Serving Data to the GLAST User Community

Don Horner (L3 GSI/GSFC) and the GLAST Science Support Center Team

GLAST Mission Overview

GLAST is an international and multi-agency space mission that will study the cosmos in the 10 keV-300 GeV energy range. The main instrument, the Large Area Telescope (LAT), is a pair conversion telescope. It will have an effective area (>8000 cm²), angular resolution (<3°) at 100 MeV, <0.15° at >10 GeV), field of view (>2 sr), and deadtime (<100µs) that will provide a factor of 30 or more advance in sensitivity compared to previous missions, as well the capability for studying transient phenomena. Data from the LAT are processed by the LAT Instrument Science Operations Center (LISOC) before being sent to the GSSC.

The other instrument on GLAST, the GLAST Burst Monitor (GBM), consists of 14 detectors that will monitor >15 of the sky, including the LAT’s field of view. Gamma ray bursts will be localized to 9° (15% of the bursts) by comparing the rates in different detectors. The GBM also extends GLAST’s burst spectral sensitivity to <10 keV to >20 MeV band. Data from the GBM are processed by the GBM Instrument Operations Center (GIOC) before being sent to the GSSC.

Although pointed observations will be possible, the observatory will mostly scan continuously because of the LAT’s large field of view; this survey mode is planned for at least GLAST’s first year. See posters in Session 24 for additional information about the GLAST spacecraft and instrumentation.

Data Properties and Impact on Data Serving

The large field of view of the LAT, combined with the continuously scanning operating mode, makes it impossible to define “observations” in the traditional sense where there is an obvious start and stop time to the data gathering. Rather any given object is constantly moving into and out of the instrument’s field of view and is typically observed for ~30 minutes every 3 hours of observing.

The low angular resolution at low energies also results in photons from one source overlapping with photons from nearby sources and requires simultaneous fitting to disentangle closely spaced objects. Typically a user will need data from a part of the sky equal to a 25-30° diameter field of view to fully analyze an object at the center of that field. This corresponds to ~1-2% of the sky for a single analysis.

The LAT is expected to collect ~3 Hz of photon data and ~30 Hz of event data continuously. This corresponds to ~100 million photons and ~1 billion events a year. With the current data record specification (~10 GB of photon data and ~1 TB of event data a year with a typical photon query returning 100-200 Mybytes of data).

It is also expected that the LAT will detect thousands of sources. The large number of sources, combined with the moderately large data volume and high degree of source overlap makes it unfeasible to prepackage the data on a source by source or even region by region basis. This would result in an unnecessary duplication of the same data multiple times in the data system.

All of these factors point toward the development of a dynamic data retrieval system that retrieves the data as needed according to the user’s unique specifications instead of relying on static prepackages files.