

The GLAST LAT Instrument Science Operations Center

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Abstract. The Gamma-ray Large Area Space Telescope (GLAST) is scheduled for launch in late 2007. Operations support and science data processing for the Large Area Telescope (LAT) instrument on GLAST will be provided by the LAT Instrument Science Operations Center (ISOC) at the Stanford Linear Accelerator Center (SLAC). The ISOC supports GLAST mission operations in conjunction with other GLAST mission ground system elements and supports the research activities of the LAT scientific collaboration. The ISOC will be responsible for monitoring the health and safety of the LAT, preparing command loads for the LAT, maintaining embedded flight software which controls the LAT detector and data acquisition flight hardware, maintaining the operating configuration of the LAT and its calibration, and applying event reconstruction processing to down-linked LAT data to recover information about detected gamma-ray photons. The SLAC computer farm will be used to process LAT event data and generate science products, to be made available to the LAT collaboration through the ISOC and to the broader scientific community through the GLAST Science Support Center at NASA/GSFC. ISOC science operations will optimize the performance of the LAT and oversee automated science processing of LAT data to detect and monitor transient gamma-ray sources.

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LAT ISOC FUNCTIONS

The LAT ISOC is organized to: support operation of the Large Area Telescope (LAT); produce and deliver LAT Level 1 data and selected Level 2 science data to the LAT Collaboration and to the scientific community through the GLAST Science Support Center. The main functions of the ISOC are: LAT command-sequence planning and construction; monitoring of LAT instrument health and safety; maintaining and modifying LAT flight software and the LAT testbed; LAT performance verification and optimization; receiving and archiving Level 0 data; processing and archiving LAT Level 1 and Level 2 data; maintaining and optimizing the software that produces LAT science data products.

The ISOC and GLAST Operations

The main ISOC operational interfaces are to the GLAST Mission Operations Center (MOC) and the GLAST Science Support Center (GSSC). LAT observations and other routine operations are planned on weekly periods. LAT data are down-linked from GLAST and delivered to the ISOC several times per day. The ISOC supports automated data receipt and ingest for "lights-out" data processing.

LAT Configuration and Maintenance

The ISOC maintains a flight-like hardware and software testbed for the LAT on-board data acquisition and processing electronics. Detector front-end simulators in the testbed allow for flight-like event data and rates in the lab. The LAT testbed is used for several purposes: development, test and validation of LAT data collection configurations; development and test of LAT flight software; verification and validation of LAT commanding.

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LAT Data Processing

Pipelined processing infrastructure is used for processing LAT event data. It is implemented on the SLAC computer farm, benefiting from existing large-scale computing infrastructure for particle physics experiments. We expect to apply 400 CPUs to LAT processing. Approximately 1% of events in LAT science datasets will be celestial photons. It is possible to apply coarse filtering of background data in early processing to reduce disk and CPU needs. All Level 0 data are archived.

Automated Science Processing (ASP)

ASP is automated Level 2 processing on reconstructed LAT event (Level 1) proton data, to search for, detect and characterize transient sources. The principal ASP functions are: detection of untriggered gamma-ray bursts; refined measurements (positions, light curves, spectra) for previously detected gamma-ray bursts; detection, characterization and monitoring of flaring blazars and other sources [1].

Data Challenges

Data Challenges are used by the ISOC and the LAT Collaboration to develop, test and demonstrate Level 1 and Level 2 processing. The full LAT Collaboration participates in data analysis, and exercises the GLAST science analysis software suite. Data Challenge 1 in 2004 simulated 1 data of LAT data. Data Challenge 2 in 2006 [2] simulated 55 days of LAT data; delivered L1 data to the GSSC; generated LAT pointing history and livetime data; developed and exercised the LAT source catalog pipeline; populated data servers at the GSSC and the ISOC; performed joint data production, simulation and analysis with the GLAST Burst Monitor (GBM) instrument team; used 200,000 CPU-hours on the SLAC computer farm to generate background and sky data. DC2 datasets have been used for test and development of ISOC science operations, to develop diagnostics, trending, reports, etc.

Operations Testing in the ISOC

Service Challenges are a successor and extension to the successful Data Challenge model. Service Challenges have a broader set of objectives: to continue to provide simulation datasets to the LAT Collaboration for science analysis development; to provide realistic datasets for ISOC science operations testing and rehearsals; and for detailed preparation and rehearsal of initial on-orbit instrument commissioning activities.

Multiple simulated datasets are in preparation: a 1-year dataset for extended science analysis testing; combined sky-survey and inertially pointed observations, as planned for on-orbit commissioning; short-duration, high fidelity simulations for detailed testing of science operations processing.

Science operations tests and rehearsals associated with Service Challenges will involve: receipt and processing of Level 0 data; the exercise of the complete Level 1 processing chain; the exercise of Level 2 automated science processing; and duty scientist activities for science operations. Duty scientist activities include support for instrument reconfigurations; calibrations; and response to LAT anomalies.

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REFERENCES

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