

The charged muon ratio at the top of the atmosphere

P. Carlson¹ and A. G. Gharibi¹

¹, Dept. of Physics, Royal Institute of Technology, 104 05 Stockholm, Sweden

ABSTRACT

A detailed study of data on pion production in proton-nucleus collisions has been made in order to better understand the observed high value of the μ^+/μ^- ratio in the range $0.2 - 2.0 \text{ GeV}/c$ at the top of the atmosphere, where the muon flux is the result of the first interaction of the cosmic ray protons with the atmosphere. This paper describes a chronological study of proton nucleus, p+Be(C), collisions. An approximate factorised expression is obtained for the differential cross section for charged pion production $\frac{d\sigma}{dx} = \frac{1}{x}(1-x)^\alpha A_1 e^{-(A_2 x)}$. The π^- multiplicity, n_{π^-} , is parameterised as function of A and \sqrt{s} . A Monte Carlo simulation method is applied to calculate the charged muon ratio using the CAPRICE94 measured proton flux at float and the $d\sigma/dx$ distributions of the pions. Our result is compared to other simulations results and to the CAPRICE94 results. Our results show that, in agreement with the experimental data, the $R_{sim.} = \mu^+/\mu^-$ ratio is higher for muon momenta below $0.6 \text{ GeV}/c$ than in the range $0.6 - 2.0 \text{ GeV}/c$.