Angular characteristics of pion-nucleus interactions

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Introduction

In the present paper pion-nucleus interactions have been studied using nuclear emulsion technique. The investigation of these interactions is expected to provide some very useful information about the multiparticle production mechanism. Nuclear emulsion is a material which memorizes the tracks of charged particles. When a primary particle collides with a nucleus, it may interact with the nucleons of the target nucleus in two ways. In the first case, independent reactions may take place between the incident particle and the nucleons present in the target nucleus. Secondly the primary particle may interact coherently with the various nucleons of the target nucleus and the secondary particles are produced. Angular distribution of charged secondaries produced in these interactions has been studied for central collision events. Different workers [1-2] have used different criterion for the selection of central collisions. We analysed the events with high shower particle multiplicity i. e., $N_s \geq 28$ and call them as central collision events.

Experimental Technique

A stack of Ilford-G5 emulsion plates each of size (7.5 x 7.5 x 0.063) cm^3 exposed to 340 GeV/c negative pion beam was used to collect the data. The interactions, which were produced within 35 μm from the top or bottom surfaces of the pellicles were excluded from the data. To avoid any contamination of primary events with secondary interactions, the primaries of all the events were followed back up to the edge of the plates and only those events whose primary remained parallel to the main direction of the beam and which did not show any appreciable change in their ionization were finally picked up as genuine primary events. In each event the tracks of different particles were classified as per usual criteria of emulsion experiments. The number of shower, grey and black tracks produced in an event were denoted by N_s, N_g and N_h. The grey and black tracks taken together are referred to as heavy tracks and their number in an event is given by $N_h(=N_g+N_b)$.

Results and discussion

The angular distribution of charged shower particles has been studied in terms of pseudorapidity variable $\eta = -\ln \tan \Theta/2$ where Θ is the space angle of the secondary particle with respect to the mean direction of the incident primary. The pseudorapidity distribution of charged shower particles emitted in central collision events of pion-nucleus interactions is shown in fig.1. From the figure it is clear that no bimodal structure is observed as reported by other workers [3-4].

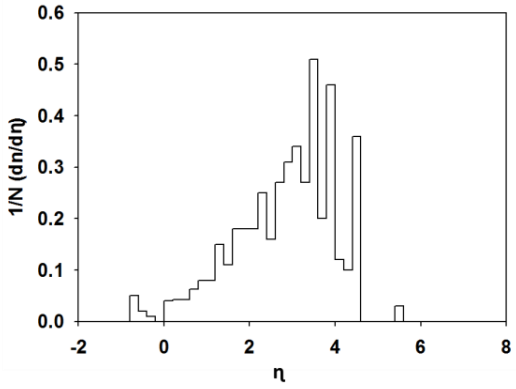

Fig. 1 Single particle pseudorapidity distribution of charged shower particles

The variation of mean pseudorapidity, $<\eta>$, with N_g and N_h is shown in fig.2. From the figure one may notice that $<\eta>$ varies consistently with

grey and heavy particle multiplicity. Therefore we may conclude that similar behavior is observed in the variation of <η> with the number of encounters made by the impinging hadron inside the struck nucleus because N_g or N_h are taken as the best measure of the number of collisions provided that N_g or N_h is not very large. Similar results have been reported by Anzon et al [3].

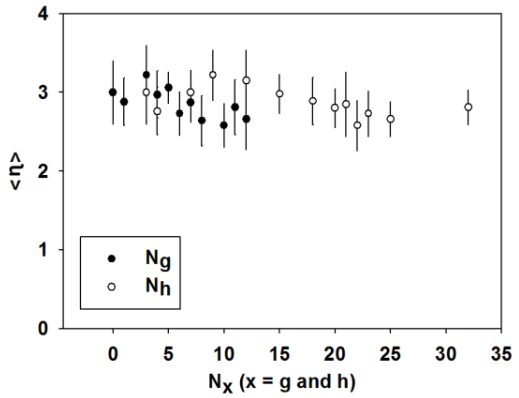

Fig. 2 Variation of mean pseudorapidity <η> with N_g and N_h

Conclusions

No evidence of bimodality is observed in the pseudorapidity distribution. A consistent variation in the mean pseudorapidity with number of collisions seems to occur.

References

[1] M. El-Nadi et al: J Phys G19, 2265 (1998), ibid Eur. Phys. J. A10, 177 (2001)
[2] K. D Tolstoy, Z. phys. A301, 339 (1981)
[3] Z. V. Anzon et al: Nucl. Phys. B129, 205 (1977)
[4] M. El-Nadi et al: J. Phys. G10, 875 (1984)