GRB analysis: FSSC's Perl script and the GBM Catalog

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Step 0: Notes

1) To characterize the light curve: a) the script uses a Bayesian-block method; b) the catalog uses RMFIT
2) To characterize the spectrum: a) the script uses the results from the light curve analysis to define the burst and background time intervals (with the background always taken before the start of the burst); b) the catalog uses RMFIT, with time intervals defined independently of the light curve analysis

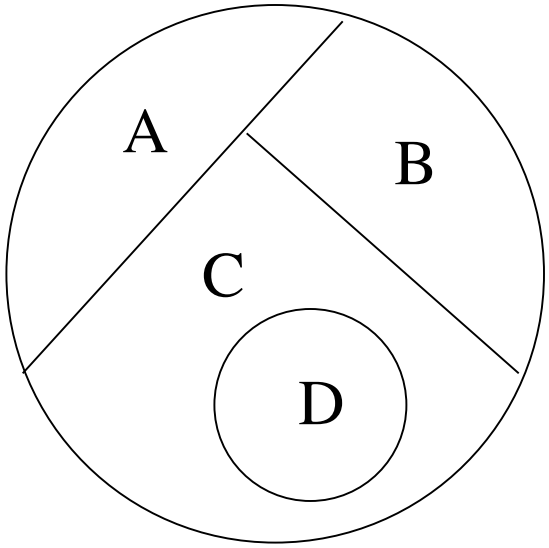
Step 1: Run script in standard mode

1) Version of software: ScienceTools-v9r27p1-fssc-20120410
2) Out of the 489 GRBs from the GBM Catalog, two are missing tte files (080804456 and 091006360)

Step 2: Script's general results

1) Case A : no light-curve extraction due to too low (<1.5) S/N
2) Case B : no bkg intervals obtained, despite S/N>1.5
3) Case C : the light curve analysis converged
4) Case D : the spectral analysis converged

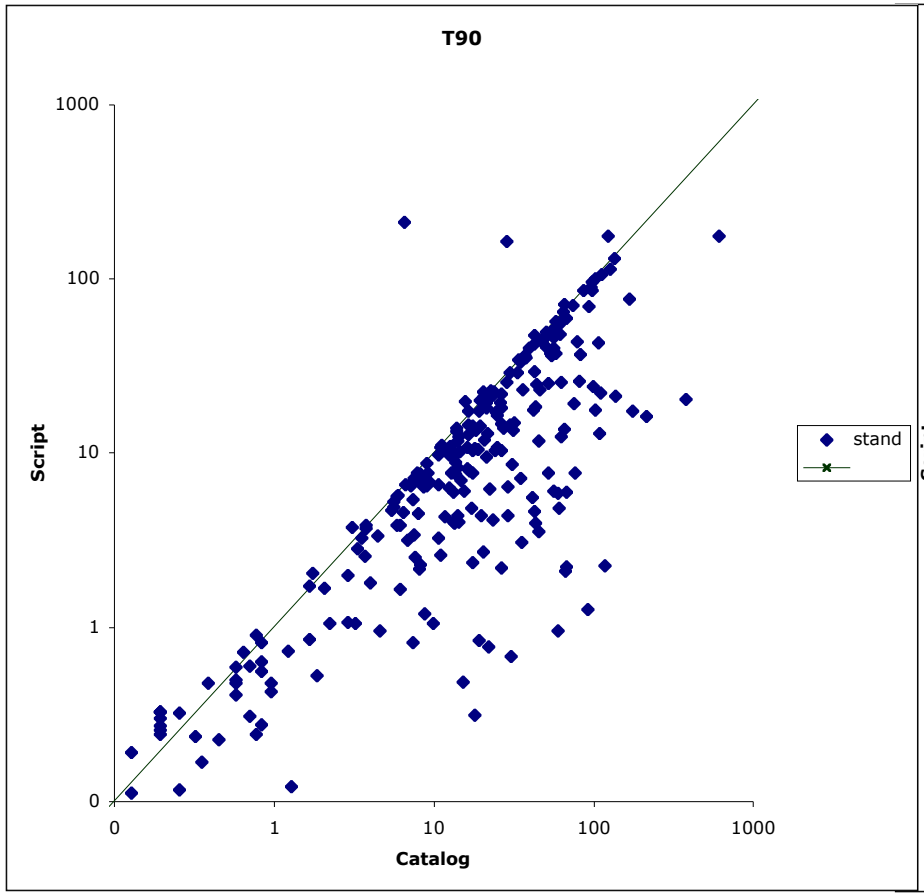
Standard: A=156, B=61, C=270 (Tot=487), D=262



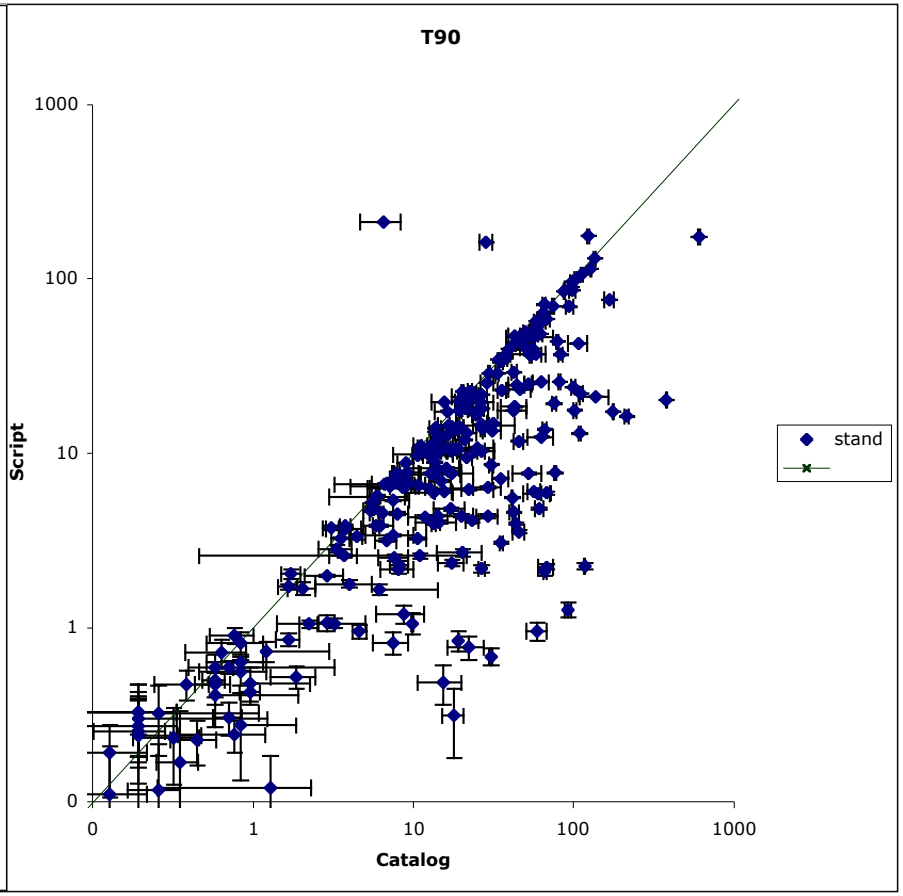
Step 3: Script vs the Catalog - light curve analysis

The T90 from the script is systematically smaller than the catalog.

The error on the T90 from the script is systematically smaller than the catalog.



No errors

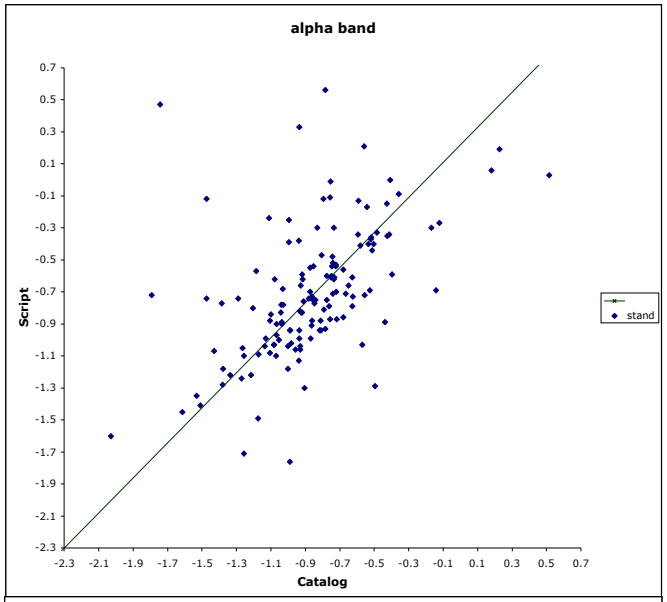


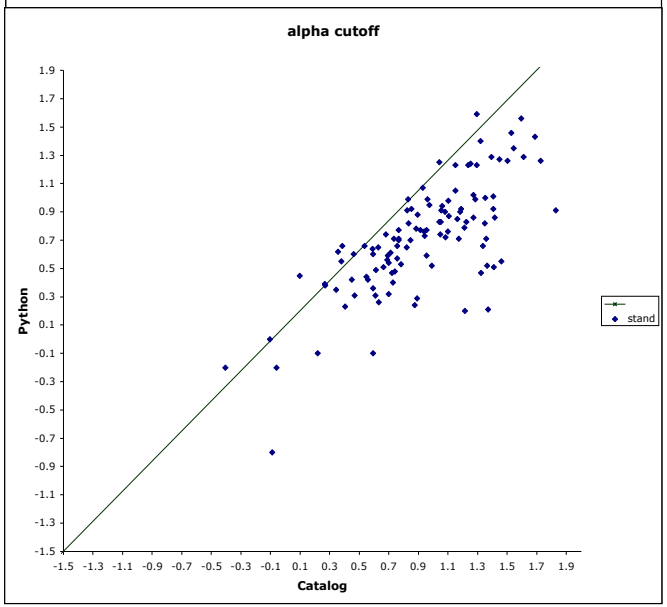
With errors

Step 4: Script vs the Catalog - spectral analysis

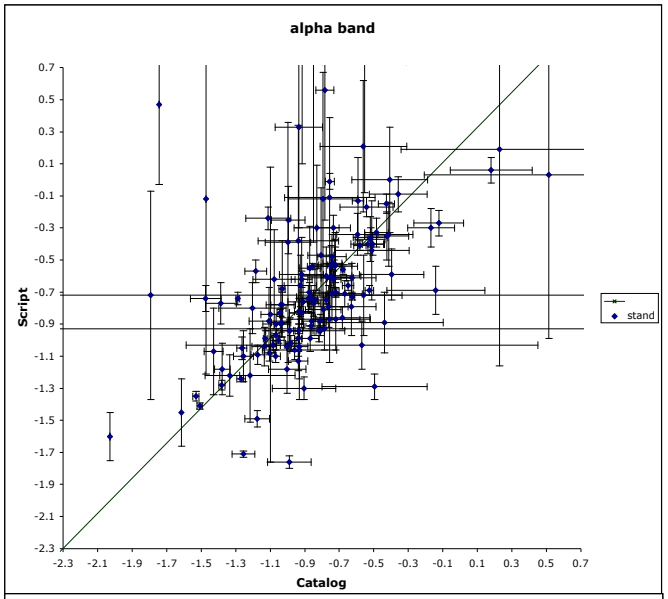
No apparent trend is observed α in the Band function. The script systematically estimates a lower index in the cutoff powerlaw model, although within one sigma.

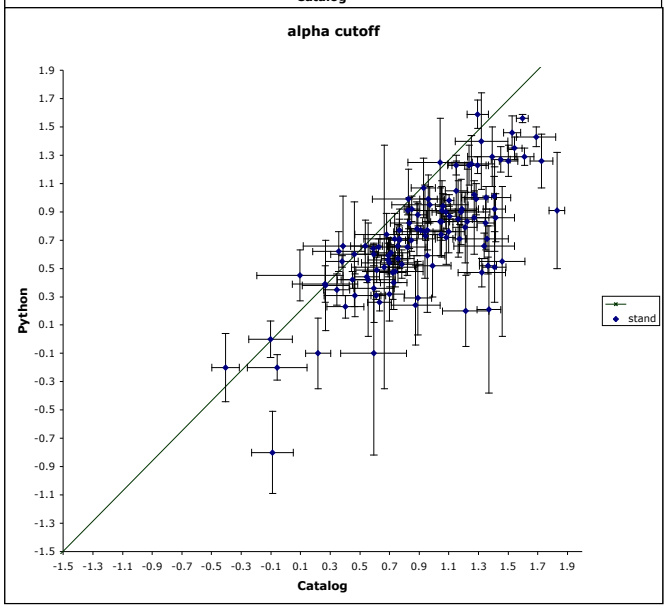
No errors





With errors



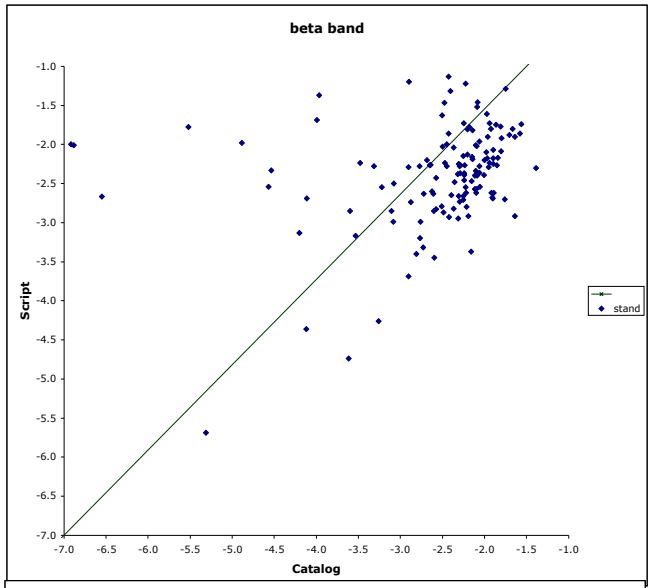


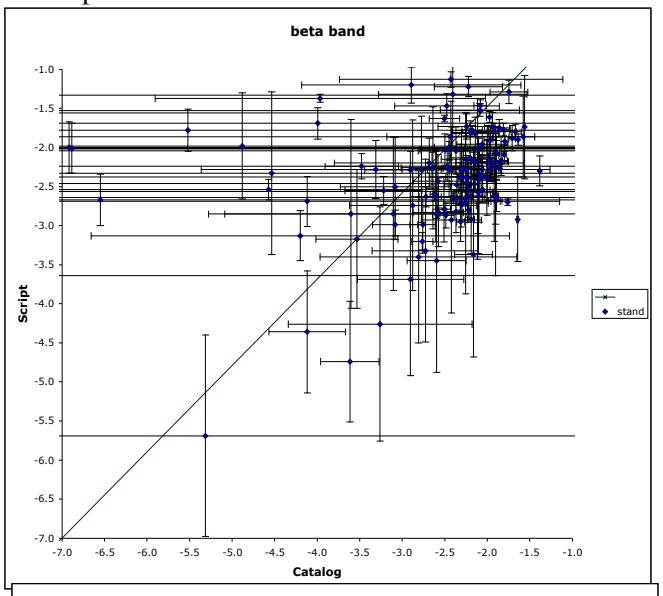
Step 4: Script vs the Catalog - spectral analysis

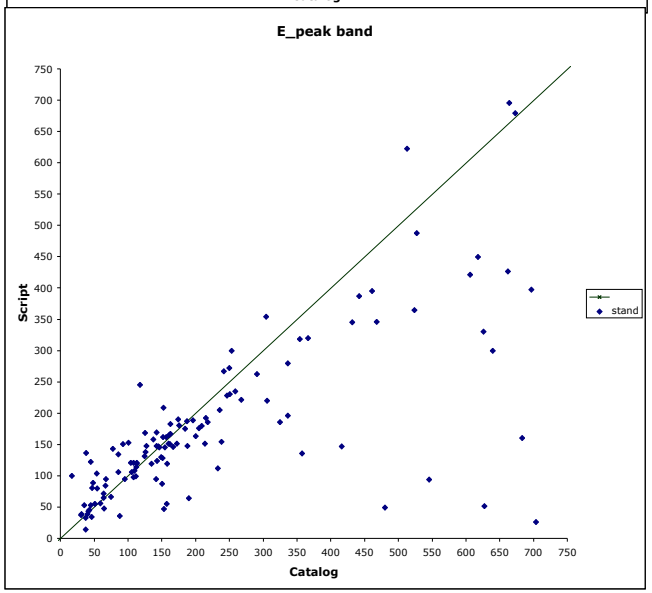
β and E_{peak} should be considered carefully for comparison. Sometimes the spectral fit does not converge properly: Xspec returns negative errors for β,while RMFIT returns very large errors for E_{peak}. Typically for low values of β and large values E_{peak} (conditions interlaced).

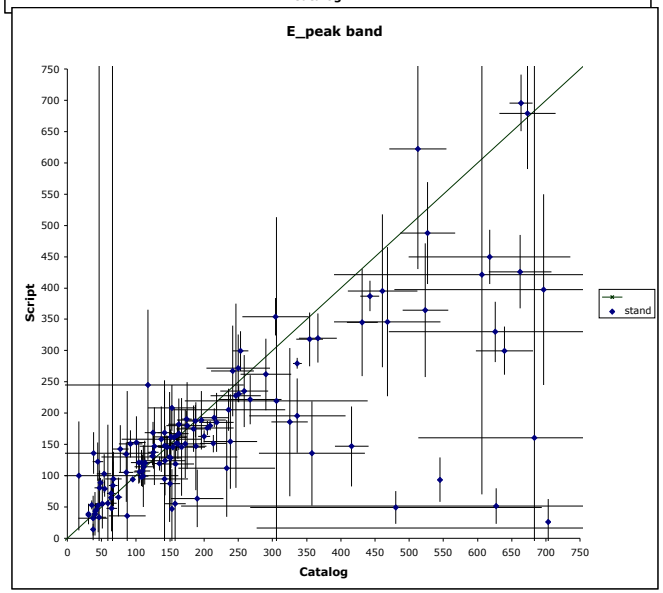
No errors

With errors



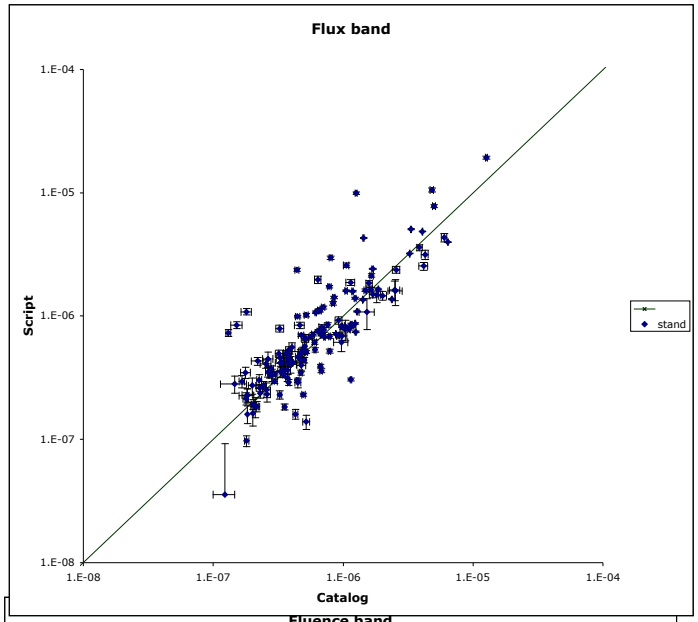


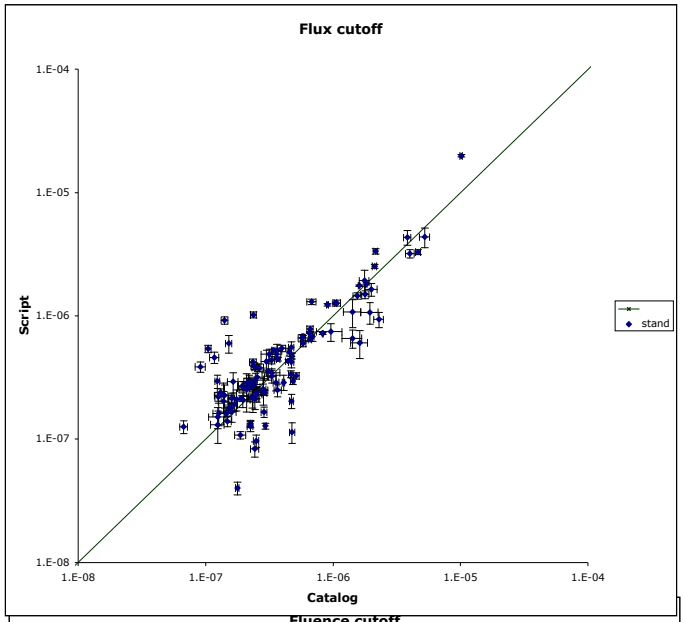


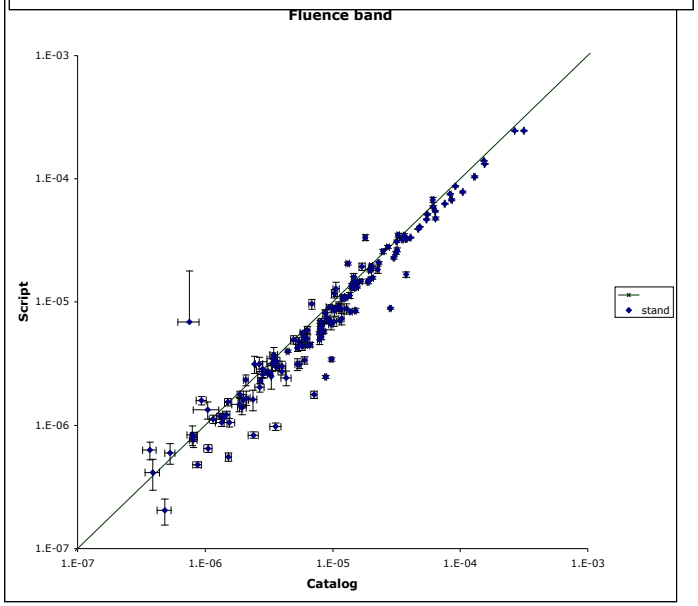


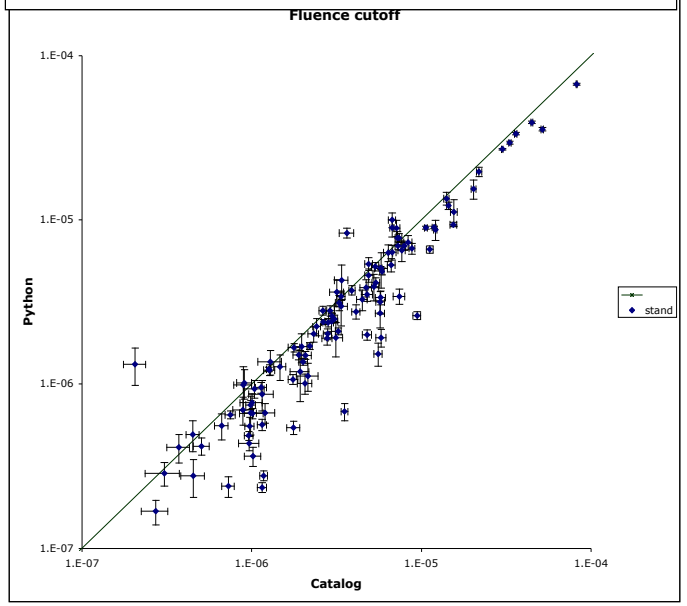
Step 4: Script vs the Catalog - spectral analysis

There is no trend observed in the flux, while the fluence is underestimated by the script, mostly because the time interval are shorter (see the plot for T90).









Step 5: Run script in different modes

a) Standard mode (the script selects automatically the best detectors and the bkg-src intervals)

b) Trigger mode (the script selects the detectors from the header of the files and automatically chooses the bkg-src intervals)

c) nnnnnnnnnnn mode (the script selects the specified detectors and automatically chooses the bkg-src intervals)

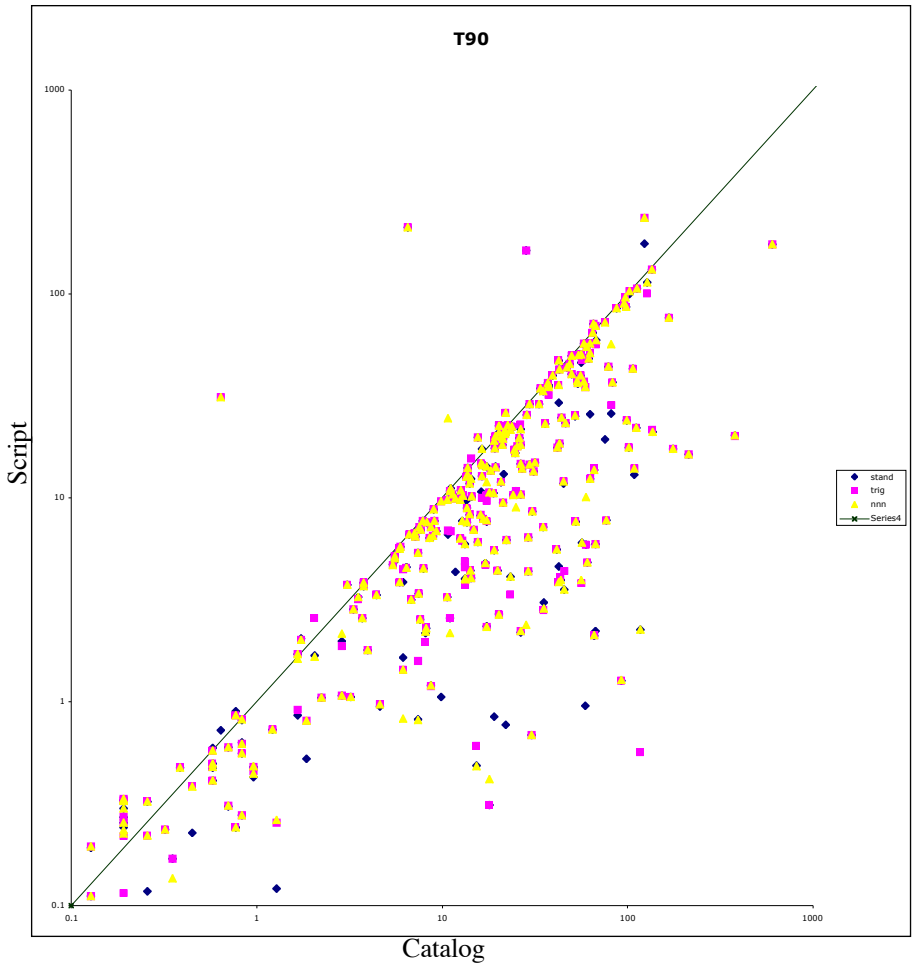
d) Interval mode (the script selects automatically the best detectors using the specified bkg-src intervals)

The last mode is not considered in this comparison due to incompatibilities between different times in the GBM catalog: the timing derived from the spectral analysis (i.e., fluence) can not be reconciled with the timing derived from the light curve analysis (i.e., T90, bkg intervals) because the two analises are independent.

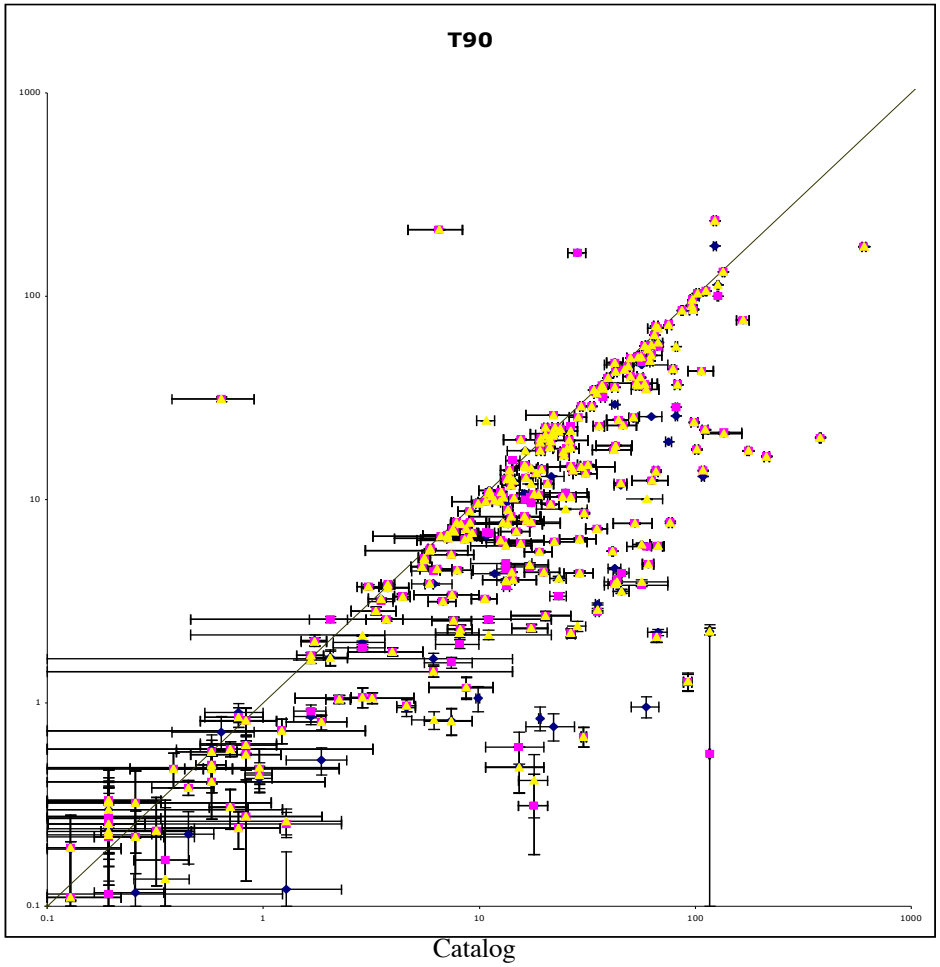
Step 5: Run script in different modes

The number of GRBs in common between the 3 methods (standard=blue, trigger=yellow, nnnn=magenta) is 254.

No trend is observed between the 3 methods



No errors



With errors