

Proton LIDAR - direct measurement of atmospheric transmission profile with Cherenkov telescopes

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Imaging Atmospheric Cherenkov Telescopes (IACTs), the most sensitive astronomical instruments in the VHE band, rely on the Earth's atmosphere as part of the detector. Therefore the presence of clouds affects observations and introduces biases which need to be corrected. Typical correction methods require knowledge of the instantaneous atmospheric profile, that is usually measured with external atmospheric monitoring devices, such as LIDAR. We present a novel method for measuring the atmospheric profile using directly the data from IACTs. This method exploits the comparison of the average longitudinal distribution of the Cherenkov light recorded in clear atmosphere, with those obtained in the presence of clouds. Using Monte Carlo simulations of a subarray of four Large-Sized Telescopes of the upcoming Cherenkov Telescope Array Observatory we evaluate the accuracy of the method in determining the basic cloud parameters. The method is shown to reconstruct the transmission of typical clouds with an absolute accuracy of a few percent. For low-zenith observations, the height of the cloud centre can be reconstructed with a typical accuracy of a few hundred metres. We evaluate the robustness of the method against the typical systematic uncertainties affecting IACTs.

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