Contribution ID: **183** Type: **Poster**

CTAO systematic uncertainties budget study

The Cherenkov Telescope Array Observatory (CTAO), currently under construction, will mark the beginning of a new era of high-precision very high-energy gamma-ray astrophysics. As operations progress, the accuracy of scientific measurements will increasingly be limited by systematic uncertainties. To address this challenge, CTAO has set ambitious performance goals for energy and angular resolution, which are essential for fulfilling its scientific objectives. Achieving these goals requires the identification of systematics effects and thorough estimation of the systematic uncertainty budget. To this end, we have undertaken rigorous studies to precisely estimate the systematic uncertainties.

One of the key challenges in systematic uncertainty estimation for IACTs arises from the complexity of the atmosphere, which serves as both the medium in which gamma rays interact and the environment where Cherenkov light is produced and propagates. Variations in molecular atmospheric density, aerosol concentration, and the mixing ratios of certain gases can significantly impact the development of electromagnetic showers and the propagation of Cherenkov light. These variations introduce uncertainties and biases in energy and flux estimations, effective area and energy threshold. To address these challenges, we analyzed time series of meteorological data spanning several years for the two CTAO sites. Based on this analysis, we generated characteristic atmospheric profiles, which were then supplied into both full and fast simulations. This approach allowed us to quantify the effects of atmospheric variations on the performance of IACTs.

In addition to atmospheric effects, uncertainties related to the telescope simulation model, for example in mirror reflectivity or in camera photodetector response, can affect energy and flux estimations. To address these uncertainties we conducted simulation studies, modifying each time a specific parameter of the telescope configuration. This approach allowed us to quantify the impact of each instrumental effect on the overall performance of the array.

In this contribution, we will present an overview of these ongoing efforts, highlighting the methodologies employed and key findings obtained so far.

Collaboration(s)

Author: VOUTSINAS, Georgios Gerasimos (University of Geneva)

Co-authors: GAUG, Markus (Universitat Autonoma de Barcelona); GUETA, Orel (CTAO); ZANIN, Roberta (CTAO)

Presenter: VOUTSINAS, Georgios Gerasimos (University of Geneva)

Session Classification: PO-2

Track Classification: Gamma-Ray Astrophysics