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Monte Carlo simulation study of the muon-induced neutron flux in LNGS

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The ultimate background for all the experiments looking for rare events in underground laboratories is represented by muon-induced neutrons. Their typical flux is three order of magnitude smaller than the flux of neutrons produced by radioactivity, but the former have an harder energy spectrum and they can travel far away from the muon track, thus they are very difficult to shield.
The LVD experiment, located at LNGS, consists of a 1000 ton of liquid scintillator and its main goal is the search for neutrinos from Gravitational Stellar Collapses in our Galaxy. LVD can detect both neutrons and muons so it is well suited for studing neutrons induced by cosmic muons.
In this work we present the full Monte Carlo simulation, developed in the framework of Geant4, that allowed us to extimate the muon-induced neutron flux coming from the rock and to measure the neutron yield in liquid scintillator and iron. The former has been found in agreement with other measurement while the neutron yield in iron represent the first measurement. The simulation has been also used to evaluate the requirement and the performances of the shield for a dark matter experiment at LNGS.

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