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An experiment to detect γ-rays of energy above 1000 GeV from Cygnus X-3

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High energy γ-rays, of energies greater than 10^{12} eV, have been detected from Cyg **X-3** (Vladimirski *et al.* 1973; Mukanov *et al.* 1979). In both experiments, 1.5 m diameter flux collectors were used to detect optical Cherenkov radiation from the small electron showers in the atmosphere. The background radiation due to cosmic ray protons was rejected in both cases by performing drift scans across the position of the object.

A new experiment is under construction with the aim of initially repeating the observations of Cyg X-3 at a similar threshold energy but at a higher sensitivity. Measurements will be made with twelve 1.5 m diameter flux collectors at an altitude of 1450 m in Utah, U.S.A. from April 1981. The detectors, which will be mounted in four separately steerable groups of three, will be operated in two distinct modes. Overlapping drift scans will be made and the source will therefore be in the field of view of at least one group of detectors at all times. Because of the 4.8 hour periodic modulation of Cyg X-3, the method enables the drift scans to be unsynchronized with the source's on-times. The second mode relies on the measurement of the arrival time differences in the signals recorded by mirror groups, which will be deployed as an array, see figure 1.

Each group contains three paraxial *f*/1 Cassegrain systems of diameter 1.5 m, on a computer-steerable alt-azimuth mounting, pointed with an accuracy of 6′. A diaphragm of diameter 5 cm placed at each focus defines a geometrical aperture of about 2°. Behind each aperture is a fast-focused 12 cm diameter photomultiplier spaced to receive an image covering the whole of the photocathode. A threefold coincidence between the anode-current stabilized tubes of a group constitutes a shower signal. In the drift scan mode, the solar times of arrival of these signals, with a resolution of 10 μs, and the amplitudes of the photomultiplier-tube pulses, will be recorded. In the array mode, three of the four independent groups' signals must be coincident. After such an occurrence are recorded the solar time, all photomultiplier-tube signal amplitudes, and the relative time of arrival of the Cherenkov light front (to an accuracy of about 1 ns) at each group. This latter measurement will enable shower arrival directions to be measured with a resolution of about 0.25°. Such a resolution, within the aperture of 2°, will allow the array to continuously track an object. The source will be allowed to drift across the field of view so that the effects of the aperture function of each group may be removed. This mode of operation has several potential advantages; time is not spent by each instrument off-source (up to 80 % in the drift scan mode) and any variations in photomultiplier-tube gain or atmospheric clarity (and hence effective energy threshold) are experienced by both source γ-rays and proton background simultaneously.

It is hoped that in the drift scan mode, a twofold increase in sensitivity will be possible owing to the increased number of detectors, and in the array timing mode a tenfold increase may be realized.

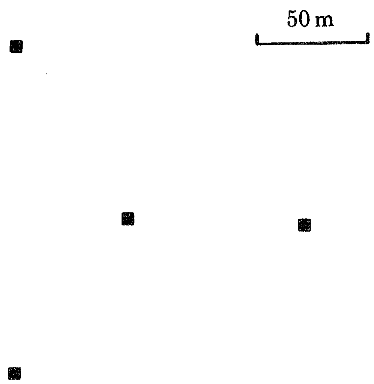

FIGURE 1. ■, Three-dish unit.

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