The Latin American Giant Observatory (LAGO) capabilities for detecting Gamma Ray Bursts

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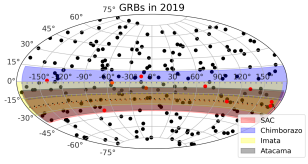
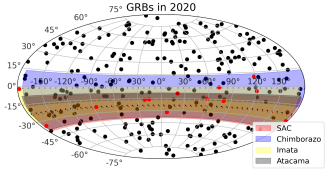
Presentation

Gamma-Ray bursts (GRBs) are bright transient events with typical energies ranging from keV to MeV. Models predict emissions at energies up to TeV in the early afterglow which was confirmed with the detection of GRB 190114C and GRB 1080720B by the MAGIC and H.E.S.S. collaboration respectively. The Latin American Giant Observatory (LAGO) consists of a network of water Cherenkov Detectors (WCD) located at different sites in Latin America. One of the main objectives of LAGO is the detection of extreme events and due to the wide Field of View (FOV) LAGO constitutes a great facility for monitoring transient events like GRBs.

Relevance

GRBs are detected from all directions of the sky. The Gamma Ray Burst Monitor (GBM) on board the Fermi space telescope reports a rate of ~240 events per year. Considering the events from the years 2019 - 2020 we found that ~12 (red circles) per year occurred in the FOV (15º) of LAGO.



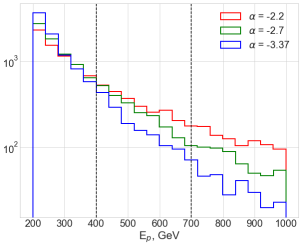


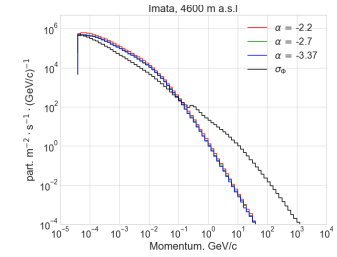
Previous simulations of photon-initiated air showers showed a significant amount of electromagnetic particles to high altitude sites.

Work

We performed simulations in four different high altitude LAGO sites. For the simulations we used the ARTI framework, a tool developed by the LAGO collaboration designed to take into account the different atmospheric characteristics at different sites. The selected sites for this work correspond to the highest sites of LAGO WCDs.

The GRB model was applied to primary photons entering in the atmosphere with zenith angles of 0º and 15º. The photon energies considered for this work are between 0.2 - 1 TeV and with three different spectral indexes: α=-2.2, α=-2.7 y α=-3.37.





Results

From the simulations it can be seen that the secondary fluxes generated by GRBs exceed the background in an energy region where the WCD has high efficiency. This combined with the rate events expected in the FOV, makes LAGO a great facility for GRBs detection.