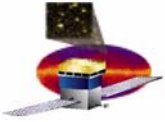


Science Groups Overview

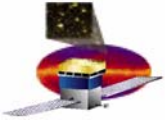
- There are 9 LAT science working groups
 - Blazars and other AGN
 - Paolo Giommi, Benoit Lott
 - Calibration and Analysis
 - Bill Atwood, Steve Ritz
 - Catalog
 - Seth Digel, Isabelle Grenier
 - Dark Matter and new physics
 - Elliott Bloom, Aldo Morselli
 - Diffuse (Galactic and Extragalactic)
Seth Digel, Isabelle Grenier
 - Gamma-ray Bursts
 - Jay Norris, Nicola Omodei
 - Pulsars, SNRs and Plerions
 - Roger Romani, Dave Thompson
 - Sources in the Solar system
 - Gerry Share
 - Unidentified Sources, population studies and other galaxies
 - Patrizia Caraveo, Olaf Reimer

Most people are members of more than one group, 188 unique names!



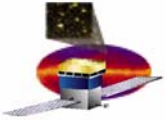
Roles of the science groups

- **Make preparations for obtaining science results with the LAT**
 - **Science Goals: Keep abreast of new science discoveries to stay current on what GLAST can do**
 - **Develop analysis algorithms and software**
 - **Develop astrophysics simulations**
 - **Plan and propose for observations at other wavelengths to complement the GLAST data**
 - **Communicate with the rest of the scientific community about GLAST capabilities and results**
 - **Write papers, present GLAST contributions at conferences.**
- **Provide forums for LAT folks to work together on all these things**
 - **Meetings, mailing lists, confluence pages...**



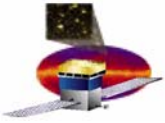
Organisation

- **Science group coordinators meet each month (on the first Friday of each month typically).**
- **The agenda, presentations and minutes from each meeting are available to all collaborators.**
 - **Multiwavelength report**
 - **Status of papers**
 - **Upcoming conferences**
 - **Discussion of simulation and analysis progress and plans**
 - **Coordination of collaboration and science group F2F meetings.**
- **Intent is that all the topics discussed at the coordinators meetings are also discussed (in more detail) in the meetings of the individual science groups.**



Conference contributions

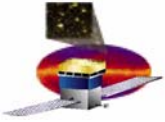
- **Substantial LAT presence at several major meetings:**
 - 17 LAT presentations at HEAD meeting
 - 11 LAT presentations at AAS meeting in Seattle
 - > 65 LAT presentations at GLAST symposium!!
- **Many other LAT presentations at topic specific meetings**
- **Plans for LAT contributions at upcoming conferences is a regular topic in most science group meetings.**



Conference Coordination

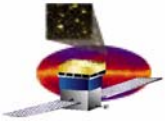
- Discuss upcoming conferences in science group coordinators meetings.
- Encourage authors to post the titles, abstracts and slides/poster on the drafts webpage.
- Final talks/posters archive at the speakers bureau.

A screenshot of a web browser displaying a Confluence page. The browser's address bar shows the URL: https://confluence.slac.stanford.edu/display/SCIGRPS/GLAST+Sympo. The page title is "GLAST Symposium, Palo Alto, Feb 5-8 2007 - GLAST LAT Science Groups - SLAC Confluence". The page content includes a "Quick links to sections:" table with the following links: Diffuse Emission & Molecular Clouds, Pulsars, Supernova Remnants, & Plerions, Unidentified Sources, Active Galactic Nuclei, Dark Matter & New Physics, Gamma-ray Bursts, Calibration & Analysis, Beam Test, Instrument Science Operations Center, GLAST Science Support Center, and Miscellaneous. Below this is a section titled "Contributions from the diffuse emission and molecular clouds science working group" with a sub-section "Developing the Galactic Diffuse Emission Model for the GLAST Large Area Telescope (poster)(reviewer Jean-Marc Casandjian)(draft: ppt-slides)". The text below discusses the Galactic diffuse emission and its role in the gamma-ray sky. The browser's status bar at the bottom shows "Done" and "confluence.slac.stanford.edu".



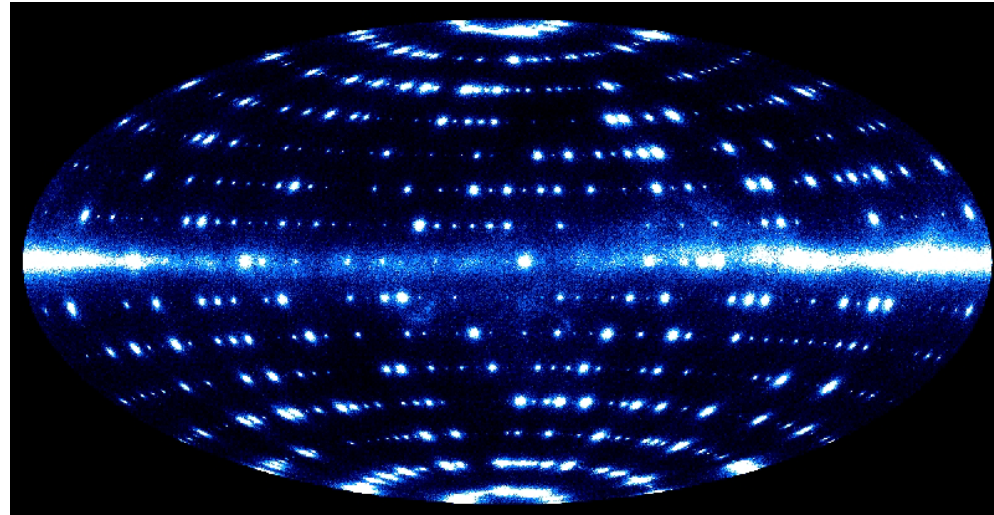
Papers

- **LAT instrument paper**
 - **Includes contributions from all the groups**
- **Calibration and Analysis group has been coordinating instrument subsystem papers**
 - **ACD - accepted by Astroparticle physics**
 - **Tkr - final draft reviewed**
- **Many conference proceedings**



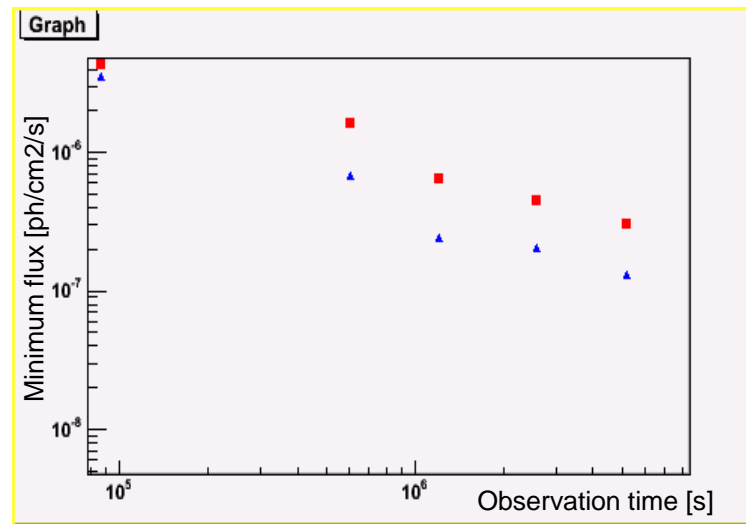
Systematic studies: Pulsars

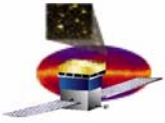
- Max Razzano - studying pulsar detection sensitivity
- Grid of pulsars with systematically changing flux superimposed on galactic diffuse background.



Plot of the minimum detected flux with time, for 2 different galactic latitudes. The red points are for $b=0^\circ$ and the blue for $b=24^\circ$.

The points appear to be well fitted with a power law $f(t) = 1/\sqrt{t}$.

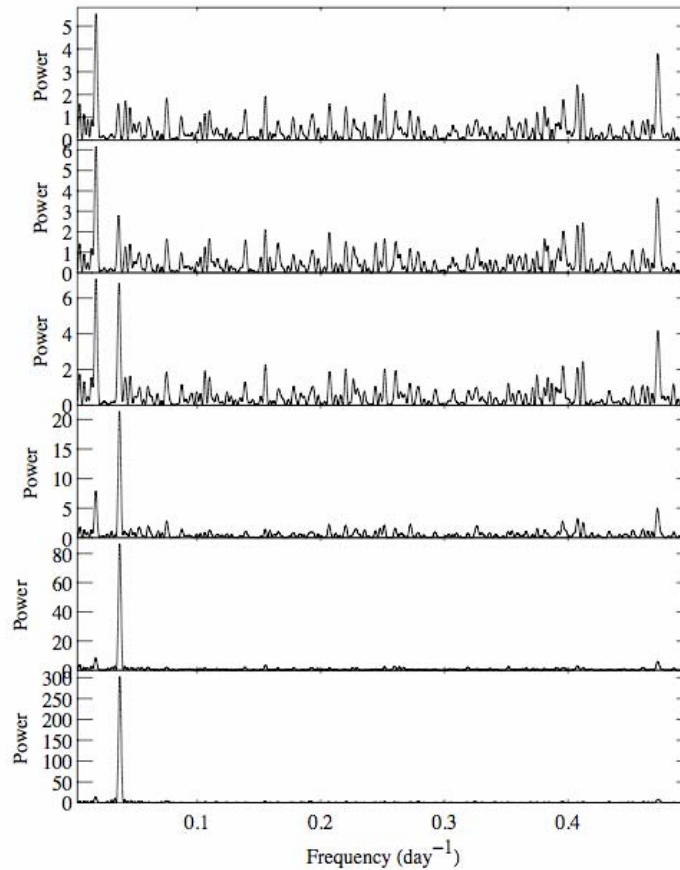




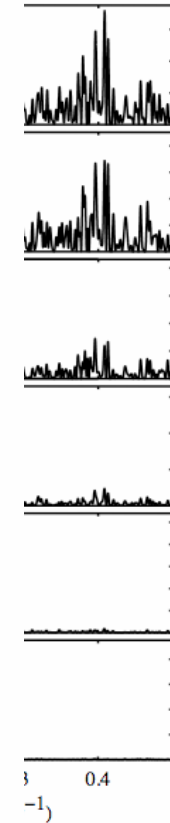
Systematic Studies: microquasars

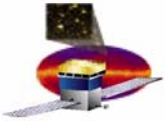
- Robin Corbet & ... simulations of decreasing in ...
- 26 day orbit pe ...

Counts/s

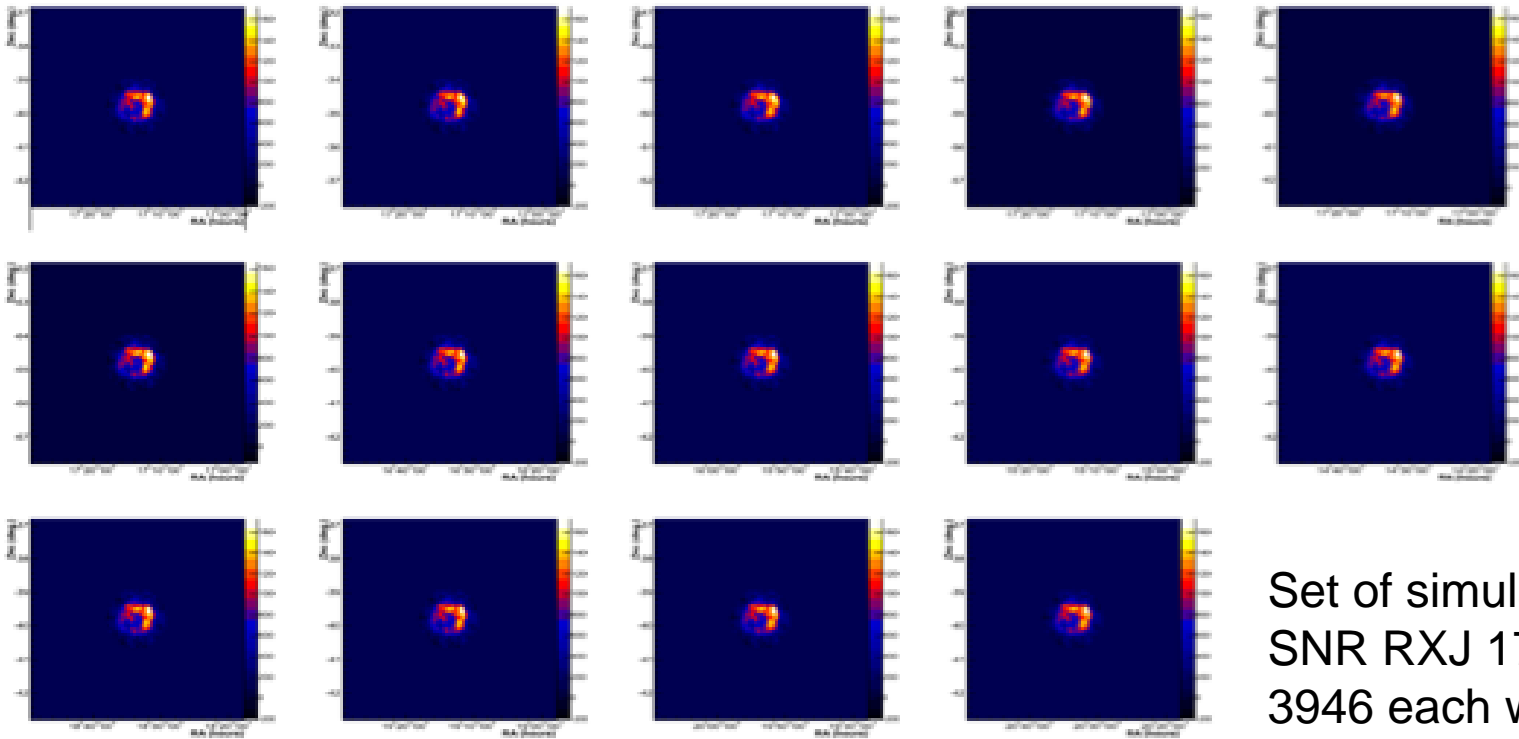


sequence of
d brightness and
lux levels.

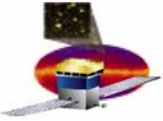




Systematic studies: SNR



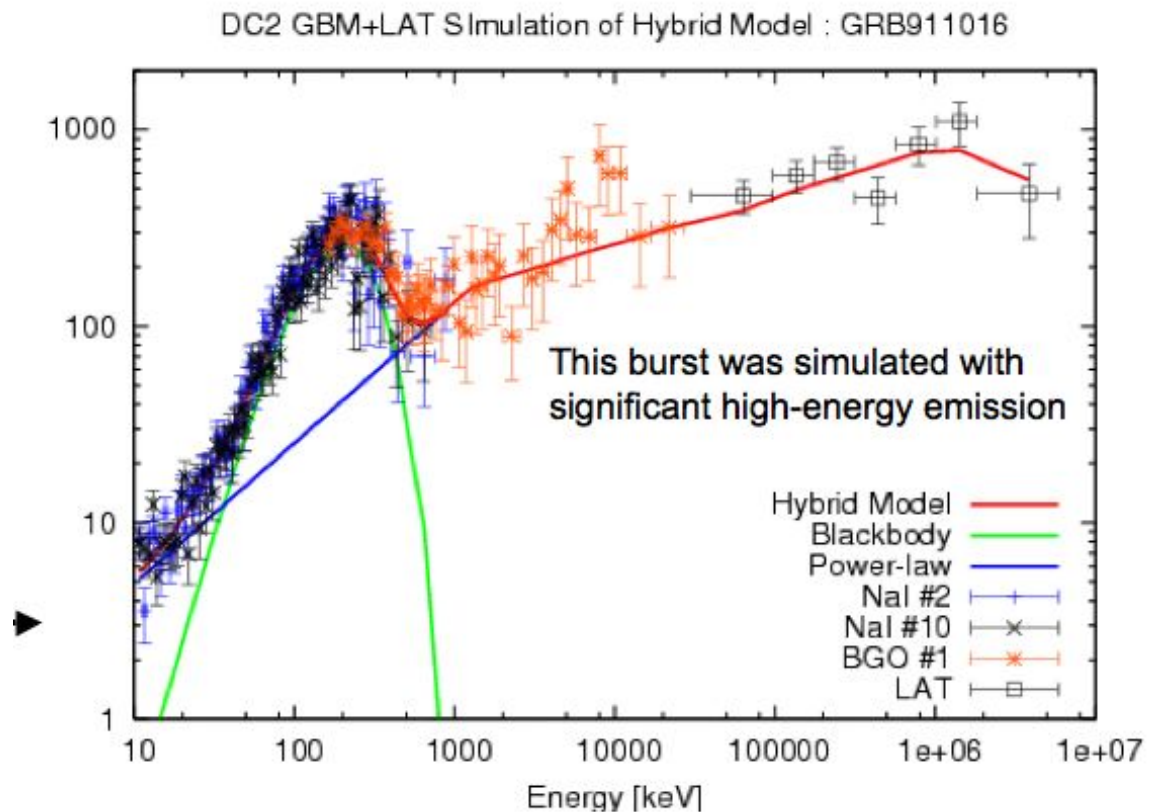
Set of simulations of SNR RXJ 1713.7-3946 each with a different spectral model (Stefan Funk)

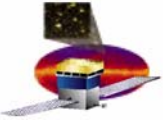


GRB Spectral Models

- The GRB group is developing more sophisticated spectral models of bursts (Omodei, Battelino).
- Developing methods to measure spectral features and using systematic simulation studies to evaluate performance (Nukri Komin)

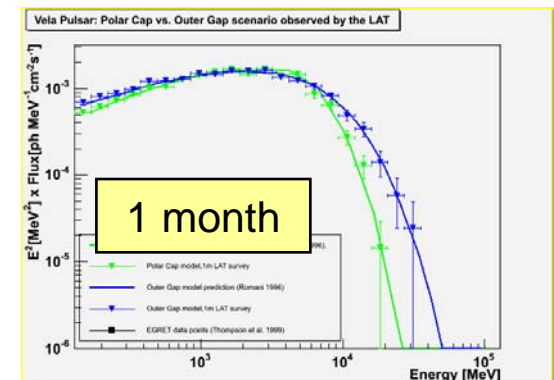
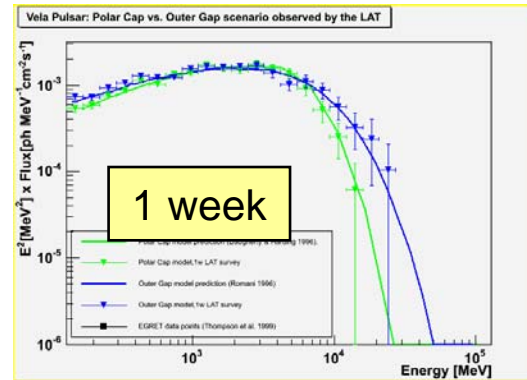
Hybrid GRB model by
Milan Battelino



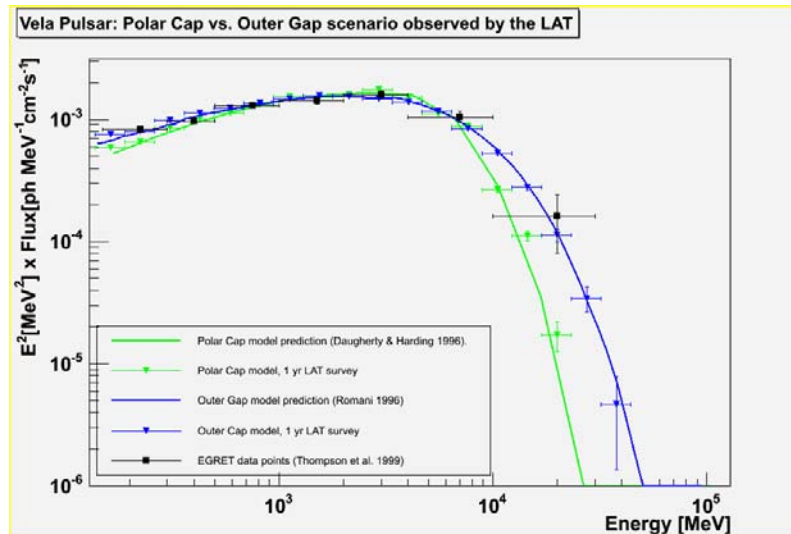


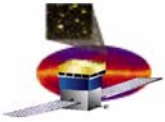
Pulsar simulations and analysis

- Razzano and Harding - simulations to illustrate the ability of LAT observations to distinguish between pulsar emission models.
- Develop analysis methods to quantify this.
- Additional simulation improvements
 - Adding models for binary pulsars
 - Including noise and glitches



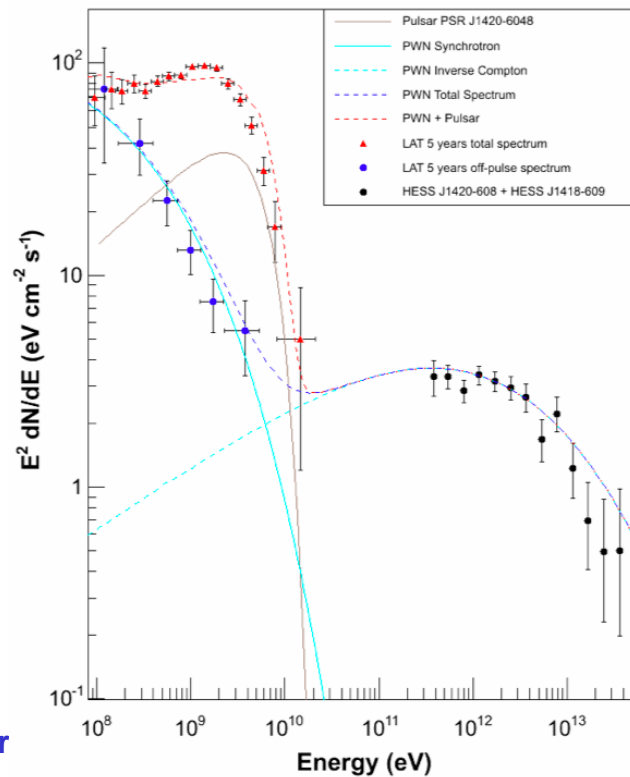
1 week (left) and 1-month Vela observation and 1 year Vela observation.



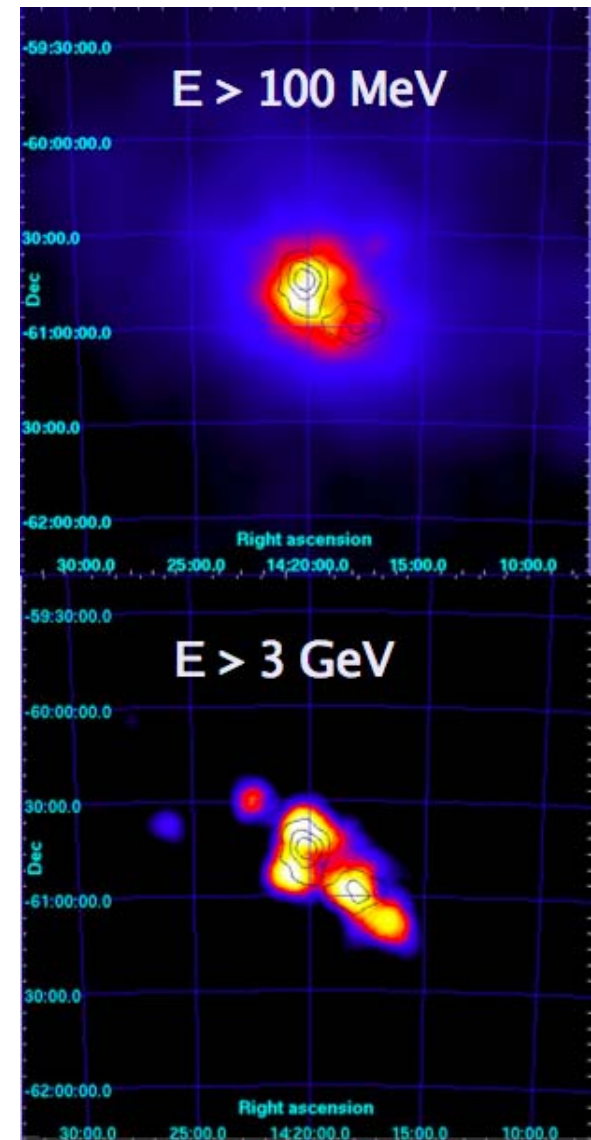


Pulsar Wind Nebula Studies

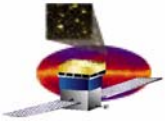
- Simulations of the kookaburra region (Stefan Funk) which contains a pulsar and a pulsar wind nebula, illustrating how phase resolved spectral studies or energy resolved spatial studies can distinguish between the two components



Julie McEner



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Analysis Methods

- Developing analysis methods to address specific science goals

GLAST LAT Collaboration Service Challenge Workshop, Nov 29-31 2006

RL algorithm for the LAT

- PSF depends on event(E,θ) → Event-by-Event deconvolution needed

Wavelet iterative denoising currently under study:

- Potentially cleaner result
- Complication of the algorithm
- Issue with dual channel to understand

Johann Cohen-Tanugi, SLAC-Stanford University

Image deconvolution methods to study extended sources (Johann Cohen-Tanugi, Hiro Tajima, Stefano Finazzi)

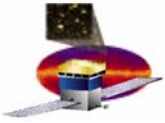
GLAST LAT - I.N.F.N. Perugia SC - I Workshop, Nov.29 - Dec.1 2006, SLAC, USA

Example: TSA of blazar variability

- Phase Dispersion Minimization.
- Gaps Window Function. periodogram GWFP.

Such methods can be well applied to real LAT light curves.

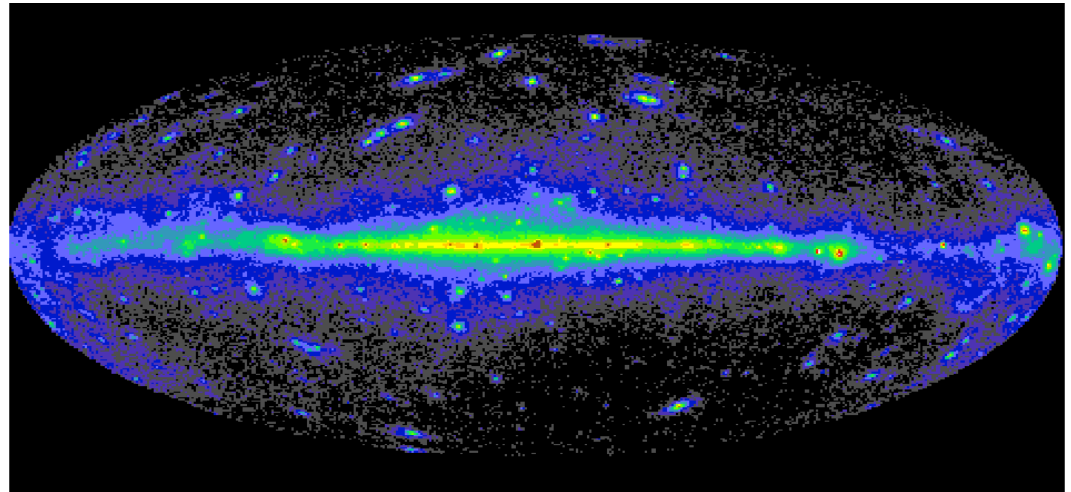
Time series analysis to study blazar variability (Stefano Ciprini, Gino Tosti)



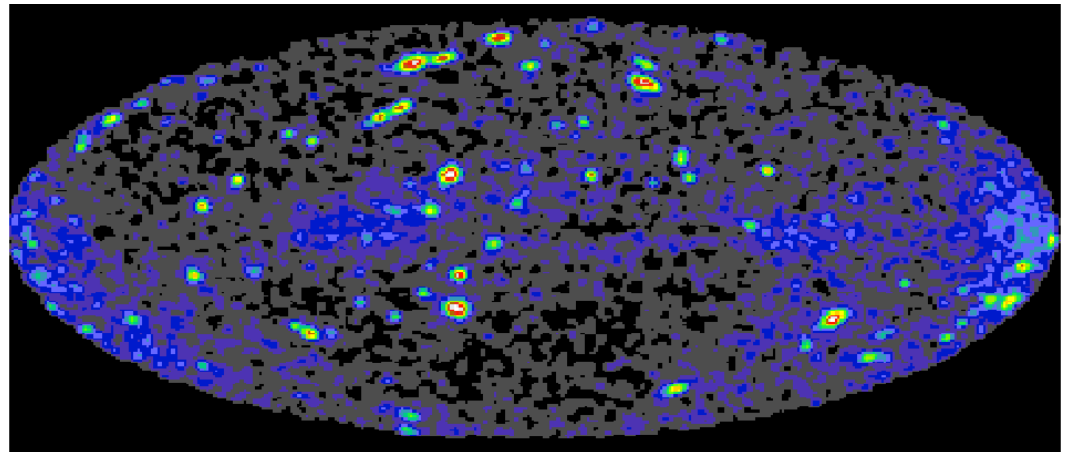
Catalog group

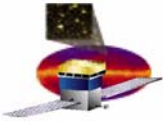
- **Giommi, Gasparini and Cutini presented a method to make variability maps of the sky.**

GLAST DC2 Sky:
Normal intensity image



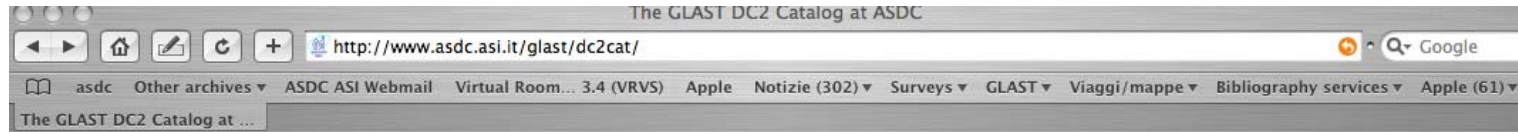
Time variability image: Image is color coded according to χ^2 probability of flux variation from a KS test on each pixel (see Giommi, White & Angelini 1995 ASPC 77,117 for the method)





ASDC catalog page

<http://www.asdc.asi.it/glast/dc2cat/>

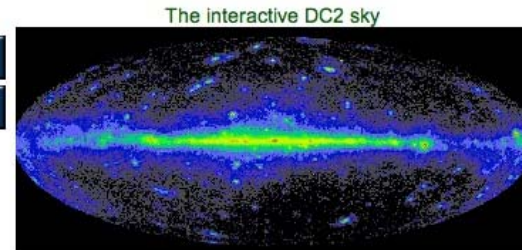


GLAST-LAT DC2 source catalog (V1) and data access at ASDC

Available parameters

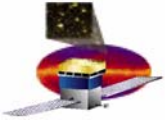
- Name
 - Ra Dec
 - Significance
 - Flux(>100MeV)
 - Radio_fl(1.4GHz)
 - Class
 - Other name
 - sp_index
 - EGRET name
 - DistCounterpart
 - Redshift
 - XFlux
 - Err_rad(95%)
- GO**

Click to start interactive catalog



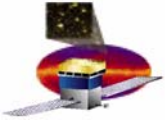
Perugia Wavelet DC2 catalog at ASDC

Entry number		DC2 name	RA (J2000.0) hh mm ss.d	Dec (J2000.0) dd mm ss.d	Gamma flux (ph/cm2/s E>100 MeV) GLAST-DC2	Source classification Browse Classif	Other source names	Egret name	Redshift
Subset selection mode: inclusive		↑ ↓	↑ ↓	↑ ↓	↑ ↓ Stat	↑ ↓	↑ ↓	↑ ↓	↑ ↓ Stat
1 <input type="button" value="Select"/>	ASDC tools & data access	MRF0021	00 10 44.5	+73 10 26.4	2.51e-7	SNR	CTA1,SNR119	3EG J0010+73	0
2 <input type="button" value="Select"/>	ASDC tools & data access	MRF0324	00 04 58.8	-52 27 00.0	1.29e-7	Unid. radio source	-----	-----	0
3 <input type="button" value="Select"/>	ASDC tools & data access	MRF0301	00 10 39.6	+02 47 27.5	9.62e-8	Unid. radio source	-----	-----	0



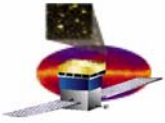
Service Challenge

- **Service challenge is the successor to the Data Challenges.**
- **Joint participation by ISOC and science groups.**
- **Sequence of simulations, of varying degrees of fidelity, to exercise our ability to extract science results from the data**
- **What is coming:**
 - **Series of 1 year quick simulation (first one in Dec 2006)**
 - **Astrophysical source updates: grb models, pulsars (noise, phase dependent spectra, more sophisticated XRB etc)**
 - **Quantify how different astrophysics models interact (e.g. blazar luminosity function on EBL studies or Galactic diffuse model on SNR studies)**
 - **Develop analyses requiring long datasets**
 - **Exercise catalog pipeline**
 - **55 day full detector simulation**
 - **Updated sky model**
 - **Improved treatment of residual background in high level analysis**
 - **Exercise and test ASP and Catalog pipelines, flow resulting data to the GSSC.**
 - **Some detector/observatory imperfections - exercise ISOC monitoring and explore the effects of these on the science results (and test communication between SO and the science groups).**



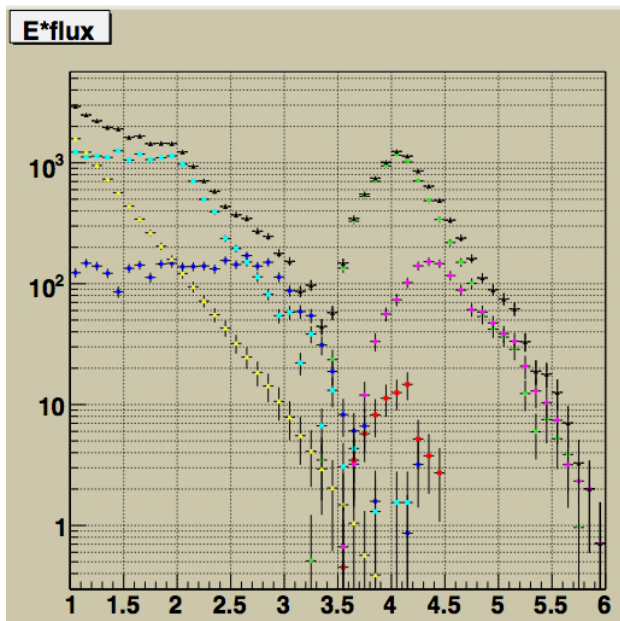
Service Challenge

- **What is coming (cont)**
 - **Series of downlink (3hr) sized full detector sims in a variety of detector and observation configuration. Simulations produced in very low-level raw format.**
 - Fully exercise level 1 pipeline
 - Exercise and develop all operations monitoring software (i.e. find and characterize instrument configurations and problems)
 - Practice ISOC science ops (duty scientist shifts etc)
 - **One year full detector simulation (June 2007)**
 - This will provide the most realistic simulation dataset to practice and develop science analysis.
 - Final iterations of instrument performance and IRFs.
 - Develop analyses that require long integration times (extragalactic and Galactic diffuse, dark matter searches etc)
 - **In parallel with these large organized simulations, the science groups are also generating smaller sets of simulated data for specific studies**
 - Populations of GRB, grids of point sources with systematically changing properties etc.

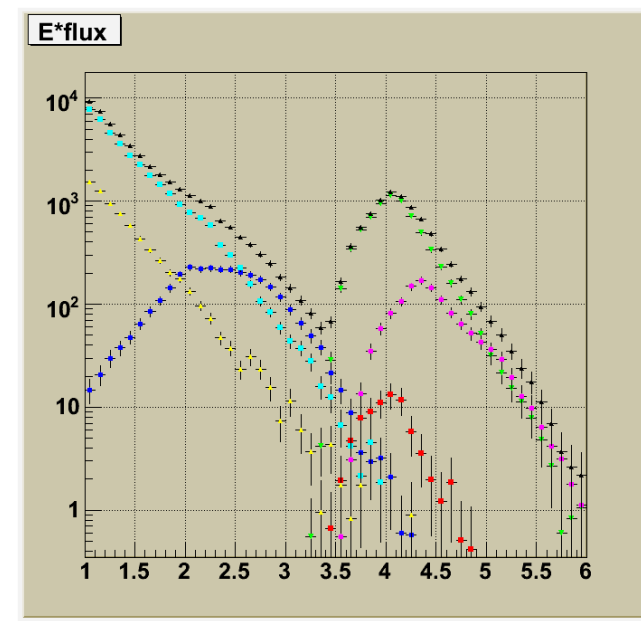


Background model review

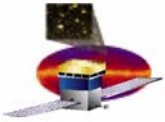
- The C&A group organised a review of the cosmic-ray background model.
- Chaired by Jonathan Ormes, implemented largely by Tsunefumi Mizuno and Toby Burnett
- Re-examined all components of the background model and compared with latest experimental measurements.
 - Updated fluxes and greatly improved detail of flux, spectral and direction distributions with orbit location.



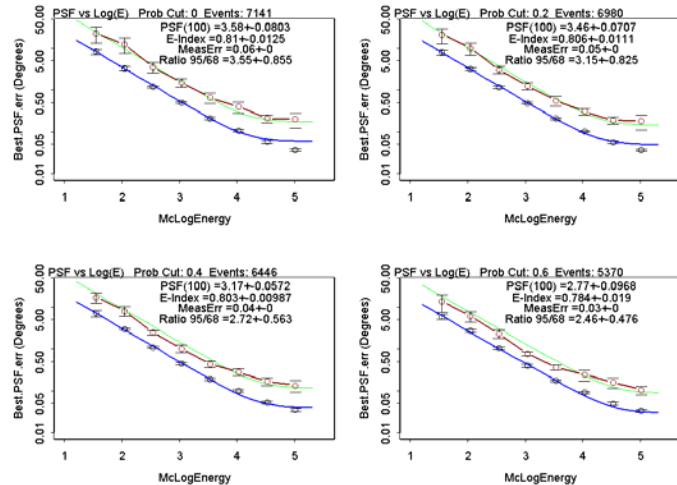
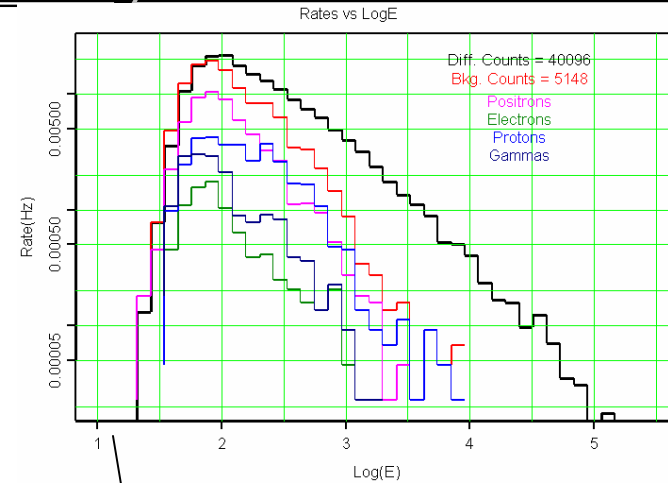
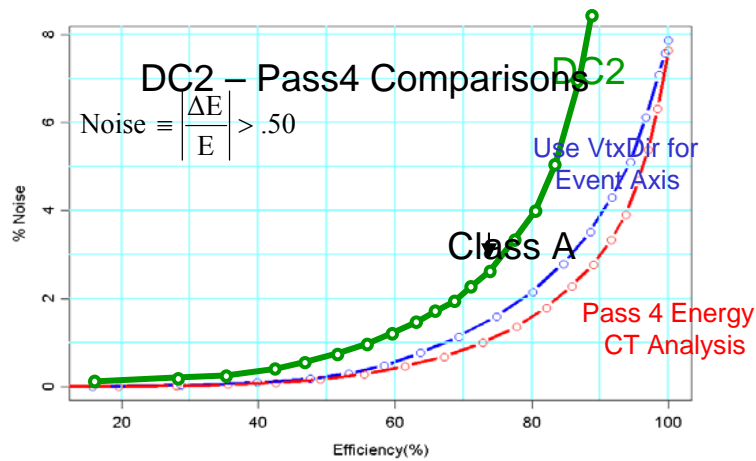
Julie McEnery



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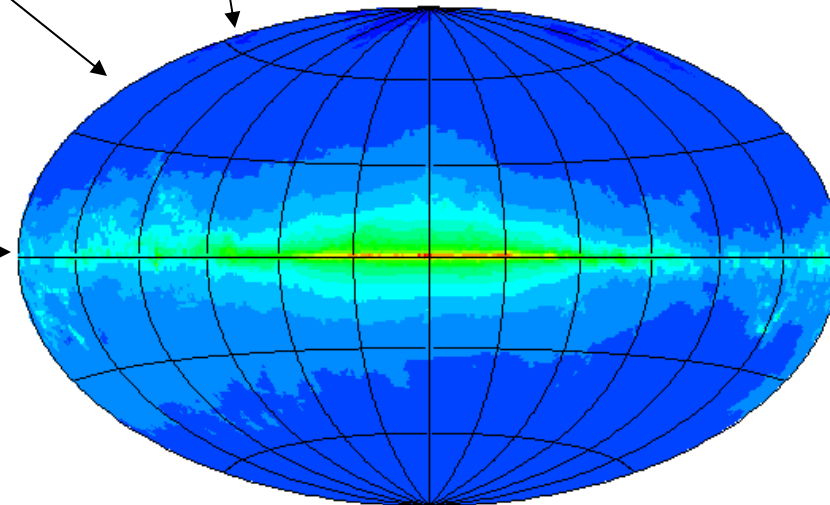
Event Selection background rejection and sensitivity



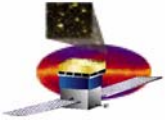
Energy resolution (Atwood)

Background rejection (Atwood)

Psf (Atwood)

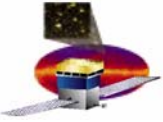


Julie McEnerly



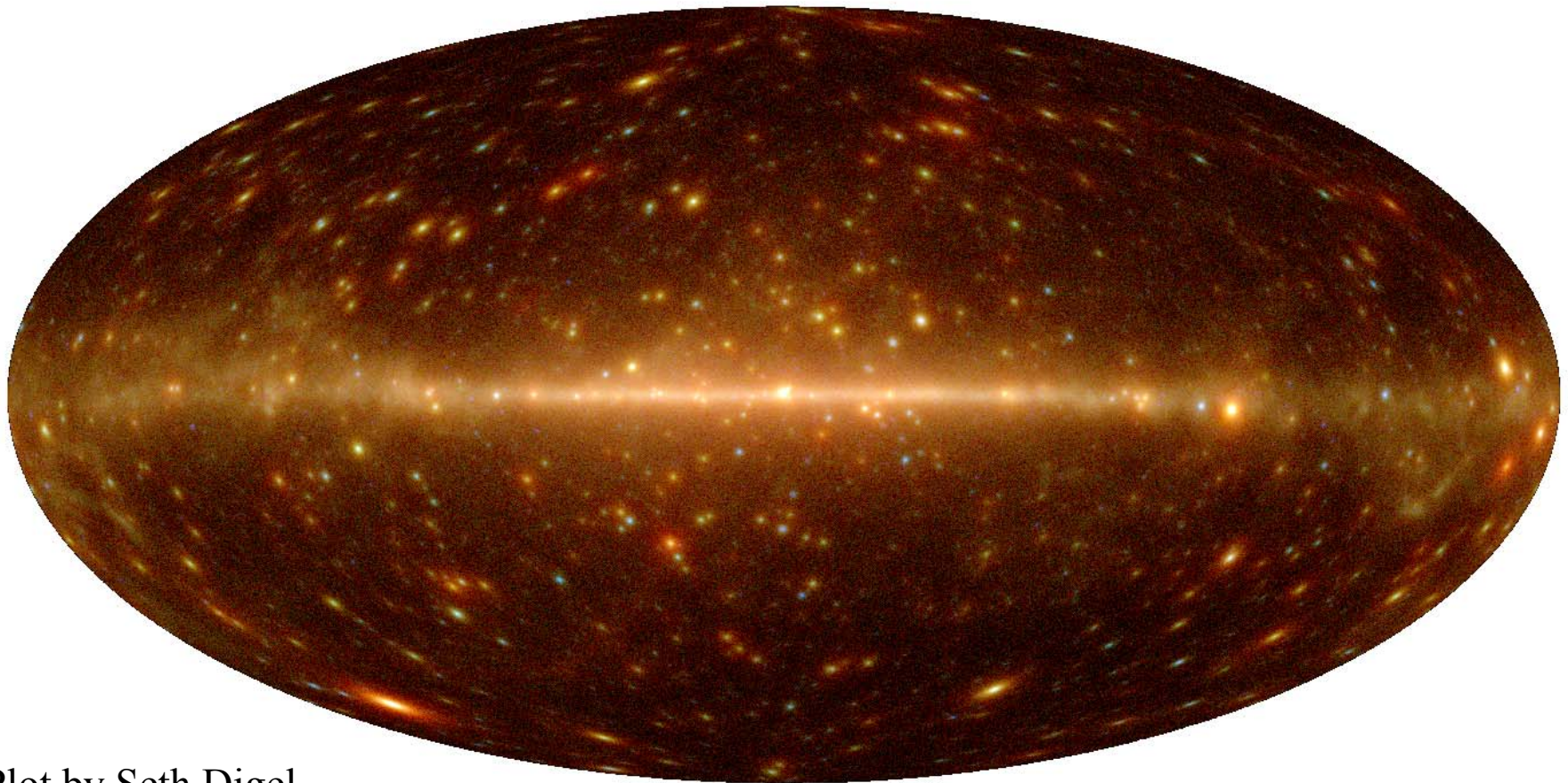
Source Simulation group

- **Provides the astrophysical sky model for the SC sims.**
- **At least one person from each science group**
 - **Jim Chiang**
 - **Seth Digel**
 - **Max Razzano**
 - **Nicola Omodei (co-Chair)**
 - **Alice Harding (co-Chair)**
 - **Stefan Funk**
 - **Ping Wang**
 - **Francesco Longo**
- **Coordinate science group simulations efforts and generate complete models of the sky for service challenge sims.**

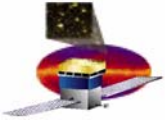


1-year obssim run

- Putting it all together:

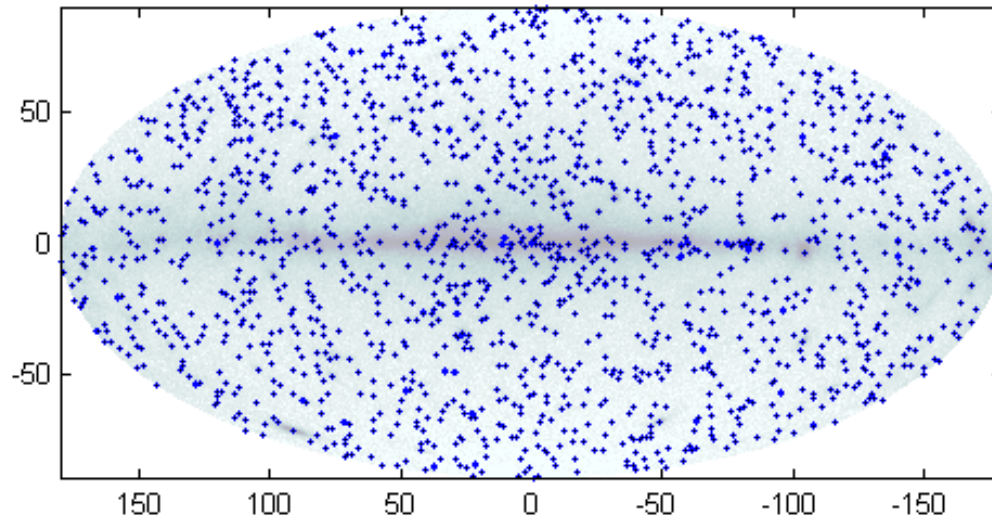


Plot by Seth Digel



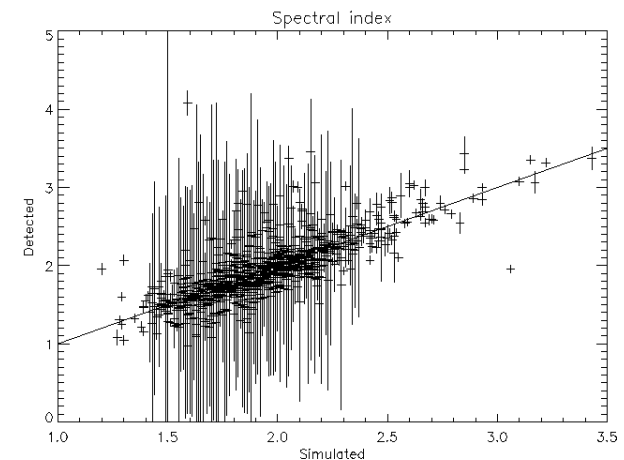
Catalog pipeline results

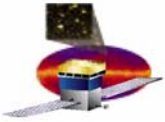
- **1605 Detections, 1566 consistent with real sources (but analysis not yet complete - does not include GRB and extended sources).**



Work is underway to use these results to understand and quantify any systematic shifts in the fit parameters.

Jean Ballet and collaborators ran the catalog pipeline on the 1 year obssim run.





Catalogs for source identification

- Need to agreement on which catalogs to cross reference against LAT sources.
- Kicked off cross-group discussions, hosted/coordinated by the catalog group

LIST OF CATALOGS OF POTENTIAL INTEREST FOR GLAST

file:///Users/mcenery/tmp/catalogs_list_0205.htm

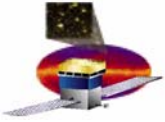
Getting Started Latest Headlines

LIST OF CATALOGS OF POTENTIAL INTEREST FOR GLAST

Color code describes availability of the catalogue in U9: pink = suggested to be addressed next (not necessarily for DC2), orange = under development for DC2, yellow = partially working, green = ready

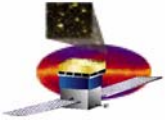
Status 2005-02-11.

Name	Publication	Notes
X rays		
INTEGRAL		INTEGRAL
XMM-Newton Serendipitous Source Catalogue (1XMM)		XMM
SEXTI catalog	Harrison+, 2003	Extragal hard X identification
WGACAT version of ROSAT sources	White+ 2000	ROSAT
ROSAT All-Sky Bright Source Catalogue (1RXS)	Voges+ 1999	"
ROSAT All-Sky Survey Faint Source Catalog	Voges+ 2000	"
High galactic latitude RASS X-ray sources	Thomas+ 1998	"
Second ROSAT PSPC Catalog	ROSAT, 2000	"
Catalog of ROSAT galaxy clusters	Vikhlinin+ 1998	"
ROSAT detected quasars	Brinkmann+ 1997	"
ROSAT detected quasars	Yuan+ 1998	"
ROSAT-FIRST AGN correlation	Brinkmann+, 2000	ROSAT/radio
RBSC-NVSS sample	Bauer+, 2000	"
Radio-loud galaxies in the ROSAT survey	Reich+, 2000	"
ASCA Galactic Plane Survey faint X-ray sources	Sugizak+, 2001	ASCA
ASCA Large Sky Survey	Ueda+, 1999	"
ASCA GIS catalog project : source catalog	Ueda+ 2001	"
ASCA AGN optical identifications	Akiyama+, 2003	"
The BeppoSAX 2-10 keV Survey	Giommi+, 2000	BeppoSAX
BeppoSAX HELLAS survey	La Franca+, 2002	"
BeppoSAX HELLAS survey	Fiore+, 2001	"
UV		



Multiwavelength activities

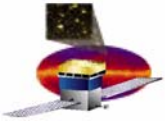
- **GLAST related proposals involving at least one LAT collaborator as co-I**
 - **RXTE**
 - 7 blazar proposals
 - **Suzaku**
 - 4 blazar proposals
 - Microquasar (LSI +61 303), LAT is also coordinating TeV and radio observations for this campaign.
 - **XMM AO6**
 - SNR (RX J1713.7-3946)
 - 3 blazar proposals
 - **Radio blazar observations**
 - **MOJAVE** - monitor the brightest blazars with VLBA
 - **VIPS** - snapshots of large number of blazars with VLBA
 - **Radio pulsar timing**
 - ATNF
 - Nancy



Multiwavelength activities

- Communicate via a group editable webpage, to coordinate upcoming activities amongst the groups.

The screenshot shows a web browser window displaying a Confluence page. The browser's address bar shows the URL: <https://confluence.slac.stanford.edu/display/SCIGRPS/Multiwavelength>. The page title is "Multiwavelength Planning - Short Term". The page content includes a navigation bar with "View", "Edit", "Attachments (0)", and "Info" tabs. Below the navigation bar, there is a section titled "This area is a discussion site for upcoming proposals." followed by a link to the "Multiwavelength Coordinating Group general page". A section titled "Notes about Target of Opportunity proposals (Berric Giebels)" contains two bullet points: "XMM, INTEGRAL and Suzaku have stringent solar and anti-solar pointing exclusion areas, that will exclude a fraction of the sky from their observation capabilities on ToOs." and "RXTE and SWIFT are the only ones accepting anti-solar pointings which means that they will be the only ones capable of participating in simultaneous MWL observations involving ground-based instruments. However Swift has a clear priority set on GRBs so they will probably not guarantee long time series unlike RXTE. Swift however has a very quick slew, when RXTE requires >1 day on ToO notices. A sensible strategy would be to have Swift catching our immediate flaring counterparts, and RXTE covering the longer time variability component." Below this, there are two sections: "Spitzer Proposals - Deadline Feb. 14" and "INTEGRAL Proposals - deadline April 20". The "Spitzer Proposals" section mentions Stefano Ciprini and collaborators in Perugia working on a Spitzer proposal, with help from Ann Weirle, presumably for blazars. The "INTEGRAL Proposals" section mentions Luigi Foschiri and Werner Collmar having already agreed to work on an INTEGRAL proposal - blazars. At the bottom of the page, there is a "Add Comment" button. The browser's status bar at the bottom shows "Done" and the URL "confluence.slac.stanford.edu".



Multiwavelength activities

- Overall coordination by the multiwavelength coordinator, but the detailed discussions happen in the science groups.

Blazar group
multiwavelength
webpage

Blazars and Other AGNs - GLAST LAT Science Groups - SLAC Confluence

Getting Started Latest Headlines

Blazars and Other AGNs - GLAST... External catalogs for identification...

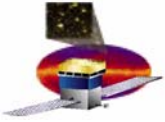
Multiwavelength Activities Related to GLAST's Blazars

Table of proposals submitted on behalf of the group

Facility	Lead	Sources	Period	Proposal	Status
Suzaku	G. Madejski	BL Lac, PKS 1510-089	2006	proposal	accepted
Swift	R. Sambruna	ToO on PKS0528+134, BLLac, 3C279, PKS1622-207, 3C454.3, OJ287 +unknown	Oct. 2007-Nov. 2008	proposal	rejected letter review
Nordic Optical Telescope	S. Ciprini	120 candidates	Apr.-Oct. 2007	proposal	rejected letter
Suzaku Cycle 2	G. Madejski	PKS0528+134	Jan.-Apr. 2008	proposal	submitted (Dec. 2006)
Suzaku Cycle 2	G. Madejski	ToO on BL Lac, PKS 0735+178, PKS 0537-441, AO 0235+164, 0716+714	Jan.-Apr. 2008	proposal	submitted (Dec. 2006)
RXTE cycle 12	G. Tagliaferri	ToO on 18 EGRET blazars	■	proposal	submitted (Jan.2008)
RXTE cycle 12	J. Carson	ToO on 3C273		proposal	submitted (Jan.2008)
RXTE cycle 12	B.Giebels	PKS 2155-304		proposal	submitted (Jan.2008)
RXTE cycle 12	G. Tosti	BL Lac		proposal	submitted (Jan.2008)
RXTE cycle 12	D. Paneque	Mrk 421, Mrk 501, 1ES 1959+650		proposal	submitted (Jan.2008)
RXTE cycle 12	G. Madejski	3C279		proposal	submitted (Jan.2008)
RXTE cycle 12	B. Lott	PKS 0528+134		proposal	submitted (Jan.2008)

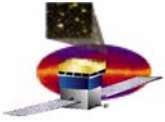
Find: miz Find Next Find Previous Highlight all Match case

Done confluence.slac.stanford.edu



Summary

- **The groups are all working well, active and broad participation from across the collaboration**
 - **Good conference participation**
 - **Many multiwavelength proposals**
 - **Lots simulation and analysis development**
- **Future**
 - **Service Challenge**
 - **Continue to develop/refine source simulations**
 - **Analysis methods**
 - **Quantify LAT science capabilities**
 - **....**
 - **Continue to develop multiwavelength plans**
- **Launch and beyond -- we really come into our own!**



Summary

- All the science groups are active and have broad participation from across the collaboration.
- Activity of all the groups is likely to increase over the next few months.
 - More people actively participating (transitioning from instrument commissioning/beamtest)
 - Multiwavelength planning and proposal writing needs to kick into high gear -- the next few months are important!
 - Many groups compiled a list of papers that could be written pre-launch, there is ~1 year left to get these done.
 - Lots of detailed source simulations and analysis
 - Infrastructure to support these studies is mature and is getting better.