A NEW STUDY OF MUONS IN AIR SHOWERS BY NBU AIR SHOWER ARRAY

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The NBU air shower array has been in operation in conjunction with two muon magnetic spectrographs. The array incorporates 21 particle density sampling detectors around the magnetic spectrographs covering an area of 900 m^2. The layout of the array (Basak et al[1]) is based on the arrangement of detectors in a square symmetry. The array set up on the ground level is around a 10 m high magnetic spectrograph housing. This magnetic spectrograph housing limits the zenith angular acceptance of the incident showers to a few degrees. The array of detectors is sensitive to air showers initiated by cosmic primaries of energy in the range 10^{14}-10^{15} eV. The detectors are scintillator counters made of plastic scintillators of two different sizes : 0.25 m^2 and 0.125 m^2. Each scintillator is of 5 cm thick mounted firmly within a box made of aluminium sheets. A DUMONT 6364 photomultiplier tube mounted suitably to view the scintillator forms a detector. The pulses from the detectors are digitised by an analog-to-digital converter and the density information from all the detectors is printed out on a paper tape by a line printer. Two muon magnetic spectrographs at a separation of 4 m have been installed in a housing which is located near the centre of the array of detectors.

A 2-metre neon flash tube (NFT) chamber which has been used as a low energy muon detector in the NBU air shower array consists of 9 layers of neon flash tubes installed in a chamber with a cover of 5 cm of lead to get rid of electrons. Each layer contains 54 tubes arranged in such a way that a single muon passing through the flash chamber must discharge the tubes lying on the trajectory of the particle. The NFT chamber covers an area of 1 m x 1 m for the localisation of muon trajectories.

An absorber of 1000 gm/cm^2 of concrete on the roof about 1 m above the spectrograph units is provided to remove the electronic component. Additional lead absorber could be placed above the top tray of the spectrograph for this purpose. The information on muon triggered neon flash tube glows for the location of particle trajectory is obtained

by a set of cameras. From the recorded coordinates of the passing muon at the four levels of detection in the spectrograph, its deflection in the magnetic field is calculated. The momentum of a muon is determined from the relation

$$P = 21.96/\Delta \quad GeV/c$$

where Δ is the deflection in t.s.unit (1 t.s. = 1.999 ± 0.0002 cm) and the constant in the numerator is the product of the geometrical factor of the spectrograph and the line integral of the magnetic induction.

Three hundred muons in the fitted showers of size range 10^4 - 10^5 particles have so far been scanned and the momenta determined in the momentum range 2 - 440 GeV/c. More than 1500 recorded showers are now in the process of scanning and fitting. Shower records that will be obtained till June '85 will be incorporated. A lateral distribution of muons of energy greater than 300 MeV in the shower size range 10^5 - 7 x 10^5 has been obtained from the record of NFT chamber.

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References

1. Basak, D.K. et al, (1984), Nucl. Instr. Meths., 227, 167.