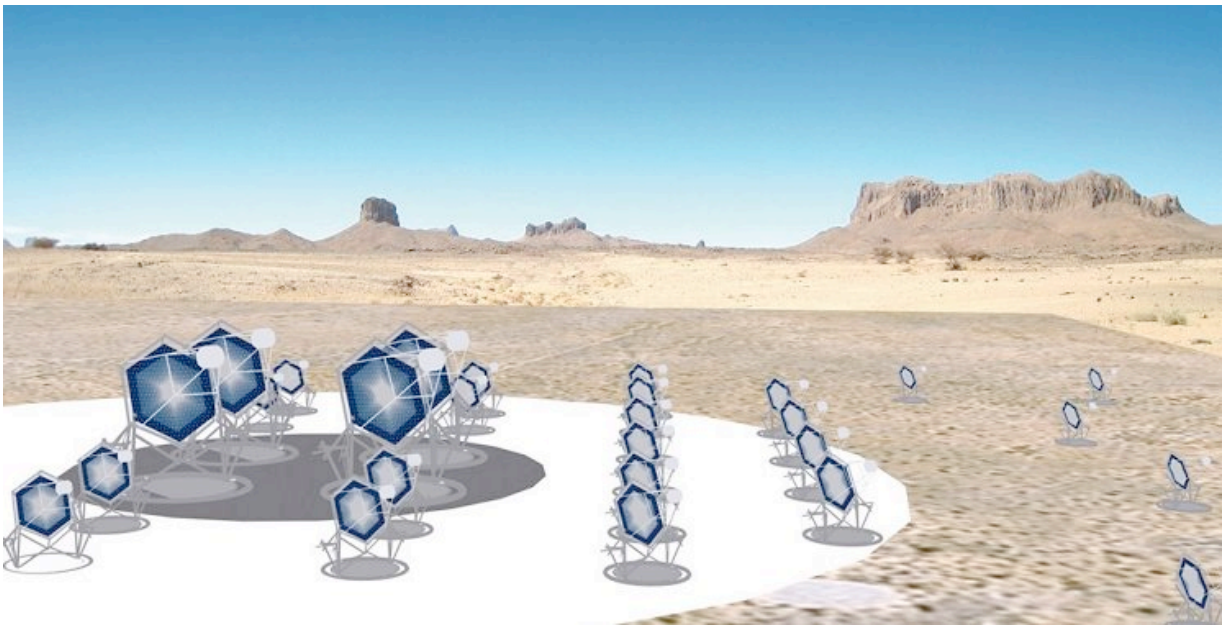
Comments on the possible parking and maintenance positions



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1. INTRODUCTION

This document addresses the problems concerning the safe positions of the telescope. In particular concerning the default parking position, survival position and maintenance position(s). Aspects related to the safety of the instrument and the operators are also considered.

The following text summarizes the discussion occurred within the WPs 3100 and 3500.

2. SAFE POSITIONS

Present days Cherenkov telescope experiments adopt a single position acting as parking position during normal operation, survival position during bad weather and maintenance position. Additional positions for maintenance reasons can be exceptionally adopted when a situation occurs.

The most common safe position adopted is with the telescope facing the horizon (or even below) at North. In this way:

a. the optical surface (being one) is never exposed to the direct light of the Sun and the risk to concentrate the light onto the camera is null;

b. the camera is easily accessible;

c. the optical surface is most protected in case of bad weather, such as: hail, heavy snow and ice.

Drawbacks arise when strong winds occur: this is the most unfavourable position because the optical surface acts as a sail with subsequent increase of the stresses over the telescope structure. A position pointing the zenith would be preferable.

The case of the dual-mirror telescope under development within ASTRI poses a new problem: the presence of two mirrors facing each other could not permit to individuate a fail safe position with respect to the Sun's concentration issue. Let's comment about this.

2.1 Facing the Zenith

As mentioned before, this is the best position to minimize the sail effect induced by the two optical surfaces. However, the telescope can see and concentrate the Sun on the focal surface instrument. In particular during the summer time, when the Sun gets its maximum height over the horizon, even marked for sites located at small latitudes.

Moreover, in case of hail the mirrors are most exposed to damages. The snow can be easily accumulated on the mirrors surfaces with the effect of increasing the snow load and the risk of "long term" icing.

This safe position seems not really attractive, apart the structural advantage although moderate for small instruments like this prototype. Different conclusions can be drawn for the mirrors.

A possible implementation could be the use of cover(s) either for the primary or secondary mirrors. The cover(s) will shield the sunlight preventing damage to the focal instrument(s) and the mirrors surfaces from ageing (reflectivity losses, local or extended damages from hail impacts, scratches, etc. etc.). Has to be mentioned that, in case such a device demonstrates its functionality in the prototype and has to be implemented in the CTA High Energy array, it will need to be fully motorized and automatized. The implementation and maintenance cost need to be evaluated against the mirrors lifetime.

2.2 Facing the Horizon (North)

As mentioned before, this is the most common park position used by the current Cherenkov experiments. The two main reasons are: a) safe with respect to the sunlight (current experiments have only one mirror surface) and b) easy access to the camera for maintenance. In particular this last aspect is very important because of the physical (size and weight) constrain of the camera itself and of the large amount of time used for set-up and maintenance. For the telescope under development within ASTRI, these aspects are largely relaxed because of the use of a SiPM-based camera.

On the other hand this parking position remains very attractive, even though the two mirrors, when considering the sunlight issue. In fact, the secondary mirror (the one facing the Sun) exhibits a small field angle and the worst case situation (Sun being on axis with the mirror) happen during Winter time. This is much pronounced for sites at large latitudes. Even in the worst condition of the telescope located close to the North Pole looking the horizon when the Sun is on the local Meridian in Winter, the Sun would not be focused on the focal instrument(s) because of the curvature of the mirror itself.

On the contrary, very severe survival conditions have to be faced in particular by the mirrors. In fact, the loads produced by strong winds will be maximized and the mirrors need to be properly developed and manufactured. This can have a not negligible impact on the feasibility and cost.

3. MAINTENANCE POSITIONS

The maintenance position will be very likely more than one because of the sunlight issue. A dedicated software should be programmed in order to compute all the safe positions with respect to a number of parametes such as: geographical location of the telescope (long and lat), actual date, hour and duration of the maintenance, subject of the maintenace. The software will provide a number of positionings for the telescope that can be considered *safe* both for the operators and for the telecope subsystems (i.e. focal instrument(s), cables, etc. etc.).

It worth to be mentioned that, also in this case, the use of tissue cover(s) on the mirrors surfaces could in principle facilitate the maintenace procedures also concerning safery aspects. It is considered an option that should be explored.