STATUS OF HAGAR EXPERIMENT AT HANLE

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A new ground-based high altitude γ-ray observatory was recently set up at Hanle in the Ladakh region of the Himalayas. It consists of wavefront sampling array of 7 non-imaging telescopes (named HAGAR), the first of its kind to be set up at so high an altitutude. The details of setup, performence studies and observation status are presented in this paper.

1 Introduction

The ground-based atmospheric Cherenkov technique has been successful in detecting celestial sources VHE γ-rays. The recent emphasis is to reduce the energy threshold further to overlap the energy range between the satellite- and ground-based detectors. One such possibility is to install telescopes at high altitudes[1,2]. We have set up the Himalayan Gamma Ray Observatory (HIGRO)[3] at Hanle ($32°.8$ N, $78°.9$ E, 4300 m amsl) in the Ladakh region near a 2 m Himalayan Chandra Telescope (HCT). Recently, an array of 7 non-imaging Cherenkov telescopes (HAGAR) has been commissioned. This will be followed by a large 21-m dia. imaging telescope (MACE).

2 HAGAR telescope array

The HAGAR (High Altitude GAmma Ray) telescope array[4] is based on wavefront sampling technique. It consists of 7 non-imaging telescopes deployed as shown in figure 1. Each telescope has 7 para-axially mounted F/1 mirrors of 90 cm dia. viewed by an UV sensitive photomultiplier tube (Photonis XP2268B) mounted at the focus behind 3° diameter mask. Each telescope's pointing is modelled by sighting large number of bright stars.

Pulses from individual PMTs are brought to the control room through coaxial cables. Signals from the 7 PMTs of a telescope are added linearly to yield a suitable trigger pulse. A real time clock synchronized to 1 Hz pulse from GPS clock, is used for recording absolute time with a resolution of 1 μs. The interrupt driven PC based data acquisition and recording system employs CAMAC based instrumentation. The trigger for data acquisition is obtained from a coincidence of any 4 out of 7 telescope pulses. For each trigger informations regarding pulse height, relative arrival time of pulses from all PMTs etc. are recorded. The typical trigger rate is about 14 Hz.

3 Performance of HAGAR from Monte Carlo simulation studies

Monte Carlo simulation of Cherenkov showers have been carried out using CORSIKA code [5]. Showers initiated by γ-rays, e^-, p and α particles incident at the top of the atmosphere were

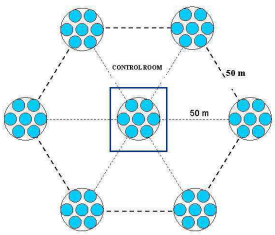
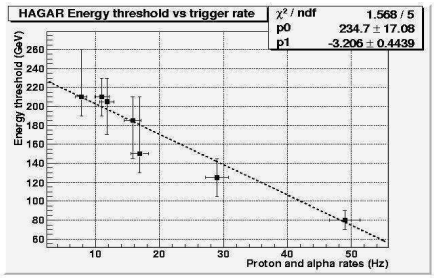


Figure 1: Photograph of HAGAR array (left) & Layout of telescopes (right)



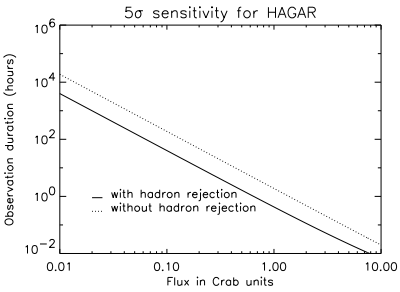


Figure 2: Threshold energy vs Trigger rate (left) Sensitivity of HAGAR array (right)

simulated. The γ/hadron segregation potential of various parameters like Cherenkov photon density fluctuations, relative timing jitter, pulse decay time etc. have been investigated[6]. Taking into account various design details, the energy thresholds, trigger rates and the sensitivity are estimated for γ-rays and cosmic rays[6]. The expected rate of trigger events and the corresponding energy threshold is shown in figure 2 together with the expected 5σ sensitivity. Dotted line corresponds to the case without rejection of cosmic ray showers. Solid line is for 98% rejection of hadronic showers and retention of 35% gamma ray showers. The energy threshold of the HAGAR system is in the range of 60 to 200 GeV.

4 Present status and Conclusions

Regular observations using the 7 element HAGAR array have started in Sept 2008. We have observed pulsars (Crab and Geminga) and AGNs (Mkn421 and 1ES2344+514). The angular resolution at present is 0.2 ± 0.1 deg. The analysis of data is going on.

Acknowledgements

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