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Monte Carlo simulations analyzing the Hadronic production on high energy emissions from thunderclouds

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The ground detection of thunderstorms related neutrons opens the window for the study of natural nuclear reactions occuring in the atmosphere. Different mechanisms of neutron production have been suggested through the years but the most accepted mechanism relies on photonuclear reactions, i.e. high energy photons interact with the atmospheric particles resulting in a neutron emission. The energy of extreme atmospheric phenomena such as Terrestrial Gamma-ray Flashes is documented to reach tens of MeV and even 100 MeV. This energetic interval allows the photonuclear reaction through Giant Dipole Resonance, which has non zero cross section values for 10-30 MeV photons and it produces a neutron or a proton. Therefore, we present Monte Carlo FLUKA simulations to compare the proton and neutron production for a photon beam in the 10-30 MeV interval. We present characteristics distance and temporal intervals for the photonuclear reaction occurance as well as an energetic analysis of the initial energy spectra of protons and neutrons. It is also under investigation the reason protons have not been observed yet during these high energy emissions although it is likely for them to be produced.