

# Predictive Maintenance for Array of Cherenkov Telescopes

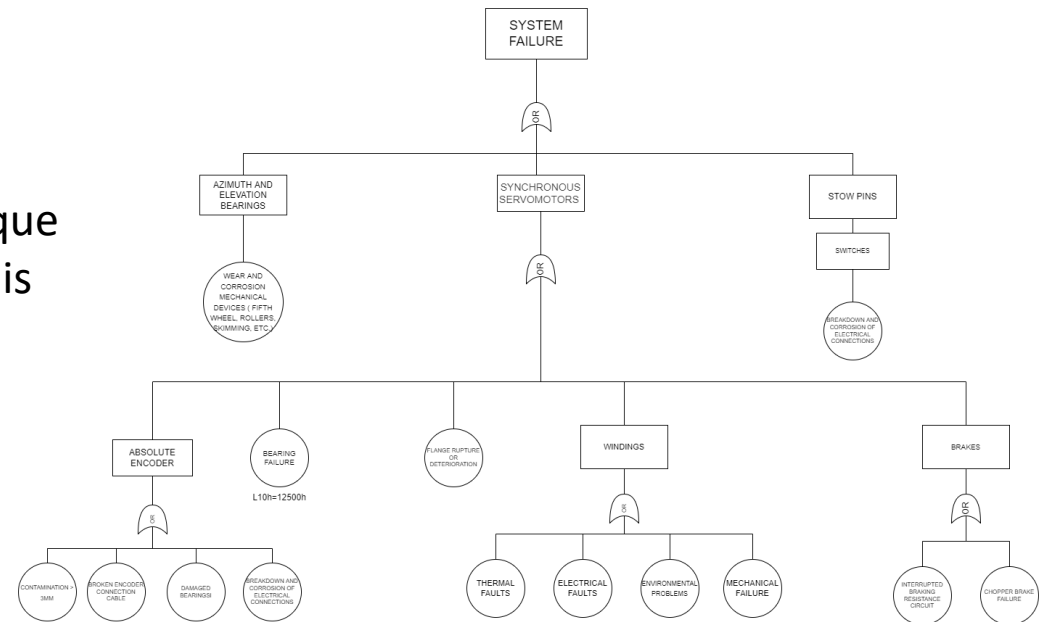
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## Why this research?

This research comes from the need to have a maintenance system able to minimize the array downtime, to increase the telescopes sub-components longevity and to reduce the costs due to unforeseen maintenance.

## Fault Tree Analysis

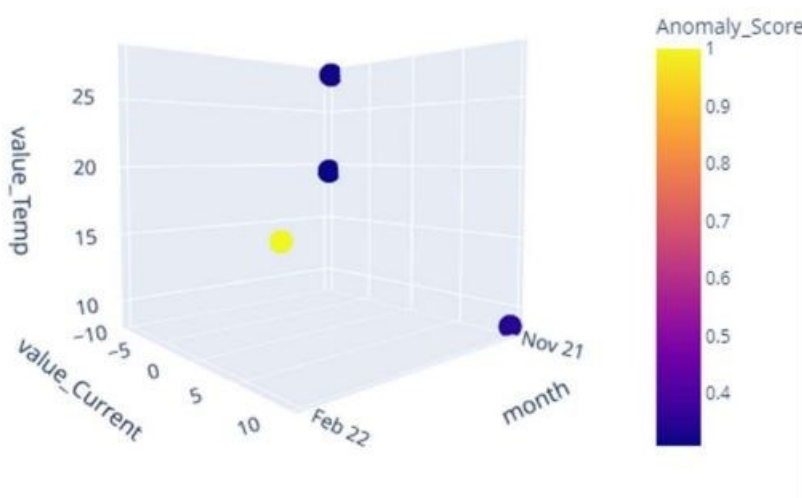
The Fault Tree Analysis (FTA) is a diagrammatic analytical technique that is used for Reliability, Maintainability and Safety Analysis. It is a top-down (deductive) analysis, proceeding from the top event level to the basic event one through successively more detailed steps of analysis until the probability of occurrence of the top event can be predicted in the context of its environment and operations.



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Unsupervised models are chosen because the data in our possession do not present information related to the failures of our telescope. The unsupervised model that gives the best result is the clustering model. In fact, it can find the fault of the telescope well ahead of time.



As an example of the failure event that occurred on February 2022. (The telescope brake failed). Our model would have signaled this at November 2021, based on the engine temperature, torque, current and status information. This would have prevented the telescope engine from breaking and would have reduced the telescope's down time.

The main outputs are: Anomaly and Anomaly\_Score. The first one is a Boolean and a value of 1 is assigned if the pattern in input is classified as an outlier/anomaly. Anomaly\_Score represents the value computed by the algorithm and represent a degree ranging from 0 to 1 of the anomaly found.

The algorithms used are:

- Clustering-Based Local Outliers (CBLO)
- Principal component analysis (PCA)
- The K-nearest neighbors(KNN)
- Isolation Forest (Iforest)

Thanks!