The progenitor of short gamma-ray bursts (GRBs) is believed to be the merger of two compact objects. This type of event will also produce gravitational waves. Since the gravitational waves discovery by LIGO, the search for a joint detection with an electromagnetic counterpart has been ongoing. Fermi GBM detects ~40 short GRBs per year, and we have been expanding our search looking for faint events in the GBM data that did not trigger on board.

- The targeted search is a dedicated search for following up gravitational wave events, and is also capable for other multi-messenger and multi-wavelength follow up such as neutrinos.
- The untargeted search is a blind search aiming to double the detection rate of short GRBs by GBM.

### Targeted Search

- Automated pipeline development for joint signals in GBM and LIGO. For observing run 1 [1], and updated for observing run 2 [2].
- Looks for coherent signals in all 14 detectors when given an input time and an optional sky map by calculating likelihood ratio of source and background.
- Search time window +/-30s of input event time, timescales from 0.256s to 8s (capable down to 0.064s).
- 3 source spectra using Band function: soft, normal, and hard.
- Upper bounds on impulsive gamma-ray emission can be calculated based on count rates in regions of the provided location probability map. See Figure 1 for example.

### Untargeted Search

- Looks for signals in 2 NaI detectors with 2.5σ and 1.25σ excess above background in the continuous time-tagged events (2μs resolution, 128 energy channels).
- The 2 signal detectors must have valid geometry for a point source.
- 18 timescales: 64ms to 32s.
- 4 energy ranges optimized for short GRBs. 27–539 keV, 50–539 keV, 102–539 keV, 102–865 keV.
- 1-day Poisson probability calculated for each event, threshold for notice is 1e-6.
- GCN notice type Fermi-GBM SubThreshold now available.
- Localization FITS file, contour sky map, and lightcurve of each event are linked via the GCN notice.
- Expected rate of notice ~70/month, higher during active periods of galactic transients.
- Time delay for notice range from 0.5 to 6 hours, due to ground processing.
- List of candidates from older data (2013 and on) are available.
  - http://gammaray.nsstc.nasa.gov/GBM/Csc/search.html

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