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Gamma/hadron discrimination using a small-WCD with four PMTs

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The Southern Wide-field Gamma-ray Observatory (SWGO) is the next-generation gamma-ray observatory, currently in a three-year R&D phase. The experiment is expected to have a large array of water Cherenkov detectors (WCD) placed at a high elevation (> 4.4 km a.s.l.) in South America. Here we present a WCD concept with reduced surface area and height stations comprising four PMTs at the bottom. We show that it is possible to reach an excellent gamma/hadron discrimination by analysing the data gathered by this station with machine learning techniques. Such performance can be achieved by analysing the shower patterns at the ground or through the PMTs signal time structure to tag muons. Moreover, it is shown that the station's performance does not depend on the array configuration (dense or sparse) nor on the shower inclination (theta < 40 deg). Such a concept reduces the cost associated with the transport of massive amounts of water to high elevation sites while keeping a high physics performance. Therefore, it could be a good candidate station for SWGO, enabling it to reach good sensitivities from low energies (~100 GeV) up to the PeV region, covering large ground surface areas (few square km).

Keywords

Detector concept; Gamma-ray wide-field observatory; Gamma/hadron discrimination; Machine Learning

Collaboration

SWGO

other Collaboration

Subcategory

Experimental Methods & Instrumentation

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