LAT-GBM Communication

Summary of recent discussions with
Michelson, Dermer, Dingus, Meegan, Ritz

Two main issues:

- LAT mode changes during GRBs (and solar flares)?
- The "repoint" decision

LAT GRB Mode Changes

Job of the LAT during normal operations:

collect photons with energy 20 MeV - >300 GeV with high efficiency and low event dead time (<100 microsec) over a wide FOV (>2 sr). Search for transients and report alerts.

Job of the LAT during a GRB:

collect photons with energy 20 MeV - >300 GeV with high efficiency and low event dead time (<100 microsec) over a wide FOV (>2 sr). Search for transients and report alerts.

EGRET science benefited from a mode change because:

- EGRET had much larger dead time (100 ms). The TASC could record spectra during a burst with 512 microsec deadtime between events. The TASC also recorded spectra down to 1 MeV (far below spark chamber threshold).
  Telemetry limitation => readout spectra more frequently: 0-1, 1-3, 3-7, 7-23 seconds after a BATSE trigger.
- Even in "wide field" mode, the EGRET tracker had a much smaller FOV so TASC-only data very significantly increased the number of observable bursts.
- To limit total-life number of triggers (finite consumables) EGRET at end of life ran in a narrow FOV mode. A burst signal would allow a higher hardware trigger rate for a period of a few hours. [note the wide field mode command went through the S/C bus with 10-30 s latency!]

GRB LAT Issues

Little is known about the high energy behavior of bursts. Many extrapolations tell us there is no need for a special mode. However, we may learn something new. Some other on-board analysis and/or event filtering [e.g., keep CAL-LO triggers even if there is no track for a finite time period after the burst?] may be useful.

Also, safety: if later in the mission something breaks and can't run continuously [battery dies, …?], we might be able to operate over shorter periods such as during bursts. These are not critical drivers, but:

It seems prudent to provide a fast link between the GBM and the LAT to handle the unknown. Messages through the S/C bus may take ~2(TBR) seconds, which is too long. **Some ceiling of complexity/cost should be set.**

Question: Does the GBM need any fast information from the LAT? (e.g., any mode changes or data-logging changes?)

Answer: **NO. (messaging can go over S/C bus)**

LAT Operations During Solar Flares

Planning is just starting on this. Current idea (W.N. Johnson et al.) is to ignore the ACD and outer ring of towers and top TKR layers during an intense flare, and log data only with the internal towers.

Is LAT-GBM direct communication useful for this mode change? Probably not. Any messaging can go through the S/C bus [UNLESS there is some crucial solar physics derivable from the first 2 seconds of a flare??].

SAA

The LAT and GBM can not operate inside the SAA. What tells the instruments to go into SAA mode? More importantly, what tells them to come back into normal operations? Need a nominal plan and at least one back-up.

Options for SAA exit detection:

- in SAA, LAT and/or GBM self-monitor rates?
- **use pre-loaded orbit positions, and have S/C issue command to instruments for entrance and exit.**
- small additional monitor on S/C or on one of the instruments?
- …

This is a separate discussion but, in any case, a fast GBM-LAT link is not necessary for this (not time critical).

The Repoint Decision

"Repoint" means modify the current observation:

- keep the burst that just occurred within the LAT FOV within the LAT FOV while the burst position is unocculted
- repoint the observatory to bring the burst that just occurred outside the LAT FOV into the LAT FOV.

The first type of message can come from either LAT or GBM or both; the second comes only from the GBM.

The first type drives the architecture for the decision and the LAT-GBM communication:

- what does the science arbitration? (The S/C makes the final logistical decision.)
- what information must be exchanged and when?

We propose the LAT makes the science decision, using information from both the LAT and the GBM, and makes the single request to the spacecraft:

- don't want the spacecraft software to do this
- GBM is not otherwise receiving any significant information from the LAT, and GBM processing is relatively simple.

=> **make the decision in the LAT**

A draft proposal for the requirements on the information packet the GBM sends the LAT now exists and will be reviewed. Specifies what information is sent, and when it is sent.

GBM Burst Alerts