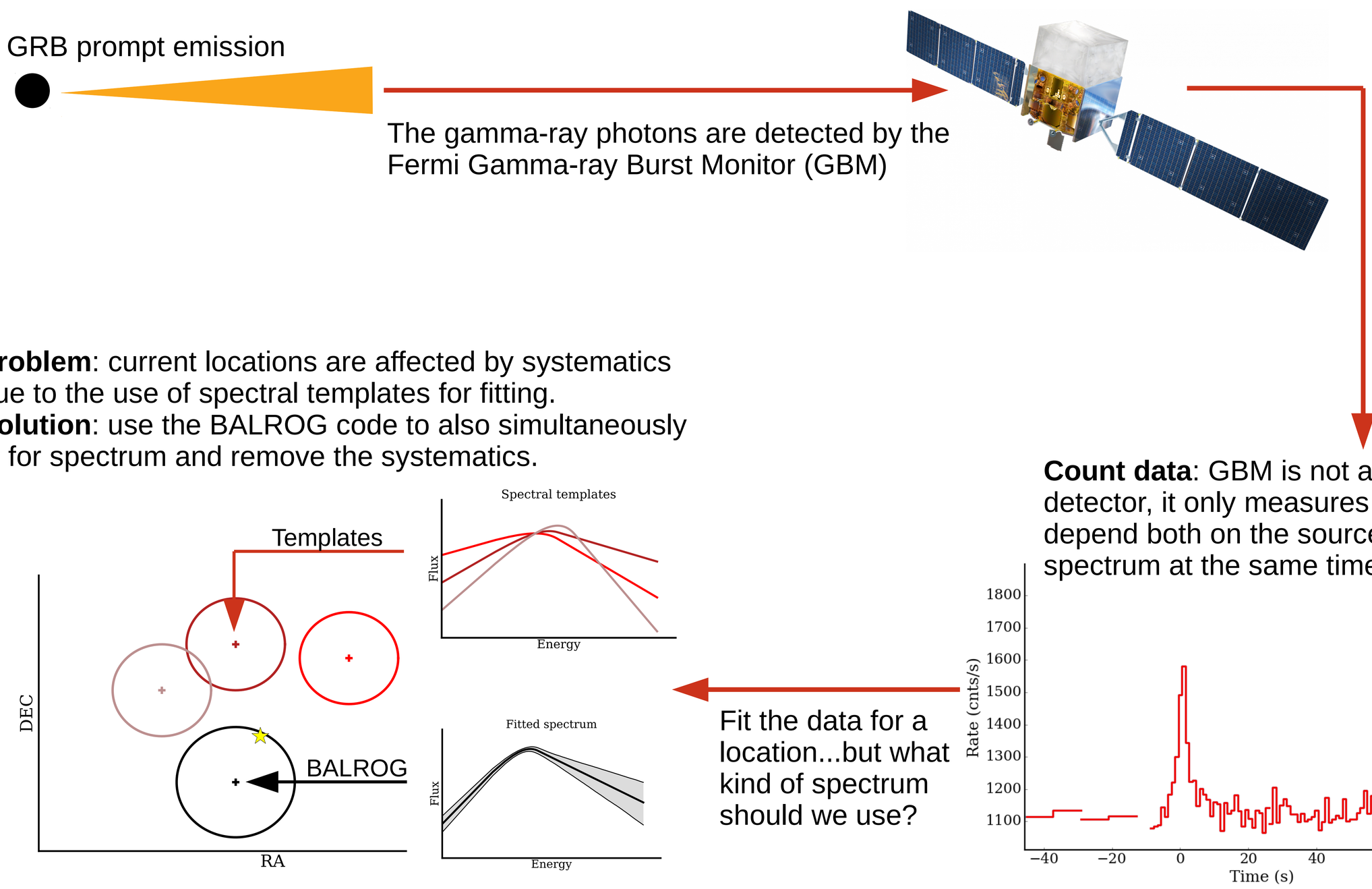
Meet the BALROG: BAyesian Location Reconstruction of GRBs for Fermi-GBM

F. Berlato, J. M. Burgess, J. Greiner, B. Biltzinger and F. Kunzweiler
Max Planck Institute for Extraterrestrial Physics

Overview



GBM locations and systematics

- Current GBM locations (DoL algorithm) are obtained through the use of three fixed spectral templates. Whenever they cannot match the real spectrum, systematics are being introduced in the localization (Berlato et al. 2019).
- The solution is to fit for both spectrum and location at the same time: this is made possible by the BALROG code (Burgess et al. 2017).
- In Berlato et al. 2019 we perform a detailed study of the performance of BALROG. We find that we are able to remove all the very inaccurate positions still present with DoL.
- We also estimate a left-over systematic contribution of $\sim 1 - 2^\circ$ compared to the original DoL 3.7° core plus 14.3° tail (Connaughton et al. 2015).

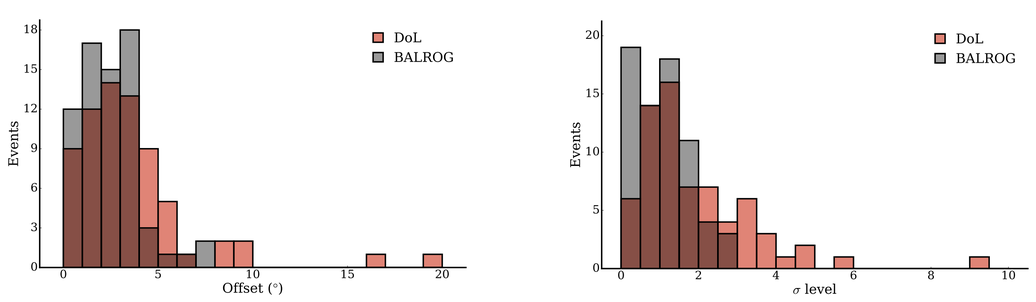


Figure 1: A comparison between the two methods for a sample of bright GRBs: separation from the real source position in terms of degrees and sigmas (i.e. error bars).

Results

BALROG is able to improve GBM's localization performance by removing almost completely the previous systematics. This allows the locations to be both more accurate and more constraining, especially for bright GRBs.

Figure 2: A practical example of BALROG performance, GRB 170705A.

BALROG real-time automated locations are available to the public at grb.mpe.mpg.de and are also distributed through GCNs to subscribers. The BALROG code is open source and available at github.com/mpe-heg.

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