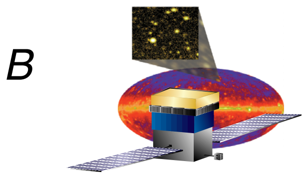
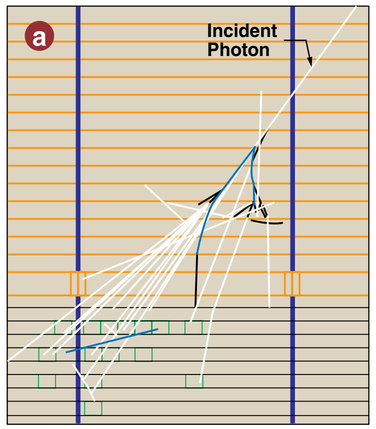
GLAST LAT/*Foldout B*
Performance

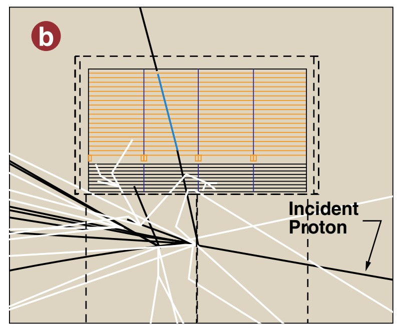


1. Detailed Instrument Simulation

(a) Simulated interaction of 100 MeV photon in the LAT. The primary interaction is in a tracker converter foil. Charged particles are shown in black, neutrals in white. The reconstructed tracks are in blue.

(b) Simulated interaction of 15 GeV cosmic ray proton in GLAST with primary interaction in the spacecraft. Most of the background remaining after analysis cuts is of this nature.





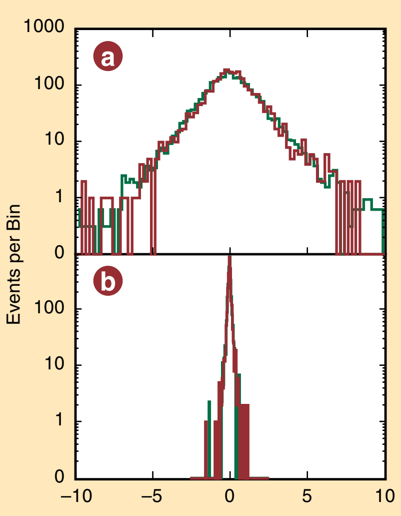
2. Beam Test Verification

Beam tests of scientific prototypes with electrons and γ-rays.

Tracker

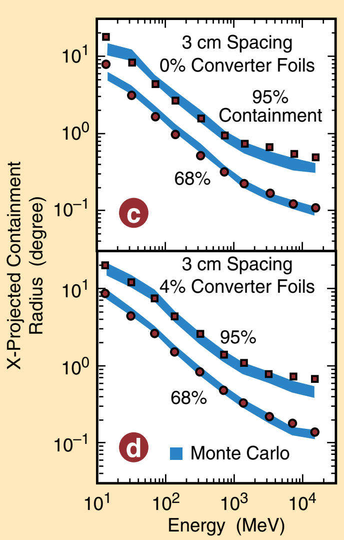
Excellent agreement of the distribution of reconstructed photon direction (PSF) with simulations demonstrate that the silicon-strip technology will meet all requirements.

Reconstructed γ-ray angle distributions for data (red) and Monte Carlo (green).



(a) 100 MeV, 4% Converter Foils, 3 cm Spacing
(b) 7 GeV, no Converter Foils, 6 cm Spacing

X-projected angular resolution as a function of energy.

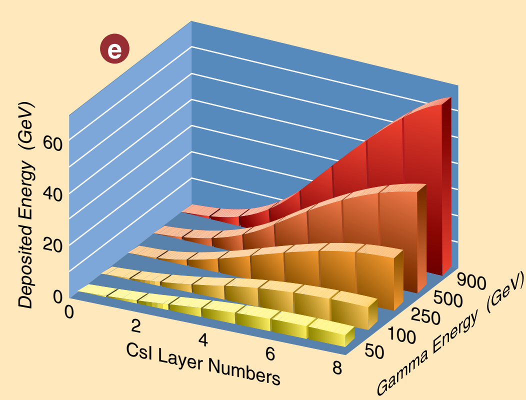


(c) No Converter Foils
(d) 4% Converter Foils

Calorimeter

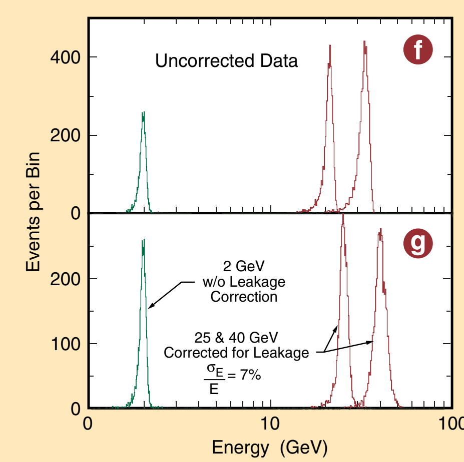
Segmentation provides measurement of shower profile allowing correction for shower leakage.

(e) Shower Profile for 8 Layer, 8.5 R.L. CAL + 1.5 R.L. TKR

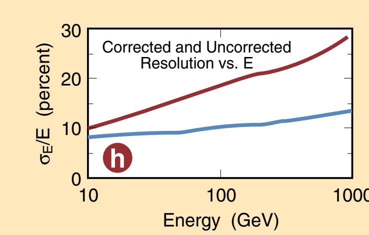


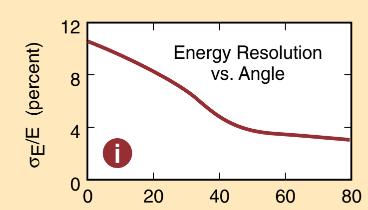
Calorimeter (13 R.L.) response to 2, 25 and 40 GeV electrons:

(f) Measured Energy
(g) Corrected data with longitudinal shower fitting.



(h) Uncorrected and corrected energy resolution for LAT.
(i) Corrected energy resolution vs. angle of incidence at 100 GeV.

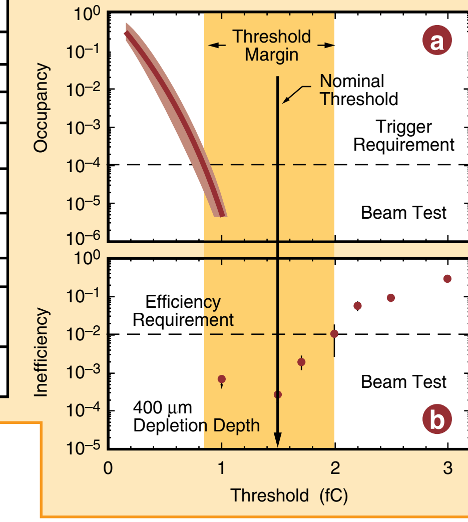




3. Hardware/Sub-system Performance Specifications

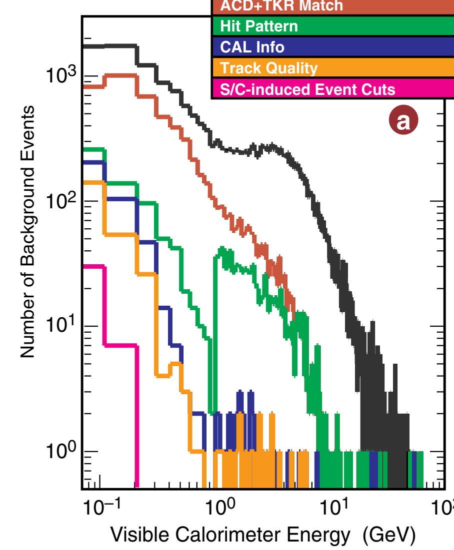
Parameter	Value	Performance Drivers and Constraints	
Tracker			
Noise Occupancy	$<10^{-4}$	Trigger rate, data volume, pattern recognition. Value determined by trigger requirement.	
Single Channel Efficiency for MIP	>99%	PSF, especially at low energy. It is crucial to measure the tracks in the first 2 planes following the conversion.	
Aspect Ratio (height/width)	0.4	Large FOV for photons with energy determination	
Calorimeter			
Depth, including Tracker	10 R.L.	Energy Resolution	Shower max within instr. up to ~100 GeV.
Sampling	>90% Active		Sufficiently high active fraction that resolution is not dominated by sampling statistics.
Longitudinal Segmentation	8 Segments		Segmentation needed to correct for shower leakage out the back. Also aids background rejection.
Lateral Segmentation	~1 Moliere Radius	Background rejection–a γ-ray shower should match well with the pair conversion in the tracker.	
ACD			
Tile Segmentation	$<1000\ cm^2$ ea.	Minimize self-veto, especially at high energy. This value is for the top. Side tiles are smaller, to achieve a similar solid angle, as seen from the calorimeter.	
Efficiency of a tile for MIP Detection	>0.9997	Cosmic ray rejection, to meet the 0.99999 requirement when combined with the other subsystems.	

Large Signal-to Noise ratio in silicon detectors allows simultanously
(a) Low Noise Occupancy
(b) High Efficiency



Background Rejection Filter Stages

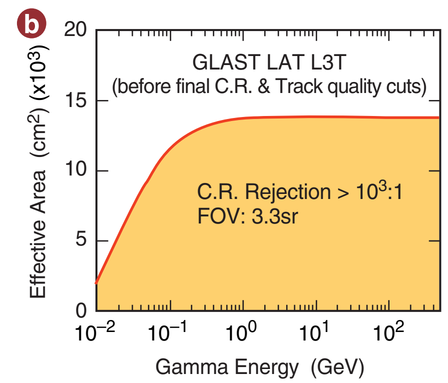
Stage	# Events Remaining
Generated	10,000,000
L1T+L2T+L3T	25,416
ACD+TKR Match	6,100
Hit Pattern	1,647
CAL Info	423
Track Quality	257
S/C-induced Event Cuts	40



4. Triggering, Analysis and Background Rejection

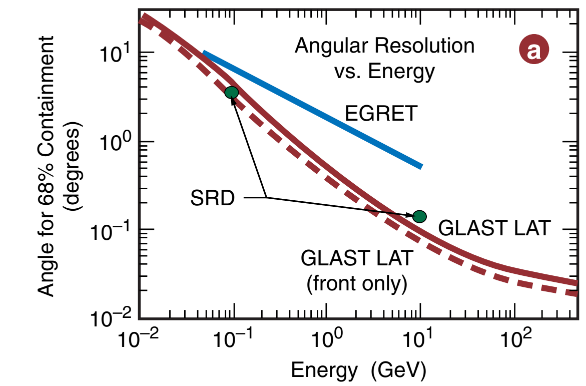
(a) Cosmic ray rejection of 2.5×10^5:1 achieved with a succession of cuts using all subsystems.
(b) On-board analysis provides sufficient C.R. rejection and good gamma ray reconstruction to enable GRB and rapid transient alert.

- L3T γ's 68% containment angle within 40% of final value shown in Fig. 5a.
- $\sigma_E/E \approx 40\%$ for TKR only γ's (E<1 GeV)

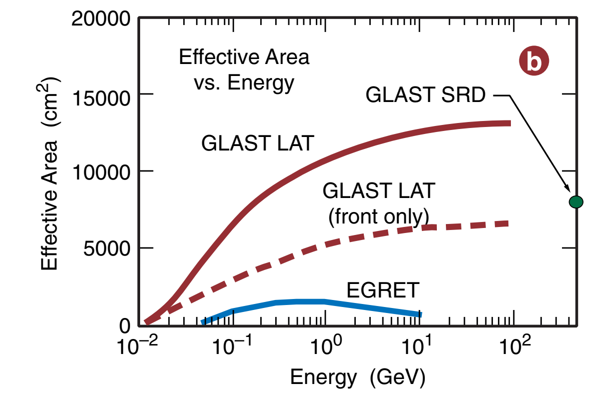


5. Instrument Performance (including all background and track quality cuts)

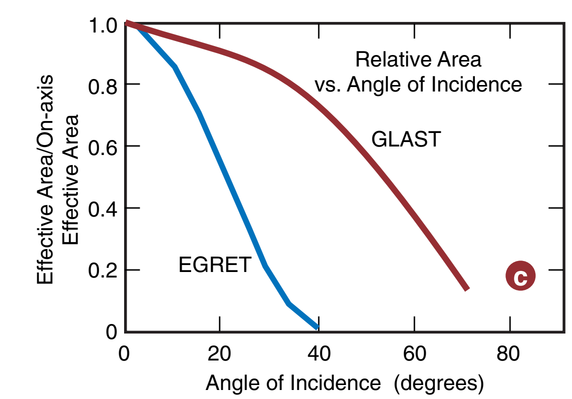
Optimized Point Spread Function



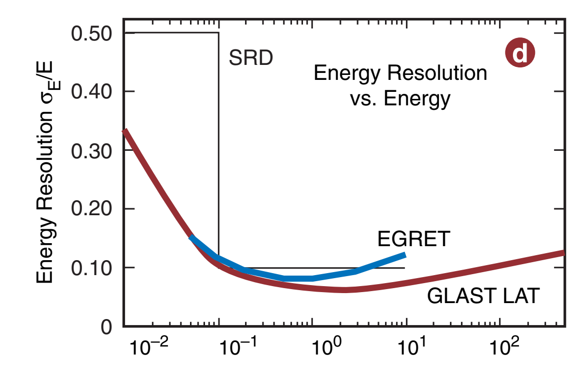
Large Effective Area



Wide Field of View
FOV: 2.4 Sr
SRD: 2.0 Sr



Good Energy Resolution



Point Source Sensitivity (high latitude)
Two Years: = 1.6×10^{-9} ph/cm^2/s (> 100 MeV)