C.1.6 Cosmic Flux as a function of the altitude

SG6215D

Ordering Options

Equipment	
Code	**Description**
WK5620CHAAAA	SP5620CH - Cosmic Hunter

Cosmic ray muon radiography is a technique capable of imaging variations of density inside a hundreds of meters of rock. With resolutions up to tens of meters in optimal detection conditions, muon radiography can give us images of the top region of a volcano edifice with a resolution that is significantly better than the one typically achieved with conventional gravity methods and in this way can give us information on anomalies in the density distribution, such as expected from dense lava conduits, low density magma supply paths or the compression with depth of the overlying soil.

www.mu-ray.fisica.unina.it

Purpose of the experiment

The measurement of cosmic ray flux as a function of altitude. The goal of this experiment is analyse muon rate behaviour by performing measurements at different altitude levels. For example, one may perform such measurements on different floors of a building, at different elevations of a hill, or even by using a hot-air balloon.

Fundamentals

The origin of cosmic radiation represents one of the most fascinating Physics discoveries of the 20th century. The first evidence of natural and non-terrestrial ionizing radiation in the atmosphere was observed in the early 1900s and subsequently studied via different typology of electroscopes by several scientists: from the Jesuit monk Theodor Wulf to the Italian physicist Domenico Pacini, to the Austrian-American physicist Victor Hess (Nobel Prize in 1936).

The measurement of the cosmic ray flux as a function of the altitude played a key role in the comprehension of the nature of both primary and secondary cosmic rays. The Earth's atmosphere acts as a filter by absorbing most of the secondary particles produced by the interaction of the primary ones with the external layers of the atmosphere itself. Muons and Pions are the most have the greatest penetrating capability and can reach the Earth's surface. For that reason they constitute the hard component of the secondary cosmic radiation. The soft component consists mainly of gamma, positrons, and electrons that are easily absorbed by the Earth's atmosphere. Initially, the flux of the secondary cosmic rays as a function of the altitude endures a slight decrease due to the loss of the contribution of natural radioactivity from the terrestrial crust. However, evident increase in the flow of revealed particles is then observed.

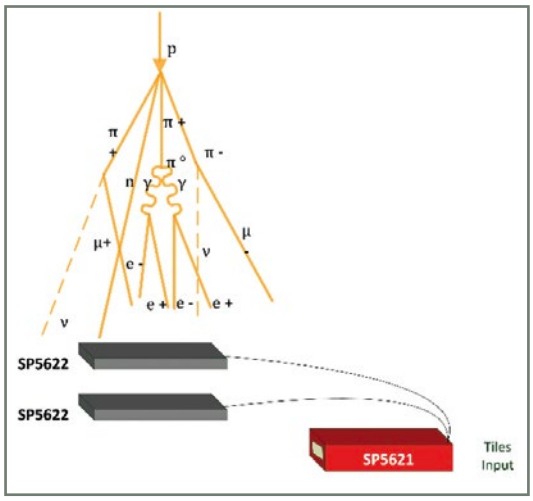
Equipment

SP5620CH - Cosmic Hunter

Model	SP5620CH	SP5622	DT5622
Description	Coincidence Module	Detection System	Detection System
			
	p. 139	p. 139	p. 139

Requirements

No additional tools or components are required.



Experimental setup block diagram.

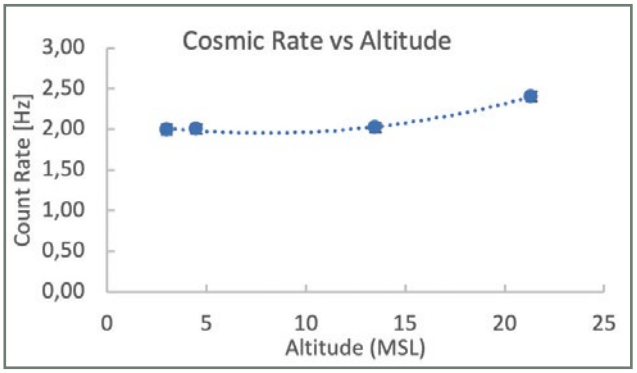
Carrying out the experiment

Connect the cable connectors of the two SP5622 to the tile inputs located on the rear panel of the SP5621 module. Power on the SP5621 module and start the acquisition via the front panel START button. When a charged particle crosses the black tile it's energy is converted into scintillation light. The photons which are produced are detected by the photosensor and converted into an electrical signal. The number of counts for each scintillator may be viewed via the SP5621 display. Select double scintillators coincidence mode via the related button on the front panel, and then select measurement integration time. Because the acquisition of events takes place only in the presence of the coincidence, all such events coming from a cosmic particle that crosses only one scintillating tile will automatically be discarded.

Before starting acquisition choose the system geometry. Be sure to keep this geometry constant even at different altitude levels. Take and record more data to obtain statistical significance.

Results

This experiment is a simple way to identify and prove the non-terrestrial origin of cosmic radiation. For better comprehension of the cosmic flux behaviour as a function of the altitude the user may cover the floor with lead bricks.



Cosmic flux as a function of altitude.