GLAST-Swift Overlap

David Band, GSSC

CRESST/GSFC/UMBC

Issue

GLAST

- **Simultaneous GLAST-Swift burst observations will result in Swift localizations and GLAST spectroscopy.**

- **GLAST will operate in survey mode. Swift points at 5-6 different targets each orbit. Therefore, overlap will be optimized through Swift scheduling.**

- **Orbits:**
  - **Altitudes of ~565 km GLAST, 590 km Swift**
  - **Orbital periods are ~96 minutes**
  - **Orbital inclinations are 25.3° GLAST, 20.3° Swift**
  - **Orbit precession periods of ~53 days**
  - **Orbits beat with a period of ~13 days**
  - **Orbital inclinations beat with a period of ~6.5 years**
  - **Orbits will decay**

Results of Analytic Calculations

- **Without optimization LAT FOV overlaps BAT an average of 0.27 and BAT overlaps LAT an average of 0.13.**
  - **LAT FOV modelled as 65° circle, BAT as 45° circle.**

- **Pointing Swift at/near the LAT FOV can increase the overlap by >3×! Operating constraints and Swift's other science objectives will reduce the actual overlap.**

- **Because of the large FOVs, GLAST's rocking, and Swift's pointing flexibility, the average overlap fraction is not sensitive to the relative inclination of the orbits.**

- **Therefore, we (DLB, Neil, and Swift team) are planning to optimize Swift's pointing without greatly burdening Swift's scheduling.**

Fundamental Optimization Concept

- Swift schedule is created every day using a set of targets distributed along Swift's orbit. Targets are:
  - Burst follow-ups
  - TOOs
  - GI selected (in GLAST era)
  - 'Fill-in' targets

- In GLAST era, Swift will observe high priority targets regardless of GLAST's pointing. Otherwise, Swift will observe northern (southern) hemisphere sources when GLAST rocks north (south). Therefore, two sets of targets, each observed every other orbit.

- Choose target sets that maximize the GLAST-Swift overlap

Proposed Methodology

- **Add to Swift's TAKO (scheduling tool) the capability to read in target files with time constraints.**

- **Develop tool that identifies targets for 'north' and 'south' target lists.**
    - **Tool can approximate Swift's constraints to filter list; TAKO enforces Swift constraints**
    - **IDL prototype developed**

Sample Prototype Output
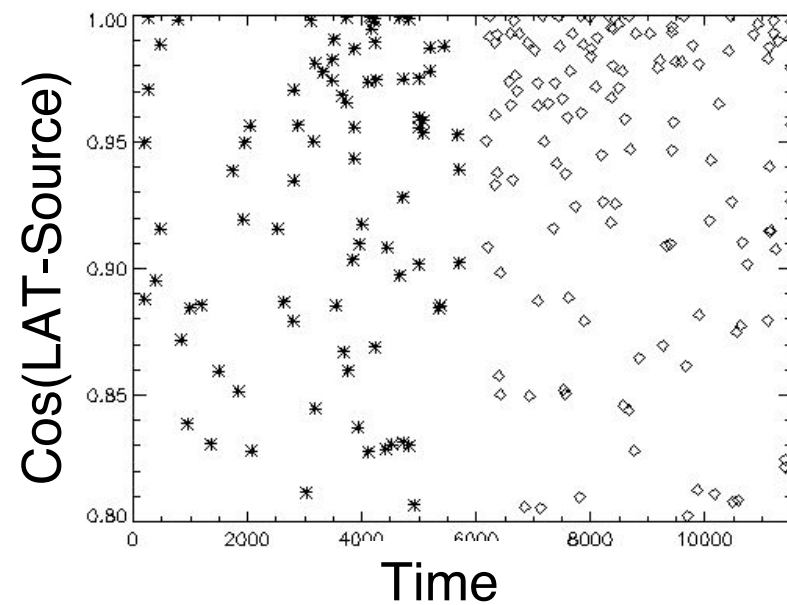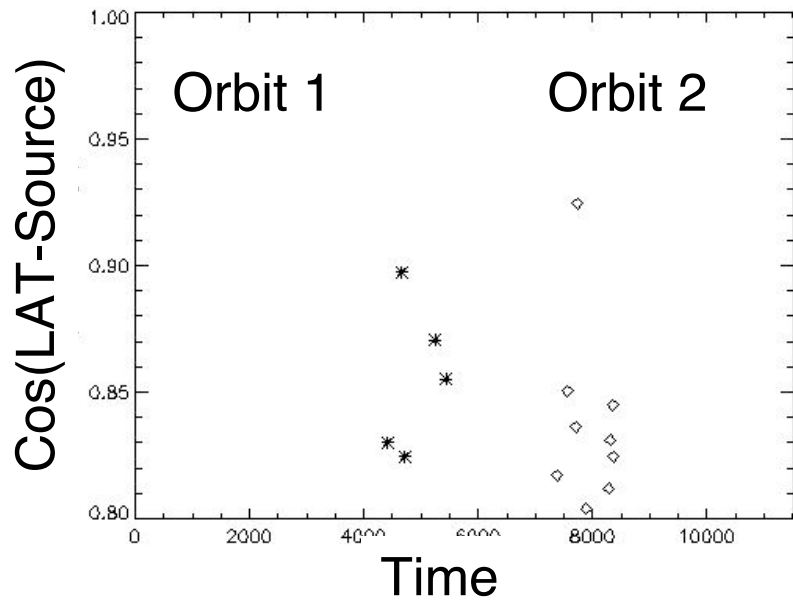
Minimum LAT-source angle in a given orbit vs. time. Two orbits are shown in each plot. The GLAST and Swift orbits are out-of-phase in the left plot, in phase in the right.

Details: Sources are Swift burst locations. DC2 timeline used. Sun, Moon, Swift visibility, Swift velocity vector constraints considered. Circular model of Swift orbit.

Summary

- **Overlap between GLAST and Swift FOVs can probably be increased by ~2x by Swift scheduling. Thus**
  - ~1/2 of BAT observed bursts will be in LAT FOV
  - ~1/4 of LAT observed bursts will be in BAT FOV

- **Impact on Swift's non-GRB science objectives will be minor.**