Transients with Fermi GBM

short GRB untriggered search

1404 GBM GRBs

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Fermi Gamma-ray Space Telescope

12 NaI detectors (8keV—1MeV)

2 BGO detectors (200keV—40MeV)

Gamma-ray Burst Monitor

Large Area Telescope

GBM:
• FOV >7sr
• Whole sky every 3 hours
Fermi Gamma-ray Burst Monitor

Regular trigger algorithms:
• Count rate increase in 2+ NaI detectors above adjustable threshold above background rate
• 10 timescales — 16ms up to 8.192s
• 4 energy ranges — [50-300], [25-50], >100, >300 keV

Untriggered search algorithms:
• Initially developed for Terrestrial Gamma-ray Flash search
  • more details at http://fermi.gsfc.nasa.gov/ssc/data/access/gbm/tgf
• Using Continuous Time Tagged Events (CTTE) — 2µs time resolution with 128 energy channels
• 2 detectors: 2.5σ and another 1.25σ above background
  • one-day probability threshold for release
• 10 timescales — 0.1s to 2.8s
• 5 energy ranges (optimized on GBM-triggered weak sGRBs)
• Unfavorable geometry of the two above-threshold detectors are eliminated
• Soft and long duration candidates are removed

Fermi GBM Counterparts to LIGO GW Candidates — J. Racusin, session R14 Mon Apr 18
Fermi GBM Follow-up of the First GW Detection — L. Blackburn, session X4 Tues Apr 19
Untriggered GBM Short GRB Candidates

http://gammaray.nsstc.nasa.gov/gbm/science/sgrb_search.html

- A list of the untriggered candidates (June 2014 to present) are listed in website above.
- Working towards creating automated GCNs, will be distinct from triggered events type.

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GBM Candidate Event

- 2014-07-09 08:49:56.600
- Found in 1.40s time binning
- 25 - 494 keV energy range
- $P=7.75 \times 10^{-14}$

ACS lightcurve

ACS native time bin

GBM timescale
GBM Candidate Event

- 2014-06-06 10:58:13.625
- **Swift GRB 140606A**
- Found in 0.25s time binning
- 93 - 494 keV energy range
- \( P=1.91\times10^{-16} \)

ACS lightcurve

ACS native time bin

GBM timescale
Outlook

- Optimization on search algorithm and thresholds are ongoing
- Pending exclusion of known gamma-ray repeaters and transients based on localization and spectrum
- Working towards correlation with Swift and INTEGRAL data
  - GRB 140606A detected by Swift is not triggered in GBM but identified by this untriggered search
- Eventual GCN notices of a distinct type

http://gammaray.nsstc.nasa.gov/gbm/science/sgrb_search.html