Measuring Cosmic Ray Muon Intensity and Momentum with Silicon Photo-multipliers

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A survey of the behavior of cosmic ray generated muons is presented. The distribution of muon intensity was determined using a portable scintillation counter known as the CosmicWatch. Measurements in coincidence were taken to observe variations of intensity with respect to altitude and angular orientation, enabling a complete mapping of the strength and source of these particles at two locations within a large, institutional structure consisting largely of steel reinforced concrete. Evidence of significant shielding of muon radiation provided by the structure was searched for and found to correlate slightly with the amount of intermediate building material. Using the same detectors, the momentum of individual muons at the Earth's surface were measured. The resulting spectrum was found to cluster near the speed of light.

Angular Correlations of γ Transitions in the Excited States of ^{34}Al

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The β-decay of ^{34}Mg was used to study the angular correlations of the γ-rays given off by the excited states of ^{34}Al. The analysis software GRSISort was used to sort the data from TRIUMF experiment S1367 and obtain angular difference correlation spectra for the characteristic γ-rays of ^{60}Co, and then for the largest transition cascade in ^{34}Al, which is one 1051 keV γ-ray followed one 364.5 keV γ-ray. My contribution to this project was the creation of these angular difference spectra. The spectra are ready to be fitted for comparison with the appropriate GEANT4 simulations.

Investigation of Cosmic-Ray Induced Background Events from Lead Shielding

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A major effort in highly sensitive experiments (such as those searching for direct dark matter interactions) is often to drastically reduce and precisely characterize the background, with some of the most problematic backgrounds being those from neutrons. Highly energetic cosmic-ray muons that are produced in the upper atmosphere are able to penetrate deep underground and interact with matter to produce such free neutrons. These free neutrons can then proceed to interact with nearby nuclei, producing secondary background gammas or other free neutrons. The particular goal of this experiment was to study these cosmic-ray induced neutron interactions in the commonly used shielding material lead.