Cosmic muon background estimate for shallow underground neutrino experiments

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One of the severe limitations in detecting neutrino signals from nuclear reactors is that the copious cosmic ray background imposes the use of a time veto on the passage of the muons to reduce the number of fake signals due to muon-induced spallation neutrons. For this reason neutrino detectors are usually located underground, with a large overburden. However there are practical limitations that do restrain from digging very deep shafts near reactor buildings.
In order to evaluate the possible background signals in the shallow-underground Neutrino Angra Detector, an estimation of the muon rates expected in the detector is needed. Actually these rates must be understood to determine the depth underground at which the detector must be installed. In order to determine an appropriate location for the detector we estimate the muon rates at different depths and the number of neutrino signals expected for different distances between the reactor and the detector.
To find a trade-off between the muon rate and the site constraints we estimate the muon rates at different depths and the number of neutrino signals expected for different distances between the reactor and the detector in order to determine an appropriate location for the detector.
We also extend the calculation of the muon rates to the case of the San Onofre neutrino detector and to the case of the Double Chooz neutrino detector where other estimates or measurements have been done.