A Comparison of Spectral Fits using Xspec and Likelihood

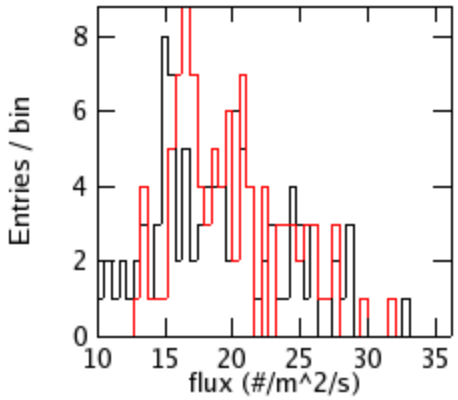
I generated several samples of 100 short, GRB-like transients, using the SimpleTransient class. These bursts were located at (RA, Dec) = (202, -63) degrees and occured at time 3000 MET seconds. These are on-axis events if one uses the default step-rocking orbit available from gtobssim. I analyzed each burst using Xspec and Likelihood. I see no obvious indication of a serious bias for either type of analysis.

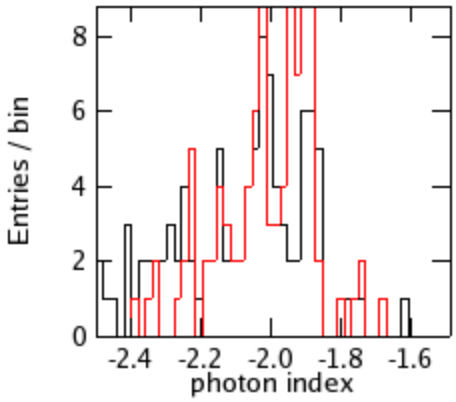
The following table gives a summary of the results:

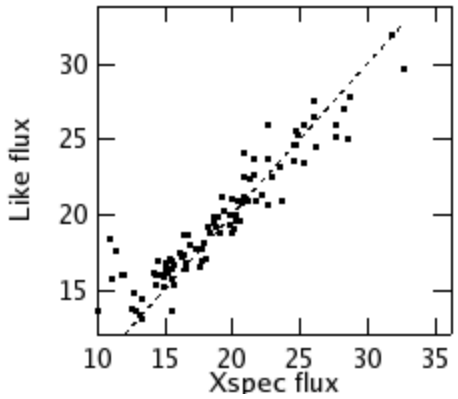
emin	emax	irfs	input flux	dt	Likelihood		Xspec		mean counts
(MeV)	(MeV)		(# m^{-2} s^{-1})	(s)	flux	index	flux	index	
30	200000	TESTF	20	10	20. +/- 4.	• 2.01 +/- 0.14	19. +/- 5.	• 2.08 +/- 0.19	35. +/- 8.
30	200000	TESTF	200	2	200. +/- 33.	• 2.00 +/- 0.10	197. +/- 33.	• 2.04 +/- 0.12	71. +/- 12.
30	200000	TESTB	20	10	20. +/- 5.	• 2.00 +/- 0.17	19. +/- 6.	• 2.08 +/- 0.23	27. +/- 8.
30	200000	TESTB	200	2	209. +/- 34.	• 2.03 +/- 0.09	207. +/- 36.	• 2.10 +/- 0.13	55 +/- 9.

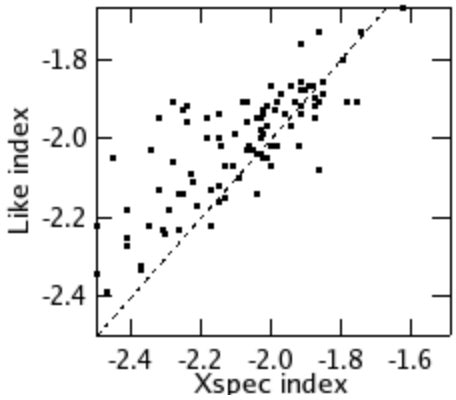
The input photon spectral index was **2** for all trials and dt is the burst duration. The fitted fluxes and indices reported above are averaged over the 100 trials per sample, and the "errors" are the root variances of those distributions. The distributions of the parameters for the Xspec fits may be somewhat broader than they should be since I did not group the channels to ensure at least 20 or so counts per bin (these fits were performed on my laptop, which does not have **grppha** installed), and I used the default chi-square statistic used by Xspec.

Here are plots of the fit parameters for the first line to give some indication of the degree of correlation between the two fits applied to each trial. The black histograms are the Xspec distributions and the red are the Likelihood distributions.









In performing the Xspec fits for these data, I set enumbins=100 for gtrspgen (and set the true energy range to match the energy range I gave to gtbin). For gtbin, I set the number of logrithmically spaced bins to enumbins=10 to help guard against too few events being in each bin. For the Xspec fits I performed on the Checkout 2 data, I used enumbins=10 also for the number of true energy bins for gtrspgen. When I do that for these data, I reproduce the 20% or so discrepancy I found in my previous analyses. Having the true energy bins as queried parameters in gtrspgen is probably not a good idea. The bounds and number of bins should be set to some nominal values **appropriate for LAT data** and be kept as hidden parameters. It should not hurt the accuracy of the Xspec fits if the true energy bounds encompass a far wider range than the channel energy bounds given to gtbin since the finite energy dispersion will effectively truncate the true energy spectrum to the relevant energy range anyways.