Implemented Maximum Background Fluxes

Particle Flux vs. Kinetic Energy

Integrates to ~10 kHz/m²

- LAT-TD-00250-01 Mizuno et al
- Note by Allan Tylka 12 May 2000, and presentations by Eric Grove
- Comparison with EGRET A-Dome rates provides a conservative ceiling on the total rate.
Implemented Average Background Fluxes

Particle Flux vs. Kinetic Energy

Integrates to ~4.2 kHz/m²

orbit-avg fluxes used for downlink and final background rejection calculations
A-dome has an area of \( \sim 6 \text{ m}^2 \), so orbit max rate (outside SAA and no solar flares) corresponds to \( \sim 16 \text{ kHz/m}^2 \).

This represents a conservative upper-limit for us, since the A-dome was sensitive down to 10's of keV.

Note peak rate is at \((24.7,260)\).
Instrument Triggering and Onboard Data Flow

Level 1 Trigger

Hardware trigger based on special signals from each tower; initiates readout
Function: • “did anything happen?”
• keep as simple as possible

- TKR 3 x-y pair planes in a row
  workhorse γ trigger
  OR
- CAL:
  LO – independent check on TKR trigger.
  HI – indicates high energy event — disengage use of ACD.

Upon a L1T, all towers are read out within 20μs

Instrument Total L1T Rate: <4 kHz>**

**4 kHz average without throttle (1.3 kHz with throttle); peak L1T rate is approximately 12 kHz without throttle and 3.8 kHz with throttle).

On-board Processing

full instrument information available to processors.
Function: reduce data to fit within downlink
Hierarchical filter process: first make the simple selections that require little CPU and data unpacking.

- subset of full background rejection analysis, with loose cuts
- complete event information
- only use quantities that
  ➢ are simple and robust
  ➢ do not require application of sensor calibration constants
- signal/bkgd tunable, depending on analysis cuts:
  γ: cosmic-rays ~ 1:~few

Total L3T Rate: <25-30* Hz>
(total event size: ~8-10* kbits)

On-board science analysis:
transient detection (AGN flares, bursts)

*assumes no compression
Testing Trigger Efficiencies On Orbit

Two kinds of inefficiencies

LOCAL
at least 2 methods to measure:
• spatial distributions of L1T’s
• compare TKR hits with TKR trigger pattern using both
  • TKR triggers
  • CAL-LO triggers (independent sample!)

GLOBAL
example: global trigger drops every 10th trigger. How would we know?
Two types of global inefficiencies:
  Time-dependent
  monitor pulsar fluxes over time
  Constant
  At least 3 methods to measure:
  • count prescales
  • periodic triggers (both hard and soft)
  • use a sensor with a counter independent of trigger system (e.g., ACD tile) to generate heavily prescaled triggers.

Test this on the ground in LAT using cosmic-ray induced muons