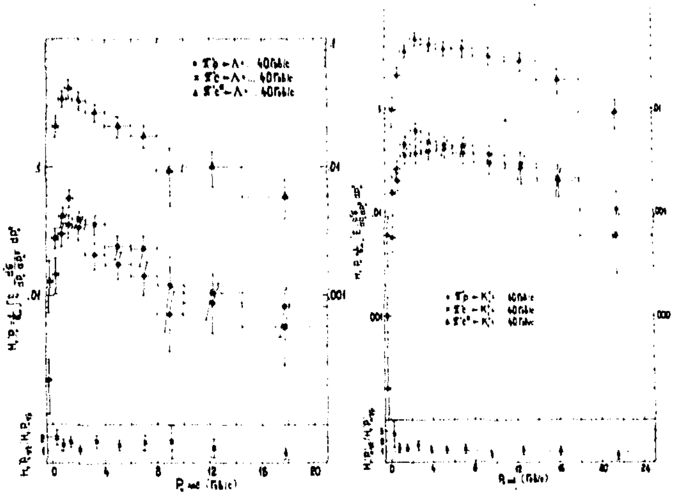

Fig.2.

Distribution of the function $H_1(P_{\parallel})$ to $P_{\parallel}$ for Λ^0 -hyperons and K_1^0- mesons.

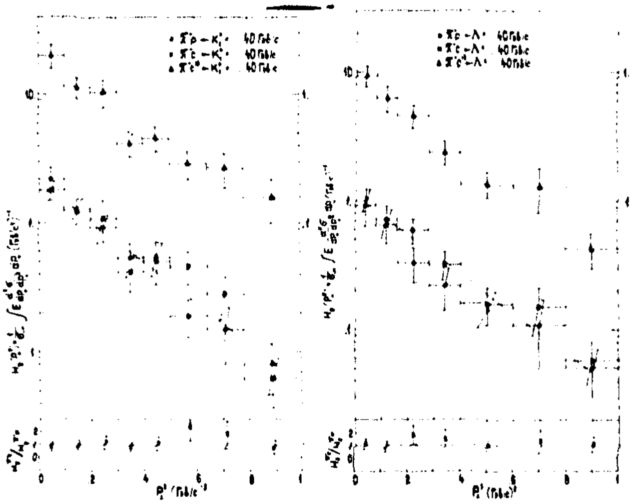

Fig.3.

Dependence of the function $H_2(P^2)$ on P^2 for Λ^0-hyperons and K_1^0-mesons.
Straight line - the result of approximation of experimental data from interactions.

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TWO-PARTICLE CORRELATIONS

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Progress in correlation studies reached in recent years makes it obvious that a real understanding of the phenomena responsible for the structure observed in correlations is impossible without precise separation of the production mechanisms playing a dominant role in different regions of the phase space. For this reason this talk will be devoted mainly to those results which provide information about the interplay between the correlations and production dynamics.

1. Longitudinal Correlations in the Central Region

The correlations are usually studied in terms of correlation functions. The most popular definitions are the following:

$$C_n^{*}(\vec{P}_1,\vec{P}_2)=\frac{1}{n^i(n^j-\delta^{ij})}\rho_n^{ij}(\vec{P}_1,\vec{P}_2)-\frac{1}{n^i n^j}\rho_n^i(\vec{P}_1)\rho_n^j(\vec{P}_2),$$

$$R_n^{*}(\vec{P}_1,\vec{P}_2)=C_n^{*}(\vec{P}_1,\vec{P}_2)\Big/\left(\frac{1}{n^i n^j}\rho_n^i(\vec{P}_1)\rho_n^j(\vec{P}_2)\right),$$

where $\rho_n(\vec{P})=\frac{1}{\sigma_n}\frac{d\sigma_n}{d\vec{P}}$, $\rho_n^{ij}(P_1,P_2)=\frac{1}{\sigma_n}\frac{d\sigma_n}{d\vec{P}_1 d\vec{P}_2}$

are one and two particle densities, i, j - *types* of the particles in the pair.

The inclusive correlation function can be defined in a similar way and rewritten in terms of the components of semiinclusive processes

$$C_n^{*}(\vec{P}_1,\vec{P}_2)=\sum_n \omega_n C_n^{*}(\vec{P}_1,\vec{P}_2)+\sum \omega_n(\rho^i(\vec{P}_1)-\rho_n^i(\vec{P}_1))(\rho^j(\vec{P}_2)-\rho_n^j(\vec{P}_2)),$$

where $\omega_n=\sigma_n/\sigma_{inel}$

The first term in this equation is the sum of the semiinclusive correlation functions taken with the weights proportional to the topological cross sections.The second term is a crossing term which originates from the mixing of the semiinclusive spectra depending on the multiplicity.The last term does not contain any information about the dynamical correlations among the produced particles[1].

The semiinclusive correlations are presented to the conference for $\pi^- p$ /2-6/, pp /7/, $\bar{p}p$ /8/ and pp /9/ interactions in the energy range 5-400 GeV/c. General structure of such correlations is illustrated in fig. 1 where the values of the semiinclusive correlation functions $C_n^*(y_1,y_2)$ are plotted against the $\frac{1}{2}(y_1-y_2)$ for a fixed value of $\frac{1}{2}(y_1+y_2)=0$ /7/ (y_1 and y_2 - rapidities of the particles in pair).

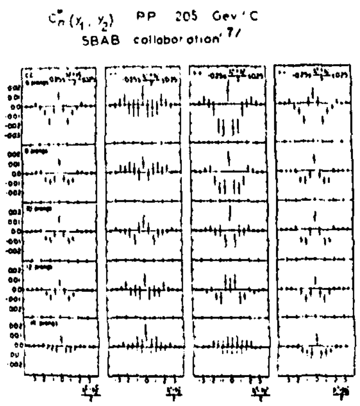

Fig. 1

a) The observed correlations are of short range and the function $C_n^*(y_1,y_2)$ decreases sharply from its value at $y_1 = y_2 = 0$.

b) The values in the central bin are of compatible size for all the charge combinations.

In the framework of the simple cluster emission model the shape of the semiinclusive correlation function can be parametrized in the form /10/

$$C_n^*(y_1,y_2) = \frac{\langle K(K-1)\rangle}{\langle K\rangle\,(n-1)}\left(\Gamma(y_1,y_2) - \frac{1}{n(n-1)}\,\rho_n(y_1)\rho_n(y_2)\right),$$

where K - is the cluster multiplicity, $\Gamma(y_1,y_2)$ - two particle density within the cluster. New data of SBAB collaboration /7/ support the conclusion from PSB experiment /11/ that the clusters are entities with multiplicity independent characteristics. As seen from data of fig. 2 where the values of $\langle K(K-1)\rangle/\langle K\rangle$ are functions of the scaled multiplicity $n/\langle n\rangle$ the multiplicity distribution within a cluster is broader than a δ-function ($\langle K(K-1)\rangle/\langle K\rangle \approx K_0-1$) and narrower than a Poisson-like distribution ($\langle K(K-1)\rangle/\langle K\rangle \simeq \langle K\rangle(n-1)/\langle n\rangle$). The small values of $\langle K(K-1)\rangle/\langle K\rangle$ in the figure imply an average number of charged particles $\langle K\rangle \leqslant 2$ which means that well known resonances, such as vector or tensor bosons could play a dominant role in the picture observed.

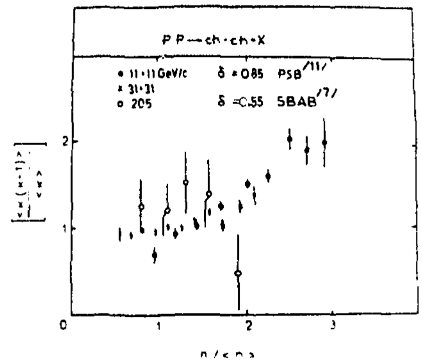

Fig. 2

The effect of ρ^0-production on longitudinal correlations was investigated by the BFGMOP collaboration in $\pi^- p$ interactions at 11.2 GeV/c /6/ (fig. 3).

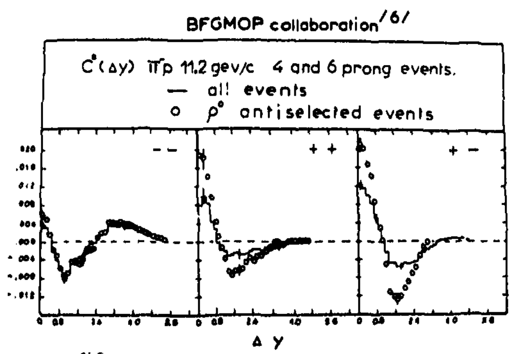

Fig. 3

The ρ^0-meson leads to the effect of forcing apart the π-pairs reducing the short range correlations in $\pi^+\pi^+$ and $\pi^+\pi^-$ systems. This conclusion coincides with a prediction made by E.Levin and M.Ryskin in the context of multiperipheral model considering the alignment of the resonances in the final state /12/.

The French-Soviet Union pp-collaboration at 69 GeV/c previously reported the existence of the maxima in semiinclusive correlation function $C_n^*(y_1=y_2)$ at $y_1=y_2=\pm 1$ for both

$\pi^-\pi^-$ and $\pi^+\pi^-$ combinations/13/. The corresponding data are now available also in pp interactions at 205 GeV/c/7/, K^-p at 32 GeV/c/14/ and $\bar{p}p$ at 22.4 GeV/c/8/. The compilation of the proton data for multiplicity $n=10$ is shown in fig. 4. Positive correlations are present

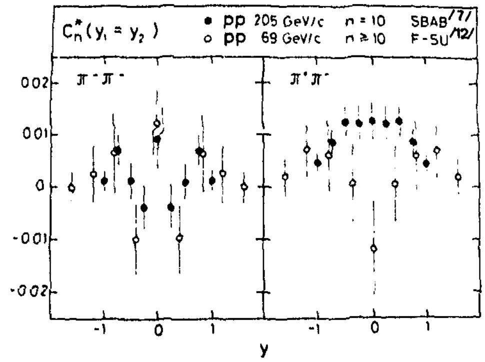

Fig. 4

in all data. The same structure as at 69 GeV/c is seen in the 205 GeV/c data for $\pi^-\pi^-$ pairs. One of the possible explanation for the maxima in $C_n^*(y_1=y_2)$ at $y_1=y_2=\pm 1$ could be the anisotropy of the resonance decay if they are produced in aligned state. The central maximum at $y_1=y_2=0$ can be a manifestation of the second order interference effect (see for example the minirapporteur talk of M.Podgoretsky at this conference).

The data for $\pi^+\pi^-$ combinations are contradictory, The dip at $y_1=y_2=0$ seen in the 69 GeV/c data is absent at 205 GeV/c. More precise data are still needed to study this effect in detail.

2. Joint Angular-Momentum Correlations

The existence of the angular correlations can be partly explained by the negative sign in the right-hand part of the corresponding inclusive sum rule which can be written for identical particles as follows

$$\int (\vec{P}_{t1}\vec{P}_{t2})\rho(\vec{P}_1,\vec{P}_2)\frac{d^3P_1}{E_1}\frac{d^3P_2}{E_2} = -\int P_t^2\rho(\vec{P})\frac{d^3P}{E}$$

which means that wide open pairs are favoured over narrow ones.

Compilation of the data for azimuthal asymmetry defined as $B=[N(\varphi>\frac{\pi}{2})-N(\varphi<\frac{\pi}{2})]/N_{tot}$ is shown in fig.5/6/ (φ is the opening angle in transverse momentum plane).

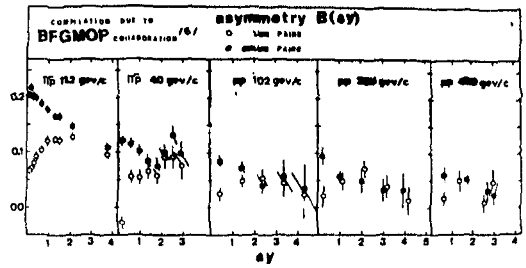

Fig. 5

Comparison for the different energies and initial states suggests that at least for small values of the rapidity difference Δy the asymmetry B for like and unlike particles have consistently a similar behaviour. Higher multiplicity and consequently more neutral particles results in a decrease of asymmetry with energy as is seen from this figure.

The constructive interference which exists in the pairs of like particles/15/ can explain the difference between the azimuthal correlations for like and unlike pairs only in the threshold region $M_{\pi\pi}\simeq 2m_\pi$ where the energy-momentum vectors of the particles in pair are almost equal. Outside this region the resonance production can contribute to the observed difference in the correlations. The corresponding data are now available from a number of experiments. Fig. 6 shows the results obtained in π^-p experiments at 40 GeV/c/16/ (a) and 11.2 GeV/c/6/ (b).

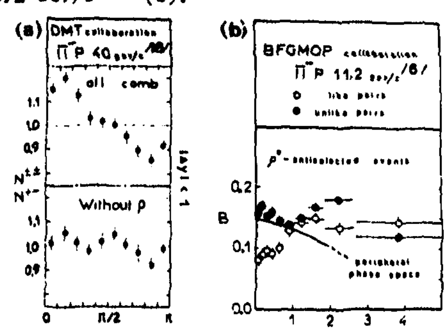

Fig. 6

When ρ -like combinations are excluded from the data no clear distinction between the distributions of the opening angle in transverse momentum plane for like and unlike pion pairs is left in π^-p data at 40 GeV/c/16/ (fig.6a).

The elimination of the events with a $\pi^+\pi^-$ couple in the ρ-region from the total sample makes the experimental data for unlike pairs consistent within the errors with statistical model prediction (fig. 6b). The situation is different for like pairs where the decrease of the asymmetry at small Δy still exists

Let us summarize now the conclusions of these two sections.

The data presented to the conference support the existence of the positive short-range correlations in rapidity space for both like and unlike charge combinations. The dependence of the semiinclusive correlation function on Δy can be parametrized in the framework of the independent cluster emission model with cluster multiplicity $\langle k \rangle \leq 2$ which means that the resonances could play a dominant role in the longitudinal correlations, even if no quantitative connection has yet been established.

The angular correlations observed in the $\pi\pi$ systems are mainly of the kinematical origin. The difference between the like and unlike charge pairs apart from the threshold region where the interference effects could be essential can be explained by the resonance production.

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