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VERITAS Prototype Performance and Construction Status

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VERITAS is an array of 12-m imaging air-Cherenkov telescopes dedicated to gamma-ray astronomy in the 50 GeV - 50 TeV energy band. A prototype telescope was successfully operated between September 2003 and April 2004, yielding detections of the Crab Nebula and Mrk421 blazar. Construction has begun on the full array.

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1. Introduction

VERITAS, the Very Energetic Radiation Imaging Telescope Array System, is an array of four ground-based telescopes dedicated to gamma-ray astronomy in the 50-GeV to 50-TeV energy band.[1] VERITAS uses the imaging air-Cherenkov technique to detect gamma rays. In this technique, Cherenkov light produced in the primary gamma ray's air shower is collected by each telescope's 12-m-diameter reflector. The light is imaged onto a camera consisting of 499 1-inch photomultiplier tubes. Gamma rays are discriminated from cosmic rays on the basis of image morphology. VERITAS is designed to measure gamma rays with an energy resolution of 10-15 % and an angular resolution below 0.1°. The VERITAS science program will include, among other topics, studies of particle acceleration in supernova remnants and active galactic nuclei, the origin of cosmic rays, measurements of the extragalactic background light, and searches for dark matter.

2. VERITAS Protype Performance

During the 2003-2004 observing campaign, the VERITAS collaboration operated a prototype telescope sited at the Whipple Observatory base camp. This prototype telescope, shown in Figure 1(left), consisted of one-fourth the full complement of mirrors and one-half of a camera. The signal and trigger electronics were nearly identical to those that will be used for the VERITAS telescopes. The Crab Nebula

*see http://veritas.sao.arizona.edu/VERITAS_members.html for a list of collaboration members.

and the blazar Mrk 421 were both successfully detected. In March and April of 2004, Mrk 421 went into a high flaring state. The prototype telescope recorded about 19 hours of on-source data and a similar amount of off-source data. The prototype detected Mrk 421 with $\sim$ 20 sigma significance. Figure 1(right) is a histogram of the alpha parameter, a measure of how closely each image points towards the camera center (as expected for gamma rays), for the on- and off-source data. The excess in the on-source data at small angles is the gamma-ray signal from Mrk 421.

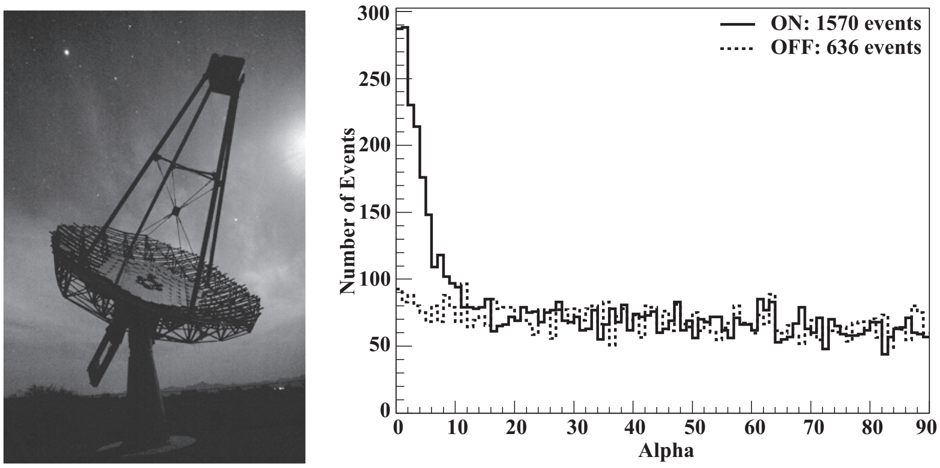

Fig. 1. (left) The VERITAS Prototype telescope, photo by Inga Spence. (right) Histogram of the alpha parameter for Mrk 421 on-source (solid line) and off-source (dashed line) data.

3. Array Construction Status

VERITAS is currently under construction at the Kitt Peak site, located at 31° 58' N, 111° 36' W at an altitude of $\sim$ 1780 m. The four telescopes form a filled equilateral triangle, with each outer telescope 80 m from the central telescope. The four-telescope array is scheduled to be operational in the Fall of 2006. The prototype telescope is being upgraded to a full VERITAS telescope and will operate at the Whipple Observatory base camp site until the remaining telescopes are complete. Science observations are expected to begin in early 2005.

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References

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