A simulation study on the performance of the ALPAQUITA experiment

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What is this contribution about? The performance of the ALPAQUITA experiment, the prototype experiment of ALPACA, is investigated using a Monte Carlo simulation. ALPACA and ALPAQUITA are air shower array experiments mainly aiming to explore southern VHE gamma-ray astronomy beyond 100 TeV and specify PeVatrons.

Why is it relevant/interesting? To get the most out of the observational period of ALPAQUITA, it is fruitful to evaluate its performance in detail and specify detectable southern gamma-ray sources. This study is also crucial to tackle hot topics of VHE gamma-ray astronomy as soon as possible from the prototype phase.

What have we done? CORSIKA7.6400 and Geant4 v10.04.p02 are used for air shower generation and detector response, respectively. The obtained simulation data are processed in the same way as the experiment and then are analyzed.

What is the result? ALPACA achieves the energy resolution of $\pm 21\%$ and the angular resolution of $\simeq 0.2°$ for 100 TeV gamma rays. Using an underground water Cherenkov type muon detector, ALPAQUITA rejects power of $\simeq 99.9\%$ for background cosmic rays, while maintaining $\simeq 80\%$ of gamma-ray signals. This high discrimination power leads to the detectability of five southern gamma-ray sources beyond several tens of TeV and one out of the five, HESS J1702-420A, beyond 100 TeV. This result tells us that the ALPAQUITA will activate the authentic start of southern VHE gamma-ray astronomy in the highest energy range in its short period of observation ahead of ALPACA.