Proposal Preparation Tools, Science Tools Overview

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Online Support Tools

- LAT source detectability tool
  - Minimum detectable flux for given exposure and Galactic latitude
- FermiSpec simulation tool
  - Fermi-specific version of HEASARC WebSpec facility
- ARK/RPS proposal submission tool
- GLASThelp online help desk
  - fermi.gsfc.nasa.gov/ssc/help
- FAQ list

LAT Detectability Tool

For a given position on the sky, and observation time, estimate the minimum 5σ 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

GLASTSpec is the GLAST version of the WWW interface for the X-ray spectral fitting package, XSPEC.

Currently, it can be used to *simulate* spectral data for different observation types by the GLAST detectors.

I haven't really looked at the page yet; but I already know that I need HELP!

Choose a Detector/Observation Type

GLAST LAT, survey, 45 deg. Galactic latitude

Specify the desired model expression by clicking on a model in the scroll box.

Available Models

- Power Law
- Gamma-Ray Burst Continuum
- Power Law with cutoff
- Broken Pow Law
- Black Body
- Power Law + Black Body

Here is a description of the models currently available through GLASTSpec.

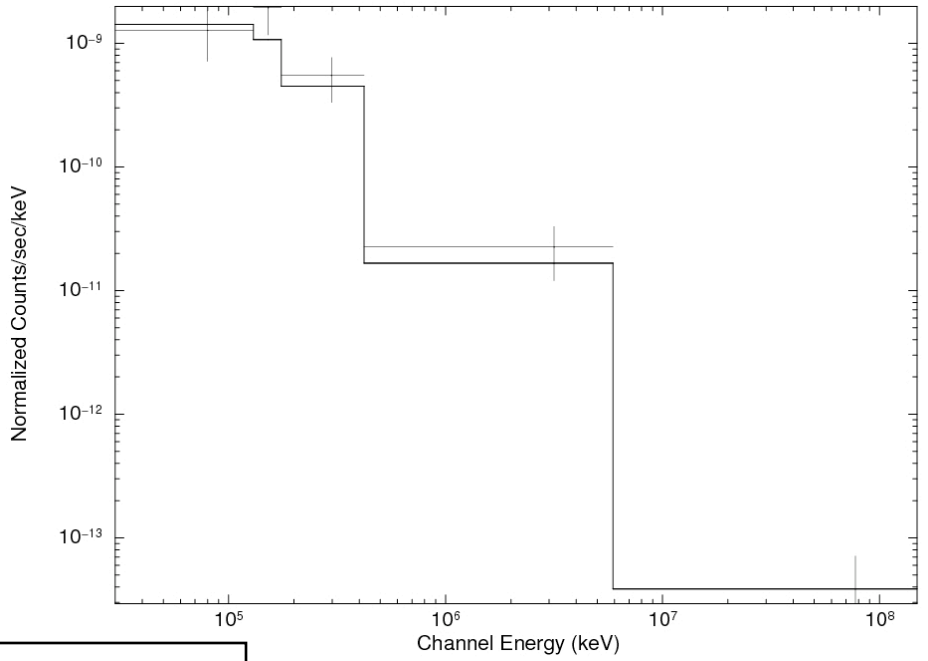
Set Model Parameters | Clear all fields | Okay, I have read this page; but I still need HELP!

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.

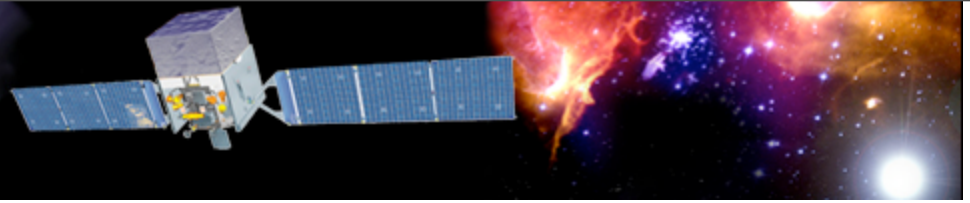
Resulting fluxes:

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.

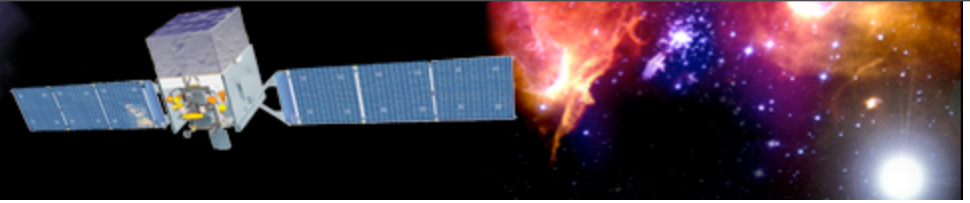
Alternative XSPEC Simulations

- 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.



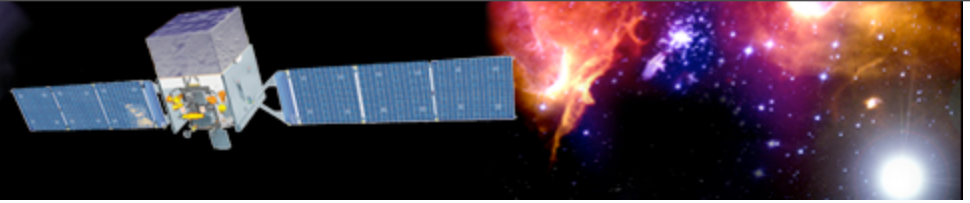
Science Tools: Summary

- *Collaborative effort: FSSC, LAT & GBM Team*
- *Are released as an FTOOLS package*
  - *Adherence to broader HEASARC standards*
  - *"Atomic" executables, FITS I/O, IRAF style parameter files*
  - *Scriptable, with GUI implementation*
  - *Existing tools used when possible and appropriate*
    - *e.g. FV, DS9, XSPEC*
- *GBM related tools released prior to Cycle 1 (8/08)*



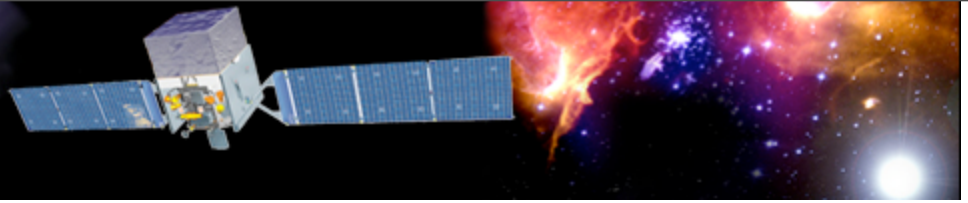
Science Tools: Summary cont.

- *Full set of LAT tools was released on Feb. 6, 2009*
- *LAT analysis has challenges associated w/PSF, backgrounds, scanning mode*
  - *Usability and viability demonstrated*
    - *Early mission science*
    - *Data challenges (GLAST LAT collaboration)*
    - *Beta testing (1st: hands-on tutorial, 2nd: distribute SW & docs)*
- *Tools and documentation are released through FSSC website*
  - *http://fermi.gsfc.nasa.gov/ssc/data/analysis/software/*

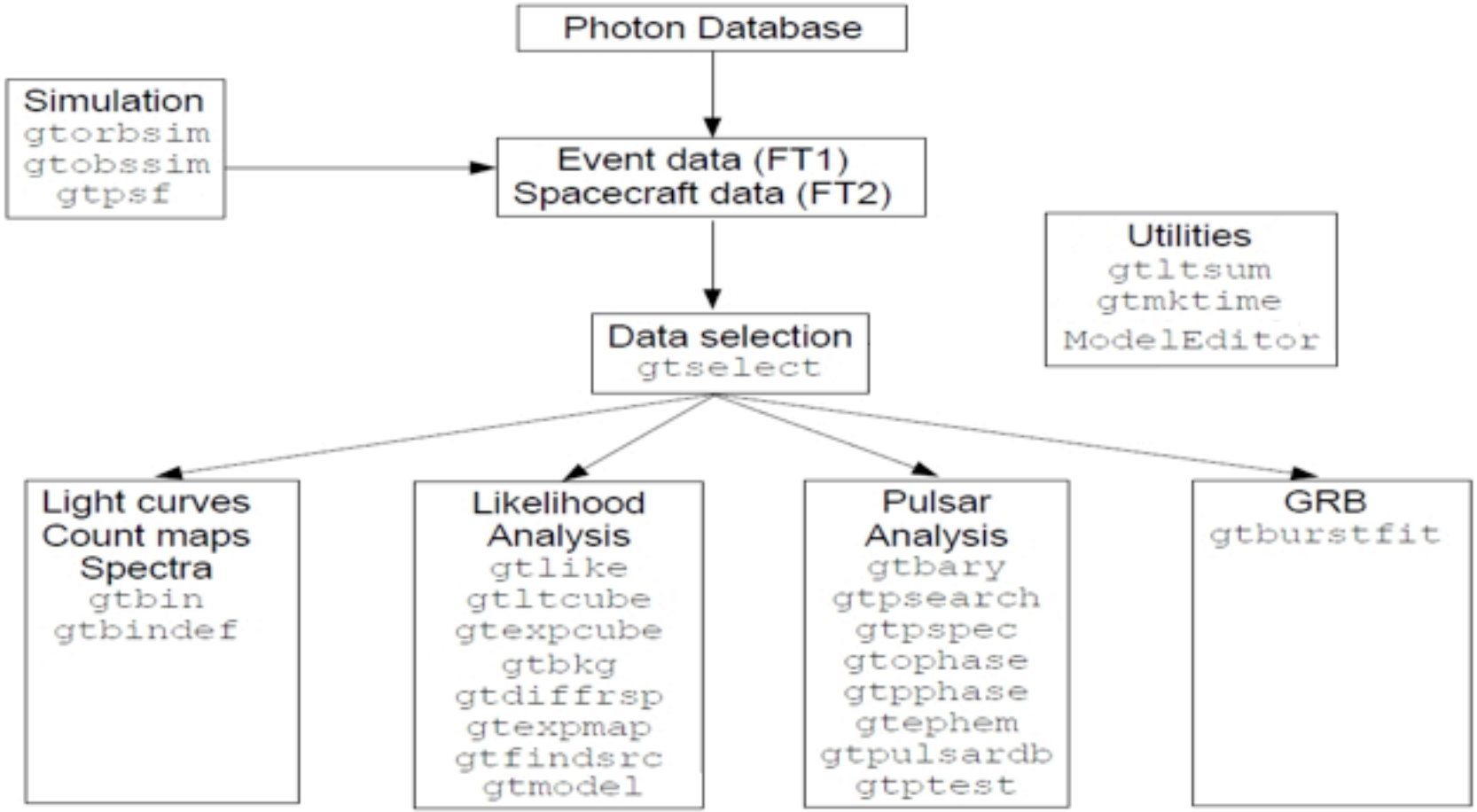


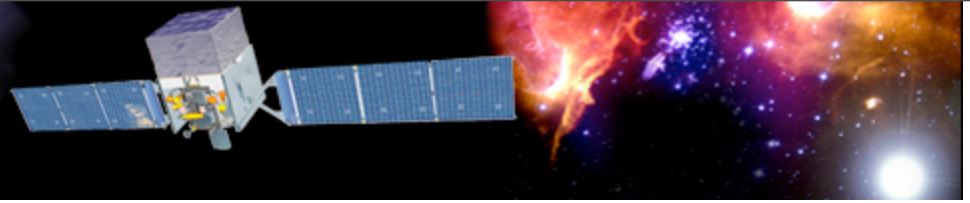
Science Analysis Tools

- *Overview of capabilities*
  - *Maximum likelihood tool—spatial-spectral analysis of region (source detection, flux)*
    - *Includes background models*
  - *Pulsars—period analysis, blind searches*
    - *Includes ephemerides database*
  - *Event-level observation simulator*
    - *enables modeling of a large variety of sources: flaring and periodic sources with spectral variability, diffuse sources, etc.*
  - *GRBs—temporal cuts, spectral analysis: FTOOLS, XSPEC*



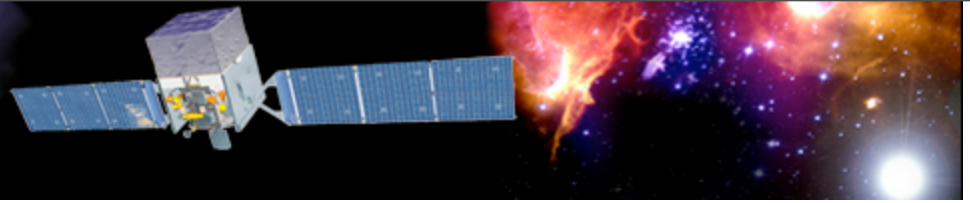
Science Tools: Flowchart





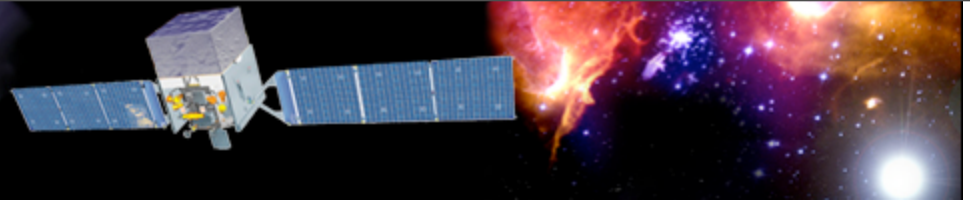
Science Tools: Documentation

- *Multi-Tier Documentation*
  - *Full set accompanies SW release*
    - *Fermi Mission Technical Handbook*
  - *Multiple levels:*
    - *Detailed analysis description ('Cicerone')*
    - *Individual tool descriptions (like fhelp)*
    - *Analysis threads (cook book examples)*



Supported Platforms

Platform	Configure Success	Build Success	Install Success	PI Thread Test pass	Pulsar Thread Test pass
SL 4 32bit	100%	100%	100%	100%	100%
SL 5 32bit	100%	100%	100%	100%	100%
SL 4 64bit	100%	100%	100%	85%	100%
SL 5 64bit	100%	100%	100%	85%	100%
OSX PPC Tiger	100%	100%	100%	100%	100%
OSX Intel Tiger	100%	100%	100%	100%	100%
OSX PPC Leopard	100%	100%	100%	100%	100%
OSX Intel Leopard	100%	100%	100%	100%	100%



Science Tools: Simulations

- *Fermi Science Tools* include simulation tool - *gtobssim*
  - *Can simulate more realistic scenarios than with web-based tools*
    - *Multiple point sources of differing intensities*
    - *Spectra including backgrounds*
    - *Mono-energetic, pulsed, or transient sources*

Science Tools: Simulations cont

```
<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>
```