GSSC Report

David Band for the GLAST SSC

Outline

- User Support
- Documents
- Testing
- Ingest and Databases
- Observing Timelines

USER SUPPORT

Source Detectability—Web-based Tool

- **Concept: What is the detectability by the LAT of a source at a given location?**
  - **The location provides the underlying diffuse background; adjacent point sources are not considered**
  - **The user inputs the observing mode and the spectral index**
  - **The user inputs 2 of detection probability, source strength and observing time; tool calculates 3rd quantity.**

- **Prototype: IDL turned into Python script with web interface**
  http://glast.gsfc.nasa.gov/ssc/dev/jd/sensitivity.html
  - **Currently the script implements a simplistic placeholder detectability calculation**
  - **The LAT team is working on a more accurate calculation**
  - **Ultimately the detectability calculation may result in either a table or a scaling relation**

Spectrum Simulations—WebSpec

- Concept: Use a web-based version of XSPEC (see http://heasarc.gsfc.nasa.gov/webspec/webspec.html) to simulate LAT and GBM spectra.

- Implementation: WebSpec runs 'fakeit' using a library of response and background files. We will have our own customized WebSpec.
  - GLAST needs a large library of RSP and BAK files (many incident angles, observing modes, backgrounds)
  - GLAST needs different spectral models

- Work to be done: I've created GBM response and background files; LAT versions are necessary.

- Side effect: This tool delivers RSP and BAK files to users.

Other User Support Tools

- More sophisticated simulations can be performed with the science analysis tools.
- The helpdesk is set up:
  http://glast.gsfc.nasa.gov/ssc/help/
- The FAQ web page is set up:
  http://glast.gsfc.nasa.gov/cgi-bin/ssc/faq/glastfaq.cgi
- The weekly timeline posting web page is set up:
  http://glast.gsfc.nasa.gov/ssc/resources/timeline/short/
  - The most current timeline is posted
  - Currently, the timeline is posted as-is
  - This page will be cloned to post the yearly timeline

User Support Tools To Be Developed

- Burst posting—we are adapting GCN scripts for our use

- GI proposal submission—we will use RPS
- TOO request submission—we will use RPS
- Instrument team observation requests—we will use RPS.

- Exposure/count mapping—we will adapt one of the tools included in the science tools to create and post maps

Current GI Program Schedule

- The legal announcement will be in Research Opportunities in Space and Earth Sciences (ROSES), most likely for 2007.
- Details will depend on current NASA policy (NSPIRES, etc.)

• Effective NRA Release	12/15/06
• Proposal Deadline	3/15/07
• Peer Review	6/15/07
• Rejections Sent Out	7/1/07
• Request Funding Proposals	8/1/07
• Launch	8/31/07
• Funding Proposals Due	9/15/07
• Funding Decision	10/1/07
• Cycle 1 Begins	11/1/07

Documentation

- Proposer's Guide—details on submitting a GI proposal beyond information in ROSES. Describes proposal preparation tools. Not begun.

- Science Plan—description of the GLAST mission, particularly information relevant to GI's scientific use of the mission. Neil Gehrels began drafting this document >2 years ago, I volunteered to continue, but little has been done since. Text can be extracted from other documents.

- User Support Manual—I am developing an internal document on operating the user support system.

- GOF Managers Website—I am putting together a website on standard GOF procedures and documents.

Science Analysis Documentation

- The science analysis tools documentation will consist of a detailed manual, a reference manual (similar to fhelp pages) and analysis threads.

- The instrument teams and the GSSC are developing documentation in support of the Data Challenges and internal 'tool checkouts.'
- Much text already exists, but must be pulled together.

- For rudimentary analysis threads, see **http://glast.gsfc.nasa.gov/ssc/dev/Analysis_Tools_Documentation/Threads/**

- An issue is how to maintain web and printable versions. However, good text is more important than good formatting.

DOCUMENTS

Science Data Products ICD

- I am editing the ICD. The 1st draft was based on the report of the Data Products Working Group from ~3 years ago.
- The GBM DPs are more mature than the LAT's, in part because many GBM products are standard FTOOLS files.
  - The GBM is introducing an RSPII format
  - The contents of the LAT event files have not yet been decided
- I produced sample files of key GBM files for DC2.
- The status is summarized at **glast.gsfc.nasa.gov/ssc/dev/data_products/science_data_products.html** and the document can be found at **glast.gsfc.nasa.gov/ssc/dev/current_documents/Science_DP_ICD.doc**

- Note: the Operations Data Products ICD (timelines, Level 0 data) has been baselined and is maintained by the MOC.

GSSC Functional Requirements Document (FRD)

- Because it was begun before the ground system, the FRD is maintained at the Project level.
- The FRD was revised and expanded extensively in response to the peer reviews.
- When Rev. A came before the Project CCB, the Project decided to review it one more time.
- The Project decided that many of the requirements are not 'functional' requirements.
- Consequently I separated the requirements into GSSC specifications and 'functional' requirements. This is the current status of the document; Rev. B is under review by the Project.
- Rev. A and B can be found at:
  http://glast.gsfc.nasa.gov/ssc/dev/current_documents/

PDMP

- At the last meeting, GUC members commented that the PDMP draft was repetitious and incomplete.
- Consequently I revised the PDMP; see **glast.gsfc.nasa.gov/ssc/dev/current_documents/PDMP.doc**
- This draft is still under development. In particular, the sections on instrument calibration and the disposition of the resulting data are incomplete.

GSSC Internal Documents

- GSSC Development Plan – (GSSC-0001)
- GSSC Verification Matrix – (GSSC-0002)
- GSSC Design Document – (GSSC-0003)
- GSSC Software Management Plan – (GSSC-0004)
- GSSC Test Plan – (GSSC-0005)
- LAT Event Summary Database Requirements – (GSSC-0006)
- SAE Database Requirements – (GSSC-0007)

⇑ Baselined

⇓ Drafted

- GLAST-HEASARC MOU – (GSSC-0008)
- Ingest System Detailed Design – (GSSC-0009)
- Operations System Detailed Design – (GSSC-0010)
- GSSC Testing Standards – (GSSC-0011)
- GSSC LAT SAE Databases Detailed Design – (GSSC-0012)
- GSSC Documentation Standards – (GSSC-0013)
- GSSC Operations Level 4 Requirements Document

TESTING

Testing

- The testing schedule for the Ground System drives the GSSC's internal software development.
- Our release dates are ~3 weeks before the Ground Readiness Tests (GRTs) to allow sufficient time for testing with the other ground system elements and problem resolution.
  - The GSSC software release (11/24/04) for GRT#1 was on time
  - GRT#1 was successfully completed (4/13/05)
  - The GSSC software release #2 is complete (4/18/05)
    - Will support GRT#2 (June 27-29 '05)
  - Software development for GSSC software release #3 (Sept 6 '05) is currently underway
    - Will support GRT#3 (Sept 27 '05)
- Internal unit and system tests of the GSSC software are implemented in our automated build and problem reporting system. This assures that software changes will pass all regression testing.

INGEST AND DATABASES

Database and Ingest System

- GSSC will ingest all science data and make them publicly available. The data system consists of:
  - A data ingest system
  - Seachable databases to hold the data
  - Web/e-mail interfaces for easy access to the data.

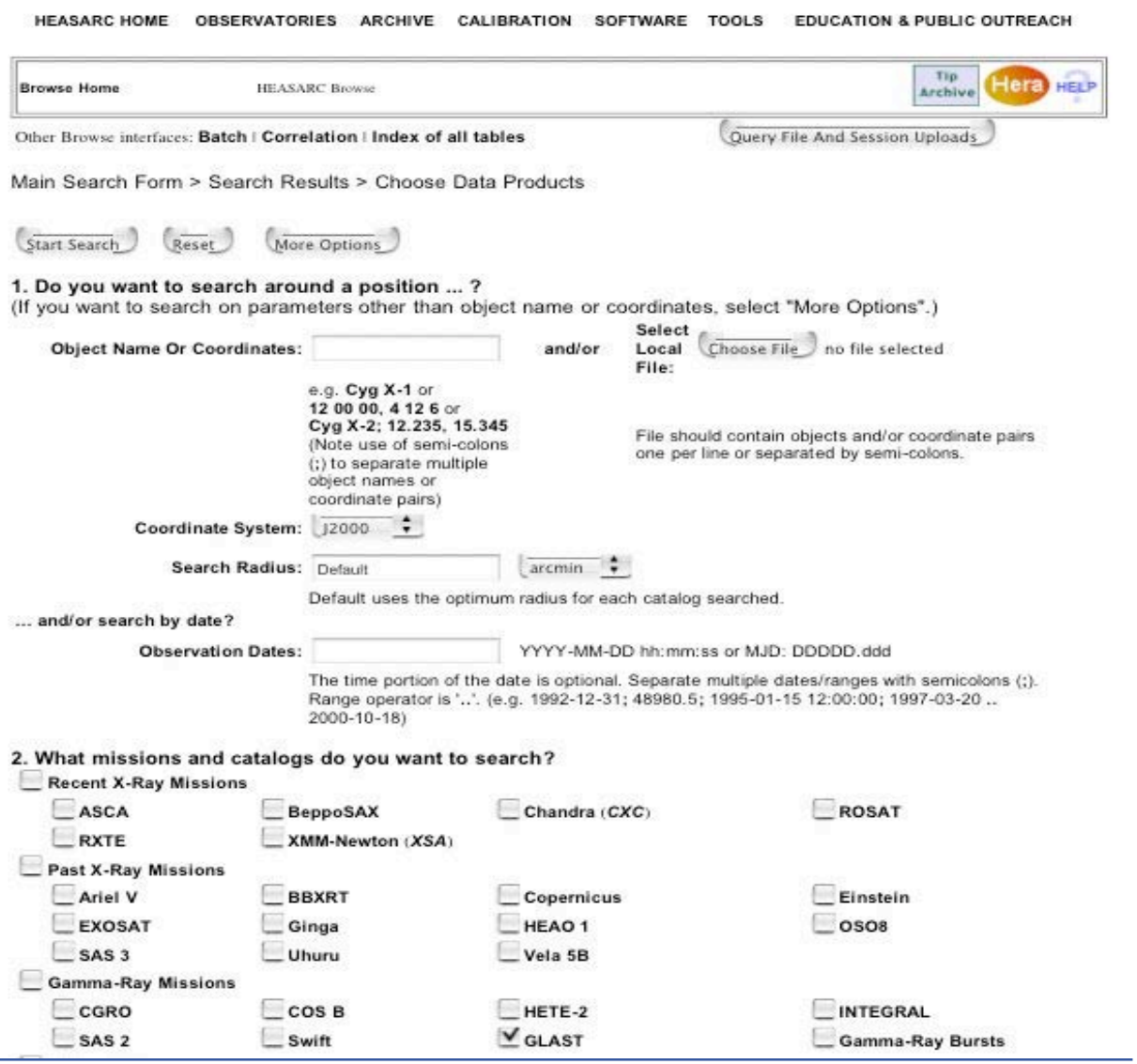
Database and Ingest Systems—Status

- The detailed designs for the GSSC's Ingest and Database Systems are mature and documented
- Automated ingest system w/tracking databases is already operational for planning/commanding products (required for GRT#1 and #2)
- Ingest of the science data products will be implemented during the summer and fall of '05
- Custom databases have been designed for LAT photon, event, and S/C position
  - Prototypes worked well for DC1
  - Improvements have been made to make design more flexible (used in 2 science tools "checkups" after DC1)
- These key databases are accessible through the GSSC's web page
- All other data will be available through HEASARC's W3Browse

Software Robustness, Databases

- Software developed with thorough, continuous testing and comprehensive documentation for maximum reliability.
  - Each subsystem has a detailed design document and a user's guide to describe the software.
  - All code is built and tested (unit tests) every night.
  - Code has in-line documentation which is turned into html nightly.
  - System tests are scripted and run many times during the development cycle.
- GBM data will be served by Browse (similar to BATSE data)
- LAT Event and Photon Data
  - On Web: photons and events searchable by 2-D spherical direction of origin, time range, and energy range.
  - Trade studies optimized the search and storage (in FITS files) of the event/photon data.
  - Currently a user can query the whole sky database in less than a minute to select a year's worth of photons coming from a randomly placed 15° radius circle.

How Browse Will Look For GLAST



HEASARC HOME OBSERVATORIES ARCHIVE CALIBRATION SOFTWARE TOOLS EDUCATION & PUBLIC OUTREACH

Browse Home HEASARC Browse Tip Archive Hera HELP

Other Browse interfaces: **Batch** | **Correlation** | **Index of all tables** Query File And Session Uploads

Main Search Form > Search Results > Choose Data Products

Start Search Reset More Options

1. Do you want to search around a position ... ?
(If you want to search on parameters other than object name or coordinates, select "More Options".)

Object Name Or Coordinates: and/or **Select Local File:** Choose File no file selected

e.g. **Cyg X-1** or **12 00 00, 4 12 6** or **Cyg X-2; 12.235, 15.345** (Note use of semi-colons (;) to separate multiple object names or coordinate pairs)

File should contain objects and/or coordinate pairs one per line or separated by semi-colons.

Coordinate System: J2000

Search Radius: Default arcmin

Default uses the optimum radius for each catalog searched.

... and/or search by date?

Observation Dates: YYYY-MM-DD hh:mm:ss or MJD: DDDDD.ddd

The time portion of the date is optional. Separate multiple dates/ranges with semicolons (;). Range operator is '..'. (e.g. 1992-12-31; 48980.5; 1995-01-15 12:00:00; 1997-03-20 .. 2000-10-18)

2. What missions and catalogs do you want to search?

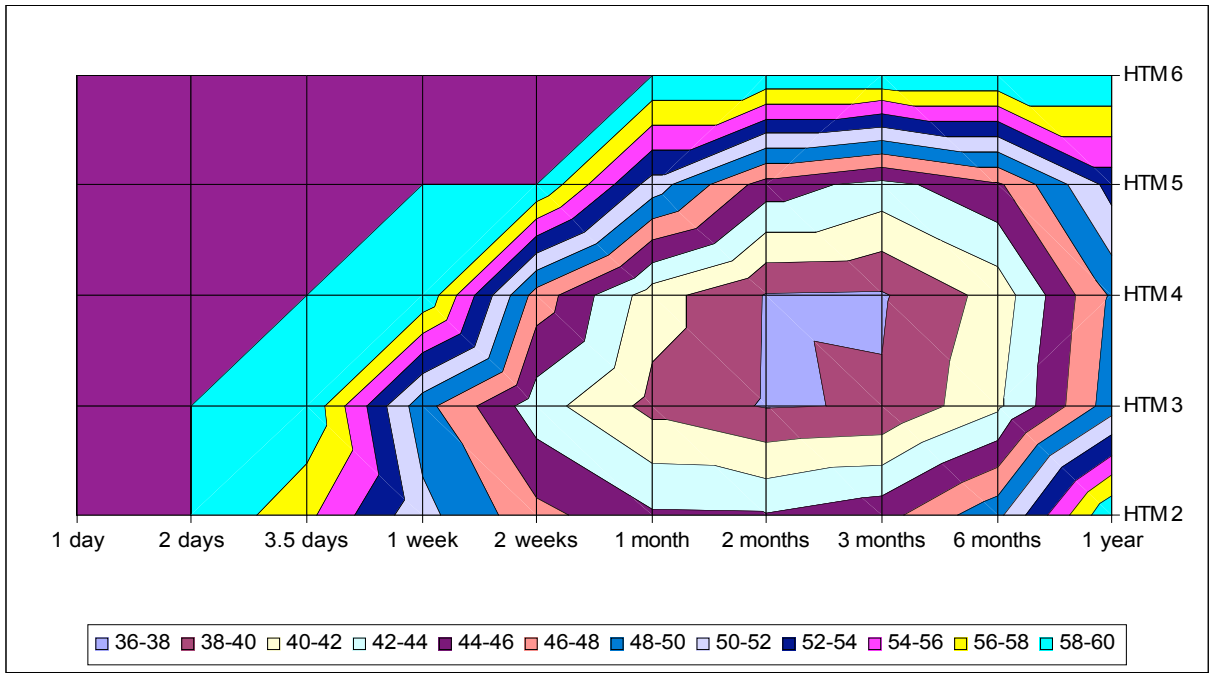
- **Recent X-Ray Missions**
  - ASCA, BeppoSAX, Chandra (*CXC*), ROSAT
  - RXTE, XMM-Newton (*XSA*)
- **Past X-Ray Missions**
  - Ariel V, BBXRT, Copernicus, Einstein
  - EXOSAT, Ginga, HEAO 1, OSO8
  - SAS 3, Uhuru, Vela 5B
- **Gamma-Ray Missions**
  - CGRO, COS B, HETE-2, INTEGRAL
  - SAS 2, Swift, ☑ GLAST, Gamma-Ray Bursts

Photon Database Internal Storage

- All data are in HEASARC-compatible FITS files
- Data are served through system with multiple nodes, each of which has a complete copy of the photon data
  - Fast data access from internal disk
  - Multiple backups in case of failure of a single data disk
- Data broken into sky regions and time periods in internal data files
- Hierarchical Triangular Mesh (HTM) used to define regions
  - Developed for Sloan Digital Sky Survey at Johns Hopkins
  - Recursively divides sky into spherical triangles
- Trade study determined optimal combination of HTM pixelization level and time binning
  - Best time of ~39 sec was Level 3 pixelization (512 sky regions) with 2 month time bins

Internal Storage Trade Study

- Explored a grid of HTM pixelization level and time bins
  - HTM Levels 2, 3, 4, 5 & 6
  - Time bins ranging from 1 day to 1 year
- Performed battery of searches to determine average search time.



OBSERVING TIMELINES

GLAST Scheduling with Tako

- The GSSC will use Tako to create observation schedules ("science timelines"). These will contain both sky survey and pointed observations.
- Tako is used for Swift, is being tested for RXTE, and will be used for Astro-E.
- GLAST's version of Tako has had its first release and contains basic functionality.
- Tako will be used for both long-term (a complete GI cycle) and short-term (weekly) scheduling.
- Tako can apply a variety of constraints such as time of day or a periodic constraint such as binary phase.
- Tako will combine together accepted proposals and sky survey observations to create a Long-Term Schedule with a precision of 1 week.

Short-Term Scheduling Process (i)

- Because of the long lead time for scheduling TDRSS, the Preliminary Science Timeline covering one week must be produced ~3 weeks ahead of being loaded to spacecraft.
- The Preliminary Science Timeline is distributed to the MOC, LISOC, and GIOC for their planning.
- MOC uses the Preliminary Science Timeline to request TDRSS contacts.

- The LISOC and GIOC send corresponding instrument commands to the GSSC.
- The GSSC examines instrument commands for effect on science observations:
  - If conflict, iterate with LISOC or GIOC
  - If no conflict, GSSC creates combined timeline ("Observatory Timeline Package") including Final Science Timeline

Short-Term Scheduling Process (ii)

- Although the Science Timeline is initially generated well in advance of upload, it may be changed a few days before the upload if:
  - (i) TDRSS contacts are not affected or
  - (ii) MOC agrees to loss of contacts; TDRSS overscheduled since contacts will be lost as a result of TOOs or ARs.
- A final review of the weekly timeline (open to GSSC, LISOC, GIOC, & Project Scientists) precedes the upload of commands to the spacecraft
- When the week ends the MOC produces an as-flown timeline that the GSSC reconciles with the Final Science Timeline.
- After this reconciliation the GSSC reschedules during a future week any observations disrupted by TOOs and ARs.

Testing the Scheduling System

- Ground Readiness Test #2 (~June 28) includes a basic test of the scheduling scheme:
  - Initial distribution of Tako-generated schedule.
  - Reception of commands from LISOC/GIOC.
  - Transmission of Observatory Timeline Package to MOC.
- Continue to test scheduling in further GRTs.
- RXTE planners are also evaluating Tako and starting to use it for complicated scheduling.

Availability of Schedules

- All schedules will be publicly available on the web.
- Includes:
  - Long Term (1 year) Schedule.
  - Most up-to-date version of Science Timeline. For every week the posted timeline progresses:
    - Preliminary -> Final -> As-Flown
  - As-flown Timeline may differ from the Final Science Timeline as a result of TOOs, ARs, and any anomalies.