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Simulation of the muon background at SUPL for the SABRE South Experiment

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The low cross section of WIMP-nucleus scattering makes detecting dark matter directly extremely difficult. To make sure a signal originates from WIMP scattering, all the backgrounds of a dark matter experiment need to be carefully studied and reduced. Among all these backgrounds, muons can mimic the annual modulation signals expected from dark matter. Therefore, the distribution of muons should be understood.

SABRE (Sodium-iodide with Active Background REjection) aims to directly detect the annual modulation signals of nuclear recoils which are claimed to be caused by dark matter as reported by DAMA/LIBRA. SABRE South will operate an array of ultra-low background Na(Tl) scintillation detectors with muon and liquid scintillator systems to both measure and reject backgrounds at SUPL (Stawell Under-ground Physics Laboratory, Australia), the first underground laboratory in the Southern Hemisphere. The 1025m-thick rock overburden can greatly suppress the muon-related backgrounds. Construction of SUPL has recently been completed and a muon telescope consisting of eight plastic detectors will be operated to measure the underground muon angular distribution.

Details of Muon detector simulations for SABRE South and an underground muon background simulation with CRY (Cosmic-ray Shower Library) and also Geant4 will be shown. In the simulation, muons are generated at sea level with CRY and incident on rocks with a thickness of 1025 m. The results of muon flux, energy distribution and angular distribution underground will be shown, and compared with the results from other underground laboratories.

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