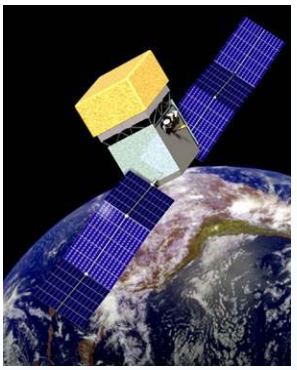
GLAST LAT cosmic ray data analysis at ground

M. Brigida, G. A. Caliandro, C. Favuzzi, P. Fusco, F. Gargano, N. Giglietto, F. Giordano, F. Loparco, M. N. Mazziotta, C. Monte, S. Rainò, P. Spinelli

on behalf of the **GLAST LAT Collaboration**

claudia.monte@ba.infn.it

Dipartimento Interateneo di Fisica "M. Merlin" dell' Università e del Politecnico di Bari and INFN - Sezione di Bari
Via Orabona 4, Bari - Italy



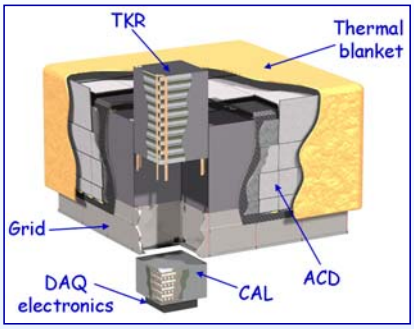


Fig. 1: GLAST LAT modular structure

The GLAST Large Area Telescope (LAT)

The Gamma-ray Large Area Telescope (GLAST) is a satellite-based observatory to study the high-energy gamma-ray sky. The Large Area Telescope (LAT) is the main instrument on board GLAST. It is a pair-conversion telescope which will survey the sky in the energy range from 20 MeV up to 300 GeV. The LAT has a modular structure (Fig. 1), consisting of a 4x4 array of identical towers, supported by a low-mass grid. Each tower is composed by a solid state detector (SSD) tracker (TKR), a CsI calorimeter (CAL) and data acquisition module (DAQ). A plastic segmented scintillator anticoincidence (ACD) system covers all the towers and provides most of the rejection of the charged particle backgrounds.
A second instrument, the GLAST Burst Monitor (GBM) will provide spectra and timing in the energy range from 8 keV to 30 MeV for Gamma-Ray Bursts (GRB).

Observatory data taking

The calibration strategy of the LAT combines the analysis of cosmic ray data with accelerator particle beams measurements.
As shown in Fig. 2, the two GLAST instruments (LAT and GBM) have been integrated onto the spacecraft at General Dynamics (GD) Advanced Information Systems in Gilbert, Arizona. The integrated LAT has been tested as a cosmic-ray observatory.
Similar tests were performed at Stanford Linear Accelerator Center (SLAC) in 2006 during the phase of Integration and Test (I&T) of the LAT instrument.

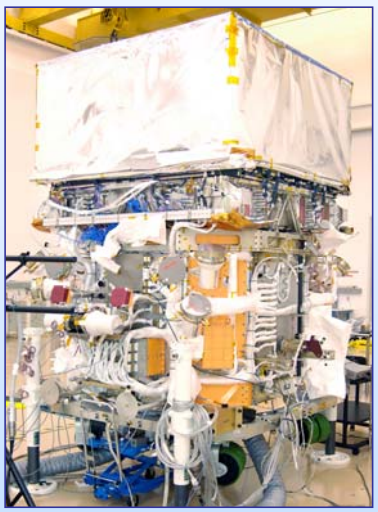


Fig. 2: The GLAST Instrument

Ground cosmic ray muon data analysis

We analyzed the cosmic ray data samples taken at GD for the integrated LAT and the final I&T data samples collected in the full LAT configuration.

Event selection:
- events triggered by both TKR & ACD;
- single track events crossing the LAT from the TKR top layer to the CAL bottom layer (see Fig. 3);
- Energy deposition in the CAL layers consistent with that of a minimum ionizing particles.

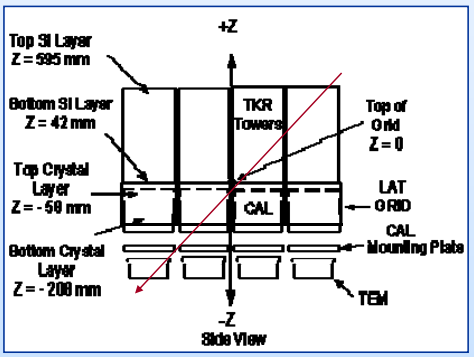


Fig. 3: Geometrical selection criteria

Monitoring of the TKR Performance

We analyzed cosmic ray data collected at the GD observatory and I&T data.
We studied the TKR hits (fired strips) and clusters (group of adjacent fired strips). Figs. 4 and 5 show the cluster and the hit distributions obtained for single tower events, like the one shown in Fig.6.

The predictions from a MC simulation developed for the I&T configuration are also shown.

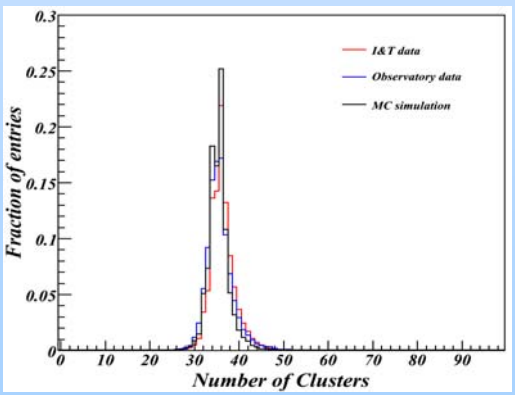


Fig 4: TKR Cluster Distributions

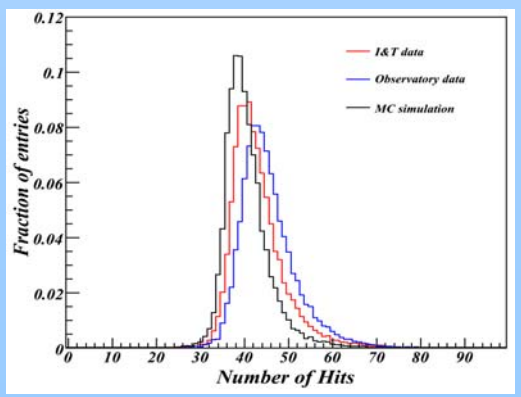


Fig. 5: TKR Hit Distributions

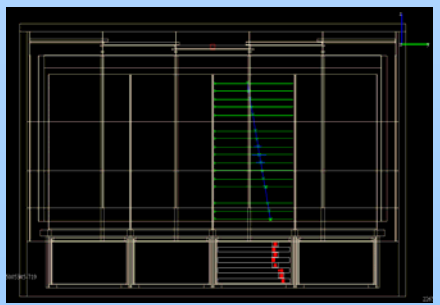


Fig 6: Event display of a single tower muon event

- The cluster distributions of cosmic ray data are in agreement with MC predictions
- The hit distributions are slightly different for the three samples. These discrepancies are currently under investigation and can be due to different DAQ settings.

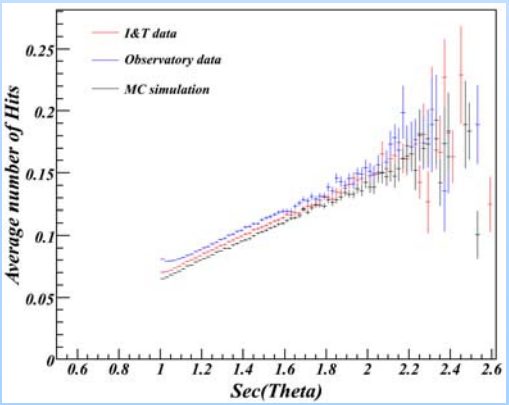


Fig.7 Average number of hit strips vs secθ

We also studied the dependence of the hit strips multiplicity on the zenith angle θ (Fig. 7) for a sample of events like the one shown in Fig. 3. As expected, the average number of hits increases linearly with secθ, i.e. it is proportional to the track length.

Conclusions

- The LAT performance is continuously being monitored during the instrument integration
- The MC simulation is still being tuned taking into account the beam test data collected at CERN in 2006