DEPENDENCE OF ANGULAR CHARACTERISTICS OF SHOWER PARTICLES ON IMPACT PARAMETER IN ^{12}C-NUCLEUS REACTIONS AT 4.5 A GEV

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1. Introduction

Emission characteristic of secondary particles produced in high energy hadronic and nuclear interactions have been extensively studied by several workers [1-6]. When high energy projectile collides with the targets nucleus, a number of charged and uncharged particles are produced. The emergence of these fast particles are known as shower and grey particles. The shower particles are generally pions with relative velocity m the range $\beta \geq 0.7$. The number of shower particle in an event is represented by N_s. The grey particles produced in an interaction, are mostly the recoil protons with an admixture of low energy pions. These tracks are form with relative velocity m the range $0.3 < \beta \leq 0.7$. The number of gray particle and event is represented by N_g. After the emergence of fast particles, the residual nucleus remain existed for a long time on nuclear time scale. Finally, the residual nucleus de-exites resulting in the emission of a large number of nucleons and other heavier fragments. This process is known as nuclear evaporation process. The particles produce through this process are generally called black particles having $\beta \leq 0.3$. These particles

are denoted by N_b . The grey and black tracks are taken together are treated as heavily ionizing tracks ($\beta < 0.7$) and their number in an interaction is given by N_h ($= N_g + N_b$) .

2.Experimental Technique

In this experiment, an emulsion stack of N1K1-BR2 with demission 18.7x9.7x0.01 cm^3 are used. These emulsion stacks are radiated by 4.5 A GeV carbon beam at synchrophasotron at Dubna, Russia. All the experimental details regarding the scanning, measurement, classification of tracks, selection criteria etc. may by found elsewhere [1-3] .

3.Experimental Results and Discussion

It is reported that events having at least 28 heavily ionizing tracks i.e. $N_h \geq 28$, may be classified as event of total disintegration of Ag and Br nuclei [7-9]. The reason for including disintegration with $N_h \geq 28$ in various analysis might be due to the fact that these events correspond to a total charge close to the average charge of Ag and Br (Z=41) and hence they cause a very high degree of breakup of the target nucleus. Thus, for studying various characteristics of secondary charged particles produced in ^{12}C-AgBr collisions at 4.5 A GeV, we have carried out a search for event with $N_h \geq 28$ and $N_h \leq 27$. Study of the angular characteristics of charged shower particles produced in 4.5 A GeV ^{12}C-nucleus interactions, is carried out in terms of pseudo-rapidity variable, η defined as

$$\eta = - \ln \tan(\Theta/2) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Θ is the angle of emission of charged shower particles in lab system and the rapidity width distribution, R(η) is defined as

$$R(\eta) = \eta_2 - \eta_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where η_1 & η_2 are respectively the minimum and maximum pseudo-rapidity values in an event. In order to study the behavior of distribution of rapidity width, we have calculated the value of R(η) using eq. (2). The distributions of rapidity widths obtained in ^{12}C-emulsion collisions at 4.5 A GeV are displayed in Fig. (1).

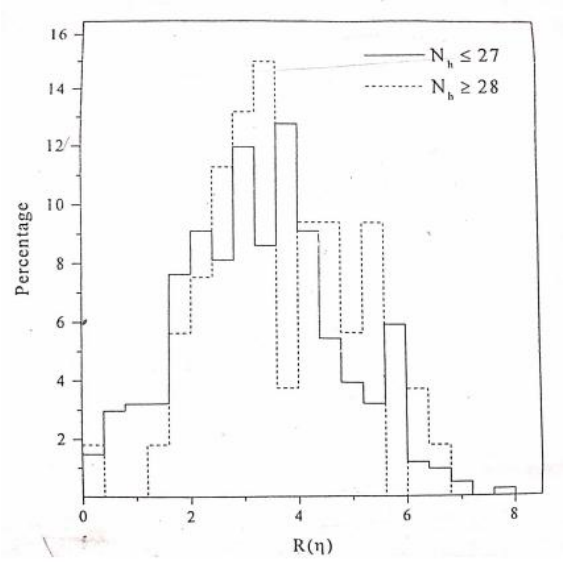

Fig.1 R(η)-distribution for Central and Inclusive collisions.

It is seen in the figure that R(η)-distribution depends strongly on impact parameter in such a way that their peaks shift towards lower value of R(η) with decreasing impact parameter. This observation can be explained in terms of the fact that shower particles produced with relatively larger angles would tend to appear in the target fragmentation region. A similar behavior of R(η)-distribution has been reported in 4.5 A GeV ^{28}Si-emulsion collisions[10].

The <η>-distribution for events with $N_h \leq 27$ and $N_h \geq 28$ is displayed in Fig.(2).

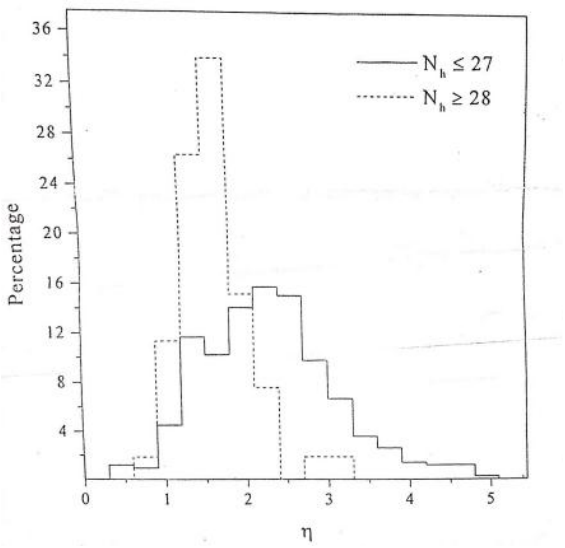

Fig.2 < η > -distribution for Central and Inclusive collisions.

is clearly evident from the figure that the peak of distribution shifts towards the lower value of <η> with decreasing impact parameter. This may be explained in terms of the fact that charged shower particles with large angles would appear in the target fragmentation region.

4.Conclusion

On the basis of present work, we may conclude that the angular characteristics of charged shower particles produced in 4.5 A GeV ^{12}C-emulsion reaction strongly depends on the impact parameters. The results also reveal that the charged shower particles with large angles would appear in the target fragmentation region.

5.References

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