Introduction

Gamma ray burst (GRBs) were detected accidentally in the early sixties by mean of the military satellites, these flashes of photons that appear for short periods of time and are very energetic. Occur a few events of this kind to date, of the information obtained from previous experiments we can observe a bimodal distribution, the first with a time less than 2 seconds (short bursts) and the second one greater than 2 seconds (long bursts), taking as limit the time interval between 0.01 and 1000 seconds for these events. These populations are associated with astronomical effects such as neutron stars, black holes and massive star collapses.

The search for GRBs by mean of the surface detectors are using the single particle technique. This simple technique gives precious information at energy much lower than the one needed to operate the shower array in coincidence. When high energy photons from a GRB reach the atmosphere, they produce cosmic ray cascades. In this process, secondary particles are produced by their interactions with the atmosphere and many photons are expected to arrive during the burst, in a short period of time. If we had an array of particle detectors, therefore we would see an increase of the background rate on all the detectors on this time scale, taking in consideration that the maximum of the shower is about 5000 or 6000 m. a. s. l. It is needed to confirm the GRB event by one of the satellite experiments that observe a common part of the sky. In this way any other background processes that give rise to particle counting excesses are discarded as for example electric storms.

A mountain detector is highly preferable since it allows us to detect cosmic rays of lower energy for single particle and coincidence techniques, the latter giving information on the arrival direction. The water Cherenkov detectors are a good option, they have sensitivity to photons, which one represent up to 90% of the secondary particles at ground level for high energy photon initiated showers.

In this kind of detectors it is necessary to take into account the conditions and its location, since it is known that there is a dependence on the operation due to temperature and pressure, it is necessary to measure these physical parameters continuously to be done online or post-analysis, a correction in the rate of particles that pass through.

Simulations

- The showers were simulated with version 6.980 of CORSIKA. We made two groups of 30 simulations, each one with a proton and a gamma as primary particle, respectively; both particles with an energy of 100 GeV. The result's particles of the showers were distributed in a square of 10 meters uniformly. We take in consideration electrons, muons and gammas of the showers, and those were injected into the tank.
- We used a 4.9.4.p01 version of GEANT4 to model the tank. At the top of the detector, the sensitive areas were placed to simulate the surface of the photomultiplier tubes, with a reflectivity of 0.9. We proposed several polygonal arrangements with a photomultiplier tube in each of its vertices at different distances from the center of the tank. With data output of simulations, it was possible to determine the number of photons that hit each photomultiplier. Thanks to these counts, we found the average number of particles respect the radial distance from the center of the tank, for both groups of simulations.

Results and discussion

We found that the maximum number of photons in the top of the tank is around 2.4 meters respect to the center. This result were compared with the measurements made at the site, these measurements are presents in this proceedings.

Conclusions

The result of the simulations suggests that the tube photomultiplier should be placed between 1.2 meters from the outer ring toward center, to reach the maximum collection of light in the photomultiplier.