GLAST Large Area Telescope:

LAT Burst Capabilities

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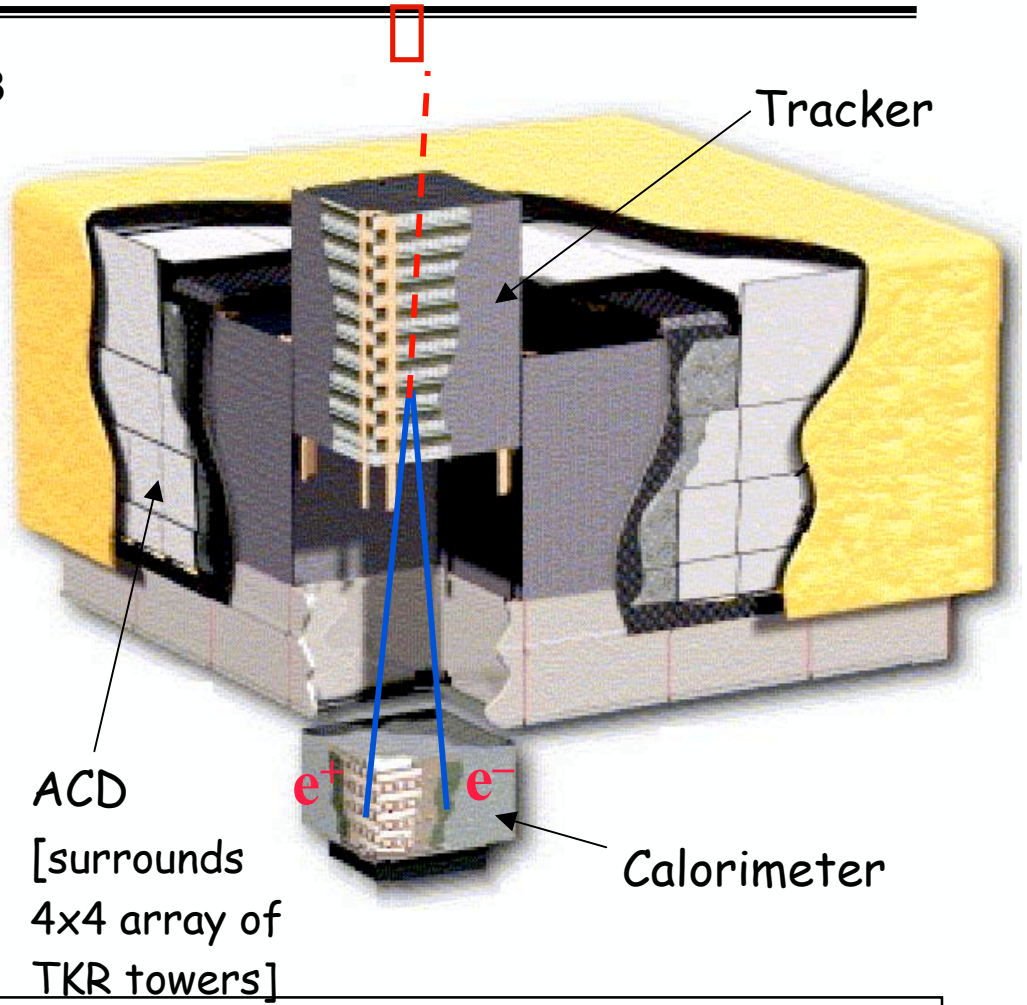
Outline

- LAT Overview, Performance
- Burst requirements on LAT
- Burst handling by LAT
- Work in progress

Overview of LAT

- Precision Si-strip Tracker (TKR) 18 XY tracking planes. Single-sided silicon strip detectors (228 □m pitch) Measure the photon direction; gamma ID.
- Hodoscopic CsI Calorimeter(CAL) Array of 1536 CsI(Tl) crystals in 8 layers. Measure the photon energy; image the shower.
- Segmented Anticoincidence Detector (ACD) 89 plastic scintillator tiles. Reject background of charged cosmic rays; segmentation removes self-veto effects at high energy.
- Electronics System Includes flexible, robust hardware trigger and software filters.



Systems work together to identify and measure the flux of cosmic gamma rays with energy 20 MeV - >300 GeV.

Gamma Conversion Material

TKR tungsten converter thickness profile:

"FRONT": 12 layers of 3% X_0

"BACK": 4 layers of 18% X_0

followed by 2 layers with no converter

- **Large A_{eff} with good PSF and improved aspect ratio for BACK.**
- **Two sections provide measurements in a complementary manner: FRONT has better PSF, BACK greatly enhances photon statistics.**

TKR has ~1.5 X_0 of material.
Combined with ~8.5 X_0 CAL provides 10 X_0 total.

Science Performance Requirements Summary

Parameter	SRD Value	Present Design Value
Peak Effective Area (in range 1-10 GeV)	>8000 cm^2	10,000 cm^2 at 10 GeV
Energy Resolution 100 MeV on-axis	<10%	9%
Energy Resolution 10 GeV on-axis	<10%	8%
Energy Resolution 10-300 GeV on-axis	<20%	<15%
Energy Resolution 10-300 GeV off-axis (>60º)	<6%	<4.5%
PSF 68% 100 MeV on-axis	<3.5°	3.37° (front), 4.64° (total)
PSF 68% 10 GeV on-axis	<0.15°	0.086° (front), 0.115° (total)
PSF 95/68 ratio	<3	2.1 front, 2.6 back (100 MeV)
PSF 55º/normal ratio	<1.7	1.6
Field of View	>2sr	2.4 sr
Background rejection (E>100 MeV)	<10% diffuse	6% diffuse (adjustable)
Point Source Sensitivity(>100MeV)	<6×10^{-9} $cm^{-2}s^{-1}$	3×10^{-9} $cm^{-2}s^{-1}$
Source Location Determination	<0.5 arcmin	<0.4 arcmin (ignoring BACK info)
GRB localization	<10 arcmin	5 arcmin (ignoring BACK info)

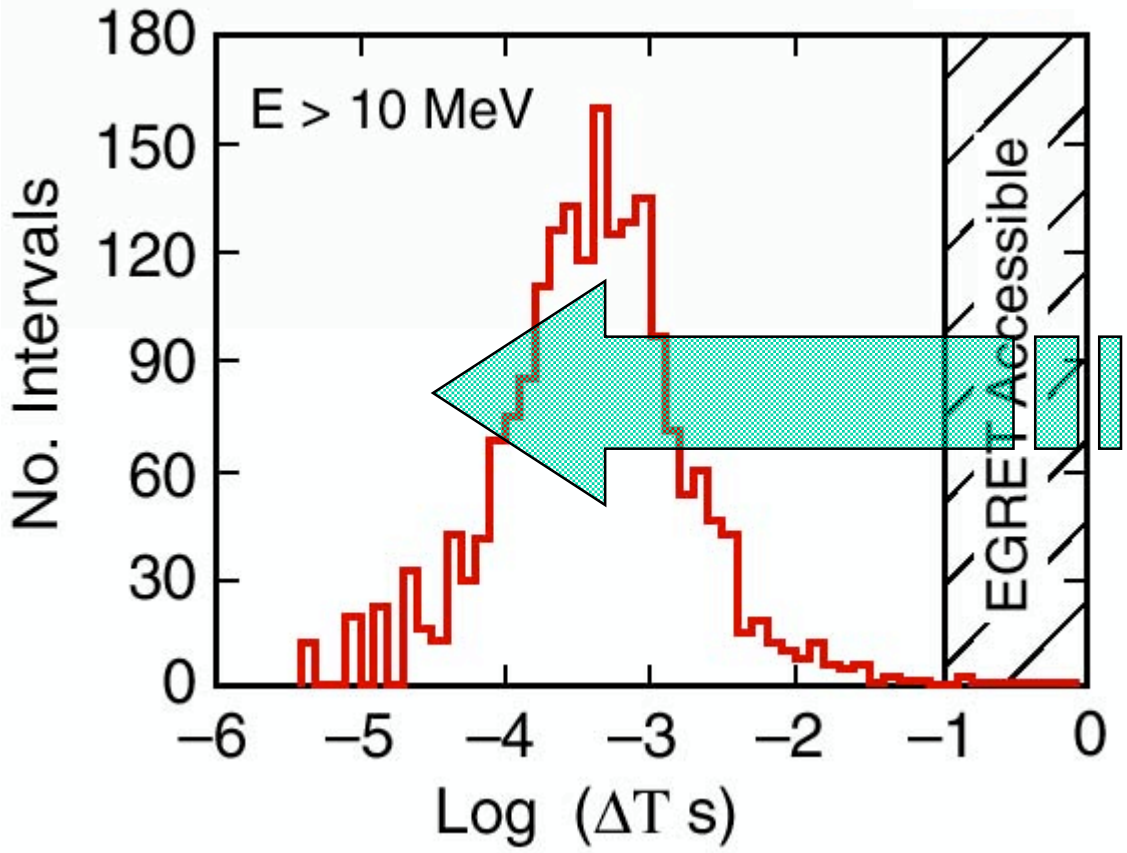
LAT meets all requirements [see January PDR/Baseline]

Burst-related Requirements on LAT

- SRD 17: GRB location accuracy on-board
  - Must specify burst characteristics to set requirement:
    - For burst (<20 sec duration) with >100 photons above 1 GeV
  - Requirement: < 10 arcmin (Goal <3 arcmin)
- SRD 18: GRB notification time to spacecraft
  - Requirement: <5 sec (Goal <2 sec)
- SRD 14: Instrument time accuracy (relative to s/c time)
  - Requirement: <10 □s (Goal < 2 □s)
- SRD 16: Dead time
  - Requirement: <100 □s/event (Goal < 20 □s/event)

GRBs and Instrument Deadtime

Distribution for the 20th brightest burst in a year (Norris et al)



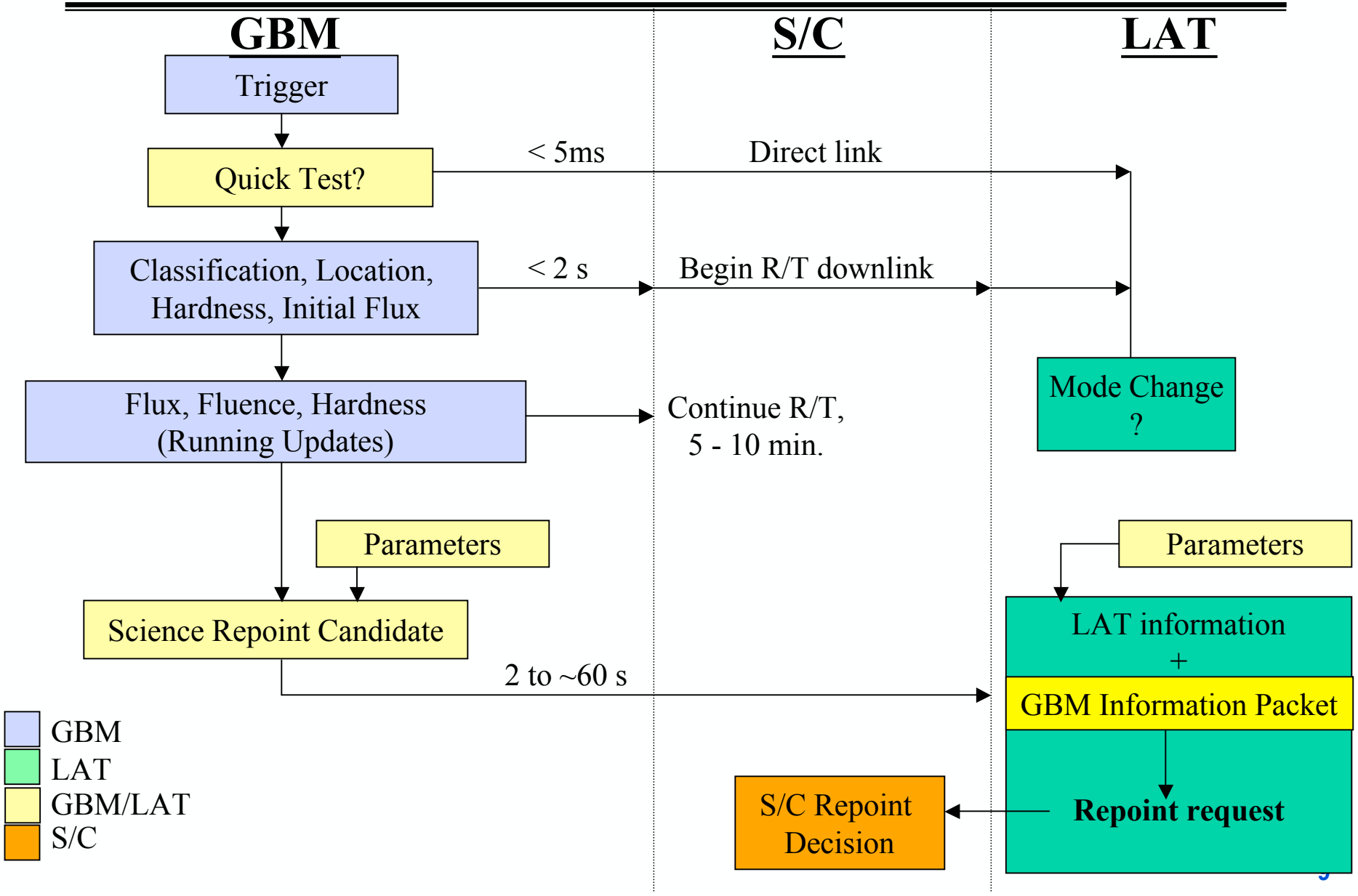
LAT will open a wide window on the study of the high energy behavior of bursts.

Time between consecutive arriving photons

Burst Handling by LAT

- A direct link for a fast signal from GBM to LAT to signal burst detection
  - allows LAT to change trigger/filter modes, if needed (no clear need has been identified yet, but the capability is kept for flexibility)
  - alerts onboard LAT process for possible use in detection algorithm
- Alerts:
  - LAT receives GBM burst alert packets, containing burst characteristics (details TBR).
  - LAT generates burst alert packets (not sent to GBM).
- Spacecraft Repoint Requests
  - To avoid multiple requests from the instruments to the spacecraft (which would require the s/c to make choices), a simple protocol has been suggested 

Burst Repoint Candidate Path



Context: Mission Repointing Plan

Summary of plan

During all-sky scanning operations, detection of a sufficiently significant burst will cause the observatory to interrupt the scanning operation autonomously and to remain pointed at the burst region during all non-occulted viewing time for a period of 5 hours (TBR). There are two cases:

1. **The burst occurs within the LAT FOV.** **If the burst is bright enough that an on-board analysis provides >90% certainty that a burst occurred within the LAT FOV, the observatory will slew to keep the burst direction within 30 degrees (TBR) of the LAT z axis during >80% of the entire non-occulted viewing period (neglecting SAA effects). Such events are estimated to occur approximately once per week.**

2. **The burst occurs outside the LAT FOV.** **Only if the burst is exceptionally bright, the observatory will slew to bring the burst direction within 30 degrees (TBR) of the LAT z axis during >80% of the entire non-occulted viewing period (neglecting SAA effects). Such events are likely to occur a few times per year.**

After six months, this strategy will be re-evaluated. In particular, the brightness criterion for case 2 and the stare time will be revisited, based on what has been learned about the late high-energy emission of bursts.