جامعـة نيويورك أبوظـي NYU ABU DHABI

Measurement of Cosmic Muons angular distribution in Abu Dhabi at sea level

#NYUADvancing_Physics

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Abstract

The cosmic muon angular distribution has been measured for zenith angles up to 75°.

We present the first measurement performed in the Arabian Gulf area at sea level.

Abu Dhabi



24.54° N 54.43° E

The Detector Main features:

10 squared (40x40 cm) detection layers each one made of two planes (10 scintillator bars each) orthogonally coupled.

200 readout channels:
WLS bers + SiPM for light detection

• Programmable trigger logic,

• Allows remote operation





Track Reconstrucion

We took ~5 hour of data (DAQ rate ~9Hz) in a desert area.

7 8 9

y-ch #

Typical event showing the track reconstruction and the rejection of outlier hits (in red). Straight line "y=m·x+b" can be represented as a point in the Hough parameter space (r, θ). r = x·Cos(θ) +y·Sin(θ), where θ is a free parameter.



Data Analysis

The linear fit of the tracks in both (x,z) and (y,z) planes allows the identification of the muon direction, which can be represented in spherical coordinates (θ , ϕ)





MC Simulation



A Geant4 application has been built to evaluate the trigger efficiency as a function of the muon arrival direction. We obtained an absolute efficiency of:

 $\mathbf{E}_{abs} = 7.8 \cdot 10^{-4}$

when exposing the detector to an isotropic muon distribution.

Results



The zenith angle dependence can be expressed as: $I(\theta) = I_o \cos^n(\theta)$ The minimization gives for the vertical intensity: $I_o = (7.54 \pm 0.13_{stat} \pm 0.15_{sys}) 10^{-3} \text{ cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$

while for the exponent we have found:

 $n = 1.91 \pm 0.10_{stat} \pm 0.15_{sys}$

Values in agreement with literature for geomagnetic cutoff of ~14GV and muon momentum >0.35 GeV/c.