GRB 970417a and nhit

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June 11, 2001

1 Introduction

At the July 1999 collaboration meeting Andy and I presented some work on obtaining energy information from the observed nhit distribution in the signal events from GRB970417. Our conclusion was that while there was a weak trend of increasing nhit with primary energy, with only 18 events it was probably not possible to obtain any energy information. However, the number of simulations we used to obtain this result was small and the statistics were poor. Since then, I have redone the analysis with a much larger database of simulations.

2 Analysis Method

The basic idea is to show that below some energy the observed nhit distribution is not consistent with the expected nhit distribution from simulation studies. I threw air-shower simulations from 50 GeV to 100 TeV. The same routines that Stefan used to match MC to data were applied (soft trigger and simulation of calibration losses). The triggered events were required to fit within 1.6 degrees. This is important as high nfit events have better angular reconstruction, so omitting this step would bias us towards low values of nhit. The resulting nhit distribution for triggered events which are within the analysis binsize were then examined. Figure 1 shows the nhit distribution for 100 GeV gamma-ray showers which have triggered, fit and been corrected for the effects of calibration, Figure 2 shows the same distribution for 10 TeV showers. Assuming the burst was a monoenergetic flux of 100 GeV photons, could we draw the observed nhit distribution (bottom panel of Figure 3 from the distribution shown in Figure 1 ? We can also assume a 10 TeV monenergetic flux and ask whether the observed nhit distribution could be drawn from the distribution shown in figure 2 ? I think that is is not improbable that the observed distribution of nhit could be draw from either 100 GeV or 10 TeV gamma-rays, and thus is consistent with any energy in between. Therefore the observed nhit distribution is consistent with any gamma-ray spectrum from 100 GeV to 10 TeV. This is NOT a constraint, we simply do not have sufficient simulations to say anything about energies lower than 100 GeV and higher than 10 TeV. In this analysis the nhit distribution does not provide any information on the energies of the events in the excess observed from GRB970417.

The results of this analysis are in sharp disagreement to Isabels analysis circulated in the recent GRB paper draft. To infer information from the Monte Carlo one must apply the same cuts to the MC as were applied to the data (in this case triggered and fit within a bin). No trigger or goodness of fit requirments were used in Isabels analysis of nhit and energy, this is the major source of the discrepancy between the two results.

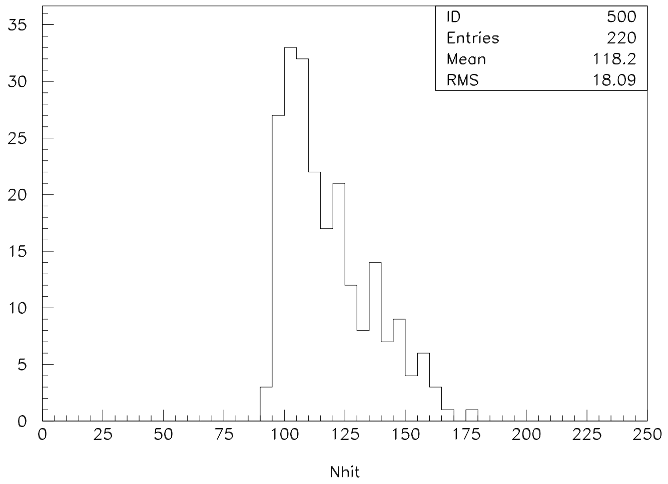

Figure 1: nhit distribution for 100 GeV gamma-rays

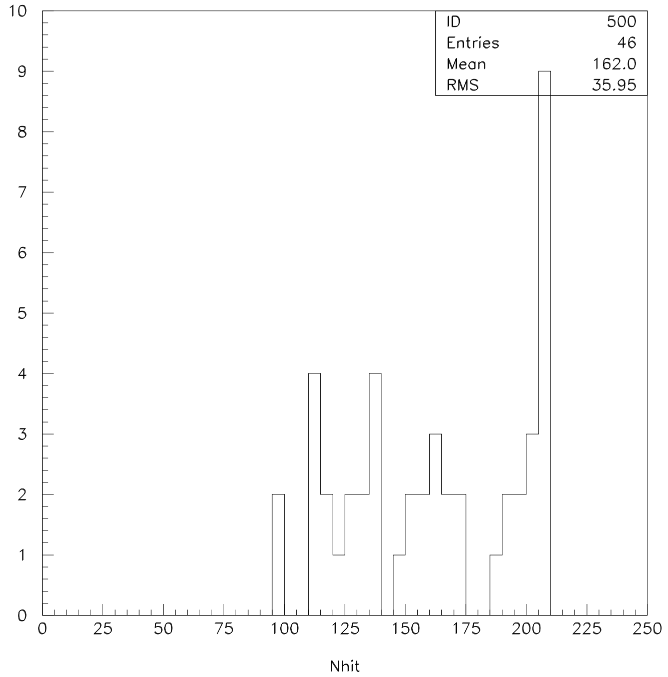

Figure 2: nhit distribution for 10 TeV gamma-rays

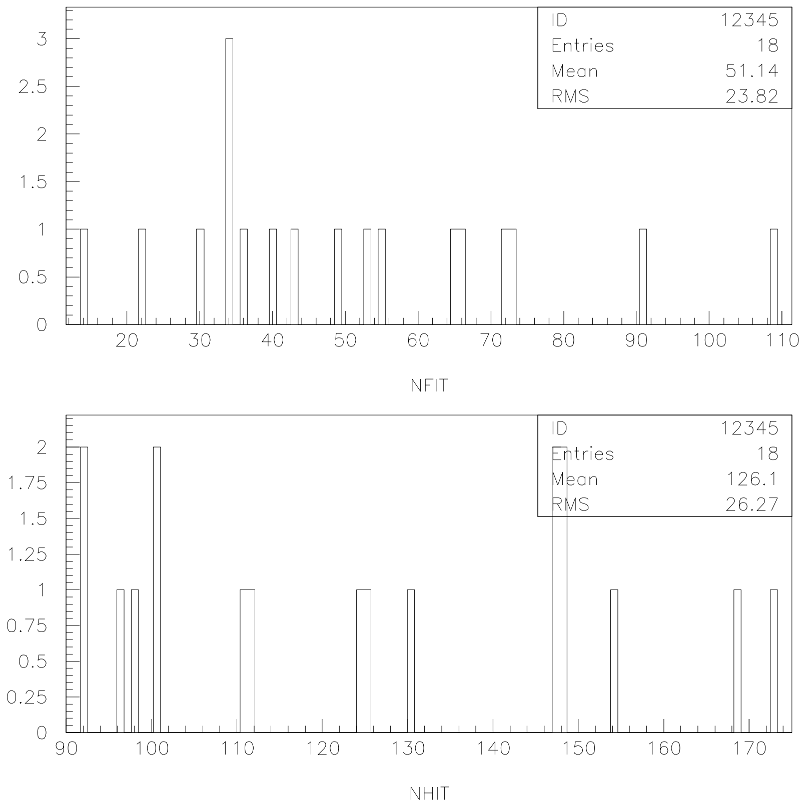

Figure 3: Nfit (top) and nhit (bottom) distributions for grb 6188