# Fermi LAT Report

**Fermi User Group meeting**
**February 17, 2015**

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*on behalf of the Fermi LAT collaboration*

# Outline

- ## Fermi LAT status

  - Instrument operations
  - Data processing pipelines

- ## Fermi Lat Source Catalogs - 3FGL release

- ## Pass 8 – preparing for release and transition of data pipeline

# Fermi LAT status

- The LAT continues to operate well with no degradations in science performance.
  - 79.8 billion events downlinked to the ISOC
  - 423.9 million photons available at the FSSC

- The international Fermi LAT Collaboration continues to provide excellent coverage for all LAT instrument operations and data processing/analysis needs
  - good coverage in all areas due to multitasking by many collaboration members
  - collaboration actively engaged in validating Pass8; (more about this later)
  - key commitments from partners for extended operations through 2018 remain firm

# Fermi LAT Status - Tracker Hot Strips
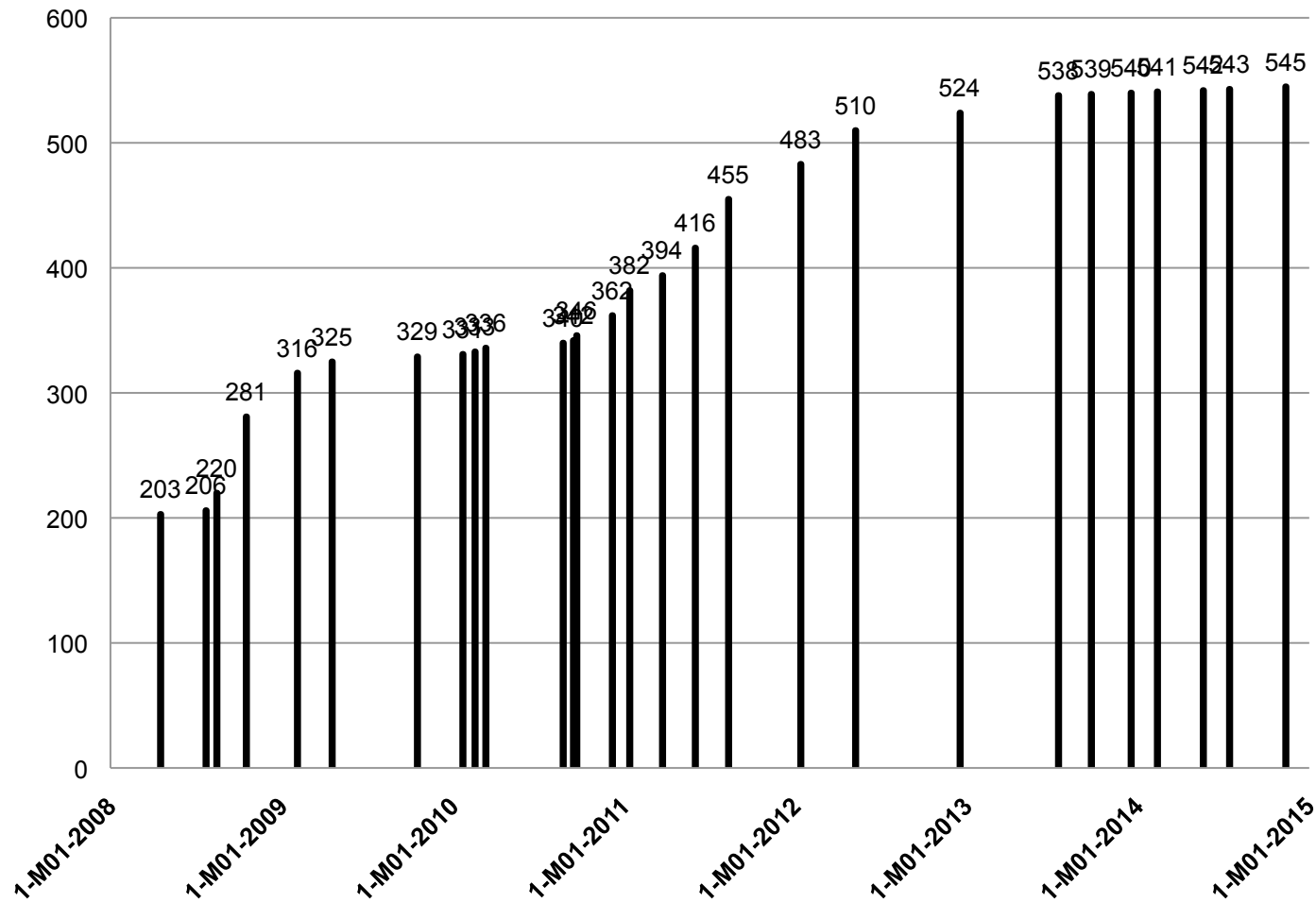


- TKR hot strip checks are performed monthly

- Total of 5 new hot strips masked during 2014; none so far in 2015

# LAT and ISOC

- SLAC and the ISOC are upgrading to RHEL6, in preparation for imminent transition of Level 1 data processing to Pass 8

- A few seconds of LAT data collection were missed on 31 December 2014, due to ATS command timing based on reduced accuracy Fermi ephemeris, conflicting with on-orbit SAA transit times

  – As a result, the ISOC has implemented routine ephemeris checking, based on SAA transit prediction repeatability checks

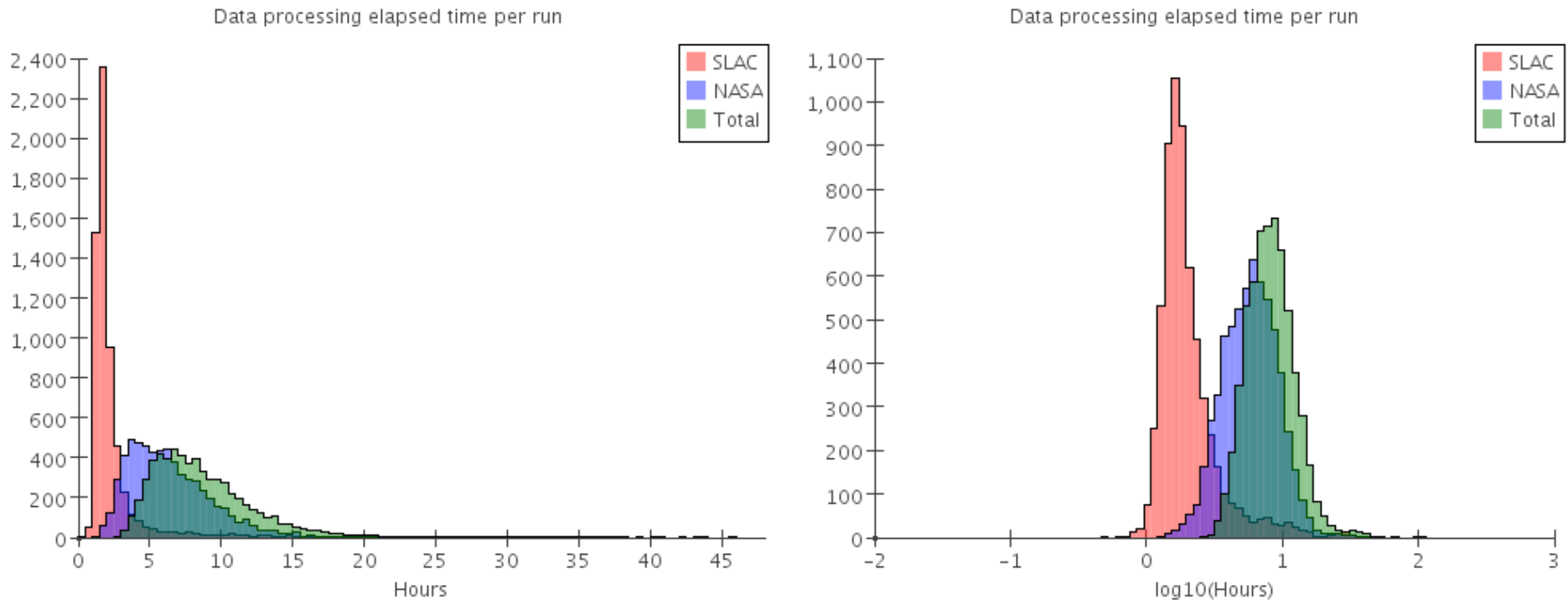- New FSW build B3-2-0 should be started on the LAT soon

# LAT data pipeline

~ 400,000 lines of code generated and maintained
by the LAT Collaboration

L1 processing typically requires 2 to 3 CPU years per week

- to date, 560 CPU years

- reprocessing has also used ~560 CPU years

# ISOC: Data Processing Latency



Time from end of run onboard Fermi to delivery of photon list to FSSC
From start of 1 January 2014 – 13 February 2015

NASA = Hours elapsed between end of data taking for run and ALL data for that run arriving at SLAC.

SLAC = Hours elapsed between ALL data for that run arriving at SLAC and data being registered in data catalog.

# Fermi LAT 3FGL Source Catalog released

# Many LAT team papers out…

## LAT Collaboration papers

| Journal | Published | In press | Total |
|---|---|---|---|
| Advances in Space Research | 0+1=1 | - | 1 |
| Astronomy and Astrophysics | 6+41=47 | 0+2=2 | 49 |
| Astroparticle Physics | 2+6=8 | - | 8 |
| Astrophysical Journal | 84+64=148 | 0+3=3 | 151 |
| Astrophysical Journal Letters | 23+23=46 | 0+2=2 | 48 |
| Astrophysical Journal Supplement | 8+2=10 | - | 10 |
| Journal of Cosmology and Astroparticle Physics | 3+5=8 | - | 8 |
| Journal of Geophysical Reserch | 0+1=1 | - | 1 |
| Monthly Notices of the RAS | 0+31=31 | 0+2=2 | 33 |
| Nature | 2+1=3 | - | 3 |
| Nuclear Instruments and Methods | 0+1=1 | - | 1 |
| Physical Review D | 8+2=10 | - | 10 |
| Physical Review Letters | 7+0=7 | - | 7 |
| Publications of the ASJ | 0+1=1 | - | 1 |
| Science | 19+0=19 | - | 19 |
| **Total** | 162+179=341 | 0+9=9 | 350 |

published in both physics and astrophysics
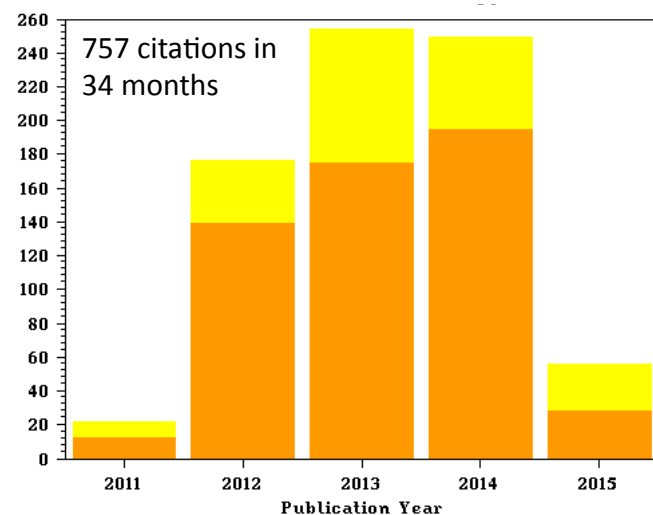journals, reflecting broad interest

*http://fermi.gsfc.nasa.gov/ssc/library/pubs/*

*http://www-glast.stanford.edu/cgi-bin/pubpub*

## Fermi Large Area Telescope First Source Catalog
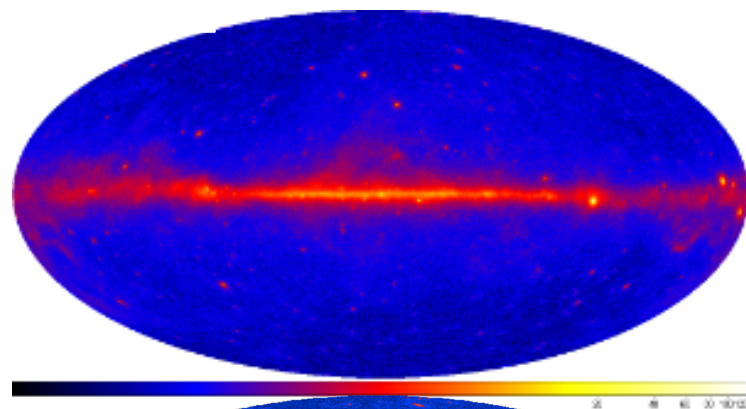Ap J Suppl **188**, 405 (June 2010)

491 citations in
56 months

NASA ADS
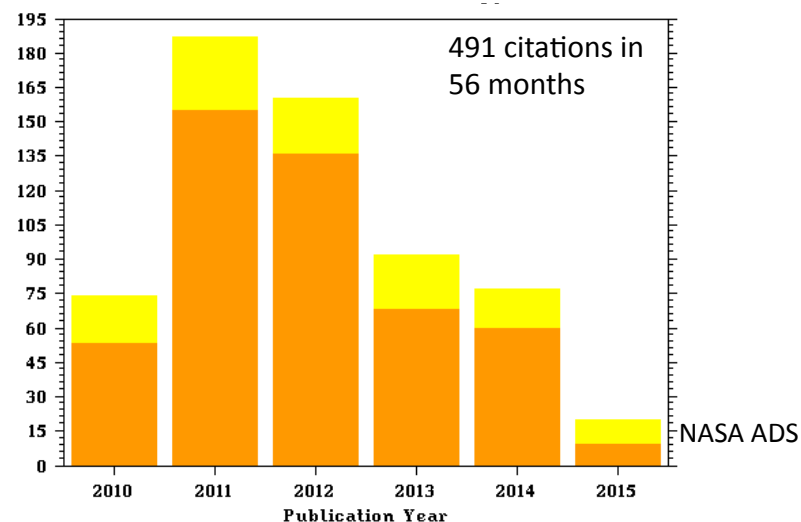
## Fermi Large Area Telescope Second Source Catalog
Ap J Suppl **199**, 31 (April 2012)

757 citations in
34 months

# 3ⁿᵈ Fermi LAT Catalog
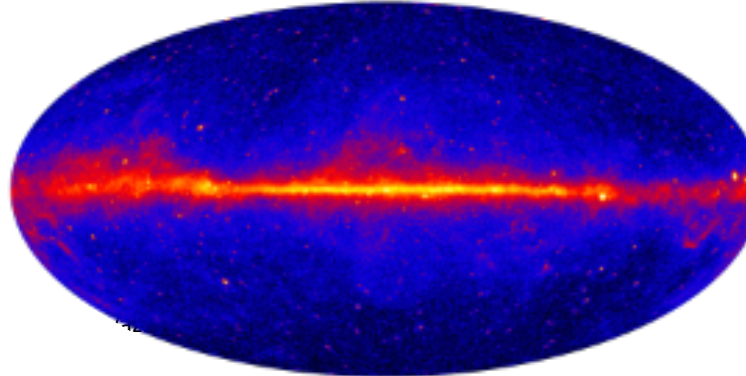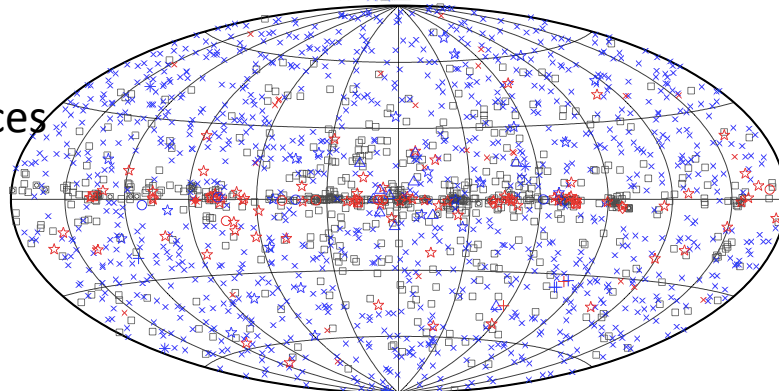
1451
sources

**1FGL**

**11 m**

1873
sources

**2FGL**

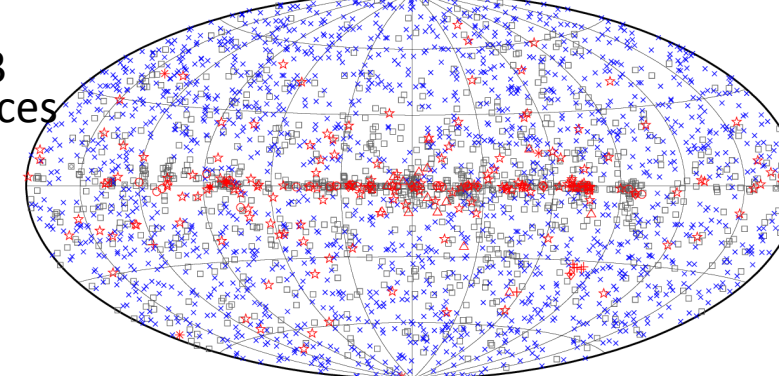**2 y**

3033
sources

**3FGL**

**4 y**
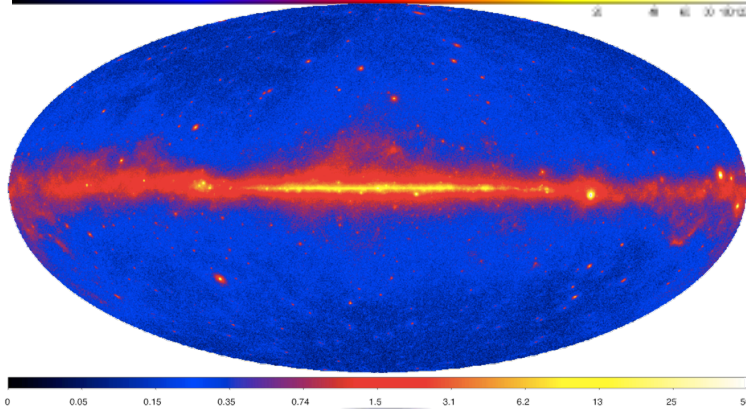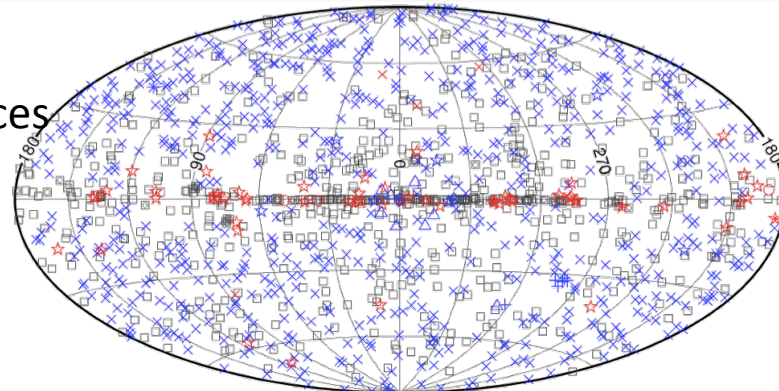
# LAT catalogs

- In addition to the LAT source catalogs, the LAT team produces several more specialized catalogs:

  The Second Catalog of Active Galactic Nuclei Detected by the Fermi Large Area Telescope
  > ApJ, 743, id. 171, (2011)

  The Second Fermi Large Area Telescope Catalog of Gamma-ray Pulsars
  > ApJ Suppl, 208, 17 (2013)

  The First Fermi LAT Gamma-ray Burst Catalog
  > ApJ Suppl, 209 11 (2013)
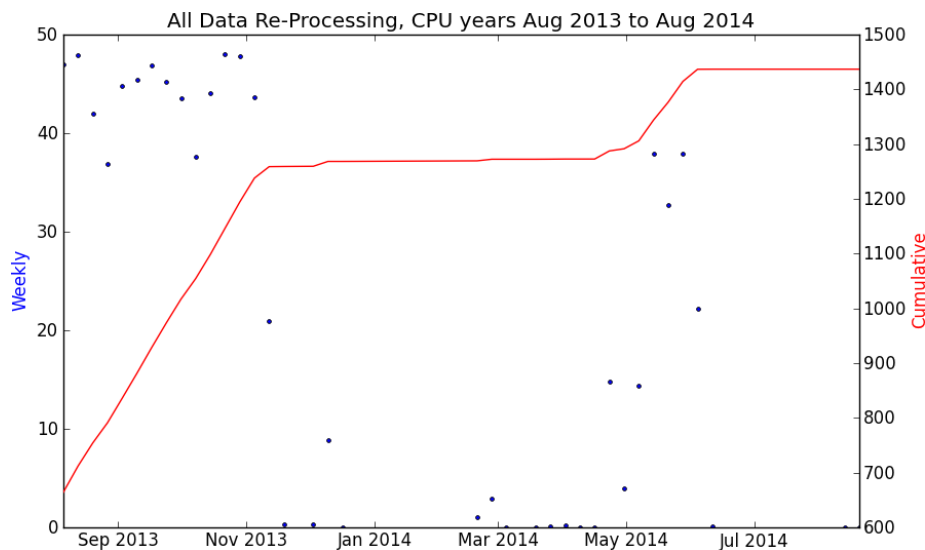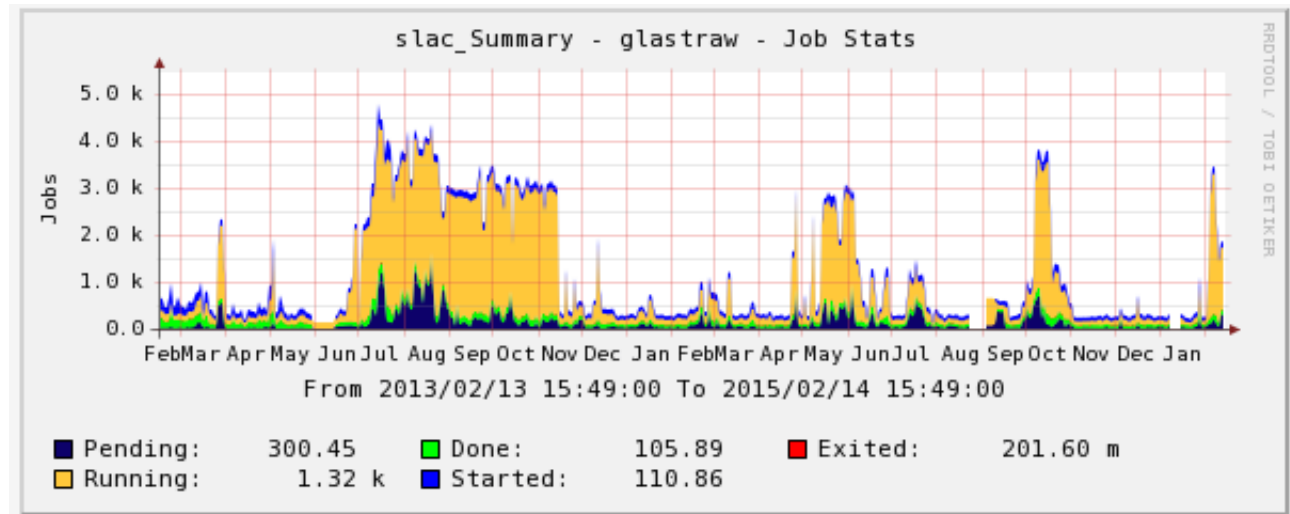
  The First Fermi LAT Catalog of Sources above 10 GeV
  > ApJ Suppl, 209, 34 (2013)

  The First Fermi LAT Supernovae Remnant Catalog
  > in preparation

# Pass 8 – preparing for release and transition of ISOC data pipeline

# Pass 8 Reprocessing status

❑ Reprocessing will be current to the end of January 2015 by the end of the week



History of Pass 8 Reprocessing to date
- Processing Pass 7 live and Pass8 episodically
- Pushing 1500 CPU-yrs for Pass 8 reprocessing

# Pass8 event reanalysis

- first comprehensive (and most significant) event level reanalysis since launch. Development underway for past 4 years; development complete; validation almost complete; reprocessing nearly up-to-date

    - involves all areas of event analysis

        - Event reconstruction;
        - Overall event structure;
        - Energy analysis;
        - PSF analysis;
        - Background rejection

- Expect pipeline processing to transition to Pass 8 and be ready for release at end of March 2015

# Summary

- LAT continues to perform well

- Science reach of LAT remains high, will be enhanced with Pass 8

- Planning to transition to Pass 8 pipeline operation at end of March - Pass 8 release at that time

- Key LAT LAT partners remain committed for extended operations phase

# Backup

LAT Report – P. Michelson        Fermi User Group meeting – February 17, 2015

# Pass8: Key Motivations
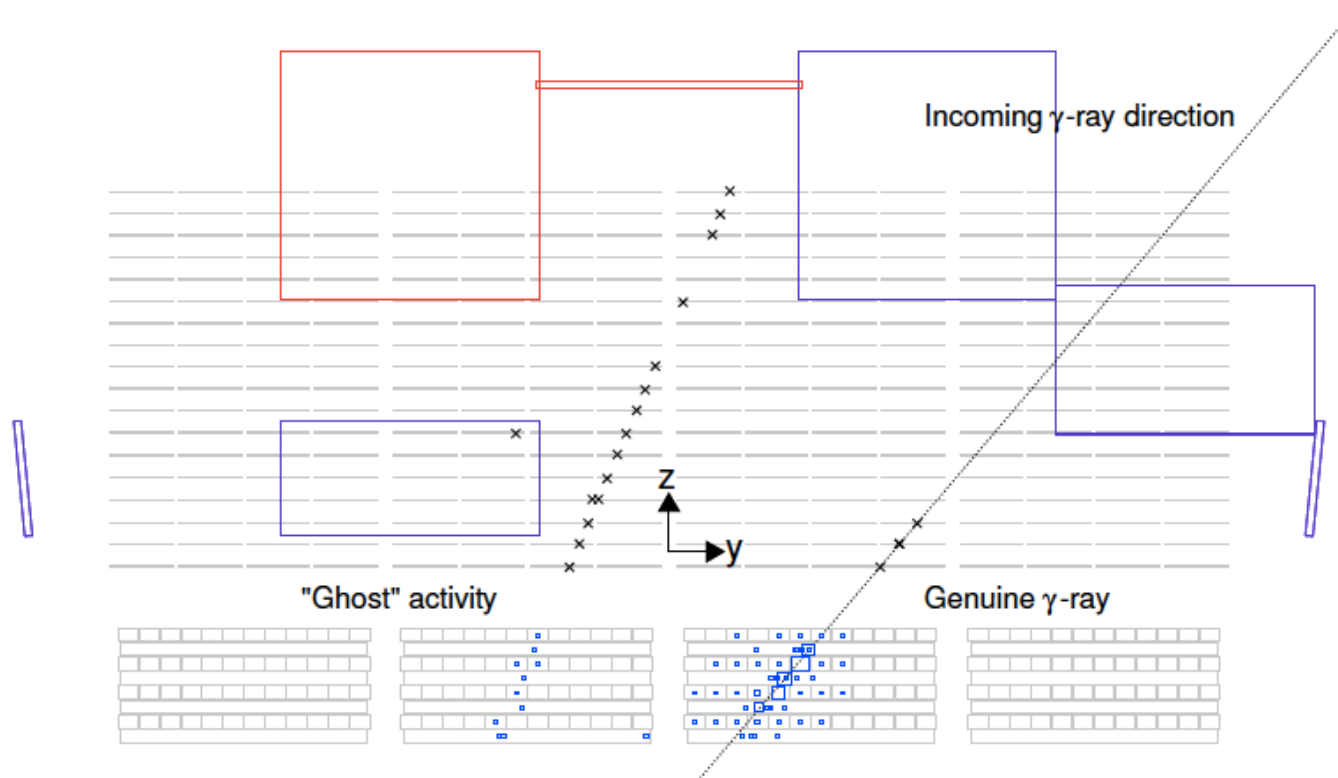


- LAT event-level analysis largely developed before launch

- considerable insights gained during the prime phase of the mission
  – e.g. instrumental pileup is one of the original and main motivations for starting Pass8 development

- Use this insight to maximize the instrument performance for science analysis

# Pass 8: Overview of Development Areas

**-- Tracker**

Kalman fit measurement errors, Point Spread function analysis, Tracker buffer truncation, tree-based pattern recognition, cosmic-ray tracking, neutral energy and vertexing, ...
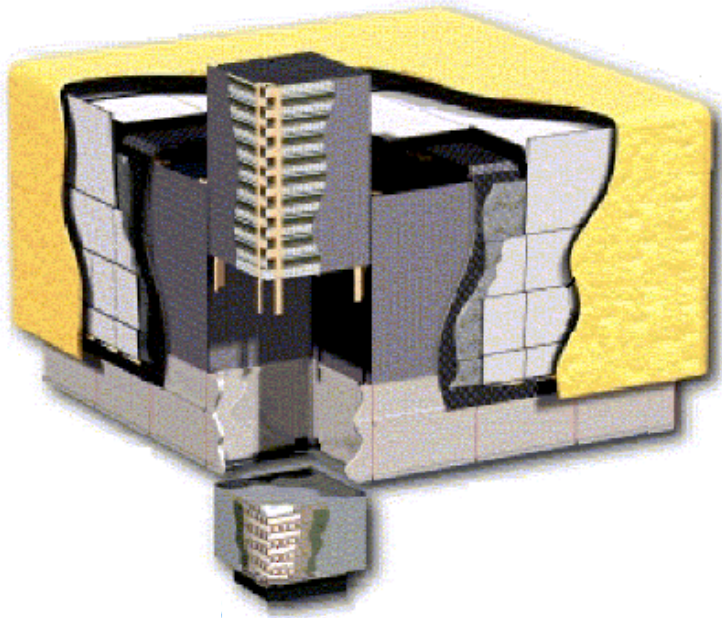
**-- Anti-Coincidence Detector**

Error propagation, , track-tile association finding and sorting, ...

**-- Calorimeter**

Crystal simulation and reconstruction, clustering, cluster classification, moments analysis and direction reconstruction, failure mitigation, crystal saturation and energy reconstruction beyond 1 TeV,

**-- More items**

periodic trigger event overlays, GEANT4 update, background rejection, extended analysis classes, tools for validation and analysis, ...