Hadronic Processes in the MMS

Objective

Measure the probability for incident proton to create gamma (>30-50 MeV) in MMS without a signal in ACD, to be compared with the results of simulations. These gammas would be **unrecognizable background**. How can it happen: proton interacts in MMS such a way that gammas from pi_0 go toward LAT, and all other charged secondaries miss the ACD (rare but possible event geometry) or create there underthreshold signals. It is clear that the probability of this case quickly goes down with the increase of incident proton energy - higher multiplicity and higher energy of secondaries. This background is important for diffuse gamma radiation especially extragalactic

Experimental Set-up

MMS in front of the instrument, with ACD tile behind it. **Important:****Tile "4" may have to be moved, because the beam has to shoot in its center, to eliminate the possibility of beam to physically miss the tile. ****Beam:** 5 GeV normal incidence **"pencil"** proton beam. **Needed statistics**~ 1M protons. If more - better. The best to provide reliable "pencil" beam would be to have 1cm by 1cm plastic scintillator attached directly in the center of MMS and included in the trigger. Desirably to increase the thickness of MMS (say have there 4 layers) to increase the effect - is there anything against it?

If the beam energy goes up to 10 GeV, the effect of background creation goes down by a factor of 2-2.5

Trigger

external beam trigger. Should be clean and free from "empty" triggers. Actually empty triggers will be identified by CU

Very important is to have a "pencil" beam (see above in "Experimental setup" section) to eliminate the events when incident particle misses the ACD due to the beam divergency. Small (1cm by 1cm) triggering scintillator attached just in front of MMS would do the best job

Data Taking Configurations and Relevant Runs

To be defined

Predictions from MC Simulations

My Geant 3 simulations predict the probability of *~1.5*10^-4 (!!!)*to have 1 or 2 gammas above 50 MeV in CU with the signal in ACD tile below 0.2 mip (400 KeV) for proton incident energy of 5 GeV. Among those there are about 70% events when there is single gamma, which is absolutely identical case to legal celestial event (2 gamma events can be removed if both are detected)

What was simulated - simple setup, with 12 cm thick (4 times thicker than the real MMS) "MMS", made of CH2 with 0.1 g/cm^3 density. The scintillator tile p- regular ACD tile, 1 cm thick. I did not do any light yield convesrion, just analyzed the energy deposited in ACD tile - I set a detection threshold at 400 KeV, which is ~0.2 normal incidence mip. Would be great if someone (Francesco?) could try this setup in Geant 4

Possible Experimental Backgrounds

In the attachment

Results and Discussions

In the attachment