

# Issues with Albedo Gammas in LAT

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September 2, 2002

History) The prototype tracker tray went through 2 vibration tests (one in Feb. 02 and the other in June 02). In the June test, the bottom tray made of carbon-carbon cracked. A team was formed under leadership of Dick Horn (TK is a member) to investigate the cause and recommend a path to recovery. From the first meeting of the team, it became apparent that the bottom tray, the mount to the Grid, and the tracker side-wall attachment need redesign.

Right after our successful completion of the Delta Lehman Review, TK proposed to the PI and IPO that the above redesign give us the last chance to add tungsten foils to the bottom trays where the current design include no foil.

TK's arguments for this proposal (to follow) are:

- 1) Without tungsten foils, a few MeV electron can give L1T trigger. They can be generated by low energy albedo gammas and  $e^-/e^+$  which are abundant.
- 2) According to Geant4 BFEM study, adding 3 W foils of nominal thickness (3%RL) will reduce the number of albedo gammas to about a half.
- 3) It is always a good practice to control the minimum energy for the trigger because low energy particles are "uncontrollable" or "unpredictable"..
- 4) If redesign is done with the major redesign due to the mechanical failure, the incremental cost and schedule impacts will be minimum.

TK has checked with the Tracker Subsystem Manager and Project Manager (Robert Johnson and Tom Borden) that tungsten foils of nominal thickness (150 micron and 250 gram, the same as the standard trays) are readily available and Tracker wall holes can be Readjusted, if so told.

This issue has also been studied by Steve Ritz, Bill Atwood. They have slightly different different view but TK agrees in most part: **the gain or the reduction is only a factor of two (or less if only 2 trays are to be changed) as you will see in the following pages.** Peter wanted this issue be better studied before bringing to the IDT meeting. However the time may run out before completing deeper studies and TK as Chair of the IDT Meeting wants to inform the Collaboration of the issue.

TK agrees with Steve Ritz and Bill Atwood that we have to simulate with our new Geant4 LAT simulator, Glead. Steve and Bill have already began such a study and the Collaboration will hear about the results.

Please feed back your thought, wisdom and opinion to any one of us.

**Please come to Sept. 10 IDT Meeting.**

# Evidence that thin W foils in the bottom trays reduces triggers by albedo gammas - What we found in BFEM -

## Albedo Gamma-rays studied with BFEM Geant 4

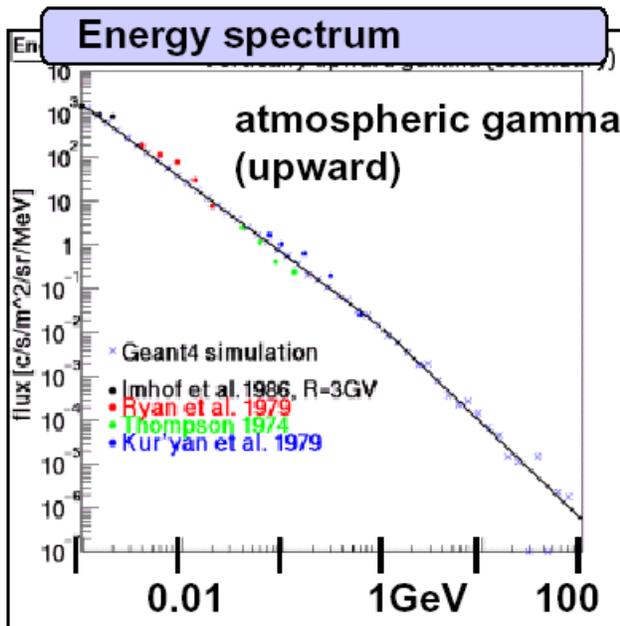
[Assumptions: Atmospheric depth =  $4\text{g/cm}^2$ ; geomagnetism = that near Palestine, TX; BFEM pointing = the zenith]

[Note: Downward moving flux is mostly due to the air above and will become almost zero for LAT in orbit; Upward moving flux is mostly due to the air below and will be similar for LAT in orbit.]

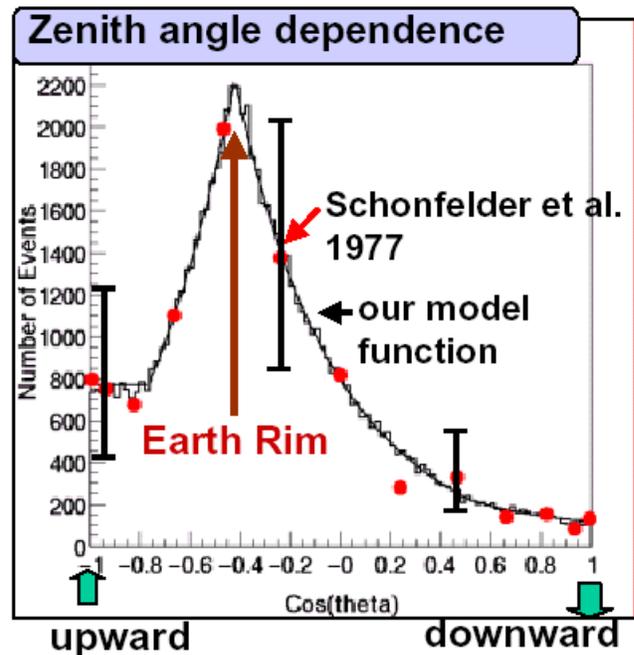
June 13<sup>th</sup>, 2002



## Cosmic-Ray Model: Gamma



•Upward gamma-ray flux is similar to that in GLAST orbit.



•Angular dependence of the flux is poorly known.

•We also implemented alpha, e-, e+, and muon spectra.

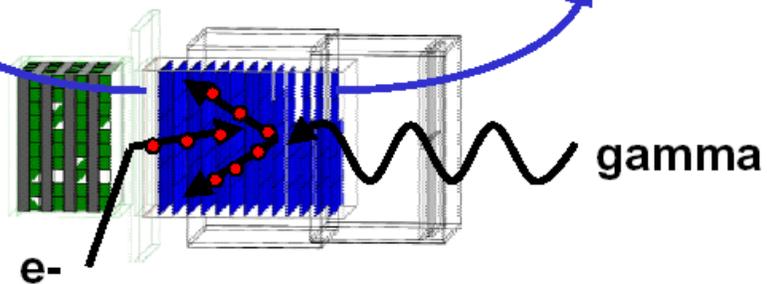
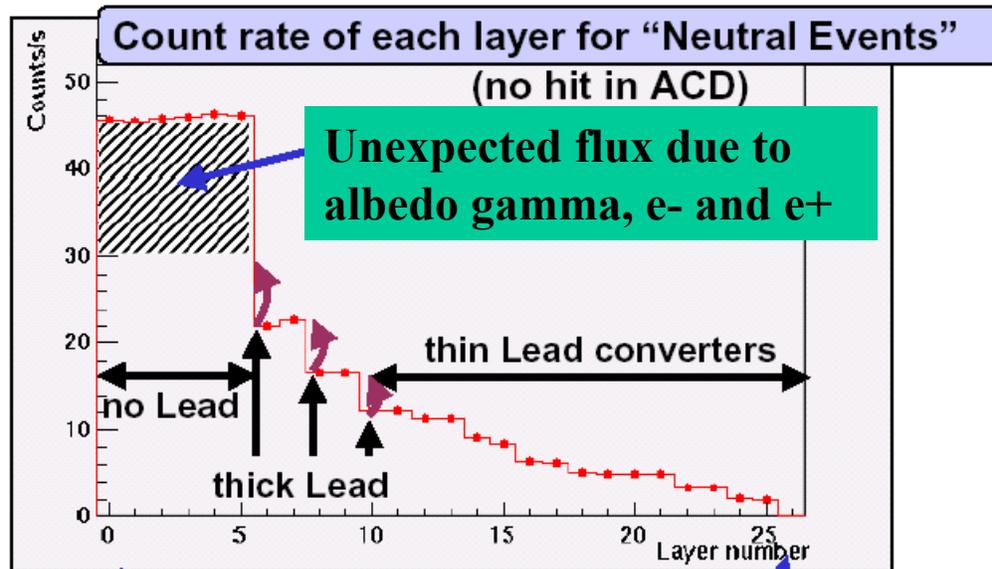
# BFEM Geometry

26 Tracker Layer or 13 XY Sets  
Segmented CsI(Tl) Calorimeter  
Anti Coincidence Detector

June 13<sup>th</sup>, 2002



## Count Rate of Each Layer for "Neutral Events": Real Data



# Accuracy of Geant4 Simulation

References: reports in Balloon Meetings; presentations given in LAT PDR (Jan. 02); Mizuno's SLAC Exp. Seminar (June 02)

**Surprise in BFEM data:** Lower portion of the tracker registered much higher trigger rate than pre-flight Geant4 prediction.

**Adjustments made:** Extension of albedo photon spectrum down to 1MeV (see previous page); lowered cutoff E for electrons and photons; adjusted to the error in the trigger (3 layers didn't participate). Now G4 agrees within 20%.

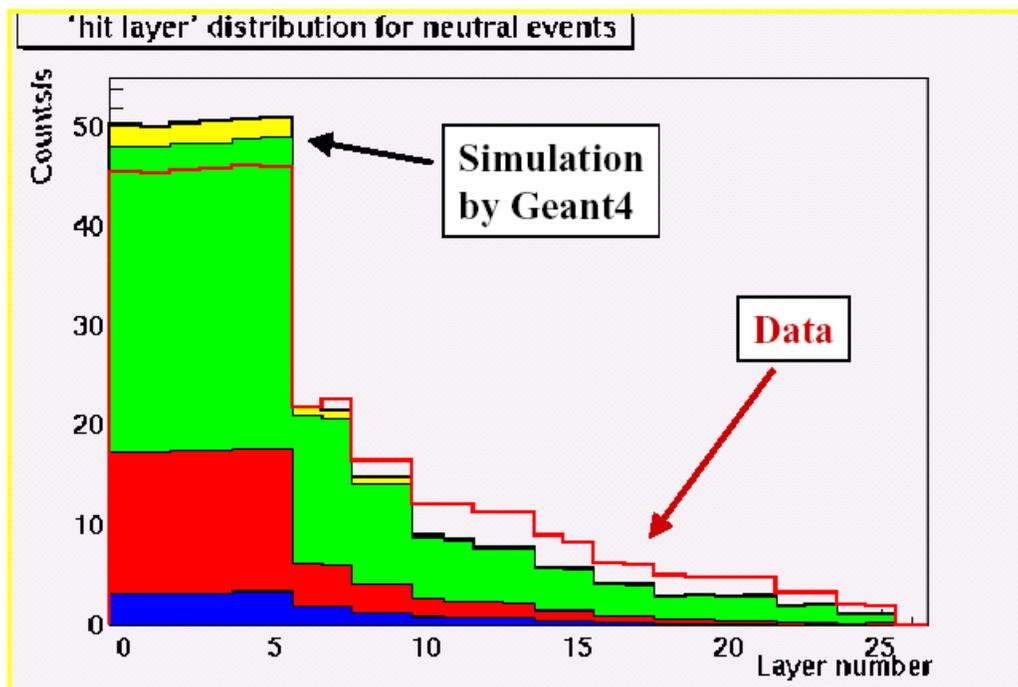


GLAST LAT Project

APS-HEAD Joint Meeting in Albuquerque , April 20, 2002

## Results vs Simulation: "Neutral" Particle Distribution

"Neutral" particle hit distribution: gammas and under-the-ACD electrons



Calorimeter side

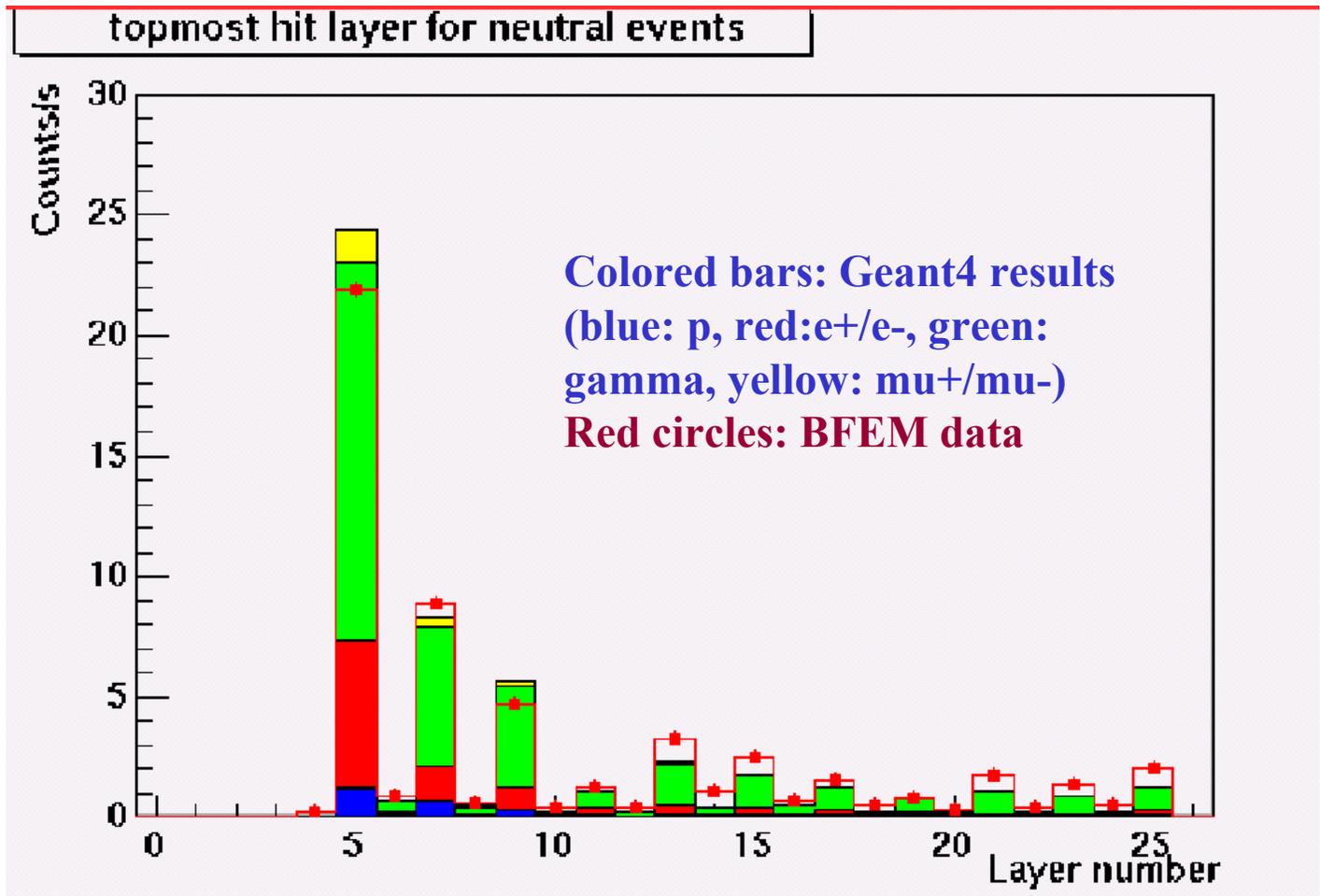
Tracker layer number

Top of Tracker

# Characteristics of the events

## -Topmost layer distribution -

These events populate heavily the last 6 layers or 3 sets of X-Y SSDs. Because there is no Pb inserted between these 6 SSDs, electrons with a few MeV could trigger BFEM.

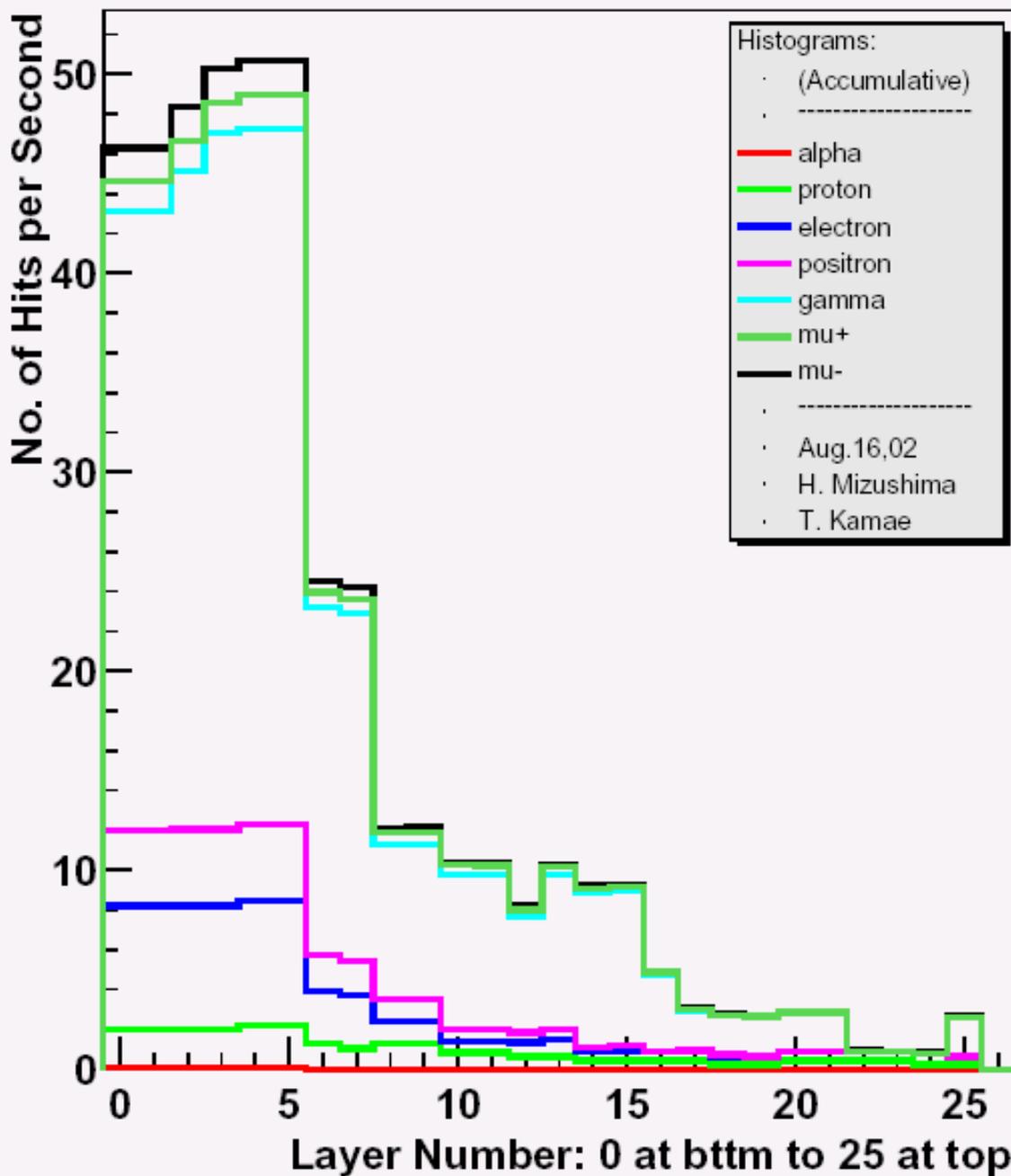


**Scaling to LAT is admittedly not easy.** TK use a scale factor of  $\sim 5$  because these events come from the periphery and LAT has  $\sim 5$  times longer periphery. This means, in worst case  $5 \times 50\text{Hz}$  of albedo triggers (“Neutrals”). **About a half of gammas are due to the downward flux and hence LAT in orbit will see these at about  $\sim 125\text{Hz}$ .**

# BFEM Geant4 Simulation

## - Current design -

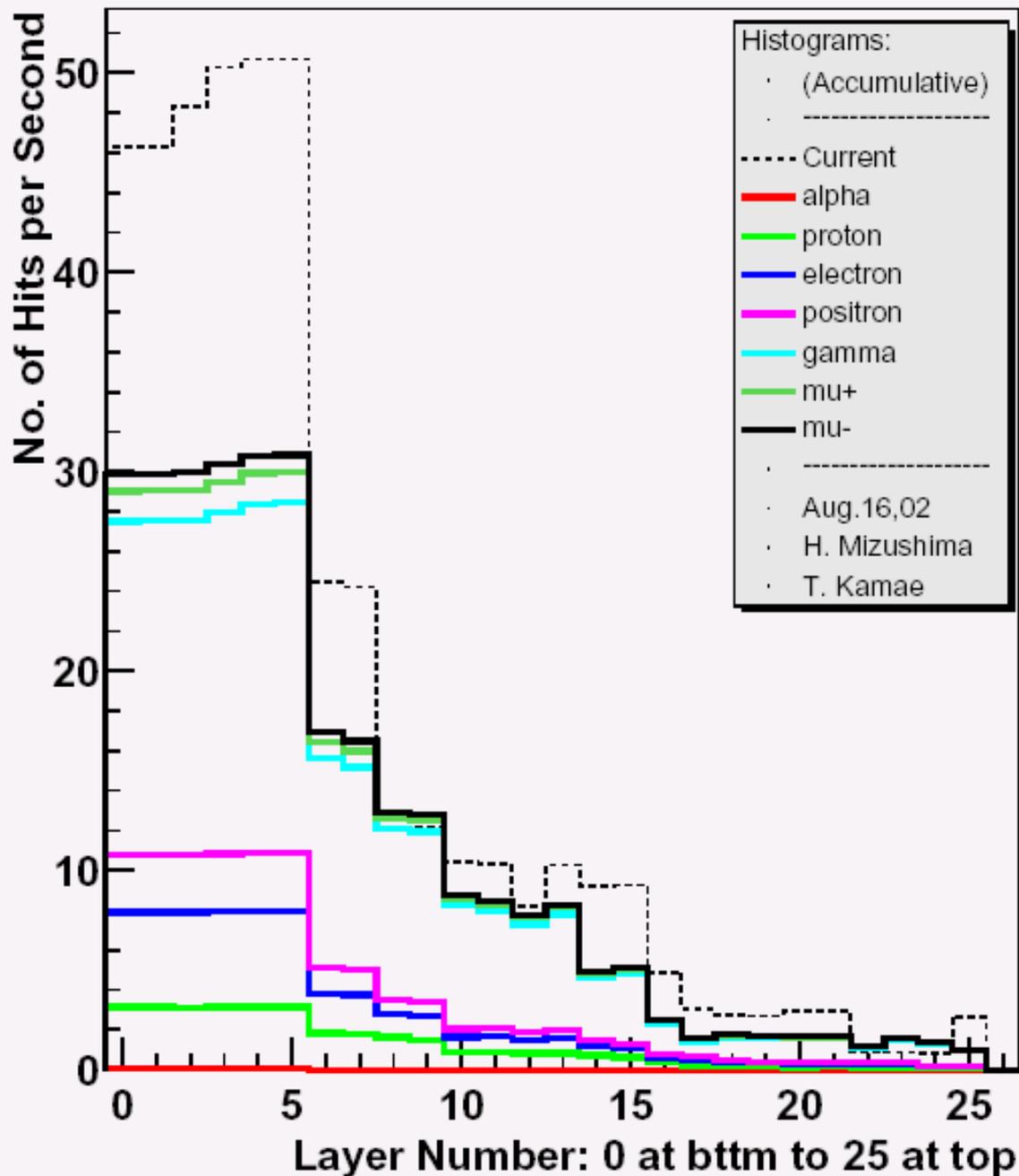
Count Rate of "Neutrals" (Current Design)



# BFEM Geant4 Simulation

## - With 3x3.6% Pb -

Count Rate of "Neutrals" (Add 3x3.6%RL)





# BFEM Geant4 Simulation

## - With 1x6% Pb -

Count Rate of "Neutrals" (Add 1x6%RL)

