Interest in Tagged Photon Beam Facility for Fermi LAT Collaboration Beam Test

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Representing the Fermi LAT Collaboration
GLAST Large Area Telescope (LAT)

Pair Conversion Telescope

Si Tracker Tower
SSDs pitch = 228 μm
12 layers × 3% $X_0$
+ 4 layers × 18% $X_0$
+ 2 layers
Total channels: 884736

16 identical towers

ACD
Segmented scintillator tiles
0.9997 efficiency

Grid (& Thermal Radiators)

CsI Calorimeter
Hodoscopic array
8.4 $X_0$; 8 planes × 12 bars
2.0 × 2.7 × 33.6 cm

3000 kg, 650 W
1.8 m × 1.8 m × 1.0 m
**The Observatory**

**Large Area Telescope (LAT)**
- 20 MeV - >300 GeV

**Gamma-ray Burst Monitor (GBM)**
- NaI and BGO Detectors
  - 8 keV - 40 MeV

**KEY FEATURES**

- **Huge field of view**
  - LAT: 20% of the sky at any instant; in sky survey mode, expose all parts of sky for ~30 minutes every 3 hours.
  - GBM: whole unocculted sky at any time.

- **Huge energy range**, including largely unexplored band 10 GeV - 100 GeV.

  **Total of >7 energy decades!**

- **Large leap in all key capabilities.** Great discovery potential.
FGST Prior to Fairing Installation
SLAC Beam Test Motivation

• Goals
  – Expose the LAT Calibration Unit (CU) to a low energy polarized photon beam.
    • Energies from ~40 MeV – 400 MeV
    • < 1 gamma into the CU per pulse
    • Different angles of incidence and position on the detector in x-y plan (z is up in the lab)
      – needs large table able to rotate and translate
  – Verify the Instrument MC (GLEAM) at Low Energy
    • Detection measurement
    • angular resolution
    • Energy reconstruction and resolution
    • Polarization measurement
Tagged photon beam in ESA

A secondary e- beam is momentum-selected in the A-line and incident on a thin radiator in ESA. The scattered electron energy is measured in a calorimeter (Pb glass), tagging the photon energy:

- capability exists but needs infrastructure
- we should determine user need first

GLAST tests

Does anybody (really) want this? Let us know!

MAYBE!! We need to do a bit more work.

Mauro Pivi SLAC, ESTB 2011 Workshop
The GLAST-LAT Calibration Unit

The CU is composed by:
- 2 complete LAT towers (TKR & CAL)
- 1 CAL module
- 5 ACD tiles

The CU is housed in a 2mm thick al Inner Shipping Container. The ACD tiles are mounted outside.
The gamma ray beam at the CERN PS T9 line was produced by bremsstrahlung of electrons through the upstream materials. A magnet has been used to separate electrons from photons. A beam dump has been used to stop electrons.

**Tagged photon beam**
- An external tracker (4 x-y view silicon strip detector) was used to track electrons upstream and downstream the magnet, read-out by means of an external DAQ
- Trigger on S4&S\text{front} & Cerenkovs
- External DAQ was synchronized with the CU one, then the data have been merged with the CU one
- Different electron beam energy in the range 0.5-2.5 GeV and magnetic field intensity have been used to provide a gamma spectrum to the CU below 2 GeV

**Not tagged photon beam**
- Trigger on S\text{front} & Cherenkov
- Full brems spectrum from 2.5GeV/c electron beam
Tagged $\gamma$ energy  PS

2.5 GeV electron beam
Summary

• Fermi LAT Collaboration is working towards a possible proposal for a SLAC beam test
  – low energy tagged photon beam - ~ 40 MeV to 400 MeV
  – Si vertex telescope to better measure incoming and outgoing e⁻ angles
  – need to know tagged photon polarization
  – < 1 gamma/ pulse

• LAT Collaboration hopes to have decided by this summer on the value of this beam test and have a proposal ready if we decide to go for it.