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# Mobile domes for TACTIC telescope

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**Abstract.** A system of mobile domes which have a minimal shadowing effect, is proposed for the TACTIC telescope being set up at Gurushikar, Mt. Abu. The important design considerations and the salient features of the proposed concept are discussed.

*Key words* : mobile domes—aerodynamic—mirror alignment—tracks

## 1. Introduction

A high sensitivity gamma-ray telescope, TACTIC, is being set up at Gurushikar, Mt. Abu to undertake detailed studies of cosmic gamma-rays at TeV energies (Bhat *et al.* 1993). The telescope comprises 4 units placed within a 20 m-side equilateral triangle (figure 1). The delicate mirrors and the focal plane instrumentation of the telescope need to be protected against the effect of rain, sun, wind and dust, necessitating the deployment of a protective cover around the telescope units when they are not in use. The dome specifications become somewhat stringent as it would be desirable to provide for undertaking telescope test and calibration runs during daylight conditions, with the dome in place, and thereby save valuable observation time for actual source monitoring.

## 2. Design considerations

The dome design should meet the following specifications :

1. Protect the telescope units against dust, rain, wind and the sun.
2. Be stable aerodynamically and withstand wind speeds up to 100 km $h^{-1}$.
3. Provide adequate thermal shielding to prevent excessive thermal cycling due to the variation in the day and night ambient temperatures. Provision should be made for proper ventilation also.
4. Should be of such a size as to accommodate the 5 m × 4.5 m × 7 m telescope, its electronics and instrumentation modules and necessary operating staff.

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5. Should have service platforms for conveniently accessing the focal plane instrumentation, mirror holders and other parts of the telescope.
6. Dome should be adequately light tight, so that calibration and stabilization of the detector can be performed well before the commencement of actual observations.
7. When the telescope is in use, it should be possible to move and park the domes sufficiently away, so as to minimize shadowing effects at low elevations.
8. Should be light weight and economical.

## 3. Details of the proposed dome

Based on the above-listed requirements, a number of design concepts were evaluated to arrive at the version depicted in figure 1, which is aerodynamically stable and blends very well with the local sky line. This dome has a two piece sliding door on one side to allow it to slide out without disturbing the telescope parked in the vertical position. Three built-in service platforms are also provided at 2 m, 4 m and 6 m levels to access the different parts of the telescope.

The dome, powered by a small oil engine, moves on tracks and is provided with adequate locking arrangements to hold it in place (figure 1). The inside dome diameter of 6 m is required to cover the telescope and its associated instrumentation. This size provides for about 0.5 m annular space in which the instrument racks, control and data acquisition

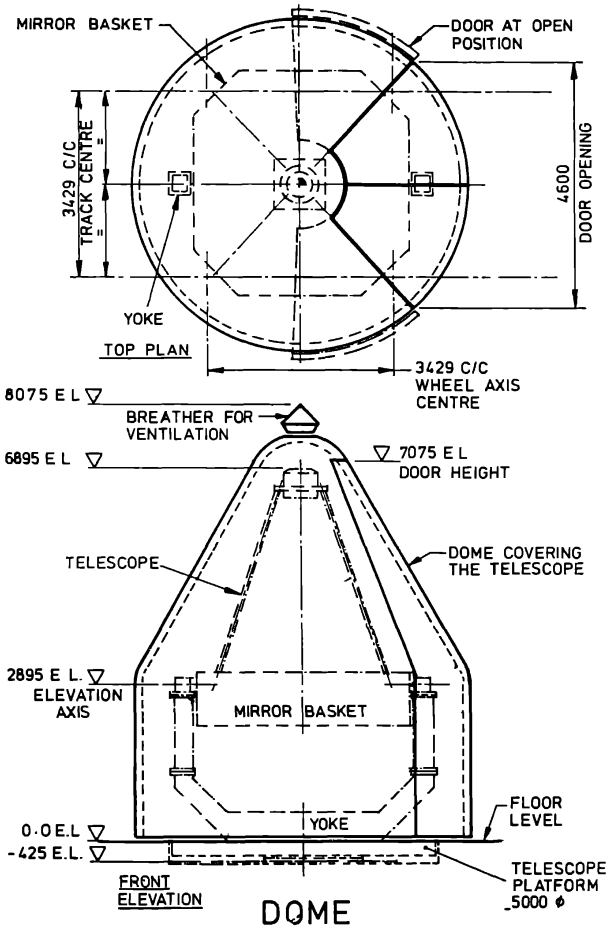


**Figure 1.** The top and front view of the TACTIC dome.

computers and other electronics modules can be housed.

The dome will be constructed using an aluminium grid structure with FRP panels to ensure that it is light weight and can be moved by two persons in the absence of powered movement. Proper thermal insulation will be provided by using a double wall structure having an air gap and glass wool insulation.

### 3.1. *Built-in mirror-alignment capability*

The dome will have a provision for 34 vertical collimated light sources which will be freely suspended from the dome ceiling and the bottom of the service platforms, when alignment of the mirrors is to be checked. The telescope can be positioned vertically to within 0.1° while the light beams are engineered to be vertical within a smaller error. These vertical pencils of light (2-3 mm diameter) will be reflected as small light spots at the focus of a perfectly aligned mirror system. Misalignment of any mirror will result in its reflected beam straying away from the focus. A misalignment of > 1° can be visually detected by locating the position of the light spot (focal plane plate scale = 0.85 arcmin per mm). For better alignments a secondary mirror-CCD camera combination will be used. The central pixel of the imaging camera which lies on the optical axis of the telescope is replaced by a secondary mirror which focuses the image to a CCD camera positioned just behind the mirror basket holding the 34 mirror facets. When not properly aligned, each mirror facet will produce a distinct image of its light source on the CCD monitor. As the CCD camera used will have a pixel resolution of at least 192 × 165, any mirror can be precisely adjusted so as to produce the image at the prime focus with better than 0.2 arcmin resolution. It is envisaged to use this system for the quick monitoring of the alignment of the mirrors before the start of the observations.

### 3.2. *Movement and parking arrangement of the domes*

The domes will be mounted on tracks and will be parked on the parking tracks during observations, as shown in figure 2. As all the 4 TACTIC units will be looking in the same

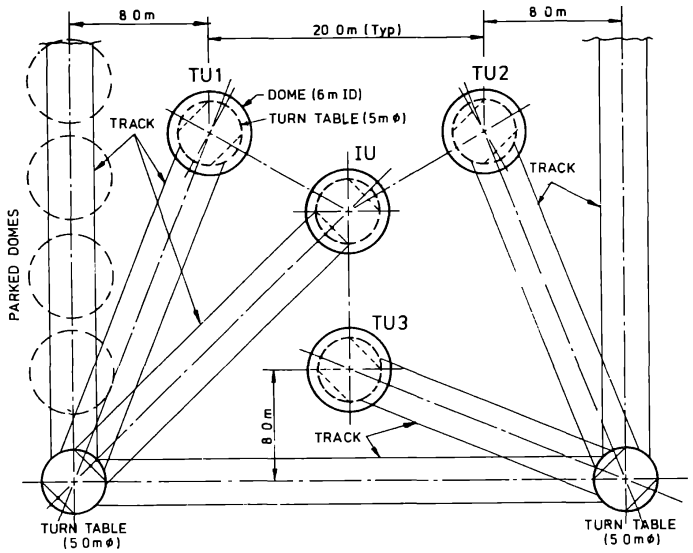


**Figure 2.** The layout of the three trigger units (TU) and one imaging unit (IU) of TACTIC along with the three parking tracks, four link tracks and two turn tables used for movement of the domes.

direction, the obstruction caused by the domes when parked, is limited to about 100° in azimuth, giving a full tracking range of about 260° for the telescope. Three straight tracks to be used for parking the domes during observations, enclose the 4 TACTIC units. Four additional tracks link the telescope sites to the two turn tables for transferring the domes from the link tracks to the parking tracks and vice versa.

## 4. Conclusions

The design discussed here has several innovative features and, apart from providing necessary protection to the telescope units, also permits day-time priming of the telescope for subsequent observations, thereby helping to save valuable observation time. Perhaps, some interesting astrophysical observations can also be carried out with telescope in the covered position, particularly on cloudy and moonlight nights.

## References

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