The GLAST Burst Monitor

Purpose: To augment the GLAST capabilities for studying gamma-ray bursts by providing extended spectral response and on-board locations to allow repointing the LAT.

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Additional Key Personnel

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Burst Monitor Approach

- Place main emphasis on the unique capability of GLAST for spectral observations.

- Have very large FOV (>>LAT) to allow repointing of the LAT.

- Use array of twelve 5” by 0.5” NaI detectors to locate GRBs (as with BATSE) and get low energy spectrum.

- Use two 5” by 5” BGO detectors to obtain broad spectral coverage.
GBM Detector Concept

Low-Energy NaI (TI) Detectors (3 of 12)

High-Energy BGO Detector (1 of 2)
Burst Locations

- **On-Board**
  - Available in several seconds
  - Sufficient accuracy to repoint LAT
  - Other data as necessary to make repoint decision

- **On-Ground Automated**
  - Uses real-time telemetry link
  - GCN notifications
  - Two or more levels of time/accuracy

- **On-Ground Manual**
  - Human interaction to achieve best accuracy
  - Available in 1-2 days
Burst Monitor Performance

- Spectral coverage from a few keV to ~30 MeV (overlap with LAT)
- Field of View: 8.6 sr (using AO definition) (LAT is 2.4 sr)
- Sensitivity
  - ~0.57 photons cm\(^{-2}\) s\(^{-1}\) (nominal on-board burst trigger)
  - ~0.35 photons cm\(^{-2}\) s\(^{-1}\) (ultimate 5\(\sigma\) sensitivity)
- On-board location accuracy <15° for most bursts
- Mass: 54.5 kg (20% contingency, mounting hardware not included)
- Power: 17.8 watts (based on BATSE, without contingency)
- Telemetry rate: 4 kbps (nonburst), 9 kbps burst
Continuous Data

- **Background spectra (BSPEC)**
  - 128 energy channels
  - 8 s time resolution
  - All detectors

- **Background timing (BTIME)**
  - 4 energy channels
  - 0.256 s time resolution
  - All detectors
Burst Data

- **Time-Tagged Event (TTE)**
  - 128 energy channels
  - 5 µs time resolution
  - ~ 10^6 events
  - ~ 50 s pretrigger
  - selected detectors
  - bursts only

- **Trigger Data (TRIGDATA)**
  - Onboard and real-time telemetry link
  - Locations
  - Spectral information
  - Other information as required by the LAT
  - Detector rates and ancillary data for automated ground locations
Simulated Instrument Performance

**NaI Detector**

\[ \theta = 15° \]

- Effective Area [cm^2]
- Photon Energy [keV]

- **Total**
- **Full energy peak**
- **Full energy + escape peaks**

**BGO Detector**

\[ \theta = 30° \]

- Effective Area [cm^2]
- Photon Energy [keV]

- **Total**
- **Full energy peak**
- **Full energy + escape peaks**

Photon Energy range:
- NaI Detector: 5 keV – 1 MeV
- BGO Detector: 150 keV – 30 MeV
Simulated Spectrum of GRB 940217

![Graph showing the simulated spectrum of GRB 940217, with the x-axis representing energy in keV and the y-axis showing the flux in keV s^{-1} cm^{-2}.]
GRB 990123 Simulation: LAT + GBM

 BATSE 24–120 keV

\[ \times 10^3 \text{ counts} \cdot \text{s}^{-1} \]

GRB 990123

Assumed (BATSE)
LAT Fit
GBM+LAT Joint Fit

Time Since BATSE Trigger (s)
Science Investigation

- Time-resolved spectroscopy of GBM triggered bursts using GBM and LAT data.

- Generation of GRB locations within seconds for repointing, detection in LAT, and dissemination to other observers.

- Production of a burst catalog.

- Untriggered burst search.
SWG Issues

- GBM sensitivity/FOV trade.
- Policy on repointing LAT.
- Data to be provided on-board to LAT.
- Coordination of rapid alerts.
- Coordination of analyses of joint spectra.