Emission feature of the shower particles produced in backward hemisphere in the interaction of $^{84}Kr_{36}$+Em at 1 A GeV

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Introduction

The nucleus-nucleus (A-A) and hadron-nucleus (h-A) interactions, after the prediction of Quark Gluon Plasma (QGP) as a new phase of matter, received much attention by the worldwide physicist because it gives brief information on nuclear matter properties such as quarks, Gluons and nuclear matter density. Nuclear emulsion detector (NED) with high spatial resolution makes it possible for the detection of the particle having short life time like charm meson, etc. Presently this detector technology is used for the rare events searches in various experiments worldwide, such as CERN, OPERA, CHORUS etc. The interaction of two nuclei can be well explained by Participant Spectator model [1]. In this paper, we have focused on the emission feature of the shower particles produced in the interaction of the ^{84}Kr with emulsion in backward hemisphere ($\theta \geq 90^0$) at 1 GeV per nucleon. We also studied the characteristics of the shower particles with different target groups (AgBr and CNO) of NED.

1. Experimental Details

NED is a composite target detector containing atoms per cubic centimeter of H, C, N, O, Ag, Br, with a little amount of I and F, the exposer of NED was performed at GSI, Darmstad, Germany [2]. We used NIKFI-BR2 nuclear emulsion plates with dimensions of 9.8 $\times$ 9.8 $\times$ 0.06 cm ^{3}. It provides high angular resolution (0.25^0) and 4π solid angle coverage. It has highest spactial resolution, i.e., <1μm. The particles tracks in NED are magnified and measured using a high magnification transmitted light optical binocular microscope. There are two standard scanning methods known as line and volume scanning, were adopted. The scanning of the events from NED plate by microscope was performed at BHU. For this analysis we have used 650 events out of 700 events. On the basis of the relative range (L), normalized grain density (g*) and relative velocity (β) all the secondary charged particles are classified in three groups. **Shower particle**(N_s): These particles have $g^* < 1.4$ and $\beta > 0.7$. **Black Particle** (N_b): These particles have $g^* > 6.8$, L < 3mm and $\beta < 0.3$. **Grey Particle**(N_g): These particles have $1.4 < g^* < 6.8$, L > 3mm and $0.3 > \beta < 0.7$ [1,2].

2. Result and Discussion

To explain the concept of multiplicity distribution for shower particles we have defined two parameters $z = \frac{N_B}{<N_B>}$ and $\psi(z) = P_N(N_B)$. The variation of ψ(z) with the variable z for the events emitted in backward hemisphere produced from the interaction of ^{84}Kr (1 A GeV), ^{32}S (3.7 A GeV) [3] and ^{16}O (3.7 A GeV) [3] with CNO and AgBr target of nuclear emulsion are shown in Figure 1, 2 respectively.

To explain the variation of ψ(z) with variable z, we have used the fitting function ψ(z) = azexp(-bz), where a,b are fitting parameters. This is referred as KNO scaling law [4]. KNO scaling is often thought to be an asymptotic feature. According to this scaling concept, if one rescales P_N recorded at different energies by extending or reducing the vertical or horizontal axes by the average multiplicity N_B, the rescaled curves will coincide. In this

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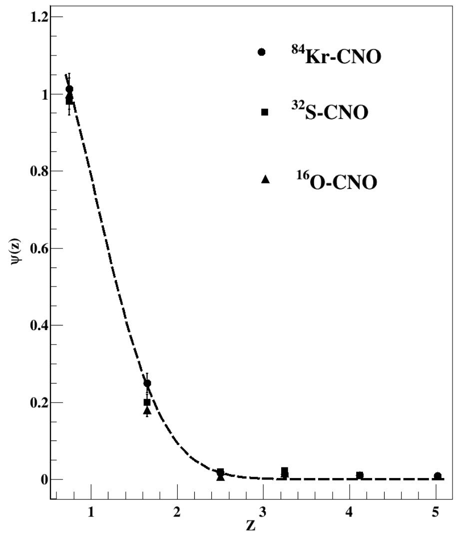

FIG. 1: The correlation in between $\psi(z)$ and Z of the shower particles for the events emitted in the interaction of ^{84}Kr (1 A GeV), ^{32}S (3.7 A GeV) [3] and ^{16}O (3.7 A GeV) [3] with CNO target in BHS.

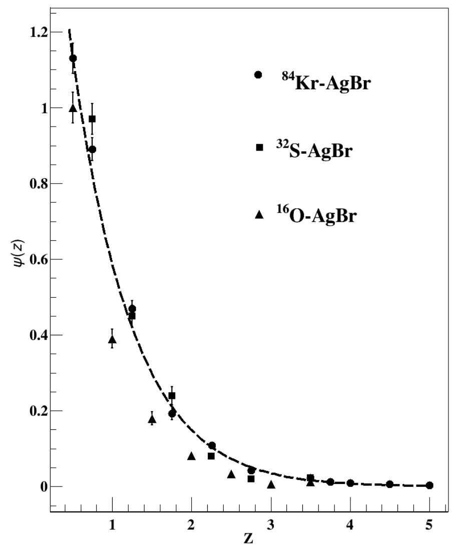

FIG. 2: The correlation in between $\psi(z)$ and Z of the shower particles for the events emitted in the interaction of ^{84}Kr (1 A GeV), ^{32}S (3.7 A GeV) [3] and ^{16}O (3.7 A GeV) [3] with AgBr target in BHS.

study we have observed that the values of a,b are quite different in each of the interaction, which reveals that there is a violation of the KNO scaling for shower events emitted in the backward hemisphere [4].

3. Conclusion

This study, reveals that the emission feature of the shower particles emitted in the backward hemisphere does not depend on the projectile mass, incident kinetic energy of the projectile and interaction with different target group of NED. It happens because most of the events produced in the participant region of the two colliding nuclei are emitted in the forward hemisphere. This detector technology is unique and presently used for the searches of rare events in various experiments worldwide.

4. Acknowledgments

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