GLAST GRB Simulations and Tracker Trigger Algorithm

High-Fidelity GRB simulations include:

- BATSE duration and peak flux distributions
- Peak flux scaled from BATSE to GLAST energies
- Number of pulses from BATSE GRB analysis
- Pulse-width distribution scaled to GLAST energies
- BATSE distribution of spectral power-law indices
- GLAST PSFs, effective area from *Glastsim* reconstruction
- Variation of PSF within GLAST field of view
- Average diffuse gamma background (~ 1 Hz)
- Simple on-board cosmic-ray background rejection (Level-3: ~ 3 Hz)

Strawman Real-time, *Unbinned* Trigger Algorithm:

- Search sliding 20-event window – forming their N□(N-1)/2 distances.
- Choose cluster for event with smallest average distance within 35° circle.
- Form joint spatial and temporal Likelihood for events within circle,

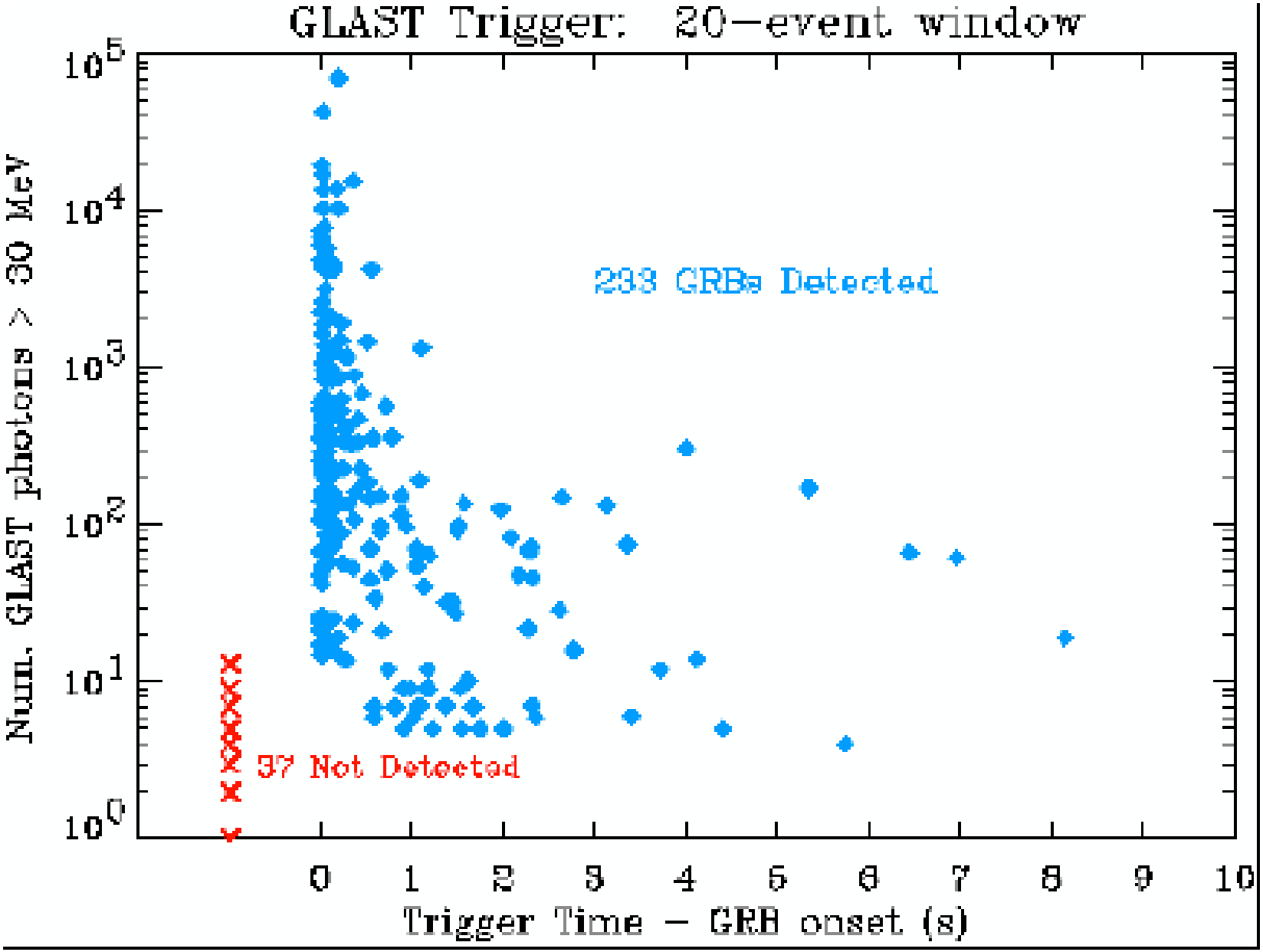
$$L = -\log\{ \square(\square\square) \square \square(\square t) \} .$$

- Set threshold such that GLAST sees < 1 false trigger per ~ week.

Summary: GLAST GRB Tracker Trigger Algorithm

- Unbinned (in time and space) approach fully exploits available information.
- Triggers on ~ 85% of BATSE-like bursts, ~ 233 / 270 (number per year).
- Triggers on ~ 78% of these bursts visible to GLAST in less than *one second*,
  With *fewer than one false trigger per 3 days*.
- Refinements will include:
  - Spatial dependence of diffuse gamma flux
    (Galactic Plane emission could dominate residual CR flux after L3T.)
  - Temporal dependence of on-board residual cosmic-ray flux
  - Reconsideration of L3T background rejection
- If trigger provided by GRB context instrument, then
  recast unbinned trigger algorithm to use positional information,
  and calculate probability of photon being associated with GRB

Regardless of trigger mode: Must provide algorithm to determine association probability


GLAST Trigger: 20-event window
Num. GLAST photons > 30 MeV
10^5
10^4
10^3
10^2
10^1
10^0
233 GRBs Detected
37 Not Detected
0
1
2
3
4
5
6
7
8
9
10
Trigger Time - GRB onset (s)