# GRB Simulations, Triggers and Alerts:
# Work Plan

**Editor: Jay Norris**
**Version 1: June 23, 2002**

This workplan is meant to be an evolving list of tasks which the GLAST GRB Science Team and affiliates have taken on as responsibilities. A discussion of purposes, requirements, and priorities for GRB simulations can be found in the document, **GRB_SimsTrigsAlerts_020621**. Generally, the priority order is to work through simulation tasks related to trigger experiments; followed by alert message characterization; and then refinement of GRB physical models.

The person listed first under the "Responsible" column in the tables below is the designated leader for the task. ("Discussion" in the Responsible column means that we need a VRVS meeting better to define the problem or approach, before assigning a productive task.) "Scheduled" means when the task is predicted to be worked on, and "Completed" is to be filled in when the task milestone is satisfied. Keeping track of predicted and completed times will afford us better estimates for future work, and some interesting annals to look back on. Where the schedule date is not filled in, the task leader needs to make an estimate.

In some task cases, only a notification to the GRB simulation group indicating that the milestone has been accomplished will be appropriate. Detailed reports discussing methods and illustrating results that should be communicated (e.g. to flight SW people or the GLAST SWG) will be necessary for some comprehensive milestones. For some task areas, "open channels" with other GLAST work groups need to be maintained, mostly by the lead person, so that up-to-date information flows both ways (examples: calorimeter group, flight SW group).

After implementing modern GRB simulation capability within the GLEAM environment – including background addition, and detection by the instrument – the first simulation milestone should be application to the problem of designing a LAT GRB trigger algorithm that can be realized in flight SW. An optimal, implementable on-board trigger algorithm is the eventual goal, but for the first achievement, demonstration of an end-to-end operation will suffice: (1) GRB simulation + GLAST background, (2) instrument detection with realistic (non-optimal) on-board tracker reconstruction, and (3) functioning trigger algorithm using LAT information. We should aim for generation of the first useful results on this front by ~ September 6, 2002, in time for the GLAST GRB meeting in Huntsville. This leaves some time for refinements by the LAT collaboration meeting in October. **June 21, 2002**

# 1. Simulations

| Task/Milestone | Responsible | Scheduled | Completed |
|---|---|---|---|
| 1. Modifications to GRBmaker | | | |
| (a) set $N_{GRBs}$ (full sky) = 667 $yr^{-1}$ | SB | 6/20/02 | 06/21/02 |
| (b) recomment GRBmaker code: edit old comments, + new summary | JPN | 6/24/02 | |
| (c) implement pulse clustering within a burst | JPN, SB | 7/10-12/02 | |
| (d) refine knowledge of $W_{pulse}(E) > 500$ keV (BATSE measurements) | JPN, JTB | 6/21-7/15/02 | |
| (e) adaptations to GRBmaker modules facilitating use with GRBsim | SB, NO, et al. | 6/18-7/15/02 | |
| (f) generate additional constraints on β distribution (EGRET+BATSE) | BLD, RDP | | |
| (g) review flux–width–$N_{pulses}$–hardness correlations; implement approximations | JPN | | |
| Note: (1.f & g) not time critical; can be asynchronous with, and follow, other tasks | | | |
| 2. Modifications to GRBsim | | | |
| (a) enable relevant distributions in colliding shell model (*** more detailed schedule, if beneficial ***) | NO, JCT, SB | | |
| 3. Addition of background to GRB photons | | | |
| (a) arrange capability to add particle background mix to GRB gammas | SB, FL, (TB) | 6/25-7/5/02 | |
| 4. GLEAM run adaptations | | | |
| (a) create module, e.g. to read output from GRB simulation, run GLEAM, and output to file readable by trigger algorithms | SB, FL, NO, (TB) | 6/25-7/5/02 | |
| 5. Extension of simulations to GBM energy regime | | | |
| (a) create capability in GRBmaker, GRBsim to simulate GBM photons for same burst as simulated for LAT | JPN, SB | 10/1-15/02 | |
| (b) design & implement capability for detection of GBMmaker photons using GBM SW | | | |
| (c) implement modeled GBM detectors & illumination method in GLEAM | RDP, FL, et al. | | |

**Summary of Simulation Plans, ~ 6/1/02–7/15/02**:

Items 1–4, above, need to be completed by mid-July, leaving ~ 1 month for trigger implementation work (7/15/02–8/15/02), and ~ 1 month for exploratory trigger runs and evaluation (8/15/02–9/15/02). Two GRB meetings immediately follow (GLAST/GBM/SWG in Huntsville 9/11-13/02; and 3rd Rome Afterglow Era 9/17-20/02) .

Item 5 becomes necessary in conjunction with development of the GRB physical model tool (A7). Parts (b) and (c) should be reevaluated (are both approaches useful, necessary?).

## 2. Triggers

| Task/Milestone | Responsible | Scheduled | Completed |
|---|---|---|---|
| 1. Resurrect strawman IDL trigger algorithm; clean up for transliteration | JPN | 6/25-26/02 | |
| 2. Transliterate IDL trigger into C++ ("GRBtrig1"), w/in GLEAM framework | SB, JPN | 7/5-15/02 | |
| 3. Exercise GRBmaker, burst detection in GLEAM, and GRBtrig1: perform experiments to establish benchmarks with realistic backgrounds | JTB | 7/15-8/15/02 | |
| 4. Review, document results of item 3. for discussion w/in GLAST collaboration | JTB, JPN | 8/15-9/1/02 | |
| 5. Pursue enhancement of spatial aspects of trigger algorithms | FL | | |
| 6. Pursue enhancement of temporal aspects of trigger algorithms | JDS, JPN | | |
| 7. explore effects of any allowed "on-board for GRBs only" cuts to reduce background; (communication about possibilities with JJ Russell) | FL, NO, JPN, et al. | | |

**Summary of Trigger Plans, ~ 6/25/02–9/1/02**: Translation, exercise of C++ GRBtrig1 algorithm; documentation of results.

## 3. **Alerts**

| Task/Milestone | Responsible | Scheduled | Completed |
|---|---|---|---|
| 1. Assessment of LAT repoint advantageousness<br>What additional considerations are needed? Presently, the issue is viewed in terms of a threshold for burst intensity and a TBD number of repoints that may be allowed per year. Some criteria for repoint that should be evaluated: number of recouped LAT bursts; estimated afterglow fluences detected. | Discussion | | |
| 2. Assessment of usefulness of GBM spatial, spectral & temporal information by LAT for ID of photons used in LAT on-board & ground localizations | | | |
| (a) spatial aspects | FL, et al. | | |
| (b) spectral aspects | DLB, JTB | | |
| (c) temporal aspects | JPN, JDS | | |
| 3. Exploration of (different) procedures for LAT on-board processing and alert message when no LAT trigger, only GBM trigger – Attempt to ID the LAT GRB photons might commence, based on GBM information. | Discussion | | |
| 4. Trade study for alert localization procedure | | | |
| (a) ID and send small set of (highest-energy) LAT events to the ground for computation of accurate localization, vs. | JPN, JTB | | |
| (b) compute on-board localization using all GRB photons, w/ degraded spatial info | NO, FL | | |
| 5. Definition of GRB parameters for inclusion in LAT alert message | | | |
| (a) spatial aspects | FL, et al. | | |
| (b) spectral aspects | DLB, JTB | | |
| (c) temporal aspects | JPN, JDS | | |

**Summary of Alert Plan (7/1-10/1/02)**: It is too early to estimate activity schedules, given that work in progress on simulation packages and trigger tasks will consume available summer time. Discussion on refinements to alert tasks to continue in meetings …

## 4. Projected GRB Simulation Workers

| Person | Initials |
|---|---|
| Sandhia Bansal | SB |
| Jerry Bonnell | JTB |
| Johann Cohen-Tanugi | JCT |
| David Band | DLB |
| Brenda Dingus | BLD |
| Francesco Longo | FL |
| Jay Norris | JPN |
| Nicola Omodei | NO |
| Rob Preece | RDP |
| Jeff Scargle | JDS |
| + 1–2 (Italy) | |