Muon Flux Monitoring in Underground Laboratory in Armenian Salt Mine.

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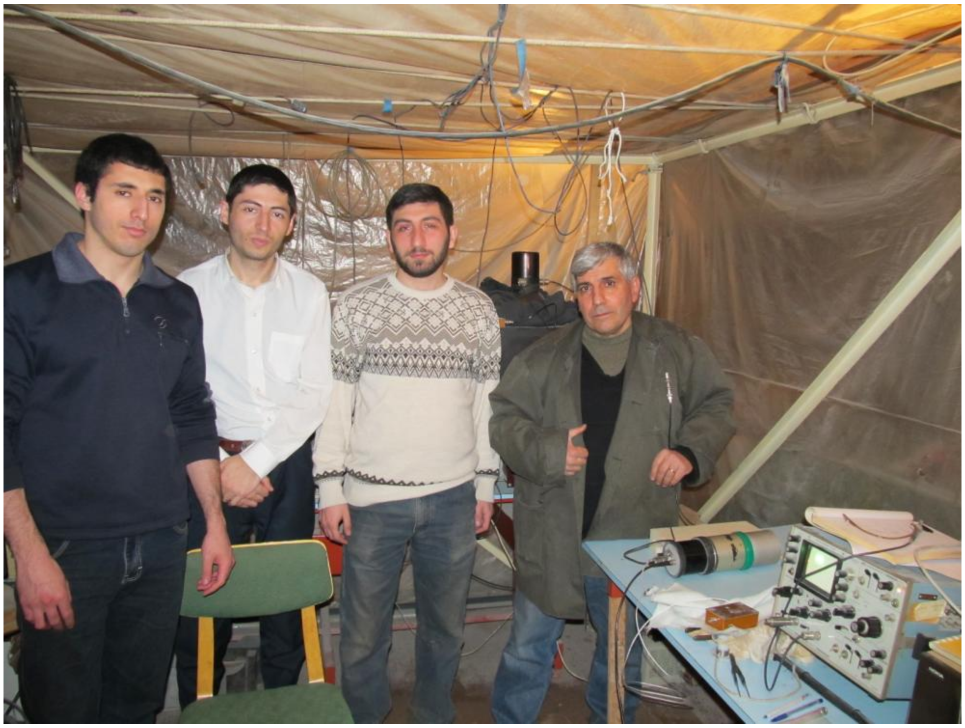

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Muons are unstable subatomic particles of the same class as an electron, but 200 times more massive. They make up much of the cosmic radiation reaching the earth's surface. Understanding muons is very important as, they are very useful probes for a number of important experiments.

Yerevan Physics Institute physicists began experiments of detecting and measuring properties of muons in the underground laboratory which is a natural filter of background radiation that can blur the information. The laboratory is placed in the Avan salt mine, at a depth of 240 m, and is equipped with modern instrumentation.

The very low background signals because of the low-radioactivity property of the salt provides big advantages in the research of the rare nuclear processes in this environment. The newly purchased High Purity Germanium Detector (HPG - GCD-20180) with its multi-channel analyzer BOSON (products of Baltic Scientific Instruments in Latvia) expands the scientific potential of the laboratory.

The depth of the laboratory determines the rather high muon energy threshold of 150

GeV. It is estimated that 0.05 muons per square m per second will reach the underground detectors.   Muon detectors consist of two pairs of 50cm x 50cm x 5cm plastic scintillators, which give off light as the muons give up their energy when they enter it. This light (and indication of the muon counts) is captured and measured using instruments called photomultiplier tubes. Each pair of the scintillators registers coinciding muon traversals to eliminate the environmental noise.

The mean value of muon flux registered by a pair of scintillators is about 47 per hour. Increasing the number of detector in the future will allow the investigation of the correlation between the underground muon flux and the upper air temperature, including, the so called, sudden stratospheric warming (SSW).

The muon-induced events are one of the main concerns regarding background in deep underground facilities where modern neutrino experiments are conducted. The careful estimation of the muon flux created by cosmic rays in the atmosphere and penetrated deep underground is of crucial importance for the neutrino experiments

The Internet connections established in the salt mine allows real-time on-line correlation analysis between the highest energy muon events in the salt mine and the muons registered at the high altitude cosmic ray research station on Mt. Aragats (a wide energy range from 1 to 5000 MeV). The muon count rates from the salt mine as well as from Mt. Aragats are available real-time on Cosmic Ray Division’s on-line database and are assessable to analyze via the user-friendly multivariate visualization platform Advanced Data Extraction Infrastructure (ADEI).