Emission feature of the target fragments with noninteracting projectile nucleons at 1 A GeV

U. Singh[1], M. K. Singh[1],* and V. Singh[2]

[1] *Department of Physics, Institute of Applied Sciences and Humanities, GLA University, Mathura-281406, India and*

[2] *Department of Physics, School of Physical and Chemical Sciences, Central University of South Bihar, Gaya-824236, India*

Introduction

The study of nucleus-nucleus interactivity at relativistic energy is prime interest since the birth of the nuclear physics [1–3]. Target fragmentation is one of the important parameter to study the mechanism of two colliding nuclei [1]. Participant spectator model explained briefly the mechanism involved in the two interecting nuclei [1]. Black and grey particles are the target fragments which emit from the target spectator region [3]. Shower particles are basically newly produced particles which emits from the participant region of the two interacting nuclei [2]. The schematic diagram of the two interacting nuclei is shown in Fig. 1. In this analysis we have mainly focused on the multiplicity characteristics of the target fragments as well as their correlations with each other.

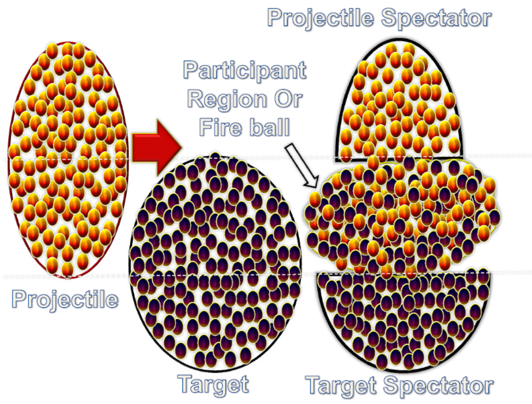

FIG. 1: The schematic diagram showing the projectile and target before collision and three different regions i.e. projectile spectator, participant region, target spectator region after collision of the projectile and target nuclei.

Experimental Detail

The Nuclear Emulsion Detector (NED) used in this study was prepaired at GSI, Darmstadt (Germany). After processed the scanning of the NED was performed at Physics Department, BHU, India. The NED is a composite (i.e. containing H, C, N, O, Ag and Br) target detector [1–3]. To scan the event of interest we have used binocular microscope (Olympus BH-2). The events are scanned by using two well defined techniques known as line and volume sacnning respectively. After performing the scanning we have differentiate the events on the basis of different parameters (range in emulsion plate, relative velocity of the events and normalized grain density) in various categories [1–3].

Shower Particles

These particles draws $g^* < 1.4$, $\beta > 0.7$. Basically pions and kaons are coming in this categories [2].

Grey Particles

These particles draws $1.4 < g^* < 6.0$, $0.3 < \beta < 0.7$ and $L > 3\ mm$. Basically it is knocked out protons which contain E_P in between 30 to 400 MeV. Tritons along with slow mesons and tracks of deuterons coming in this categories [3].

Black Particles

These particles draws $g^* > 6.0$, $\beta < 0.3$ and $L < 3\ mm$. Basically protons having E_P less than 30 MeV coming in this categories [1].

*Electronic address: singhmanoj59@gmail.com

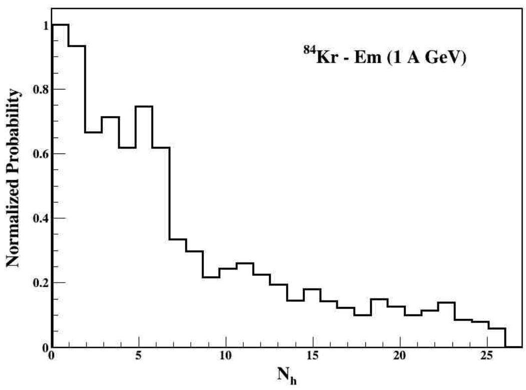

FIG. 2: The Emission feature of N_h for ^{84}Kr-Em (1 A GeV).

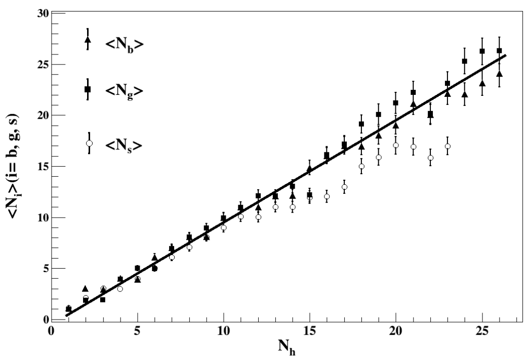

FIG. 3: The Emission feature of N_h with respect to $< N_b >$, $< N_g >$ and $< N_s >$ for the events emerged at the interactivity of ^{84}Kr-Em (1 A GeV). The fitting line is just to guide the variation of data pont.

Heavily ionizing charged particles

The total of grey particles and black particles (i.e. $N_h = N_g + N_b$) are known as heavily ionizing charged particles.

Result and Discussion

Target fragmentation is one of the important parameter to reveals the mechanism of the two interacting nuclei at relativistic energy. In the present analysis we mainly focused on the emission feature of the target fragments with noninteracting projectile nucleons at 1 A GeV. The multiplicity distributions of N_h for the projectile $^{84}Kr_{36}$ is shown in Fig. 2. As we can see from Fig. 2 that the emerging possibility nature of N_h is different for different range of N_h values. The emerging probability is highest for the N_h values in between 0 to 2 and lower for the N_h values in between 3 to 6 as compared to that for 0 to 2. While for N_h values in between 7 to 26 it showing different behaviour and emission probability is decreasing slowly as we move for N_h value from 7 towards 26.

Fig. 3 showing the variation of N_h with respect to $N_i(i = b, g, s)$. From Fig. 3 we can observed that the variation from 0 to 10 is similar for black, grey and shower particles. While when we move N_h value higher than 10 we observed that the emission probability of black and grey particles is little different from each other and the probability for shower is more different than that of black and grey particles.

Conclusion

The present study show that the emission probability of target fragments (black and grey particles) and shower particles are depending strongly on the collsion geometry of the two interacting nuclei. This study also reveals that the degree of dissolution of the target nuclei is one of the important parameter in the emission of secondary charged particles.

Acknowledgments

Authors would like to thanks to all the members of GSI Darmstadt, Germany envolved in the developement of NED using $^{84}Kr_{36}$ projectile at 1 A GeV.

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