





Gamma-ray Large Area Space Telescope



Overview of Cookbook Examples

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The Gamma Ray Large Area Space Telescope

Thanks to Chuck Patterson, Jim Chiang, Nicola Omodei, David Band, Masaharu Hirayama, Heather Kelly, Jürgen Knödlseder and many others



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Science Tools





Use Cases of ST

GLAST LAT Project

Science Tools Workshop, June 12-14, 2002

Use case 1

- Contributed by D. Band, J. Chiang, S. D., P. Nolan, J. P. Norris
- Determine the average spectrum of 3C 273 for a particular one-month period
 - 1. Extract the gamma-ray data from the Level 1 database using U1, selecting a large enough region of the sky, and making standard cuts on zenith angle
 - 2. Generate the corresponding exposure using U3 after using U2 to extract the pointing/livetime history
 - 3. Define a model for the region of the sky using U7, which should be nearly automatic but allow for interactive editing; U7 uses U5 and A8
 - 4. Use U4 to generate maps of the region using the data and the model as a sanity check; display tool uses U8.
 - 5. Then iteratively use A1 to optimize the positions and fluxes of the point sources, pruning any that do not belong for this time range, adding any not already cataloged. A1 uses IRFs in D6
 - 6. With other parameters fixed, rerun A1 with various spectral models for 3C 273, or run A1 sucessively for narrow energy ranges to define the fluxes and uncertainties



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User Workbook Science Tools Tutorials

| Home: Software SciTools Setup S | Data Source election Analysis | GRB Analysis | Pulsar Analysis | Observation Simulation | SciTools References | Advanced Data Access |
|-------------------------------------|----------------------------------|-----------------|--------------------|---------------------------|------------------------|-------------------------|
| Data Extract Selection: LAT Data | Explore LAT Data | | | | | |
| | | | | | | |
| | r I | 2 | | | | |
| | | N | | | Prir | nt Version |
| | | | | | | |
| Extract LA | T Data | | | | | |
| | from the Cla | at Colon | co Cupp | art Cantar | | vehalte and |
| erform further | selections. | st Scien | ce Supp | on center | (6550) M | vebsite and |
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| synopsis: | | | | | | |
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| nis thread lead | - / | | | | | |

and make simple binning procedures to explore LAT data





Tutorial 1



At the end of the tutorial you should be able to generate CMAP and LC from gtbin and learn how to use gtselect and the data server at GSSC





User Workbook Science Tools Tutorials

| | GLAST SAS User Workbook |
|--|---|
| SITE MAP DCII | |
| Home: Software Da SciTools Setup Sele | ta Source GRB Pulsar Observation SciTools Advanced Data |
| Source Likelihood Analysis: Tutorial | Binned Likelihood Analysis Source Likelihood Tutorial from Python Identification |
| | |
| | Print Version |
| Likelihood | Tutorial |
| A step-by-step ex | ample of an unbinned likelihood analysis. |
| Prerequisites | |
| • event data fi (sometimes re | le in FT1 format eferred to as the photon data file) |
| spacecraft d (also referred) | ata file in FT2 format to as the pointing and livetime history file) |
| See Extract L | AT Data. |
| SciTools Referen | ce Pages: If you want the SciTools Reference pages to open in a popup |

These tutorials help you to analyze GLAST source data. In particular you are guided to use the Binned and Unbinned Likelihood analysis on a particular sky region both at command interface and with a Python UI

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Tutorial 2



At the end of the tutorial you will be able to perform likelihood analysis (binned and unbinned) on specific region of the sky, making cnts and src maps, exposure maps ... you should be able to generate xml models of the sky regions

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User Workbook Science Tools Tutorials

| 1 | GLAST SAS User Workbook |
|---|--|
| SITE MAP DCII | |
| Home: Software SciTools Setup | Data Source GRB Pulsar Observation SciTools <mark>Advanced Data</mark> Selection Analysis Analysis Analysis Simulation References |
| Source Likelih Analysis: Tutor | ood Binned Likelihood Analysis Source ial Likelihood Tutorial from Python Identification |
| | Delet Version |
| | Print Version |
| Source iden (gtsrcidTuto | rial) |
| A step-by-step exar | nple of LAT source identification. |
| Prerequisites | |
| • LAT point sou | rce catalogue file |
| SciTools Reference click on: Open Popu | e Pages: If you want the SciTools Reference pages to open in a popup window, p Reference Window. |
| Steps: | |
| 1. <u>Get counterpa</u> <u>catalogue</u> | t needed for source identification. |
| 2. <u>Run gtsrcid</u> | to do the job. |
| Condition Table Well Constitution | |

This tutorials helps to identify a particular source on the sky with data from external catalogs





User Workbook Science Tools Tutorials



These tutorials let you to do a spectral analysis on GRB using GBM and LAT data. XSPEC is required.





Tutorial 3



The tutorial lets you to bin the GBM data and perform joint spectral analysis with GBM and LAT data.

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User Workbook Science Tools Tutorials

| A CONTRACT | | | | | | |
|---|--|--|--|--|--|--|
| G | LAST SAS User Workbook | | | | | |
| SITE MAP DCII | | | | | | |
| Home: Software Data SciTools Setup Selection | Source GRB Pulsar Observation SciTools Advanced Data Analysis Analysis Simulation References Advanced Access | | | | | |
| Pulsar Pulsar Anal. Arrival Analysis: Tutorial Corre | Time Period Pulse Phase Binary Orbital Ephemeris Ephemeris ction Search Calculation Phase Calculation Computation Utility Data File | | | | | |
| | | | | | | |
| N | Print Version | | | | | |
| Pulsar Analysi | is Tutorial | | | | | |
| This tutorial illustrates | the flow of a basic pulsar analysis, using the following pulsar tools: | | | | | |
| Pulsar Tools: | Tool Tutorials: | | | | | |
| • gtbary | Arrival Time Correction | | | | | |
| gtpsearch | Period Search Tutorial | | | | | |
| gtpphase | Pulse Phase Calculation | | | | | |
| • gtophase | Binary Orbital Phase Calculation | | | | | |
| gtephcomp | Ephemeris Computation Utility | | | | | |
| gtpulsardb | Ephemeris Data File | | | | | |

These complete tutorials guide you in the analysis of PSR data.





Tutorial 4



After the series of tutorials on PSR you will be able to find the PSR period having applied barycentric corrections and phase search using ephemerides calculation

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This tutorial is useful to simulate new source models and test your ideas...



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Tutorial 5



In the Observation Simulator tutorials you will find how to simulate a realistic sky, defining simple source models. You will be directed also to the description of the complete modeling of PSR and GRB modeling available.

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Conclusions

• Try to use the tutorials

GLAST LAT

- e.g. start from gtobssim to create your "own" sky and then reanalyze the DC2 sky on the same region
- They are proved to be effective in getting the users really involved in GLAST analysis
- Follow carefully tomorrow's tutorials on real DC2 sky

