

National Aeronautics and Space Administration



Fermi
Gamma-ray Space Telescope

www.nasa.gov/fermi



Analysis Coordinators' Report

S. Digel & G. Tosti

LAT Collaboration Meeting
August 31, 2010
SLAC

Outline

- **Context (year 3) & goals (science) for the meeting**
- **Scientific organization of the collaboration**
 - **Science working groups**
 - **Collaboration service work**
- **Notes from the Pub Board**



Context: 2+ years in

- As of sometime today, Fermi will have completed **12,233 orbits** (~530 M km)
- As of Saturday afternoon, the DataCatalog had Merit files for 11,995 runs, totaling **25,824,962,607 events** downlinked and processed
- And the AstroServer had **381,080,399 events** (since August 4, 2008, Pass 6 Transient class)
- The LAT has been running reliably and well...

Context (cont.)

- **With the data we are seeing advances going like $T^{1/2}$ (sensitivity) and T (unique transient sources)**
- **More exciting advances are being driven by analysis improvements/development of new methods**
 - **Event level (classification, IRFs)**
 - **High-level analysis methods & refinement of model for Galactic diffuse emission**
- **You will hear (or present) a lot about these this week**

Goals for the Meeting

- **Beyond advancing current analyses and papers...**
- **Defining the analysis timeline for year 3**
 - **With the transition to Pass 7.3, 2FGL, 2LAC, and GRB catalog as notable milestones**
- **Recognizing the development, advancement of new analysis methods – both for specific applications and for general use**

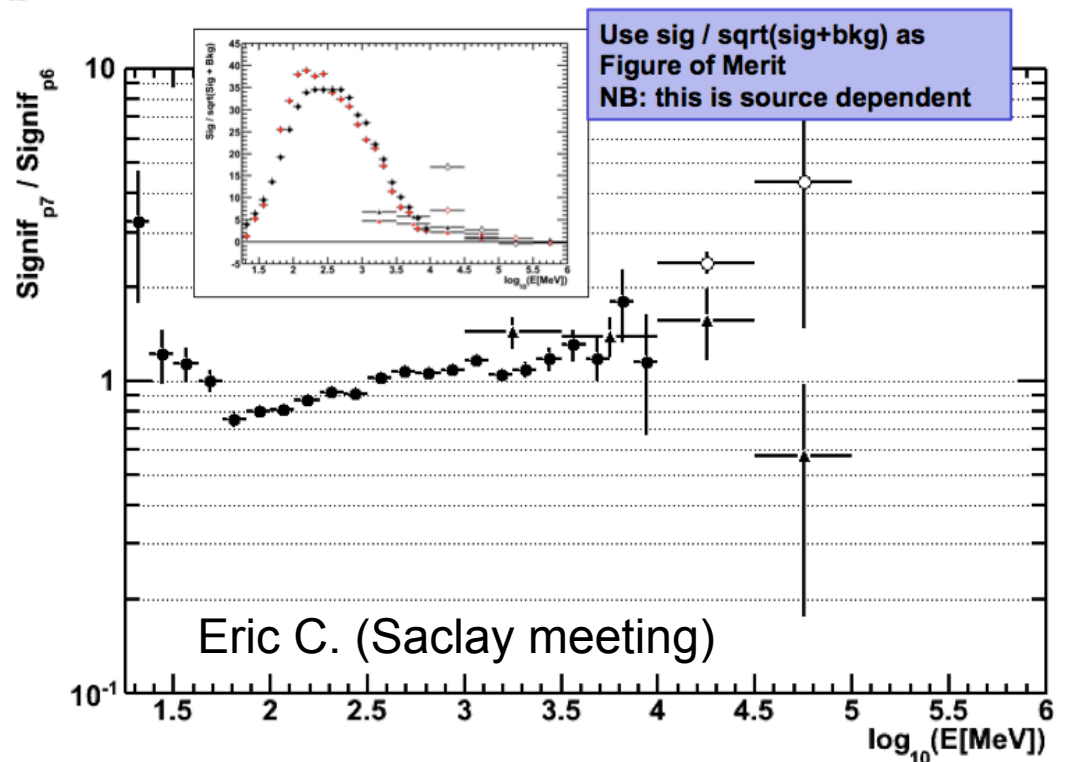
More on new analyses

- **For event classification and instrument response**
 - **Pass 7 is in the final stages of implementation, as Pass 7.3 [more on Friday from Luca L.]**
 - **Pass 8, which involves refinements at the event reconstruction level, was the subject of a workshop here last week [more on Friday from Robert J.]**
 - **Regarding instrument response, validation/evaluations against flight data have been advanced by Eric C., Riccardo, Philippe, Toby, Marshall, Stefano G., and Steve F., among others [C&A splinter tomorrow, and Marshall on Friday] not to mention subsystem calibration work...**
- **These enable the science that we can do with gamma rays and cosmic rays**

Reminder about Pass 7

- Pass 7.3 represents the new standard of Fermi LAT analysis
- Significant increase of the effective area <100 MeV and at high energy relative to Pass 6 for the standard classes
- New event classes are also available in Pass 7
 - E.g., S3, ExtraDiffuse

Sensitivity relative to Pass 6



More on new high-level analysis methods

- **Categories:** **spectral**, **temporal**, **spatial** spectroscopy, timing, localization/extent
- You'll hear about several this afternoon – some by name as general tools and some in the context of the particular analyses that they enabled
 - In the context of general (likelihood) analysis, we and the mission have been well served by having a standard, stable analysis (and indeed have been required to have and distribute one)
 - With more data and time and broadening scope of studies (e.g., systematic searches for extended sources) this is the appropriate time to fold in new tools
- Spectral analysis issues group led by Liz Hays explored methods systematically ~1 year ago – and the development of systematic tests via simulated data sets and detailed comparisons drove advances in development of methods

Still more on new methods

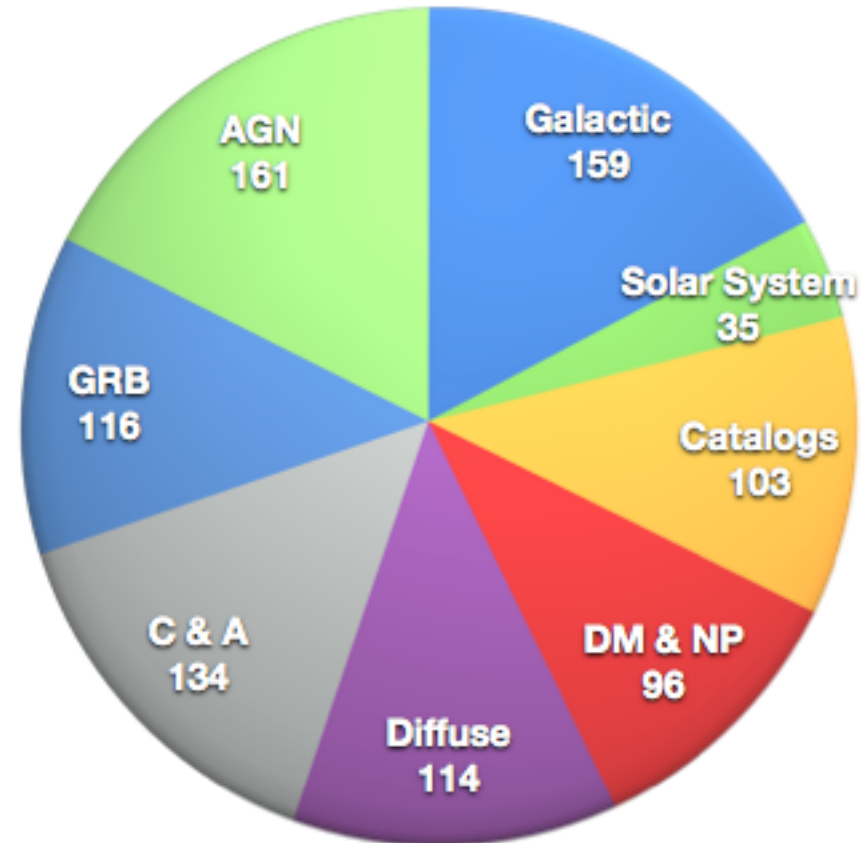
- **For a method to be adopted for general uses in the collaboration (i.e., leading to publication) it needs to satisfy several requirements**
 - **Works (obviously) with documented performance against simulations and some reference real-data analysis (e.g., spectrum of Vela)**
 - **Stable, in the sense that it has a ‘release’ version and version tracking**
 - **Documented for use and supported**
- **We’ll work to promote progress through these steps**

LAT Statistics Board

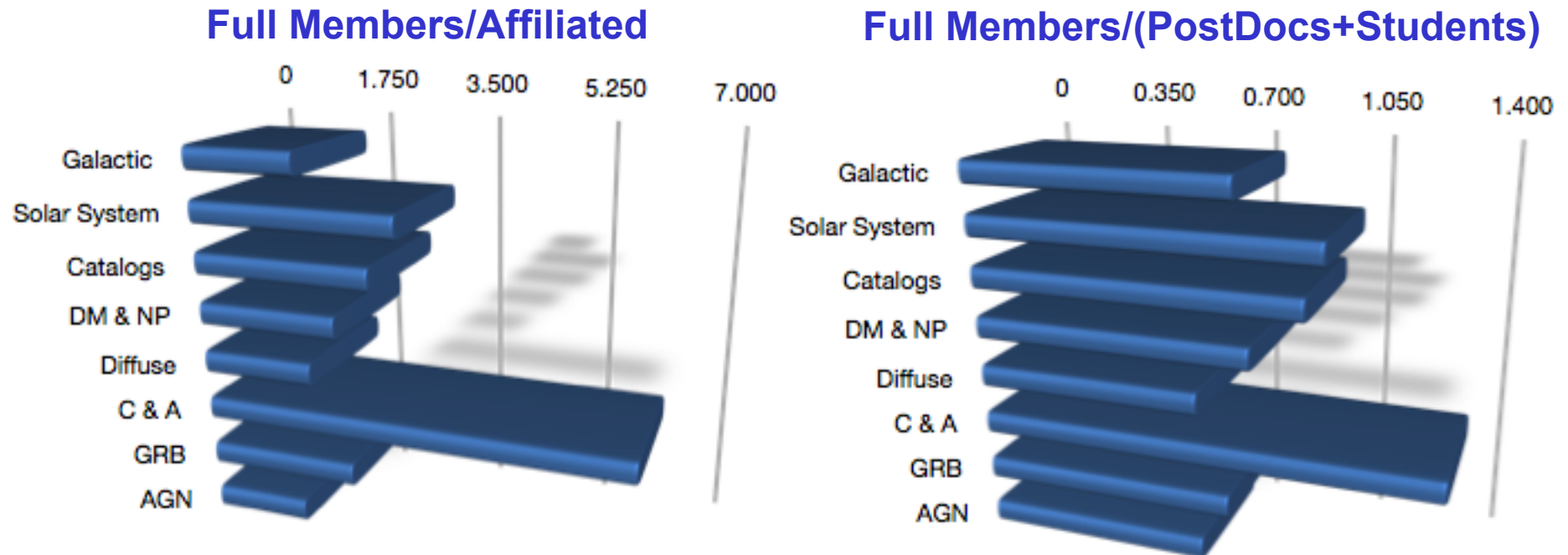
- **With new methods and pushing the limits, questions about statistical methods have been coming up**
- **LAT Statistics Board has been organized as an **advisory** body**
 - **Jean Ballet, Jim Chiang, Jan Conrad, Pat Nolan, Jeff Scargle, AC/DC**
- **Details, including a link to the mailing list (statslist) and posted answers from the Statistics Board are available here**
 - <https://confluence.slac.stanford.edu/display/SCIGRPS/LAT+Statistics+Board>
- **Feel free to subscribe to statslist and to participate in the e-mail threads there**
- **The Statistics Board is available at any stage – from when you are figuring out your analysis to when an internal referee is trying to understand your new method**

Science Working Group Membership

- From the database as of today: **356 collaboration members & affiliates**
- **Full members (97), Affiliated (80), Postdoc (82), Students (97), & Technical (9)**
- **On average each member is subscribed to 2.6 science groups, making the number of Science group members 918**



Two Derived Quantities (the 'Omodei Plots')

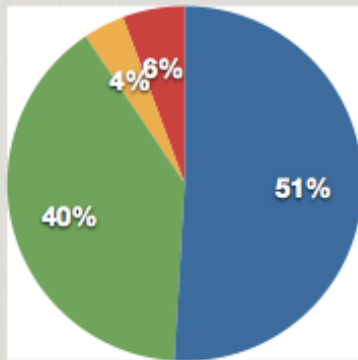


- **Full Members/Affiliated:** people working mainly for Fermi
- **Full Members/(PostDoc+Students):** “age” of the Science Groups

Collaboration Service Work

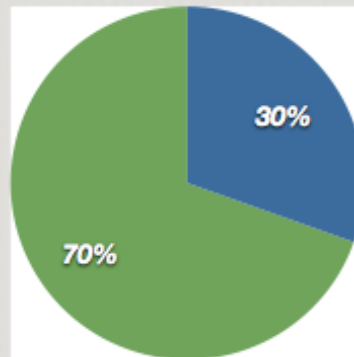
Figures as of March

Data Monitoring

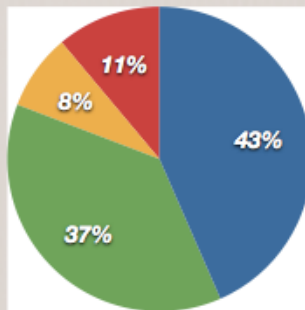


Italy USA France Japan

LT PROCESSING

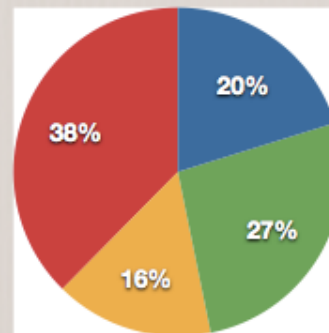


FLARE ADVOCATE SHIFTS COVERAGE



Italy USA France Japan

BURST ADVOCATE SHIFT COVERAGE



Italy USA France Japan

- Distribution across the collaboration
 - Sweden is also covering some Burst Advocate shifts
- Many other classes of “service works” are not summarized here
 - Generation of MC, maintenance of the infrastructure,...

Publications by the Collaboration

Summary of Fermi LAT science publications 30 August 2010

Category I and II papers in refereed journals

Journal	Published	In press	Total
Astronomy and Astrophysics	1+1=2	2	4
Astroparticle Physics	1+2=3	-	3
Astrophysical Journal	39+5=44	7	51
Astrophysical Journal Letters	16+3=19	-	19
Astrophysical Journal Supplement	3+0=3	-	3
Journal of Cosmology and Astroparticle Physics	2+2=4	-	4
Nature	2+0=2	-	2
Physical Review D	1+0=1	2	3
Physical Review Letters	4+0=4	-	4
Science	9+0=9	-	9
Total	78+13=91	11	102

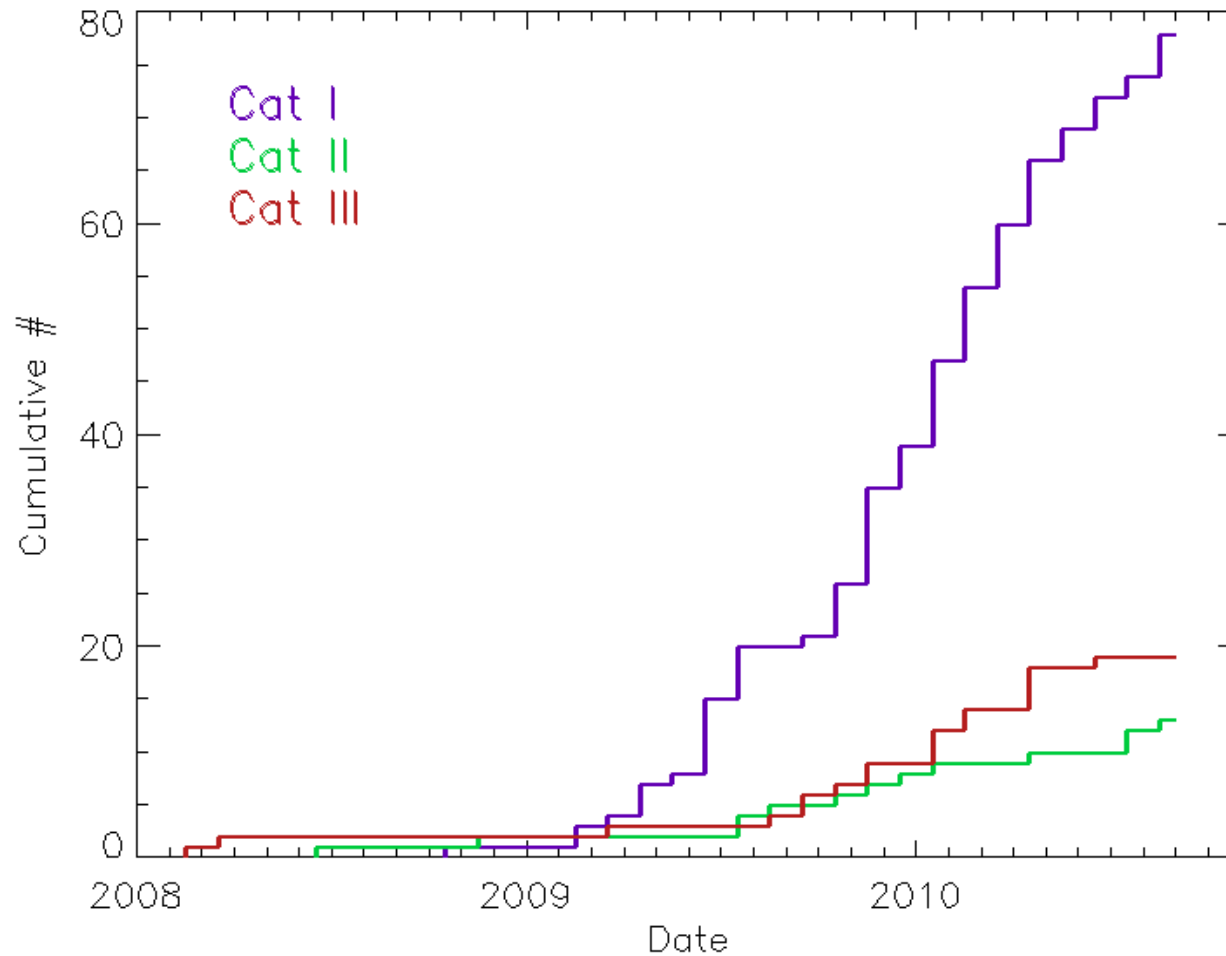
Papers submitted to journals: 10 (not yet accepted for
Near submission: 3 publication)

Rapid publications:

Astronomers' telegrams: 97
GCN circulars: 27

From Pat's page: https://www-glast.stanford.edu/cgi-prot/pub_headcount
LAT Collaboration Meeting, SLAC, 31 August 2010

LAT Collaboration papers published



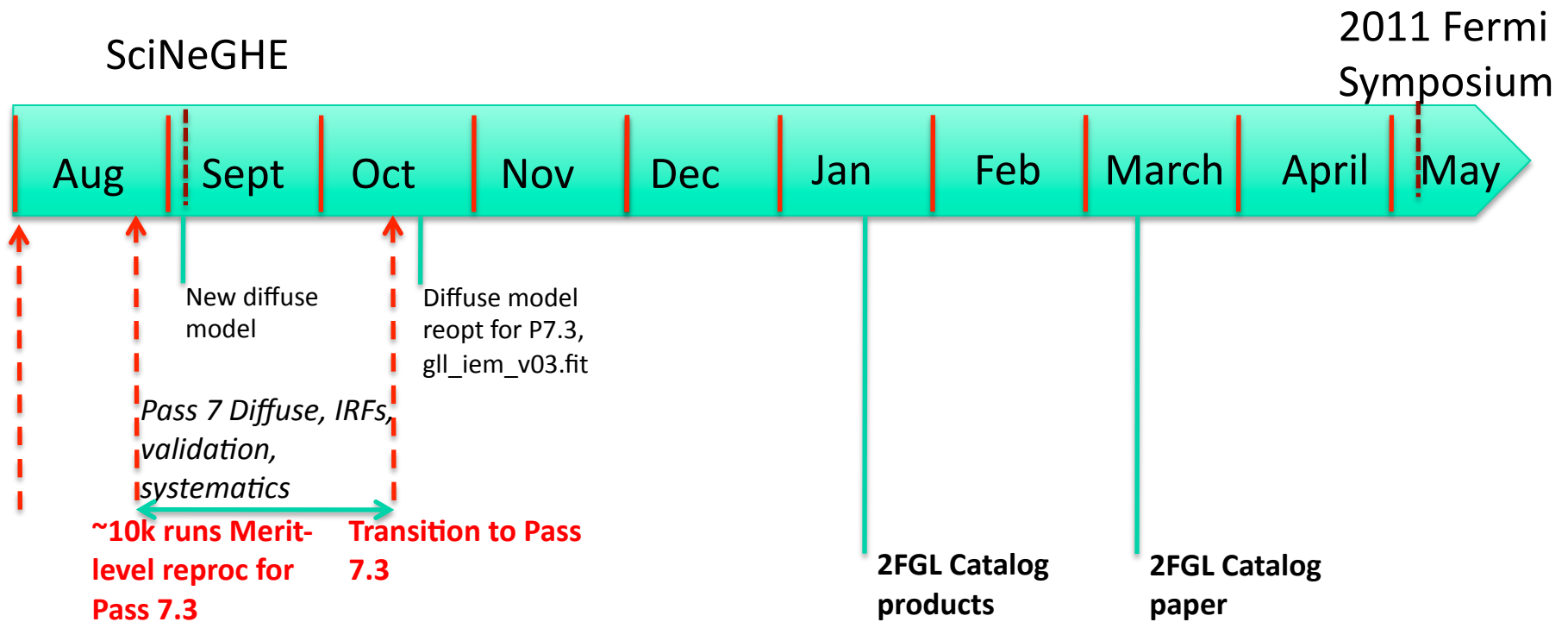
- Cumulative numbers of published papers, from March 2008

- **Paper citations (rankings from ADS for papers published since Jan. 2009)**
 - **CR electrons: 336 since May 2009 (#8)**
 - **LAT instrument paper: 291 since June 2009 (#13)**
 - **Bright Source List: 190 since July 2009 (#23)**
 - **LAT Bright AGN Sample: 154 since July 2009 (#36)**
 - **GRB 080916C: 139 since March 2009 (#48)**
 - **CRE interpretation: 86 since Sept. 2009 (#130) [Cat II]**
 - **QG with GRB090510: 78 since Nov. 2009 (#161)**
 - **Vela I: 64 since May 2009 (#256)**
 - **LAT Pulsar Catalog: 63 since April (#262)**
 - **1FGL: 57 since June (#314)**

Science Impact (2)

- **Among papers published since Jan. 2010 (also from ADS, rankings among the 63489 abstracts since that time)**
 - **LAT Pulsar Catalog: 63 (#12)**
 - **1FGL: 57 (#19)**
 - **1LAC: 49 (#24)**
 - **Isotropic Diffuse Background: 40 (#39)**

Backbone of Science Timeline for Year 3



- **Some milestones are common for all of the science working groups**
 - **Pass 7.3 adoption (validation analyses, generation of IRFs, re-evaluation of high-energy PSF in flight data (ultimate Pass 6 IRFs))**
 - **2FGL Catalog runs**
 - **Diffuse emission model (gll_iem_v03)**



Updated Snapshot of the Science Working Groups

~Now During Year 3

Catalog	6M, BSL	1FGL	18MSL Identif. Unid	2FGL Identif. Unid
C&A	P6V1	P6V3	P6V8	PASS 7.3 Pass 8
Diffuse	!GeVExcess	<i>gll_iem_v02.fit</i>	“Reconciliation” with GALPROP Galactic Center	New model, galaxies
AGN	LBAS	1LAC AGN Population Galaxy Clusters	EBL study	2LAC, Hard sources, MW, new populations
Galactic	Blind Search MSP	Pulsar Catalog	Galactic Center	Populations (SNRs, Pulsars)
GRB	Bright GRBs	Bright GRBs, LIV		UL paper LAT GRB Catalog
DM&NP		DM Galaxy Clusters Lines, Dwarfs	Galactic Center	New UL’s, limits on large extra dimensions
Solar	Steady Sun, Moon	Steady Sun, Moon	Steady Sun, Moon	June 12 Solar Flare

Remember the Analysis Users Forum

- It has been a very useful way to follow analysis results across the collaboration
- But lately the rate of postings has declined – analysis work tends to show up on the Confluence pages for individual papers, or be shown in slides at group EVO meetings
- That's fine, but for these cases, please consider adding a 'stub' news item [now called *Blog Post*] in the Analysis Users Forum just to indicate that such a page or presentation exists, and provide a link to it
 - Also include the relevant labels...

<https://confluence.slac.stanford.edu/display/SCIGRPS/Analysis+Users+Forum>

Notes from the Publication Board

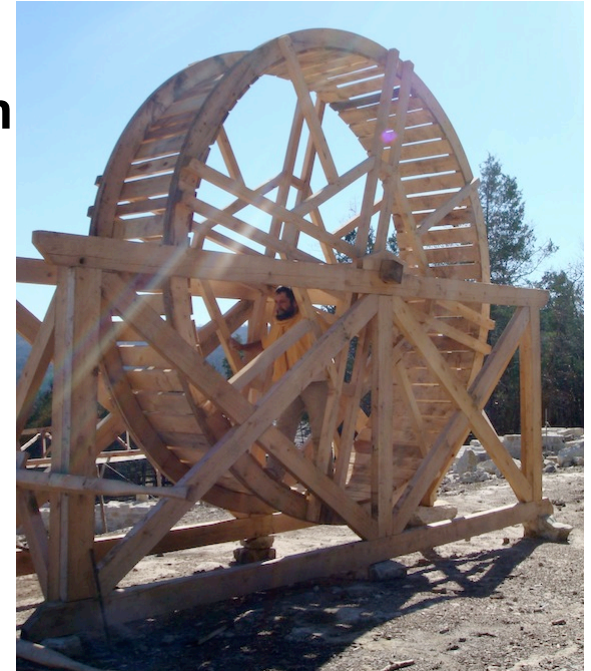
- The modern way to send requests to the Pub Board is via the links accessible from ‘Modify the characteristics of an existing paper’ or ‘Browse and download LAT papers’ table
 - Keeps group leads and referees in the loop on approvals
 - Database tracking system (by Pat) on the Pub Board side

https://www-glast.stanford.edu/cgi-prot/pub_requests

- The page ‘**Guidelines for Preparing LAT Scientific Communications**’ initially compiled by Teddy Cheung is an invaluable reference

<https://confluence.slac.stanford.edu/display/SCIGRPS/Guidelines+for+Preparing+LAT+Scientific+Communications>

- Concisely describes how various collaboration policies are actually implemented



Reminders from the Publication Board

- Please use the Pub Board page for your paper to post drafts **early and often**
- For Cat II papers there's no obligation or expectation that internal referees should become co-authors
 - Referees should consider it extremely useful service work for the collaboration
 - Coordinating authors *can* choose to invite internal referees to be co-authors; including acknowledgments is also an option
- Reviews of proceedings papers are handled at the science working group level
 - Please do upload your proceedings papers to the Speakers' Bureau page for your talk/poster
- Lastly, please mention ***Fermi Gamma-ray Space Telescope*** once in your papers before referring to ***Fermi***

Conclusions

- **The quality, quantity, and impact of LAT collaboration science remain high**
- **After 2 years of science data, the low-hanging fruit may have been picked but we are seeing deeper with more data and deeper understanding of the LAT data**
- **Let's take advantage of the opportunity**