Monitoring the Sun with the Large Area Telescope

Nicola Omodei, Stanford University
on behalf of the Fermi Large Area Telescope Collaboration

Abstract

Every orbit the Sun crosses the field of view of the LAT for approximately twenty minutes, making Fermi a valuable resource to monitor high-energy gamma-ray radiation during solar flares. Fluxes and upper limits (>100 MeV) are derived in near real time and are made accessible through public websites. We present preliminary comparisons between Pass 7 and Pass 8 data, showing that, thanks to increased effective area, to improved spatial resolution, and to new event classification, the new Pass 8 data enhance the capability of the LAT to observe solar flares.

The **SunMonitor** analysis: automated pipeline scripts analyze Fermi LAT data **>100 MeV** accumulated during consecutive 3 hours time windows (approximately 2 orbits). *Unbinned* Likelihood analysis is performed selecting a 12 degrees region centered at the Sun position. When the Sun is significantly detected (Test Statistics>20) the Flux >100 MeV is computed (red point), otherwise the Upper Limit (at 95% C.L.) on the flux is calculated (blue points).
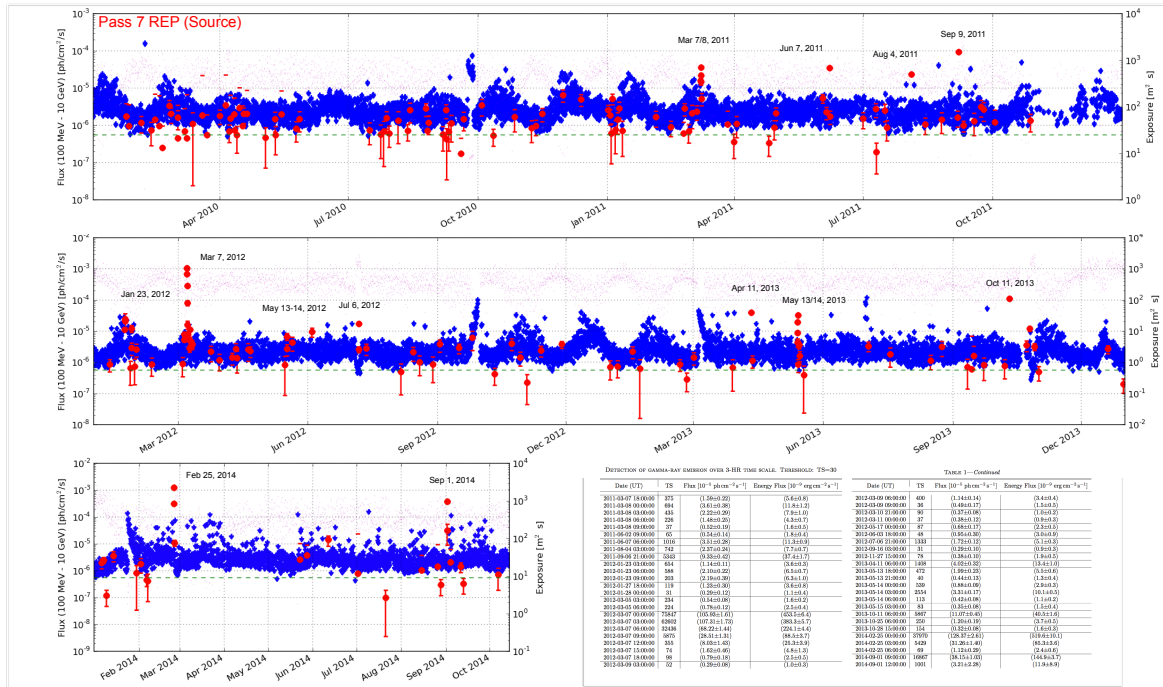
Availability of the results: flux values are calculated quasi real-time and uploaded to public websites:

RHESSI browser:
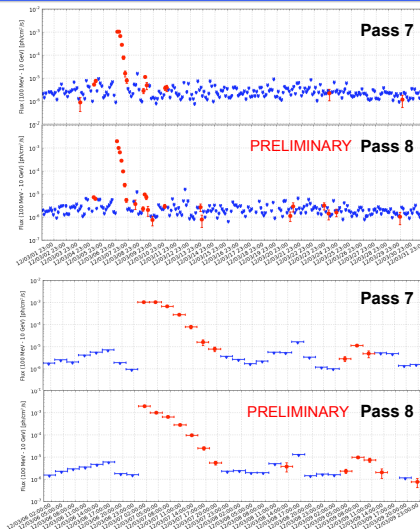http://sprg.ssl.berkeley.edu/~tohban/browser/

Fermi solar:
http://hesperia.gsfc.nasa.gov/fermi_solar/

Stanford University:
http://www.slac.stanford.edu/~omodei/ SunMonitor/_PNG/

Caveats: This analysis is only a quick look and more careful analysis should follow up! (i.e. Bad Time Intervals are not removed and might introduce errors in the calculation of the flux for very bright Solar Flares, when the ACD pileup is an issue!)

Pass 7 REP (Source)

Mar 7, 2012 — Jan 23, 2012 — May 13-14, 2012 — Jul 6, 2012 — Apr 11, 2013 — May 13/14, 2013 — Oct 11, 2013

Feb 25, 2014 — Sep 1, 2014

DETECTION OF GAMMA-RAY EMISSION OVER 3-HR TIME SCALE. THRESHOLD: TS=30

Pass 8 is coming up!

Pass 7

PRELIMINARY Pass 8

Pass 7

PRELIMINARY Pass 8

Pass 8 analysis: the LAT team is redesigning the reconstruction, event selection and classification analysis, **improving LAT performances at both low and high energy**. Preliminary results show that, without optimization of the **SunMonitor** analysis, with Pass 8 more solar flares will be detected with larger statistic and better resolution.

SDO/AIA 304 Å — SDO/AIA 304 Å — SDO/AIA 1600 Å
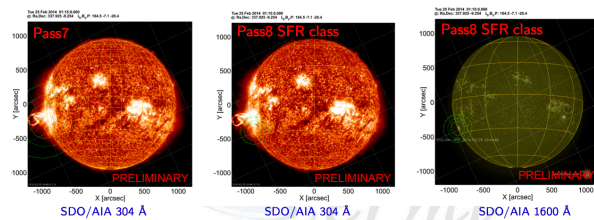
-Larger effective area at low energy to increase the number of detection and better constrain the spectral shape;
-Improved Point Spread Function to better pin-point the site of gamma-ray emission;
-Better control over the ACD pileup resulting in larger statistics and accurate measurement of fluxes during bright solar flares;

"If the sun refused to shine, I would still be loving you." - Led Zeppelin