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Methods for statistical detection of GRBs in the context of the LST-CTAO

Gamma-Ray Bursts (GRBs) afterglows are rapidly decaying signals that pose significant detection challenges, requiring improved methods to track their temporal evolution. In this study, we systematically compare various techniques for detecting GRB-like transient emissions at very high energies (VHE, >100 GeV). Our analysis includes time-dependent extension of the standard method (i.e., Li & Ma 1983) and other previously developed methods in the literature, alongside a novel likelihood-based approach, which directly fits spectral and temporal decay features to IACT data. Through dedicated observation simulations, we evaluate the performance of these methods for the Large-Sized Telescope prototype (LST-1) of the Cherenkov Telescope Array Observatory (CTAO). We characterised the enhanced sensitivity found in some of these methods compared to the standard significance estimation. For GRBs simulated with very fast afterglow decay, an improvement of more than a factor of two is seen in detections for some of the methods presented here, compared to the standard Li&Ma approach.

Collaboration(s)

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