ASSOCIATED CORRELATION EFFECTS IN π^-p-INTERACTIONS AT 40 GeV/c

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Results of an experimental study of semi-inclusive reactions in π^-p interactions at 40 GeV/c are presented in this paper. The work was done within the framework of the 2-m JINR propane bubble chamber international collaboration[1]. The results reported are based on the analysis of ~10400 inelastic interactions. Data processing was described elsewhere[2].

The distribution of an associated multiplicity as a function of transverse momentum of the trigger $\pi^\pm$-meson from reaction

$$\pi^-p \to \pi^\pm + (n-1)_{ch} + \ldots \qquad (1)$$

is shown in fig.1. Data from π^-n-collisions (on quasi-free neutrons of the carbon nucleus) are also given for comparison.

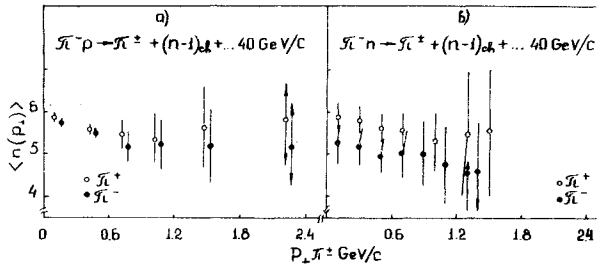

Fig.1.The associated charged multiplicity as a function of transverse momentum of the trigger $\pi^\pm$-mesons.

A weak dependence of the associated multiplicity on $p_\perp$ is seen for low $p_\perp$ region ($p_\perp \lesssim 0.5$ GeV/c), whereas $\langle n(p_\perp)\rangle$ is nearly constant for higher $p_\perp$. The experimental results were approximated by the expression

$$\langle n(p_\perp)\rangle = a + b/p_\perp \qquad (2)$$

deduced within the framework of the diffraction excitation model for semi-inclusive reactions[3,4]. Small values of parameter b (e.g, for π^--mesons $b = 0.08 \pm 0.02$) point a rather weak correlations between n and $p_\perp$.

However it turns out that such behaviour of the $\langle n(p_\perp)\rangle$ is the result of averaging over some different dynamical effects that manifest themselves in different phase-space regions; that we see in fig.2, where the associated multiplicity dependence on $p_\perp$ is shown for different kinematical regions of trigger $\pi^\pm$-mesons. Note

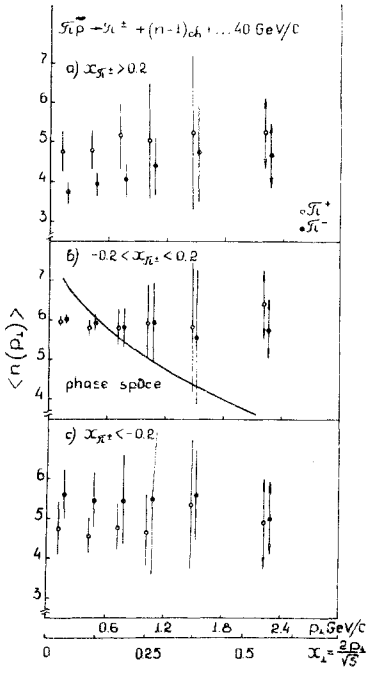

Fig.2. The same dependence in different phase space regions of the trigger particle.

the following main features: i) the $\langle n(p_\perp)\rangle$ values in fragmentation regions - fig.2a) and 2c) are lower than in the central region - fig.2b) because of the diffraction-type mechanisms of the particle production; II) an approximate constancy of the $\langle n(p_\perp)\rangle$- e.g., in the central region - is the result of the influence of the process dynamics - the fact clearly seen when comparing the experimental data with Monte-Carlo generated events[5] - curve in the fig.2b); III) the associated multiplicity for the trigger π^--mesons from beam fragmentation region shows tendency to increase.

Further analysis of the $\langle n(p_\perp)\rangle$ for fast π^--mesons reveals that particles produced in the central region are responsible for this rise of the $\langle n(p_\perp)\rangle$ - fig. 3b).

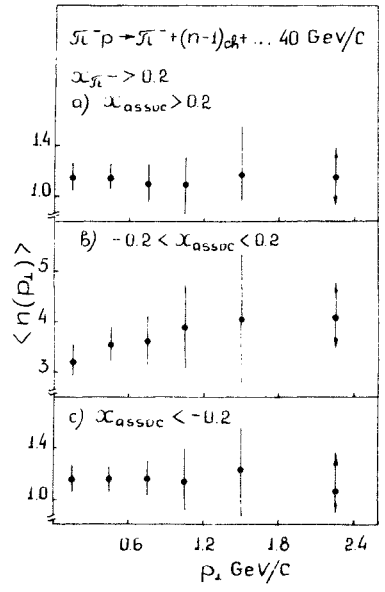

Fig.3. The same dependence for trigger π^- in the beam fragmentation region; associated particles in different phase space regions.

So in this case we can't explain the rise of the $\langle n(p_\perp) \rangle$ for forward emitted π^--mesons by means of the model of beam particle excitation in the course of its interaction with the target hadron constituents[6].

When taking two subsets of associated particles: those having the same direction of the $\vec{p}_\perp$ as the trigger particle and the ones with the opposite direction, the different behaviour of the $\langle n(p_\perp) \rangle$ is seen - fig.4. Whereas the associated multiplicity decreases in the same hemisphere it has a tendency to rise in the opposite one - while correlations of a kinematical origin produce a fall of the $\langle n(p_\perp) \rangle$ in both hemispheres-curves in the fig.4.

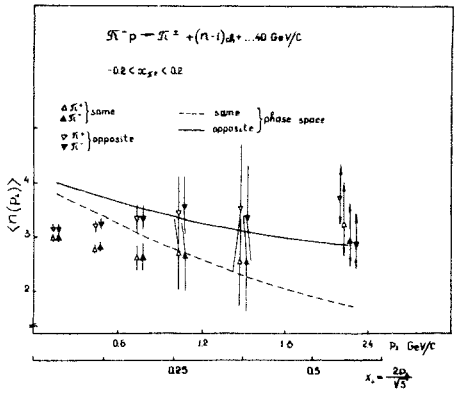

Fig.4. The same dependence for $\pi^\pm$-mesons from the central region in the same and opposite hemispheres.

We have studied further the dependence of the average transverse momentum of associated particles on the value of $p_\perp$ of the trigger particle. Our data show an increase in the $\langle p_\perp \rangle_{ass}$ with the increase in the $p_{\perp\, trig}$ value- fig.5 - which is well approximated by a linear dependence

$$\langle p_\perp \rangle_{ass} = a_1 + b_1 \cdot p_{\perp\, trig} \qquad (3)$$

(e.g. for π^+-mesons $\chi^2/N = 5.86$, $a_1 = 0.354 \pm 0.001$, $b_1 = 0.028 \pm 0.003$).

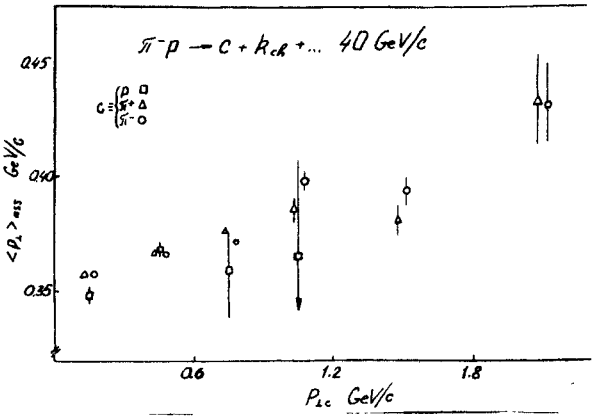

Fig.5. The average transverse momentum of associated particles as a function of the $p_\perp$ of the trigger particle.

When analysing the average associated $p_\perp$ in different azimuthal cones we see that in the cones with opening angle $\varphi > 90^\circ$ $\langle p_\perp \rangle_{ass}$ increases when increasing $p_\perp$ of the trigger the more the closer is φ to 180° - fig.6. However $\langle p_\perp \rangle_{ass}$ increases also for particles in the narrow cone on the same side ($\varphi < 30^\circ$), whereas it decreases in two other cones. It agrees rather well with the big correlations observed at the ISR for high $p_\perp$ particles in the cases of $\varphi \approx 0^\circ$ and $\varphi \approx 180^\circ$[7].

Note in conclusion that the results reported here point at the associated productions of particles with $p_\perp$ greater than the average one and the data do not contradict "jet-type" models.

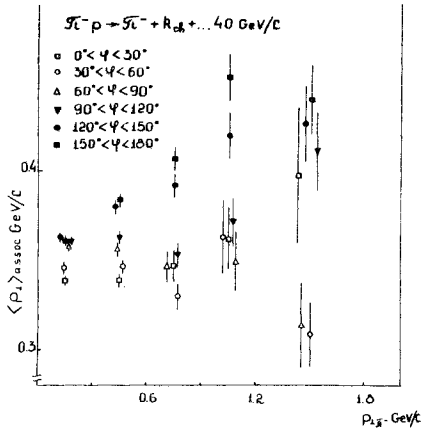

Fig.6. The same dependence in different azimuthal cones for the trigger π^--meson.

The authors are grateful to the staff of the 2-metre chamber international collaboration and to the group of physicists and laboratory assistants of the High Energy Nuclear Physics Problem Laboratory of the Tbilisi State University.

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INVESTIGATION OF SOME INCLUSIVE DISTRIBUTIONS OF Λ^0-HYPERONS AND K^0_1-MESONS IN π^-C^{12} INTERACTIONS AT 40 GEV/C

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In this paper we present results on the investigation of some inclusive spectra of Λ^0-hyperons and K^0_1-mesons produced in π^-C and π^-C^{12} interactions at 40 GeV/c. (Symbol π^-C applies to the π^--meson interactions with carbon without accounting pion interactions with quasifree nucleons).

As an experimental material for physical investigation were used events selected from the films of 2m JINR propane chamber, obtained in π^--meson beam at the Serpukhov accelerator. Questions concerning the measuring of πp-events and section definition of their production are considered in papers /1/ and /2/. Distributions for π^-C and π^-C^{12} interactions are compared with corresponding distributions for $\pi^- p$ collisions.

Momentum Characteristics of Λ^0-Hyperons and K^0_1-Mesons

In Fig.1 normalised momentum distributions of Λ^0 and K^0_1 particles are presented for π^-C^{12}, π^-C and $\pi^- p$ interactions. Comparison of distributions for $\pi^- p$ and π^-C collisions makes it possible to examine the influence of nucleus over the considered distributions. It may be seen that in π^-C interactions the part of slow particles is slightly higher and there is a tendency of decreasing the number of particles with maximal momenta. An average momenta of Λ^0 and K^0_1-particles in π^-C interactions are less than in $\pi^- p$ collisions (see Table I). Momentum distributions of Λ^0 and K^0_1-particles for π^-C^{12} interactions within the range of errors coincide with corresponding distributions for $\pi^- p$ collisions.

In Table I the average characteristics of Λ^0-hyperons and K^0_1-mesons produced in $\pi^- p$, π^-C and π^-C^{12} interactions are given.