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Assessing aerosol induced errors in Monte Carlo based air-shower reconstruction for atmospheric Cherenkov detectors

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Aerosol levels influence the wavelength dependent transmission properties of the atmosphere. Variations in aerosol levels therefore affect the amount of Cherenkov light from air showers that can reach an atmospheric Cherenkov detector. As the amount of detected Cherenkov light is directly related to a primary shower particle's energy, deviations between actual and assumed atmospheric transmission properties yield errors in reconstructed particle energies as well as energy axes of instrument response functions (IRFs).
In this work, a scheme is presented to assess this influence and potentially reduce related errors in the air-shower reconstruction. The proposed scheme relies on estimations or measurements of the aerosol optical depth (AOD) and atmospheric density profiles which are then used in radiative transfer simulations to generate atmospheric transmission profiles. In combination with detector specific quantum efficiencies and generalised shower evolution models, the scheme does not rely on detailed simulations of the different atmospheric conditions but only on the transmission profile on which the initial reconstruction algorithm is based on.
The scheme is derived and presented on the example of the H.E.S.S. Experiment which employs Imaging Atmospheric Cherenkov Telescopes in the Khomas Highland of Namibia to detect cosmic gamma rays in the GeV to TeV energy range.

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