Science group Activities

- Overview of science groups
- Organising ourselves
  - Papers
  - Conferences (presentations and proceedings)
  - Multiwavelength proposals.
- Working together
  - Science Goals
  - Science/Source simulations
  - Analysis Development
  - Quantitatively understanding how the LAT will address scientific questions

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 Extragalatic
  - 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

Organisation

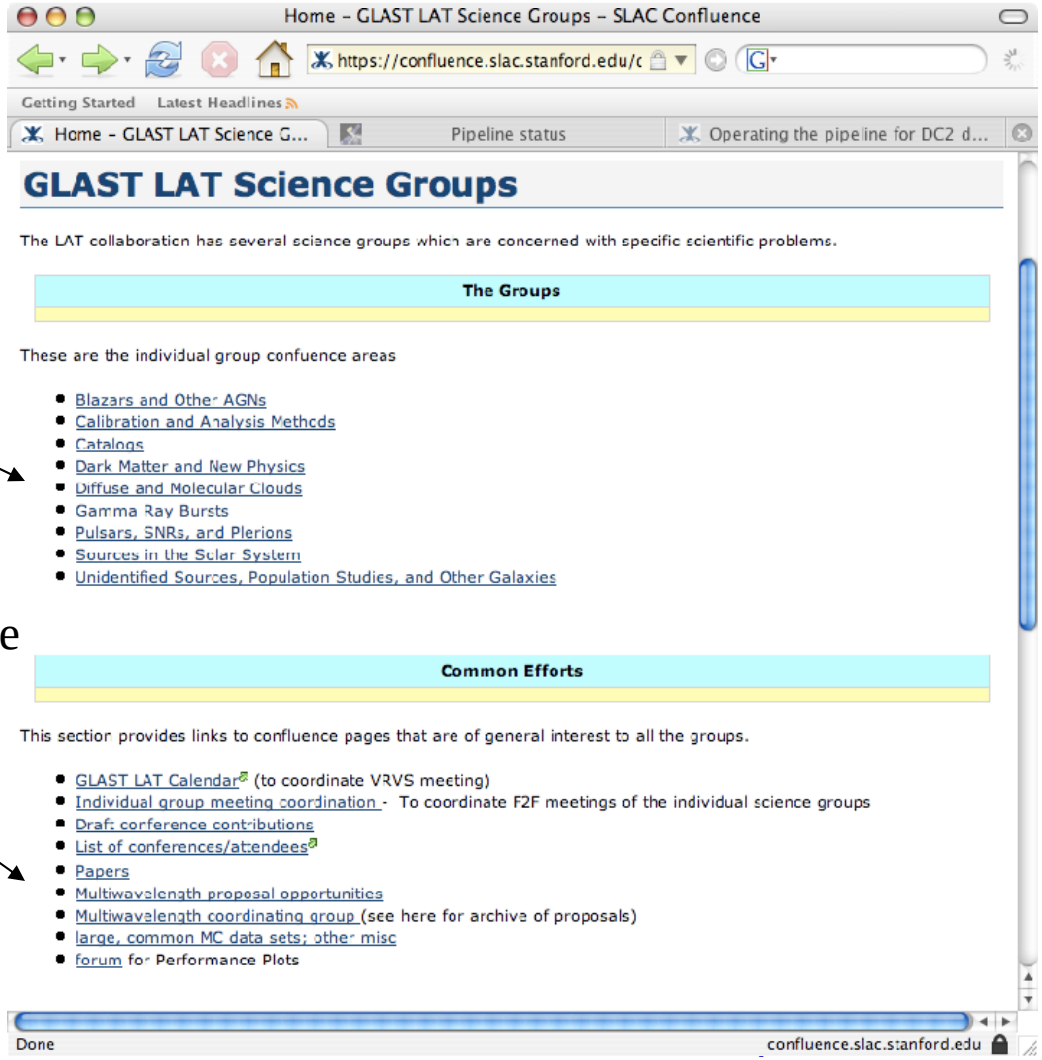
- Science group coordinators meet each month (on the first Friday of each month typically).
- The agenda, presentations and minutes from each meeting are available to all collaborators.
  - Multiwavelength report
  - Status of papers
  - Upcoming conferences
  - Discussion of post DC2 simulation and analysis plans
  - Automated Science Processing
  - 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.

Main Science Groups Confluence Page

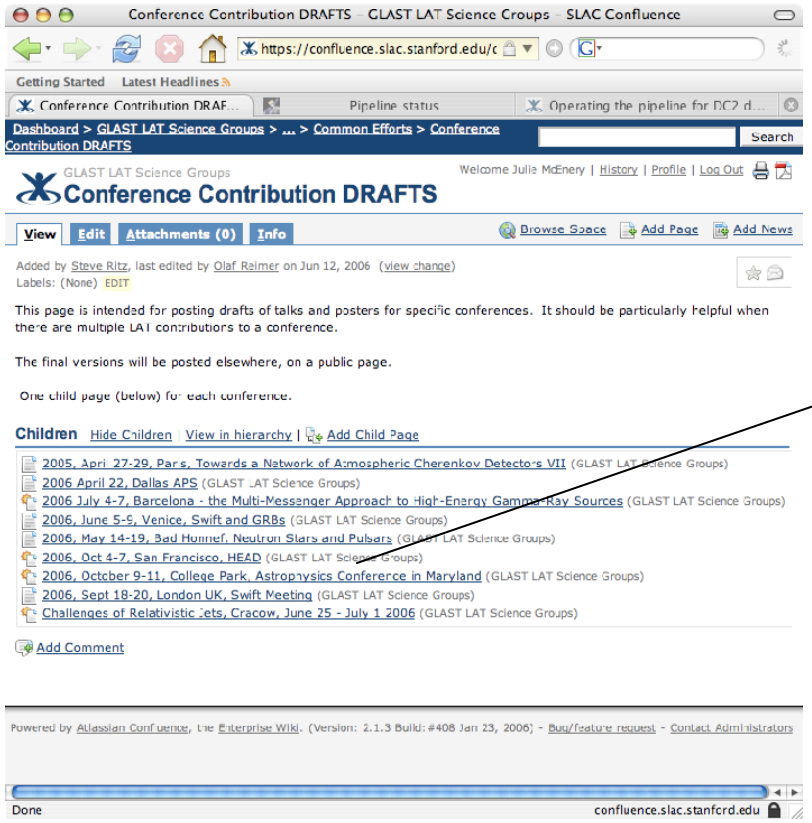
Individual group pages

Links of general interest to all the Science groups.

3 of particular interest: papers, conferences and proposals

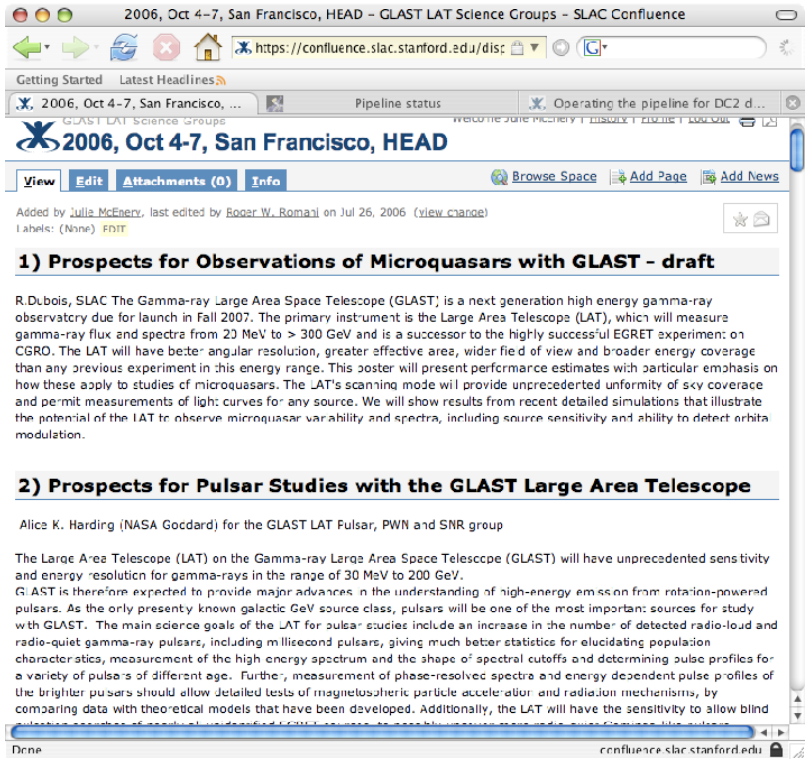


Conference Organisation



A place to share abstracts/presentations to gather comments and coordinate contributions

2006 HEAD meeting (21 abstracts)



Meeting links contain abstracts, presenting authors, presentation (slides/poster) and proceedings.

Conferences cont.

- Coordinating LAT presence at conferences is important.
- One of the roles of the science groups is to identify relevant topic specific conferences and to identify analyses/studies from within the groups that are worthy of presentation.
- Conference presentations are generally discussed/distributed within the science group.
- Upcoming conferences are discussed each month in the science group coordinators meetings.
- The speakers bureau (chaired by Ronaldo Bellazzini) has oversight of and coordinates all LAT presentations.
  - They are informed of plans/suggestions for upcoming conferences.
  - Maintain a speakers bureau webpage containing guidelines, archives of final talks etc.

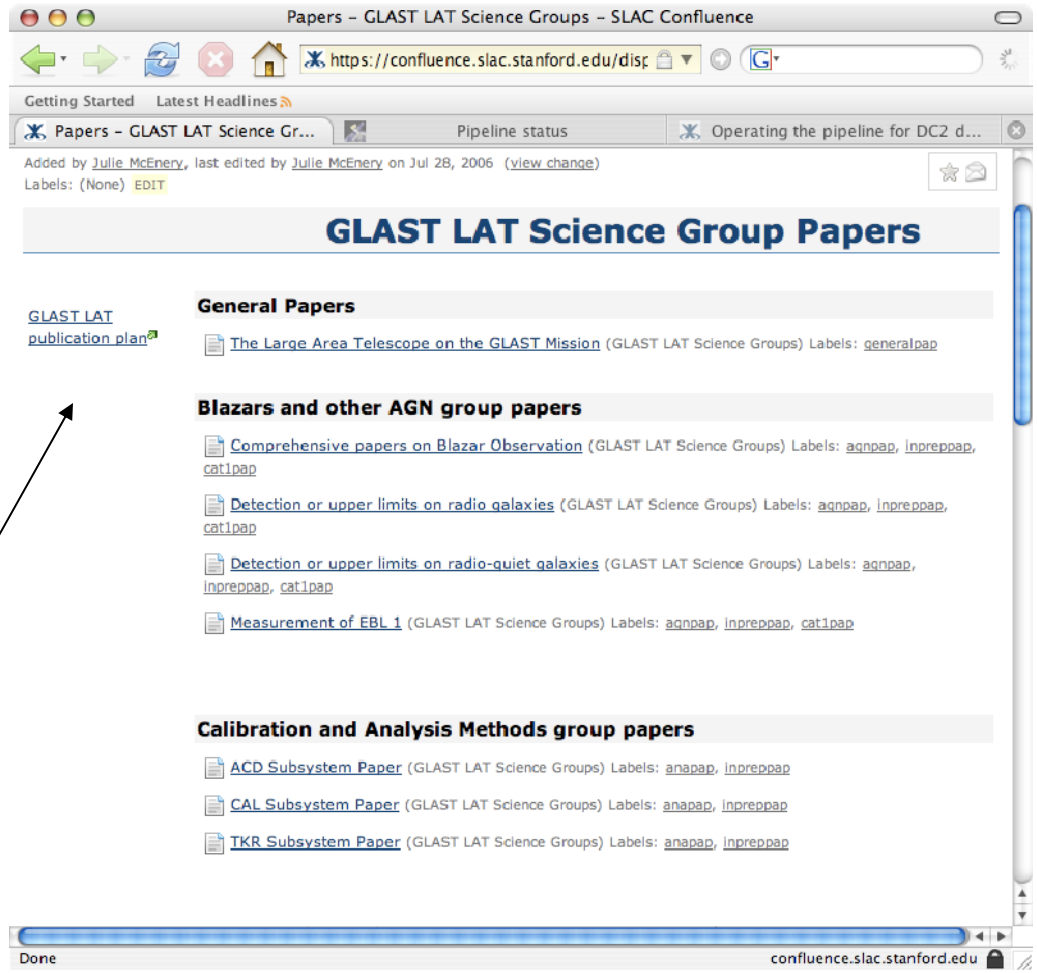
Papers

Papers generally have a confluence page of their own, within the relevant science group.

The confluence “labels” feature pulls them all together to make a complete list.

Recent (or currently) active papers on this page include: LAT instrument, ACD, elog and GRB theory.

links placed here to pages/information of general interest to assist with papers.



Papers cont.

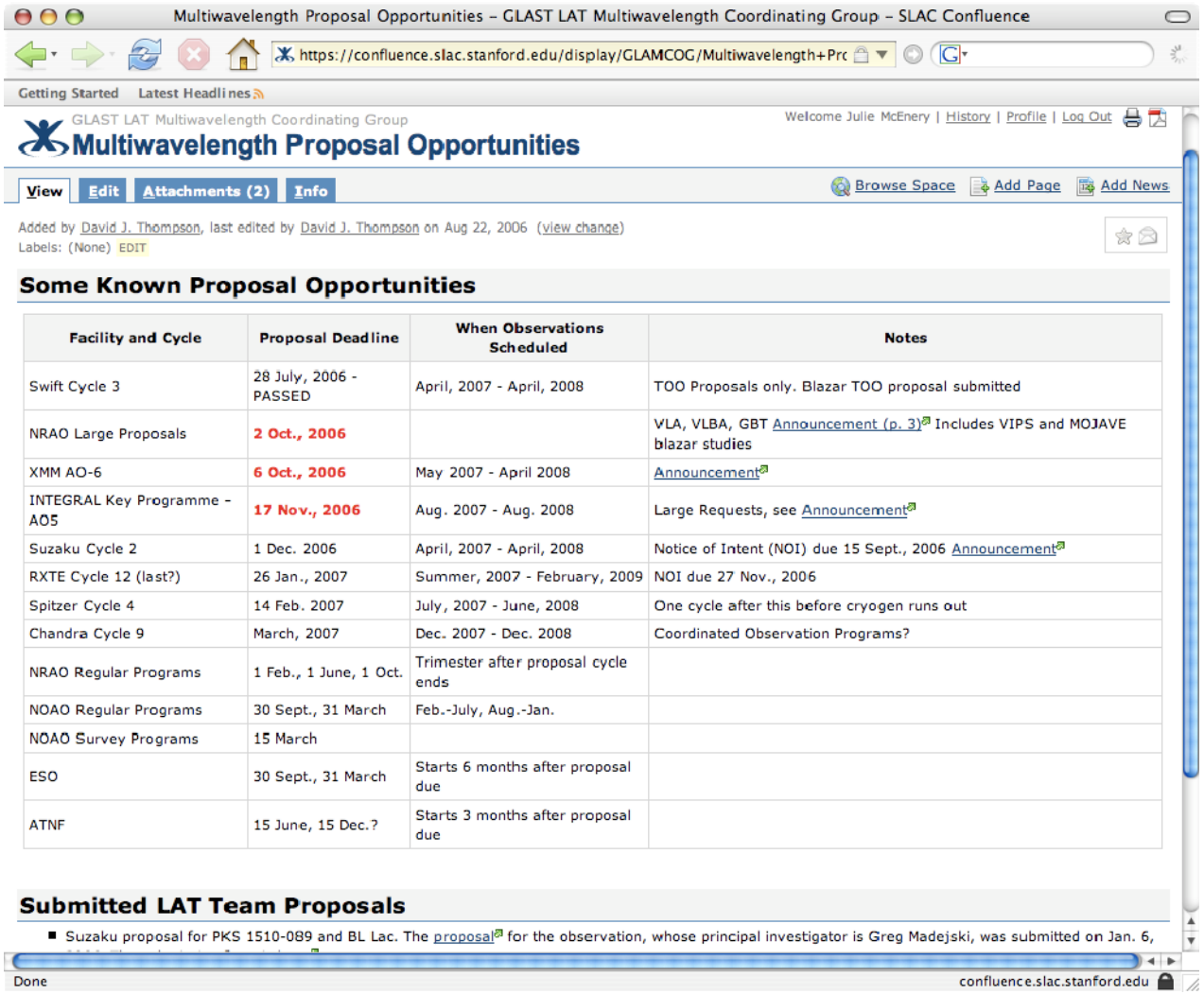
- In some cases, papers by LAT collaborators that are relevant to the LAT are discussed in the science groups.
  - This is to be encouraged.
- Likely to be an increasing number of LAT science papers as we approach launch.
  - "official" updated response functions will soon be available.
  - We are doing astrophysics simulations of increasing detail, to quantitatively understand what the LAT will say about gamma-ray sources and source classes.
  - We need to make sure that the process of writing a LAT paper is a happy rewarding one for authors.
- Groups are also working on defining papers to be written shortly (<1 year) after launch.

Multiwavelength planning

- **Most of the groups have extensively discussed their multiwavelength needs and desires.**
  - **The results of these discussions were sent to the multiwavelength coordinator.**
  - **Descriptions of these discussions can generally be found on each groups confluence page.**
- **Multiwavelength observing proposals have been discussed in several groups and a few proposals (to Swift and Suzaku) have been submitted to support LAT observations.**
  - **The upcoming proposal cycle is of particular importance as in many cases it will be the first opportunity to propose for multiwavelength data which overlaps with LAT observations.**

Multiwavelength Proposals

The multiwavelength coordinating group (Dave Thompson) have provided lists of upcoming proposal opportunities and archives of submitted proposals



Multiwavelength Proposal Opportunities – GLAST LAT Multiwavelength Coordinating Group – SLAC Confluence

https://confluence.slac.stanford.edu/display/GLAMCOG/Multiwavelength+Prc

Getting Started Latest Headlines

GLAST LAT Multiwavelength Coordinating Group

Welcome Julie McEnery | History | Profile | Log Out

Multiwavelength Proposal Opportunities

View | Edit | Attachments (2) | Info Browse Space Add Page Add News

Added by David J. Thompson, last edited by David J. Thompson on Aug 22, 2006 (view change)
Labels: (None) EDIT

Some Known Proposal Opportunities

Facility and Cycle	Proposal Deadline	When Observations Scheduled	Notes
Swift Cycle 3	28 July, 2006 - PASSED	April, 2007 - April, 2008	TOO Proposals only. Blazar TOO proposal submitted
NRAO Large Proposals	2 Oct., 2006		VLA, VLBA, GBT Announcement (p. 3) Includes VIPS and MOJAVE blazar studies
XMM AO-6	6 Oct., 2006	May 2007 - April 2008	Announcement
INTEGRAL Key Programme - AO5	17 Nov., 2006	Aug. 2007 - Aug. 2008	Large Requests, see Announcement
Suzaku Cycle 2	1 Dec. 2006	April, 2007 - April, 2008	Notice of Intent (NOI) due 15 Sept., 2006 Announcement
RXTE Cycle 12 (last?)	26 Jan., 2007	Summer, 2007 - February, 2009	NOI due 27 Nov., 2006
Spitzer Cycle 4	14 Feb. 2007	July, 2007 - June, 2008	One cycle after this before cryogen runs out
Chandra Cycle 9	March, 2007	Dec. 2007 - Dec. 2008	Coordinated Observation Programs?
NRAO Regular Programs	1 Feb., 1 June, 1 Oct.	Trimester after proposal cycle ends	
NOAO Regular Programs	30 Sept., 31 March	Feb.-July, Aug.-Jan.	
NOAO Survey Programs	15 March		
ESO	30 Sept., 31 March	Starts 6 months after proposal due	
ATNF	15 June, 15 Dec.?	Starts 3 months after proposal due	

Submitted LAT Team Proposals

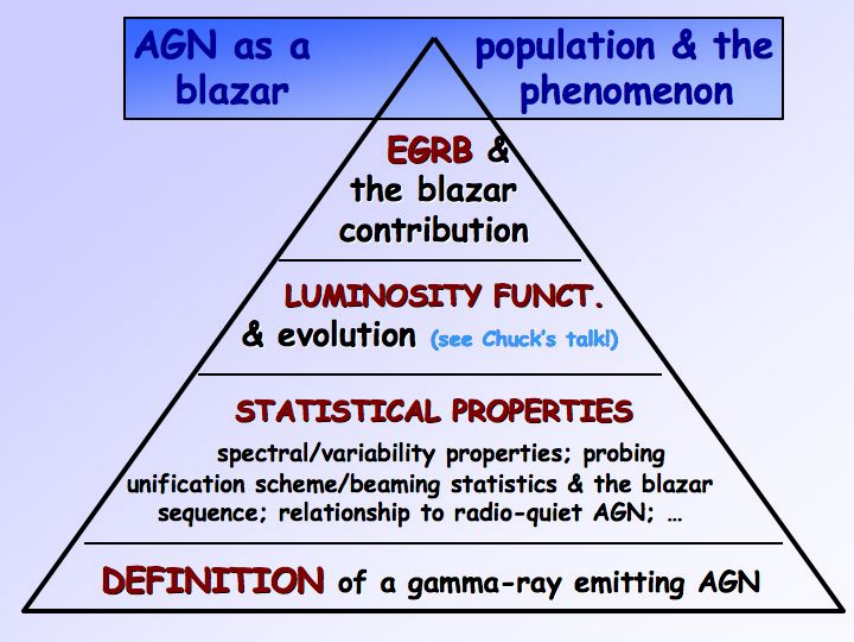
- Suzaku proposal for PKS 1510-089 and BL Lac. The proposal for the observation, whose principal investigator is Greg Madejski, was submitted on Jan. 6,

Done confluence.slac.stanford.edu

Group Activities

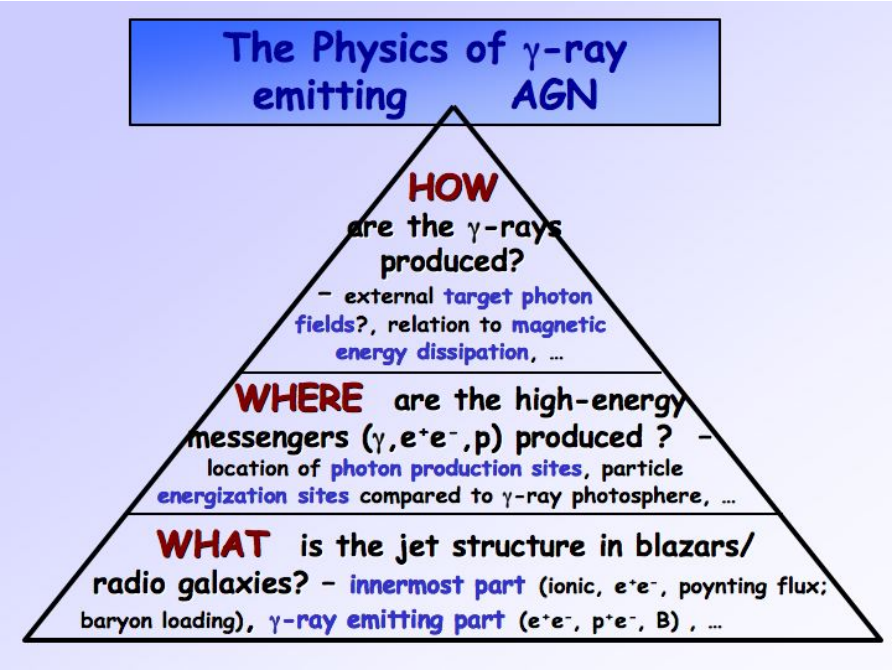
- The groups themselves have several means of communication
  - Most groups meet ~biweekly (via VRVS/telecon)
  - Email lists
  - Confluence pages (group editable webpages)
- Group activities and discussions include:
  - Science goals
  - Analysis methods development
  - Source simulations
  - Contributions to the LAT instrument paper
  - Development of papers
  - Multiwavelength planning
- Significant differences in the nature of each groups activities
  - Some are more technical (C&A, Catalog)
  - Some have a very broad mandate (Unids and population studies)

Science Goals



Most of the groups have discussed the science goals of their group, and what observations and analysis is required to address them.

Some slides from the AGN science goals talk presented by Anita Reimer at the Aug 2006 LAT collaboration meeting.



Science Goals

In many cases the discussions were inspired (or at least intensified) by a need to compile shory science sections for the LAT instrument paper.

Key Questions from Unids group (from their LAT paper contribution)

(1) Are there more classes of gamma-ray emitters than PSR and AGN in the GeV domain? If so, which are those?

(2) Do we detect population(s) of gamma-ray sources which may contribute significantly to the extragalactic diffuse gamma-ray background?

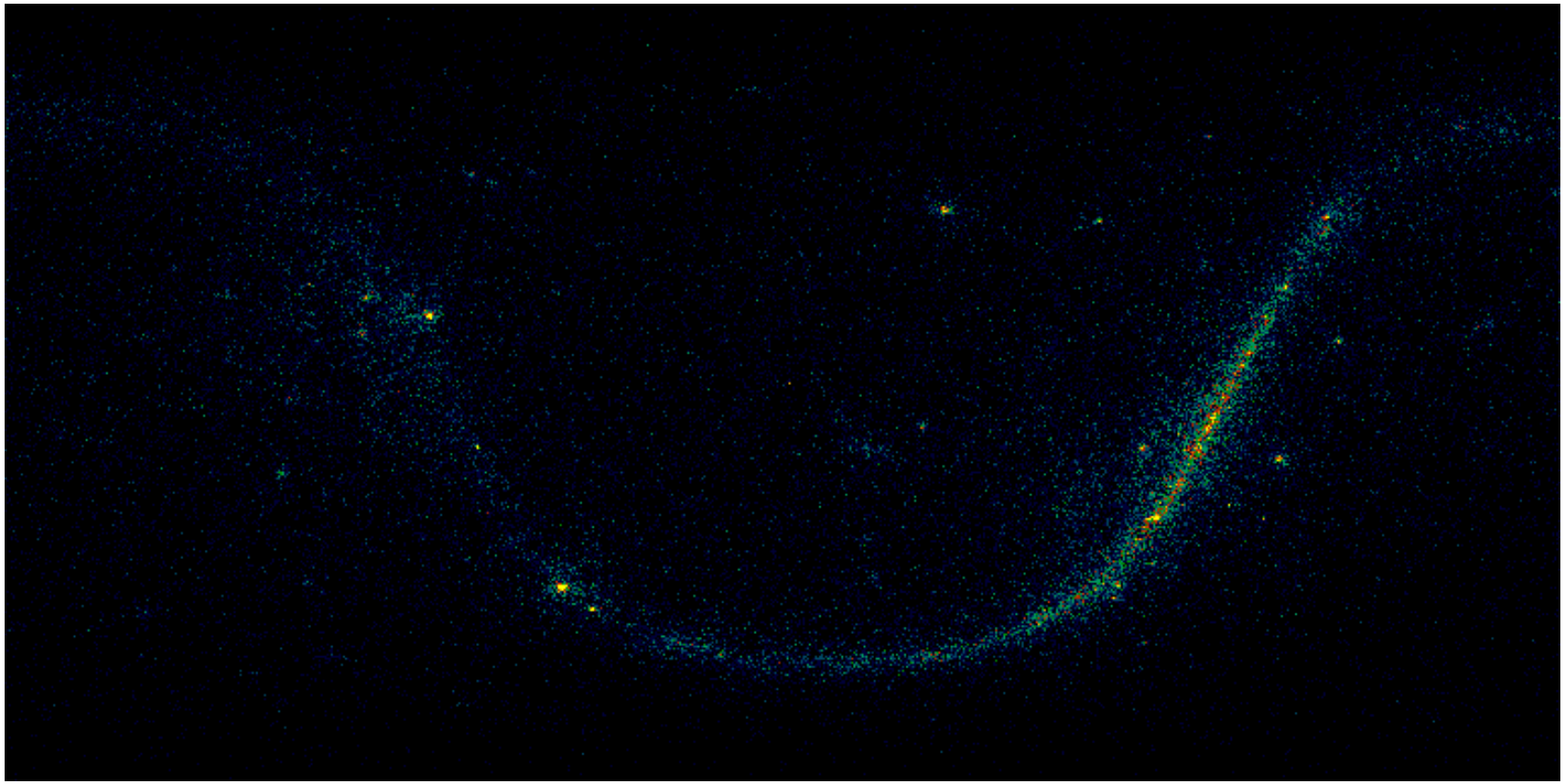
(3) Is our understanding of the production and propagation of cosmic rays in our Milky Way compatible with those in other normal Galaxies, or environments at evolutionary different activity states like starburst galaxies?

4) To what extent is the GeV sky variable? What are the characteristic variability time scales in different source populations? Do distinctive/repetitive variability pattern exists? To what account we are confronted with transient or even serendipitously discovered variability phenomena?

(5) Can we pinpoint the nature of the gamma-ray emission from the Galactic Center?

(6) Are there unique phenomena exclusive/peculiar to the GeV sky?

Astrophysics Simulations



- **The Data Challenge 2 sky (movie by Jerry Bonnell)**

DC2 - what was it and what did we do?

- 55 days of simulated GLAST data

- What did we do?
  - Update instrument simulation
  - Revamp event classification analysis and IRFs
  - Develop data servers and refine event formats
  - Develop science analysis software and documentation
  - Develop a ~complete astrophysical sky model (kept a secret)
  - DC2 kickoff meeting (3 days in March 2006, data released)
  - Participants study the simulated data to try and learn about the simulated sky.
  - DC2 closeout (3 days in May 2006, sky model revealed)
  - People are still using the DC2 data to study/develop analysis methods.
- Each one of these bullets represent a large amount of work by many people.

DC2 - Sky Simulations

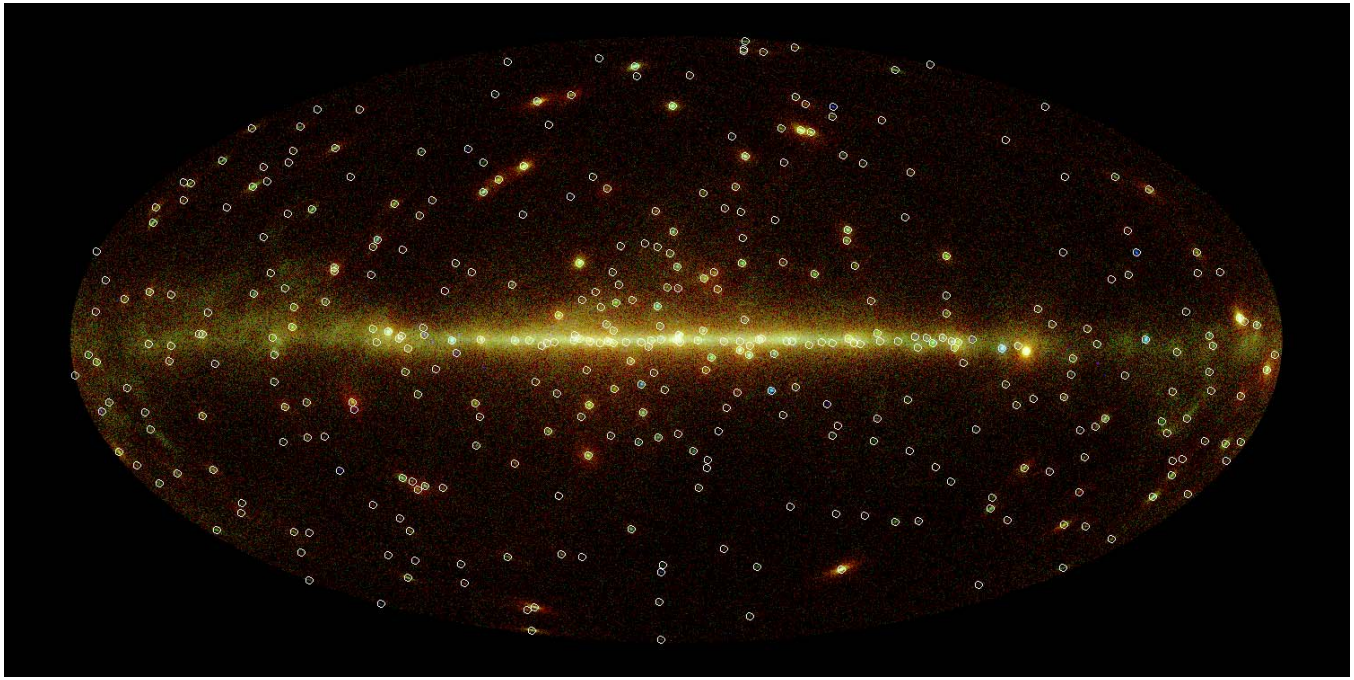
- **Main component of the sky model were produced by small working groups from across the collaboration**
  - **AGN - Jim Chiang, Paolo Giommi (populations), Gino Tosti (lightcurves)**
  - **Pulsars - Populations (Alice Harding), Implementation of periodic/spectral properties (Max Razzano)**
  - **Galactic Sources - SNR (Omar Tibolla, Seth Digel), populations (Diego Torres, Seth Digel, Olaf Reimer)**
  - **GRB - Prompt emission (Nicola Omodei, Jay Norris), Afterglows (Nicola Omodel, Julie McEnery)**
  - **Dark matter - Ping Wang, Larry Wai, Eric Nuss**
  - **Diffuse Galactic emission - Seth Digel, Igor Moskalenko +**
- **Almost all the software to generate these sources is now available to the whole collaboration**
  - **Allows anyone to pursue more detailed studies**
- **Source simulations are now being pursued more systematically and in greater detail in most of the science groups.**

DC2 Catalog

Catalog analysis pipeline developed by Jean Ballet and collaborators, runs a source detection algorithm and then runs more detailed analysis on each source to produce a table of the basic gamma-ray properties of each source.

Released at the beginning of DC2, provides a starting point for more detailed analyses.

380 sources

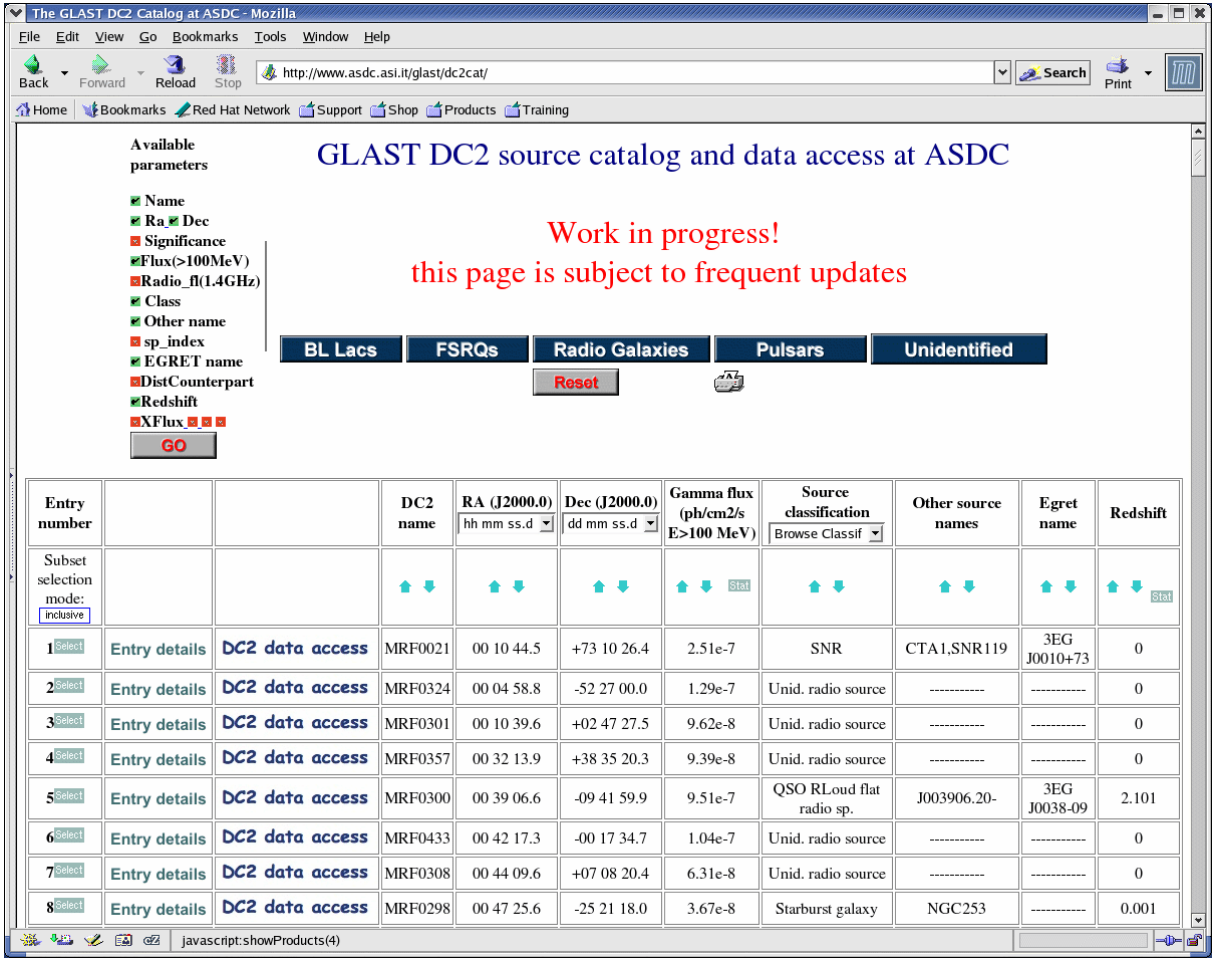


Verifies that the automated pipeline processing from low-level data to source characterization.

More on Catalogs

Cross reference the catalog sources against other catalogs to produce identifications.

Displays the catalog data in an interactive way and links in data from other wavelengths.

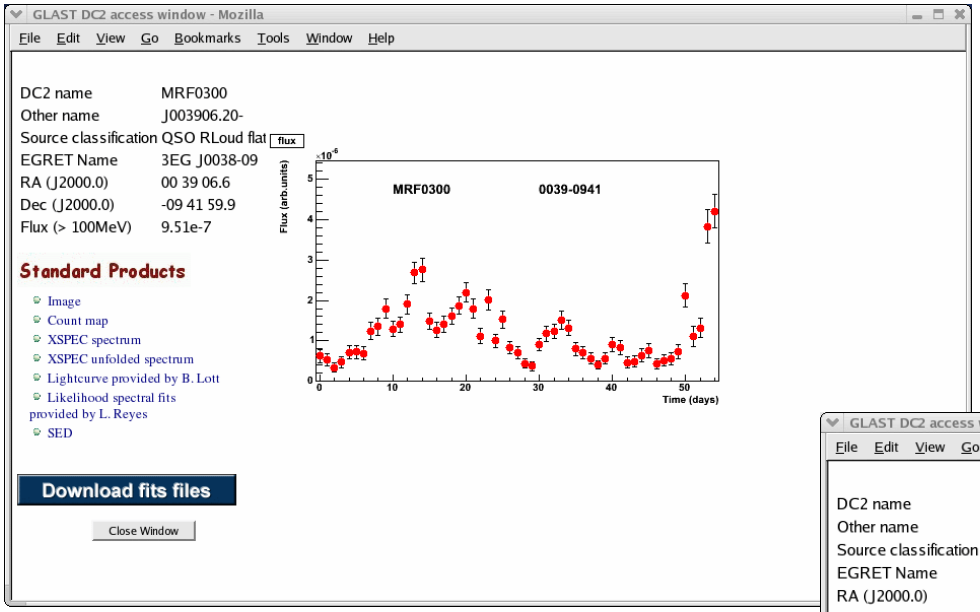


Entry number			DC2 name	RA (J2000.0) hh mm ss.d	Dec (J2000.0) dd mm ss.d	Gamma flux (ph/cm2/s E>100 MeV)	Source classification Browse Classif	Other source names	Egret name	Redshift
Subset selection mode: inclusive										
1 Select	Entry details	DC2 data access	MRF0021	00 10 44.5	+73 10 26.4	2.51e-7	SNR	CTA1,SNR119	3EG J0010+73	0
2 Select	Entry details	DC2 data access	MRF0324	00 04 58.8	-52 27 00.0	1.29e-7	Unid. radio source	----------	----------	0
3 Select	Entry details	DC2 data access	MRF0301	00 10 39.6	+02 47 27.5	9.62e-8	Unid. radio source	----------	----------	0
4 Select	Entry details	DC2 data access	MRF0357	00 32 13.9	+38 35 20.3	9.39e-8	Unid. radio source	----------	----------	0
5 Select	Entry details	DC2 data access	MRF0300	00 39 06.6	-09 41 59.9	9.51e-7	QSO RLoud flat radio sp.	J003906.20-	3EG J0038-09	2.101
6 Select	Entry details	DC2 data access	MRF0433	00 42 17.3	-00 17 34.7	1.04e-7	Unid. radio source	----------	----------	0
7 Select	Entry details	DC2 data access	MRF0308	00 44 09.6	+07 08 20.4	6.31e-8	Unid. radio source	----------	----------	0
8 Select	Entry details	DC2 data access	MRF0298	00 47 25.6	-25 21 18.0	3.67e-8	Starburst galaxy	NGC253	----------	0.001

Produced by ASDC group – Giommi and collaborators

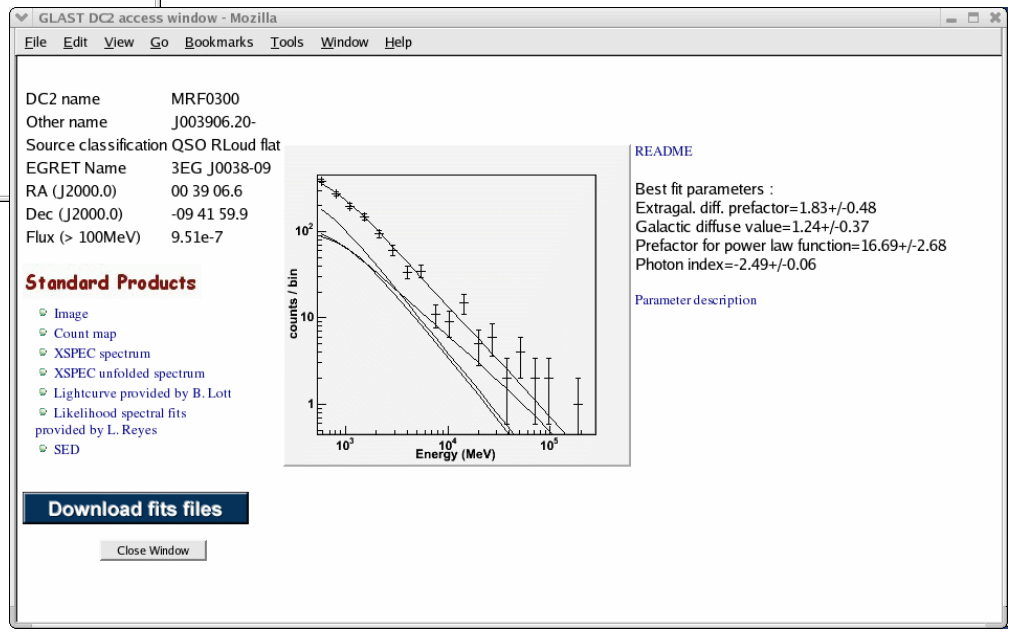
Lightcurves and Spectra

From the catalog at ASDC, there are links from each source to DC2 data products



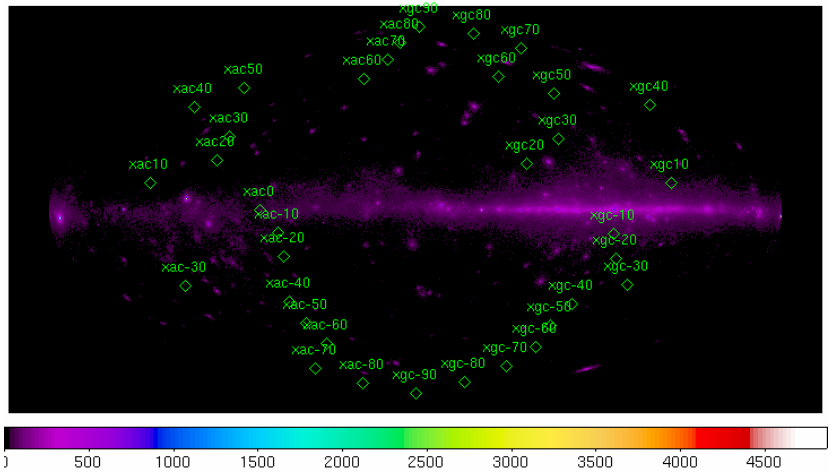
"Quicklook" lightcurves produced by Benoit Lott.

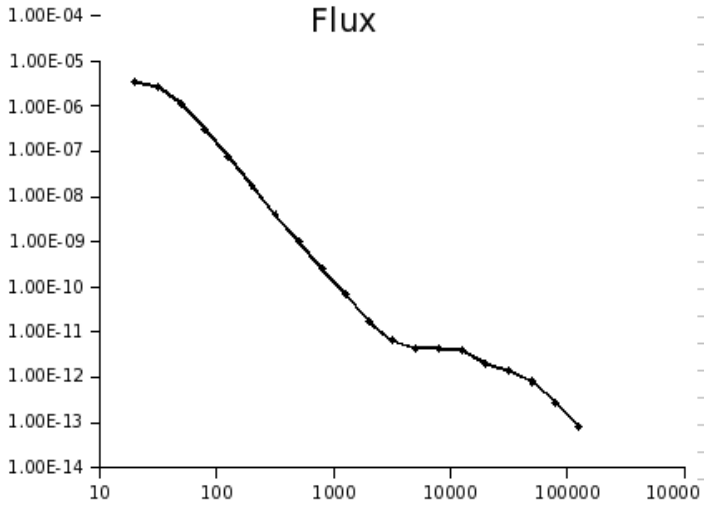
Spectral fits for each source were produced by Luis Reyes. These are simple power-law fits, but provide a plot which can guide users to different models if needed.



Diffuse sources

- **Goal: Study flux and spectral properties of the extragalactic background. This will include a study of the effect of residual background, contribution from galactic diffuse and resolving the point sources.**
- **Riccardo Rando performed an analysis of the extragalactic diffuse spectrum. He produced a mapcube fits file which described the residual background which was subsequently used by several people in source analyses.**



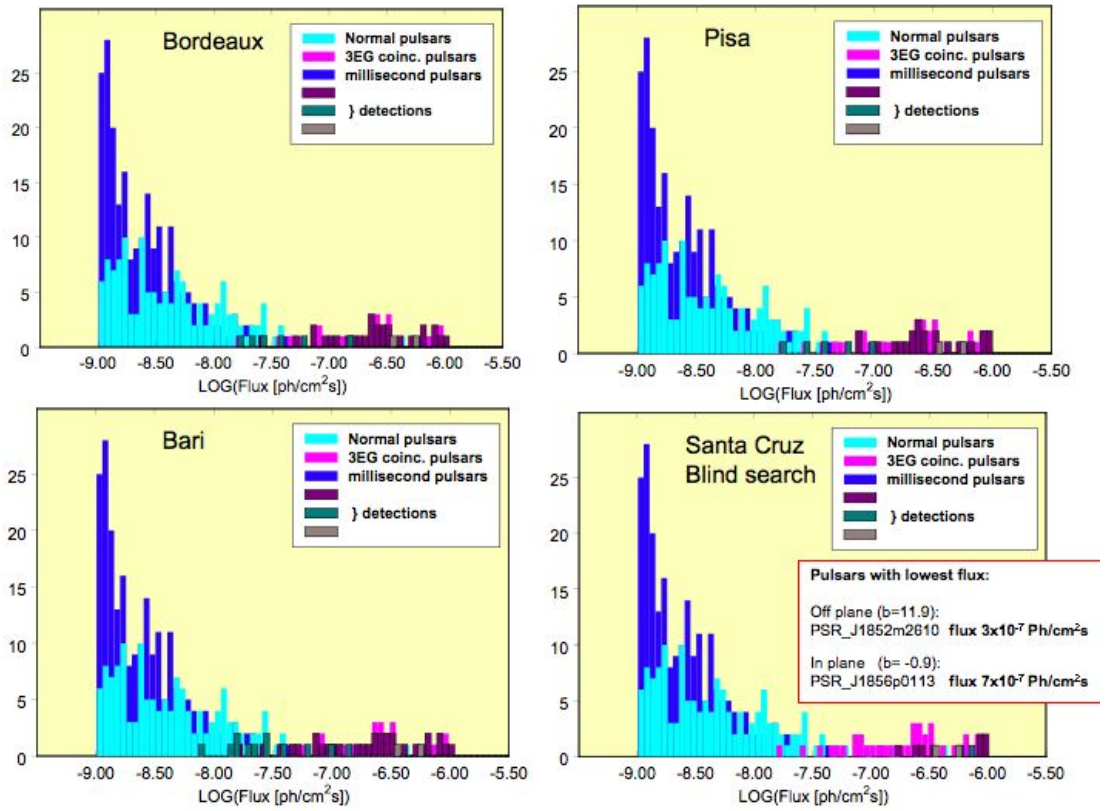


Continuing to use the DC2 data

Several independent pulsar analyses were performed during DC2

Comparing the results of these analyses to the true DC2 sky gives a picture of the pulsed sensitivity for both blind searches and those using pulsar ephemerides under realistic conditions.

Comparison of 4 independent pulsar analyses shown by Alice Harding at the LAT collaboration meeting



Science Simulations and Analysis

- **The "successor" to DC2 will involve much more direct participation from the sciencegroups.**
  - **Each science group is likely to plan its own sequence of source simulations, these will be coordinated as much as possible to maximise the usefulness of each dataset.**
    - **Planning (and in many cases executing) the astrophysical simulation studies lies within the science groups**
  - **Systematic studies of high level science analyses.**
    - **Performance plots**
    - **Understand how different realisations of the sky affect science goals, e.g. blazar luminosity function(s) for EBL studies, Galactic diffuse model for Galactic population studies etc**
  - **Provide inputs to the sky models for the service challenges.**

Multiwavelength planning

- **Most groups have extensively discussed their multiwavelength needs and have written documents or webpages to describe the science cases driving these needs.**

Slide shown by Nicola Omodei at the LAT collaboration meeting summarising the GRB group discussions

Planning for GRB multiwavelength observations

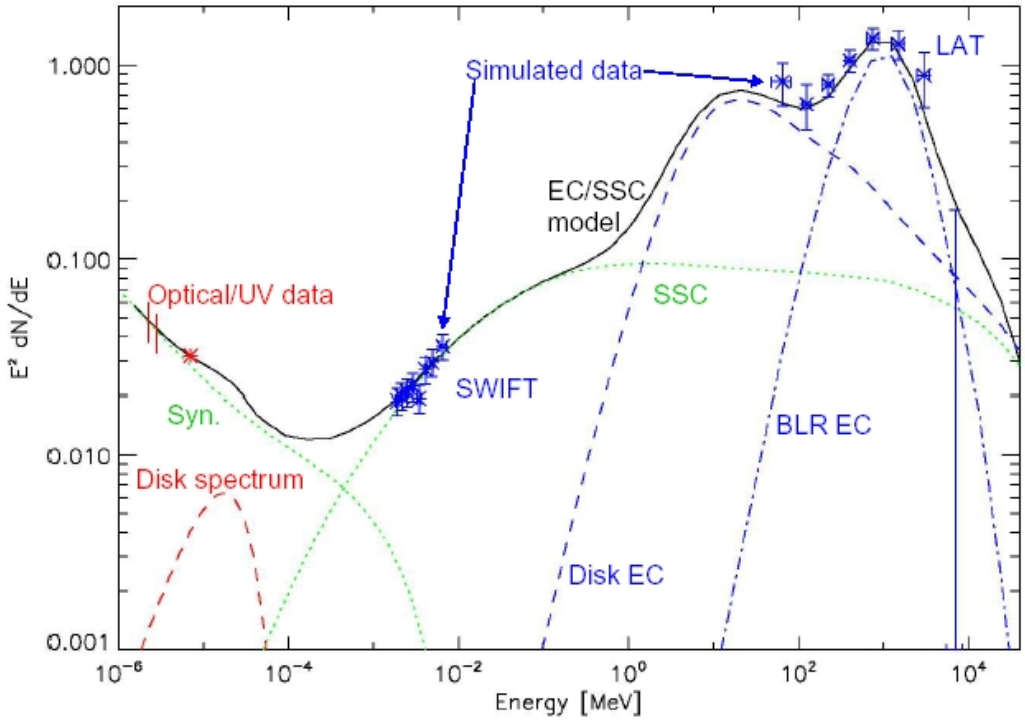
- Gamma-Ray Burst science requiring multi-wavelength observation:
  - https://confluence.slac.stanford.edu/download/attachments/2157/GRBs-multi-lambda-science.pdf
- Importance of NIR cameras (I, z, J,H, K)
  - 60% detection Rate for Swift
  - Relatively wide fov (30 arcmin)
- Synergy with TeV observatories
  - Observatories with low energy threshold (50 GeV)
  - Fast movement for rapid repositioning
  - Jointly study of the cosmological cut-off
- Major facilities already aware:
  - Swift, Liverpool, REM, VERITAS, MAGIC, HESS, Milagro, as well as the other GCN connected facilities…
  - Coordination of Swift and GLAST pointings when possible, XRT follow-up of GLAST position

GRB science group activity report

Multiwavelength planning

- **The science groups have discussed and worked together on multiwavelength observing proposals (to Swift and Suzaku so far)**

SED of 3C279 illustrating how GLAST and Swift data could be used together to understand blazar emission mechanisms (plot made by Jennifer Carson for 2006 Swift ToO proposal.



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 commisioning/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.