I&T&C Organization Chart

I&T&C Manager
Elliott Bloom
WBS 4.1.9

I&T Engineer
B. Grist
WBS 4.1.9.1

Reliability & QA
D. Marsh
WBS 4.1.9.2

Instrument Operations Coordinator
S. Williams

Mechanical Ground Support Equipment
TBD

Online Manager
R. Claus

Integration, Facilities, Configuration, and Test O.Millican (Acting)	Particle Test Manager **G.Godfrey**	Environmental Test Manager M. Lovellette	Science Verification, Analysis, and Calibration E. do Couto e Silva
I&T Preparation 4.1.9.3	I&T Preparation 4.1.9.3	I&T Preparation 4.1.9.3	I&T Preparation 4.1.9.3
EM1 Model I&T&C	EM1 Model I&T&C		EM1 Model I&T&C
Calibration Unit I&T 4.1.9.4	Calibration Unit I&T 4.1.9.4		Calibration Unit I&T 4.1.9.4
Flight LAT I&T 4.1.9.6	Flight LAT I&T 4.1.9.6	Flight LAT I&T 4.1.9.6	Flight LAT I&T 4.1.9.6
Mission I&T Support 4.1.9.7	Mission I&T Support 4.1.9.7	Mission I&T Support 4.1.9.7	Mission I&T Support 4.1.9.7

Verification Matrix

- Requirements flow down from
  - LAT Science Requirements Document – Level II Specification LAT-SS-00010-1 (found in LAT-SS-9.1)
  - Summarized by the Instrument Scientist (Steve Ritz)

Parameter	Constraint	Requirement	Goal	Proposed Verification (all statistics are TBR)	Spec Ref	Beam Tests that do the Verification
A_{eff}	20 MeV	> 300 cm^2	> 1000 cm^2	Sim, BT (>10,000 tagged photon triggers at 20±5 MeV, normal incidence)	5.2.1	1) Chan rad, 20 and 50 Mev γ, norm incid 2) Van de Graf 17.6 Mev γ 3) Brem beam, simultaneously all γ energy bins from 20 Mev to 30 Gev, variety of angles and tranverse positions.
	100 MeV	> 3000 cm^2	> 8000 cm^2	Sim, BT (>5,000 tagged photon triggers at 100±10 MeV, normal incidence)	5.2.1	1) Coherent Brem, .1,.2,.5,1,2,5,10,30 Gev, norm incid 2) Brem beam, simultaneously all γ energy bins from 20 Mev to 30 Gev, variety of angles and tranverse positions.
	1,10 GeV	> 8000 cm^2	> 10,000 cm^2	Sim, BT (>1000 tagged photon triggers at 1±0.1 GeV and 10±1 GeV, normal incidence)	5.2.3	1) Coherent Brem, .1,.2,.5,1,2,5,10,30 Gev, norm incid 2) Brem beam, simultaneously all γ energy bins from 20 Mev to 30 Gev, variety of angles and tranverse positions.
	300 GeV	> 6400 cm^2		Sim, BT (>1000 tagged photon triggers at 10±1 GeV, then extrapolate. Simulations must match measured backsplash rates to better than 10% -- earlier measurements must be reviewed and, if necessary, another set of measurements must be made.)	5.2.1	
	1 TeV		> 9500 cm^2	Sim, as 300 GeV case above.	5.2.1	
A_{eff} knowledge (1σ)	20-50 MeV	< 50 %	< 20 %	Sim (compare the simulation predictions with the measured values for spec refs 5.2.1 and 5.2.3 above. Effective area below 100 MeV is changing rapidly, and this region must be mapped out carefully. Sim in 10 MeV bins)	5.2.4	
	50-300 MeV	< 25 %	< 10 %	Sim (as above)	5.2.4	

Verification Matrix

Energy Resolution	20-100 MeV	< 50 %		Sim (TKR front and back separately at 20, 50, 100 MeV), BT (tagged photon triggers from 5.2.1 above)	5.2.2	1) Chan rad, 20 and 50 Mev γ, norm incid 2) Van de Graf 17.6 Mev γ 3) Coherent Brem, .1,.2,.5,1,2,5,10,30 Gev, norm incid
	100 MeV – 10 GeV	< 10 %		Sim (TKR front and back separately, at 0.1, 0.2, 0.5, 1, 2, 5, 10 GeV), BT (tagged photon triggers from 5.2.1 above)	5.2.2	1) Coherent Brem, .1,.2,.5,1,2,5,10,30 Gev, norm incid 2) Positrons 1,2,5,10,30, 45 Gev, variety of angles and transverse positions.
	10-300 GeV	< 20 %		Sim (TKR front and back separately, at 10, 50, 100, 300 GeV), BT (tagged photon triggers from 5.2.1 above)	5.2.2	1) Coherent Brem, .1,.2,.5,1,2,5,10,30 Gev, norm incid 2) Positrons 1,2,5,10,30, 45 Gev, variety of angles and transverse positions.
	> 10 GeV >60° incidence	<6%	< 3 %	Sim (at 60°, at 10, 50, 100, 300 GeV)	5.2.2	1) Positrons 1,2,5,10,30, 45 Gev, variety of angles and transverse positions.

Verification Matrix

Single Photon Angular Resolution (SPAR) – 95 % On-Axis		< 3x SPAR 68% On-Axis	< 2x SPAR 68% On-Axis	Sim (see cases for 68 % On-Axis) BT Need a factor >20 statistics, or >20k events in each energy/angle bin studied. This parameter must be carefully studied on the ground, as it will be difficult to extract on-orbit. **These studies also drive the purity requirements on the photon beam.**	5.2.6	1) Brem beam, simultaneously all γ energy bins from 20 Mev to 30 Gev, variety of angles and tranverse positions.
Single Photon Angular Resolution (SPAR) – 68 % Off-Axis at FWHM of FOV		< 1.7x SPAR 68% On-Axis	< 1.5x SPAR 68% On-Axis	Sim, averaged over phi and at phi=0, 30, 45 deg **BT TBD (bins of energy, angle, impact position and conversion layer). This test drives the photon beam time requirements.**	5.2.7	1) Brem beam, simultaneously all γ energy bins from 20 Mev to 30 Gev, variety of angles and tranverse positions.
Field of View (FOV)		> 2 sr	> 3 sr	Sim (same points as BT), BT (at least one energy in range 1-5 GeV at >5 angles from 0 to 80 degrees, using >1000 tagged photon triggers in each bin)	5.2.8	1) Brem beam, simultaneously, all γ energy bins from 20 Mev to 30 Gev, variety of angles and tranverse positions.
Time Accuracy		< 10 µs	< 2 µs	BT (20±5 MeV, 100±10 MeV, 10±1 GeV photons or electrons; measure (event time stamp – beam clock) distributions.	5.2.11	1) All BT runs record time from Linac RF
Background Rejection		> 10^5:1	> 10^6:1	Sim (using best current background flux model) **BT TBD**	5.2.12	1) 200 K protons
Dead Time		< 100 µs	< 10 µs	Cosmic Ray Test (reducing CAL and TKR trigger thresholds to raise L1 rate to 10 kHz) BT (electron and photon events from 100 MeV to 10 GeV and multi-electron event s with effective energies up to 300 GeV)	5.2.13	1) Ground cosmics 2) All BT runs 3) Airplane cosmics

Verification Matrix

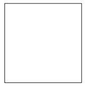
Source Location Determination	Source flux 10^{-7} ph cm^{-2} s^{-1} (high gal. lat. source, spectral index -2 above flat background, no cutoff to 10 GeV and no s/c effects)	< 1 arcmin (1σ radius)	< 0.5 arcmin (1σ radius)	Analysis (using measured, parameterized A_{eff} and SPAR functions with sky simulation)	5.2.9	
Point Source Sensitivity	> 100 MeV at high gal. lat. after 2 year survey	< 4×10^{-9} cm^{-2} s^{-1} (5σ detection)		Analysis (using measured, parameterized A_{eff} and SPAR functions with sky simulation)	5.2.10	
GRB Location Accuracy On-Board	Within LAT FOV, < 10^{-2} ph cm^{-2} (E > 1 GeV) for less than 30 secs	< 10 arcmin (1σ radius)	< 1 arcmin (1σ radius)	Analysis (using measured, parameterized A_{eff} and SPAR functions with sky simulation)	5.2.14	
GRB Notification Time to Spacecraft	Within LAT FOV, < 10^{-2} ph cm^{-2} (E > 1 GeV) for less than 30 secs	< 3 s	< 1 s	Instrument/spacecraft simulator	5.2.15	
AGN Location Accuracy On-Board	Within LAT FOV at high gal. lat., with $\Delta F > 2 \times 10^{-6}$ ph cm^{-2} s^{-1} (E > 100 MeV) for more than 1000 secs		< 2° (1σ radius)	Analysis (using measured, parameterized A_{eff} and SPAR functions with sky simulation)	5.2.16	
AGN Notification Time to Spacecraft	Within LAT FOV at high gal. lat., with $\Delta F > 2 \times 10^{-6}$ ph cm^{-2} s^{-1} (E > 100 MeV) for more than 1000 secs		< 1 min (after recognition)	Instrument/spacecraft simulator	5.2.17	

Particle Beam Sources

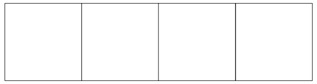
- Cosmics rays on the ground
  - All individual towers and the full LAT
- Van de Graff (17.6 Mev γ)
  - EM tower + qualification towers + only known energy γ into full LAT
- SLAC End Station A positrons (7 days) (1-45 Gev)
  - Four qualification towers
  - Calibrate energy response
- SLAC End Station A photons (22 days)
  - Four qualification towers
  - Measure PSFs and effective areas
- SLAC End Station A protons (30 days)
  - Four qualification towers
  - Measure proton rejection
- Cosmic rays in airplane (25,000 - 35,000 feet) (few hours)
  - Full LAT

Ground Cosmics

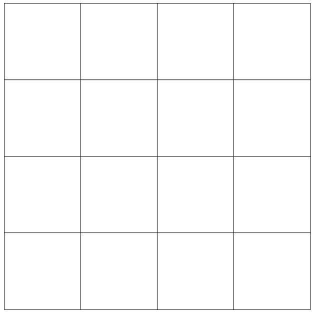
- Each tower as it becomes available at SLAC
  - ~10^6 muons @ ~20 Hz x 1 day (use 3 in-a-row tracker trigger)
  - Natural cosmic solid angle distribution. No muon telescope.



- Four Tower Calibration Unit

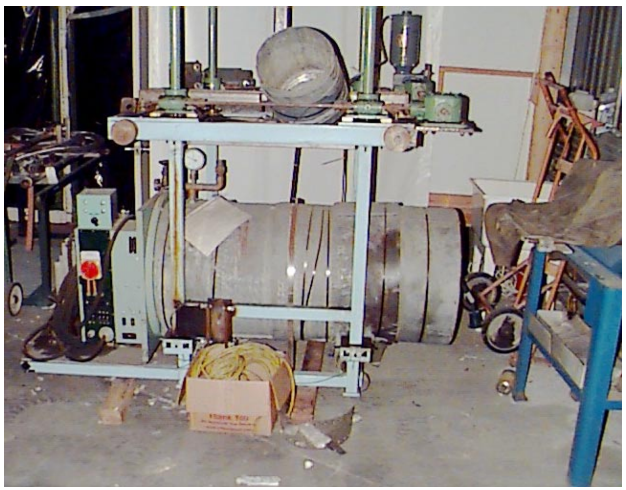


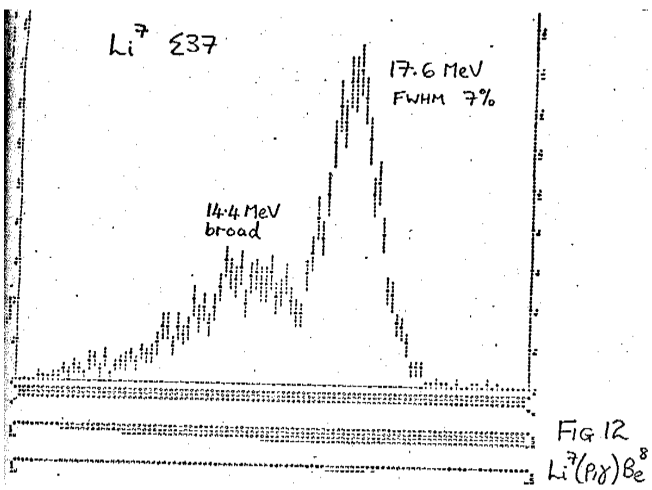
- Full LAT
  - ~10^8 muons @ ~300 Hz x 4 days (use 3 in-a-row tracker trigger)
  - Calibrate individual CsI xtals
    - ADC chans/Mev
    - Positional dependence
  - Calibrate tracker
    - Dead and noisy strip map
    - Straight tracks survey relative tray and tower positions
  - Calibrate ACD
    - ADC chans / Mev
    - Calibrate discriminator thresholds
    - Efficiency vs position
  - Trigger and DAQ
    - Search for problems
    - Efficiency vs position



Van de Graff

- (450 Kev) P + $Li^7 \rightarrow Be^8 + \gamma$ (17.6 Mev) (~1 Hz into 2π sr)
- EM tower and qualification towers
  - Calibrate energy response and resolution
  - 10^4 photons/tower @ .1 Hz x 1day
- Full LAT
  - Only known energy γ the full LAT DAQ will see before orbit





Xtal Ball spectrum. Sum of 37 NaI xtals. ~1800 γ in the 17.6 Mev peak. It's 7% FWHM is due to the resolution of the detector. The bump at 14.4 Mev is due to a broad excited state of Li7.

Strategy

- First, calibrate Four Tower Calib Unit energy response and resolution
  - 1–45 Gev e+ with variety of x,y,θ,Φ (7 days) (extrapolate to γ response with MC)
  - .1, .2, .5, 1, 2, 5, 10, 30 Coherent brems γ peaks, norm incid (3 days)
  - 20 and 50 Mev channeling radiation γ peaks, norm incid (2 days)
  - 17.6 Mev γ from Van de Graff

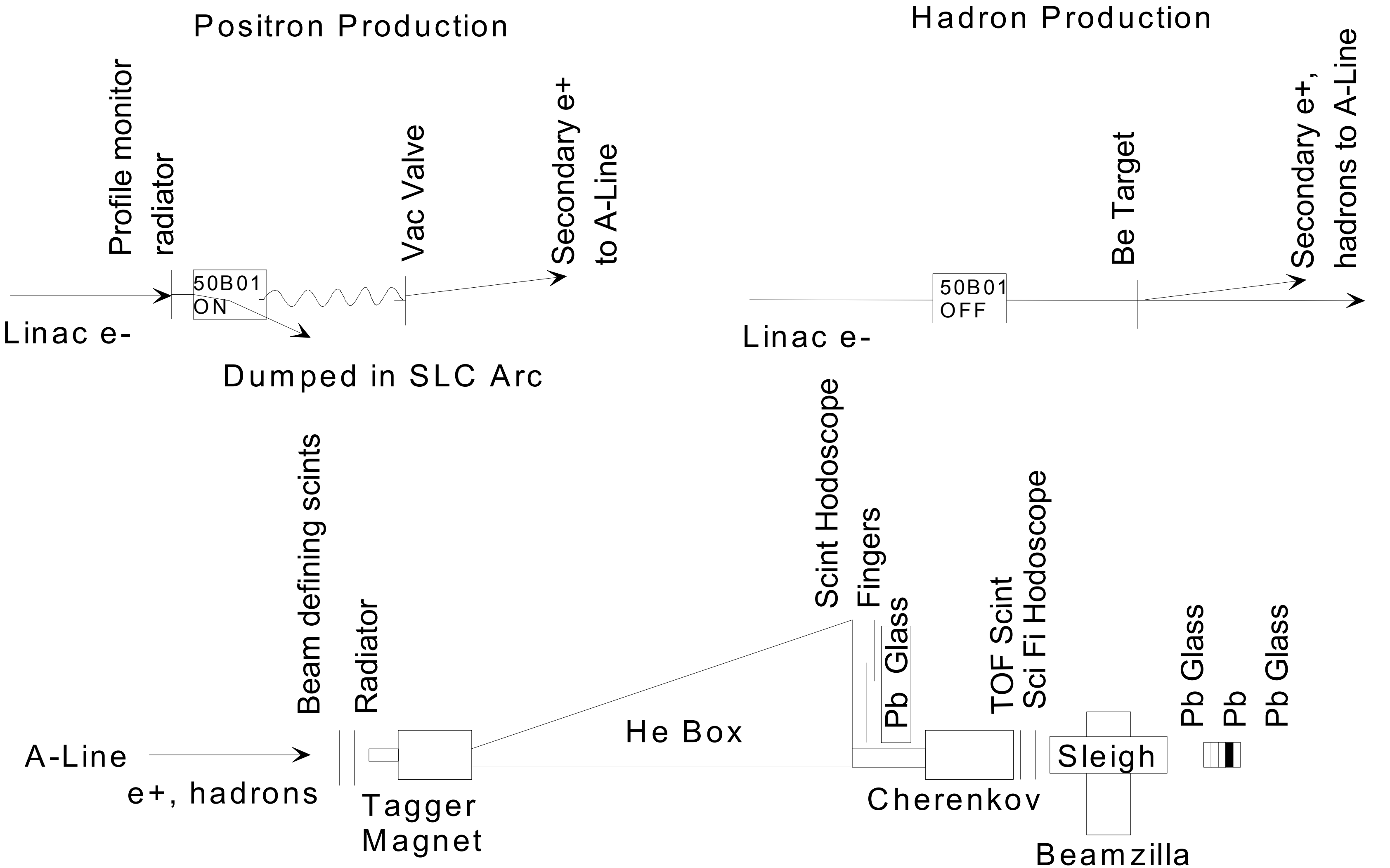
- Second, measure PSF and effective area
  - Bremsstrahlung γ beam at one e^+ energy (30 Gev) (17 days)
  - Simultaneously measures all γ energies from 20 Mev to 30 GeV
  - Brems spectrum has equal numbers of γ per % width energy bin.
  - Use already calibrated LAT to bin the photons into ±25% energy bins.
  - An example of bin edges= [Gev]
  - .017, .026, .038, .057, .086, .19, .29, .44, .65, .98, 1.5, 2.2, 3.3, 5.0, 7.4, 11, 17, 25

- Third, switch to hadron beam
  - ~200 K protons @ .0044 /pulse x 30 Hz x 30 days x .58 accel effic
  - This is the number of protons we recorded in 30 days in Beamtest 99.

End Station A Hardware

- Same as GLAST Beamtest '99 except:
  - Upstream quartz radiator and dump magnet replaces our old copper radiator and tagger magnet.
  - Instrument goniometer ("Beamzilla") to be upgraded to hold 4 towers in a clean, controlled, monitored, and approved environment.
  - Only certified people to work with flight hardware
- Schedule (abbreviated)
  - Aug '03 — First qual tower arrives at SLAC
  - Jan 5, '03 - Mar 7, '04 — Requested 2 months of ESA running around this period.
  - Jul '04 — Full LAT flies to environmental test

ESA Test Beams and GLAST Tower (Beamtest '99)



Runtime Estimate: ESA Positrons

$pos\_per\_pulse := .37$	Poisson probability of exactly one positron per pulse for an average of
$pulserate := 30$	[Hz]
$npositrons := 5000$	Number of positrons per point
$nenergies := 6$	Number of energies (1,2,5,10,30,45 Gev)
$nangles_{\theta} := 3$	0, 30, 60 deg
$nangles_{\phi} := 2$	0, 45 deg
$nxy := 4$	Transverse positions
$acceleffic := .5$	Accelerator running effic
$grid := 64$	Grid of xy positions at normal incidence
$setup := .25$	Setup time for each energy

$$Runtime := \frac{npositrons \cdot (nangles_{\theta} \cdot nangles_{\phi} \cdot nxy + grid) \cdot nenergies}{acceleffic \cdot pulserate \cdot 86400 \cdot pos\_per\_pulse} + nenergies \cdot setup$$

$Runtime = 7$ [days]

Runtime Estimate: ESA Coherent Brem

Calculation (Peter Bosted) of γ spectrum for four different beam energies and diamond xtal angles.

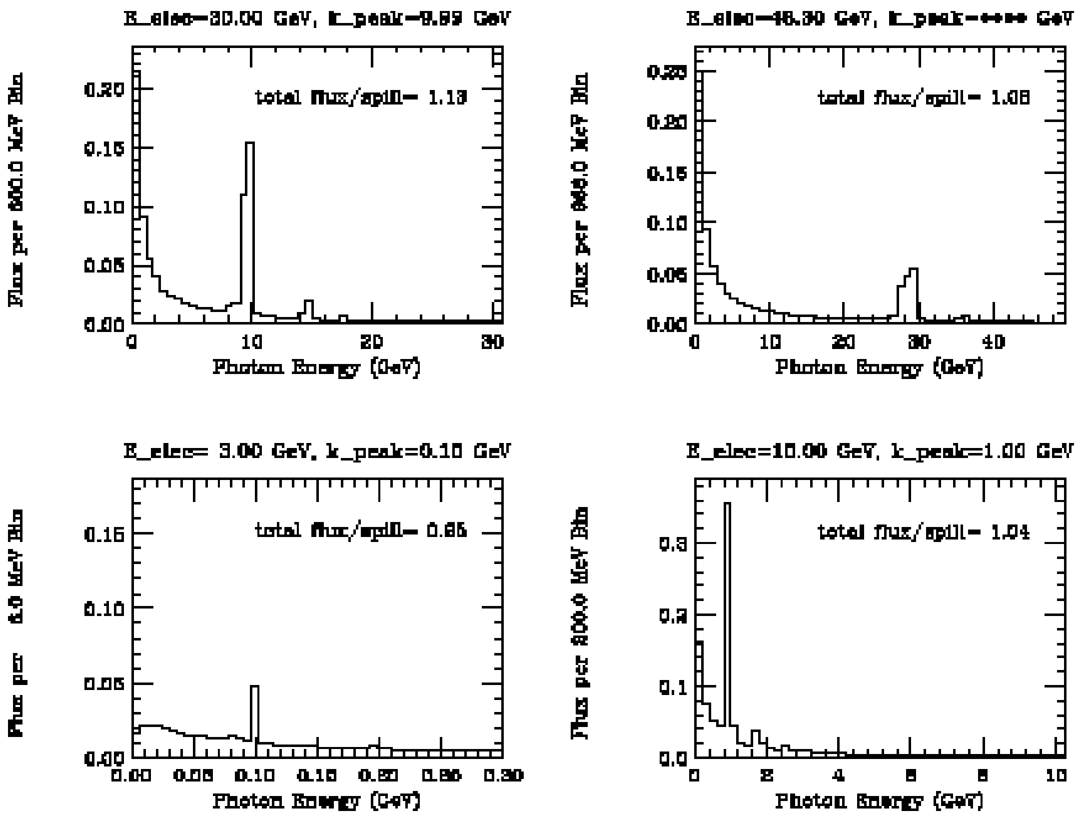


Figure 1: Number of photons per spill per energy bin indicated for the settings of Table I.

$nenergies := 8$	Number of energies (.1, .2, .5, 1, 2, 5, 10, 30)
$n\gamma avrg := 1$	Avrg of full spectrum + coherent brem / pulse
$pulserate := 30$	[Hz]
$n\gamma peak := 10000$	Number of γ s desired per point in the peak
$nangles_\theta := 1$	0 deg
$nangles_\phi := 1$	0 deg
$nxy := 1$	Transverse positions
$acceleffic := .5$	Accelerator running effic
$setup := .25$	Setup time for each new energy

$k := 0 .. nenergies - 1$

$frac_k :=$ Frac of all gams in the peak

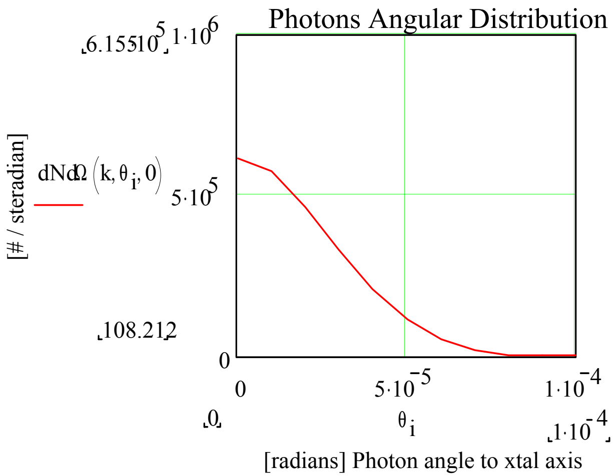
$frac_k$
.05
.1
.2
.40
.4
.4
.29
.15

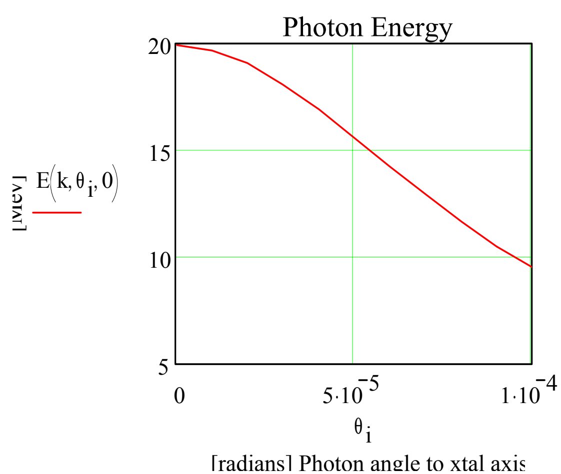
$$Runtime := \sum_k \frac{n\gamma peak \cdot (nangles_\theta \cdot nangles_\phi \cdot nxy)}{acceleffic \cdot pulserate \cdot 86400 \cdot n\gamma avrg \cdot .37 \cdot frac_k} + nenergies \cdot setup$$

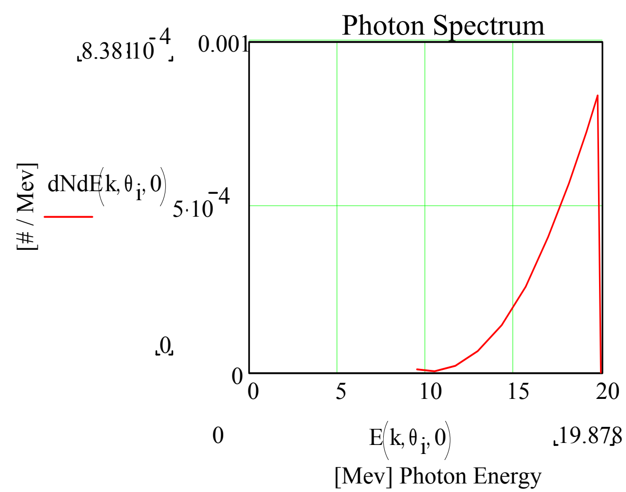
$Runtime = 3$ [days]

Runtime Estimate: ESA Channeling Radiation

- Positron bounces back and forth between two lattice planes in a xtal.
- Graphs below are for 6 Gev positron beam on a 50 um thick diamond xtal.
- .0029 γ / e^+ in the third plot's peak
- Only ~.0001 γ/ positron pollution of peak from bremsstrahlung (if e+ channels)
- Possible problem: Angular divergence of secondary e^+ beam is larger than the channel's acceptance. The many e^+ that don't channel will just cause brems background.







Runtime Estimate: ESA Channeling Radiation

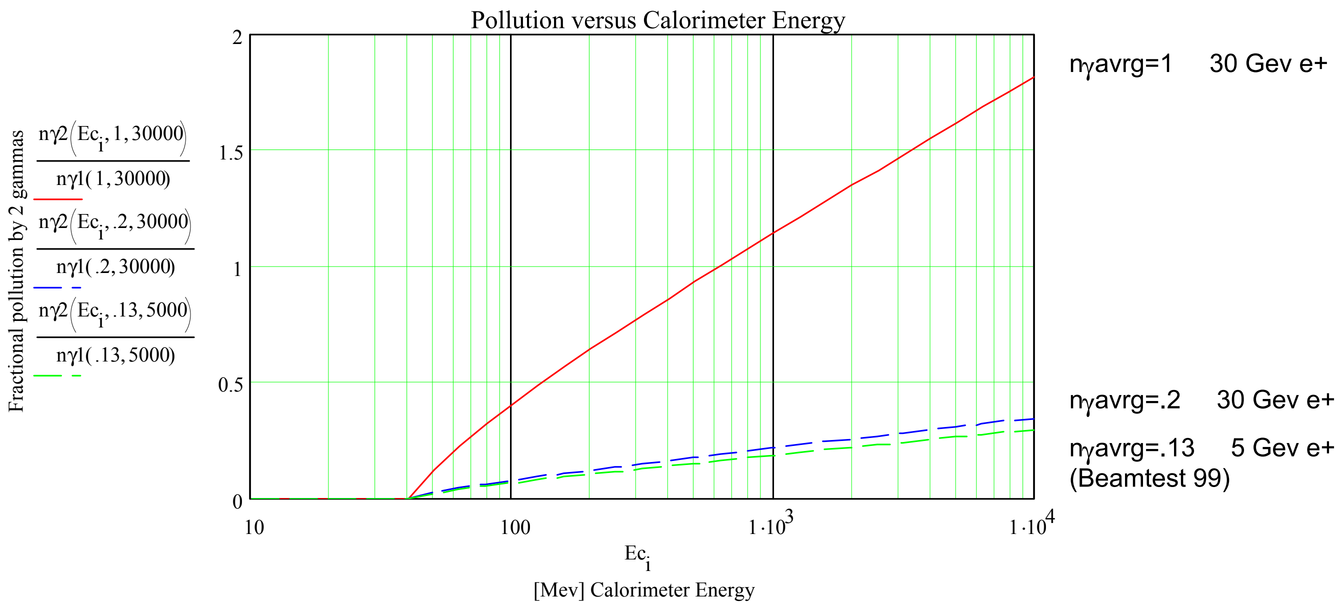
$nenergies := 2$	Number of energies (20, 50 Mev)
$n\gamma avrg := 1$	Avrg of full spectrum brem + chan peak / pulse
$frac := .1$	Probability of exactly one gam and it is in chan peak (guess)
$pulserate := 30$	[Hz]
$n\gamma peak := 10000$	Number of γ s desired per point in the peak
$nangles\theta := 1$	0 deg
$nangles\phi := 1$	0 deg
$nxy := 1$	Transverse positions
$acceleffic := .5$	Accelerator running effic
$setup := 1.$	Setup time for each new energy

$$Runtime := \left[\frac{n\gamma peak\cdot(nangles\theta\cdot nangles\phi\cdot nxy)}{acceleffic\cdot pulserate\cdot 86400\cdot n\gamma avrg\cdot .37\cdot frac} + setup\right]\cdot nenergies$$

$Runtime = 2$ [days]

Brems Beam Measurements of PSF and Effective Area (Photons / Pulse vs. Photon Pollution)

- Average number of photons / pulse =1 maximizes the Poisson probability of exactly 1 photon in the pulse, but:
  - Sometimes 2 γ/pulse (eg: 20 Mev + 980 Mev). PSF can't tell which converted.
  - If the 980 Mev γ converts we measure the correct 1 Gev PSF.
  - If the 20 Mev γ converts we put tails on the 1 Gev PSF
- Calculation for 30 Gev positron beam and two # γ/pulse (1 and .13)
  - Brems γ's detectable 20 Mev to 30 Gev, ±25% calorimeter energy bins



- Therefore, trade off # γ/pulse (runtime) vs. PSF pollution
  - Must always use MC to unfold the true instrument PSF at a given energy

Calculation That Gives the Photon Pollution Plot

Assume that the calorimeter is being used to select the desired energy photon. Assume the positrons/pulse times radiator thickness are adjusted to give $n\gamma avrg$ "full spectrum photons" per pulse.

$Emin := 20.$ [Mev] minimum energy converable gamma

$$poisson(n, navrg) := \frac{e^{-navrg} \cdot navrg^{n}}{n!}$$

$fracwidth := .5$ fractional full width of the gamma's energy bin

Calculate the probability per pulse that there is exactly one brems photon in the calorimeter bin energy range. This is the poisson of 1 given the avrg number of photons per pulse in the bin.

$$n\gamma 1(n\gamma avrg, Ebeam) := poisson\left[1, n\gamma avrg \cdot \left(\frac{1}{\ln\left(\frac{Ebeam}{Emin}\right)} \cdot fracwidth\right)\right]$$

Calculate the probability per pulse that there are exactly two photons that sum up to be in calorimeter energy bin. Since we select on calorimeter energy, we can not tell that there are really two photons of undesired lower energies.

$$n\gamma 2(Ecal, n\gamma avrg, Ebeam) := \left(\frac{n\gamma avrg}{\ln\left(\frac{Ebeam}{Emin}\right)}\right)^{2} \cdot \int_{Emin}^{if((Ecal - Emin) < Emin, Emin, Ecal - Emin)} \frac{1}{E \cdot (Ecal - E)} \, dE \cdot (fracwidth \cdot Ecal)$$

Not all of these two photon events are bad, though we are assuming they are for simplicity. One photon may be within fracwidth. Then there is only a 50% chance that the lower energy photon is the one to convert and pollute the point spread function measurement. If both photons are outside fracwidth, then there is a 100% chance that the conversion is pollution.

$i := 0 .. 30$ $\quad Ec_{i} := 10^{\frac{i}{10}+1}$

Runtime Estimate: ESA Bremsstrahlung

Use 30 Gev e^+ beam. Choose $n\gamma avrg$ to give 22% lower energy γ pollution for 1 Gev γ bin. This is ~same pollution as in Beamtest 99.

Gamma running to measure PSF and Effic with a brems beam.

$n\gamma avrg = 0.2$	Avrg number of full spectrum (20 mev - 30 GeV) gammas per pulse
$ngam\_brem = 0.013$	Poisson prob of exactly one γ per pulse that is in a 50% full width energy b
$pulserate := 30$	[Hz]
$ngammas := 10000$	Calorimeter gammas per energy bin (psf measurement)
$nangles_\theta := 3$	0, 30, 60 deg
$nangles_\phi := 2$	0, 45 deg
$nxy := 4$	Transverse positions
$grid := 6$	Normal incidence positions exploring the edge of the LAT
$acceleffic := .5$	Accelerator running effic

$$Runtime := \frac{ngammas \cdot (nangles_\theta \cdot nangles_\phi \cdot nxy + grid)}{acceleffic \cdot pulserate \cdot 86400 \cdot ngam\_brem}$$

$Runtime = 17$ [days]

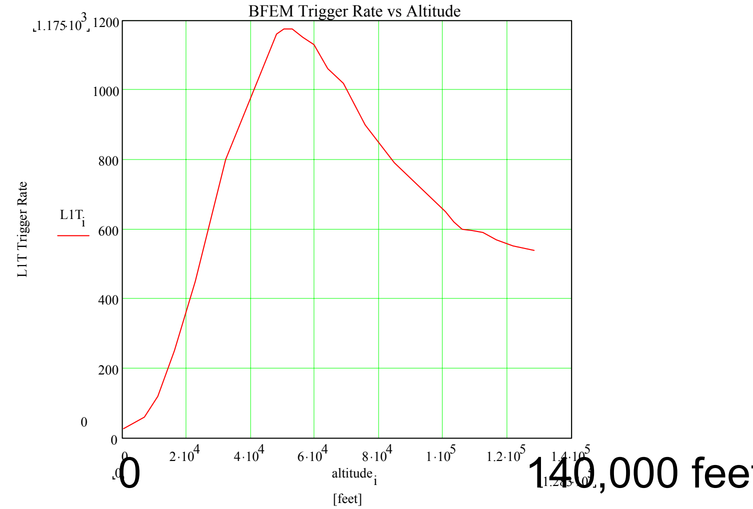
Runtime Estimate: Protons

- Avrg of 1 particle/pulse maximizes the exactly 1 particle pulses
- Mostly positrons and pions
- .0044 protons/pulse (measured in Beamtest '99)
- ~200 K protons @ .0044 /pulse x 30 Hz x 30 days x .58 accel effic
- Choose a select variety of x,y,θ,φ
- Full proton rejection = ACD rejection x Pattern cut rejection
- Expect pattern cut rejection of 10^2 to get full rejection of $10^{5\text{-}6}$.
  - Ignore the ACD (otherwise the scintillator will reject ~all the protons!)
  - Only measure the pattern cut rejection factor and validate the MC

Cosmics in Airplane

- Full LAT in an airplane (during airplane ride to NRL environmental test)
- L1T trigger rate measured in single tower during Balloon Flight

Altitude [Feet]	BFEM L1T [Hz]	Notes
0	25	Ground
25,000	540	Same rate as in orbit
35,000	900	Airplane flight
50,000	1175	Pfotzer max
127,000	540	~Orbital rate



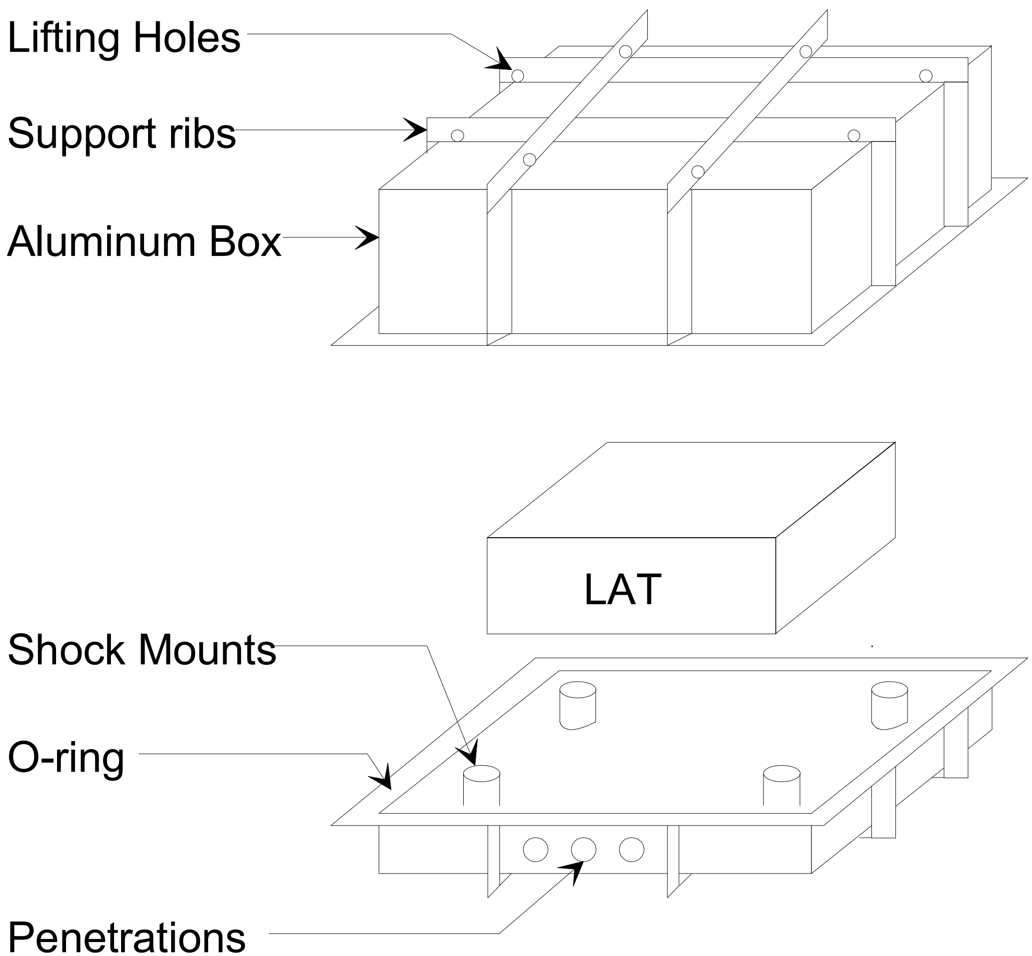
- At 25,000 feet verify the flight hardware at orbital L1T rates
  - ~25 (BFEM size towers) x 540 Hz = 13.5 kHz
  - DAQ doesn't crash
  - Software filter handles the rate and produces the expected downlink rate
  - Livetime is accurately measured
- At 35,000 feet test the flight hardware at > orbital L1T rates
  - ~22 kHz saturates the LAT trigger
  - DAQ should not crash

LAT Shipping Box Features

- Capabilities already present from taking cosmics in Bldg 33.
  - Mechanical support points on grid
  - Liquid cooled heat exchangers bolted to grid radiator surfaces
  - LAT only works in horizontal position because of grid heat pipes
  - Portable 1-2 Kw liquid chiller (<0° C for SLAC pre-thermal-vac tests?)
  - Pseudo solid state recorder on the 30 Mbit/sec data cable
  - Cat 5 cable to the GSE computer (=Laptop computer in plane)
  - LAT runs on 28vdc
- New shipping box features
  - Shock mounts to support points on grid
  - Box thermal insulation so elec power + chiller stabilizes temperature
  - MicroDAQ (3 of them) Monitors (Temp,Press,Hum,3 axises accel)
  - Flow dry nitrogen to keep humidity low
- DAQ philosophy (like Balloon flight)
  - Turn on 28 v power and LAT comes up recording data in a preset config.
  - Laptop is for realtime voltage, current, environmental monitoring
  - Laptop is for limited “mission creep” (few commands, event display,..?)
  - ~No new software beyond existing flight and GSE

LAT Shipping Box Conceptual Drawing

LAT Transport and Environmental Test Box



Schedule

Task	FY '02				FY '03				FY '04				FY '05			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Cosmic tests in Blg 33																
Design fixtures			X	X												
Build fixtures					X	X										
Tower data taking								X	X	X						
LAT data taking										X	X					
Van de Graff																
Refurbish		X	X	X												
Prepare Bldg 33		X	X	X												
Install					X											
Tower data taking							X	X								
ESA Beam Test																
Prepare beamline equip for summer '02 install	X	X	X													
Install diamond target and dump magnet				X												
Pre-GLAST Coherent+Channeling test runs					X				X							
Modify Beamzilla				X	X											
Install equipment on ESA floor						X	X	X								
GLAST Qual tower calibration unit data taking										X						
Airplane Cosmics																
Arrange for plane		X														
Design LAT Box			X	X												
Build LAT Box					X	X										
Use LAT Box in SLAC temp tests											X					
Flight to environmental tests												X				
Flight from environmental tests														X		
Man years of GLAST people																
Physicist - Group EK (Gary Godfrey)	0.5				1				1				0.5			
Post Doc - Group EK (new)					1				1				1			
*Physicist - Ray Arnold's group					0.5				0.5							
*Post Doc - Ray Arnold's group					0.5				0.5							
*Mech Engineer	0.25				0.25											
*Designer (BJ)	0.25				0.25											
*Mech Tech - Group EK (John Broeder)	0.25				0.25				0.25				0.25			
*Elec Tech (Justin Escalera)					0.25				0.25							
Man year profile=	1.25				3.75				3.25				1.75			
Notes:													Total man years=		10	
1) * means the labor is charged to GLAST budget																
2) SLAC does not charge beamline mods and accelerator running costs to GLAST																
3) SLAC EFD does not charge ESA setup costs to GLAST																