First Look at FMA VdG Data

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1. Runs Analyzed
2. Cal-Hi without Cal-Lo: What triggered?
   • What Triggered: GemConditionsWord
   • Hard X-ray Bursts from VdG
   • Response of Cal Studied by CalMaxEne
   • How Was EM1?
3. Upward VdG Photons
   • Vertex Z Distribution
   • VtxZDir Distribution
   • Tkr1NumHits and Tkr1EndPosZ
   • X/Y Distribution at Z=−100 to 100 mm
4. Conclusion
Runs Analyzed in This Report

- Run 135000971: VdG at Cal Side: 138kevts, 3600sec
- Run 135000954: VdG off (Cosmic Ray): 101kevtd, 3600sec
- Run 135000949: VdG at Top (75mm): 284kevts, 3600sec
- Run 135000945: VdG at Top (75mm) No Zero-Suppression: 143kevts, 1564sec
What Triggered: GemConditionsWord

What causes CalHi without CalLo?

GemConditionsWord for CR, VdG Top, VdG Side

![Graph showing data with different conditions and entries per bin.]

- BlueFilledSquare: VdG below CalLayer 1 Run971
- GreenOpenTriangle: VdG Normal NoZeroSupp Run945
- GreenOpenSquare: VdG Normal ZeroSupp Run949
- RedColumn: Hor Cosmic Ray Run954
Hard X-ray Bursts from VdG
Can VdG deposit a few GeV?

CalEneSum Distr: CR, VdG Top, VdG Side

BlueDashed: VdG below CalLayer 1 Run971
GreenDotDashed: VdG Normal NoZeroSupp Run945
GreenDot: VdG Normal ZeroSupp Run949
RedSolid: Hor Cosmic Ray Run954

VdG at Cal Side
Response of Cal Studied by CalMaxEne

Cutoff at 1GeV >> Hits in Photodiodes

Multiple hard X-rays hitting on a smaller photodiode can make such distribution.
How Was EM1?
Something has been changed

CalEnergySum: EM1 VdG+CR/CR:CalLO/Tkr Trig

VdG at Cal Side with CalLO

1GeV
Vertex Z Distribution
VdG at Cal Side vs. Top

VtxZ0 Distr: CR, VdG Top, VdG Side

- BlueFilledSquare: VdG below CalLayer 1 Run971
- GreenOpenTriangle: VdG Normal NoZeroSupp Run945
- GreenOpenSquare: VdG Normal ZeroSupp Run949
- RedColumn: Hor Cosmic Ray Run954
VtxZDir Distribution
Tendency to align to z-axis

VtxZDir Distr: CR, VdG Top, VdG Side

Blue Dashed: VdG below CalLayer 1 Run971
Green Dot Dashed: VdG Norm No Zero Supp Run945
Green Dotted: VdG Norm Zero Supp Run949
Red Column: Hor Cosmic Ray Run954
Tkr1NumHits and Tkr1EndPosZ (1/2)

Cosmic Ray vs. VdG at Cal Side

Tkr1NumHits
Cosmic Ray
FMA horizontal

Tkr1EndPosZ
Cosmic Ray
FMA horizontal

Tkr1NumHits
VdG Side + CR
FMA horizontal

Tkr1EndPosZ
VdG Side + CR
FMA horizontal
Tkr1NumHits and Tkr1EndPosZ (2/2)

(VdG + CR) - CR

Most stops at 1st encounter with Super-Layer

Many enters from the bottom as electrons.
Small fraction events start at the edge

Tkr1EndPosX and Y

(VdG + CR) - CR

Tkr1EndPosX

Tkr1EndPosY

Tkr1EndDirX

Tkr1EndDirY
Tkr1PosX and Y at Z=100, 50, 0 mm

(VdG + CR) - CR
Tkr1PosX and Y at Z=0, -50, -100 mm

\[(VdG + CR) - CR\]
Conclusion

1. **Good start:** Thanks to Eduardo, Xin, Gary G., Paul K., Anders and others
2. **Simple mitigation needed for hard X-ray hitting photo-diodes**
   - Require some signal in another photo-diode in a same log
3. **Need a robust method to eliminate e/$\gamma$ coming through Cal.**
   - $100\gamma(17.5\text{MeV})/s/sr$ produced 10/s “reconstructed” $\gamma$ events
   - In orbit, we expect ~2-300$\gamma$/s, ~2-300e/s (below ACD), ~1000p/s (below ACD)
     >> up to 50/s triggers (very crude guess: probably an overestime?)
     >> must filter down (on ground) to <0.005 $\gamma$/s to meet the Science Req.
4. **Hint of small difference between with and w/o zero-suppression**