Contribution ID: **88** Contribution code: **INSTR/SW** Type: **Poster**

End-To-End Optimization of the Layout of a Gamma-Ray Observatory

Wednesday 4 September 2024 08:28 (1 minute)

The array layout design of an ultra-high-energy gamma rays water Cherenkov detector represents a big challenge at the time to reach a sensitivity in the PeV energy scale. This is the current phase where the Southern Wide-field Gamma-ray Observatory (SWGO) collaboration is. In this work we address the array layout problem building a continuous model whose parameters are the primary particle energy and direction (E, θ, ϕ), the shower core position (X_0, Y_0), and the tanks positions (x_i, y_i). Using a big dataset of gamma and proton events that covers an energy range from 100 TeV to 10 PeV, and a zenithal angle range from 0-65 deg; we perform a likelihood ratio test statistic to do the gamma/hadron classification and then we applied a stochastic gradient descent algorithm to find the optimized tanks positions. This is done finding the maximal value of a utility function which depends on the instrument resolution (reconstruction of the primary particle energy and direction), gamma-ray flux and the capability of detecting a point-like source with a fixed significance. Thus, after running the pipeline a determined number of epochs, typically where the utility function finds a stable value, any initial array layout evolves to a configuration where the performance in the PeV energy scale is improved.

Primary author: DORIGO, Tommaso (Istituto Nazionale di Fisica Nucleare-Sezione di Padova, Italy.)

Co-authors: SHEN, Alexander (Carnegie Mellon University); LEE, Ann (Carnegie Mellon University); NARDI, Federico (Universite Clemont Auvergne, France.); DONINI, Julien (Universite Clemont Auvergne, France.); MASSERANO, Luca (Carnegie Mellon University); RECABARREN, Luis (University of Padua); AEHLE, Max (University of Kaiserslautern-Landau (RPTU), Germany); DORO, Michele (Dipartimento di Fisica e Astronomia "G.Galilei", Universita di Padova, Italy); GAUGER, Nicolas (University of Kaiserslautern-Landau (RPTU), Germany); IZBICKI, Rafael (Carnegie Mellon University); S. S, Sidharth (IISER, Mohali.)

Presenter: RECABARREN, Luis (University of Padua)

Session Classification: Poster hang