The dependence of the weighted average transverse momentum on Feynman variable for π^--mesons, shown on Fig.2, varies more distinctly at change of incident deutrons momentum [2]. As far as the nuclear interactions are similar at considered energies of collisions with nucleon-nucleon ones [4], this change in behavior of correlations permits us to assume the change of meson production mechanism at these energies in nucleon-nucleon interactions.

The features in correlation between kinematical parameters of particles considered in [1,2] need the further study and offerred approach proves to be helpful in research of nucleus-nucleus interactions.

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METHOD OF THE LIGHT FRAGMENT IDENTIFICATION IN CENTRAL COLLISIONS OF 160 A GeV LEAD PROJECTILE WITH NUCLEI OF PHOTOEMULSION

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Previously [1,2] we studied the ^{6}Li fragmentation with 4.1 GeV/c per nucleon momentum. Here we discuss the possibility of investigation of lead nuclei fragmentation with energy 160 A GeV in central interactions with nuclei in photoemulsion. We suggest to use the new method of fragment angle measurement with respect to the fiducial track, which is one of the fragment's track in the same event. To provide the high reliability of the fragment charge estimation it was suggested to use the blob length sum.

The inclusive transverse momenta distribution of fragments with mass number A_F obey the Rayleigh distribution with constant σ_F^2 , which follows, in generally, the parabolic dependence [3]

$$\sigma_F^2 = \sigma_0^2 \cdot \frac{A_F \cdot (A - A_F)}{A - 1} , \qquad (2)$$

where $\sigma_0^2 = P_F^2/5$ is determined by a Fermi momentum of initial projectile nucleus with mass number A. Constant σ_0^2 is the dispersion of the normal distribution $N(0.0, \sigma_0^2)$ for the projectile nucleon momentum projection in the projectile c.m.s. on the arbitrary axis. It is possible to determine the constant of the fragment transverse momenta distribution from the distribution of the fragment transverse momentum projection $P_{\perp\varphi} = 2 \cdot Z \cdot P_0 \cdot \mathrm{tg}\varphi$ on the emulsion plane.

From the kinematics of Pb+Ag collisions at 160 A GeV it follows that the expected mean value of the angle φ between the projection on the emulsion plane of the momentum vector of α−particle, which is the fragment of ^{208}Pb, and the projection on this plane the momentum vector of initial nucleus

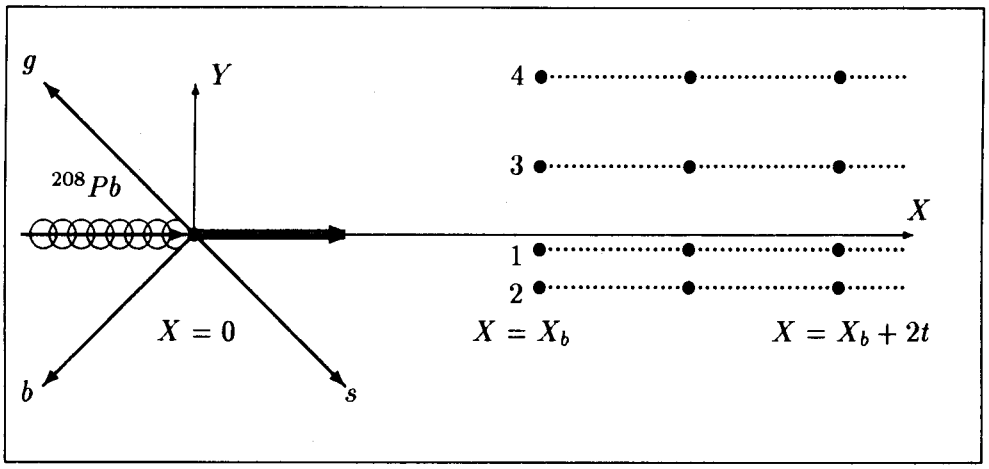

Fig. The measurement scheme of Y – coordinates of tracks of fragments 2,3,4 with respect to the fiducial track 1. In the points labeled by (•) the X, Y, Z coordinates are recorded

$$< \varphi_\alpha >= \sqrt{\frac{\pi}{2}} \cdot \frac{\sigma_F}{4 \cdot P_0} \tag{3}$$

is equal to $\simeq 4 \cdot 10^{-4}$ rad. The value σ_F is obtained from (1) with $A_F = 4$ and $P_0 = 160$ GeV/c. Thus, to study the fragmentation process in our conditions it is desirable to measure the angle φ with the accuracy $\simeq \cdot 10^{-5}$ radians. To provide this one of the tracks of ^{208}Pb fragments is used as fiducial one and the angles of the different fragments are measured with respect to this track.

The method of measurement of fragment angles with respect to the fiducial track is schematically presented in Fig. At the distance about 5 – 10 mm downstream the interaction point the beam of ^{208}Pb fragments looks like a single track which is thinner than initial one. Only at $X_b = 10 \div 15$ mm the fragment tracks move separate enough so that the measurements are possible. The track closest to the initial particle direction along the OY axis is assigned to be a fiducial track. The fragment y–coordinates are measured beginning from $X = X_b$ cm, in $t = 0.1$ cm interval for X coordinate. We measure the y–coordinates of fragment tracks moving across the beam. For N values x_i, y_i of some fragment, if we assume y_i to be the difference between y– coordinates of the fragment track and of the fiducial track, the estimate of the angle φ between these tracks by the least squares method will be

$$\varphi = \frac{N \cdot \sum x \cdot y - \sum y \cdot \sum x}{N \cdot \sum x^2 - (\sum x)^2}. \tag{4}$$

The indexes i at x and y as well as the summation limits from $i = 1$ to $i = N$ are omitted. For $N = 10$, $t = 0.1$ cm and graduation price of y– coordinate $2.125 \cdot 10^{-6}$ cm we have the minimal angle which can be measured $\varphi_{min} = 2.6 \cdot 10^{-7}$ rad. The mean value of the zero angle is equal to $9.3 \cdot 10^{-8}$ rad with an error $\simeq 4 \cdot 10^{-6}$ rad. For the true values of the angle $\varphi = 0.005$, 0.01, 0.02, 0.04, 0.08, 0.16, 0.32, 0.64 and 1.28 mrad the computer simulation showed that the mean values of their estimates are shifted for multiple measurements. The

estimates of all angles are less than their true values by $(4 \div 8) \cdot 10^{-7}$ rad (except the zero angle). The standard deviations of all estimates are independent on angles and equal to $\simeq 4 \cdot 10^{-6}$ rad. Thus, the multiple measurements of the close angles in nuclear emulsion showed that the angles $\varphi = (1 \div 4) \cdot 10^{-4}$ rad can really be measured. For the average angles $(3 \div 5) \cdot 10^{-4}$ rad the replication error of results is found to be $1 \cdot 10^{-5}$ rad.

The other problem which takes place in the investigation of the relativistic nuclei fragmentation is to determine the fragment charge with high reliability. Usually we utilize the density of $\delta-$electrons. But for the light fragments ($Z = 1,\ 2$) the density of $\delta-$electrons is small , so one should count them at the length of track about several centimeters. The background contribution increases. In this case the count of the number of gaps with length larger than predetermined one becomes more effective then the count of $\delta-$electrons. The whole information about the track structure can be obtained from the blob spectrum. From the blob spectrum it is possible to estimate the particle ionization G up to ten times larger than the minimal one for the single-charged particle. In the case of relativistic fragments the problem of the charge estimations at small Z with blob spectrum is more simple. Now it is enough to differ 1, 4, 9...−multiple ionization losses one from another. This is a typical problem of the objects classification by their signs . We can resolve it in such a way that the reliability of fragment charge estimation will be sufficiently high.

It is well known that the density function of blob lengths b is exponentially distributed with constant Λ. After the measurement of K blob lengths on the track of fragment, which charge Z we want to determine, the sum of blob length is found to be $B_K = \sum_{i=1}^{i=K} b_i$. The expected value of this sum is $< B_K >= \Lambda_Z \cdot K$, and the density function B_K is the Erlang distribution of K order. According with the base classification idea the most reasonable value Z is one for which the modulus of difference $B_K - \Lambda_Z \cdot K$ has the minimal value.

Denoting $c_1 = \Lambda_Z / \Lambda_{Z-1}$, $c_2 = \Lambda_Z / \Lambda_{Z+1}$, one obtain for the reliability of the fragment charge estimate close to the expected value of the blob length sum a simple expression

$$P_K = \frac{1}{1 + c_1^K \cdot e^{-K \cdot (c_1 - 1)} + c_2^K \cdot e^{-K \cdot (c_2 - 1)}} \cdot \qquad (5)$$

It is evident that when K increases, the reliability of Z classification uniformly tends to 1. That is, for any, as small one likes value ε, there exists the K value for which $1 - P_K = \varepsilon_K$ is less than ε.

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