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Characterization of background noise in muography using the Muon Telescope (MuTe)

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The MuTe is a hybrid muon telescope used for density imaging of volcanos by means of measurements of the atmospheric muon flux attenuation depending on the amount of rock crossed at different angles. The detector will be placed at one of the most dangerous volcanoes in Colombia, the Cerro Machin volcano, located in the South-West of Colombia. MuTe hodoscope reconstructs 3841 different directions reaching an angular resolution of 32 mrad for an inter-panel distance of 2.5 m. The MuTe has a spatial resolution of ~25.6 m assuming an 800 m distance to the volcano.

Taking into account muography suffers of contamination from different physical sources such as upward coming muons, scattered muons, particles of the soft component of Extended Air Showers (EAS) and particles arriving simultaneously, MuTe incorporates two particle identification systems, a water Cherenkov detector (WCD) and a Time-of-Flight system in order to filter such fake events. The WCD measures the energy loss (> 50 MeV) of the detected particles (muons or background) allowing us to differentiate single muons, electrons/positrons, and multiparticle events. On the other hand, using ToF measurements (~50 ps resolution), Mute is able to estimate the momentum of detected muons establishing an energy threshold for reducing the background contribution of scattered muons. Additionally, upward coming muons are filtered using the arrival direction of detected particles which is determined also by the ToF system.

We found that near 36% of the recorded events belong to the electromagnetic component of EAS (electrons and positrons), roughly 30.4% is caused by multiparticle events that arrive with time differences < 100 ns and the las 34% are caused by muons. The muonic component of the data is composed of scattered muons, upward coming muons and high energy muons (> 1 GeV).

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