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INVESTIGATION OF P, $\pi^{\pm}$ CHARGED PARTICLE CORRELATIONS IN π^{-} C INTERACTIONS AT 5 GEV/C WITH EMISSION OF A PARTICLE IN THE BACKWARD DIRECTION

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In 1957, D.I.Bloknintsev [1] proposed a hypothesis on the existence of nuclear matter coherent fluctuations to explain the massive fragment knock-out of nuclei [5]. Later, this hypothesis was used by A.M.Baldin [2] to explain the cumulative effect. It should be stressed, however, that there is a principle difference between the fluctuations of nuclear matter and clusters discussed in nuclear physics. Indeed, the typical momentum transfer in the cumulative process $t \approx -2M\epsilon$, where ϵ is the total energy of the particle emitted, M is the mass-clot of nuclear matter, reaches a few $(GeV/c)^2$. This momentum transfer corresponds to the localization of this process in the range of about 0.1f, i.e., ten times smaller than that of the usual nuclear cluster. Under these conditions the nuclear matter fluctuation could be treated as an elementary particle consisting of the larger than usual number of quarks. Hadron collisions with such a particle should be rather similar to inclusive hadron processes with a large transverse momentum.

Such quark-parton modification of the nuclear fluctuation hypothesis allowed one of the authors [3] to propose the qualitative explanation of some cumulative particle production regularities on nuclei.

The essential prediction of such a model is the presence of the angular correlations between two particles emitted in the same direction ($\theta = 0°$) and especially in the opposite one ($\theta = 180°$). This is a result of the central collision and of the following collapse of two partons.

Correlations of this type have been observed recently in hadron processes with the large transverse momenta $P_\perp$ [4].

The purpose of the present experiment is to search for and study the correlations at the emission angles of charged particles (P, π^+-mesons) in π^--carbon interactions at 5 *GeV/c*.

As many as $4054\,\pi^-C$ interactions have been found in scanning 20 000 pictures obtained with the one-meter propane bubble chamber. These events were measured and analysed.

The correlations at the lab. system emission angles for different particle pairs (protons, P, and charged pions) have been investigated. One of particles taken was always emitted in the backward hemisphere (lab. system).

Figure 1 shows the experimental distributions of $\cos\theta$, where θ is an opening angle for the proton-proton pairs and for the proton charged particle ones in the corresponding intervals of the "trigger" particle (proton)

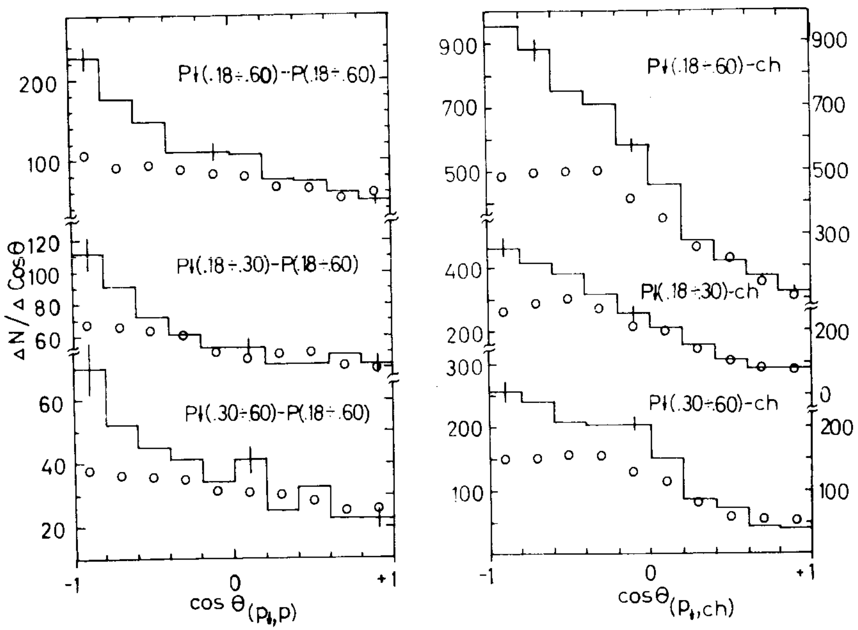

Fig. 1.

momenta. The similar distributions have been obtained also for these cases when π^+ and π^- mesons were selected as "trigger" particles. The background distribution $V_b(x)$ shown in *fig. 1* was constructed on the basis of the single-particle polar angle cosine distributions (a "trigger" particle-1 and a particle in matter - 2) in the following way:

$$V_b(x) = \int W_1(x_1)\,W_2(x_2)\,\delta(\hat{x}-x)\,dx_1\,d\phi_1\,dx_2\,d\phi_2,$$

where

$$\hat{x} = \vec{n}_1\vec{n}_2 = x_1x_2 \pm\sqrt{(1-x_1^2)(1-x_2^2)}\cos(\phi_1-\phi_2),$$

$\vec{n}_1$ ($\vec{n}_2$) is a unit vector in the emission direction of the particle, 1(2), in the lab.s., x_i, ϕ_i are the polar angle cosine and the azimuthal angle of the i-th particle emission, $i=1,2$, W_1 and W_2 are the single-particle inclusive distribution of the polar angle emission cosine (in the corresponding interval of particle momenta), x is the cosine of the opening angle between two particles (lab. s).

Figure 1 shows clearly an excess of the events above the background curve (the background distribution was normalized to the experimental one in the region of $0.5 < x < +1$) especially at $x=-1$ ($\theta=180°$), i.e., a noticeable correlation of particles emitted in opposite directions is observed. This figure shows also the data on the emission angle of particles for two intervals of the "trigger" particle momenta.

Figure 2 shows the ratio of the experimental distribution to the background one $C(x)=V_{exp}(x)/V_b(x)$ for various "trigger"-particles (p, π^+, π^-). This ratio has a maximum at $x=-1$ and amounts to about 2. Besides, the present data (*Fig. 2*) show that as a rule $C(-1)$ is larger for the faster "trigger" particles (the back protons within the momentum interval of 300÷600 *MeV/c*) than for the lower ones (180 ÷300 *MeV/c*).

The similar picture for the angle emission distribution is observed when studying the large transverse momentum interactions (azimuthal correlations) [4]. In the case of large $P_\perp \sim 2\div5$ *GeV/c* our results on $C(x)$ are

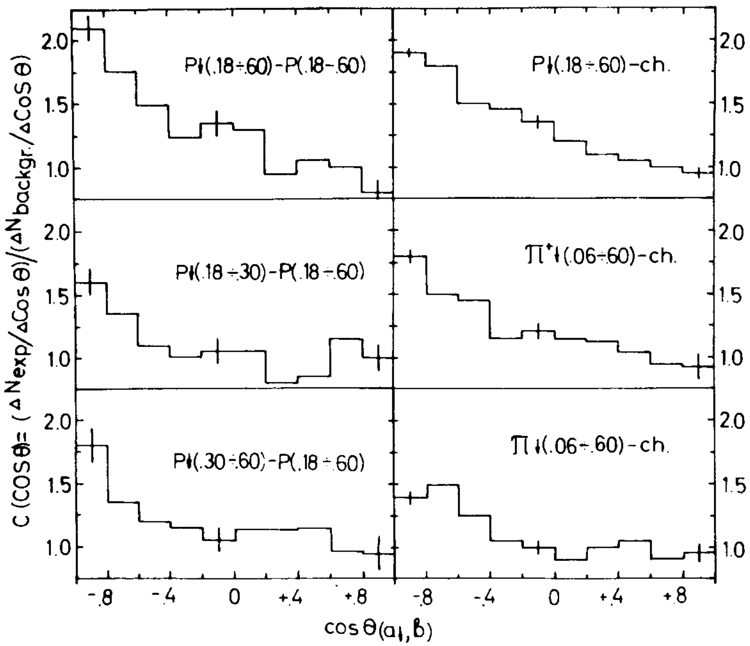

Fig.2.

in agreement with the above quoted experiment [4].

The obtained results allow us to treat the correlation observed in our experiment to be due to the incoming π^--quasi-elastic collision with the massive coherent nuclear matter fluctuation ("flucton") inside the carbon nucleus.

The correlation similarity in the cumulative and in the large $P_\perp$ particle production processes could be treated in favour of these two production mechanisms similarity.

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