Fermi

Gamma-ray Space Telescope

Users Group Meeting
5 Nov 2010

Mission Status Update

J. McEnery, E. Hays

Status Highlights

- **Observatory is operating smoothly, FOT continues to look for ways to improve operations.**
  - **Closely monitor reaction wheels - no issues or concerns.**
    - **Reaction wheel life test ends in August.**
    - **Updated FSW to handle reduced wheel observation modes - code complete, testing is underway.**
  - **Battery management - performance is stable**
  - **CSS noise dropouts**
  - **Solar eclipse on Jan 4**
  - **Thermal sensor (RTD/TIB) management**
  - **Adjusted the Earth Avoidance Angle from 20 deg. to 5 deg. (2010-259)**
- **GI Cycle 4**
- **Level 1 requirements review on May 19 - Passed!**
- **Press and outreach coordination and planning, tied to major science results releases.**

Observations summary (since last meeting)

- Almost exclusively in nominal data taking in survey mode
  - 50 deg rocking angle from May 27 2009 onwards
  - Adjusted the slew rate to slow the transition and lower peak wheel speeds (2010-259)
  - Changed phase (to perform rocking maneuver when Earth is cooler to minimize battery heating).
- ARRs (1-2 per month)
  - Duration of ARR reduced to 2.5 hours (from 5 hours)
- 2 TOO
  - Cygnus X-3, Crab
  - Being more proactive about notifying community
- 1 modified survey mode observation
  - Two orbits south, 1 orbit north to enhance coverage during PSR B1259 periastron.
- LAT Calibrations
  - ~6 hours

Nadir pointed observation

- **Accepted cycle 4 GI proposal to point at the Earth**
  - **50 Orbits**
    - **Nominally 2 orbits/day, 1 day per week for 25 weeks (i.e. 3 hours per week)**
    - **Starting in the Autumn**
  - **Planning a test observation in July**
    - **Some planning/preparation required as we may need to adjust configuration of the observatory (LAT, GBM and spacecraft)**

Observations planning

- The Science Policy Document (linked from the main Fermi users group page) describes the current policy for balance of observation modes
  - >70% sky survey + ARR
    - ARR rate is lower than originally planned, duration now shortened
  - <= 20% pointed mode, planned TOO
    - None in cycles 1,2,3;
  - <= 10% Mission discretionary time - MDT (unplanned TOO, time critical science observations between GI cycles, calibrations)
    - 3C454.3, Crab and Cyg-X3 TOOs; PSR B1259 modified survey mode
    - Small amount of calibrations/engineering <1 day/year
    - Reported to FUG
- Unused pointed mode and MDT allocation is assigned to sky survey.

- It was anticipated that we may want to increase the allocation of pointed mode later in the mission - do we?

Data, software and all that

- **Formed a steering group between project, LAT team and FSSC to coordinate releases of LAT data and software updates.**
  - **Low background data selection available in November LAT data update - DONE**
  - **Plans for updated instrument response functions (improved description of PSF and effective area) - DONE**
  - **Updates on diffuse models, catalog, data processing**
  - **Discussions on release of additional software - python scripts, pointlike etc**
  - **Future enhanced data releases - LAT burst mode data etc**

- **LAT, GBM, FSSC group to exercise and validate GRB (LAT +GBM) analysis methods.**

LAT "burst mode" data

- LAT team has developed GRB analysis methods that use loose event selections (sometimes known as LLE - LAT Low Energy).
  - Provides additional effective area (I.e. more counts) especially at low energies.
  - Very high background contamination.
- Details of final event selection and reconstruction parameters is not yet finalized, but it is clear that this type of event selection is useful for GRB studies with LAT.
  - Data volume is very high (factor of 10-30 greater than current LAT data)
  - Analysis requires instrument responses calculated with a dedicated montecarlo simulation of the GRB location.
- Investigating ways to make this data (and associated high level products needed for its analysis) produced more routinely for each GBM trigger.
  - Goal is to make these data publicly available by the end of the year

Solar Flares And The LAT

- **Solar flares cause increased hit rate in the ACD:**
  - **Pile-up effect:**
    - **Most pronounced in the largest tile on the side towards the Sun.**
  - **Does not affect the ACD Veto which is used onboard in the trigger and event filters.**
  - **Does not cause any loss of events onboard.**
- **Photon identification algorithm:**
  - **Uses the total energy in the ACD.**
  - **Increased ACD activity causes the classification algorithm to reject the event.**
  - **This causes an offline photon (identification) loss:**
    - **We have the events but they are not identified as photons!**
- **Data Quality Flag:**
  - **Periods with significant photon rate loss are flagged as BAD in the FT2 file.**

Sun position in FT2 file

- **During periods when the sun is very bright, it is essential to exclude times when the sun lies close to your ROI**
  - **FSSC provided a script to add sun location to the FT2 files, users can use gtmktime to define time periods to exclude from the analysis (described in a note to fermi-news, and as a news item on webpage)**
  - **LAT team is planning to update the FT2 file definition so that the Sun position is always written to the FT2 files (so that users will no longer need to run the script).**

GI Program Review

- Part of a general evaluation of the NASA R&A program (including APRA, ATP, ADP).
- Chandra, Spitzer, Hubble and Fermi were asked to present to the panel
- Fermi presentation was at the AAS meeting in Seattle
- The following slides are from that presentation…

Program Description

- **Unique nature of Fermi defines GI Program**
  - **Proposals are typically requests for grant support rather than data rights, spacecraft orbits or *ksec***
  - **NOAO, NRAO & Suzaku(new) joint programs**
  - **Pointed observations (ToO &/or Scheduled)**
- **Open to international community**
  - **No grants issued outside the US**
- **Proposal Categories**
  - **Data analysis, coordinated observations, & theory**
- **Proposal sizes**
  - **Regular: 1 or 2(new) year, ~<$80k/year**
  - **Large: up to 3 years, ~<$200k/year**
    - **Accommodate investigations that require significant resources, or a long duration (e.g. MW monitoring campaign)**
- **GI program developed in partnership with the Fermi Users Group**
- **$8M total budget**

Assessing program success

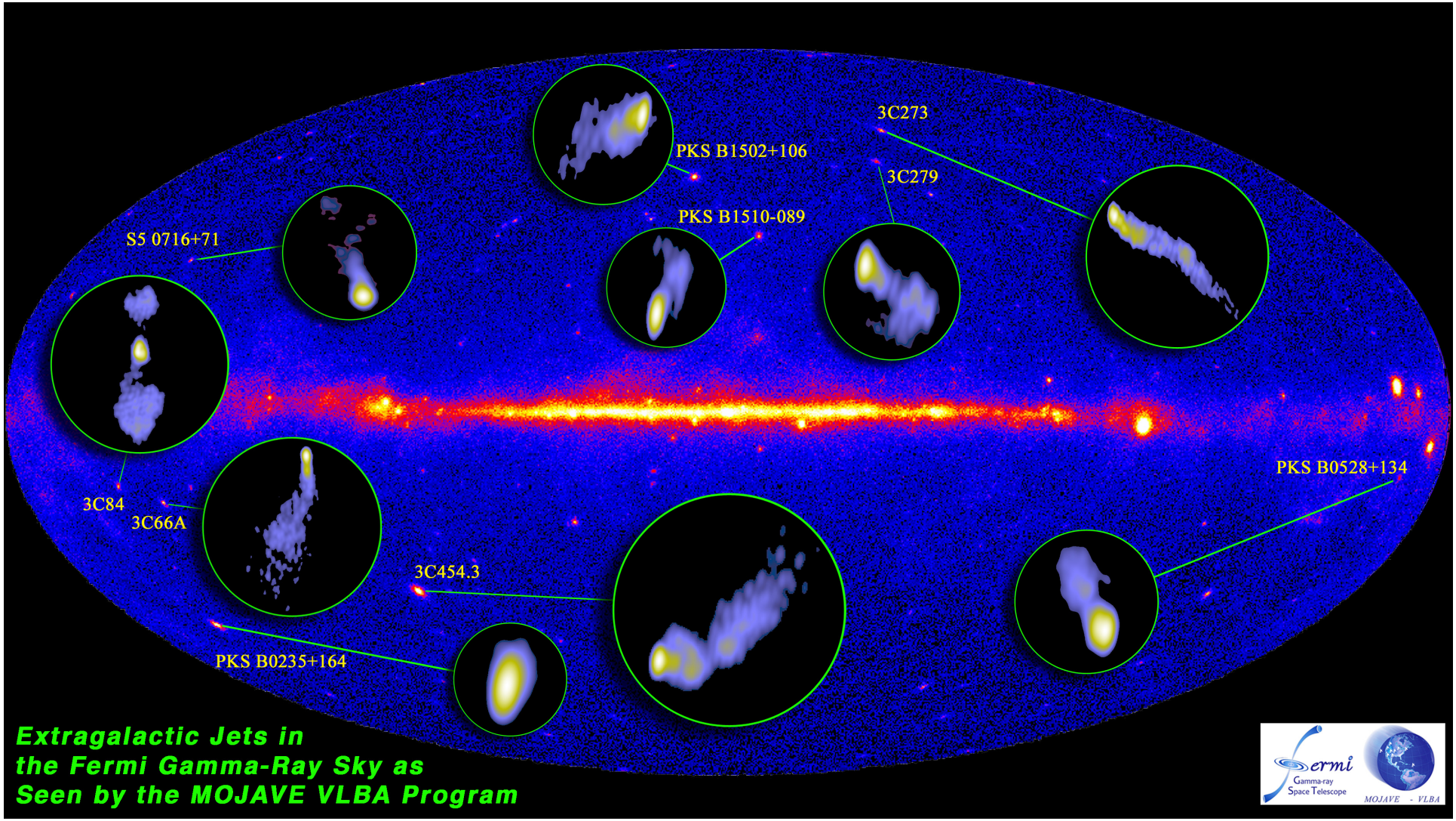
- **Large proposals**
  - **Progress report due each year, reviewed by GI review panels.**
  - **Strong encouragement to provide community resource**
    - **software, models, MW data**

- **Regular proposals**
  - **For two year awards, we will ask for a progress report at the time that the second year of funding is requested.**

Assessing Program Success

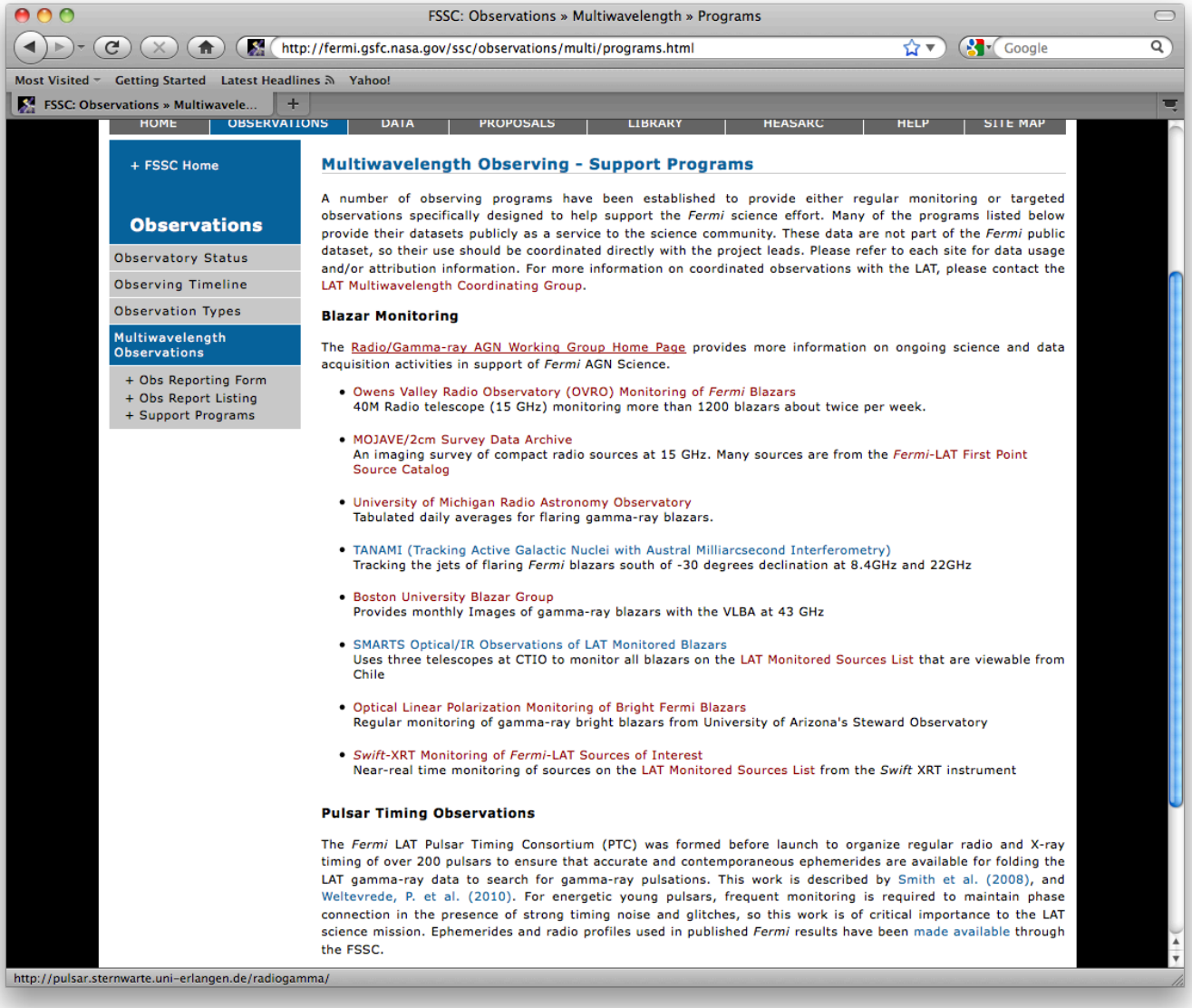
- **Fermi Users Group**
  - **Reviews plans for each GI cycle (including review process, program changes etc)**
  - **Reviews results**
- **FSSC and Fermi project organize regional GI workshops.**
  - **Los Angeles, Santa Cruz, Berkeley, Palo Alto, Chicago, Boston, New York, Ann Arbor**
  - **Solicit feedback and suggestions from prospective and past GIs**

VLBA Monitoring of Fermi AGN with MOJAVE

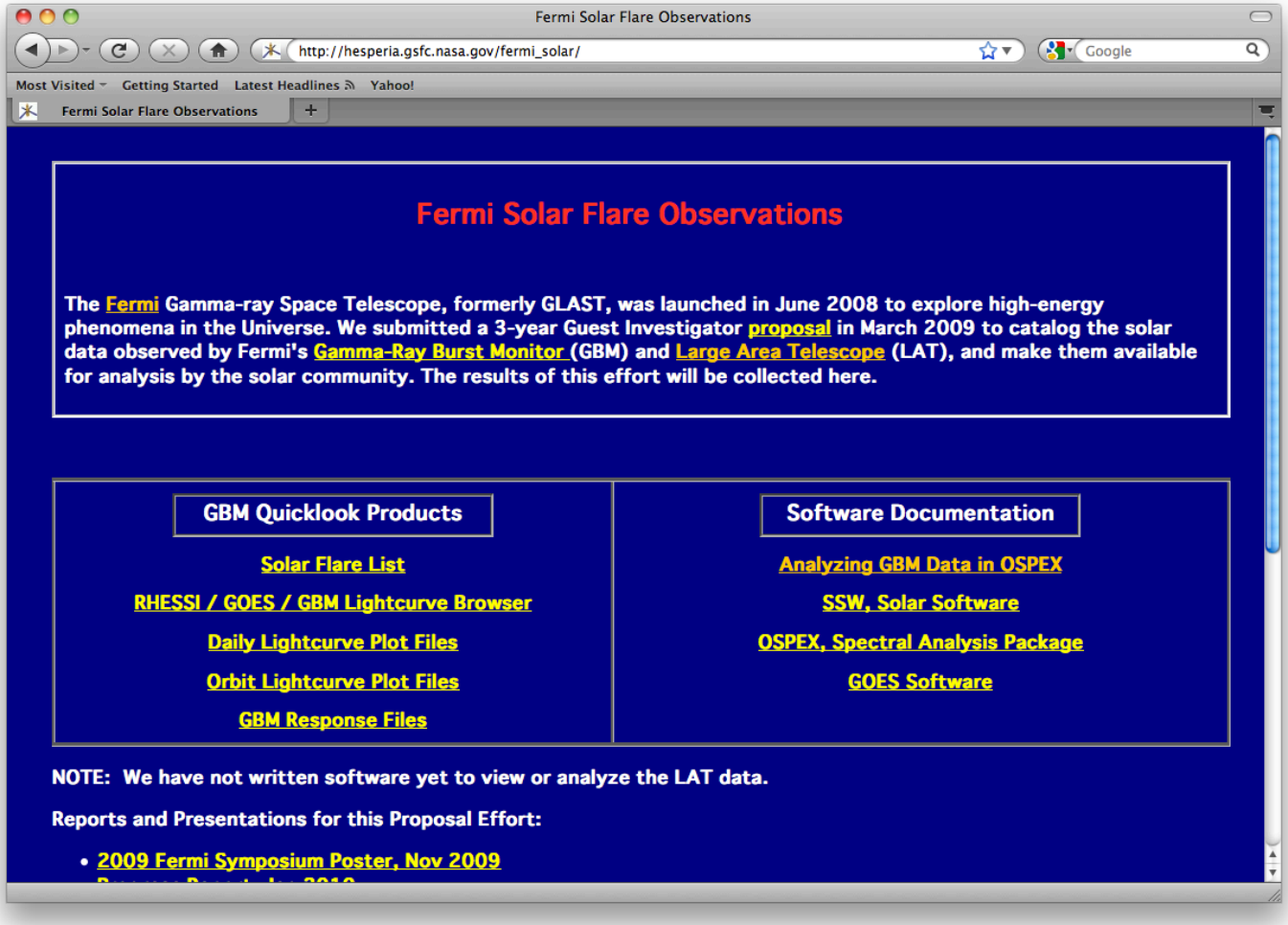


- **M. Lister et al, Large, Correlative**

Leveraging GI program to provide MW resources



Solar Physics with Fermi

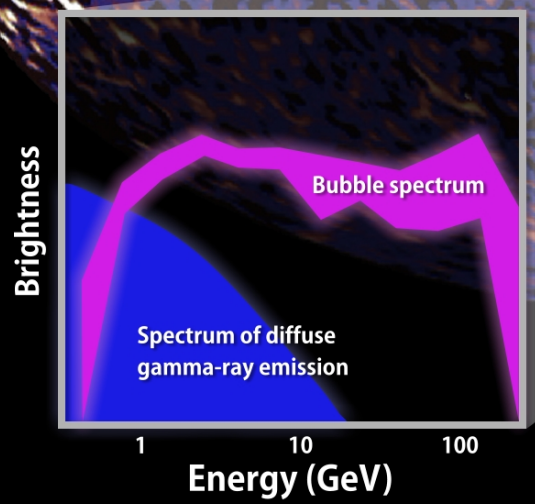


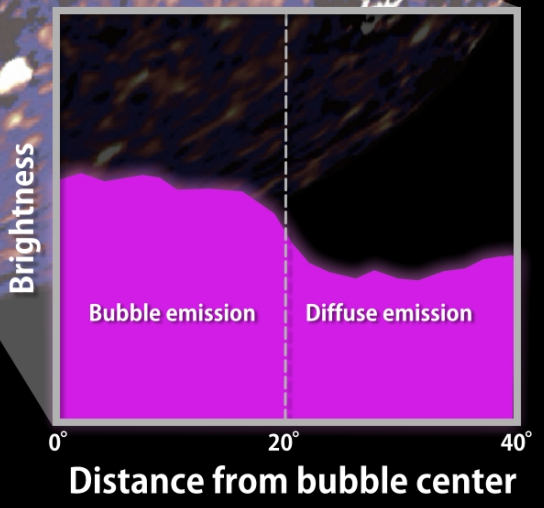
- **Making Fermi solar data available in formats compatible with standard solar analysis software.**
- **B. Dennis et al, Large proposal, data analysis**

Fermi Lobes

The bubbles display a harder (more energetic) spectrum than the diffuse emission.

The bubbles display sharp edges (less than 2°), which suggests a sudden, impulsive event.





D. Finkbeiner et al, Regular, data analysis

Pulsar Timing

- **Pulsar timing**
  - **Gamma-rays**
    - **Timing models of gamma-ray pulsars (P. Ray, Regular, data analysis)**
  - **Radio**
    - **Timing models of young radio pulsars (F. Camilo, regular, correlative)**
    - **Search for ms pulsars at location of Fermi sources (S. Ransom, regular, correlative)**

Pulsar timing models are essential for many Fermi studies (not just pulsars!), LAT team collects timing solutions, FSSC makes these available to the community.

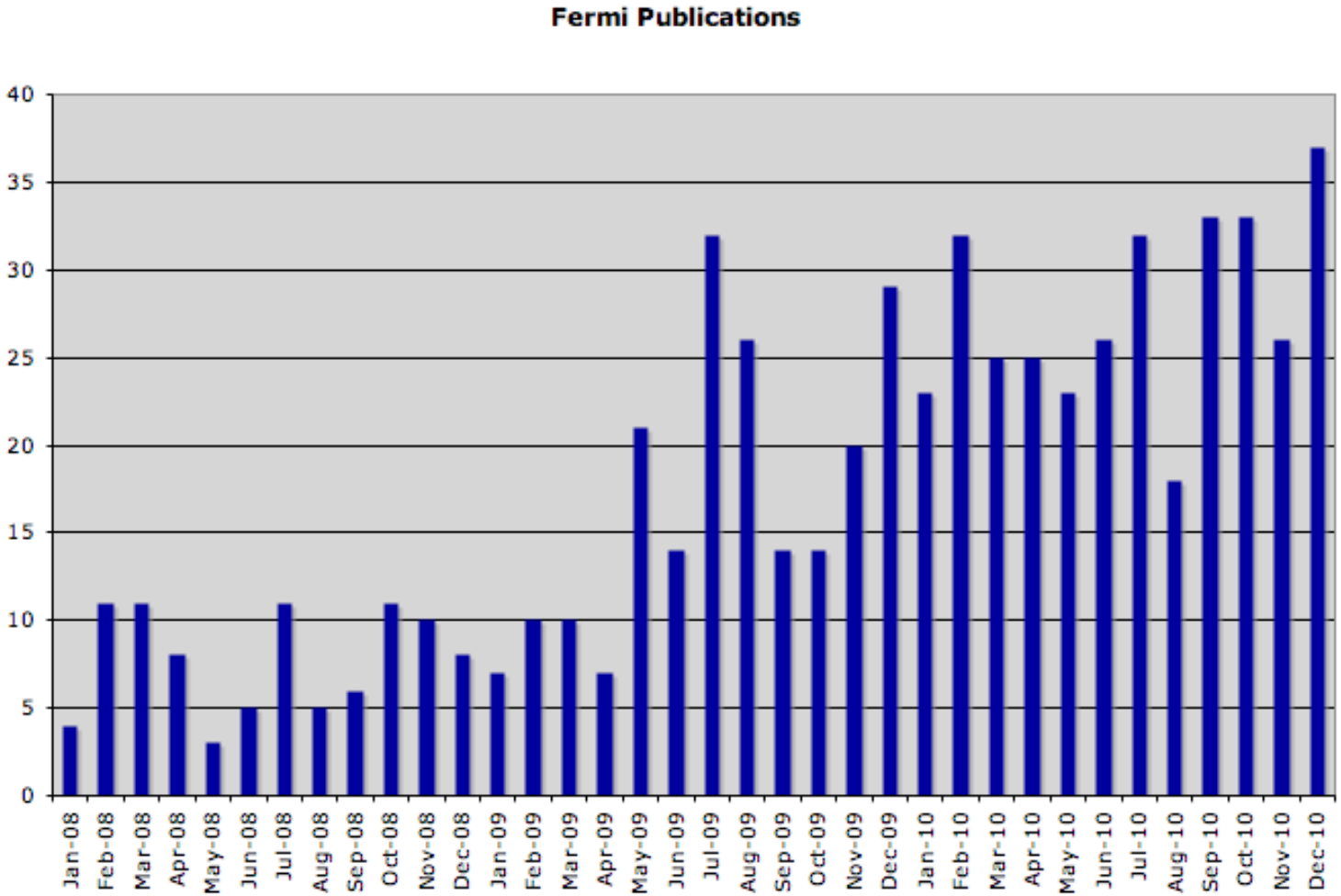
GI program provides funding for the analysis, and observations (from NRAO program)

GI Program Review Summary

- **Primary role of the GI program is to provide financial support for Fermi studies**
  - **GI program has supported many significant science results**
  - **GI program enables GI's to obtain and distribute resources that are of use to the Fermi science community**
- **The Fermi GI program was developed with the input and guidance of the Fermi Users Group.**
  - **All changes are reviewed by (and often suggested by) the FUG**
- **The FSSC and the Fermi proactively seek feedback and input from the GI community.**
  - **Workshops, booths at major meetings etc**
- **Suggestions on how to improve the Fermi GI program are always welcome.**

The Fermi GI Program is extremely important to the scientific success of the Fermi Mission

Published Refereed Papers



Also collecting lists of PhD students using Fermi data.

Fermi and Public Outreach

- Now make short video podcasts to accompany each press release
  - Post on nasa.gov, youtube (nasa channel), Goddard
- Over 700,000 views on 3 videos produced since last November.

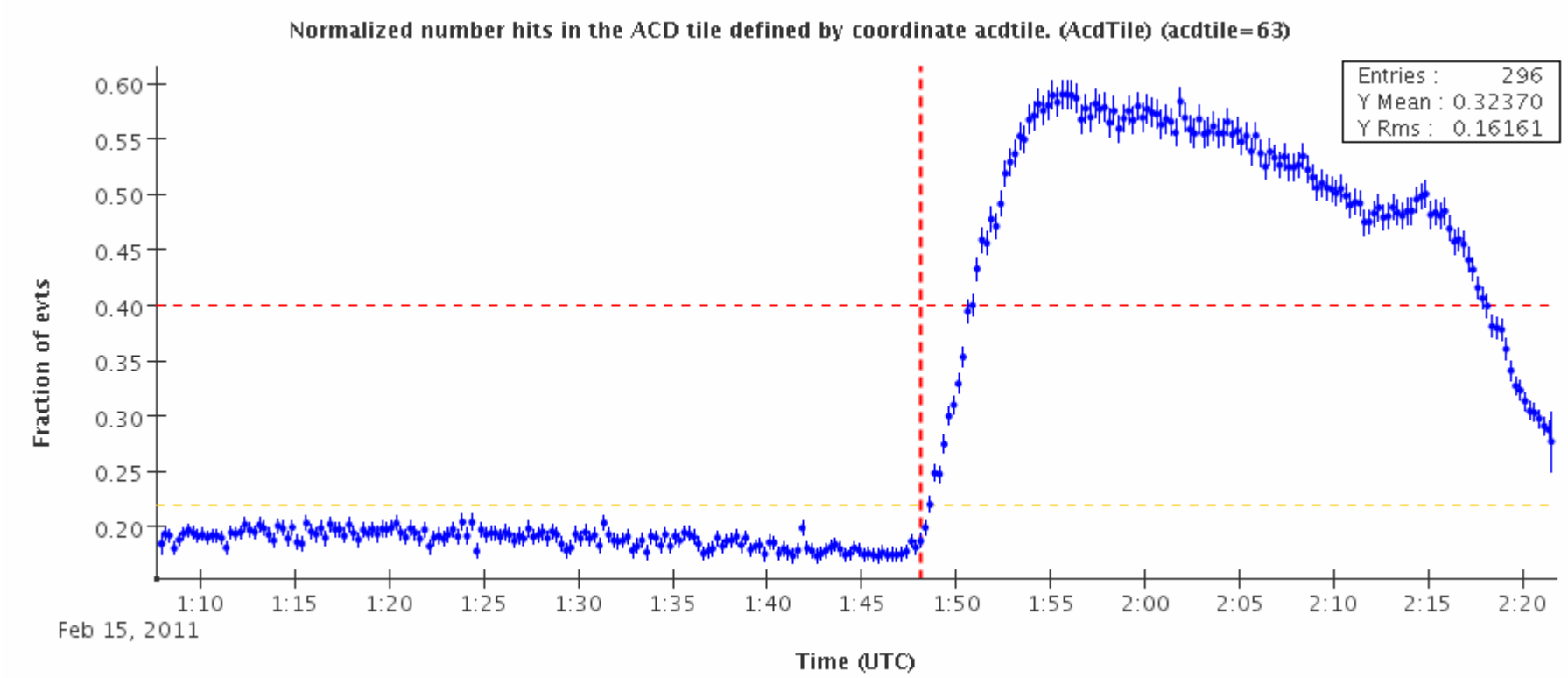
- "NASA's Fermi Catches Thunderstorms Hurling Antimatter into space," AAS press briefing, Jan. 10. Story picked up by Time, USA Today, PC World, Ars Technica, IGN, Yahoo News
- "NASA Satellites Find High-energy Surprises in 'Constant' Crab Nebula," AAS press briefing, issued Jan.12. Spent about two weeks as a NASA.gov most-viewed story. Picked up by New Scientist, MSNBC, Space Daily, Sify, Astronomy, SatNews, Physics World
- "NASA's Fermi Finds Giant, Previously Unseen Structure In Our Galaxy" and held media telecon (Nov. 9); resulted in stories in: New York Times, LA Times, USA Today, Nature, Science News, Discovery News, Space.com/MSNBC, AFP, UPI, BBC

Fermi Gamma-ray Space Telescope

Questions?

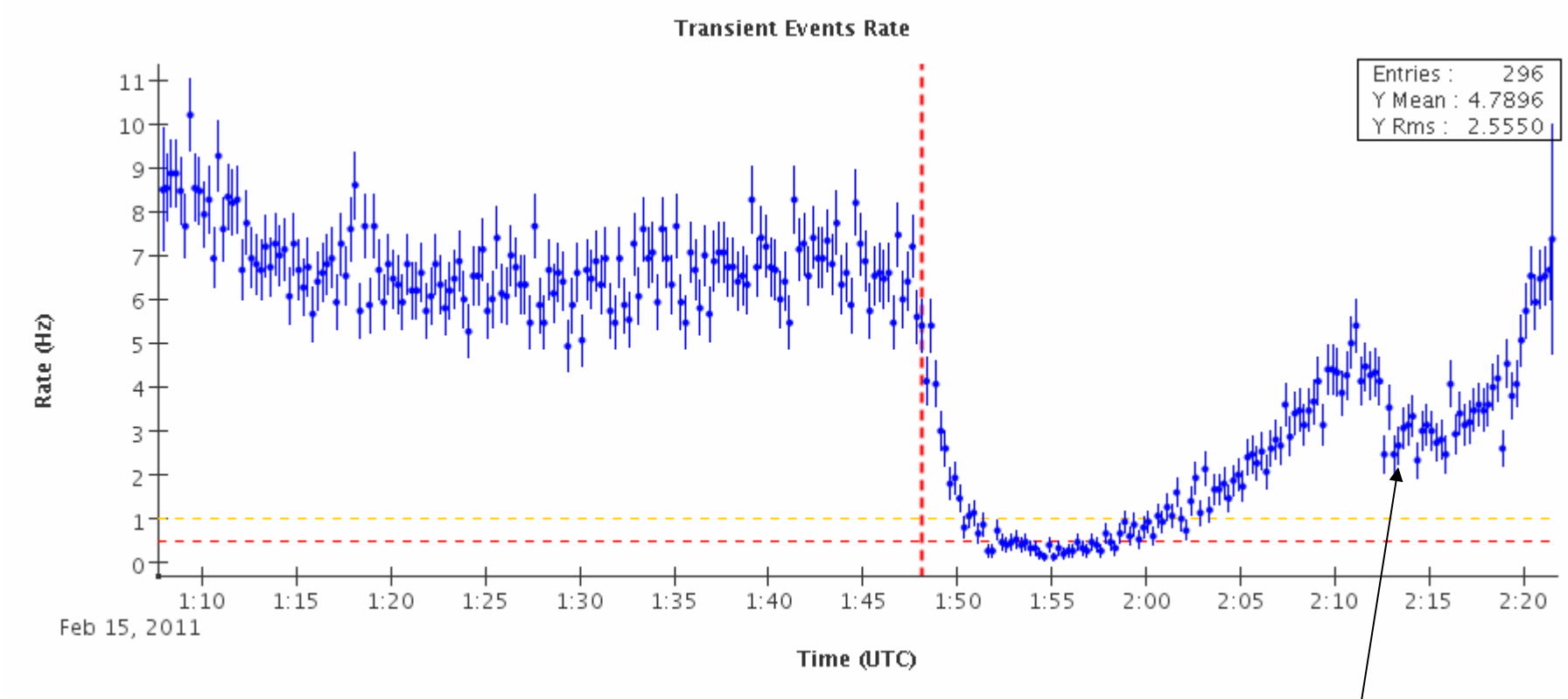
February 15, 2011 X-Class Solar Flare

Normalized rate of hits in the largest ACD tile on the Sun side



February 15, 2011 X-Class Solar Flare

Transient Photon rate



This drop is due to Rocking