# BCAL: Matching M.C. Resolution to 2006 Beam Test

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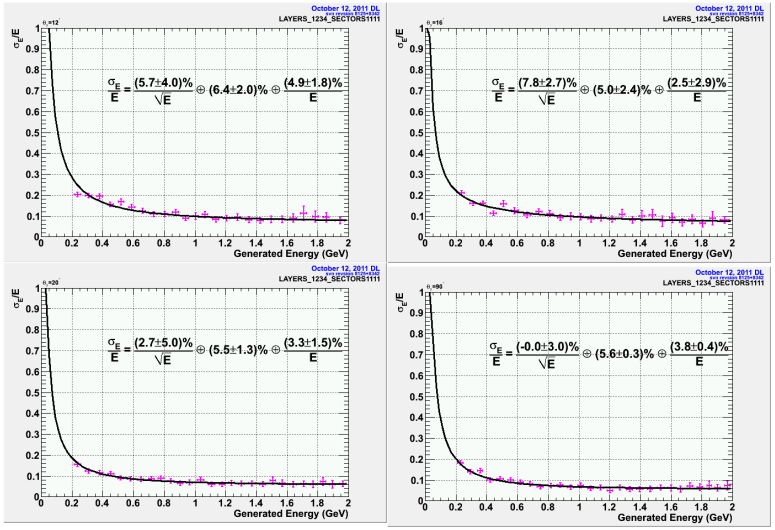
# Motivation

*Controversial plots shown at previous meeting indicating 5%-6% floor terms in energy resolution*




- Plots of BCAL energy resolution shown last week raised flags due to inconsistency with previous results, including those from the 2006 Beam Test shown below.

*Plot from published results of 2006 Beam Test indicating energy resolution*

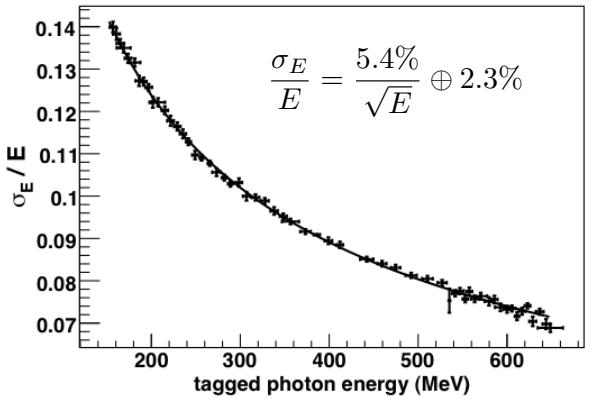
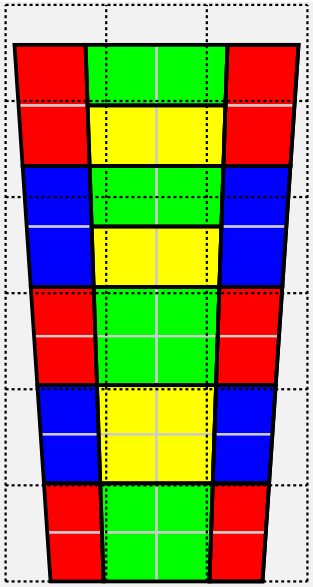



Figure 5.7: Energy resolution vs. $E_{\mathrm{BEAM}}$ for photons for $\theta = 90°$ and $z = 0$ cm. The fit gives $\sigma_E/E = 5.4\%/\sqrt{E(\mathrm{GeV})} \oplus 2.3\%$. The fit of Fig. 5.6 corresponds to the $40^{th}$ datum from the right ($19^{th}$ from the left) in this figure.

# Matching 2006 Beam Test conditions



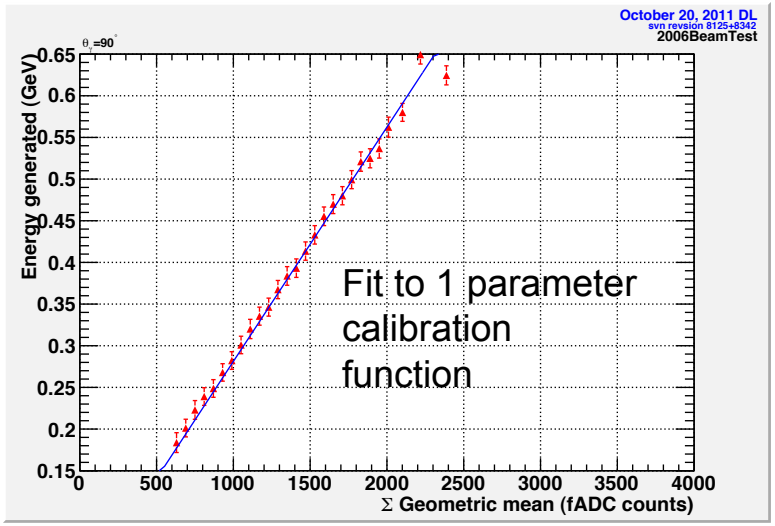
Segmentation to match 2006 Beam Test

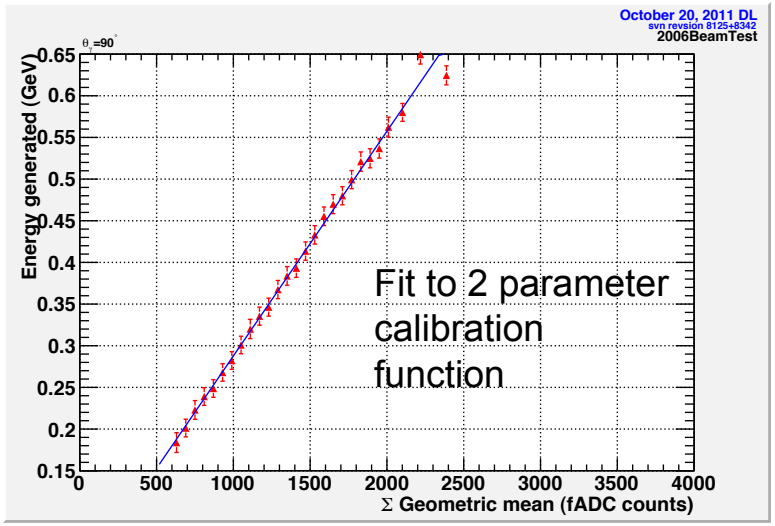
Energy: 150MeV – 650MeV
Angle: 90$^{o}$
Position: center of module

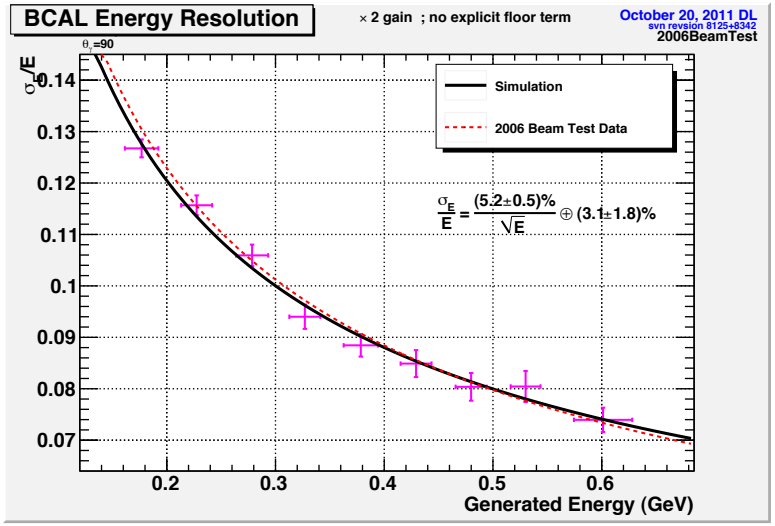
Physical size and shape of prototype module was different from trapezoidal shape of final module design.

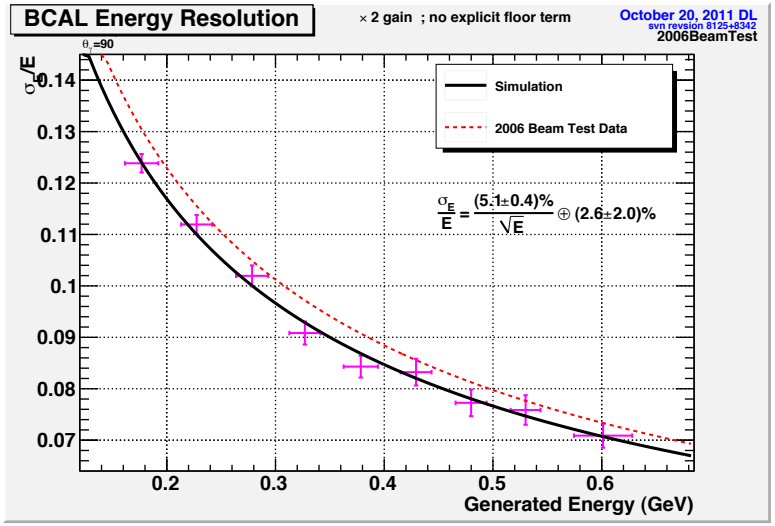
Fiber in prototype produced nearly have as much light (75 photons/MeV/side vs. 145 photons/MeV/side)

# Calibration and results

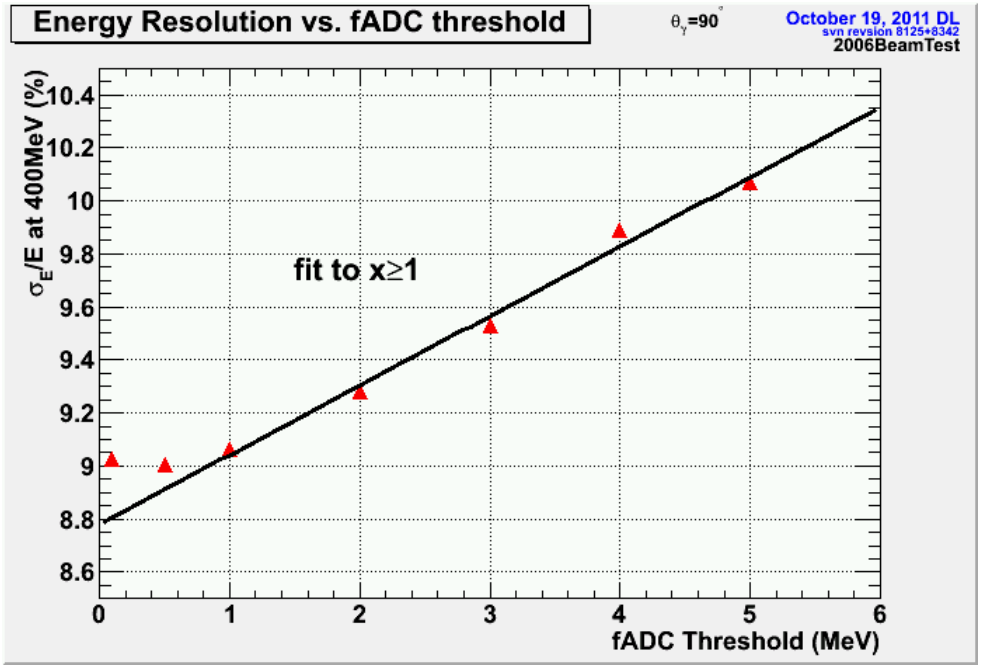


# Threshold Dependence

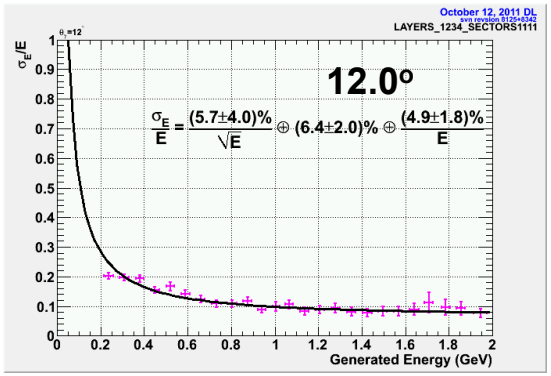



Energy resolution depends on threshold

Values plotted are for near end so actual threshold would be 3.7 times greater for doubled ended readout due to attenuation

For energy resolution plots shown in previous slides, 1MeV threshold (in units of this plot) were used.

# Energy Resolution

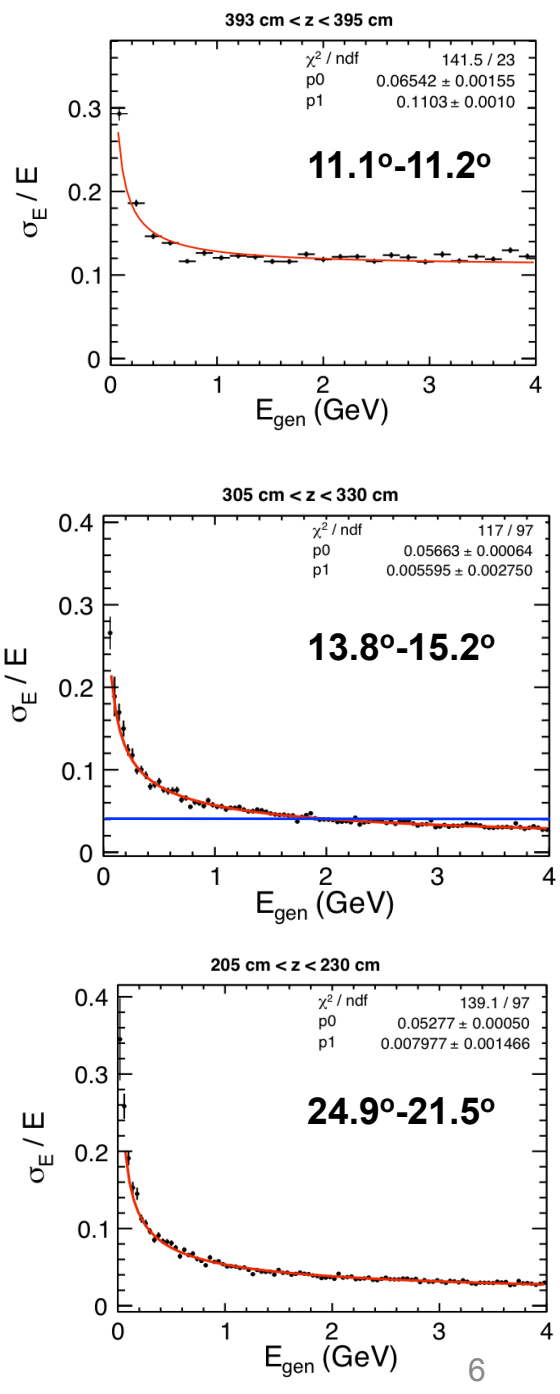



The simulation was modified:

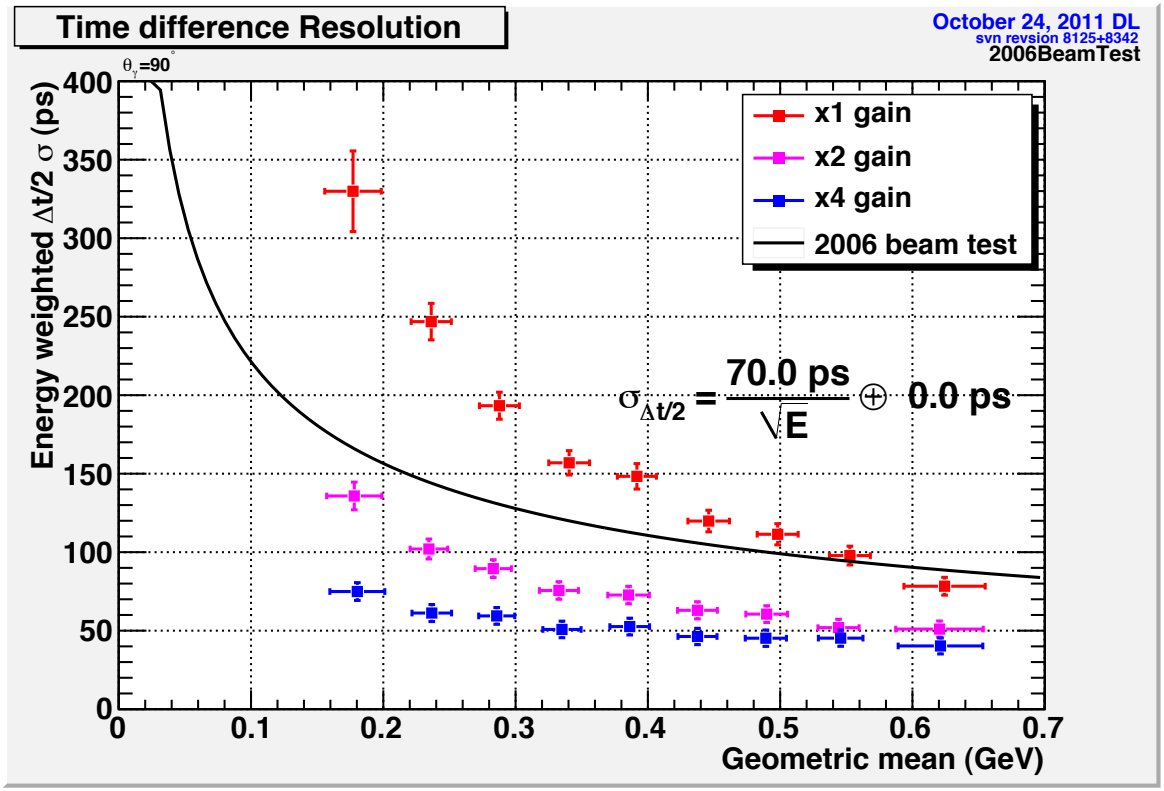
- Removed explicit adding of floor term in smearing due to sampling fluctuations
- Reduced fADC threshold so that it no longer matched TDC threshold (~factor of 5)

*n.b. Blake's simulation did indicate large floor term in forward direction, possibly due to leakage through downstream end*

Plots from Blake's thesis



# Time Difference Resolution




Consistent time difference resolution with 2006 Beam Test (with qualifications).

# Summary

- Energy Resolution now seems consistent with beam test results
- Time difference seems consistent with beam test results
- GlueX-doc-1854