

Van de Graaff Runs and Status

March 8, 2005
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1) 12 hours of VG runs are scheduled for Tower A in the single bay.

2) Requirements from:

LAT-TD-03489-02 Ad Hoc Committee on End to End Testing

9. VDG tests

Run the VDG to collect 1 million (TBR) events at mean trigger rates of 100 Hz and 1 kHz (rates TBR). This test can be accomplished using either the VDG alone or the low-rate VDG mixed with solicited condition triggers as described above. Produce the following plots:

- i. A two-dimensional spatial image of the reconstructed VDG source in instrument coordinates. The images at higher and lower rates must match each other to 10%.
- ii. Histograms of time intervals between sequential events, and the accompanying FFT power spectrum. The deadtime corrected histograms of time intervals and resulting power spectrum is made for different trigger rates and for selected reconstructed energy bins. No unexplained, statistically significant features should be present in the power spectrum.
- iii. Reconstructed VDG energy spectrum. The higher-rate and lower-rate data sets must match.

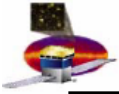
The VG is running consistently at a rate that will deliver 300 Hz of converted 17.6 Mev gammas to the full LAT ($300 \text{ Hz} \times 3600 \text{ sec} = 1.1 \times 10^6 \gamma\text{s}$).

Without a new accelerator column this is the highest rate the VG will achieve. Thus:

9i) Scheduled only at 300 Hz in LAT (100 Hz in single tower). VG target clearly seen in EM1 and EM2 tracks.

9ii) FFTs will be made on all VG data. BGO FFTs show flat Leahy Power=2. Reasonable EM1, EM2 FFTs have not been made yet because of no good clock. GASU will have a clock (sync'd to GPS ??)

9iii) Reasonable EM1 energy spectra have been made for zero suppression off. Zero suppression off VG data scheduled with TowerA and LAT.

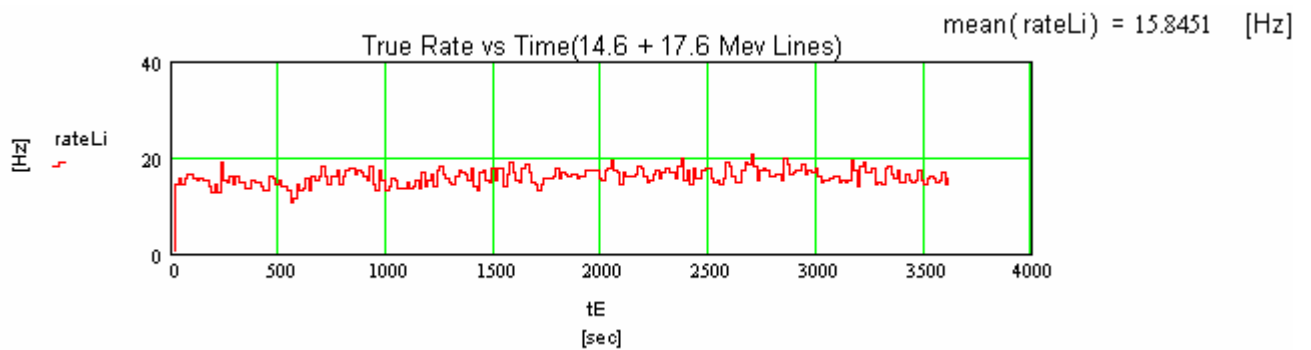
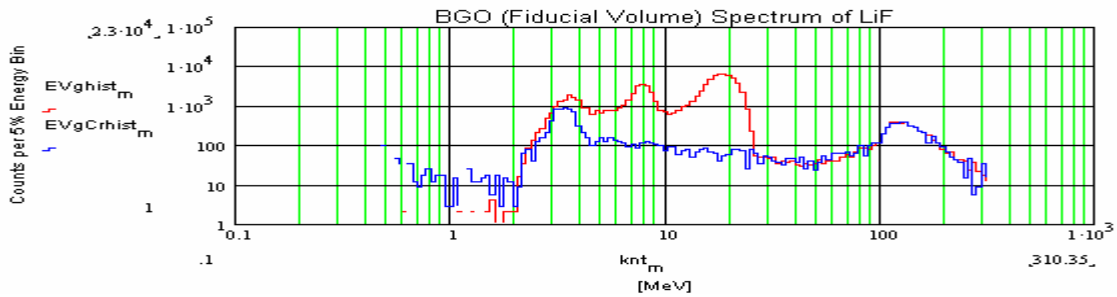


VDG Runs

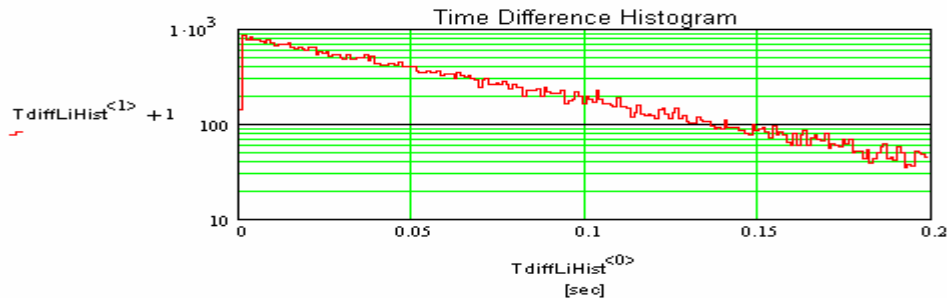
- **Current Data Taking configurations (13h)**
 - **9/1 : VDG, Nominal settings (1h)**
 - No zero suppression
 - **9/2, 9/3, 9/4: VDG, Nominal settings, vary rates (3 x 1h =3h)**
 - Place target at 3 different positions (1", 2", 4" from topmost Si tray) use Zero suppression On
 - **9/5, 9/6: VDG, Nominal settings but add pulse generator(2x 1h = 2h)**
 - Overlay Pulse generator at 1 and 10 kHz on VDG triggers
 - **9/7: Flight configuration, horiz orientation and TEM diagnostics is ON (1h)**
 - » Only occurs for tower A when tested with VDG photons – side below top layer of CAL
 - **9/8: Flight configuration, horiz orientation and TEM diagnostics is ON (1h)**
 - » Only occurs for tower A when tested with VDG photons – side above bottom of TKR
 - **B16: Flight configuration, horiz orientation and TEM diagnostics is ON (4h)**
 - **B11: same as B16 but with VDG OFF (1h)**
 - » Background estimation before tests with VDG photons

Recent VG Performance

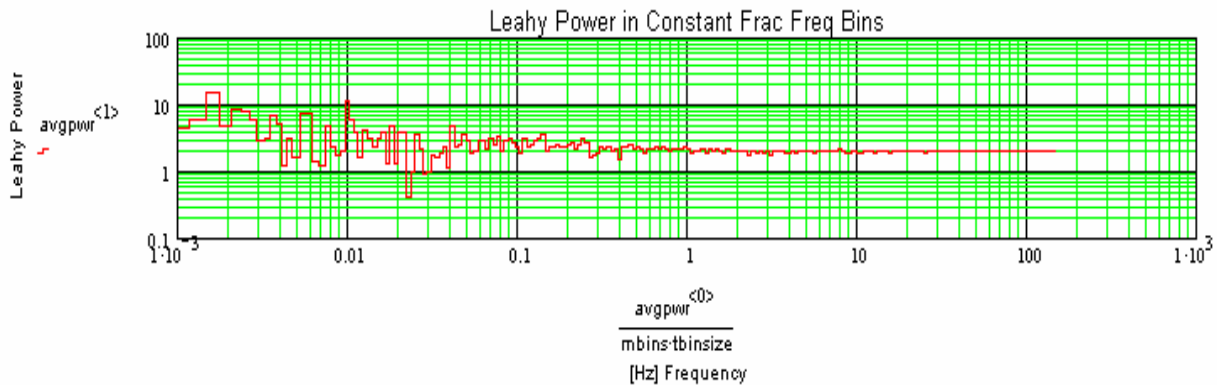
VG106.DAT simultaneous with EM2 run 139004752 (EM2 4 inch from LiF)



TdiffLiHist := Thist(TdiffLi, 200, .001)



avgpwr := vavrg(|pwr(Thist(tLi, mbins, tbinsize)), .05)

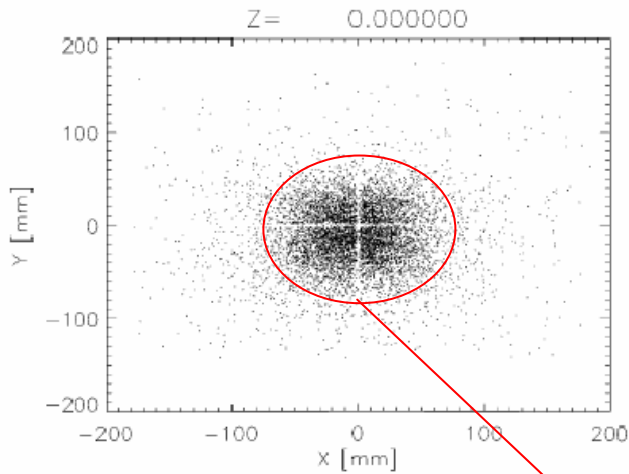


Monte Carlo Trigger Rates Summary

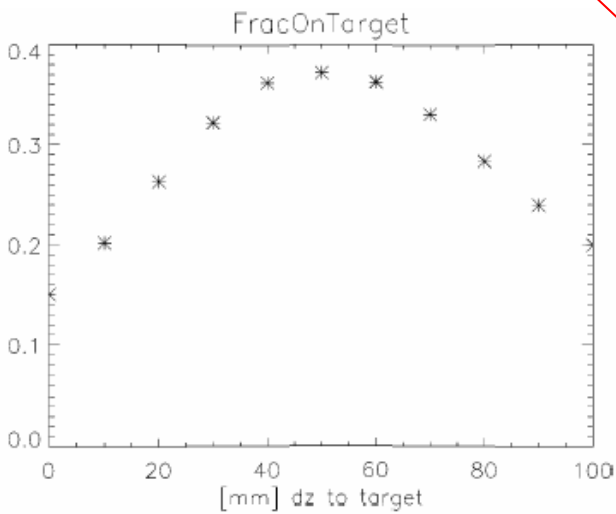
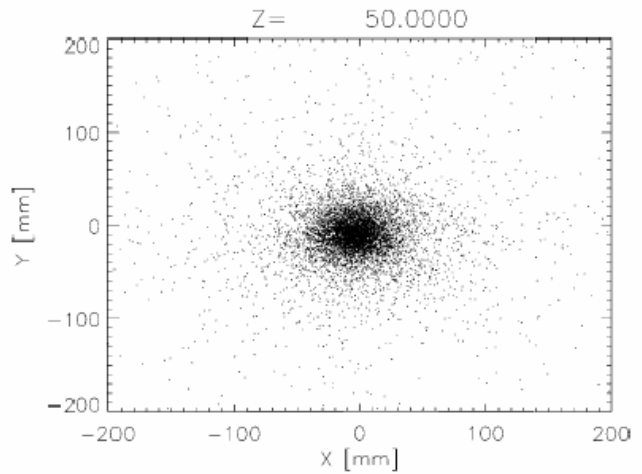
Configuration – Van de Graaff On	MC $\Omega \times$ effc [sterad]	Relative to BGO	γ Rate [Hz]
BGO (14.6 + 17.6 Mev lines)			
BGO front face 6.0" from center of target.	.148 \pm .001	1.000	15. (LiF target)
3-in-a-row Tracker Trigger			
EM1 top tray face 2.0" from center of target	.308 \pm .003	2.08 (2.2 seen)	
EM2 top tray face 1.0" from center of target	.495 \pm .004	3.34	
EM2 top tray face 2.0" from center of target	.398 \pm .004	2.69	
EM2 top tray face 4.0" from center of target	.271 \pm .003	1.83	
Tower top tray face 1.0" from center of target	1.099 \pm .011	7.42	
Tower top tray face 2.0" from center of target	0.909 \pm .015	6.14	
Tower top tray face 4.0" from center of target	0.657 \pm .012	4.44	
LAT16 top ACD face 1.0" from center of target	3.11 \pm .03	21.0	
LAT16 top ACD face 2.0" from center of target	2.95 \pm .03	20.0	
LAT16 top ACD face 4.0" from center of target	2.64 \pm .03	17.8	
LAT16 top ACD face 8.0" from center of target	2.10 \pm .02	14.2	
LAT16 top ACD face 16.0" from center of target	1.44 \pm .02	9.7	
LAT16 top ACD face 32.0" from center of target	.76 \pm .01	5.1	
LAT16 top ACD face 15' from center of target	.046 \pm .003	.31	
Configuration – Z-axis vertical, Cosmic rays sea level			Tracker Trig Rate [Hz]
3-in-a-row Tracker Trigger			
EM1			21.5 \pm .2
EM2			23.4 \pm .2
Tower			25.7 \pm .9
LAT16			309 \pm 9
Configuration – Z-axis vertical, Cosmic rays at sea level. Test device is between the muon telescope paddles.		Frac of Tel Trigs that should make Trker Trigs	Muon Telescope Trig Rate [Hz]
Old 24"x24" muon telescope (75" spacing)			2.97 \pm .04
EM2		.70 \pm .01	
Tower		.71 \pm .01	
New 15.5" x 15.5" muon telescope (75" spacing)			.89 \pm .02
EM2		1.00 \pm .02	
Tower		1.00 \pm .02	

EM1 VG Results

Tkr1 position in top layer



Tkr1 extrapolated to Target Z=50. mm



$\sim 0^\circ$ Effic = $\frac{\gamma \text{ per steradian seen in EM}}{\gamma \text{ per steradian seen in BGO}}$
 $= \frac{1200 / (.02 \times 2\pi \text{ ster})}{1152 \text{ sec} \times 13.35 \text{ Hz} / (.15 \text{ ster})}$
 $= .093 \pm .01 \quad (\text{due to } \pm 5\% \text{ BGO dist error})$

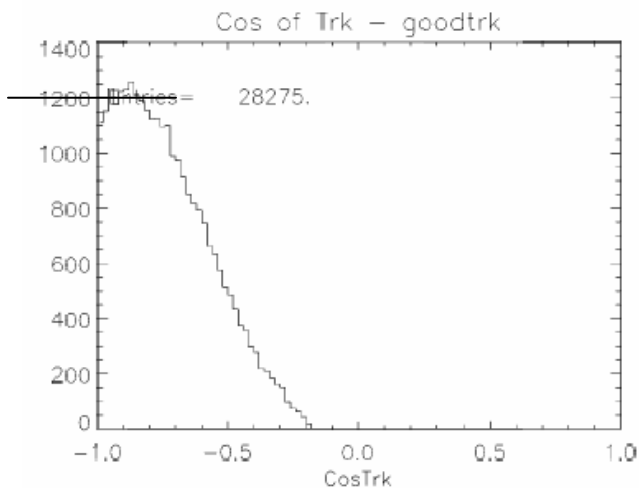
$\theta_{68 \text{ Measured}} = \text{acos}(.88) = 28^\circ \quad (\text{at } 0^\circ)$

$\theta_{95 \text{ Measured}} = \text{acos}(.46) = 63^\circ \quad (\text{at } 0^\circ)$

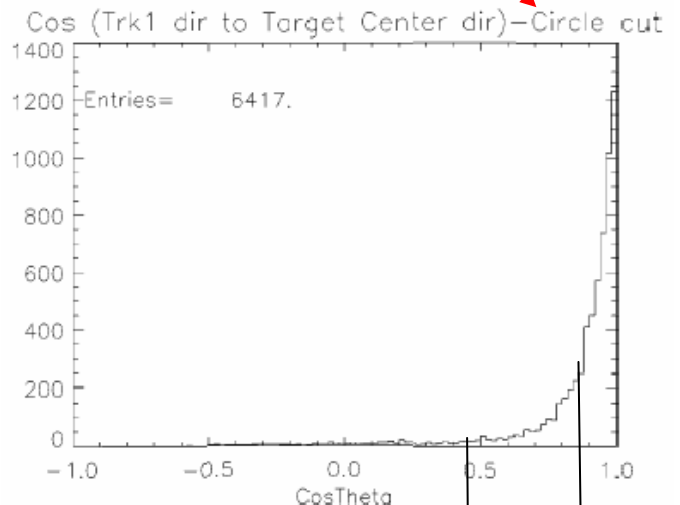
$\theta_{\text{target}} \sim (.75'' / 2.0'') \times (180 / \pi) = 21^\circ$

$\theta_{68 \text{ EM PSF}} \sim \text{sqrt}(\theta_{68 \text{ Measured}}^2 - \theta_{\text{target}}^2) = 21^\circ$

$\theta_{95 \text{ EM PSF}} \sim \text{sqrt}(\theta_{95 \text{ Measured}}^2 - \theta_{\text{target}}^2) = 59^\circ$



Tkr1ZDir



$\text{Cos}\theta_{95} = .46$	$\text{Cos}\theta_{68} = .88$
$\theta_{95} = 63.^\circ$	$\theta_{68} = 30.^\circ$

“Wildfire Events” from VG Now
(cause track recon to take excessive time)

EM1

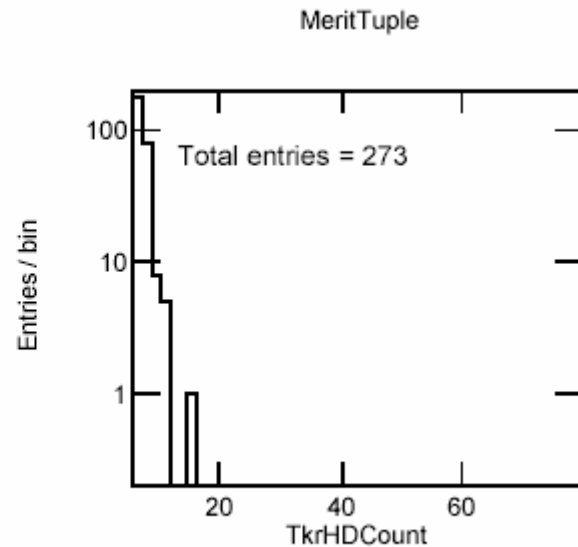
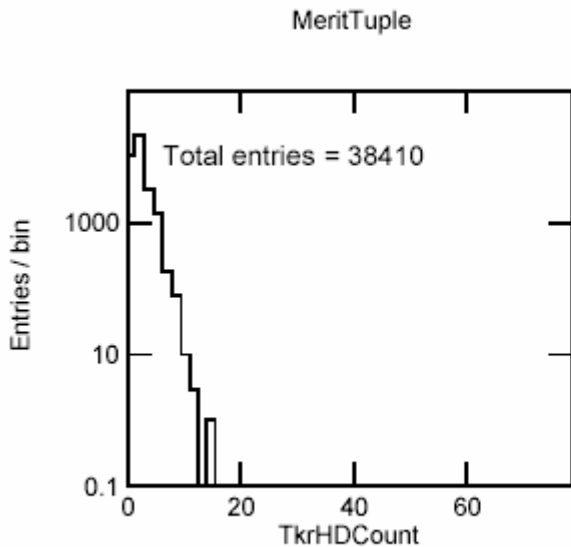
No Wildfire Events Seen

Run 031007004501

1” Target to EM1

BGO=13.35 Hz

TkrHDCount =number of unused clusters in the first xy layer



EM2

Wildfire Events Seen

Run 139004752

232/5000 = 5% of events

4” Target to EM1

$(232/5000) * (70249/3602 \text{ sec}) = .9 \text{ Hz}$

BGO=15.82 Hz

