PROGRESS REPORT ON THE UTAH FLY'S EYE

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ABSTRACT

All 67 mirrors of the Fly's Eye have been operational for about a year. At a site 3.4 km from the first eye, a second eye has been started, with 8 mirrors operational. Coincident observations of showers from the two eyes occur at the rate of 2 hour^{-1} which is about 20% of the showers observed at Fly's Eye I. Planned modifications of the Fly's Eye include the instillation of optical filters to reduce the effects of the Cherenkov light and background star light on the received scintillation signal. A prototype higher resolution eye (with 256 photomultiplier tubes/mirror unit) is also being tested.

1. Introduction

Utah Fly's Eye (see Figure 1) is now operating with 2 stations separated by a distance of 3.4 km. The first station1 (Fly's Eye I) consisting of 67 1.6 meter mirrors and 880 photomultiplier tubes became fully operational in the summer of 1981. Fly's Eye I has a solid angle coverage of 99% of 2π steradians. Fly's Eye II with 8 mirrors and 112 photomultiplier tubes operates in the coincidence mode with Fly's Eye I. The physical parameters of Fly's Eye I and II are listed on the following page.

Figure 1. Utah Fly's Eye

Physical Parameters of Fly's Eye I and II

TABLE I	FEI	FEII
1. # of mirrors	67	8
2. Diameter of mirror	1.6 meters.	1.6 meters
3. Focal length	1.6 meters	1.6 meters
4. # of PMT & Winston cones	880	112
5. Mirror obscuration	~ 13%	~ 13%
6. Average mirror/cone reflectivity	~ 85%	~ 85%
7. PMT/cone angular coverage	~ 10mr	~ 10mr
8. # Electronics analog channels	2640	336
9. Charge dynamic range	~ 10^5 linear	~10^5 linear
10. Time resolution	25ns	25ns

2. Data Summary

From Nov. of 1981 to April of 1983 (about 600 observation hours) 4000 reconstructable showers with energy greater than lO17eV and distance up to 12 km were recorded. Results from the analysis are reported elsewhere in this Conference (EA4-22, XG4-19, MN4-15, OG4-18, -31).

3. Event Reconstruction & Intrinsic Accuracy of Event Reconstruction.

The details of event reconstruction have been reported elsewhere.2 Recently, a collimated light flasher was used to calibrate the geometry of the mirrors. A xenon flash tube, EGG FX279, collimated by means of a 8-in F-2 mirror, was used to generate a vertical beam of light to simulate an upward going shower. Scattered light detected by the detector is used to check the optical efficiency, atmospheric scattering of light and the tracking accuracy of the mirrors. Figures 2a and 2b show the angular and spatial resolution obtained with the flasher. We conclude that the detector has an angular resolution of about ±2° and a spatial resolution of about ± 7.5%. A combination of mirror pointing inaccuracy (1°), detector granularity (5°), and shower track length (~50°) contributes to the angular resolution.

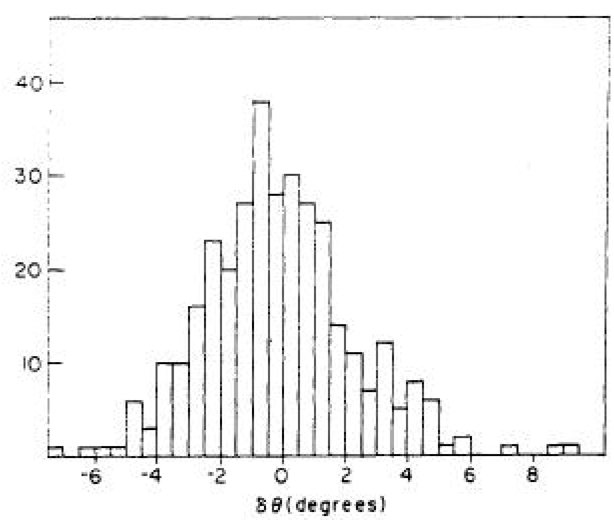

Figure 2a

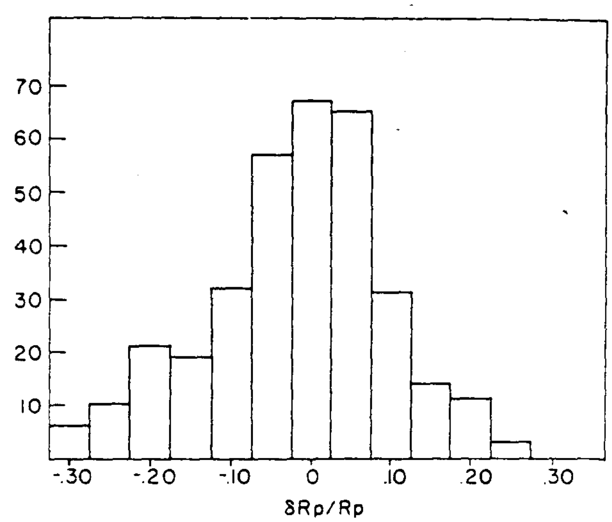

Figure 2b

4. Recent Developments

a). Light Flasher: We are currently installing 24 collimated flashers around both Fly's Eye's. These flashers will provide a night-to-night calibration of the optical efficiency of the mirror-cone phototube system and a constant check on the geometric stability of the detector as well as atmospheric conditions.

b). Optical Filters: A thin, lm, UG1 blue filter with transmission peak around 360 mm designed to reduce light from stars and other sources has recently been tested. Figure 3 shows a typical photomultiplier d.c. output as a function of zenith angle with and without the filter. Noise reduction exceeds a factor of 8 while the signal from N_2 fluorescence is reduced a factor of only 2. Significant improvement of detector sensitivity can be achieved with the installation of UG-1 filters. At present both FEI and FEII are optimized to detect showers between 10^{17} and 10^{19}eV at impact parameters up to ~12 km.

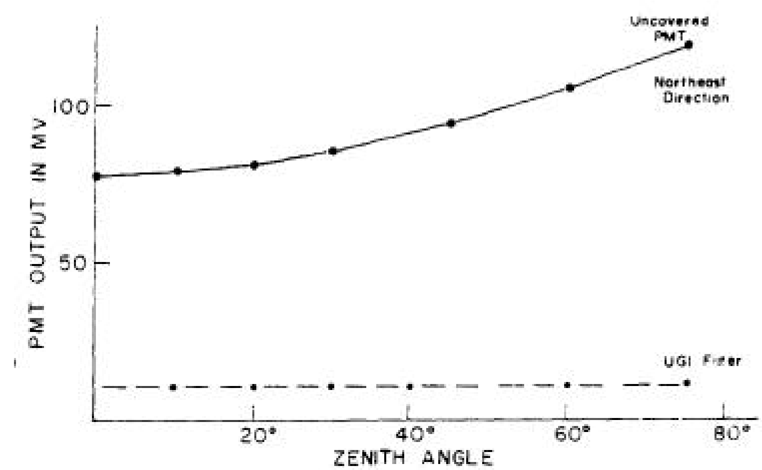

Figure 3.

Coincidence events (2/hour at current triggering conditions) between the two detectors are now being analyzed to check the systematics in track reconstruction, Cherenkov-light contamination, and atmospheric scattering. The detectors will be running in this mode for another year. After that, the optical filters will be installed and the detectors will be tuned for more distant events (~20 km).

5. Future Development

The development of a high resolution (-1°/PMT) is currently under consideration. New phototubes with close packing capability are now being sought from various manufactures. Compact analog and timing circuits are under study.

6. Acknowledgements

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7. References

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2. H. E. Bergeson et al., 1975, Proc. Int. Conf. Cosmic Rays, Munich, 8, 3059.

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