Analysis Coordinator Report

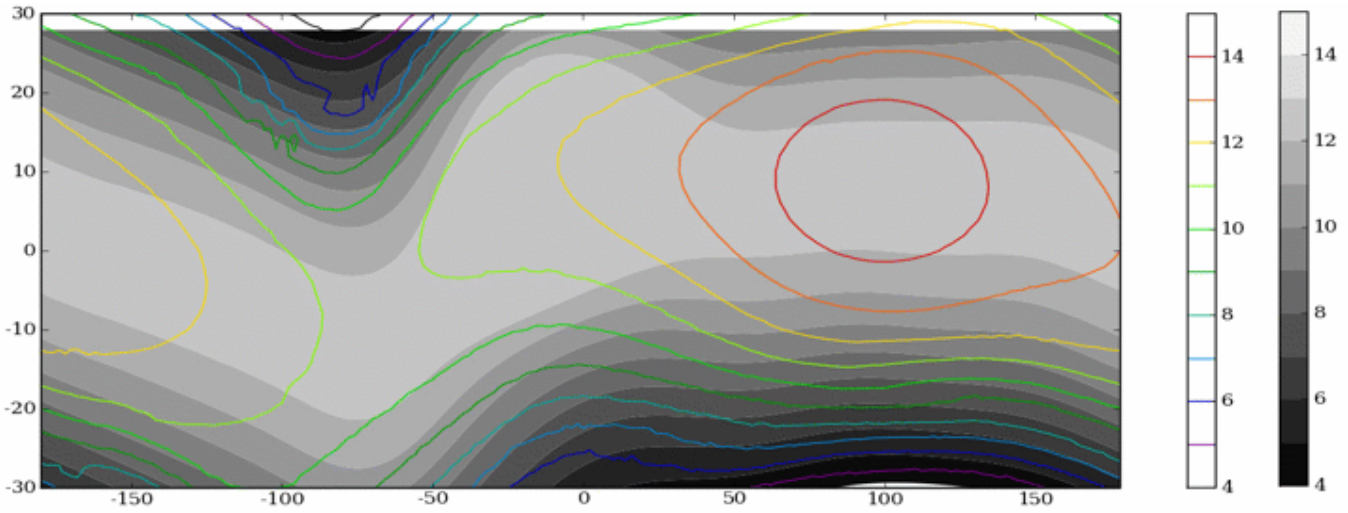
- Group roles and responsibilities
- Focus on launch readiness
  - Background model
  - Final prelaunch analysis
  - Diffuse model
  - Catalogue
  - Synergy with ISOC
  - First light sims (and associated analysis plans)
- Multiwavelength planning
- Papers
- Post launch plans

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, tune event selections
  - Develop astrophysics simulations
  - Plan and propose for observations at other wavelengths to complement the GLAST data
  - Plan and coordinate proposals to the GLAST GI program
  - 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…

Background model

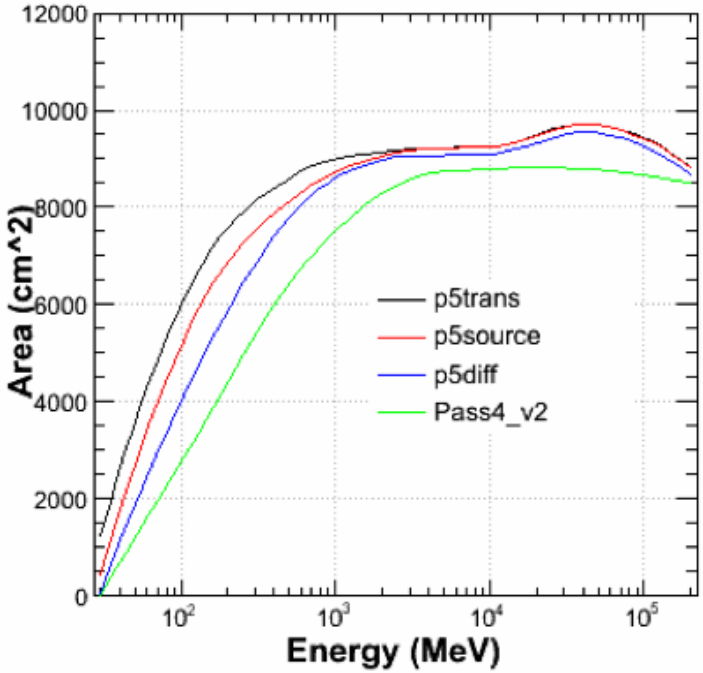
- **The C&A group organised a review of the cosmic-ray background model. (completed last year)**
  - **Chaired by Jonathan Ormes, changes implemented largely by Tsunefumi Mizuno and Toby Burnett**
- **Continuing to make additional refinements**
  - **Updating calculation of geomagnetic cutoffs (Ackermann)**
  - **Studying potential refinements based on data from PAMELA (Ormes)**



Plot comparing old (solid) and new (line) cutoff rigidities.

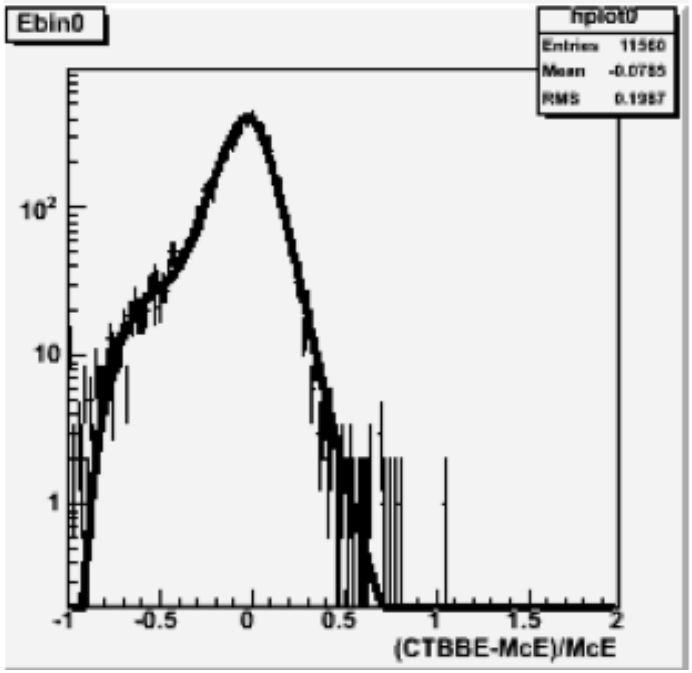
Event Selection analysis

- We send ~400 events/s to the ground, of these, less than 5 Hz are celestial gamma-rays.
- Updated background rejection/event selection analysis (Bill Atwood)
  - Significantly better performance, particularly at low energies.
  - Condenses a large number of variables into a few key parameters which can be tuned within science groups for specific science goals.

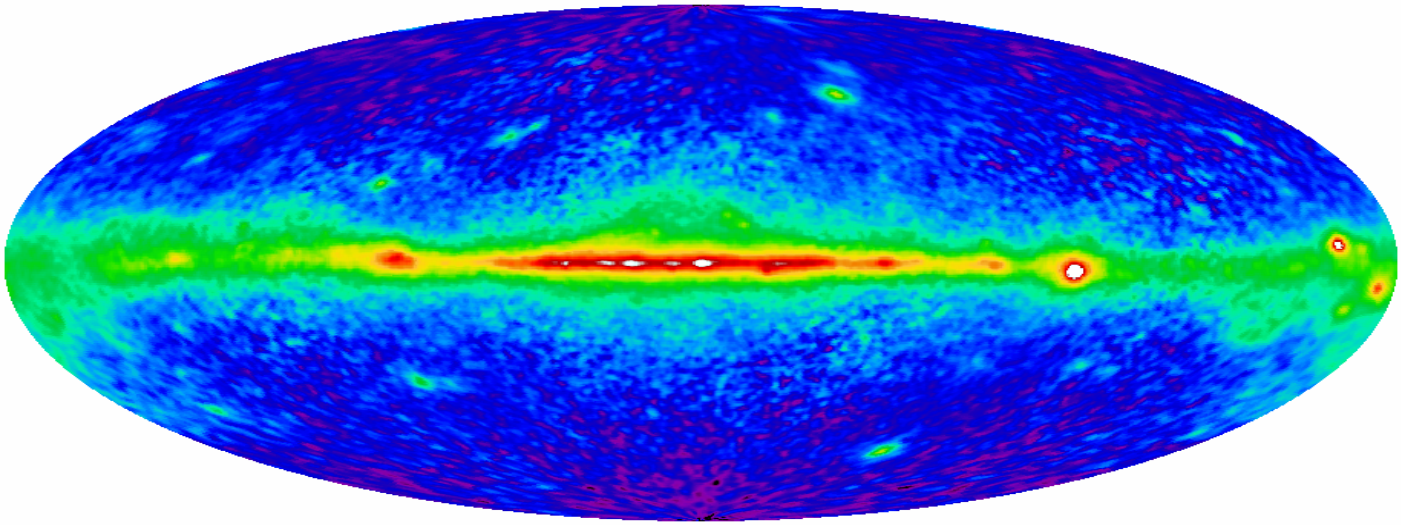


Instrument response functions

- **C&A group have convened a small team to parameterize the resulting instrument performance (Rando*, Burnett, Chiang, Ballet, Digel, McEnery…).**
  - **i.e. fit functional forms to point spread function, energy dispersion etc - allowing them to be used in the sciencetools.**
  - **Develop infrastructure to allow collaborators to easily implement "custom" IRFs.**



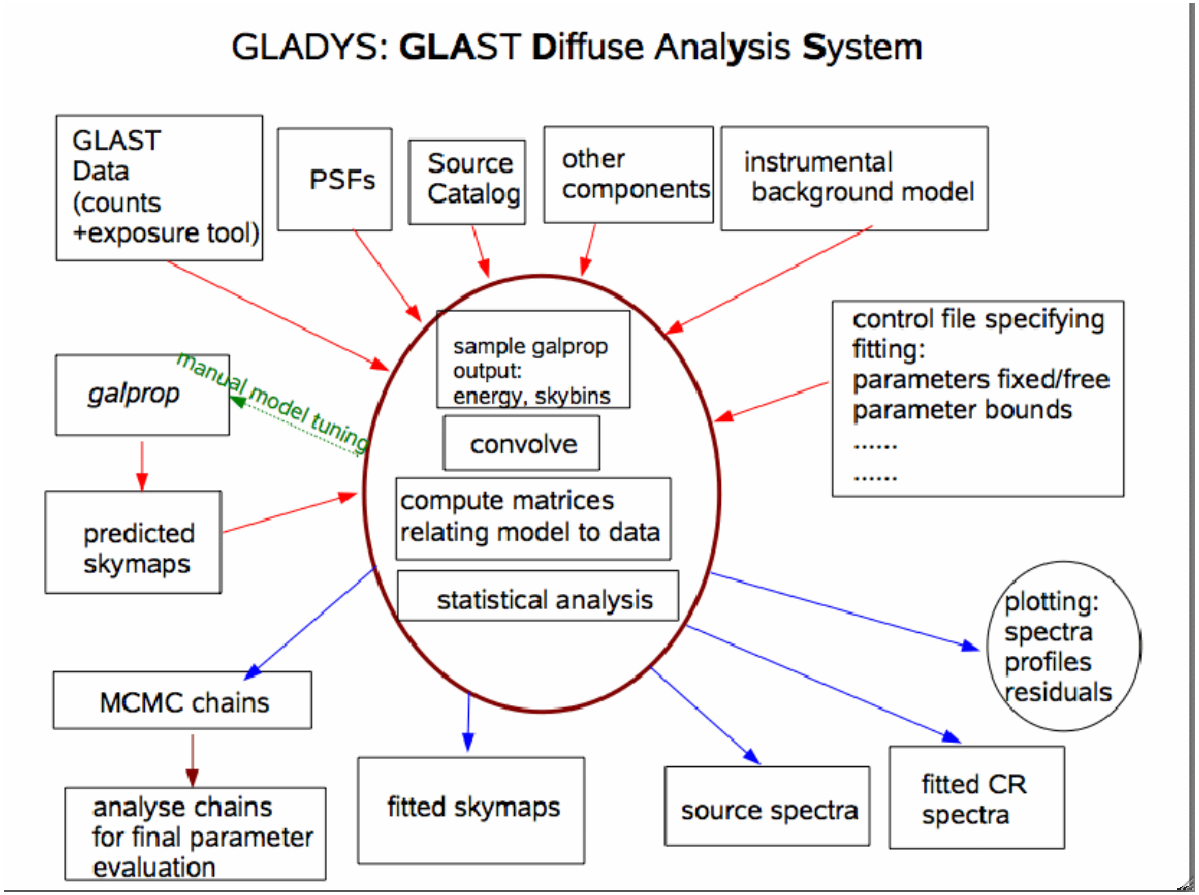
Diffuse Model



- High energy gamma-ray sky is dominated by diffuse emission from the Galaxy (60% of the 1.4 M γ EGRET saw came from diffuse emission in the Galaxy, less than 10% were from point sources in catalogue).
- To study Galactic gamma-ray sources and isotropic emission, this diffuse component must first be understood.
- Extensive work in the diffuse group on modeling the emission from our Galaxy (the resulting model was used in the data and service challenges).

Fitting diffuse models

- **Focus of the Diffuse group's studies is turning towards how to fit diffuse models to the GLAST data.**

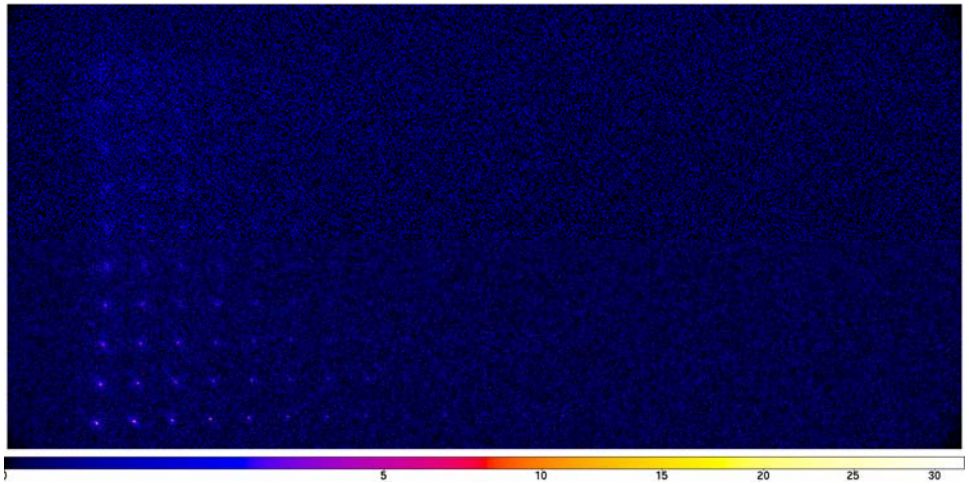


Andy Strong

Catalogue

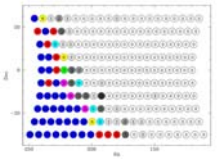
- In DC2 we learned the value and importance of having a gamma-ray source catalogue to provide a starting point for many science analysis.
  - Plan to produce “interim” catalogues early in the mission for internal use.
- Catalogue pipeline (Saclay)
  - Two steps:
    - Source detection (find the candidate gamma-ray sources)
      - Useful for both catalogue and ASP flaring source searches
    - Source characterization (determine flux, spectra, location and associated errors)

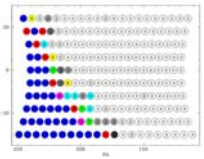
Evaluating Source Detection Algorithms

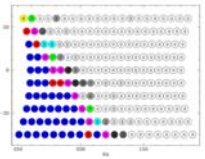


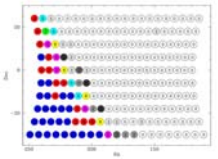
Compare source detection algorithms on a simulated test pattern (Stephens)

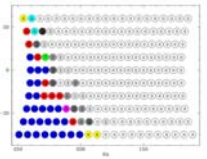
- **Source detection algs contributed by Starck, Ballet, Stephens, Tosti and Burnett**

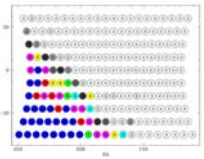

Optimal Filter

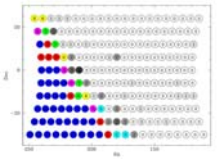

Optimal Filter 2

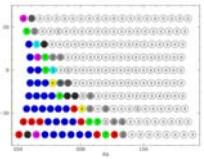

PGWave


Sliding Box


SExtractor

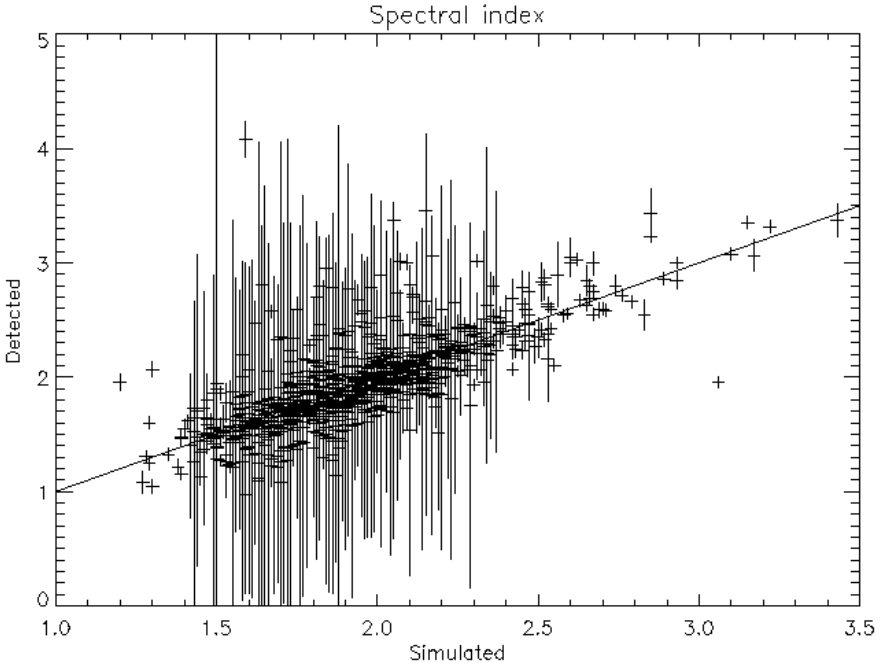

UWLikelihood


VST

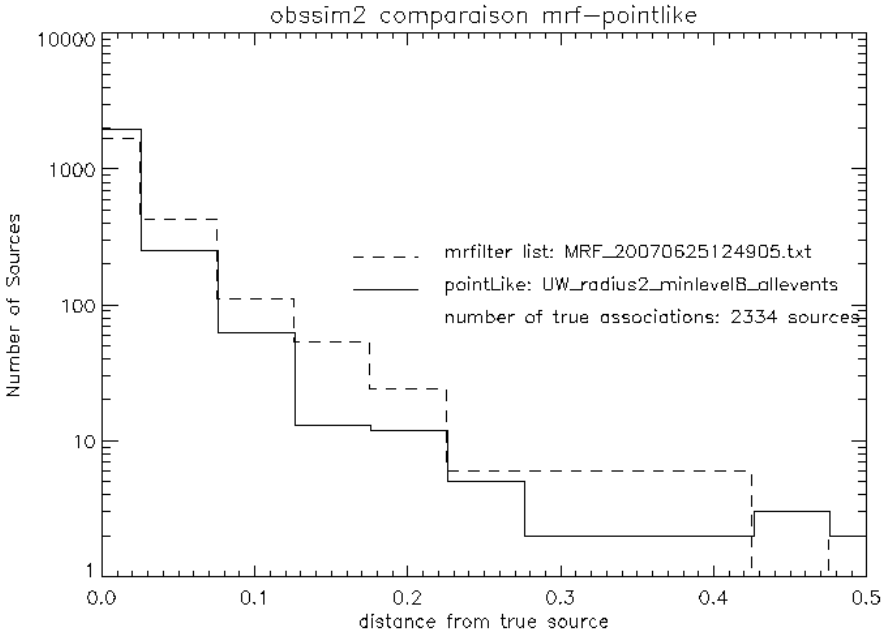

MRFilter

Source Characterization

Comparing fit vs true spectra (Ballet)



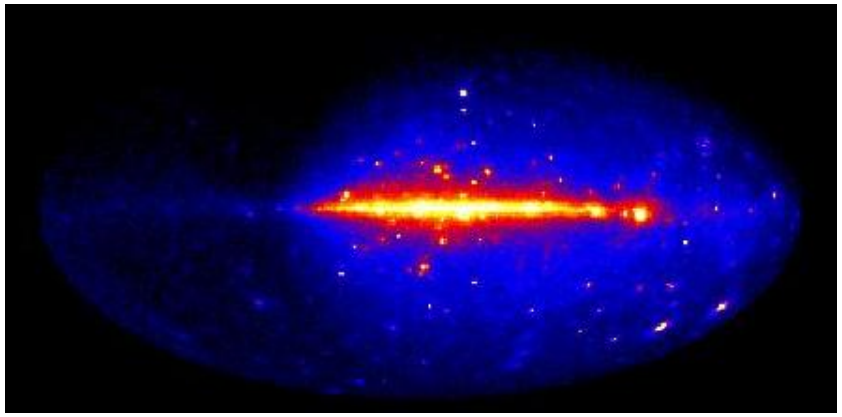
Exploring the improvement in source localisation using “fast” likelihood. (Burnett, Pupard)



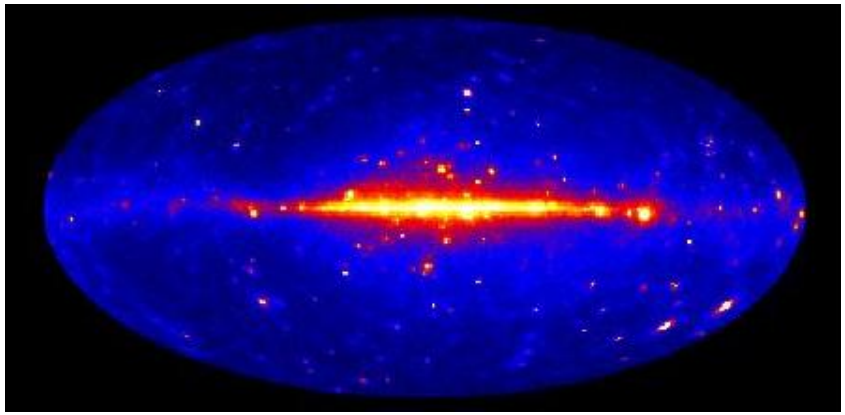
- **Evaluating performance of spectral fits within the catalogue pipeline has proved invaluable for exercising (and uncovering bugs) in the high level analysis software.**

First light observations

Two weeks



Five weeks

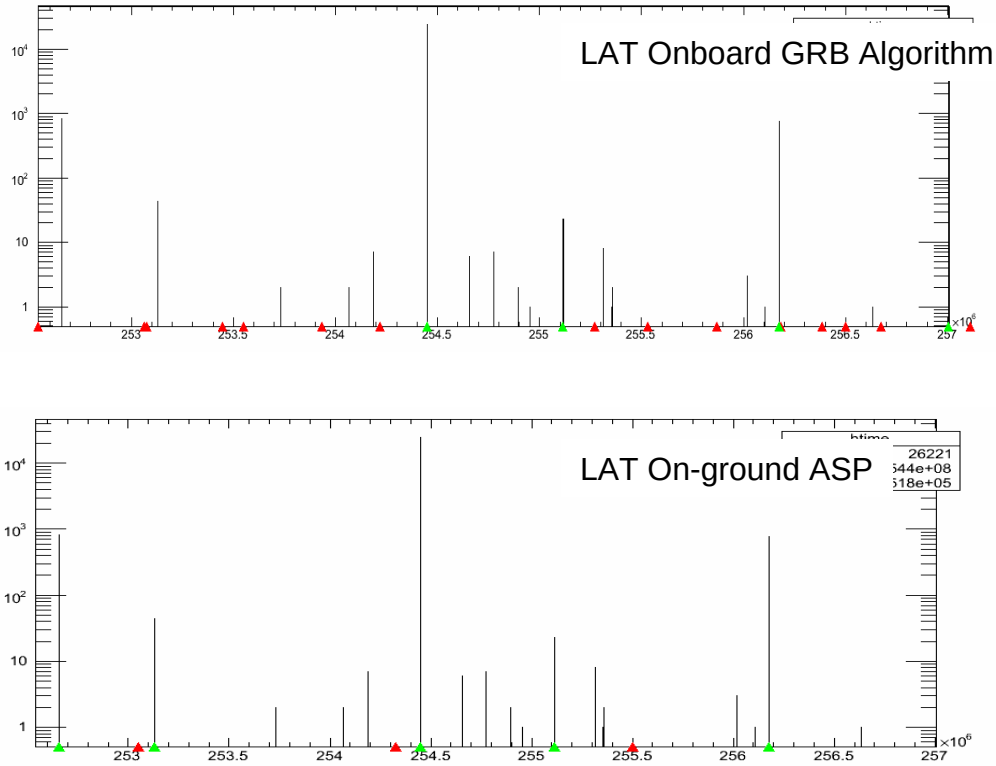


- **The latter part of the 60 day LEO period will feature an extended (~2 week) pointed observation, after which we will start survey mode observations.**
- **The figures are from a simulation of one of the proposed observation strategies.**
  - **We are about to produce a much higher fidelity simulation of this to quantify timing and alignment calibrations and to explore possibilities for first light images/results.**

Transient Analysis

- **Gamma-ray Bursts:**
  - **Three main analysis areas:**
    - **Overlap with ISOC/FSW on evaluation of onboard GRB trigger algs (Omodei, Kuehn, Thayer…)**
    - **Work with ISOC/SO on ASP processing of GRB alerts and offline GRB trigger algs. (Omodei, Chiang)**
    - **Detailed offline analysis/studies**
  - **Group developed the simulations used to test all of these analyses, currently working to coordinate better across all three to make sure that we compare "apples with apples"**
  - **Develop plans for burst advocate (LAT collaboration member with responsibility to coordinate and perform follow-up activities for LAT GRB)**

Testing GRB trigger algs



- **GRB trigger alg rewritten to easily run offline (Kuehn).**
- **ASP GRB trigger alg implemented (Chiang)**
- **Make side-by-side comparison on the same simulated data (Omodei)**
- **Also tested one GRB by running the low level data through the front end simulator (Thayer)**

Additional synergy with ISOC

- **AGN group**
  - **Work with ISOC/SO on development of source monitoring in ASP (obtaining flux/spectra as a function of time for a pre-selected source list) (Tosti, Chiang)**
  - **Provide list of AGN to be monitored**
  - **Develop plans for LAT flare advocate - LAT member responsible for analysis and coordination of LAT response to flaring sources.**
- **Pulsars**
  - **Pulsars are great calibration sources**
    - **Timing**
    - **IRF validation**
    - **Monitor stability of instrument performance (Aeff etc)**
  - **Group members work with ISOC/SO for routine operations and also participate in LEO planning.**

Burst and Flare advocates

- **Burst and Flare advocates are LAT collaborators with a specific interest in GRB and AGN science.**
- **LAT Burst Advocate - drawn from the GRB group. Performs LAT analysis for specific bursts. Participates in observatory-wide follow-up telecons. Composes GCN Circulars.**
- **LAT Flare advocate - Drawn from AGN group. Performs LAT analysis of flaring objects discovered in ASP. Assists in coordinating triggering of LAT team ToO. Communicates AGN flare results to the the AGN group.**

Papers

- **Tkr subsystem paper revised to address external referees comments and resubmitted. Internal reviewers were L. Rochester and R. Hughes. Contact author: R. Johnson**
- **Tkr environmental test paper draft released for review, C&A internal reviewer comments received (B. Giebels). Contact author: N. Mazziotta**
- **ACD detector paper draft released for review, C&A internal reviewer comments received (from G. Godfrey and N. Mazziotta). Contact author: Alex Moiseev**
- **Partial drafts or outlines exist for papers on cal subsystem and tracker manufacturing papers.**
- **Draft of a paper on LAT searches for dark matter - first paper on detailed LAT capabilities to a specific science question!**
- **Summary LAT paper almost complete - need to update the figures.**
- **Many plans for additional papers relating to science sims and LAT sensitivity to specific science questions.**

Dark Matter and New Physics paper

Search for Dark Matter in the gamma-ray sky with GLAST

Category 2 paper, to be submitted Summer 2007, Contact author: Jan Conrad

Synoposis of the cat II paper:

1. Introduction (Bloom/Morselli) (received)
2. GLAST (Bloom/Morselli) (received)
3. GLAST sensitivity to DM
   - 1) Galactic Centre (Morselli) (received)(updated 2007-07-10)
   - 2) Halo (Sander) (not received)
   - 3) Satellites/Spikes (Wang) (received)
   - 4) EGB (Conrad) (received)
   - 5) Lines (Bloom) (not received)
   - 6) Point Sources (Morselli) (received)
4. Background to the DM signal (Moskalenko) (received)
5. Model sensitivities (Lionetto) (received, to be merged with contribution from Aldo Morselli)

First Year Papers

- **We are starting to shift our focus from pre-launch to guaranteed first year papers:**
  - **First light observations/pulsars**
  - **Instrument performance**
  - **Planned multiwavelength campaigns**
  - **Papers to accompany 6 month high confidence source list**
  - **First year catalogue**
  - **Diffuse model**

  - **There will be many more papers, but we don't yet know the details.**

Group interactions

- **In addition to overlap with ISOC, there is also significant overlap between the groups themselves.**
- **Some examples:**
  - **Unid group involved in flare advocate discussions (a flaring source will not always be an AGN)**
  - **Solar group involved in burst advocate discussions, and general issues of transient analysis.**
  - **Many groups work on extragalactic diffuse emission: DM&NP, diffuse, AGN, Unid…**
  - **Solar IC emission is relevant to both solar and diffuse groups.**
  - **And lots lots more.**

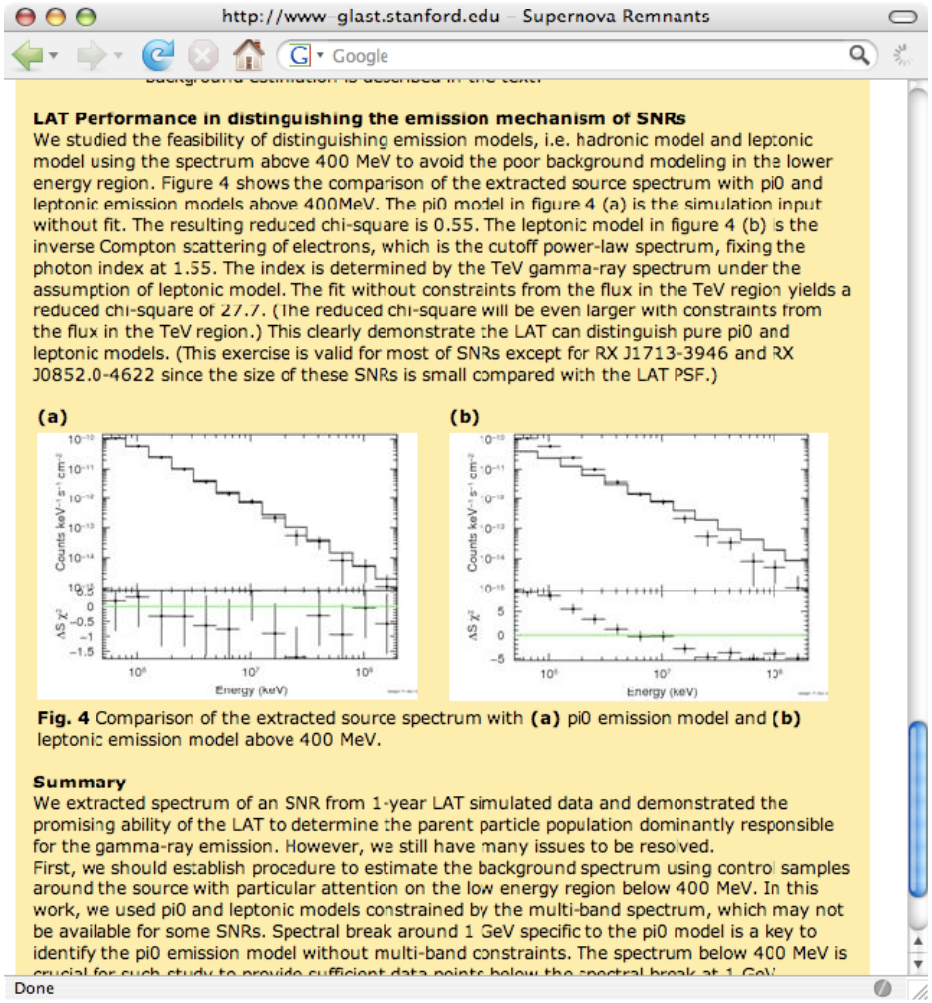
LAT Newsletter

- **Internal to the LAT team, forum to openly share status, issues, information etc.**
- **Released ~monthly. Editors: Richard Dubois, Berrie Giebels and Julie McEnery. Produced by Chuck Patterson.**

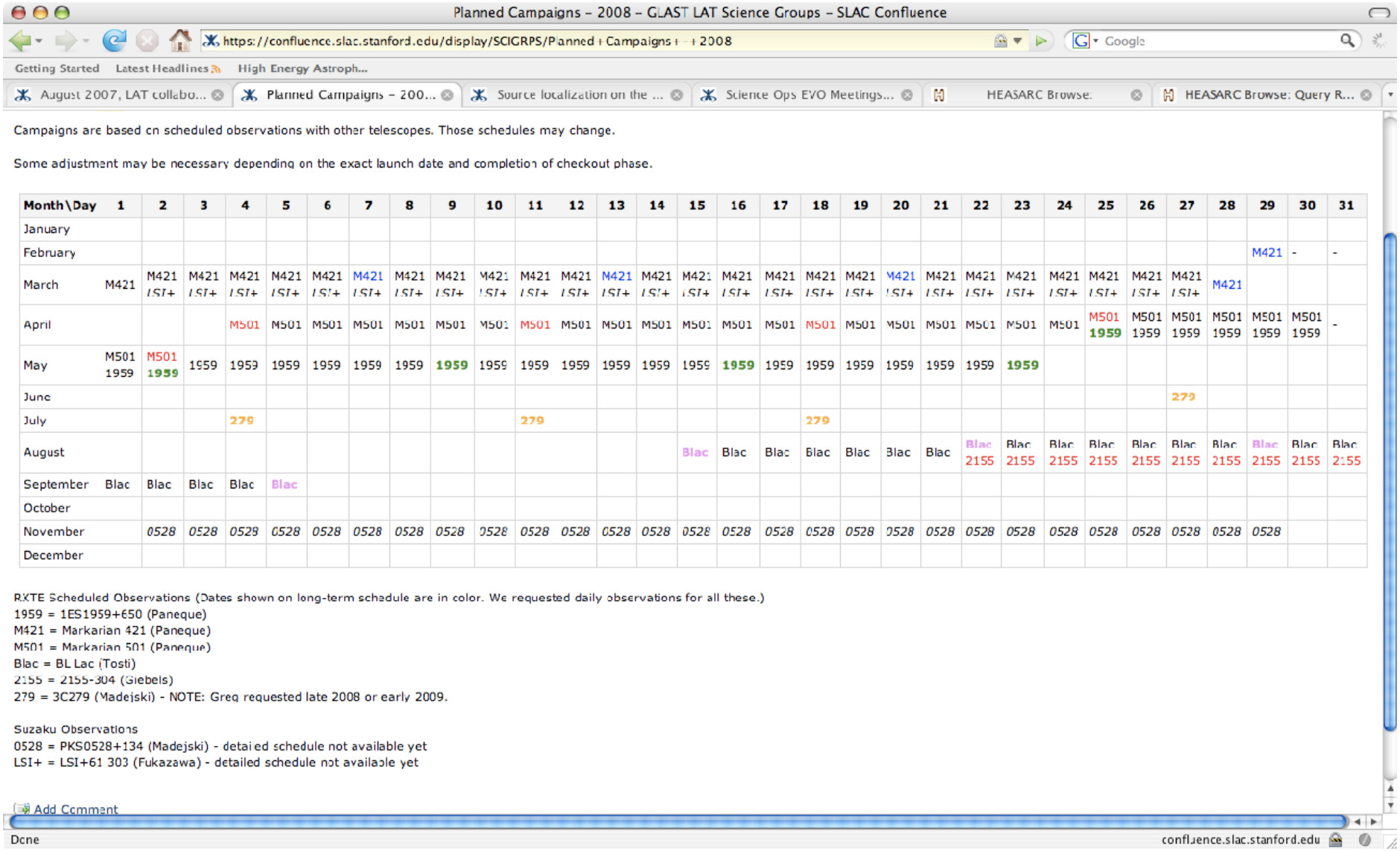
Featured science article

Each issue includes a more detailed science article.

Katagiri et al.



Multiwavelength readiness



Campaigns are based on scheduled observations with other telescopes. Those schedules may change.

Some adjustment may be necessary depending on the exact launch date and completion of checkout phase.

Month\Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January																															
February																													M421	-	-
March	M421	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421 LSI+	M421		
April				M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501	M501 1959	M501 1959	M501 1959	M501 1959	M501 1959	M501 1959	-
May	M501 1959	M501 1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959	1959							
June																											279				
July				279							279							279													
August															Blac	Blac	Blac	Blac	Blac	Blac	Blac	Blac 2155	Blac 2155	Blac 2155	Blac 2155	Blac 2155	Blac 2155	Blac 2155	Blac 2155	Blac 2155	Blac 2155
September	Blac	Blac	Blac	Blac	Blac																										
October																															
November		0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528	0528		
December																															

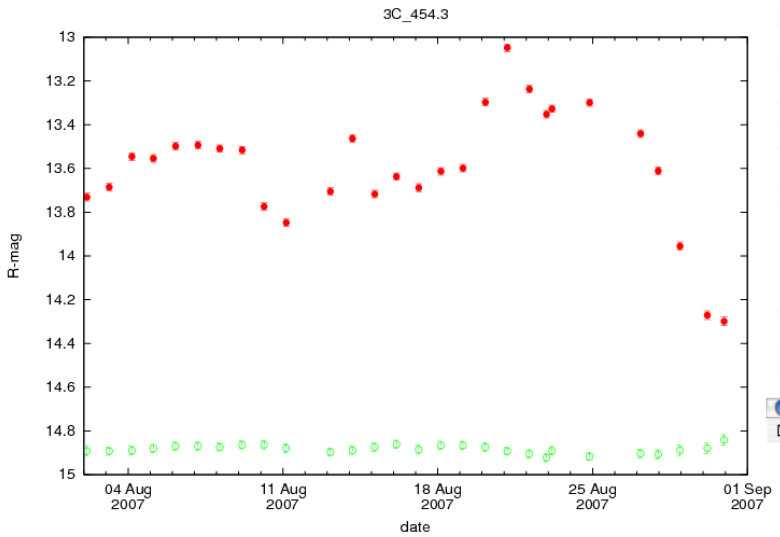
RXTE Scheduled Observations (Dates shown on long-term schedule are in color. We requested daily observations for all these.)
1959 = 1ES1959+650 (Paneque)
M421 = Markarian 421 (Paneque)
M501 = Markarian 501 (Paneque)
Blac = BL Lac (Tosti)
2155 = 2155-304 (Giebels)
279 = 3C279 (Madejski) - NOTE: Greg requested late 2008 or early 2009.

Suzaku Observations
0528 = PKS0528+134 (Madejski) - detailed schedule not available yet
LSI+ = LSI+61 303 (Fukazawa) - detailed schedule not available yet

Add Comment

Multiwavelength Campaign on 3C454

- **LAT team announced a multiwavelength campaign on 3C454.**
- **Campaign managers were Ann Wehrle and Matthias Kadler**
- **Excellent opportunity to test our readiness for these activities.**



July, 2007, Multiwavelength Campaign on 3C454.3 – GLAST LAT Multiwavelength Coordinating Group – SLAC Co...

https://confluence.slac.stanford.edu/display/GLAMCOG/

Getting Started Latest Headlines High Energy Astroph...

August 200... | 3C_454.3_l.... | Source locali... | July, 2007,... | HEASARC Bro... | HEASARC Bro...

Multiwavelength Campaign for Blazar 3C454.3 (2251+158), z = 0.86

News

September 1
The 3C454.3 campaign ends on Sep 1; observers are asked to send data to the campaign managers (awehrle_ssi@earthlink.net or Matthias.Kadler@nasa.gov) by Fri, Sep 28, 2007.

August 2
*AGILE significance for July 24-30 is 10 sigma!

July 27
*AGILE has announced a preliminary gamma-ray detection of 3C454.3

In addition, the RXTE ToO has been requested based on the AGILE trigger.

July 24
*The AGILE gamma-ray satellite has repointed to 3C454.3. The announcement is HERE. The contact person for AGILE is Stefano Vercellone

July 20
*Tuorla Observatory, Finland, optical light curve - Please note that these data are unpublished and preliminary. Please contact the Tuorla Observatory for information (Leo O. Takalo , takalo@utu.fi)
*X-ray flux of 3C454.3 is still rising - Swift/XRT QuickLook Analysis on Jul 20: 5.7e-11 erg/s/cm^2 (compared to 4.6e-11 erg/s/cm^2 on Jul 17)

July 19
*WEBT has extended their long-term campaign on this source
*Swift Target of Opportunity Request has been approved
*Spitzer observation scheduled for July 28
*The MAGIC TeV telescope has been observing 3C454.3 for the past three nights.

Observation Table Tentative list of observations being conducted as part of the 3C454.3 campaign

Announcement of the Campaign (July 19, 2007)

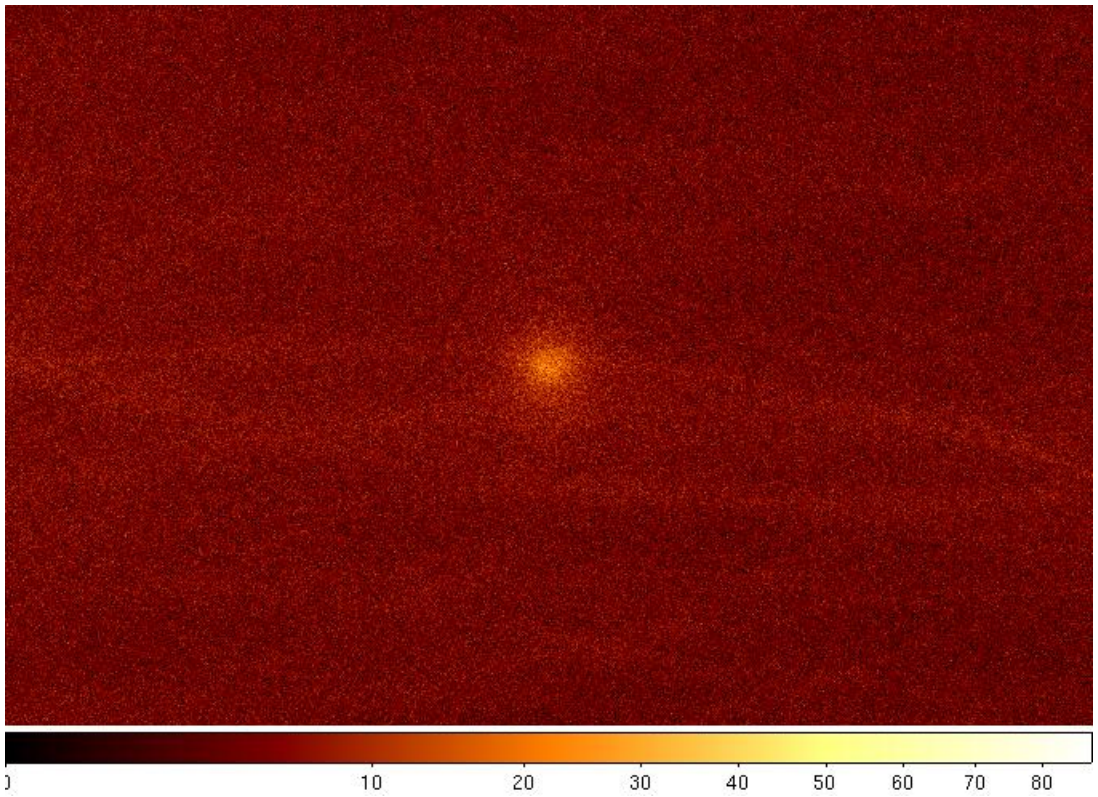
Done confluence.slac.stanford.edu

Forming a post-launch plan

- As we learned in DC2, some things are ~prerequisites before science analysis can begin in earnest
  - Background rejection and event selections -> IRFs
  - Diffuse model
  - Catalogue
- All three of these will be refined; as they improve, our ability to confidently study fainter sources and finer details will improve.
- We need to coordinate things, so that provide the most recent versions of IRFs and diffuse model prior to a new catalogue analysis.
- Need to fit all of this in more broadly with other guaranteed/predicable science papers. E.g. bright pulsars
- Other science studies/analysis are fixed externally - e.g. MW campaign on a blazar.

The year ahead

- **Develop and refine analysis and collaboration procedures using the service challenges.**
  - **Major effort needed for analysis of one-year service challenge simulation.**
  - **Exercise real time science operations**
    - **ISOC test**
    - **3-4 week real time test (to practice burst and flare advocated)**
- **Develop analysis (IRFs, diffuse model etc) for launch.**
- **MW proposals (we will soon enter the next proposal cycle)**
- **Develop detailed analysis and publication timeline for the few months after launch.**



Nico Giglietto

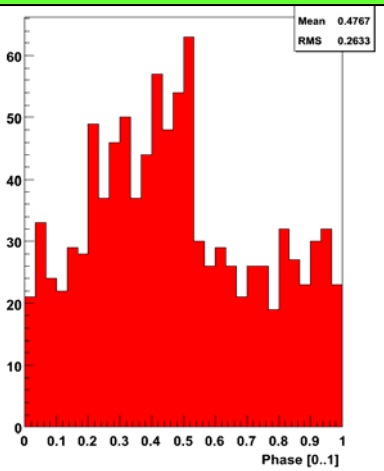
- **Developing moving source analysis in Solar and DM&NP groups.**

Organisation

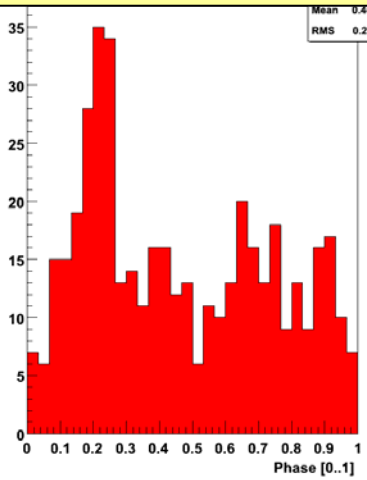
- Science group coordinators meet each month (on the first Friday of each month typically).
- The agenda, presentations and minutes from each meeting are available to all collaborators.
  - Multiwavelength report
  - Status of papers
  - Upcoming conferences
  - Discussion of simulation and analysis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

Blind Pulsar Searches

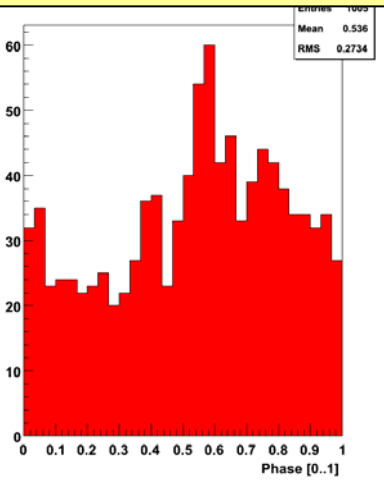
3EG J1710-4439, l = 343 b = -2.86



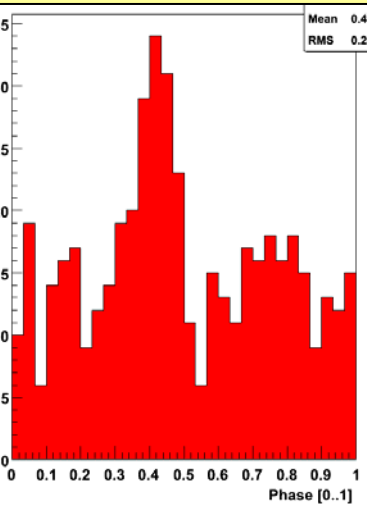
3EG J1937-1529, l = 23.95 b = -17.12



3EG J1824-1514, l = 16.37 b = -1.16



3EG J1834-2803, l = 5.92 b = -8.97



Science Simulations and Analysis

- **The "successor" to DC2 will involve much more direct participation from the science groups.**
  - **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

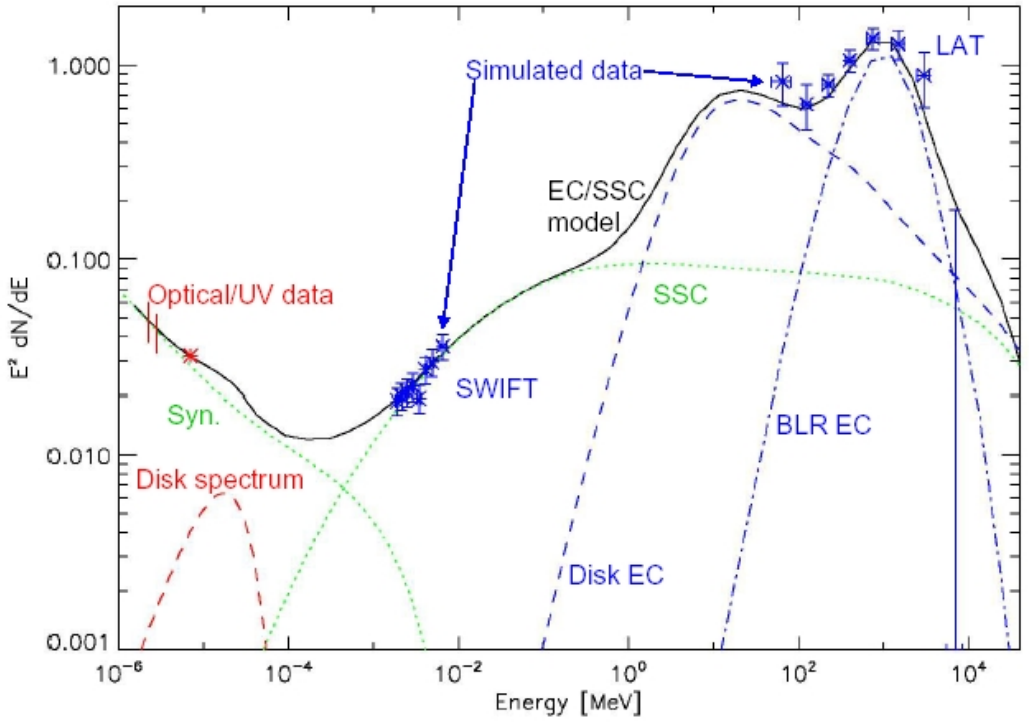
- Gamma-Ray Burst science requiring multi-wavelength observation:
  - https://confluence.slac.stanford.edu/download/attachments/2157/GRBs-multi-lambda-science.pdf
- Importance of NIR cameras (I, z, J,H, K)
  - 60% detection Rate for Swift
  - Relatively wide fov (30 arcmin)
- Synergy with TeV observatories
  - 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.

Radio

AGN

- Summary Web page (Greg Taylor, Matthias Kadler, and Lars Fuhrmann leading)
  http://www.slac.stanford.edu/~lott/radio_blazar_revised.html
- VIPS, MOJAVE, USNO, Marscher programs for VLBI
- Michigan, Metsahovi, OVRO, Effelsberg/IRAM monitoring
- Australian VLBI counterpart of MOJAVE proposal submitted

Pulsar Timing

- Parkes, Jodrell, Nançay have large timing programs
- Arecibo and Green Bank proposals submitted (not LAT team)

Other

- VLA (Frail) for GRB follow-up
- MOST, (Gaensler) for unidentified source follow-up
- Ryle, (Pooley) for LSI +61 303 monitoring
- CfA (Dame), NANTEN (Fukui) for diffuse/molecular clouds
- NRAO joint proposal opportunities

Readiness Status – Excellent!

Infrared

Far-IR (Space-Based) – primary interest AGN

- **Spitzer: despite heroic efforts by Ann Wehrle and Jennifer Carson, we were not awarded any Spitzer time from our proposals. Next opportunity (last with cryogen) this Fall.**
- **AKARI (ASTRO-F): conducting all-sky survey, concluding this Fall. May provide an archive.**
- **Herschel: launch in second half of 2008, will have GI program.**
- **WISE: launch in 2009, all-sky survey**

Near-IR (Ground-Based) – AGN, GRB

- **Magdalena Ridge (Norris): proposal in progress**
- **ESO/VLT- VIZIR (Chatay)**
- **Other near-IR coverage from some optical facilities**

Readiness Status – Not So Good

Optical

AGN

- WEBT (Tosti), GTN (Sonoma), other groups (e.g. Carini, Hiroshima) – monitoring and follow-up
- HET (Romani), maybe SALT – redshift measurements
- Swift UVOT

GRB

- ROTSE, RAPTOR, others associated with GCN and Swift

Unidentified – Surveys, Time Variability

- PanSTARRS (Wood)
- SKYMAPPER (contact through Cameron)
- SDSS (Anderson)

General – NOAO joint proposal opportunities

Readiness Status - Good

X-Ray

AGN

- Swift BAT and XRT – Discussions with instrument teams
- Suzaku – one proposal accepted. MW campaign
- RXTE – six proposals accepted, TOOs and Planned Intensive Campaign (PIC)
- INTEGRAL – four proposals accepted.
- XMM – two related proposals accepted

GRB

- Swift

Pulsars - Timing

- RXTE – four proposals accepted

Unidentified – Surveys, Time Variability

- Swift – interested
- Chandra – one proposal accepted
- INTEGRAL- three proposals accepted,
- Suzaku – LSI +61 303 proposal accepted

Near Future

MAXI – Japanese all-sky monitor (2009)

ASTROSAT – Indian MW satellite (2008/09)

Readiness Status – Good – but not enough for 1000 blazars

TeV

TeV telescopes are the nearest neighbors to LAT in the electromagnetic spectrum. They share nearly all our scientific interests.

We have close contacts with all the TeV groups.
H.E.S.S. has been working closely with us to develop a written agreement.
Informal, close contacts with VERITAS, MAGIC, CANGAROO, and MILAGRO.

Readiness Status - Excellent