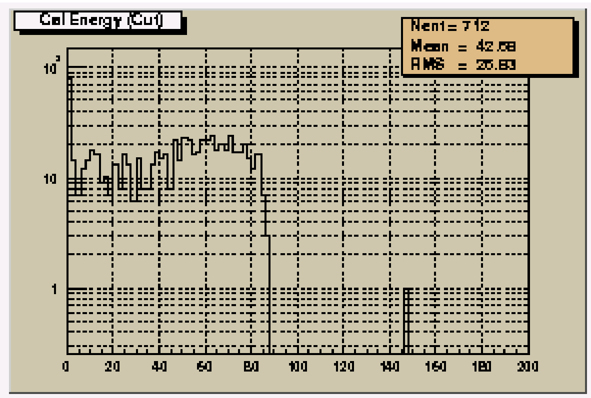
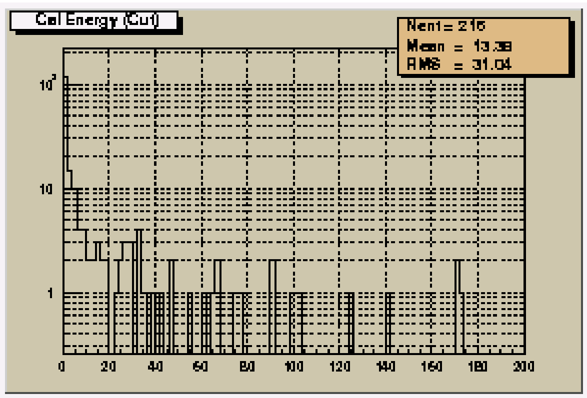
Steve's Calorimeter Energy Distributions

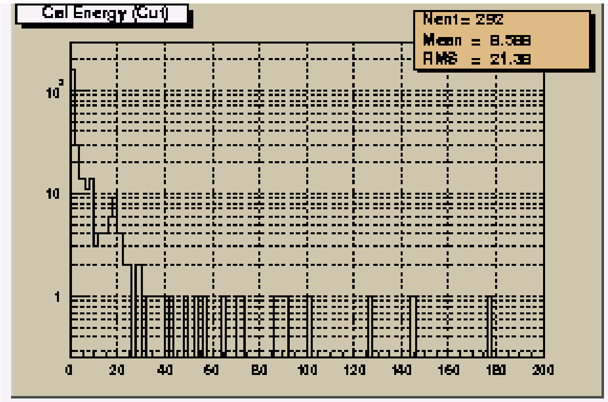
Expectation: Events will be typified by low energy deposited in the CAL
Data cut on a valid 3-in-a-row which starts in Layer 15



SIGNAL



ALBEDO



SIDE ALBEDO

TK argues:
Take the two right panels above. They will give problem for 20-200MeV gammas. Source count of 50k at 100MeV (assume 100MeV bin) corresponds to >1 year observation (10^7s) of a few 100mCrab source. Number of albedo photons to be compared with the source count (10^7s) should have been ~10^{10} or 2x10^5 higher than shown above. (Here 1/5 of gammas are assumed to trigger.) We can eliminate most albedo photons by our angular resolution represented by PSF. PSF (fwhm) at 100MeV is 2.3x3.5deg square = 4msr = 0.002 of LAT fov. So we should multiply the right two panels by ~400 for one Crab point source. If we claim to detect few mCrab sources (we'd better be), we have to multiply the 2 right pannels by >10^5 !!! Even with very effective on-board filtering and off-line rejection scheme, we should go after additional reduction factors.

Steve's Negative Impacts? (II)

•There are two categories of background that will likely be worsened with additional tracker material:

–horizontal primary particles (not tracked) that interact in the additional material creating secondaries that either look like, or are, gammas. The lowest row of ACD tiles were added to help reject these in the last layers of the TKR, however the efficiency requirement on these tiles is less strict since no candidate gammas come from this region. Additional converter (which does not add effective area for science) will be a target for background generation.

TK: Conversion in the added tungsten foils is least likely give L1T trigger unless the event splashes upward and downward at the same time.

–a major advance of GLAST over EGRET is the lack of a TOF system, enabling a much larger FOV. It is necessary for the instrument to distinguish upward from downward-going energy by other means. One method of removing upward gammas from primary interactions in the CAL is requiring a found track to be somewhere close to the CAL. The additional material will convert ~6% more upward-going photons closer to the CAL, removing this useful distinction. The additional converter in the TKR will make the problem of upward-going event rejection worse.

TK: This is against what we found in BFEM. The higher the threshold for electrons crossing the bottom 3 trays, the less will be triggers from upward splash from CAL

Steve’s Extra-G Background vs Albedo Gammas

TK: Need a little more info on this plot. If ~3 events/s are left over ~2sr (the left Table), the emissivity (total flux/solid angle) will be $1.5\mathrm{x}10^{-3}$/s/msr. Ext-Gal Gamma-ray Background per msr will be ~10^{-10} (number/cm^2/s/MeV/msr at 100MeV) x 3000cm^2 x 100MeV = $3\mathrm{x}10^{-5}$/s/msr. Hence we need rejection (off-line) of ~3 orders of magnitude to get the right panel. If we do, TK’s worry will be gone.

Albedo Gamma Rates

	L1T rate [Hz]	L1T rate with Throttle [Hz]	After filters [Hz]	After fiducial cut [Hz]
zenith	250	190	2	2 (no cut)
rock 35°	260	200	3	3 (no cut)
rock 60°	300	250	8	1 (<45°) 3 (<53°)

Notes:
- rates for other backgrounds will be reduced somewhat by the same angle cut, not taken into account here.
- small incremental L1T rate not a problem
- calculating the gamma direction only happens at a relatively low rate, if needed (after other filters), so incremental CPU load not a problem.
- can reduce the downlink contribution to whatever we need with a tighter fiducial cut.

Background Rejection Results

- Requirement: <10% contamination of the measured extragalactic diffuse flux for E>100 MeV
- Residual background is 5% of the diffuse (6% in the interval between 100 MeV and 1 GeV). Important experimental handle: large variation of background fluxes over orbit – compare diffuse results over orbit.
- Below 100 MeV [no requirement], without any tuning of cuts for low energy, fraction rises to 14%. This will improve.
- Peak effective area: 10,000 cm² (at ~10 GeV).
- Effective area at 300 GeV: 8,000-10,000 cm², depending on analysis selections.
- At 20 MeV, effective area after onboard selections is 630 cm². Different physics topics will require different (and generally less stringent) background rejection on the ground.