

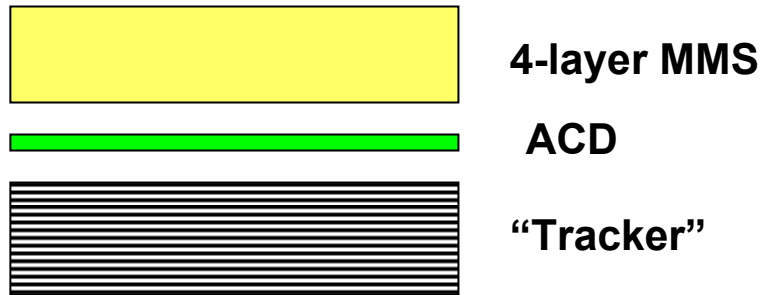
Background created in LAT MMS by protons

*Analysis of CERN-2006 beam test
results*

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Beam Test VRVS*

From my presentation on June 28, 2006:

Simulated (my Geant-3 code):
normal incidence protons on
4-layer thick MMS



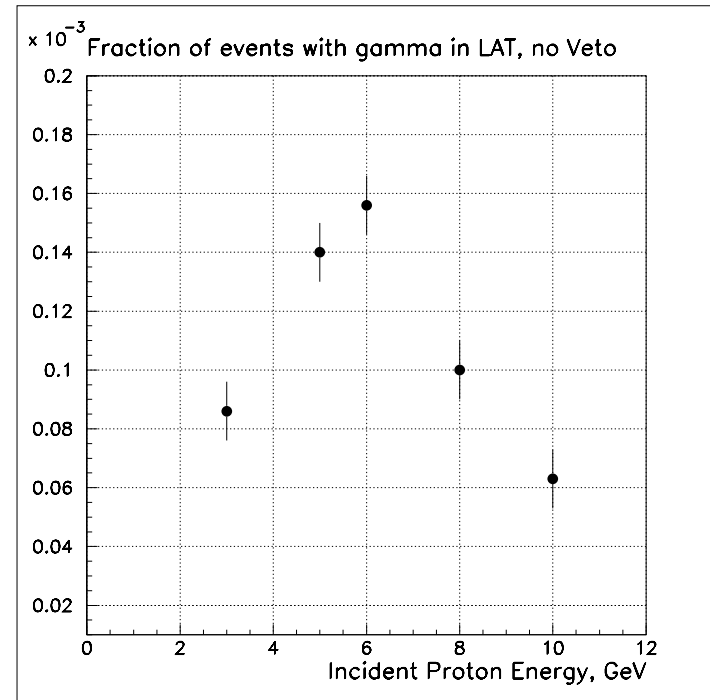
Conclusion: 1M proton events at 6 GeV will produce ~ 150 gamma-background events

Alex Moiseev 11/02/2006

Events were selected by:

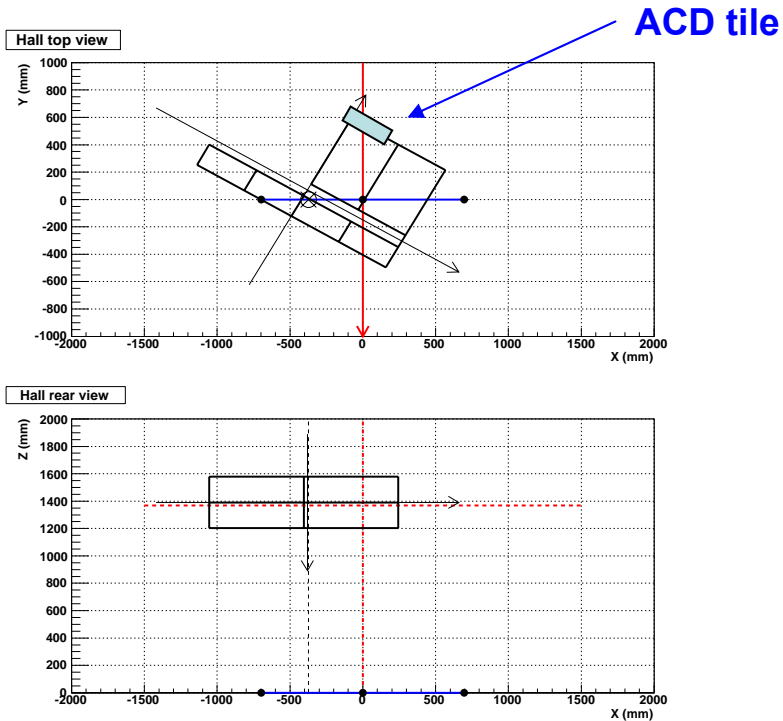
- signal in ACD < 400 KeV (~0.2 MIP)
- presence of at least one gamma with energy > 50 MeV in "Tracker"

Results:



Beam test at CERN, PS, July-August 2006

CU Position in MMS runs



List of available **proton** runs:

P, GeV	MMS	X, Y, Z, Theta	Runs	MC
6	Yes	93, 23, 600, -30	700001380 - 700001388	Not yet
10	Yes	93, 23, 600, -30	700001371 - 700001379	Not yet
6	No	561, 13, 0, 0	700001423	156 LHEP, 181 Bertini
10	No	561, 13, 0, 0	700001419	155 LHEP

Up-front Problems in Data Analysis:

- there was no proton run taken in the same configuration but without MMS, so it was impossible to directly compare the results obtained with and without MMS to remove side effects (hall background, beam contamination, CU functioning etc.). It makes difficult to select a clean sample of MMS-caused gamma events
- Monte Carlo simulations (by BeamTestRelease) are not available yet; Francesco is working on it. When it becomes available, obtained results will be better understood

Step 1. Initial (“auto”) selection of gamma-background candidates

- Geometry cuts: $VtxX0 > 85$
 $-20 < VtxY0 < 60$
- $AcdTileCount = 0$
- $Tkr1FirstLayer < 17$
- $CalEnergyRaw > 50$
- $Tkr1SSDVeto > 1$
- $CalTotRLn > 4$

Note: ACD tile crossed by the beam has a light yield of 15 p.e. and is viewed by a single PMT. With such parameters, it provides charged particle detection efficiency of 0.9991-0.9997 assuming detection threshold set to respectively 0.25-0.2 MIP

This results in ~ 250 missed protons in 500,000 events. From the other side, according to the simulations, we expect ~ 75 gamma-background events in such event sample. The use of the Tracker rejection power is necessary!

Step 2. Manual events selection

Purpose – attempt to remove obviously wrong events, which would be taken care of if “no-MMS” run was available

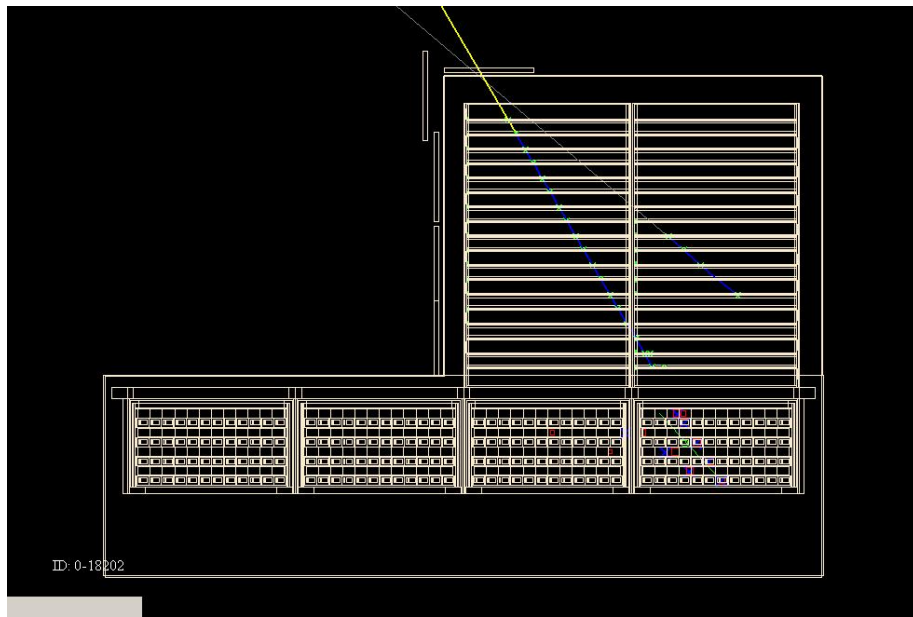
I created subsets of events which passed the “auto” cuts shown on previous slide (thanks to [David Paneque](#) who provided very good instructions how to do this), and checked them manually by FRED (thanks to [Luis Reyes](#) and [Riccardo Giannitrapani](#) for helping me to get FRED running)

Impressions:

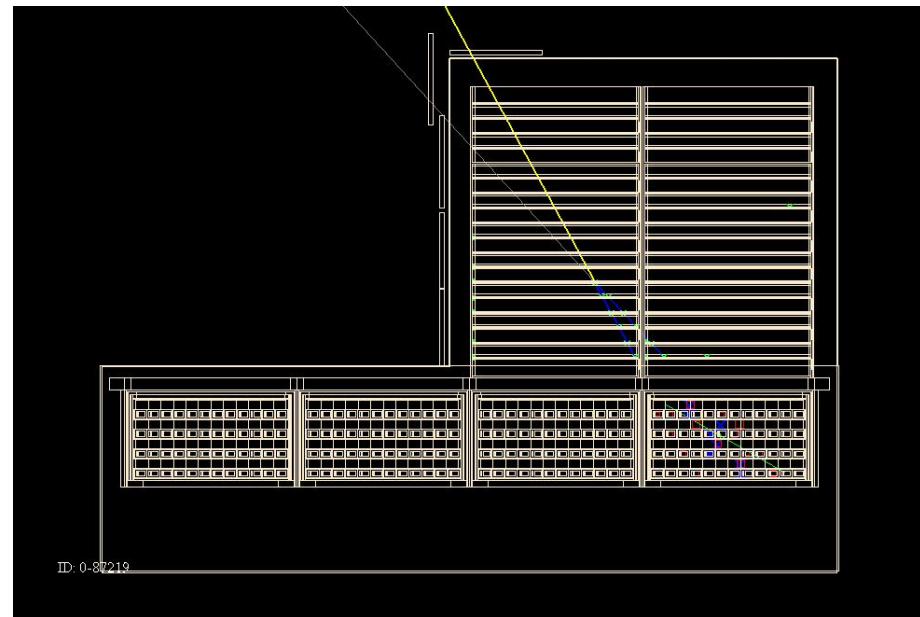
- Low energy gamma events look messy and very hard to reconstruct – I am amazed how the track reconstructor handles them
- Significant fraction of events, ~70%, look very reasonable as nice gamma-events (V-events, two gamma events)

Criteria of manual event removal:

- gamma-events but coming well away from MMS and beam direction – potential background
- charged particle tracks, especially pointing to the crack between two ACD tiles
- obviously spurious events



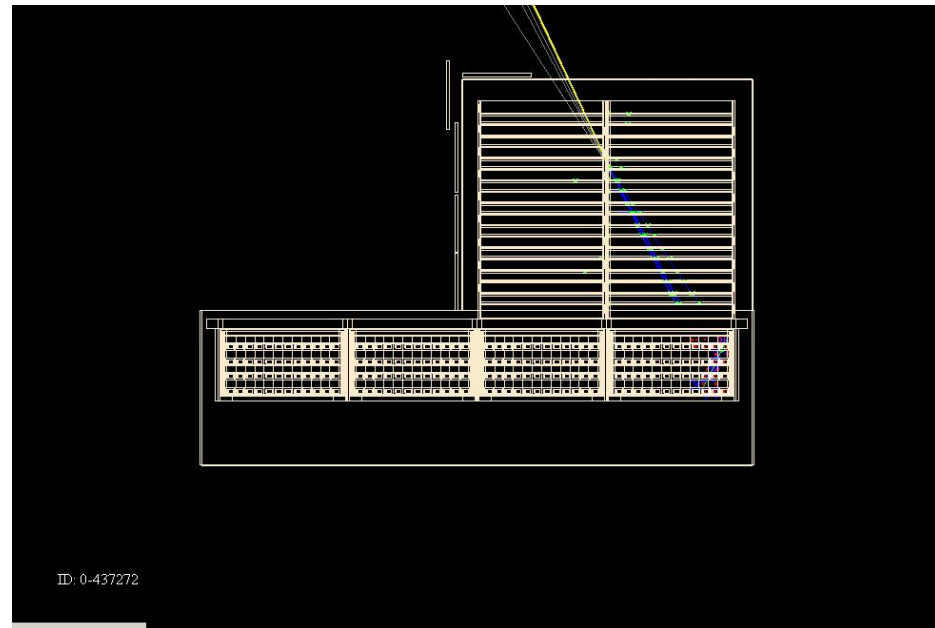
Good gamma-event



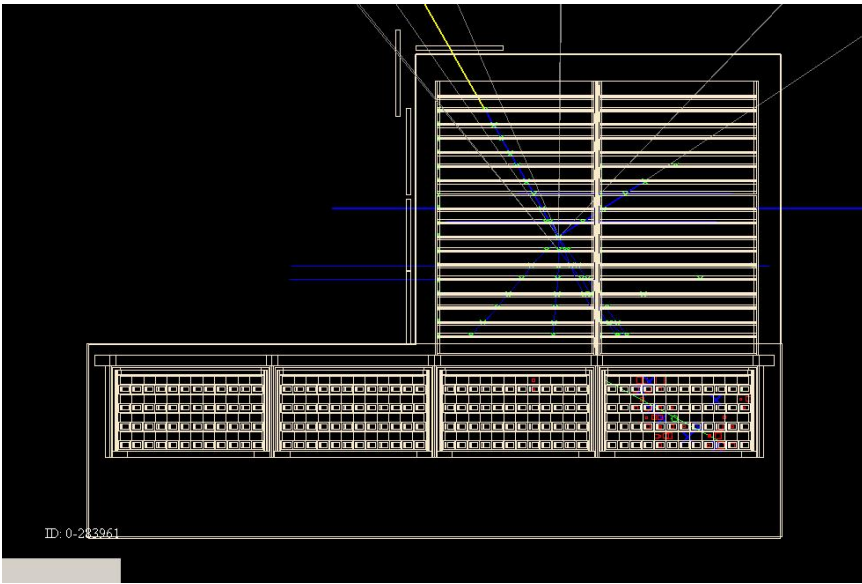
Good gamma-event



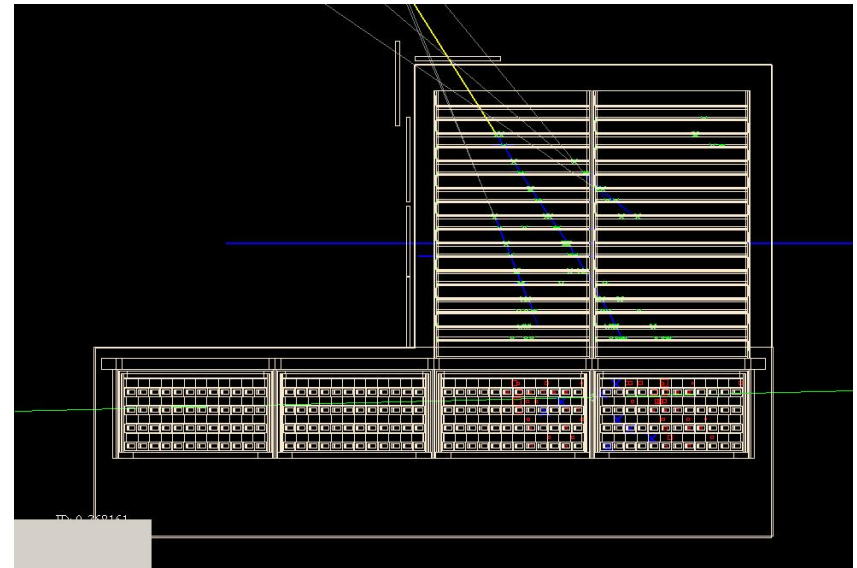
“Crack” event - removed



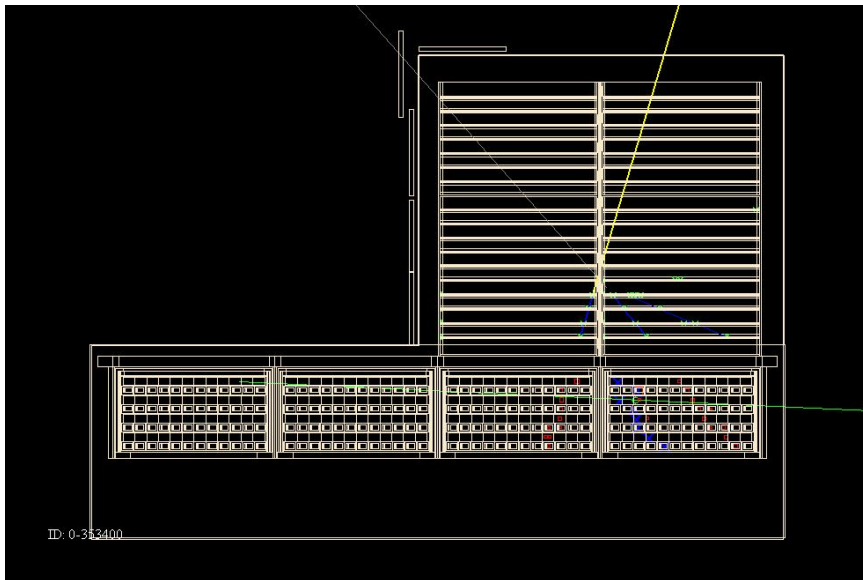
“Background” event - removed



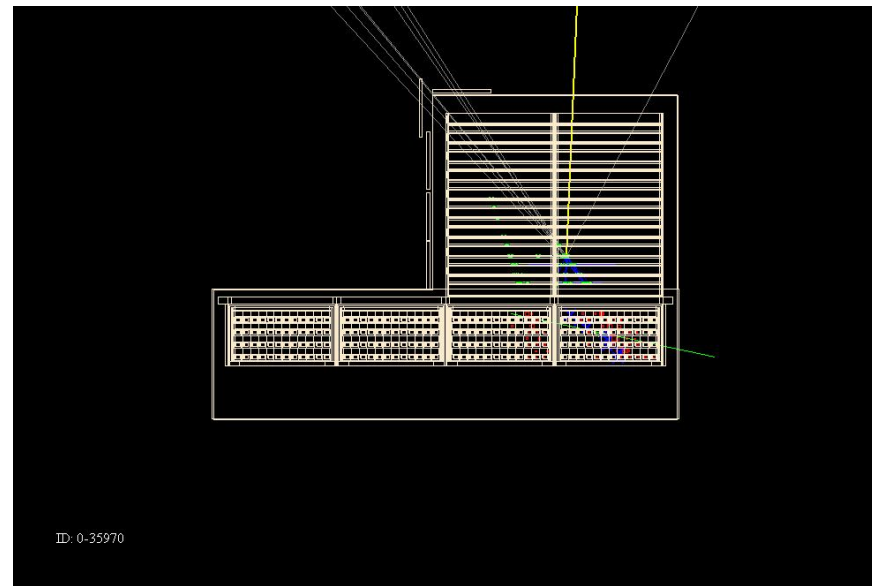
Proton, interacted in the middle of the tracker?



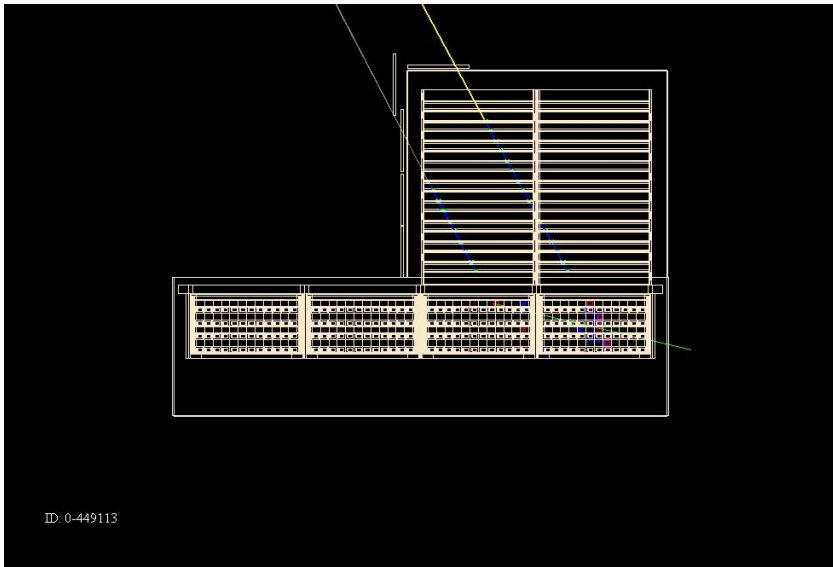
3 gammas!



Neutron, interacted in the middle of the tracker?

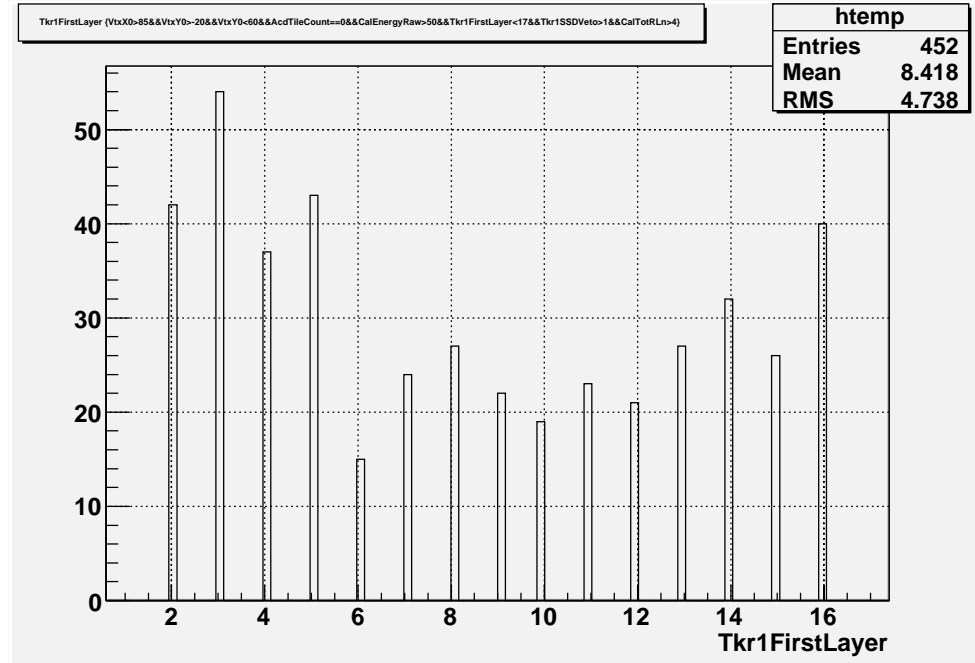


2 gammas



“Double” event – see them regularly, removed

Tkr1FirstLayer after “auto” cuts



I visually inspected ~50% of events passed “auto” cuts and propagated obtained fraction of survived “visual” cuts events to all statistics

RESULTS



	Total number of events	Number of events passed “auto” cuts	Number of events passed “visual” cuts	“Irreducible” background
6 GeV Protons, MMS	2.24×10^6	452	318	1.4×10^{-4}
10 GeV protons, MMS	2.6×10^6	567	414	1.6×10^{-4}

Conclusions:

- Obtained probability of production of “Irreducible” gamma-background events is consistent with that predicted by Geant-3 simulations
- Predicted energy dependence was NOT observed
- BeamTestRelease simulations are waited
- Attempt to use runs without MMS was not successful – ACD tile was not crossed by the beam in that runs, which resulted in ~50 times more background events. Maybe more careful look at these runs would be more productive