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Probing the hadronic energy spectrum in proton air interactions through the fluctuations of the EAS muon content

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The average number of muons in air showers and its connection with the development of air showers has been studied extensively in the past. With the upcoming detector upgrades, UHECR observatories will be able to also probe higher moments of the muon distribution. Here we present a study of the physics of the fluctuations of the muon content. In addition to proving that the fluctuations must be dominated by the first interactions, we show that the fluctuations and entire shape of the distribution of the number of muons is determined by the energy spectrum of hadrons in the first interaction.

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