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,
  \[ L = - \log \left\{ \mathbb{P}(D_x) \cdot \mathbb{P}(D_t) \right\}. \]
- 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