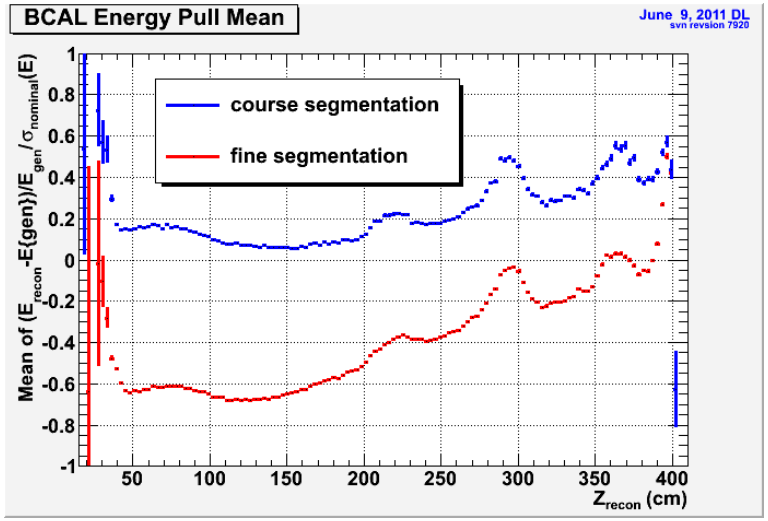


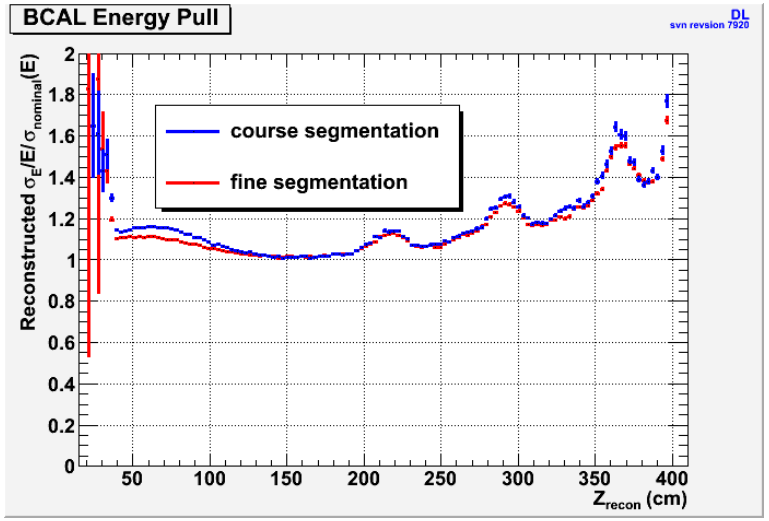


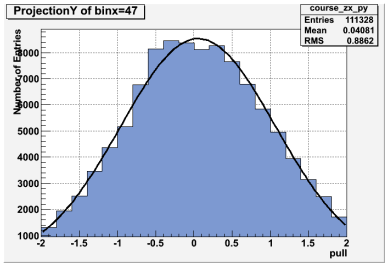
The energy dependence of the width was not included in these plots. The Gaussian fits were done to distributions like the one on the left.

The calibration should have flattened out the systematic better. This needs to be looked into.

Energy Pull







Single bin with Gaussian fit leading to values in above plots

Dividing out each bin by the nominal energy resolution gives pulls indicating (in part) how well the simulated data follows that resolution function

$$\sigma_{resi} = \frac{0.054}{\sqrt{E}} \oplus 0.023$$

$$resi = \frac{E_{corr} - E_{gen}}{E_{gen}}$$