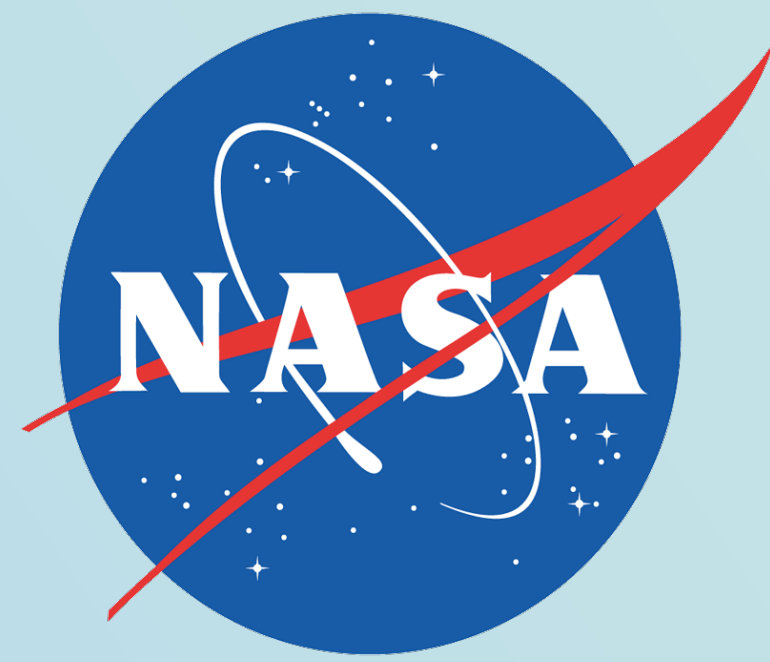




# The GLAST Science Support Center

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## Abstract

The GLAST Science Support Center (GSSC) serves as the mission's primary interface to the scientific community. The GSSC supports the planning and scheduling of science observations and maintains a publicly accessible archive of all GLAST data products. The GSSC also maintains and distributes data analysis software and documentation as well as providing technical and scientific support. In addition, the GSSC will administer the guest investigator program for NASA Headquarters and provide proposal preparation tools and documentation. We present an overview of our role in each of these activities.

Much of the information in this poster is presented in more detail in **Posters 19.1 and 19.34**. Also see Posters 19.8 and 19.29 for the role of the LAT and GBM Instrument Operations Centers.

## Guest Investigator Program

The GLAST mission will support a Guest Investigator (GI) program that will be administered by the GSSC for NASA Headquarters. It is divided into two phases: the first year and the rest of the mission.

For the mission's first year (the first GI cycle), GIs may not propose GLAST observations and will not have access to the LAT's photon data until the beginning of the second year when these data become public to the scientific community. From the beginning of the mission the LAT team will post light curves of ~20 strong sources as well as the characteristics of bright transients. Therefore investigators may request support for multi-wavelength observations during the first cycle. The NRA release for this cycle is currently scheduled for February 2007 with proposals being due in June 2007.

During the subsequent cycles, there will be ~100 accepted GIs. GIs during these cycles may request pointed observations or special survey patterns as part of their proposal if scientifically justifiable. However, it is expected that most, if not all, of these proposals will be for support to analyze data acquired during survey mode operation. During this phase of the mission, all data, including the data from the first year will be available to the public from the GSSC's website (see section on Providing Data to the Community). See **Poster 19.1** for details about the GI Program.

## Proposals

To assist scientists in making Guest Investigator proposals, the GSSC will provide a set of tools for planning observations and submitting proposals.

### Proposal Submission

Proposals will be submitted through the GSSC website using RPS and will consist of a two phase proposal process. Initially proposers will submit their science proposals for review. Those Guest Investigators who are selected will then submit the funding portion of the proposal.

### Proposal Planning Tools

These tools will include an exposure and sensitivity calculator as well as observation simulation tools to assist potential Guest Investigators in assessing the feasibility of observing their desired targets. The planned tools include the following.

**Source Sensitivity Calculator** – This tool estimates the detectability of a point source by the LAT based on the source spectrum, flux and sky position using a precession averaged exposure calculation.

**GLAST Simulated 1D Spectral Analysis** – This is the HEASARC's WebSpec tool, extended to use the GLAST response functions. These response functions will also be downloadable to be used in XSpec.

The above tools will be available for cycle one. The following will be available for all subsequent cycles.

**Exposure Time History Display** – This tool generates and plots the exposure time history for a specific point on the sky to allow proposers to determine the amount of exposure already accumulated on their desired targets.

**Count and Exposure Maps** – The GSSC will provide counts, exposure and flux maps of the entire sky on various time scales ranging from a week to the entire mission.

The following tools are part of the SAE (see Analysis Tools section) and can be used for proposal planning after the first cycle.

**Orbit Simulator** – This tool will allow the user to model various pointed and survey profiles to see the effect on the exposure and data accumulation.

**Observation Simulator** – Using an orbit model from the Orbit Simulator or a standard profile, this tool allows the user to generate simulated LAT data for analysis.

**LAT Spectral Analysis Tool** – This is the main data analysis tool of the SAE and works both on actual data from the spacecraft and data generated by the Observation simulator to analyze the observed or simulated data.

## User Support

One of the primary roles of the GSSC is to support the user community throughout the lifetime of the GLAST mission. This is not limited to only providing data and tools. It also includes assistance in using the provided tools and education about the capabilities of the GLAST instruments and the nature of the data. The GSSC will also provide individual assistance with software and data issues as needed. To address this role, the GSSC is planning a number of support activities both during the mission and before launch.

### Before Launch

The primary focus of the GSSC's user support role prior to launch is educating of the user community about the capabilities and nature of the mission. The GSSC will achieve this in a number of ways including posters and talks at scientific conferences and tutorial sessions providing hands-on experience with simulated GLAST data and maintaining an up-to-date website with the current status and information about the GLAST mission.

### During the Mission

During the mission the GSSC's website will continue to provide updates about the status of the mission as well as provide a gateway for users to access the data and tools. The GSSC will also continue to host conferences and workshops to provide education and experience with the GLAST Science Software and a forum for users to report on scientific results obtained from the GLAST data. The GSSC website will also host a variety of tutorials and a help desk and FAQ to assist users in analyzing data and provide support for problems encountered.

## Targets of Opportunity

GLAST supports Target of Opportunity (ToO) observations. Requests for ToO observations can be submitted via the GSSC website using an RPS form similar to that used for the RXTE mission. Once submitted, the GSSC advises the Project Scientist whether the proposed ToO is feasible; the Project Scientist is responsible for approving or rejecting the proposal.

The ToO submitter will be notified of the acceptance or rejection of the request. If the request is accepted, the GSSC prepares a ToO Order that is sent to the MOC. Once the ToO is approved by the Project Scientist, the ToO order will be generated and uploaded to the spacecraft within six hours. The status of all accepted ToO proposals will be tracked on the GSSC website.

## Providing Data to the Community

All public data from the GLAST mission will be available through the GSSC's website (<http://glast.gsfc.nasa.gov/ssc/data>). Much of the data will be served through the NASA High Energy Astrophysics Science Archive Research Center's (HEASARC) Browse interface (<http://heasarc.gsfc.nasa.gov/db-perl/W3Browse/w3browse.pl>) and the GSSC website will provide a link to this interface. Browse is the interface to the archive for all of NASA's high energy astrophysics data from both current and previous missions. Those data not available through Browse will be served directly from the GSSC's website. Here we provide a short overview of the types of data available and the data access policy for the GLAST mission. For full details on the data available see the description of the various data products presented in poster 19.34.

### Science Data

GLAST will provide a variety of scientific data from its primary instruments, the Gamma-ray Burst Monitor (GBM) and the Large Area Telescope (LAT). In addition to the primary data products from the two instruments, various source catalogs as well as data from bursts and other transients will be provided.

### Spacecraft data

In addition to the science data, various data products dealing with the spacecraft will be available. This will include proposed and observed science timelines for coordinating simultaneous multi-wavelength observations, spacecraft alerts, pointing and livetime history data, and various other spacecraft related data.

### GLAST Data Policy

During the first year of the mission, LAT event data are available only to the instrument team and the interdisciplinary scientists as they calibrate the instrument. About a month after the end of the first year, these data will become publicly available. Starting the second year, all subsequent data acquired by the spacecraft will be immediately in the public domain and there will be no proprietary data period. The only exception to this is that during the first year, data corresponding to detected transients and a few selected sources will be made publicly available as well. Full details on the GLAST Data Policy can be found at [http://glast.gsfc.nasa.gov/ssc/data/Data\\_Policy.html](http://glast.gsfc.nasa.gov/ssc/data/Data_Policy.html).

## Observation Scheduling

The GSSC is responsible for generating the scientific observing plan for the GLAST mission based on the accepted proposals from the Guest Investigator Program and the sky survey requirements. This is done at two levels, a long-term schedule for the entire cycle (1 year), and a detailed weekly timeline that is used by the GLAST Mission Operations Center (MOC) to generate the spacecraft commands. Both of these schedules are available to the scientific community as they become available to allow for planning of multi-wavelength and simultaneous observing campaigns.

### Long-term Schedule

The long-term schedule is generated before the beginning of the cycle from all of the accepted GI proposals. This timeline will be posted on the GSSC website and the GIs will be notified of the expected observation dates for their targets. The long-term schedule will be updated during the cycle as necessary to account for deviations created by Target of Opportunity (ToO) observations or Autonomous Repoints (ARs) which are automated slews of the observatory to observe transient sources that meet criteria defined in the onboard software. ARs are expected to occur one to two times a month.

### Weekly Timeline

The weekly timeline contains the detailed information about the specific observations to be made during a given week with a time resolution of one minute. This timeline is used by the MOC to generate the actual commands sent to the observatory to perform the observations.

A preliminary weekly timeline is generated and available ~3 weeks before the start of the week it is to cover. This preliminary timeline is used to plan any necessary spacecraft and instrument events for that week as well as the TDRSS contacts necessary to download the spacecraft data.

A few days before the week is to begin, the GSSC generates a final weekly timeline that takes into account any necessary changes from the MOC or instrument operations centers (IOCs) and uses an updated spacecraft ephemeris to refine the observation schedule. This final timeline is used by the MOC to generate the observatory commands.

After the week's observations have been completed, the MOC provides the GSSC with an as-flown timeline generated from spacecraft telemetry that shows what the observatory actually did. The GSSC checks this as-flown timeline against the final science timeline to verify that all scheduled observations were carried out and reschedule any that were missed due to ToO observations or ARs.

At all times during this process, the scientific community will have access to the most up-to-date version of the timeline available for any given week. Thus until ~3 weeks before the start of a given week, information will be available from the long-term schedule. Once planning has begun, the preliminary schedule will be available until a few days before the start of the week, when the final timeline becomes available.

## Analysis Software

The GSSC will provide a suite of data analysis tools and libraries for use in analyzing the GLAST data. This software is being developed by the instrument teams with assistance from the GSSC to provide a solid and robust framework for interpreting and analyzing the GLAST data. Here we provide a short overview of the Standard Analysis Environment (SAE) software.

### General Analysis

The SAE provided by the GSSC will consist of several general purpose tools to assist in analyzing data including a data sub-selection tool, tools to generate source models and extract source parameters from existing catalogs, and the workhorse of the GLAST data analysis, the Likelihood tool to perform maximum likelihood fits of the data with the specified models. The suite also provides an event binning tool to create time, energy and spatially binned data sets and tools to compute exposure and response matrices.

### GRBs

The SAE will provide several tools to assist in the study of gamma-ray bursts including tools for spectral and temporal data analysis and model fitting as well as tools for generating the necessary response functions and binning events for analyzing GLAST data with existing tools such as XSPEC. These tools can be used to analyze both LAT and GBM data, either individually or simultaneously.

### Pulsars

The SAE will provide a number of tools to assist in pulsar analysis including a barycenter arrival time correction tool, period search and profiling tools, and a pulsar ephemeris extraction tool to retrieve pulsar ephemerides from a pulsar database.

### Data Simulation

The SAE also provides an observation simulator that can simulate LAT data based on an input source model and optional spacecraft orbit profile.

**GSSC Website:** <http://glast.gsfc.nasa.gov/ssc>