

# BCAL Simulation

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# Code Modifications

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

[https://haldsvn.jlab.org/repos/trunk/home/davidl/Studies/2011.06.03.bcal\\_calib](https://haldsvn.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 photoelectrons generated due to energy deposition in *mcsmeas*
- Replaced energy calibration procedure with table lookup rather than parameterized function

# Original Calibration Procedure

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

Here,  $E_{corr}$  is what is also called  $E_{raw}$  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  $E_{raw}$  less than the true value of  $E$ .

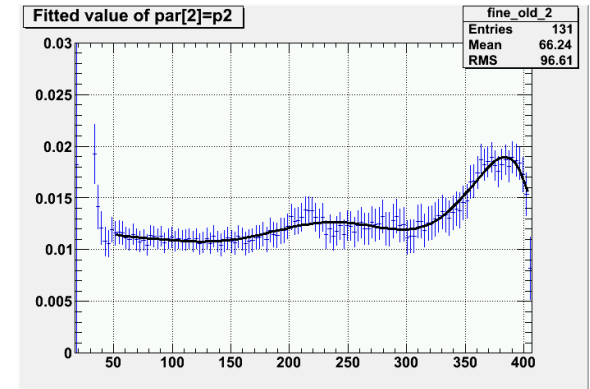
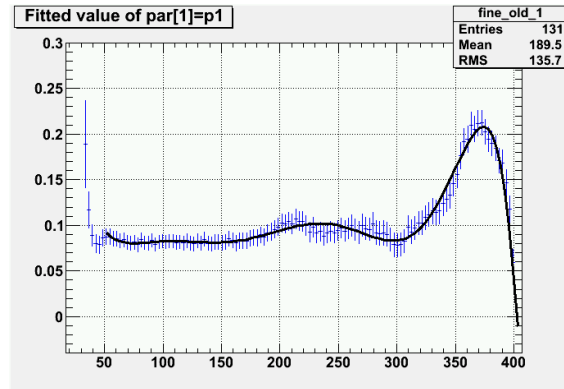
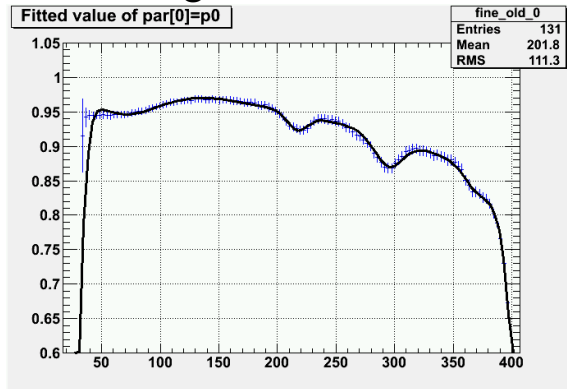
The original calibration procedure fit the ratio of  $E_{corr}$  to  $E_{gen}$ , the generated photon energy.

- This was done for slices of  $z_{entry}$
- Each parameter was fit to a 3<sup>rd</sup> 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

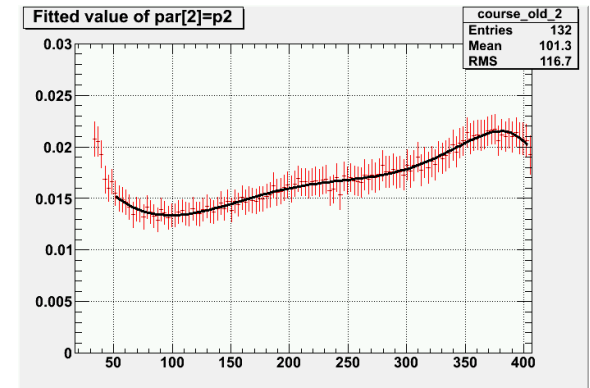
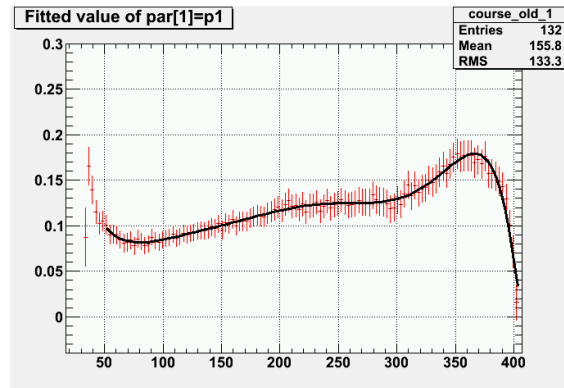
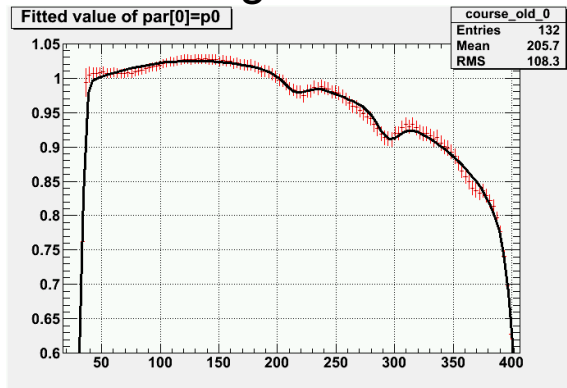
# Fit Parameters

## KLOE Algorithm

### Fine segmentation



### Course segmentation



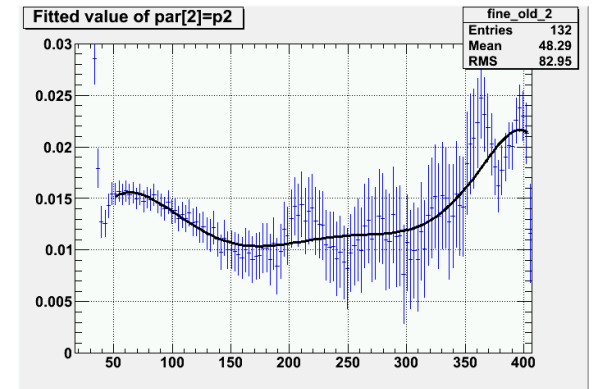
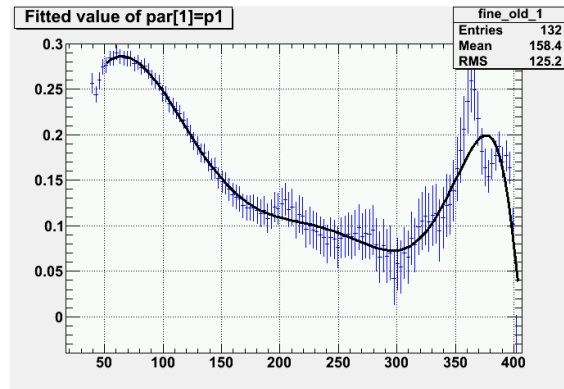
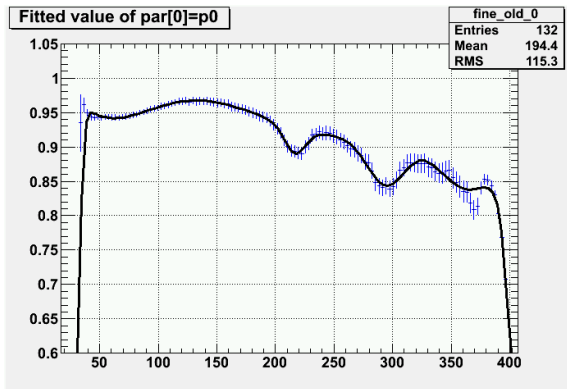
Fit to 21 parameter function with 4 parameters allowed to float

Fit to 8<sup>th</sup> order polynomial

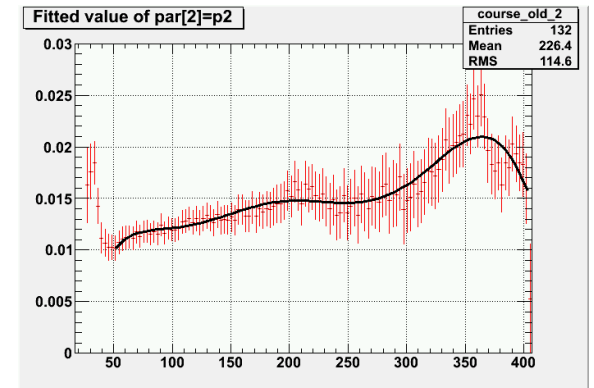
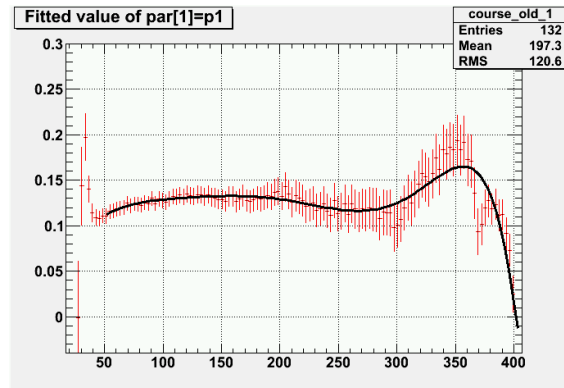
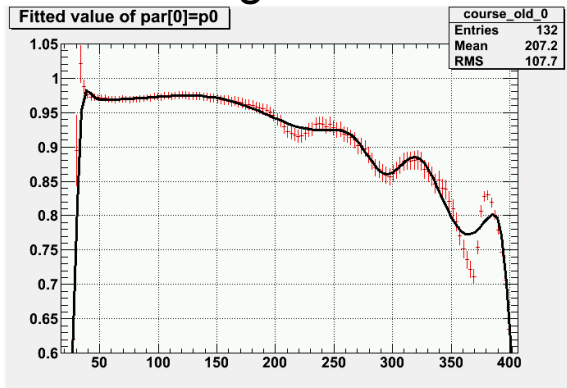
# Fit Parameters

Matt's Algorithm (under development)

## Fine segmentation



## Course segmentation



Fit to 21 parameter function with 4 parameters allowed to float

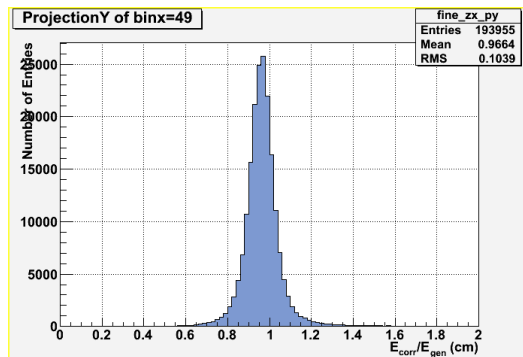
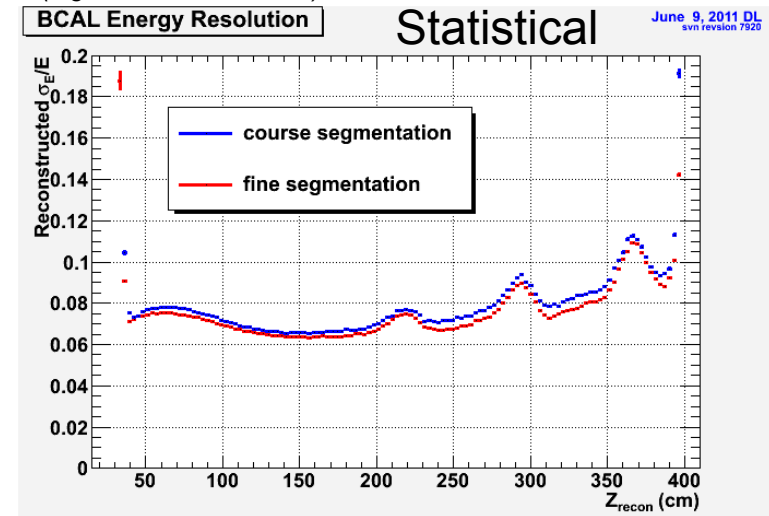
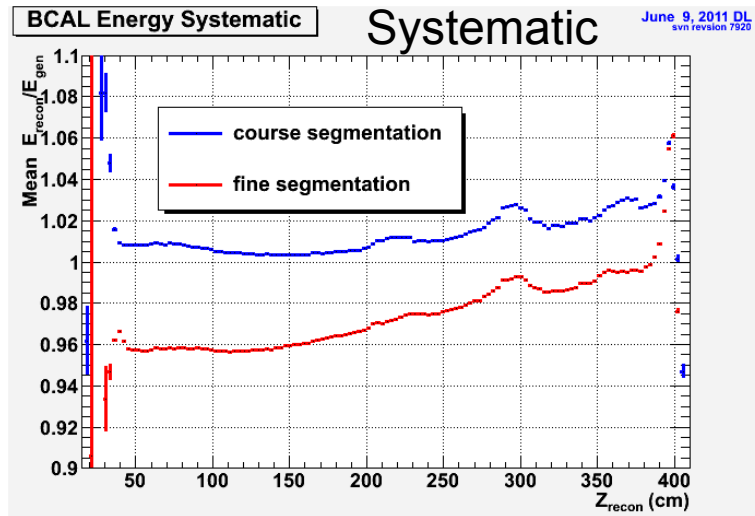
Fit to 8<sup>th</sup> order polynomial

# Resolutions ?

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

$$0.0 \leq E_\gamma \leq 2.0 \text{ GeV}$$

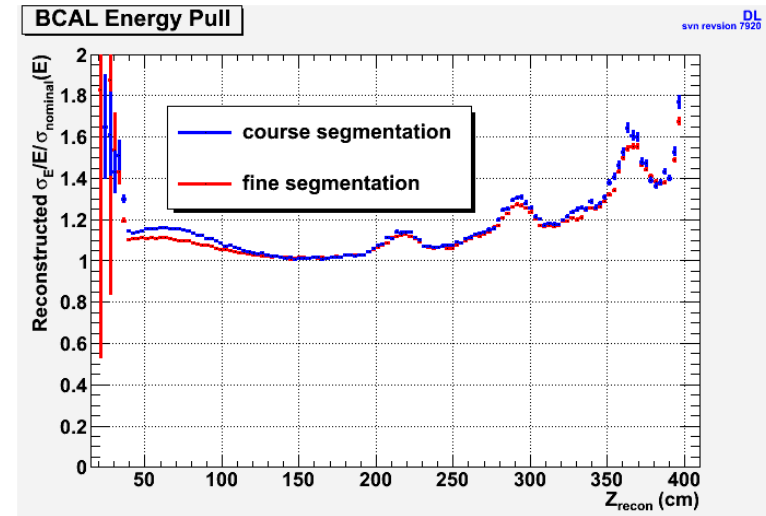
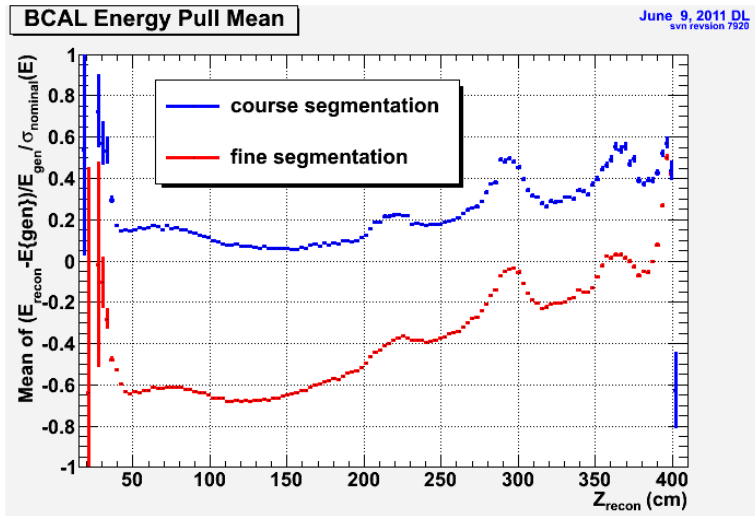
$$10^\circ \leq \theta \leq 110^\circ \text{ (logarithmic distribution)}$$



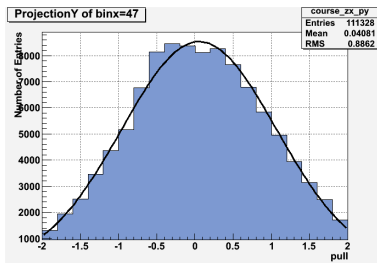
The energy dependence of the width was not included in these plots. The Gaussian fits were done to distributions like the one on the left.

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

# Energy Pull



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



Single bin with Gaussian fit leading to values in above plots

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

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