NRA Cycle-2: Proposal Preparation Details

Chris Shrader,
Fermi Science support Center
NASA/GSFC

Synopsis

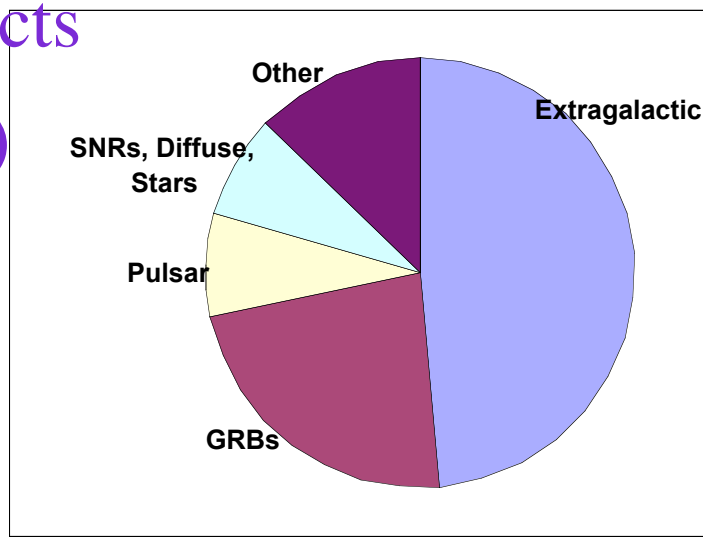
- Description of GI program
- Cycle1 summary
- What's new for Cycle-2
  - Implementation timeline
- Fermi SSC User Support Services
- Current & future *Fermi* public data archive
- How to submit a proposal

Program Description

- Unique nature of the Fermi GST defines the Guest Investigator Program
  - Proposals are typically requests for grant support rather than data rights, spacecraft orbits or *ksec*
- Program open to international Community
- Annual mission proposal cycles
- Data analysis, coordinated observations, theory, analysis methodologies
- Pointed observations
  - ToO, Scheduled

Cycle-1 Summary

- LAT data was proprietary during year 1
  - Limited high-level product release
  - GBM data analysis, related theory, coordinated observations and analysis methodologies
- No proprietary data after 9/2009
- 167 proposals received, 44 accepted
  - Included 8 large (multi-year) projects
- Average grant $80k (~$4M total)
  - ($170k large)



New for Cycle-2

- Anticipate ~2X increase in participation;
  - ~$8M grant support
- LAT data analysis is likely to be the predominant mode of participation
- Possible to request pointed observation
  - Scheduled &/or ToO (likely to be limited)
- Instrument performance established
- Bright Source List: resource to proposers
  - >10_ significance list, released Feb 9
  - Instrument team generates all-sky catalog after year 1
- Software suite available
  - Simulation capability
  - Assess analysis capabilities

Cycle-2: A few Details

- As for Cycle 1, opportunity for joint NOAO and NRAO facility programs
  - Up to ~10% of time on various NRAO facilities
  - ~1-5% on various NOAO telescopes
  - Refer to FSSC web pages for details of agreement
- Two stage proposal process
  - Stage 1 scientific evaluation; ARK/RPS submission
  - Stage 2 budget proposal: NSPIRES
- Stage 1 proposal form requires proposer supplied budget cap, + absolute ceilings ($100k & $200k) imposed by NRA

Cycle-2 Timeline

Cycle 2 proposal aids posted on GSSC website	December 6, 2008
Science tools released	February 6, 2009
Preliminary LAT source list released	February 6, 2009
Cycle 2 Phase 1 (Science) proposals due	March 6, 2009
Cycle 2 Phase 1 proposal review	Mid May 2009
Results of proposal review released	Mid June, 2009
Cycle 2 begins	August 14, 2009
Cycle 2 funding released	August, 2009
LAT Data Release	September 2009

User Support: FSSC

- The FSSC is responsible for all areas of User Support:
  - **Developing & maintaining a public data archive**
    - **Coordinated w/HEASARC**
  - **Maintain public distribution site for the analysis software**
    - **developed in collaboration with the Instrument Teams.**
  - **Administer Guest Investigator Program for NASA HQ**
  - **Providing technical and scientific support to GIs.**
  - **Providing the science timelines to the MOC**
- The FSSC is an organization within the NASA GSFC Astrophysics Science Division
- FSSC staff includes scientists, scientific programmers, and administrative support staff

Proposer Support Details:

- Web services:
  - Mission news & information,
  - Post NRAs & support materials
  - Online support tools
  - Planning tools (mission timelines, predictor, multi-wavelength campaign logging)
- Distribute & support science analysis SW
- Phone & e-mail technical/scientific support
- Support proposal reviews, grant administration
- Reporting to Fermi Users Group

<http://fermi.gsfc.nasa.gov/ssc/>

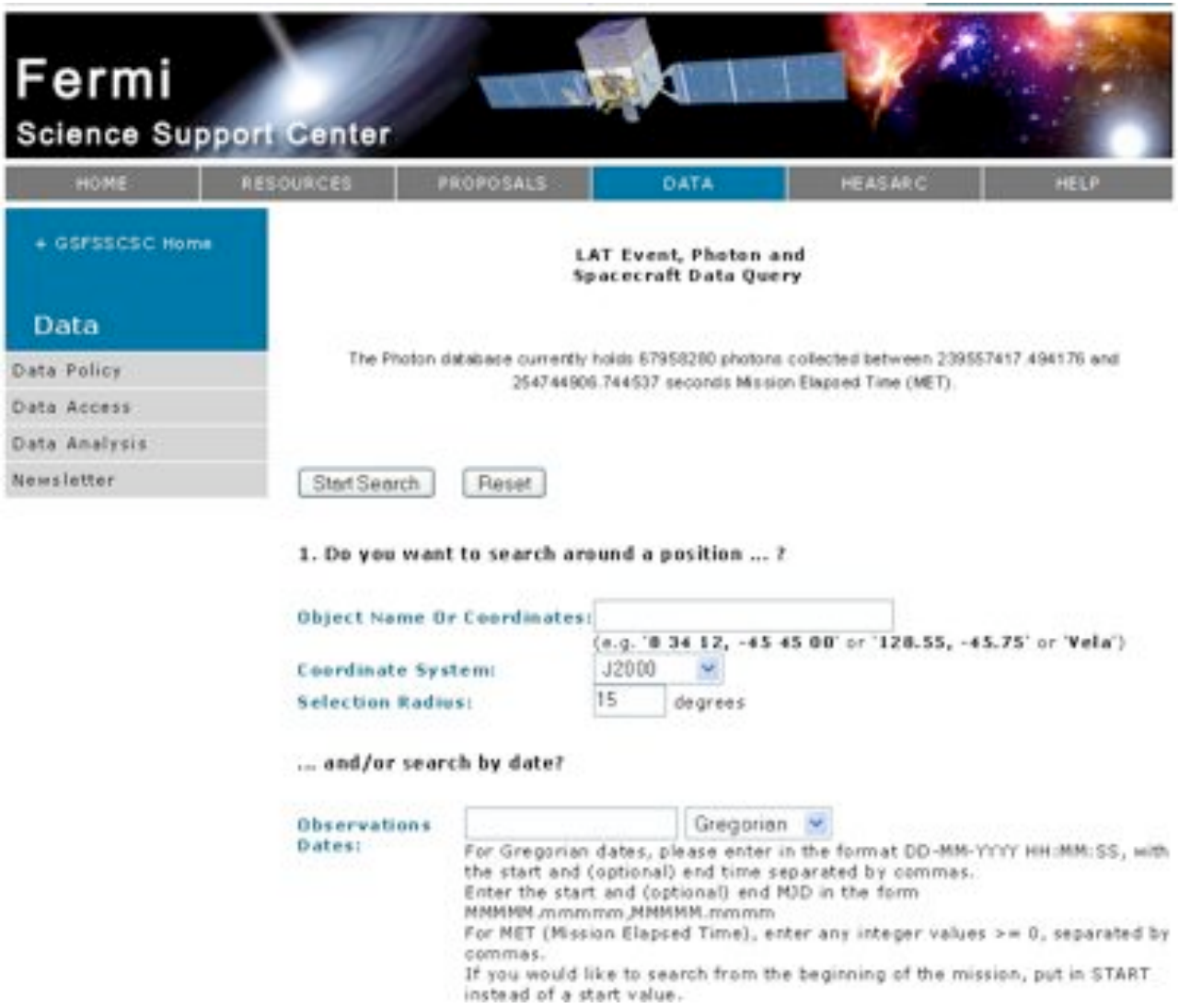
Basic Data Policy

- Mission cycle 1:
  - Selected high-level LAT products
  - Information on transient discoveries
  - Full GBM data release
- Mission cycle 2 & beyond:
  - All Science Data Are Public As Soon As Processed
  - Automated pipeline, SLAC→ FSSC
  - <2-day latency requirement, but typically ~<1 day

Public Data Archive

LAT data server is operational, but not publicly accessible until 9/2009.

Basic products: screened event lists, spacecraft history file



Public Data Archive

Currently available databases include LAT lightcurves (~25 objects), GBM trigger, GRB and continuous data.

FERMI : 4 tables

Table (short name)	Num parameters	Num entries	Data Products?	Priority	Table type
Fermi GBM Burst Catalog (fermigbrst)	43	118	Y	HIGH	Object
Fermi GBM Daily Data (fermigdays)	4	168	Y	HIGH	Observation
Fermi GBM Trigger Catalog (fermigtrig)	26	173	Y	HIGH	Object
Fermi LAT Monitored Source List (fermilasp)	20	943	N	HIGH	Object

Databases are implemented under HEASARC Browse. Some are additionally accessible via simple www interface.

Public Data Archive: LAT LCs

Fermi Science Support Center

HOME | RESOURCES | PROPOSALS | DATA | HEASARC | HELP

- FSSC Home

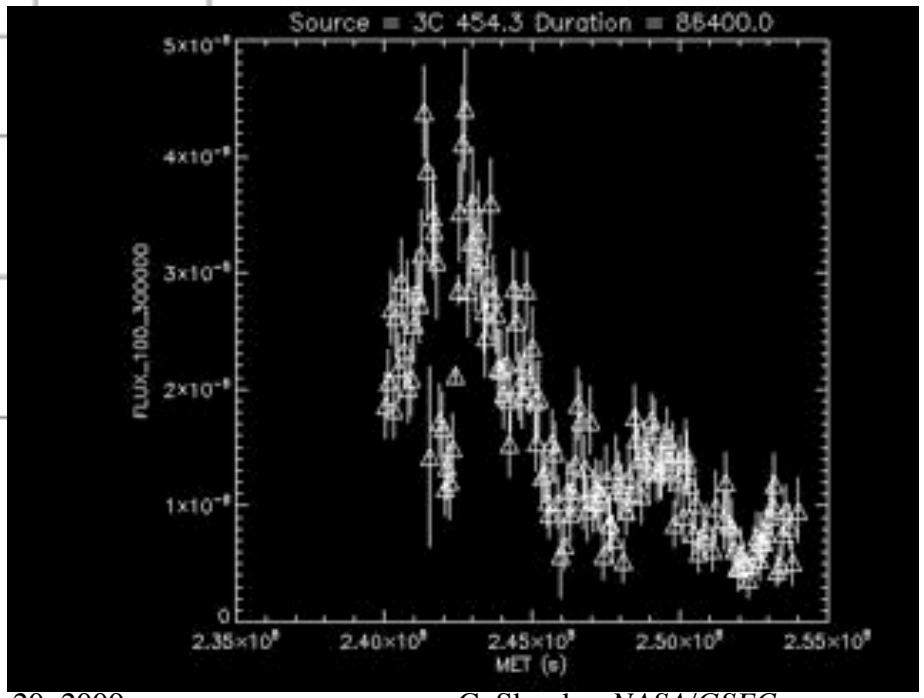
Data

- Data Policy
- Data Access
  - + LAT Data
  - + GBM Data
- Data Analysis
- Newsletter

Monitored Source List Light Curves

Source	RA	Dec
0208-512 » Daily Light Curve » Daily Light Curve Fits File » Weekly Light Curve » Weekly Light Curve Fits File	32.6930	-51.0170
0235+164 » Daily Light Curve » Daily Light Curve Fits File » Weekly Light Curve » Weekly Light Curve Fits File	39.6620	16.6160
1406-076 » Weekly Light Curve » Weekly Light Curve Fits File	212.235	
1510-089 » Daily Light Curve » Daily Light Curve Fits File » Weekly Light Curve » Weekly Light Curve Fits File	228.170	
1633+382 » Daily Light Curve » Daily Light Curve Fits File » Weekly Light Curve » Weekly Light Curve Fits File	248.815	
3C 273	187.278	

WWW interface to LAT lightcurves



LAT GRB Summary Info

Fermi LAT GRB Table

Fermi SSC Home > LAT GRB Search

- 4 bursts met your search criteria.
- Database last updated: Monday, December 22, 2008, 14:55:19 EST
- Download this table as a tab-delimited text file: grb_table_1233073601.txt

GRB	Time [UT]	Trigger Number	LAT RA (J2000)	LAT Dec (J2000)	LAT Counts	LAT Burst Advocate	GBM RA (J2000)	GBM Dec (J2000)	GBM Fluence [10^{-5} erg/cm^2/s]	
081215A	18:48:36.85	251059717	TBD 00:00:00.0	TBD 00:00:00.0	TBD	Julie McEnery	135.0 09:00:00.0	53.8 53:48:00.0	5.44	68.9
081024B	21:22:41	246576161	322.9 21:31:36.0	21.204 21:12:14.4	n/a	Nicola Omodei	n/a	n/a	0.034	4.2
080916C	00:12:45	243216766	119.88 07:59:31.2	-56.59 56:35:24.0	n/a		121.8 08:07:12.0	-61.3 61:18:00.0	19	n/a
080825C	14:13:48	241366429	233.96 15:35:50.4	-4.72 04:43:12.0	n/a		232.2 15:28:48.0	-4.9 04:54:00.0	2.4	n/a

* All numbers are preliminary and may be revised as we do reprocessing (s/w improvements, thinking/experience improvements). Users are encouraged to view the ac

Fermi SSC Home > LAT GRB Search

Summary information –trigger time, sky position, net counts, GBM fluence – is available on line to facilitate GRB researchers

Public Data Archive: GBM

Burst Data Products

- Time-Tagged Events (TTE)— counts in 128 energy channels from each detector
- Background Spectra—estimated background spectra for the period of the burst
- Detector Response Matrices (DRMs)—the detector response matrix
- Catalog entry—summary info: duration, fluence, lightcurves , spectral params
- CTIME and CSPEC —series of spectra w/different temporal & spectral resolution
- TRIGDAT—burst alert telemetry, information downlinked after a burst.

Continuous Data Products

- CTIME and CSPEC— series of spectra w/different temporal & spectral resolution
- Calibration and Housekeeping Files

GBM: Database Access

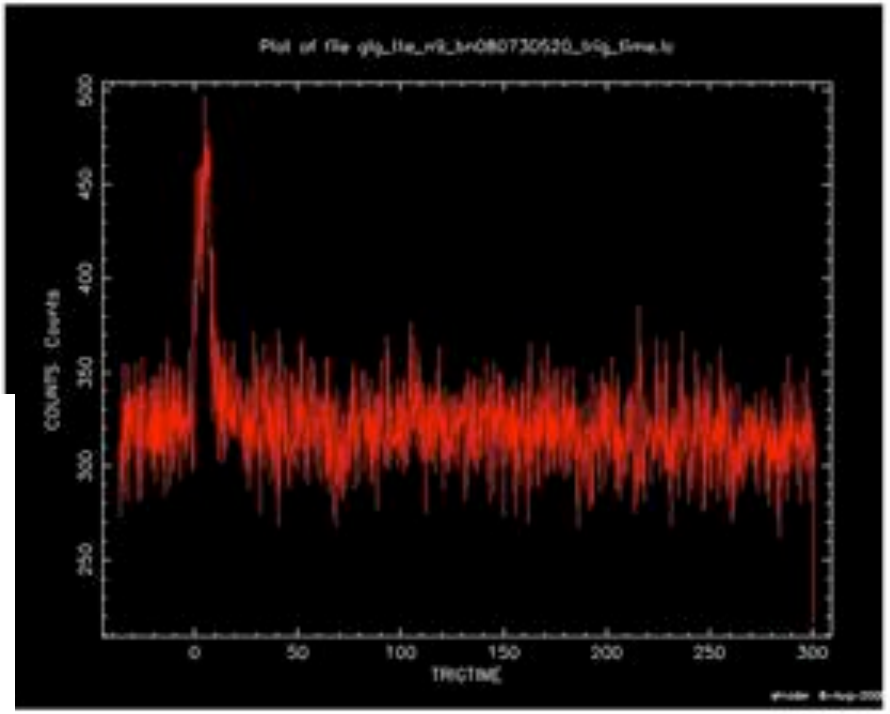
GBM Burst catalog. Revised calibrations and improved backgrounds are forthcoming in the near future.

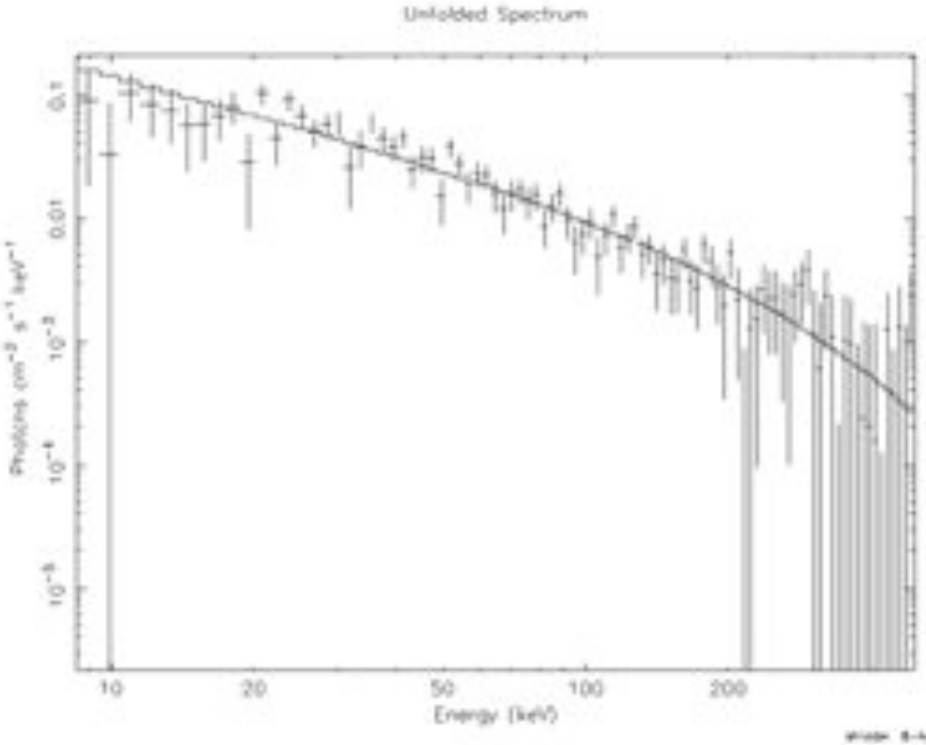
Fermi GBM Burst Catalog (fermigbrst) Bulletin README

Select All	Services	version	trigger name	name	ra	dec	time	end time	trigger time	reliability
	Q R N S O H	0	bn080912360	GRB080912360	02 04 04.0	-06 39 00	2008-09-12 08:36:41.01	2008-09-12 08:46:56.01	2008-09-12 08:38:55.02	0.3647
	Q R N S O H	0	bn080916009	GRB080916009	07 18 16.0	-57 47 00	2008-09-16 00:10:30.98	2008-09-16 00:20:45.97	2008-09-16 00:12:44.99	0.9373
	Q R N S O H	0	bn080916406	GRB080916406	23 05 32.0	-61 51 00	2008-09-16 09:43:03.96	2008-09-16 09:53:18.01	2008-09-16 09:45:17.97	0.4824
	Q R N S O H	0	bn080919790	GRB080919790	13 50 28.0	+78 09 00	2008-09-19 18:55:21.98	2008-09-19 19:05:36.99	2008-09-19 18:57:34.98	0.5686
	Q R N S O H	0	bn080920268	GRB080920268	08 19 16.0	+00 06 00	2008-09-20 06:23:34.97	2008-09-20 06:33:49.97	2008-09-20 06:25:48.03	0.8353
	Q R N S O H	0	bn080924766	GRB080924766	05 17 36.0	+33 58 00	2008-09-24 18:20:24.98	2008-09-24 18:30:30.99	2008-09-24 18:22:35.96	0.3569
	Q R N S O H	1	bn080925775	GRB080925775	06 27 04.0	+21 11 00	2008-09-25 18:33:40.98	2008-09-25 18:43:55.03	2008-09-25 18:35:54.99	0.5529
	Q R N S O H	0	bn080927480	GRB080927480	03 20 32.0	+38 10 00	2008-09-27 11:28:17.04	2008-09-27 11:38:31.00	2008-09-27 11:30:32.00	0.7098
	Q R N S O H	2	bn080928628	GRB080928628	06 54 20.0	-65 01 00	2008-09-28 15:02:43.04	2008-09-28 15:12:58.03	2008-09-28 15:04:56.01	0.4000
	Q R N S O H	0	bn081003644	GRB081003644	17 55 44.0	+26 01 00	2008-10-03 15:25:06.04	2008-10-03 15:35:13.00	2008-10-03 15:27:17.02	0.4941
	Q R N S O H	1	bn081003779	GRB081003779	14 24 12.0	-72 08 00	2008-10-03 18:39:27.96	2008-10-03 18:49:33.97	2008-10-03 18:41:39.03	0.5216
	Q R N S O H	0	bn081006604	GRB081006604	09 32 32.0	-64 50 00	2008-10-06 14:27:18.98	2008-10-06 14:37:57.01	2008-10-06 14:29:34.02	0.9137
	Q R N S O H	0	bn081008832	GRB081008832	19 47 36.0	-46 12 00	2008-10-08 19:55:50.02	2008-10-08 20:05:56.03	2008-10-08 19:58:01.00	0.8118
	Q R N S O H	1	bn081009140	GRB081009140	16 44 19.2	+17 12 36	2008-10-09 03:18:45.01	2008-10-09 03:29:00.01	2008-10-09 03:20:57.98	0.6902
	Q R N S O H	0	bn081009690	GRB081009690	04 45 56.0	+16 22 00	2008-10-09 16:31:18.97	2008-10-09 16:41:33.01	2008-10-09 16:33:37.04	0.5137
	Q R N S O H	2	bn081012045	GRB081012045	05 14 45.6	-00 39 36	2008-10-12 01:03:08.04	2008-10-12 01:13:21.99	2008-10-12 01:05:22.04	1.0000

GBM Analysis

GBM data can be analyzed using a subset of the Fermi Science tools suite + HEASARC *FTOOLS & XSPEC* packages.

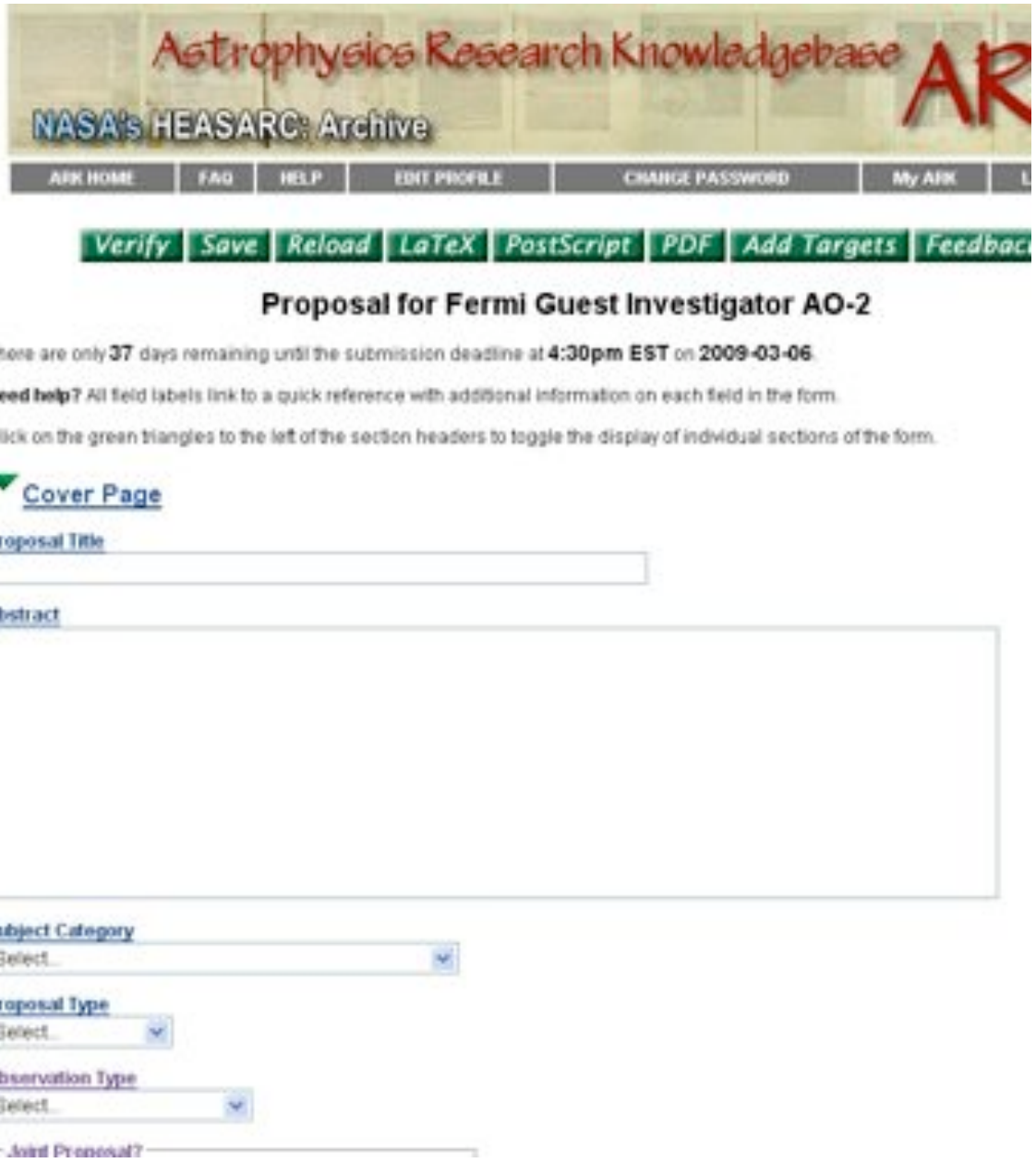




Submitting a proposal

- Stage-1 (scientific) proposal submission is straight forward
  - HEASARC ARK/RPS facility
- No paper submission or institutional signatures required at this stage
- Web-based form, self documented, verification feature
- 4- and 6-page limits for regular/large proposals
  - Science justification as PDF attachment
- 1-page technical appendix for joint NOAO or NRAO programs
- Stage-2 proposal managed by NRESS
  - Must use NSPIRES facility

Submitting a proposal



ARK/RPS page for Fermi Cycle-2 program. Straight forward, internally documented web form. Sub-menus for NOAO, NRAO requests. File input accommodated for large target lists. Verification feature & upload function.

Summary

- Cycle-2 deadline is rapidly approaching!
  - March 6, 2009
- Online web-based tools available
  - LAT detectability tool, FermiSpec, ARK/RPS
  - Hierarchical documentation set
- Source list, analysis software now available
- Expanded opportunities
  - no proprietary data for Cycle-2 & beyond
- We look forward to your participation!

Extra Slides

Online Support Tools

- LAT source detectability tool
  - Minimum detectable flux for given exposure, latitude
- FermiSpec simulation tool
  - Fermi-specific version of HEASARC WebSpec facility
- ARK/RPS proposal submission tool
- GLASThelp online help desk
  - <glasthelp@milkyway.gsfc.nasa.gov>
- FAQ posting

LAT Detectability Tool

For a given position on the sky, and observation time, estimate the minimum 5_ flux. Spectrum is fixed at Γ=2.1

LAT Detectability Tool

Returns corresponding source photon flux. Limitation: fixed spectral index source, uses 'lookup table' approximations.

LAT Source Detectability

Source Position (galactic coordinates in degrees): l = 77.438, b = -38.583
Observation Time (in Survey Mode): 1 week
LAT Source Detectability (> 100 MeV): 6.89965e-08 ph/s/cm^2

This is the flux of a point source at the specified position that will result in a 5 sigma detection (Test Statistic or TS=25) over the specified observing time in survey mode. The source is assumed to have a power law spectrum with an index of -2.1.

Return to the input form.

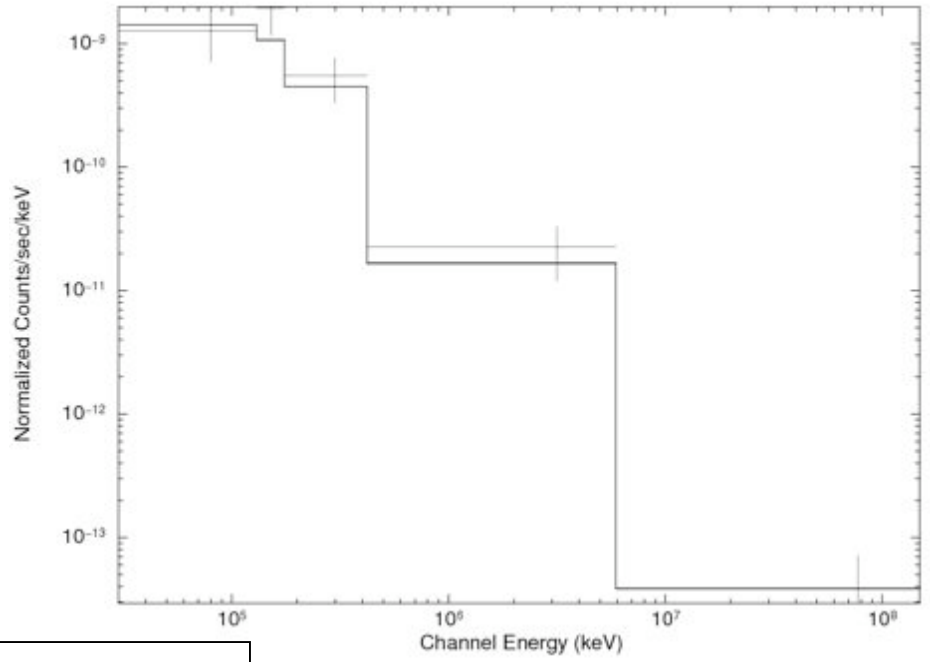
FermiSpec Tool

Uses the simulation capability of the XSPEC package to generate simulated spectrum. Simplifying assumptions are necessarily invoked.

FermiSpec Tool

In this example, a simple Γ=2.2 powerlaw source at mid-galactic latitude was used.

Output binning is S/N limited (user specification)



The following model parameters were fit for this simulated data set:

For the Power Law component:

Photon Index = 2.27515 (+ 0.741,- 0.220)
Redshift, z = 0.8
Normalization = 4.34853

This model resulted in a reduced chi^2 of 0.8116 and a count rate of 0.000371887 cts/s over the fitted energy range.

Resulting fluxes:

Energy Band	Low Energy	High Energy	Count Rate (counts/sec)	Photon Flux (photons cm^-2 s-1)	Energy Flux (ergs cm^-2 s-1)
1	1e5	3e8	0.000277167	3.80692e-07	2.49974e-10

If the resulting fluxes are not what you were expecting, you may wish to adjust the normalizations for the components you have chosen and try again.

Alternative XSPEC Simulations

- Alternatively the (LAT or GBM) instrument response matrices can be downloaded
  - Backgrounds used for these scenarios are also downloadable
- Thus, experienced XSPEC users can do additional simulations utilizing the *fakeit* function of that package
- A precaution: This approach involves simplistic assumptions.
  - Rigorous analysis necessarily involves simultaneous spatial+spectral models/response.

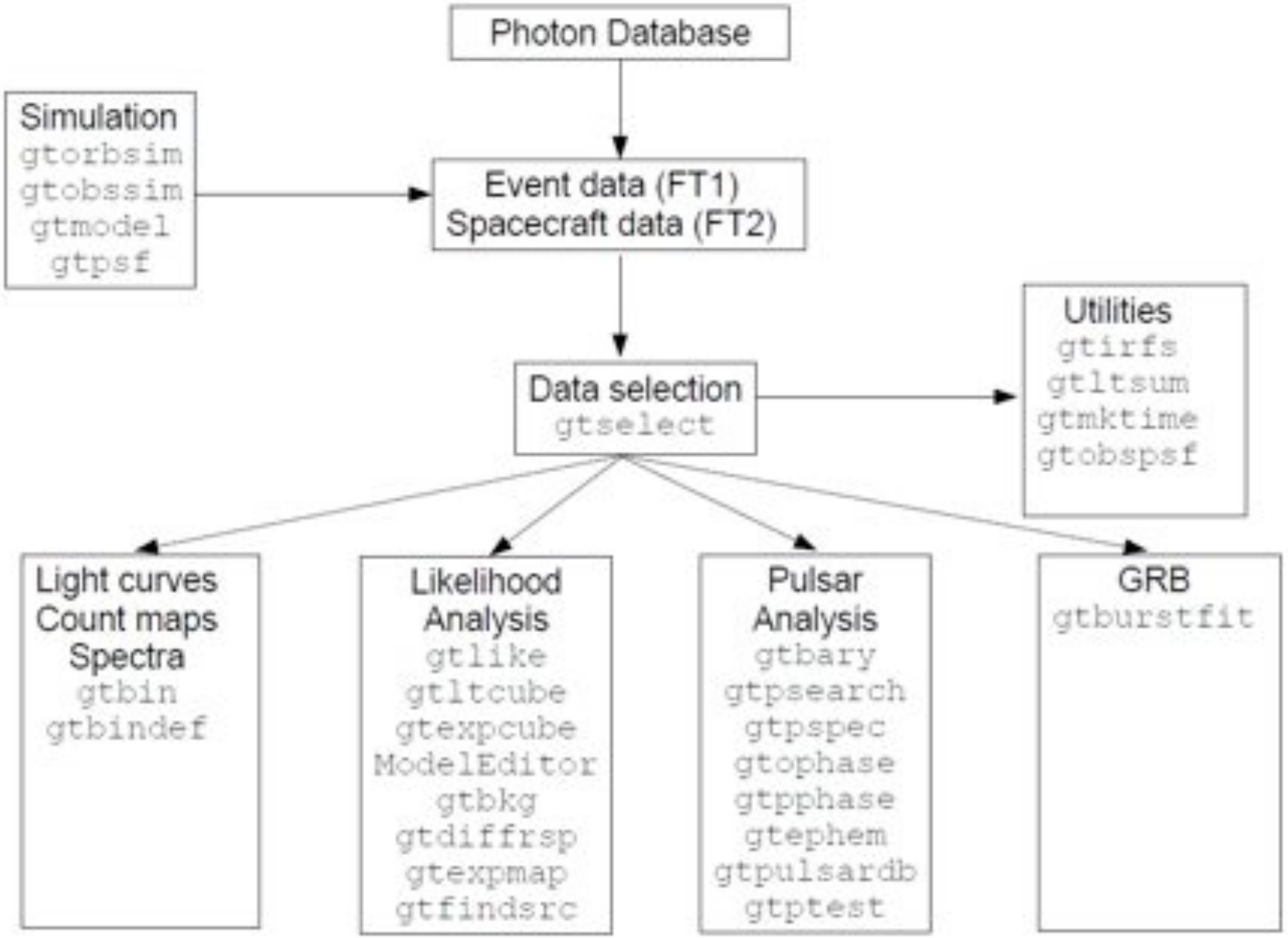
Science Tools: Summary

- Collaborative effort: FSSC & LAT Team
- Will be distributed as an "FTOOLS" package
  - Adherence to broader HEASARC standards
  - "Atomic" executables, FITS i/o, IRAF style param files
  - Scriptable, plus GUI implementation
  - Existing tools used when possible and appropriate
    - e.g. FV, DS9, XSPEC
- GBM related tools released prior to Cycle 1 (8/08)
  - Full set of LAT tools prior to Cycle 2 (2/6/09)!
- LAT analysis has unique complexities associated w/PSF, backgrounds, scanning
  - Usability and viability demonstrated
    - **Early mission science!**
    - Data challenges (GLAST LAT collaboration)
    - Beta testing (1st: hands-on tutorial, 2nd: distribute SW & docs)

Science Analysis Tools

- Overview of capabilities
  - Maximum likelihood tool—spatial-spectral analysis of region (source detection, flux)
    - Includes background models
  - Pulsars—period analysis, blind searches
    - Includes ephemerides DB
  - GRBs—temporal cuts, spectral analysis: Ftools, XSPEC
- Tools and documentation will be released through FSSC website

Science Tools: Flowchart



Science Tools: Documentation

- Multi-Tier Documentation
  - Full set accompanies SW release
    - Fermi Mission Technical Handbook
  - Multiple levels:
    - Detailed analysis description ('Cicerone')
    - Individual tool descriptions (like Ftool help)
    - Analysis threads (cook book examples)
    - Also, 'Crash Course' guide

Supported Platforms

FSSC has ported the science tools various popular unix platforms. Goal is to support all HEASARC supported environments.

Custom builds for other platforms will be accommodated to the extent possible.

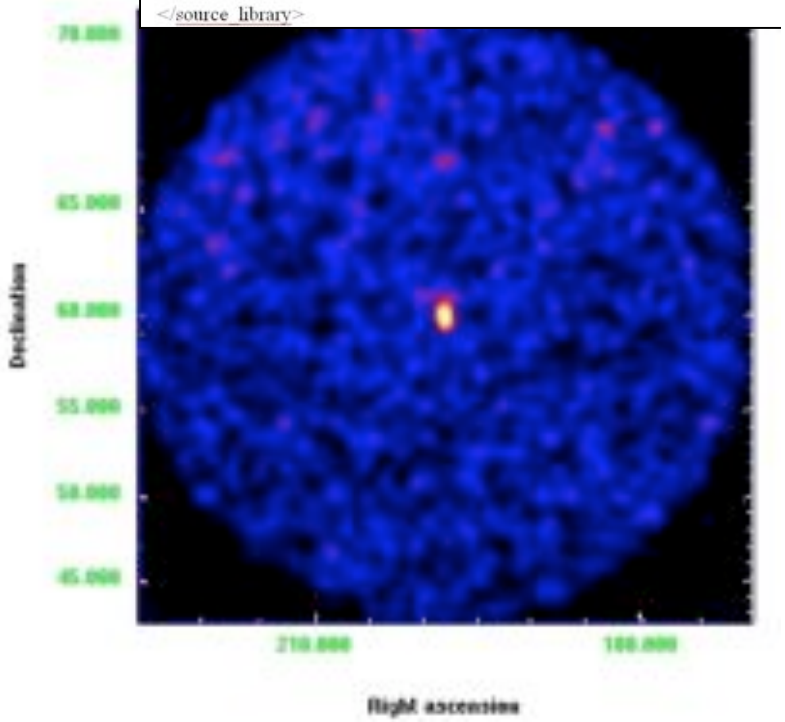
Platform	Configured Correctly	Built Correctly	Installed Correctly
SL4 32-bit	100.00%	100.00%	100.00%
SL4 64-bit	100.00%	100.00%	100.00%
SL5 32-bit	100.00%	100.00%	100.00%
SL5 64-bit	100.00%	100.00%	100.00%
OSX PPC Tiger	100.00%	100.00%	100.00%
OSX PPC Leopard	100.00%	100.00%	100.00%
OSX Intel Tiger	100.00%	100.00%	100.00%
OSX Intel Leopard	100.00%	100.00%	100.00%

Science Tools: Simulations

Science Tools include simulation tool; *gtobssim.* Proposers can simulate more realistic scenarios than w/web based tools, *e.g.* multiple point sources of differing intensities, spectra including backgrounds, mono-energetic sources, pulsed or transient sources.

```
<source_library title="Example1">

 <source name="mysource" flux="0.005">
    <spectrum escale="MeV">
      <particle name="gamma">
        <power_law emin="30.0" emax="200000." gamma="2"/>
      </particle>
      <celestial_dir ra="198" dec="67"/>
    </spectrum>
 </source>
  <source name="Galactic_diffuse">
   <spectrum escale="MeV">
    <SpectrumClass name="MapCube" params="18.58,GP_gamma.fits"/>
    <use_spectrum frame="galaxy"/>
   </spectrum>
  </source>

  <source name="Extragalactic_diffuse">
   <spectrum escale="MeV">
    <SpectrumClass name="Isotropic" params="10.7, 2.1, 20., 2e5"/>
    <use_spectrum frame="galaxy"/>
   </spectrum>
  </source>
</source_library>
```

```
% fhelp gtobssim

NAME

      gtobssim - Generate photon events from astrophysical sources
                 and process those photons according to the specified
                 instrument response functions.

USAGE

      gtobssim infile srclist scfile evroot simtime startdate use_ac
      ra dec radius irfs seed



DESCRIPTION

Gtobssim is a GLAST Science Tool that allows the user to simulate
point and diffuse GLAST observations using a specific spectral shape
for a selected region of the sky in GLAST survey and pointing
modes. Its intended use includes observation and proposal planning, as
well as assessing actual GLAST observations.
```



Proposal Support Tools