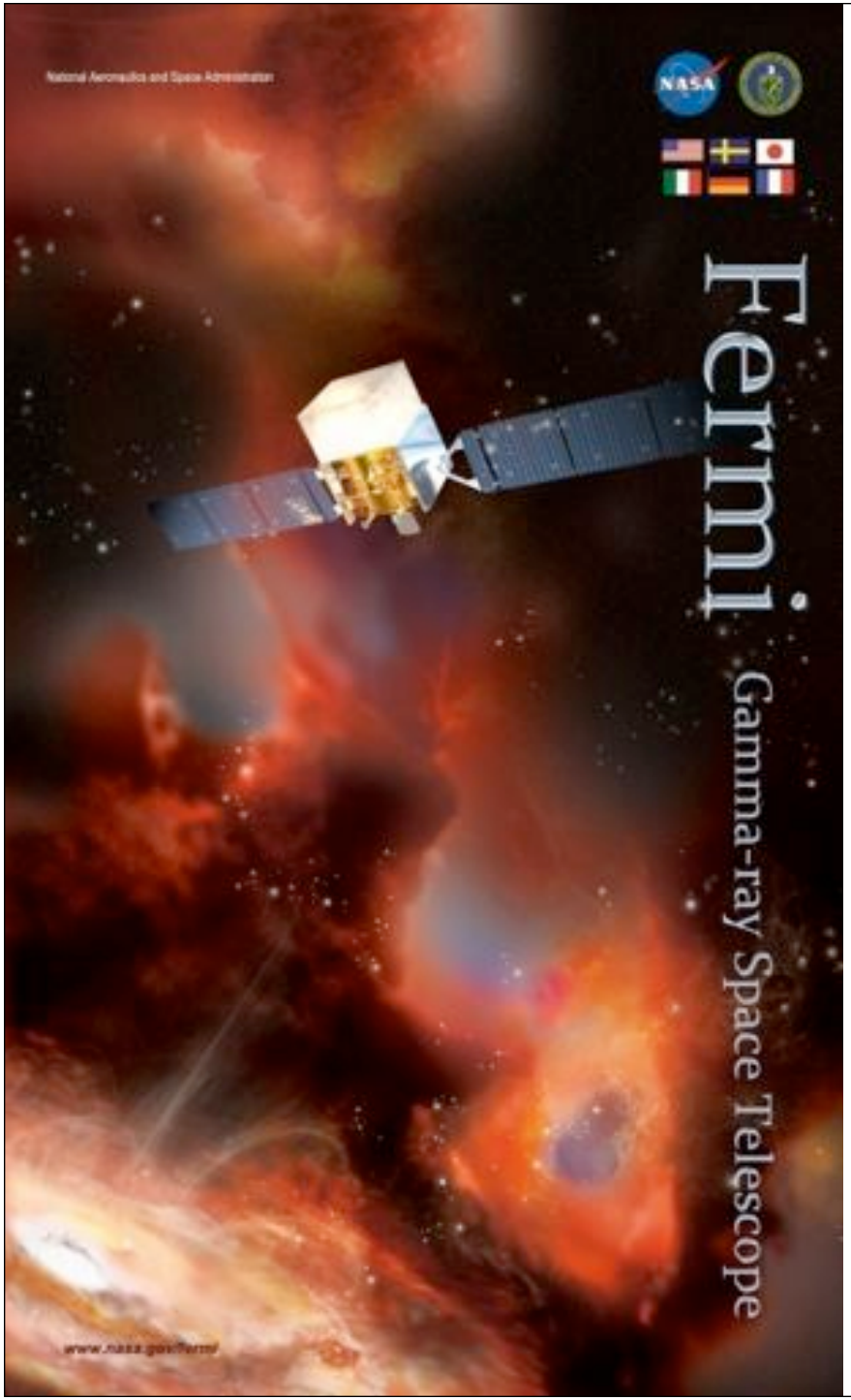


A catalog of flaring gamma-ray sources

Alice Allafort[1]

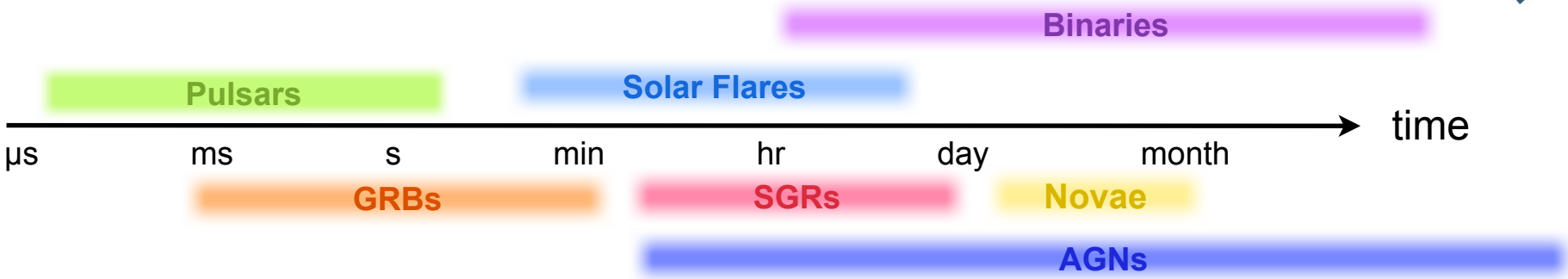
Rolf Buehler[1], **Marco Ajello**[1,2], **Stefan Funk**[1],

on behalf of the *Fermi*-LAT Collaboration

[1]Stanford/SLAC/KIPAC, [2]UCB

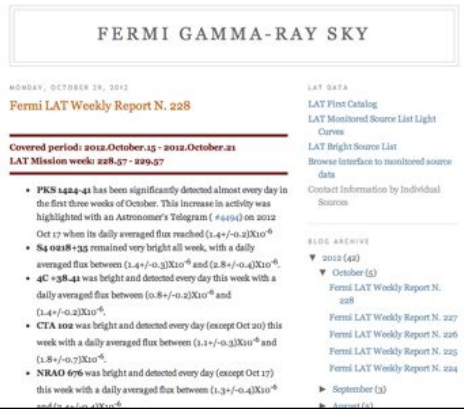
4th Fermi Symposium -- Oct 28 - Nov 2, 2012

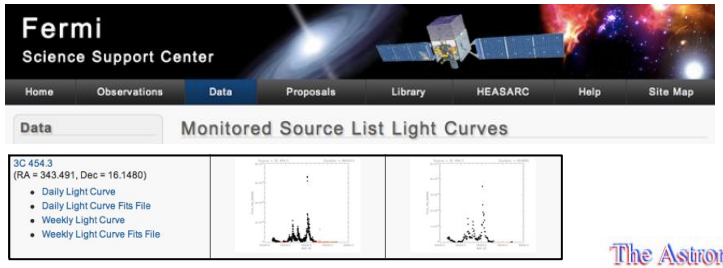
Variability in gamma rays with *Fermi*



- New sources detected or identified through their variability
- *Fermi* continuous full-sky monitoring for the multi-wavelength community

- Current flaring monitoring with the *Fermi*-LAT
  - Automated Science Processing, based on daily peak finder and likelihood analysis
  - *Fermi* blog, Monitored sources light curves, ATels






The Astronomer's Telegram

Identification of the new gamma-ray blazar NRAO 676 through Swift follow-up observations

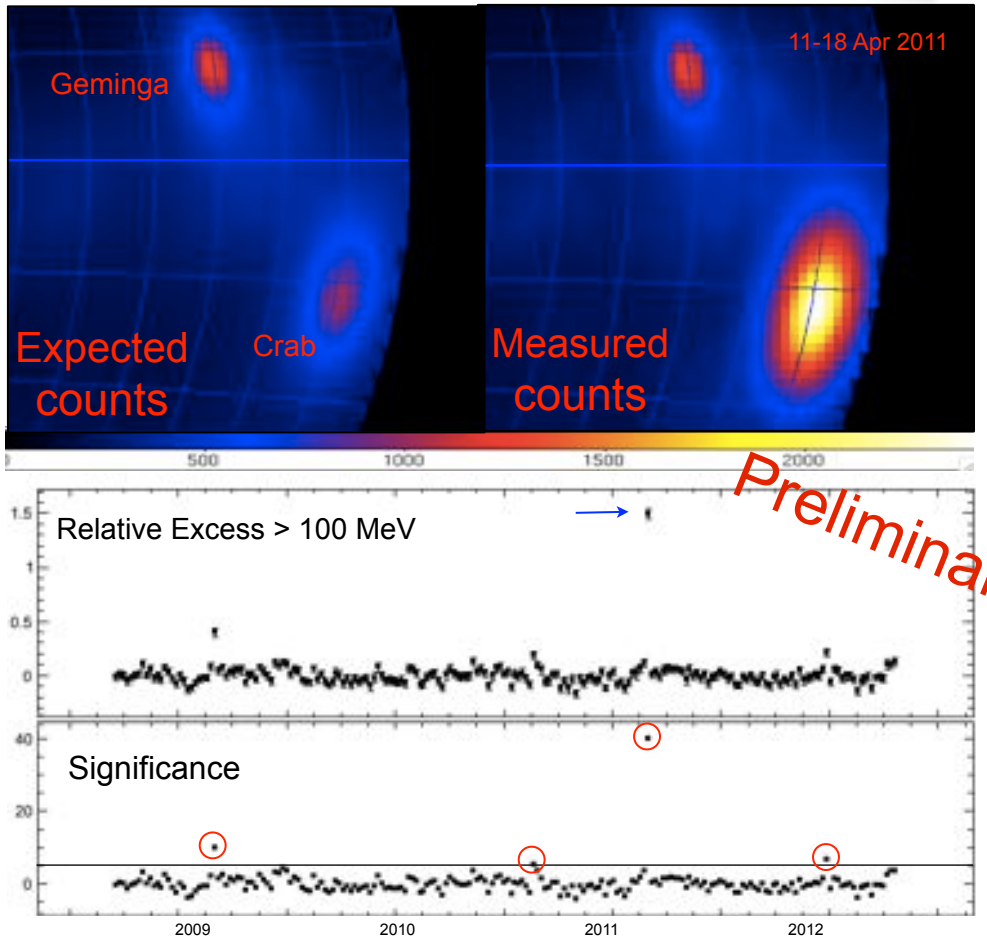
ATel #4527; Stefano Ciprini, Dario Gasparrini, Sara Cutini (ASDC and INAF Rome, Italy) on behalf of the Fermi Large Area Telescope Collaboration
on 29 Oct 2012; 16:18 UT
Credential Certification: Stefano Ciprini (stefano.ciprini@asdc.asi.it)

Principle

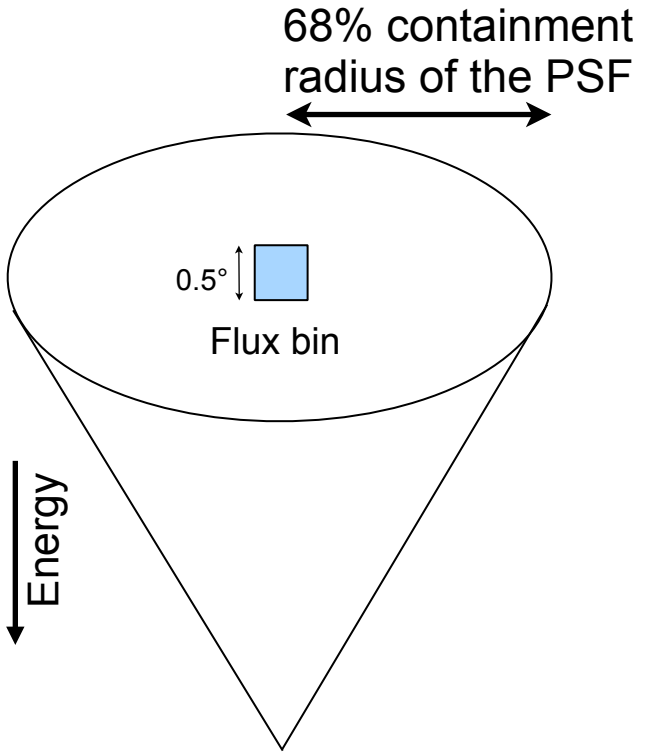
We compare the **observed** photon counts to the **expected** value from long-term average.

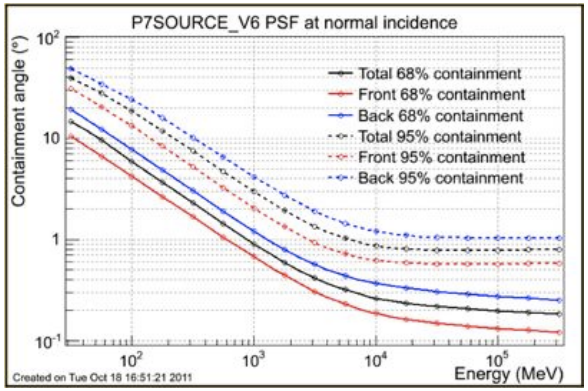
- Arbitrary time binning and energy range
- Simple and fast
- No systematics due to the modeling of the diffuse emission

  → particularly suited for **plane transients**
- Unbiased view of the whole sky, including negative fluctuations



Method





- **Observed** counts maps are generated by counting events within a 68% containment radius *as a function of Energy and Incidence angle* ***(E,θ)***
- An **expected** counts map is generated from:

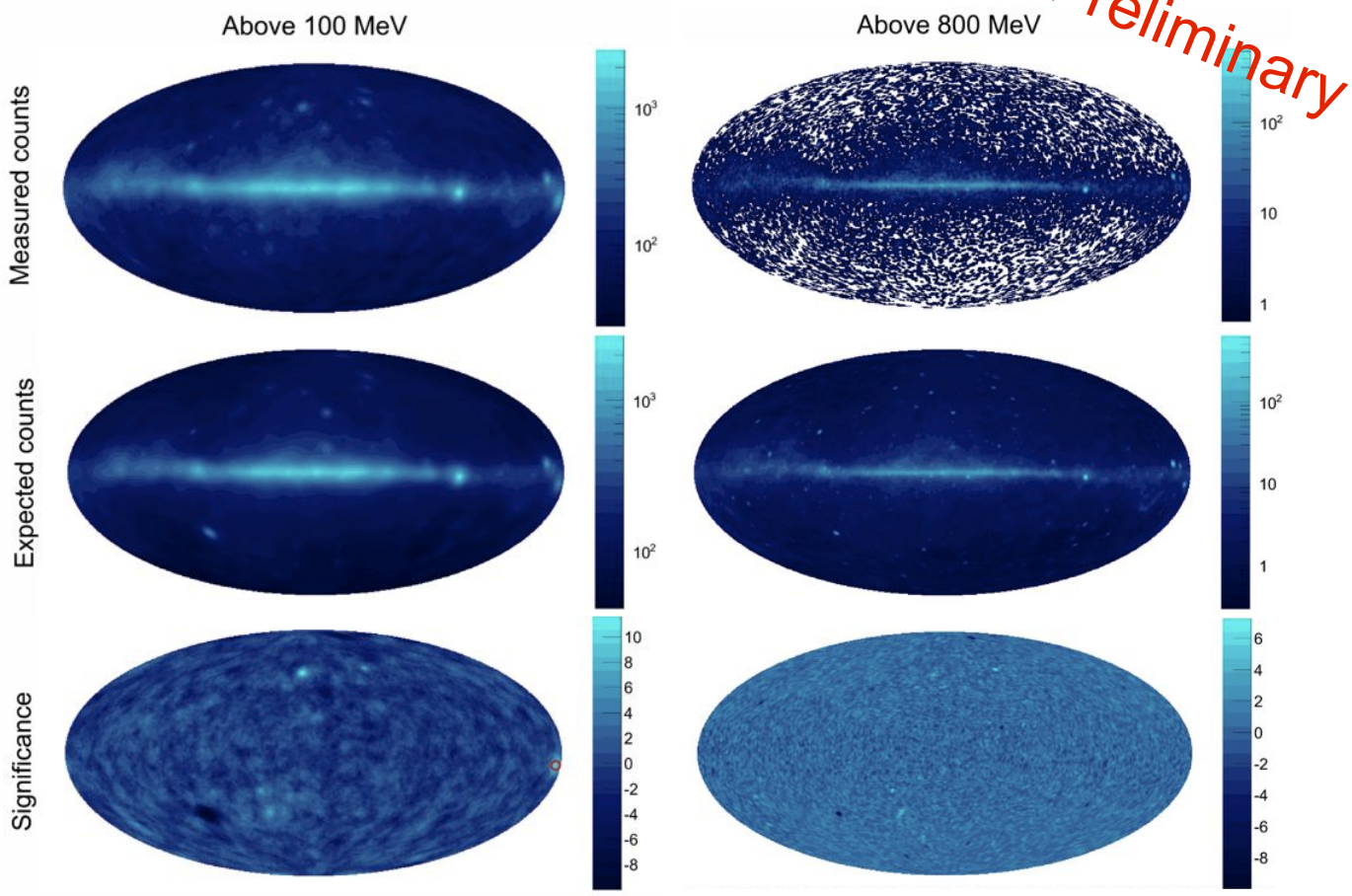
$$N_{expected} = \sum_{E,\,\theta} N_{total} * \frac{\varepsilon_{week}}{\varepsilon_{total}}$$

ε: exposure (E,θ)

- Significance using Poisson statistics

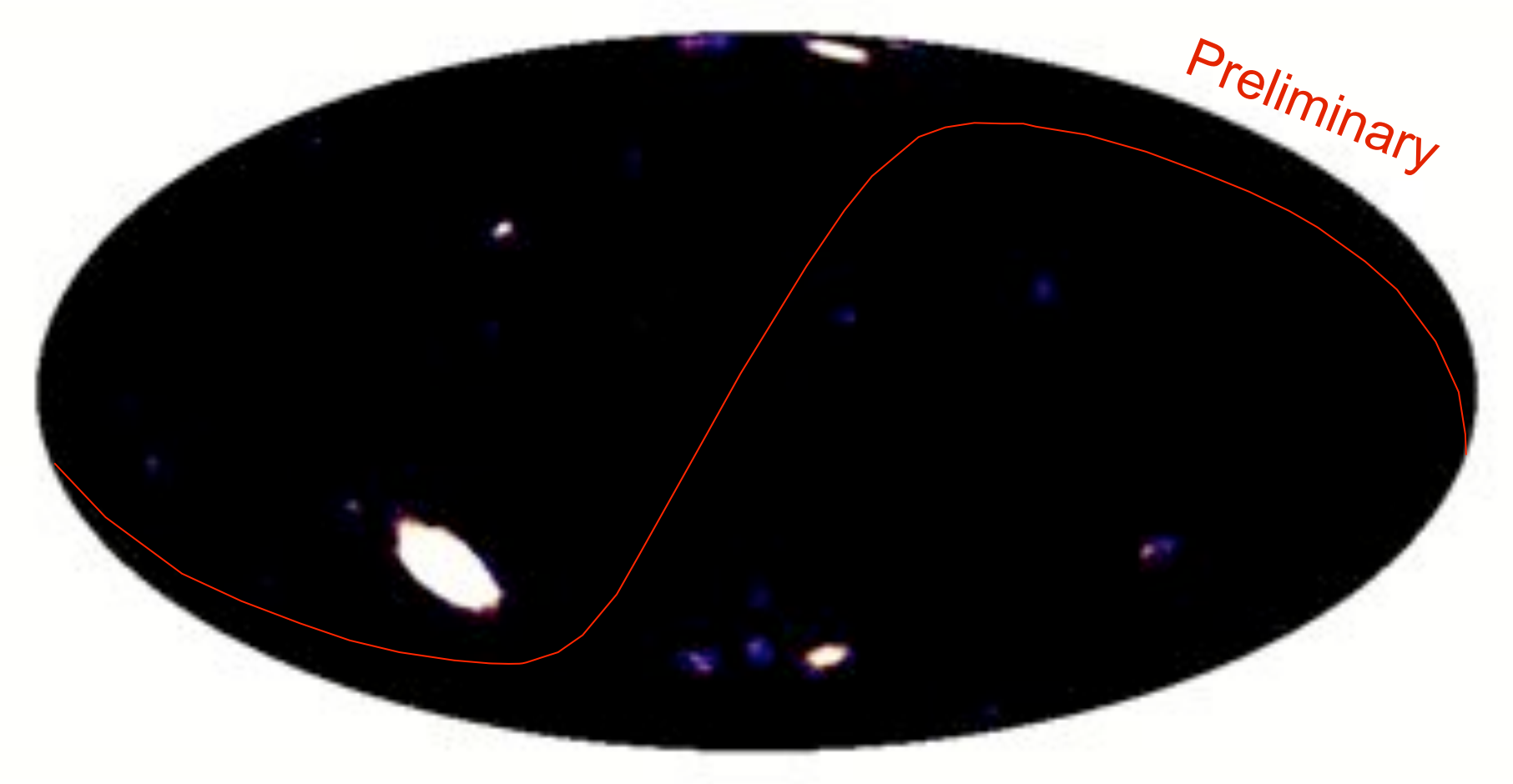
Technique

Example for one week:



Extract peaks with significance >5σ above 100MeV or >5.5σ above 800MeV
→ expect ~1 false flare over entire sky and 206 weeks

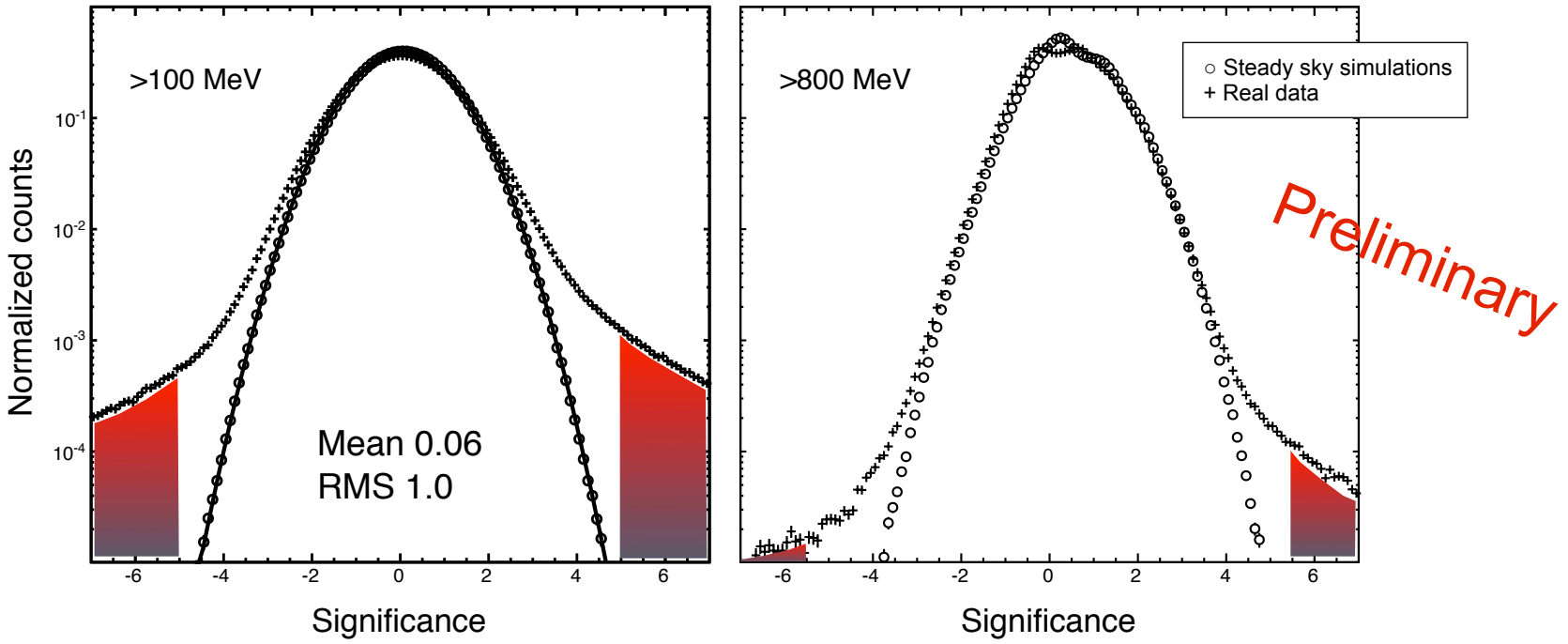
Weekly analysis



Motion of the Sun: appears as variable source along ecliptic

➤ Exclude flares within 15° of the Sun.

Validations



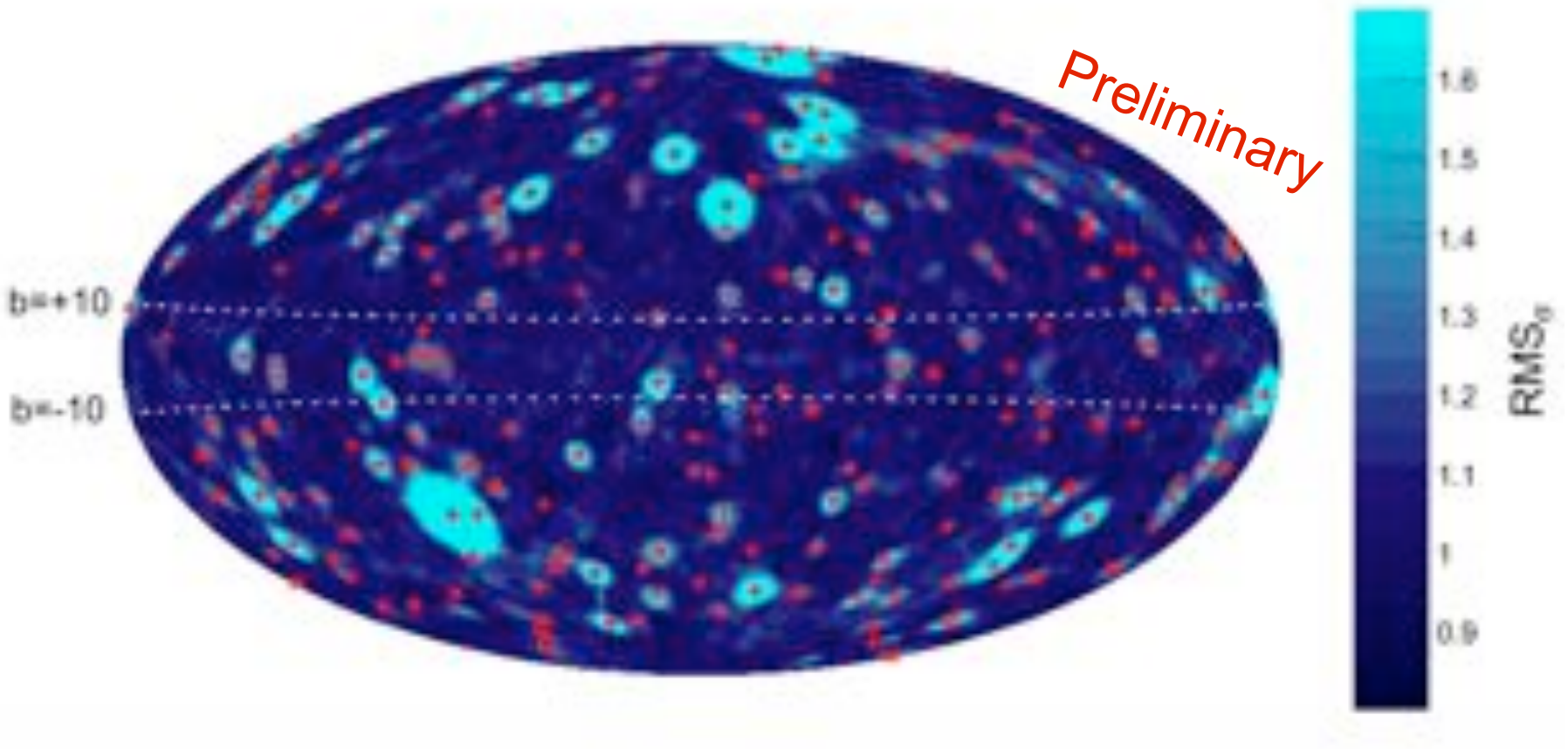
Tests with non-variable full-sky simulations for 36 months of data.

➤ method works: Significance follow a Gaussian distribution with RMS 1.0

Systematics errors on level similar to the 2% adopted for the variability analysis of the 2FGL catalog (Nolan et al. 2012)

➤ Vela and Geminga compatible with constant

All sky catalog



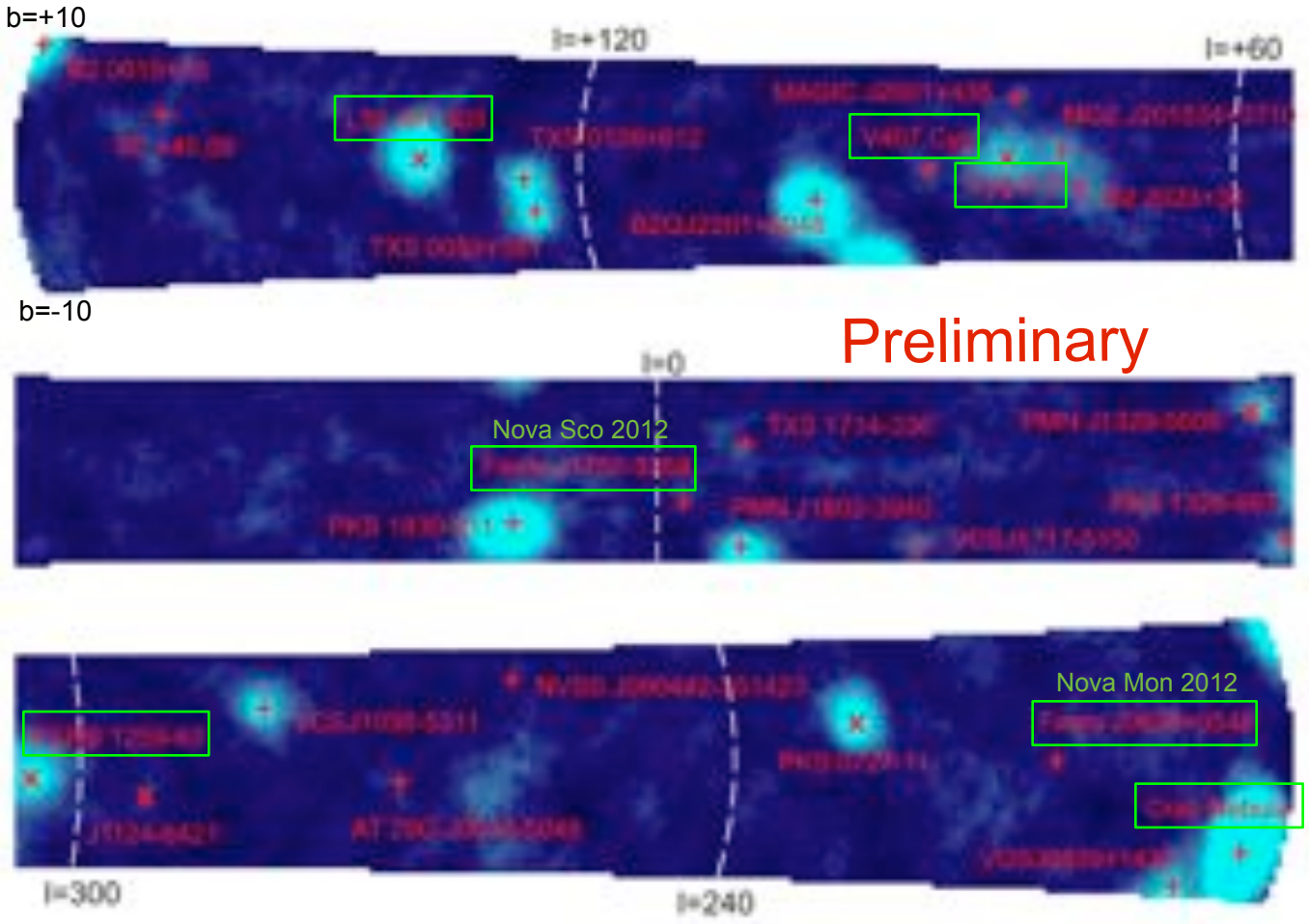
- Weekly flares grouped using a Minimum Spanning Tree algorithm
- Built a catalog of 218 flaring sources

167 sources associated with 2FGL blazars

29 sources with no 2FGL association

Find the 4 most fluent GRBs:
GRB080916C, GRB090510, GRB090902B, GRB090926A

Galactic plane transients



Total of **27** Galactic plane transients.

7 of known Galactic origin:
- 3 Binary systems
- Crab Nebula
- 3 novae

(Talk by C. Cheung)

20 sources coincident with AGNs

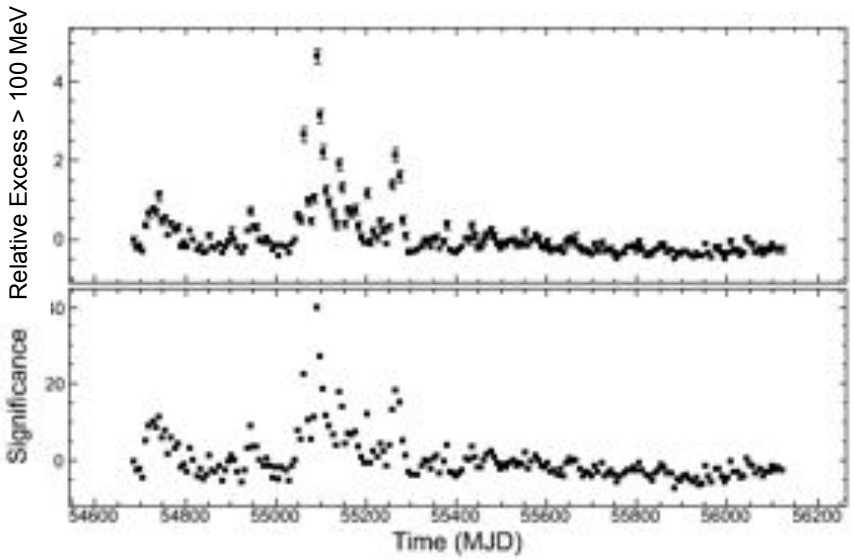
From the AGN flare density in the extragalactic sky, we expect 23±2 flares in the Galactic plane.

AGN "Fractional Variability"

- **Instantaneous access to lightcurve for any point in the sky**
- **Compare different AGN populations:**

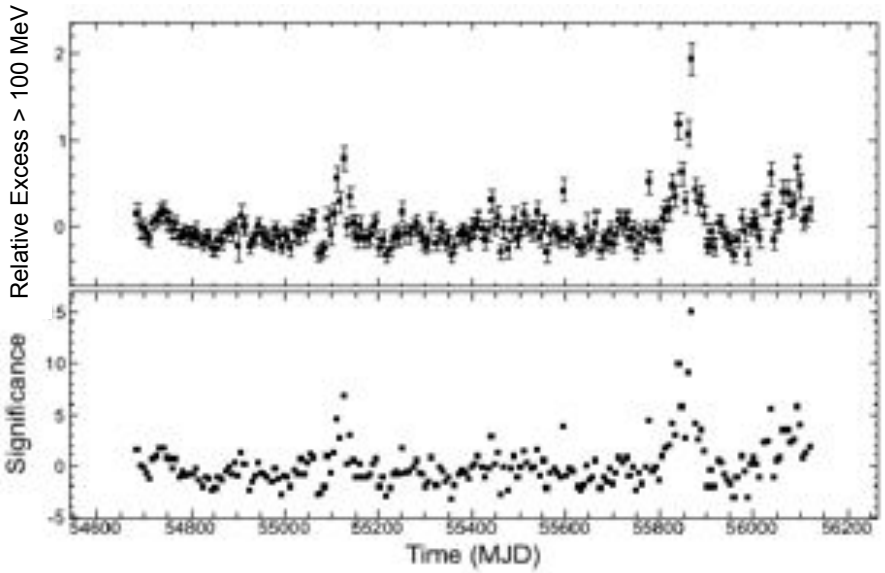
FSRQs

ex: 3C 273 with 22 weeks flaring



BL Lacs

ex: OJ 287 with 7 weeks flaring



Talk by B. Lott and others

Conclusion

- **First all sky catalog of *Fermi*-LAT flaring sources: 218 detected on weekly timescales.**

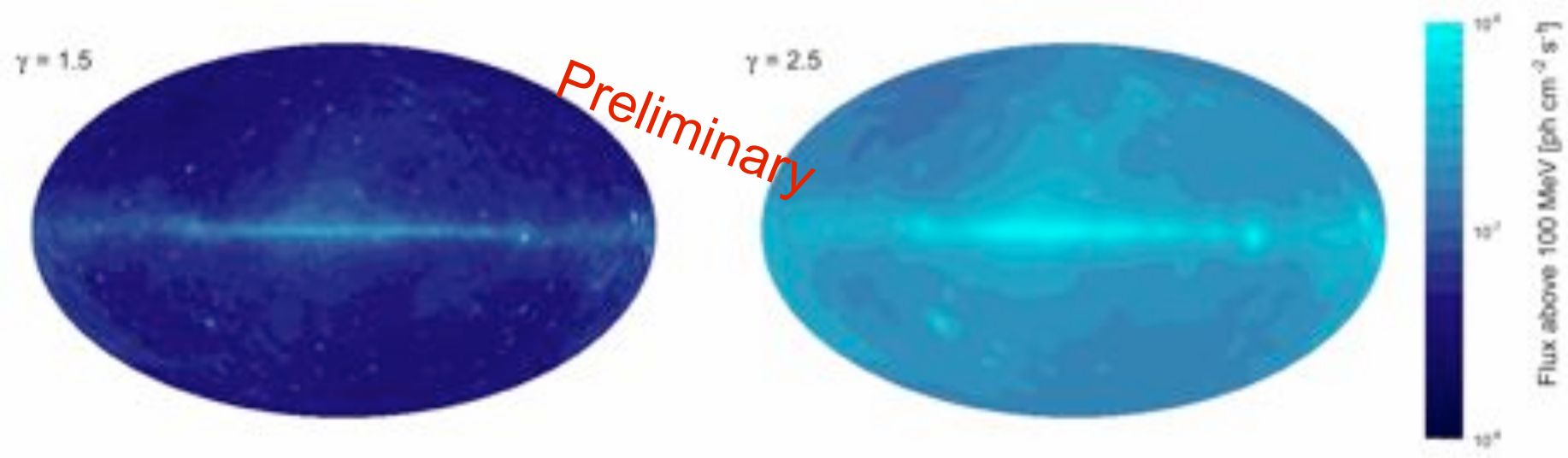
- **Variable source populations:**
  - **Characterize AGN populations properties**
  - **New Galactic gamma-ray transient population: Novae**
  - **Other Galactic sources expected with known binaries and AGN density.**

- **Toward an exhaustive view of the variable sky**

- Ongoing additional projects:
  - Real time online product available to the public
  - Testing on other time scales

Backup

Sensitivity



Average weekly flux required for catalog detection