GLAST Sensitivity to Gamma-Ray Bursts and Support for Joint Swift-GLAST Observations

David Band, GSSC

CRESST/GSFC/UMBC

Relevant GLAST GRB Capabilities

- LAT (<20 MeV to >300 GeV)
  - Onboard trigger, ~15 s latency
  - Ground trigger (sensitivity greater because background events filtered out), ~6 hour latency
  - Localization of ~10' about twice a month
    - Small number of counts—sensitive to fluctuations
    - Very dependent on spectrum
  - Spectroscopy
  - Data out to ~65° from LAT axis

- GBM (<10 keV to 30 MeV)
  - Rate triggers: ~200 bursts per year
  - Localization: ~10° on board, few degrees on ground
  - Spectroscopy
  - Data down to horizon

Relevant GLAST GRB Capabilities, cont.

- **Spacecraft**
  - **Swift-like burst telemetry through TDRSS, connected to GCN**
  - **Scans sky (default). Strong burst will result in autonomous repoint to burst location for 5 hours (except for Earth occultation)**
  - **TOO on 6 hour timescale (probably much less)**
  - **Swift-GLAST FOV overlap for ~1/6 of bursts**

- **Combinations of Swift, GBM, and LAT observations or detections result in:**
  - **Swift localization leading to LAT afterglow observations**
  - **LAT localization leading to Swift afterglow observations**
  - **GBM and LAT broadband spectroscopy of Swift bursts**

Guest Investigator Program—Overview

- $4M for 40-50 research programs, available starting ~60 days after launch (L > December 14, 2007)

- In Cycle 1 you can propose for:
  - Analysis of data released by GLAST mission
  - Support correlated observations relevant to GLAST
  - Theory related to GLAST (~10% of funds)
  - Data analysis techniques relevant to GLAST data
  - ***Time on NRAO telescopes***

- In Cycle 1 you cannot propose for:
  - Changing GLAST's observing plan (possible in Cycles 2+)
  - Analyzing LAT event data (even if you have access)

GI Program, cont.

- Two phase proposal system
  - Phase 1—Technical proposals submitted through RPS
  - Phase 2—Budgets for approved technical proposals submitted through NSPIRES
- Two types of proposals
  - Regular—1 year research plan. 4 page technical justification
  - Large (legacy)—three year research plan, resubmitted after 1st and 2nd year. 6 page technical justification
- Foreign scientists:
  - Can propose but cannot receive NASA funding (NRAO time, useful for funding by other agencies)
  - US co-Is—funding consistent with the level of effort

GI Program, cont.

- Notice of Intent (NOI) should be submitted through GSSC website by July 13
- GLAST science team members (instrument teams, GSSC):
  - Can receive funding for research using publicly available data
  - Cannot propose a research program based on their access to LAT event data in Cycle 1
- Fellows program will be announced and administered separately

Schedule

Date	Months-L	Event
		Cycle 1
Mid June 2007	-6	Proposal materials on GSSC website
7/13/2007	-5	Notice of Intent due date
9/7/2007	-2	GI Cycle 1 proposal deadline
>12/14/2007	0	LAUNCH!!!
January 2008	1	Results of phase 1 evaluation
	2	Release of GBM SAE Tools
	2	GI Cycle 1 Begins
March 2008	3	Funding decision
		Cycle 2
	6	Effective NRA Release; Release 0.9 of SAE
	8	SAE Workshop—Release of preliminary catalog
	9	GI Cycle 2 Proposal Deadline
	14	GI Cycle 2 Begins; Release 1.0 of SAE

Source of All (GLAST GI Program) Knowledge

http://glast.gsfc.nasa.gov/ssc

Cases

GLAST-Swift Synergy

- **Burst occurs in LAT (GLAST) and BAT FOVs**
  - **Swift localizes burst**
  - **Swift and LAT search for afterglow**
  - **GLAST provides broadband spectroscopy**
  - **Strong burst: no immediate response necessary (LAT repointed autonomously for 5 hours)**
  - **Weak burst: consider LAT TOO (but LAT scans position); response time is <6 hours**

- **Burst occurs in BAT but not LAT FOV**
  - **Swift localizes burst**
  - **Swift and LAT search for afterglow**
  - **GBM (GLAST) may provide 10 keV-30 MeV spectroscopy**
  - **Consider LAT TOO (but LAT scans position); response time is <6 hours**

GLAST-Swift Synergy, cont.

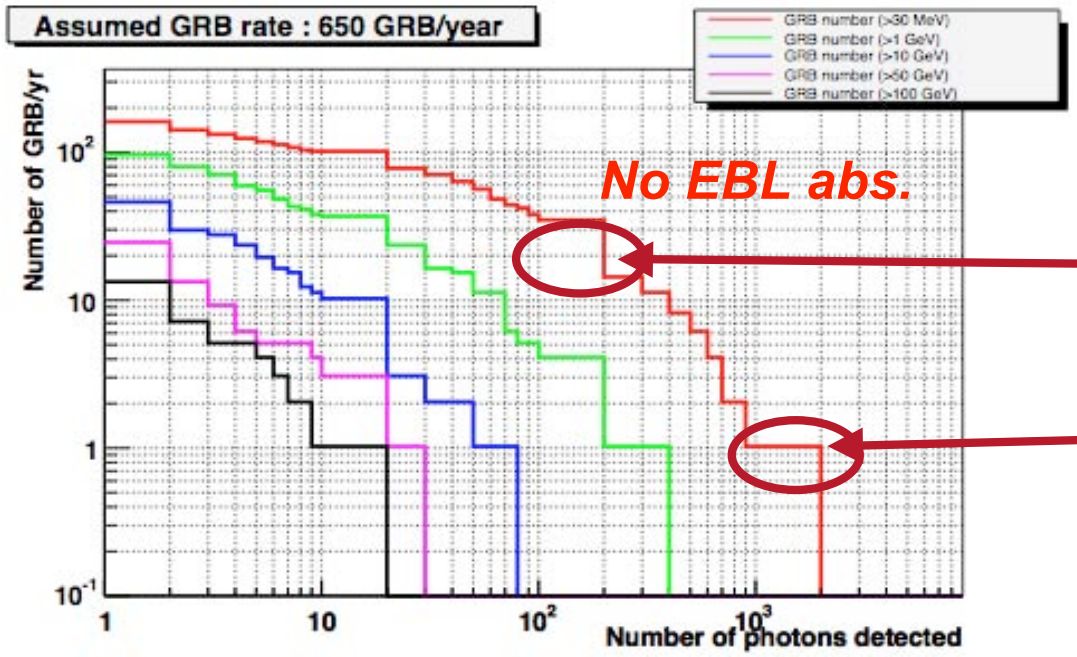
- **Burst triggers LAT (GLAST) but not in BAT FOV**
  - **GLAST provides broadband spectroscopy**
  - **LAT and possible Swift afterglow searches**
  - **Strong burst: no immediate GLAST response necessary (LAT repointed autonomously for 5 hours)**
  - **Weak burst: consider LAT TOO (but LAT scans position); response time is <6 hours**
  - **GLAST localization may suffice for XRT TOO followup**
    - **Onboard GLAST position available within ~15 s**
    - **Ground GLAST position available within ~6 hours**

GLAST-Swift Synergy, cont.

- **Burst triggers GBM (GLAST) but not in BAT FOV**
  - **GLAST provides broadband (<30 MeV) spectroscopy**
  - **LAT and possible Swift afterglow searches**
  - **Strong burst: no immediate GLAST response necessary (LAT repointed autonomously for 5 hours)**
  - **Weak burst: consider LAT TOO (but LAT scans position); response time is <6 hours**
  - **GLAST GBM localization is insufficient for Swift followup**

Expected Detection Rate

- Based on BATSE detection rate, the GBM should detect ~200 bursts per year.
- The LAT detection rate depends on the relatively unknown ~GeV emission. Using BATSE data and extrapolating to LAT band, estimate LAT rates.



A few bursts per month with 100 counts

~1 burst per year with 1000 counts

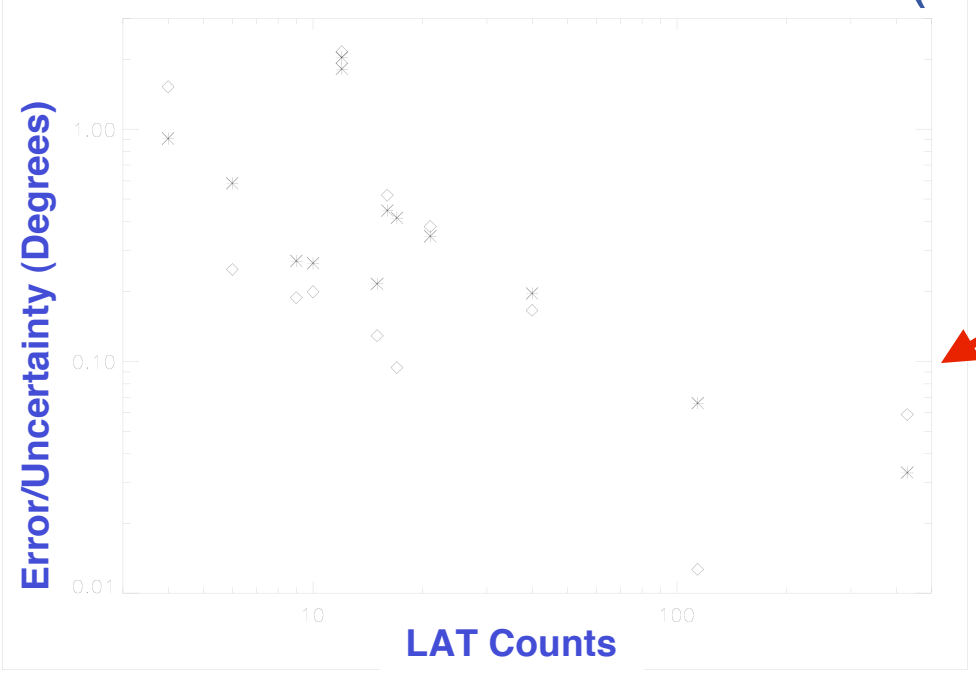
Burst Localization

- GBM—dependent on burst strength
  - Statistical:
    - [15°, 9°, 1.5°] for [threshold, brightest 40%, brightest 5%]
  - Systematic:
    - Onboard: ~10°
    - On ground: 1-2°
- LAT—depends on number of detected counts (& spectrum)

DC2 Simulations

♦—difference between 'true' and calculated positions

x—calculated uncertainty



6 arcminutes