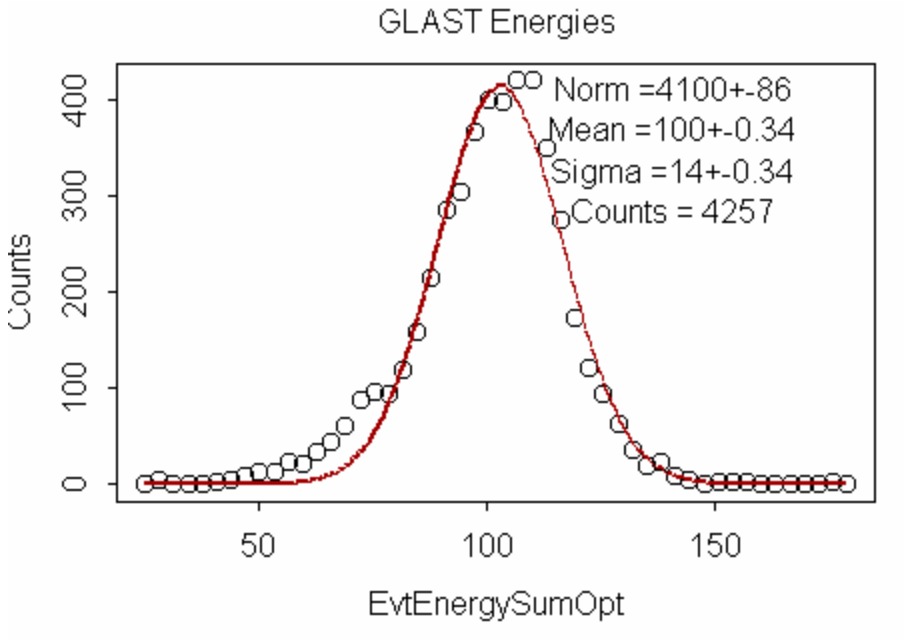
DC1 Energy Evaluation

Data Sample:
100 MeV γ's within 5° ON-AXIS

Cuts:

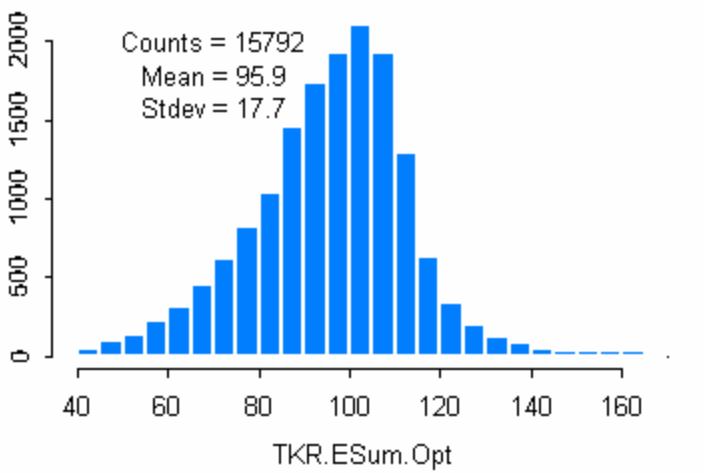
1) CalCsIRLn > 2.
2) CalEnerdgySum > 5
3) CalTwrEdge > 50
4) TkrTwrEdge > 35
5) TkrEnergyFrac < .7



NOTE: Edge Cuts kill ~ 32% of Events

Dec. 2002 Results (See GlastEnergy, Dec. 2002)
- Same input Data
- Suspect that Edge Cuts made

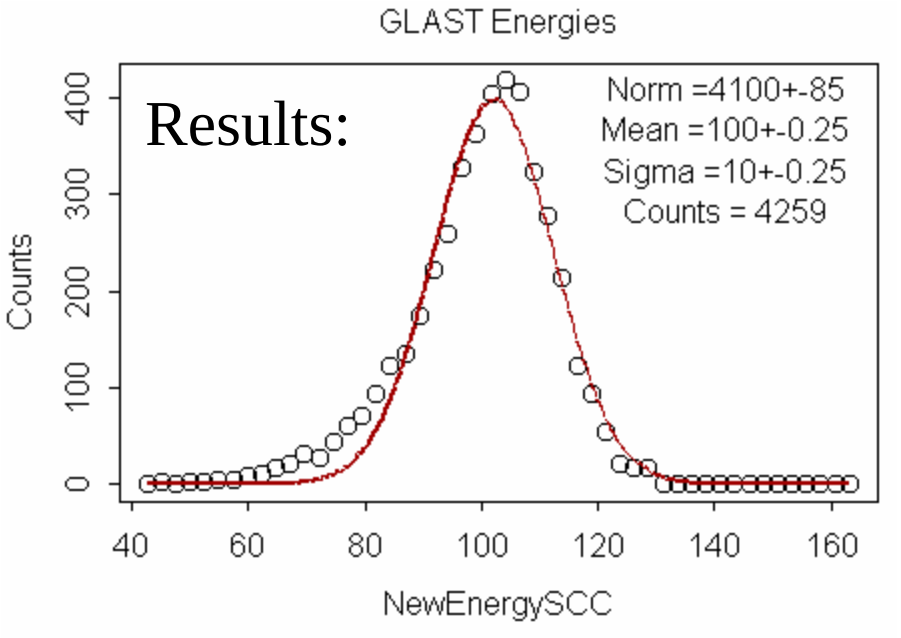
Evidently THINGS HAVEN'T CHANGE MUCH - Memories are better then REALITY!



FWHM = 35 MeV (σ = 14.8%)

New Approach:

1) Previous method relied on building corrections from basic principles. This proved to be complex.
2) Try a "Global" approach:
   - Know energies fall off near edges
     JUST FIT IT
   - Know there are 3 intertwined pieces
     TrkEdges, CalEdges, Cal-Leakage
   - Choose limiting cases to fit each



Step 1:

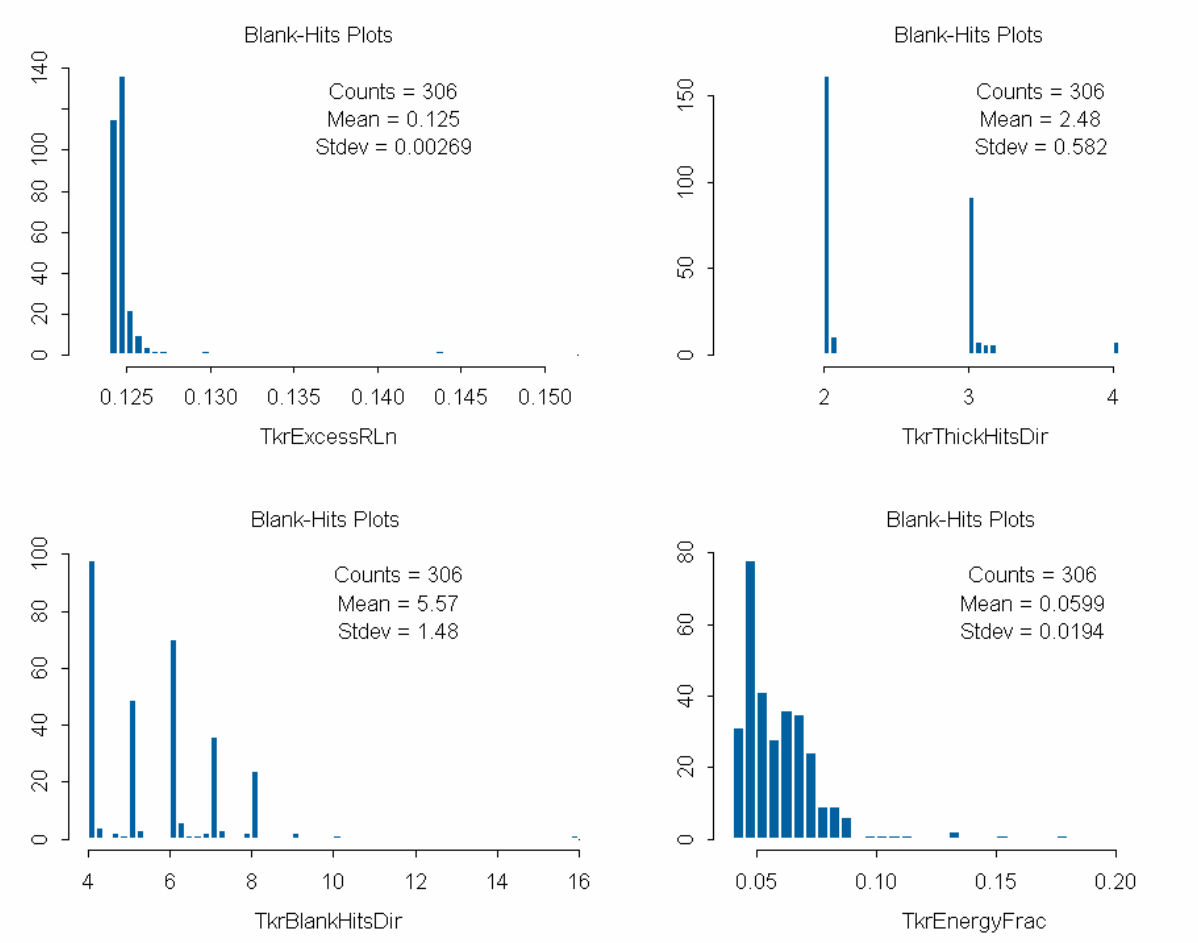
Fix the contribution of TkrBlankHits.

- Select Events which start in last Layer (limited Event Sample)
- Fit ThickHits, BlankHits, and Excess RL to missing energy
  (NO CAL CORRECTIONS - Leakage small & far from edges)

Definition of TkrExcessRLn:

TkrRadLength - (.045*TkrNoThinLayers + .195*TkrNoThickLayers)/(-Tkr1ZDir)

Independent Var's Used in Blank Hits Fit



Tkr1FirstLayer > 14
- 100% Error

BlankHit Fit

DEPENDENT VARIABLE: TKR.TARGET

Coefficient Estimates

Variable	Estimate	Std.Err.	t-Statistic	Pr(|t|)
(Intercept)	-42.32	22.88	-1.85	0.07
TkrBlankHitsDir	0.33	0.34	0.96	0.34
TkrThickHitsDir	1.93	0.87	2.22	0.03
TkrExcessRLn	490.22	191.08	2.57	0.01

Tkr1FirstLayer > 13
- 45% Error

Question:

Why Energy/Hit SO BIG??

BlankHit Fit

DEPENDENT VARIABLE: TKR.TARGET

Coefficient Estimates

Variable	Estimate	Std.Err.	t-Statistic	Pr(|t|)
(Intercept)	26.36	4.30	6.13	1.50E-9
TkrBlankHitsDir	0.36	0.16	2.20	0.03
TkrThickHitsDir	2.17	0.24	9.13	0.00
TkrExcessRLn	-61.00	36.47	-1.67	0.09

Tkr1FirstLayer > 12
115% Error

BlankHit Fit

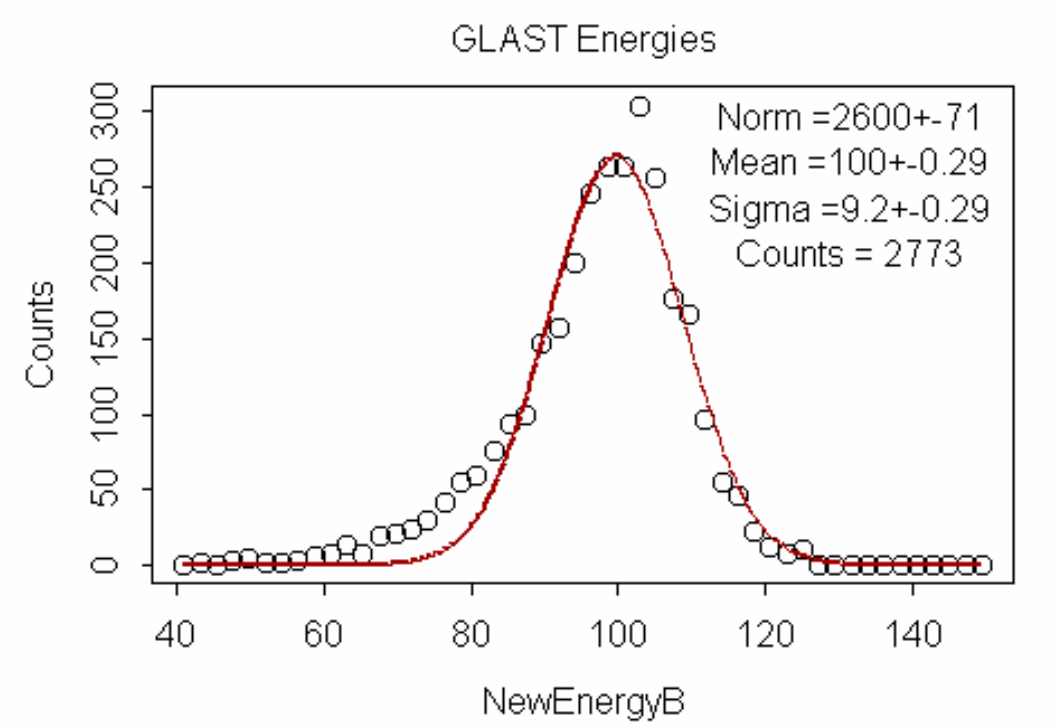
DEPENDENT VARIABLE: TKR.TARGET

Coefficient Estimates

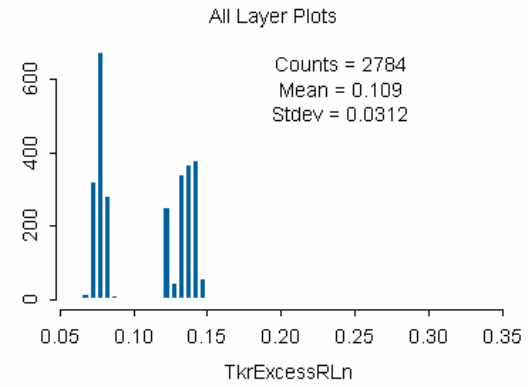
Variable	Estimate	Std.Err.	t-Statistic	Pr(|t|)
(Intercept)	36.04	3.95	9.12	0.00
TkrBlankHitsDir	0.11	0.13	0.87	0.39
TkrThickHitsDir	2.34	0.13	17.38	0.00
TkrExcessRLn	-126.20	32.68	-3.86	1.20E-4

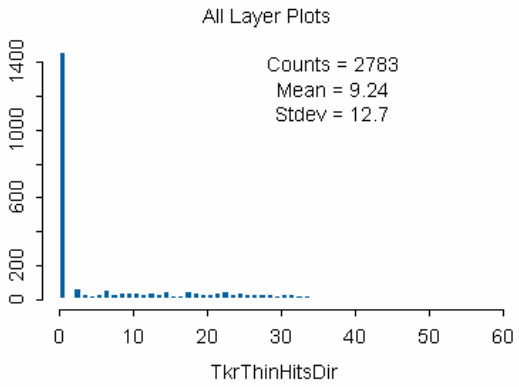
Choose to use
.2 MeV/BlankHit

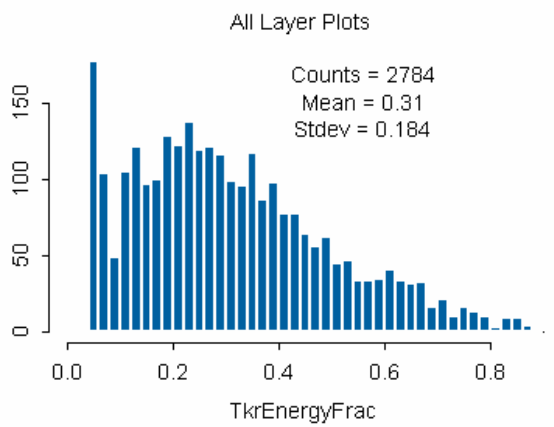
This was the largest before
Effect was deleterious to
Fits for all Layers

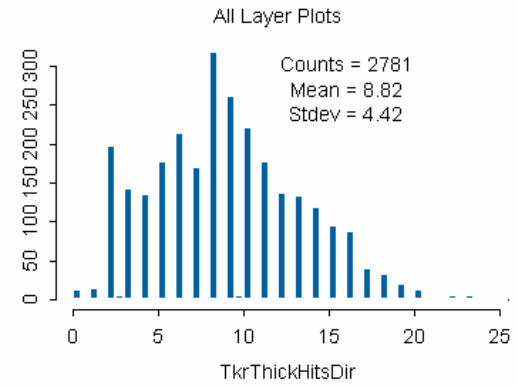


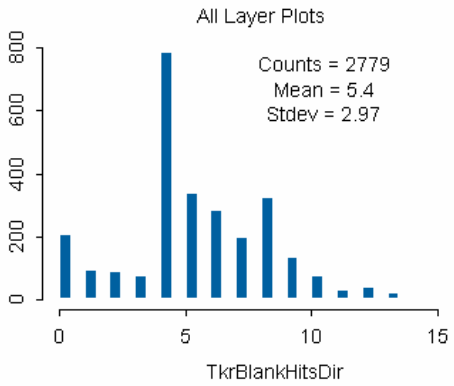
Step 2:
Fix the Coefs for Thick Tracker Layers
- Same Event selection as before except now allow all Thick Layers
- Fix the Blank Layer pieces as determined in Step 1

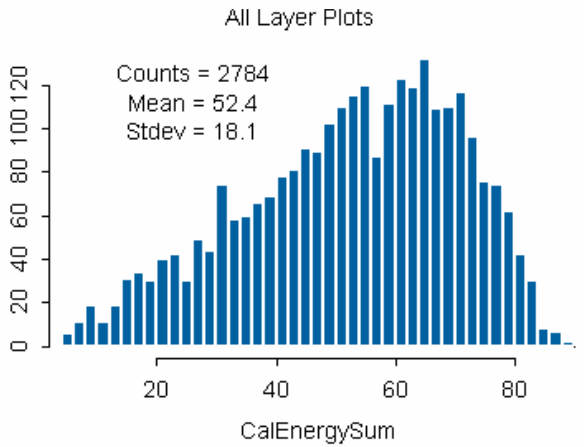












Thick/Thin Fit

DEPENDENT VARIABLE: TKR.TARGET2

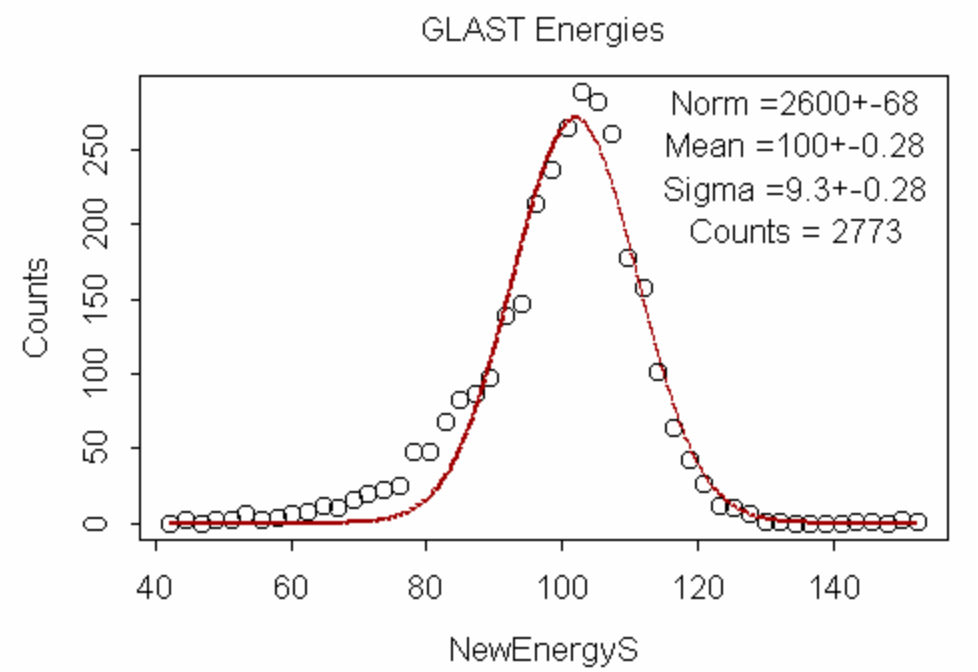
Coefficient Estimates

Variable	Estimate	Std.Err.	t-Statistic	Pr(|t|)
TkrThinHitsDir	1.09	0.02	57.54	0.00
TkrThickHitsDir	2.08	0.05	42.70	0.00
TkrExcessRLn	150.40	3.72	40.47	0.00

Question:

- Why is the ratio of Thick/Thin = 2 when ratio of RLn's is .195/.045 = 4.3

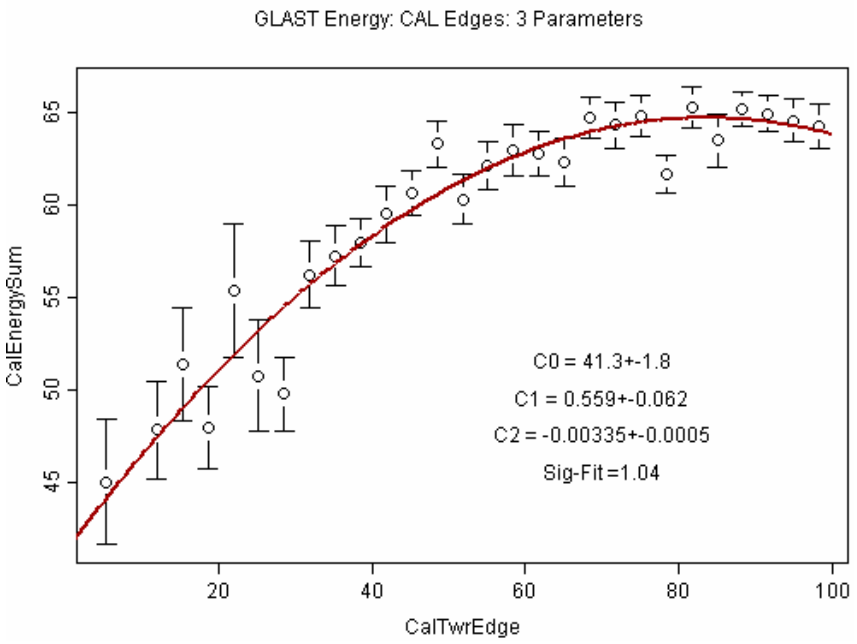
Results:



Step 3:

Correct Events near CAL Tower Edges

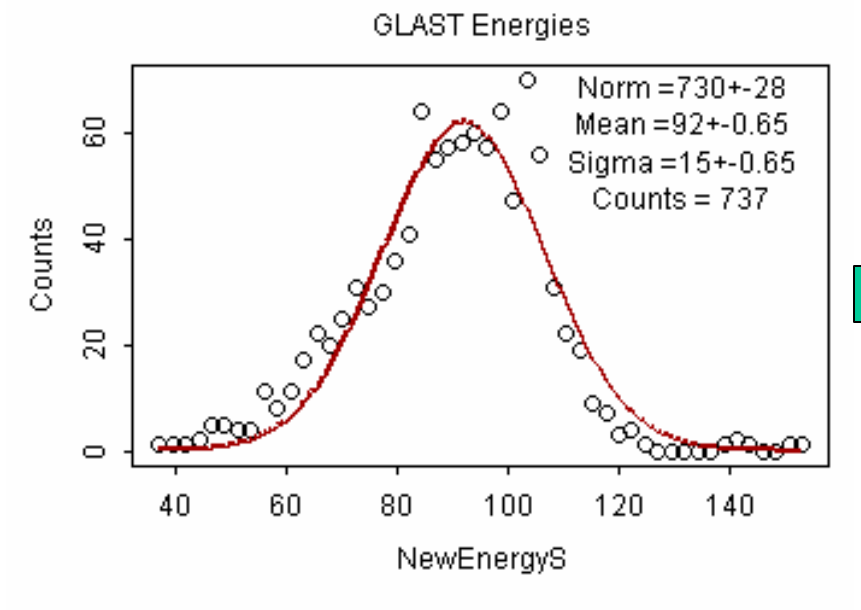
- Starting from above - Observe how energy changes as a function of distance to Tower Edge.
- Require > 70% of the Energy to be in the CAL

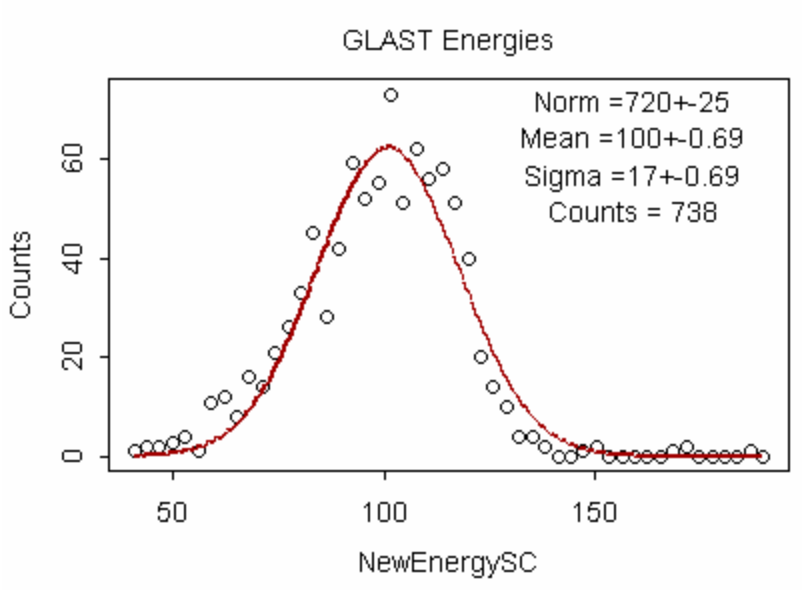


CAL Edge Correction for $\cos(\theta) < -.996$ (5^o)

$$\frac{68}{41.3 + .559 \cdot S_{CalEdge} - .00335 \cdot S_{CalEdge}^2}$$

NOTE: Correction only applied to CalEnergySum



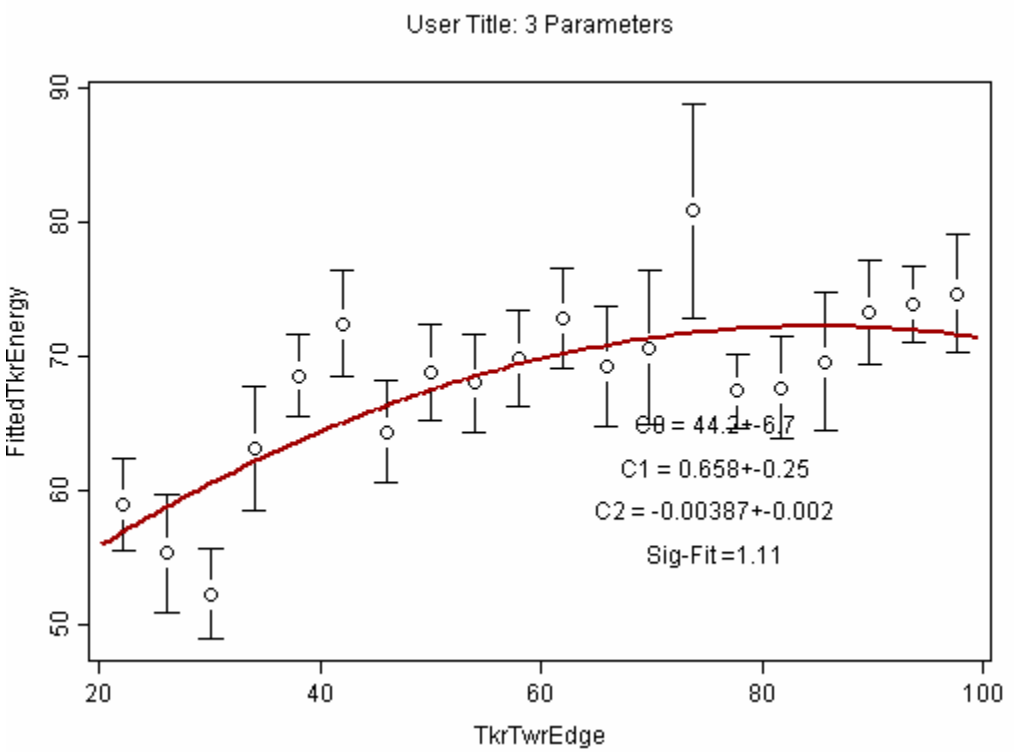


Now do Tracker Edge Correction

- Similar to above except reverse rolls of Tracker and CAL

1) Require > 70% of the energy to be in the Tracker

2) Require CalTwrEdge > 50

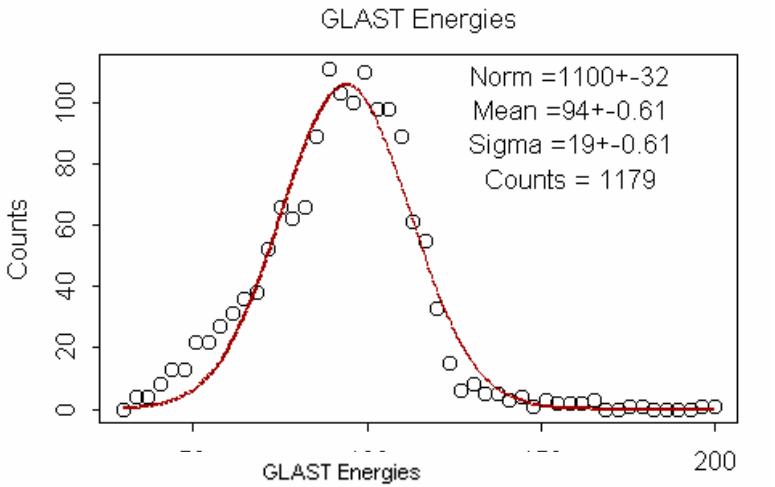


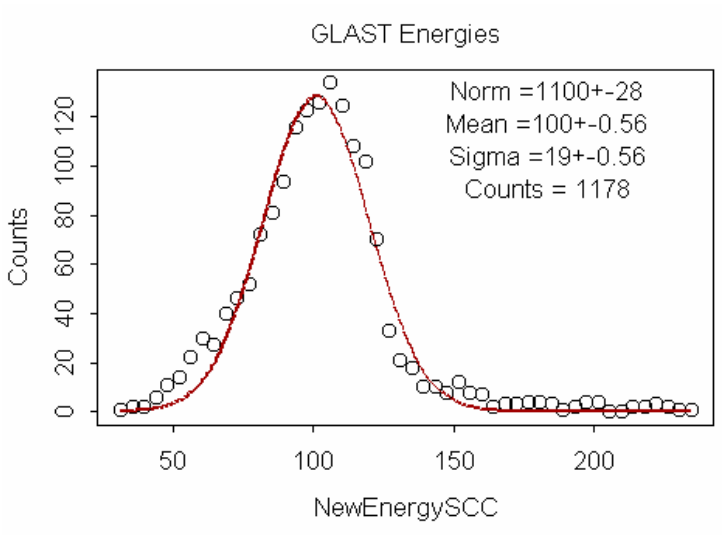
$$\frac{72}{44.3 + .658 \cdot S_{TkrEdge} - .00387 \cdot S_{TkrEdge}^2}$$

NOTE:

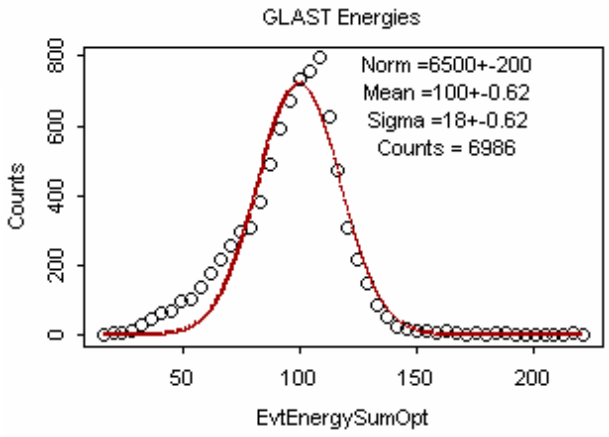
1) Correction only applied to TrkEnergy

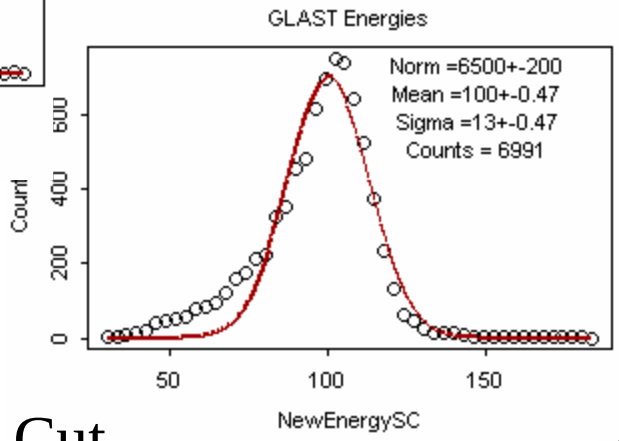
2) Correction almost the same as in CAL!

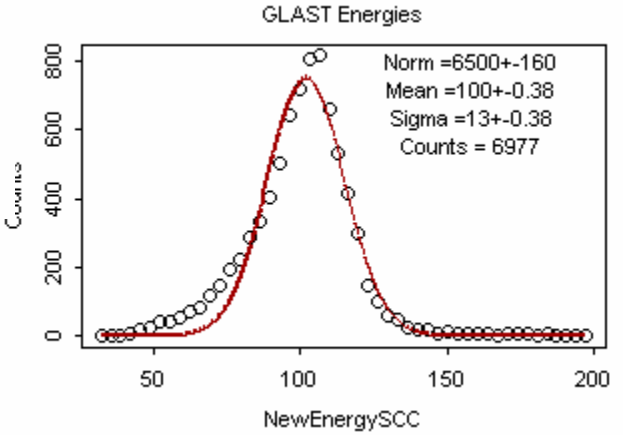




Review: Correction Progression





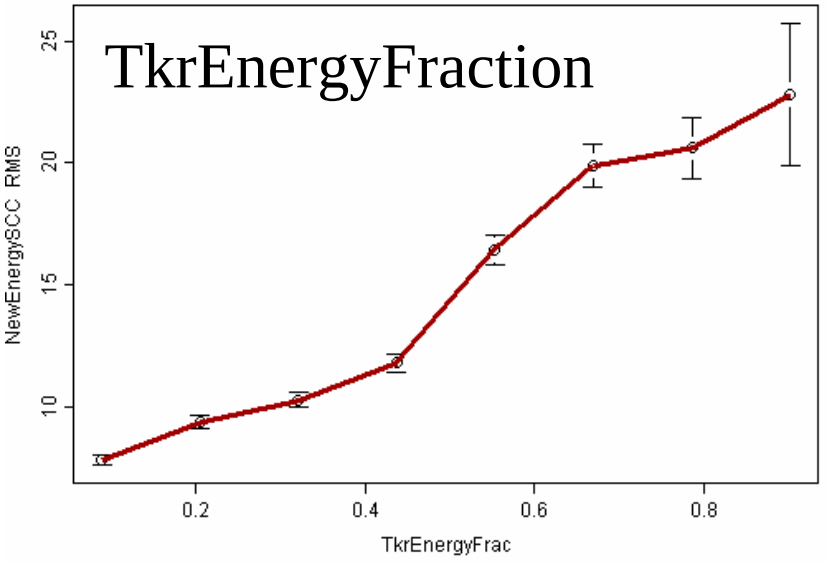


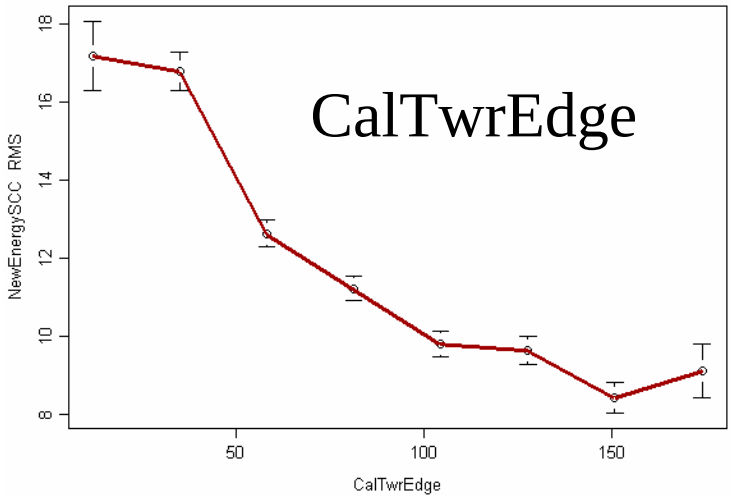
No Edge Cuts

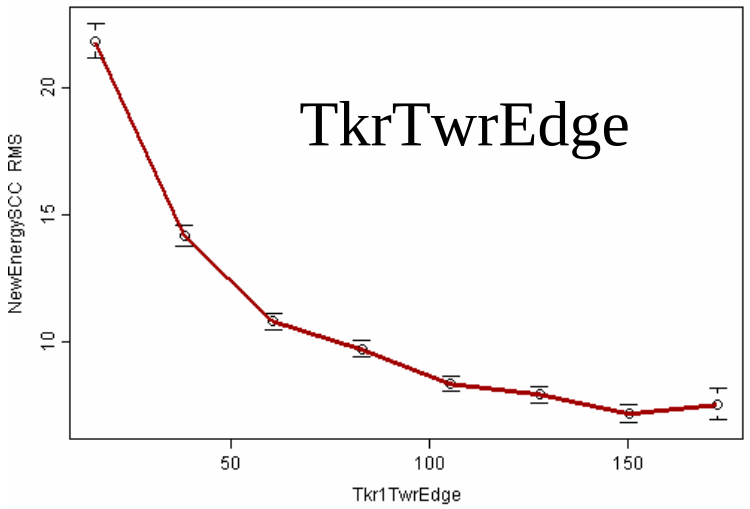
No TkrEnergyFrac Cut

Energy Resolution Dependencies

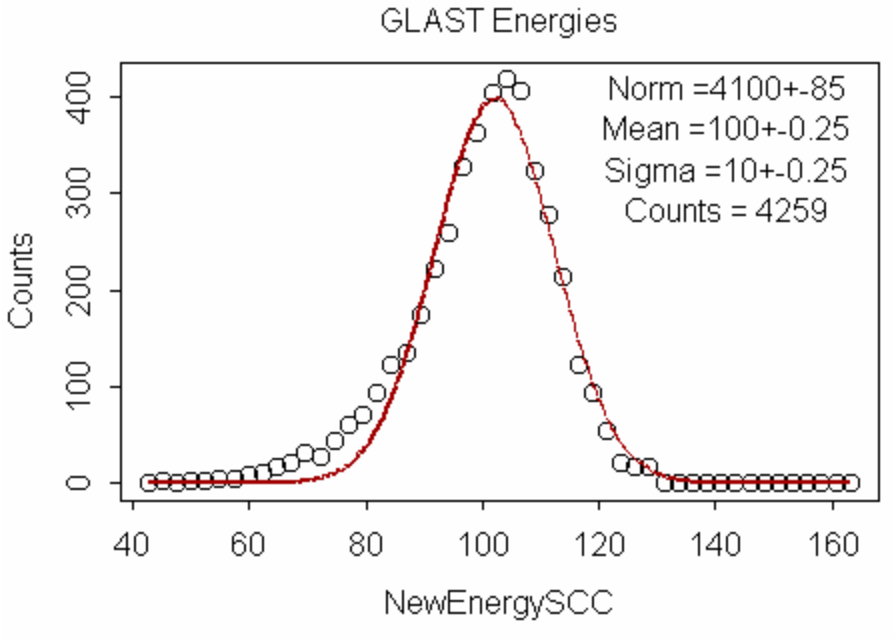
Resolution Get Worse as
1) TkrEnergyFrac increases
2) Cal Energy Centroid gets near edge
3) Track Head gets near edge







Results as shown at the start of talk



Off Axis Behavior

New Sample of Events: $0 < \theta < \pi$

Expect Correction to "go away" as $|\cos(\theta)|$ decreases

⇒ Cracks become Gaps

Expect resolution to worsen due to thickening Tracker

(Our Tracker is a POOR CALORIMETER!)

Approximate as 1st Order Correction:

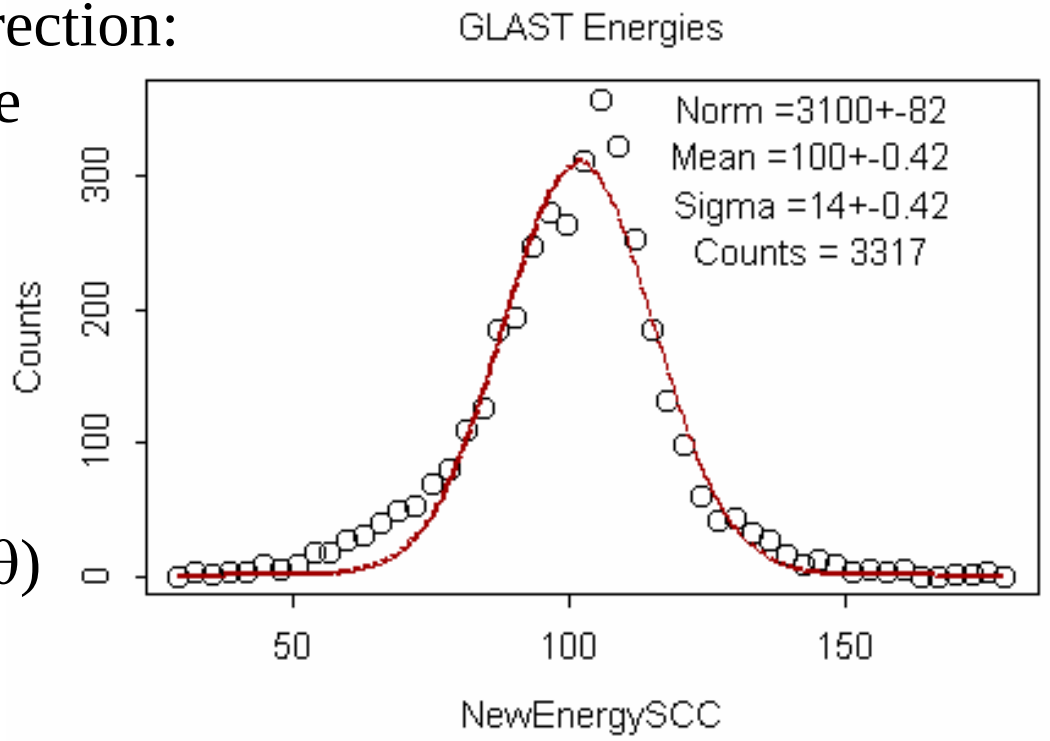
Previous Corrections Become

1+ (cos(θ))*(Correction-1)

See worse energy resolution

10% ➡ 14%

See little dependence on cos(θ)



<u>To Do:</u>

Higher Energies - Need to add Leakage Correction

- Check Edge corrections (esp. in CAL)