

National Aeronautics and Space Administration



Fermi

Gamma-ray Space Telescope

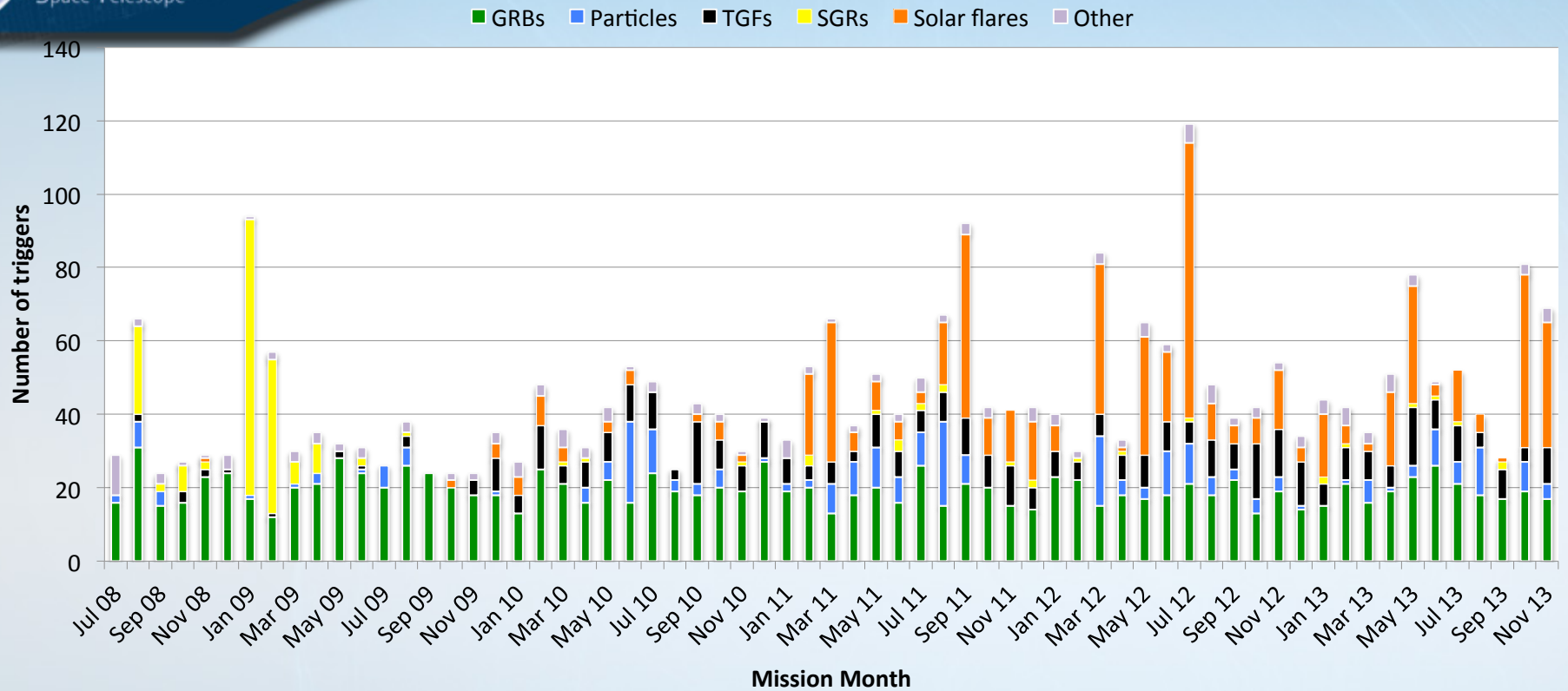
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Fermi GBM Status, Results, Plans

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GBM Trigger Rate



2949 triggers as of November 30, 2013 (excluding commanded)

Gamma-ray bursts (GRBs): 1262 (triggered twice on each of two long GRBs)

Soft gamma repeaters (SGRs) aka magnetars: 197 (from 5 sources)

Terrestrial gamma flashes (TGFs): 410 (at least 600 additional untriggered)

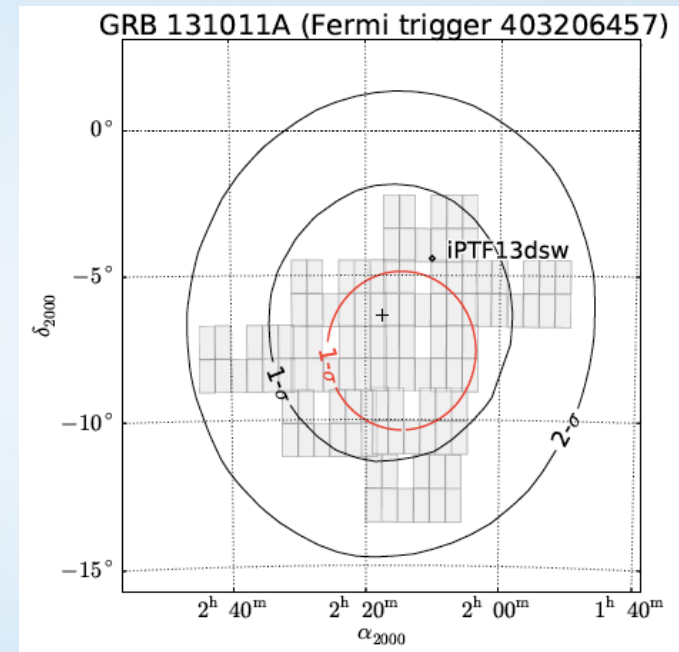
Solar Flares: 625

Others (particles, galactic XRBs, accidental, uncertain): 453

111 positive Autonomous Repoint Recommendations

Operational Changes & Improvements

- Weekends & periods of high solar activity:
 - Continuing to disabled soft energy (22–50 keV) trigger algorithms
- Continuous TTE
 - Nov 26: Completed one year of operation
 - Provides full coverage of Fermi orbit for ground-search TGFs
 - Average ~4.6 Gbyte/day; maximum day ~6.2 Gbyte
 - Interrupted twice for a total of 5.3 days (mitigation of SSR management issues)
- New data product: location contours
 - Distribute the χ^2 map convolved with an input systematic uncertainty model to return 1σ , 2σ , and 3σ contour maps for our localizations
 - iPTF detected afterglow of GRB 131011A; produced upper limits for several short GRBs
 - Considering potential improvements: additional file formats, distribution of ground-automated localizations, simplified production process
- High count-rate test
 - Lab tests with BGO EU and strong ^{137}Cs & ^{60}Co sources
 - Completed in August
- Konus cross-calibration
 - Awaiting more data from Konus





GBM Team Science Activity

- Papers in refereed journals (since Aug 2013)
 - Multiwavelength Observations of GRB 110731A: GeV Emission from Onset to Afterglow (ApJ)
 - The First Pulse of the Extremely Bright GRB 130427A: A Test Lab for Synchrotron Shocks (Science)
 - Fermi LAT Observations of the Extraordinary Gamma-ray Burst GRB 130427A (Science)
 - The Bright Optical Flash and Afterglow from the Extraordinary Gamma-Ray Burst GRB 130427A (Science)
 - Probing Curvature Effects in the Fermi GRB 110920 (ApJ)
 - The First Fermi-LAT Gamma-Ray Burst Catalog (ApJS)
 - The Interplanetary Network Supplement to the Fermi GBM Catalog of Cosmic Gamma-Ray Bursts (ApJS)
 - Variable jet properties in GRB 110721A: time resolved observations of the jet photosphere (MNRAS)
 - Initial breakdown pulses in intracloud lightning flashes and their relation to terrestrial gamma ray flashes (JGR)
 - Fluence Distribution of Terrestrial Gamma-ray Flashes Observed by the Fermi Gamma-ray Burst Monitor (JGR)
- Papers in press or submitted
 - Pulse Properties of Terrestrial Gamma-ray Flashes detected by the Fermi Gamma-ray Burst Monitor (JGR)
 - Time-resolved Analysis of Fermi GRBs with Fast and Slow-Cooled Synchrotron Photon Models (ApJ)
 - Localization of Gamma-Ray Bursts using the Fermi Gamma-Ray Burst Monitor (ApJS)
 - The 2nd Fermi GBM Gamma-Ray Burst Catalog: The First Four Years (ApJS)
 - The Fermi GBM Gamma-ray Burst Spectral Catalog: Four Years Of Data (ApJS)
- Press activity
 - GRB 130427A media teleconference (Nov 21); Google+ Hangout (Nov 22)

GBM Team Science Activity

- Conferences with presentations
 - Explosive Transients: Lighthouses of the Universe (Santorini, Greece)
 - Third Workshop on Robotic Autonomous Observatories (Torremolinos, Spain)
 - Hotwiring the Universe (Santa Fe)
 - Black holes, jets and outflows (Kathmandu, Nepal)
 - Supernovae and Gamma-Ray Bursts 2013 (Kyoto, Japan)
 - American Geophysical Union (San Francisco)
 - 27th Texas Symposium on Relativistic Astrophysics (upcoming, Dallas)
- Papers for near-term submission
 - An Observed Correlation between Thermal and Non-Thermal Emission in Gamma-Ray Bursts
 - The 5-year GBM magnetar Catalog
 - Time-resolved spectroscopy of SGR J1550-5418 bursts
 - Insight into the prompt emission period with simultaneous γ -ray/NIR wavelength observations of γ -ray burst 121217A

Other GBM-Related Papers

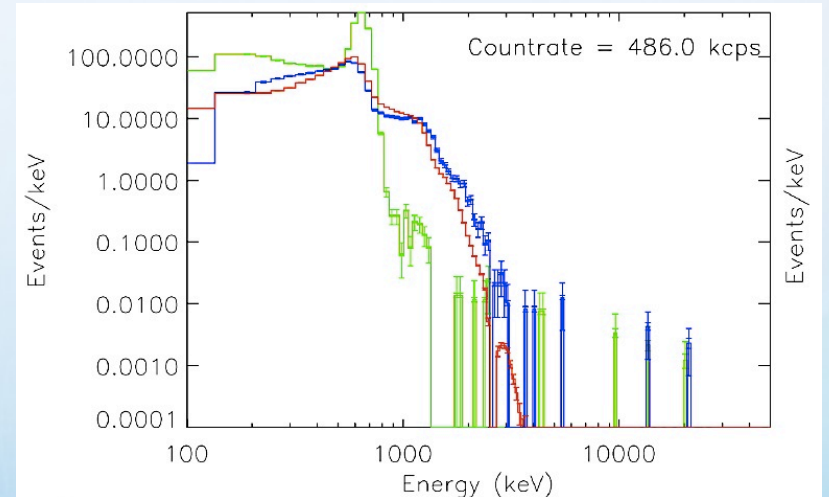
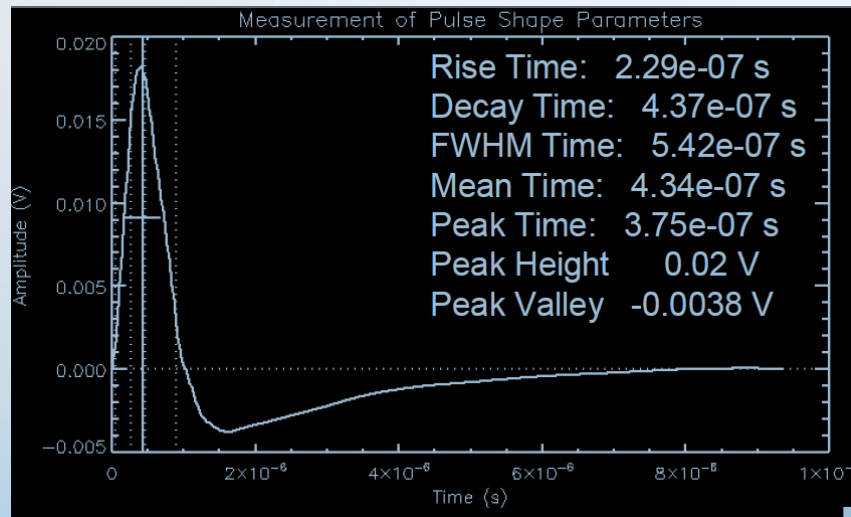
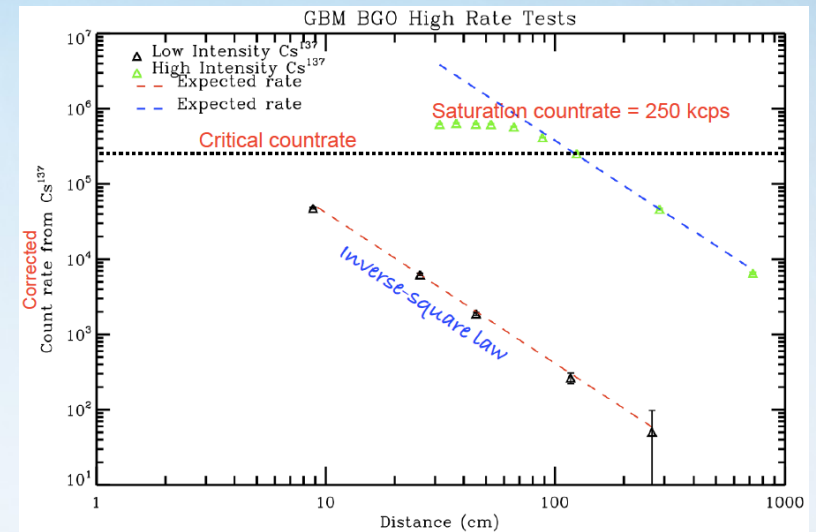
- Direction dependent background fitting for the Fermi GBM data (A&A)
- A Lingering Non-thermal Component in the Gamma-Ray Burst Prompt Emission: Predicting GeV Emission from the MeV Spectrum (ApJ)
- Discovery and Redshift of an Optical Afterglow in 71 deg²: iPTF13bxi and GRB 130702A (ApJ)
- Pulse-wise Amati correlation in Fermi gamma-ray bursts (MNRAS)
- A Search for Pulsations in Short Gamma-Ray Bursts to Constrain their Progenitors (ApJ)
- GRB 091024A and the Nature of Ultra-long Gamma-Ray Bursts (ApJ)
- The $E_{\text{peak}} - E_{\text{iso}}$ relation revisited with Fermi GRBs. Resolving a long-standing debate? (A&A)
- The Hurst exponent of Fermi gamma-ray bursts (MNRAS)
- Terrestrial gamma-ray flashes (NIMPA)

GRB Catalogs

- **The 2nd *Fermi* GBM Gamma-ray Burst Catalog: The First Four Years**
 - A. von Kienlin & GBM team
 - 953 GRBs: 492 (Year 1&2) + 462 (Year 3&4)
 - Catalog analysis for each GRB:
 - Location (BA locations + non GBM locations from instruments providing a better location accuracy)
 - Duration in 50 – 300 keV range (T90 , T50)
 - Peak Flux and Fluence
 - Peak Flux for 64 ms, 256 ms and 1.024 s
 - 10 – 1000 keV & 50 -300 keV
 - Additional information on:
 - Trigger Statistics
 - Exceptional Operational Conditions during Year 3&4
- **The *Fermi* GBM Gamma-ray Burst Spectral Catalog: Four Years of Data**
 - D. Gruber & GBM team
 - 943 GRBs (very faint bursts were excluded by selection criteria)
 - Catalog analysis for each GRB:
 - Time-integrated spectral fits
 - Fits to the brightest time bin
 - Four different spectral model: PL, Band, COMP, SBPL
 - Analysis similar but not identical to Goldstein et al. 2012
 - All 487 GRBs from the first two years have been re-fitted using the same methodology as that of the 456 GRBs in years three and four.
 - More than 7500 spectra

High-rate calibration

- Investigated performance of GBM detectors at high counting rates
- Used BGO flight spare & EM DPU
- Intense ($\sim$ mCu) sources: Cs^{137} & Co^{60}





Summary & Near-term Plans

- GBM operations and performance are nominal
 - Full-time untriggered TTE data collection proceeding smoothly
- No significant operational changes planned for next few months
- Work on validating energy calibration & understanding high-rate behavior
- Continue distribution of GRB localization contours
 - Distribute via GCN
 - Investigate areas for improvements
- Additional science catalog efforts
 - GRB time-resolved spectroscopy
 - TGF ground-search (1 year of full-time TTE)