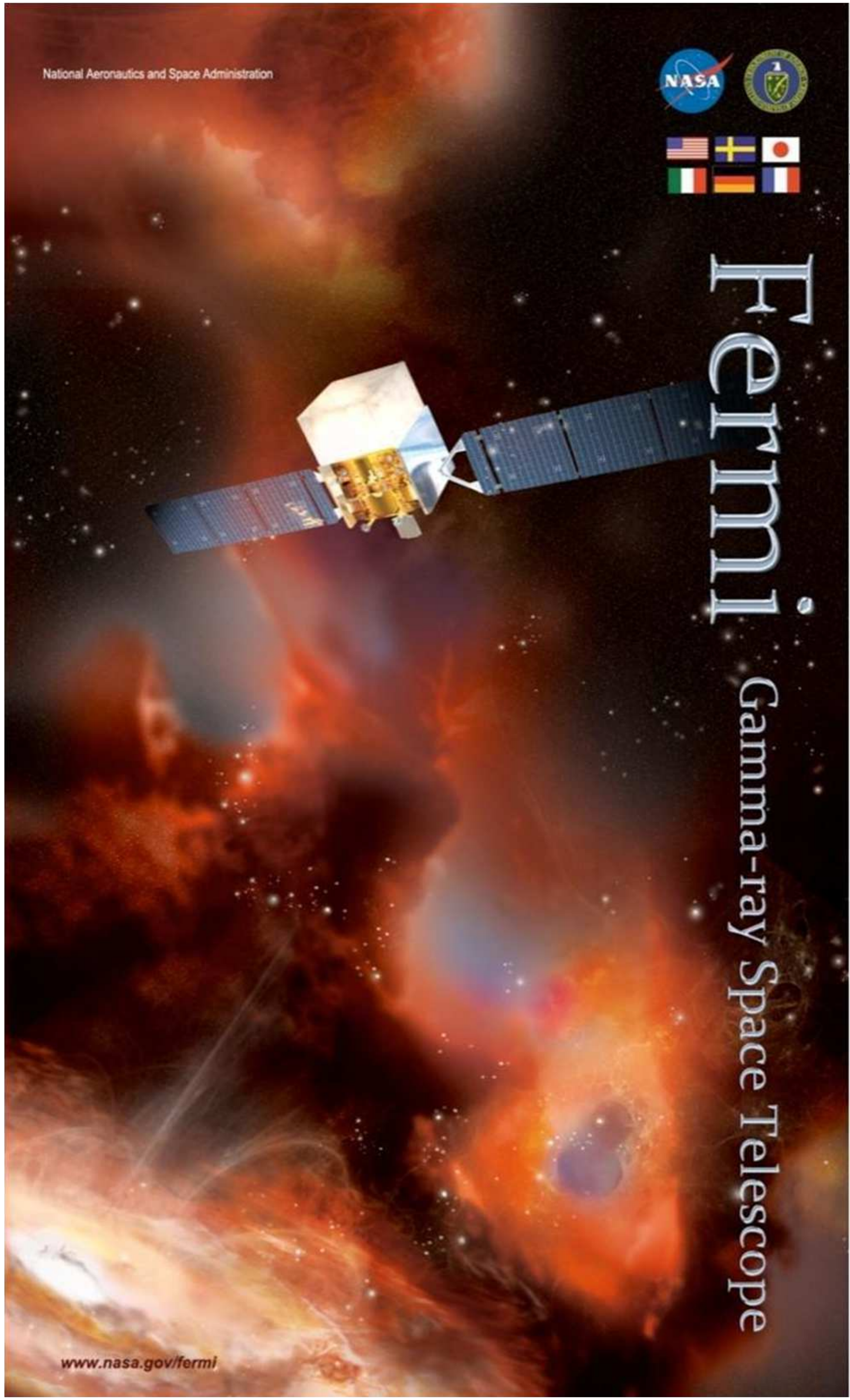

An adaptive-binning method for LAT lightcurves

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Motivations

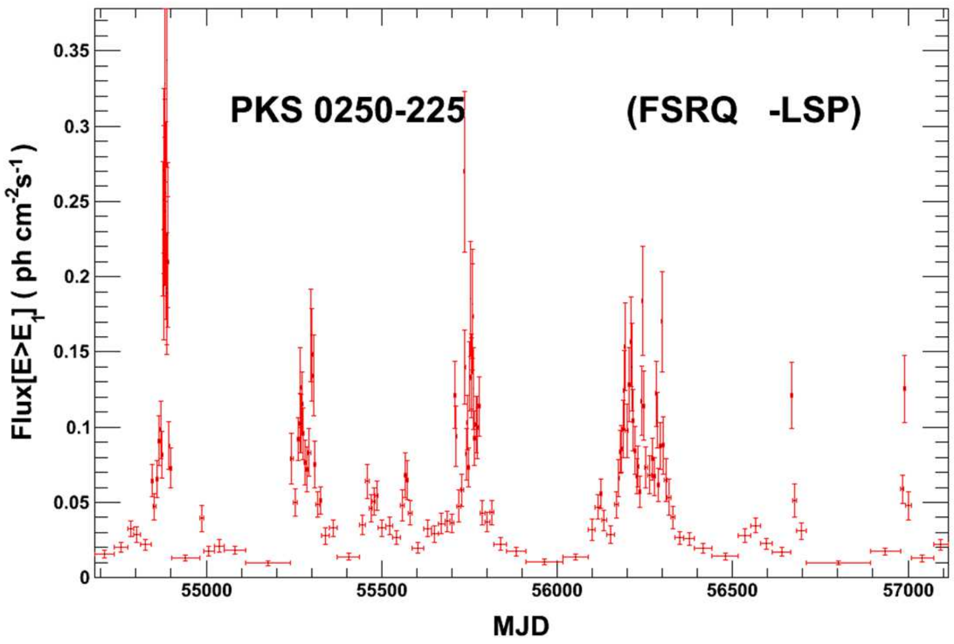
Principle: **adapt the bin widths of a light curve according to a user-defined condition, constant relative uncertainty on flux or constant significance**

Similar to « constant signal-to-noise ratio » prescription used at other wavelengths

Aiming at mitigating the following deficiencies of fixed-binned light curves:

- **too short bins: upper limits**
- **too long bins: loss of information**

See Lott et al., 2012, A&A 544, A6 for details



A few words of caution:
A short bin is *not* equivalent to a short flare (in contrast to the Bayesian-Block method)!
Bin width depends both on flux and exposure.

https://www.slac.stanford.edu/~lott/ABM/ABM_appendix.pdf

Technicalities

Input:

- FT1 file (ROI centered at the source location, *time-ordered* photon list)

- FT2 file

« Step 1 »: **Computation of bin list with a simple python script (~10 min) requires a precomputation of exposure vs time (~10 min/year) at one energy (1 GeV), one location**

Options:

- constant relative uncertainty on flux *or* constant significance (TS)

- normal *or* reverse time arrow

« Step 2 »: **Recomputation of flux, index, uncertainties, TS for the different bins with the standard pylikelihood analysis (batch jobs launched in parallel)**

Full package (including tutorial) available at:
https://www.slac.stanford.edu/»lott/ABM_mult_P8.tar.gz

1. Create the input file

The input parameters are contained in ascii file, an example of which (input_J1246.7-2546.txt) is given here (https://www.slac.stanford.edu/~lott/input_J1246.7-2546.txt).

parameter	comment
ft2file = ft2_uptodate.fits	name of the ft2 file covering the whole time range
ft1file = ft1_J1246.7-2546_filt.fits	name of the gtselected ft1 file[1].
MacroC = TS_estimate_P7.C	leave unchanged
rspfunc= P7REP_SOURCE_V15	must match the selection of the FT1 file[2] .
critval = 20.0	criterion: target relative flux uncertainty (here 20%) if crit=1 or target TS if crit=0
crit = 1	0: bin widths based on constant TS, 1: bin widths based on constant relative flux uncertainty
reverse = 1	time arrow. 0: normal, 1: reversed
expfile = exp_J1246.7-2546.txt	name of the output exposure file
anafile= times_J1246.7-2546.txt	name of the output file containing the bin times
SRC_RA = 191.68	source ra
SRC_DEC = -25.78	source dec
Index = 2.10	source photon spectral index
Flux = 1.43e-07	source seed flux [4]
Elowerl = 269.566	lower energy limit of the reported integral flux [5]
normeg=1	normalization of EG background [6]
normgal=1	normalization of GAL background [6]
indexgal=0	spectral index of GAL background [6]

python comp_E1.py input_file.txt

* Confusing sources can be included by running *confusion 3LAC.py*, creating a file sources_in_roi_#sourcename.txt

2. Create the ROI ft1 file, using gtselect+gtmktime; The photon list must be time ordered, this is not always so in the FSSC files. Use: fsort ft1_file_name TIME method = "heap"

3. Compute exposure > python comp_exposure_phi.py input_file.txt

   The exposure file (exp_J1246.7-2546.txt in the above example) is created during this step.

4. Compute the time bins

   python time_estimate_v2.py input_file.txt

5. Perform the standard gtlike analysis using the time bins obtained in step 4 to obtain publishable fluxes.