Serving Data to the GLAST Users Community

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Abstract

The scientific community will access the public GLAST data through the website of the GLAST Science Support Center (GSSC). For most data products the GSSC website will link to the NASA High Energy Astrophysics Science Archive Research Center’s (HEASARC) Browse interface, which will actually serve the data. For example, data from the GLAST Burst Monitor (GBM) from a given burst will be packaged together and accessible through Browse. However, the raw and event data produced by the Large Area Telescope (LAT), GLAST’s primary instrument, will be distributed through the GSSC interface. These data will be collected over the LAT’s large field-of-view, usually while the LAT is scanning the sky, and thus photons from a particular direction cannot be attributed to a single “observation” in the traditional sense. Users will request all photons detected from a region on the sky over a specified time and energy range. Through its website the GSSC will also provide long and short term science timelines, spacecraft position and attitude histories, exposure maps and other scientific data products. The different data products provided by the GSSC will be described.

GBM Data

Data products for the GBM will be similar to those of the BATSE instrument on the Compton Gamma Ray Observatory. For bursts, catalogs with derived parameters, which include preliminary lightcurves and spectral fits, will be provided through Browse. The catalog entries will link to data packages which will include accumulated counts (CTIME and CSFRC files), time tagged events, response functions, backgrounds, and other files necessary to analyze the data. New bursts will be added to the catalog as soon as the data is received from the GBM. Although burst alert notices will go out immediately, the data will not enter the archive until the GIOC is finished processing the data.

Spacecraft and Other Data

In addition to the science data, various data products dealing with the spacecraft will be available on the GSSC website to help scientists and observers. These will include proposed and observed science timelines, spacecraft position and attitude histories, interstellar emission model and an instrument background model. These will be as refined as the mission progresses and updated infrequently. The GSSC will also provide and various data on the exposure and live-time of the LAT instrument updated with each photon database update.

LAT Data

Photon and event data will be served through the GSSC’s LAT data server. The GSSC produces the photon database based on event data received from the LsIRC.

Data Properties and Data Analysis

The LAT will detect photons that can be used in data analyses up to ~500 keV. The effective area decreases off-axis, but the solid angle increases, and therefore a large fraction of the data will be taken off-axis. The LAT will be continuously scanning the sky all the time. The LAT will also scan the Earth limb. While GLAST can point at individual sources, there will rarely be any advantage of the LAT’s large FOV. Usually GLAST will rock ~30° above and below the orbital plane once per orbit for uniform sky coverage.

LAT Data Server

The LAT Data Server will provide users with access to events, photons, and position and attitude history from the LAT. It will be accessed by users through a customized web interface hosted by the GSSC.

All public data from the GLAST mission will be available through the GSSC’s website. Most of the data will be served through the HEASARC Browse (an interface to all of NASA’s high energy astrophysics data from both current and previous missions). The GSSC website will link to this interface. Those data not available through Browse will be served directly from the GSSC’s website.

GLAST Data Policy and Access

All GBM data is public immediately from the beginning of the mission. During the first year, the LAT event data are proprietary to the instrument team and the Interdisciplinary scientists, although lightcurves and spectra of detected transients and ~50 selected sources will become public as soon as possible. A month after the end of the first year, the event data will become publicly available.

Starting the second year, all subsequent science data acquired by the spacecraft will be immediately in the public domain without a proprietary data period. Full details on the GLAST Data Policy can be found on the GSSC website.

Poster 19.1

For more information about the GLAST Data Policy and Access, please visit the GSSC website.

GNM Website: http://glast.gsfc.nasa.gov/ssc

GLAST Data Products

Where to Get Them

Lists of all accepted and executed ToO requests and their status.

GBM Burst Catalog and Data

Derived parameters (fluence, peak flux, etc.) including lightcurves and spectral fits and data (accumulated counts, etc.) for GBMs.

GBM Daily Data

Accumulated counts, position and attitude history, etc. for each day of the mission.

HEASARC’s Browse

GBM Trigger Catalog

Derived parameters and data for all triggers. Similar to the Burst Catalog.

LAT Data Server

The LAT Data Server will provide users with access to events, photons, and position and attitude history from the LAT. It will be accessed by users through a customized web interface hosted by the GSSC.

The user enters the desired position with optional energy and time cuts and will then be served a page with the estimated query time and a link to a results page. When the data files (FITS format files) are ready, they will be made available for download on the results page.

The data server is implemented as a small cluster of Linux PCs which operate on event data stored in FITS files. Based on the user’s query, the photons matching the data cuts are extracted and presented to the user as a downloadable FITS file. The photon and event databases will be updated immediately when new data are received by the GSSC from the LAT instrument team.

LAT Data

It is impossible to define an “observation” for the LAT in the traditional sense. Given the large field of view of the LAT and the continuously scanning operating mode, any given object is constantly moving in and out of the instrument’s field of view and is typically observed for ~30 minutes every 3 hours of observing. Also, the low angular resolution at low energies results in photons from one source overlapping with photons from nearby sources and requiring simultaneous fitting to disentangle closely spaced objects. Typically a user will need data from a part of the sky equal to a 20-30° diameter field of view to fully analyze an object at the center of that field. This corresponds to ~1.2% of the entire sky for a single analysis.

The LAT will trigger on a large number of events, only a small fraction of which will be actual photons. Filtering will reduce the ~2.5 Hz of triggers to ~30 Hz delayed from the GSSC from which ~2-3 Hz of photons will be extracted. This corresponds to ~100 million photons (~1 billion events a year). With the current data record specifications, this translates into ~10 GB of photon data and ~1 TB of event data a year with a typical photon query returning 100-200 Mbytes of data.

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

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 prepackaged files.

GBM Data

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LAT Events. Full detailed description of events (particles and gamma-rays) reconstructed by the LAT.

LAT Photons. LAT events identified as photons. LAT event data product of the GLAST mission.

LAT Spacecraft File. Record of pointing, instrument mode, and live-time in 3s intervals.

LAT Live-time Cubes. Data cubes showing the accumulated live-time for any given position on the sky.

LAT Point Source Catalog. Table of detected sources with derived information.

LAT Burst Catalog. Derived parameters for GRBs detected by the LAT.

Pulsar Ephemerides for pulsars that may be detectable by the LAT.

LAT Instrument Response Functions. Data necessary to calculate response functions.

GBM Burst Catalog and Data

Derived parameters (fluence, peak flux, etc.) including lightcurves and spectral fits and data (accumulated counts, etc.) for GBMs.

GBM Daily Data

Accumulated counts, position and attitude history, etc. for each day of the mission.

GBM Trigger Catalog

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CALDB

GBM Calibration Files and PHA Lookup tables. Data necessary to calculate response functions and channel to energy conversions.