


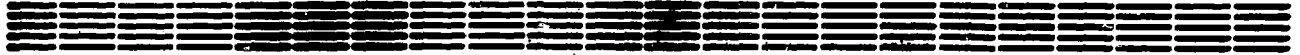
ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ  
ЕРЕВАНСКИЙ ФИЗИЧЕСКИЙ ИНСТИТУТ  
YEREVAN PHYSICS INSTITUTE



R.G.BADALYAN, <sup>G</sup>H.R.GULKANYAN

ON THE POSSIBILITY OF MEASUREMENT OF  
KAON STRANGE VALENCE QUARK AND PROTON  
STRANGE SEA DISTRIBUTIONS IN DRELL-YAN  
PROCESSES

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Ռ.Չ.ԱՐԳՈՒՅԱՆ,      Հ.Ռ.ԳՈՒԼՔԱՆՅԱՆ

ԴՐԵԼԼ-ՅԱՆԻ ՊՐՈՑԵՍՆԵՐՈՒՄ ԿԱՌՆԻ ՏԱՐՕՐԻՆԱԿ ՎԱԼԵՆՏԱՅԻՆ  
Է ԼՐԱԿԻ ԵՎ ԳՐՈՏՈՆԻ ՏԱՐՕՐԻՆԱԿ ԾՈՎԱՅԻՆ ԲՎԱՐԿՆԵՐԻ  
ԲԱՆԴ ՈՐԴՆԵՐԻ ՉՈՓՄԱՆ ՀՆԱՐԱՎՈՐՈՒԹՅՈՒՆՆԵՐԻ ՄԱՍԻՆ

ույց է տրված, որ Դրելլ-Յանի էկստոնային զույգերի ծնման ին-  
չյուզիվ և կլիստինկյուզիվ /ուղեկցող պիոնի գրանցմամբ/ պրոցեսների  
համառոտ ուսումնասիրությունը հնարավորություն է տալիս չափել ու կառ-  
նի վալենտային քվարկների և պրոտոնում տարօրինակ ծովային քվարկներ,  
բաշխման ֆունկցիաները, ինչպես նաև այն ֆունկցիաները, որոնք նկարա-  
պրում են կառնի վալենտային /տարօրինակ կամ ոչ տարօրինակ/ քվարկի  
աննիհիլացման հետևանքով նրա/կառնի/ հատվածավորման տիրույթում գոյա-  
յած բազմապարտոնային վիճակներից պիոնների առաջացման պրոցեսը: Հաղ-  
բոնների առաջացման ռեկոմբինացիոն մոդելի շրջանակներում ստացվել է  
կենդանու շակումներ Դրելլ-Յանի կլիստինկյուզիվ պրոցեսների ղիֆերն-  
զիվ կտրվածքների համար:

Երևանի Փիզիկայի ինստիտուտ

Երևան 1988

Р.Г.БАДАЛЯН, Г.Р.ГУЛКАНЯН

О ВОЗМОЖНОСТИ ИЗМЕРЕНИЯ РАСПРЕДЕЛЕНИЯ  
СТРАННОГО ВАЛЕНТНОГО КВАРКА КАОНА И СТРАННОГО МОРЯ  
ПРОТОНА В ПРОЦЕССАХ ДРЕЛЛА-ЯНА

Показано, что совместное изучение инклюзивных и полуинклюзивных (с регистрацией сопровождающего "меченого" пиона) процессов рождения лептонных пар Дрелла-Яна в  $K^+p$  и  $K^-p$  - взаимодействиях позволяет измерить валентную часть структурных функций каона, распределение странного моря в протоне, а также функцию фрагментации в пионы многопартонных состояний, образованных в области фрагментации каона в результате аннигиляции его валентного (странного или нестранного) кварка. В рамках рекомбинационной модели образования адронов получены предсказания для дифференциальных сечений полуинклюзивных процессов Дрелла-Яна.

Ереванский физический институт

Ереван 1988

R.G. BADALYAN, H.R. GULKANYAN

ON THE POSSIBILITY OF MEASUREMENT OF KAON  
STRANGE VALENCE QUARK AND PROTON STRANGE  
SEA DISTRIBUTIONS IN DRELL-YAN PROCESSES

It is shown that a joint study of inclusive and half-inclusive (with a detection of the accompanying "tagged" pion) processes of Drell-Yan lepton pair production in  $K^+p$  and  $K^-p$  interactions allows one to measure the valence part of kaon structure functions, strange sea distribution on the proton, as well as the fragmentation function into pions for multi-parton states produced in the kaon fragmentation region as a result of annihilation of its valence (strange or nonstrange) quark. Predictions for differential cross sections of semi-inclusive Drell-Yan processes are obtained within the hadro-production recombination model.

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## Introduction

During the recent two decades a great number of experimental studies have been implemented on the measurement of hadron structure functions in deep-inelastic processes (scattering of leptons on nucleons, the Drell-Yan processes of lepton pair production in hadron-hadron interactions). However, despite all these, yet there remain many uncertainties concerning parton distribution functions in hadrons - pion, kaon and even nucleon. Say, the suppression factor of the proton strange sea,  $\lambda_p$ , is poorly known - different estimations give the values in the limits of  $\lambda_p = 0.1 - 0.5$  [1-7], great uncertainty exists also in the  $x$ -dependence of the distribution function of  $S(\bar{S})$ -quarks in nucleon (at parametrization  $xS_p(x) \sim (1-x)^{n_p^s}$  different estimations yield the value  $n_p^s = 3-7$  [1-8]). Still more uncertainties exist in the parameters of pion and kaon structure functions. More or less confident data for a pion are available only for its valence quarks distribution, whereas parameters of its sea quarks distribution are measured with an

accuracy of  $\sim 50\%$  [9-11] . Quite poor information on the Drell-Yan processes is available for a kaon, and even then it concerns only its nonstrange valence quark [9-12] .

The main difficulty in extracting information on strange quark distributions in hadrons is connected with their insignificant contribution to lepton pair production in the inclusive Drell-Yan processes. This circumstance stimulated one to make attempts as to derive such information by involving model representations on a quark-parton mechanism of kaon fragmentation into hadrons with low transverse momenta (the fusion model [13,14] , recombination model [15-17] ). The application of such models to the description of experimental data on kaon fragmentation into vector mesons at high energies apparently allows one to derive a rather confident information on valence quarks distribution (at least for a nonstrange valence quark as shown by the comparison with data [18] obtained from the Drell-Yan processes).

Nevertheless, the necessity to derive a more complete exact information on kaon structure functions requires further experimental studies and application of various model approaches.

The main goal of this work is to study a possibility to obtain data on distribution of the strange valence quark in kaon and the strange sea in proton by means of experimental study of both usual (inclusive) Drell-Yan processes in kaon beams and semi-inclusive reactions of lepton pair production accompanied by a "tagged" pion:

$$K^+ p \rightarrow \pi^+ (\mu^+ \mu^-) X \quad (1a)$$

$$K^- p \rightarrow \pi^- (\mu^+ \mu^-) X \quad (1b)$$

In addition, the study of processes (1) offers new possibilities to obtain information on properties of nonperturbative processes in strong interactions, in particular, on hadronization mechanisms of complex multi-parton quark-gluon systems produced in the fragmentation region of the incident meson at annihilation of one of its (anti)quarks in the target. Also interesting is a comparison of the measured from (1) fragmentation function of such a system into pions with similar functions in soft hadron processes and in processes of current quark hadronization in deep-inelastic lepton-nucleon scattering as well as in processes  $e^+e^- \rightarrow$  hadrons.

In Sections 1 and 2 we consider experimental possibilities of the measurement of poorly known kaon and proton structure functions as well as fragmentation functions into pions for complex multi-parton systems containing one of kaon valence quarks. In Section 3, within the approach based on the recombination mechanism of hadroproduction [19,20] we have obtained predictions (dependent on parameters of kaon and proton structure functions) for differential cross sections of half-inclusive Drell-Yan processes. We give quantitative estimates which show that at the detection (as a trigger) of the fast  $\bar{K}^+$ -meson in the incident kaon fragmentation region in reaction (1a) the measurement of distribution functions of strange quarks in kaon and proton is possible.

1. Analysis of Inclusive Reactions of Drell-Yan  
Lepton Pair Production

Before turning to the consideration of half-inclusive processes (1), we should note that significant possibilities for partial removal of available inaccuracies and blanks in kaon and proton structure functions are offered also by a more detailed experimental study of the Drell-Yan inclusive processes:

$$K^+ p \rightarrow (\mu^+ \mu^-) X \quad (2a)$$

$$K^- p \rightarrow (\mu^+ \mu^-) X \quad (2b)$$

The question is about the verification of the poorly measured distribution function of a nonstrange valence quark of a kaon and poorly known distribution of strange sea in a proton. Indeed, consider differential cross sections of processes (2)  $(\xi = (\frac{4\pi d^2}{9M^2}) M/s \sqrt{\frac{x^2}{4} + \frac{M^2}{s}})$  :

$$\left( \frac{d^2\sigma}{dx dM} \right)^+ = K \xi \sum_{j=1}^3 f_j^+(x, M) \quad (3)$$

$$\left( \frac{d^2\sigma}{dx dM} \right)^- = K \xi \sum_{j=1}^3 f_j^-(x, M) \quad (4)$$

$$f_1^\pm(x, M) = \frac{1}{9} S_K^V(x_1) S_P(x_2) \quad (5a)$$

$$f_2^+(x, M) = \frac{4}{9} U_K^V(x_1) U_P^S(x_2) ; \quad f_2^-(x, M) = f_2^+(x, M) + \frac{4}{9} U_K^V(x_1) U_P^V(x_2) \quad (5b)$$

$$f_3^\pm(x, M) = \frac{1}{9} U_K^s(x_1) \{ 4U_p^v(x_2) + d_p^v(x_2) + 10U_p^s(x_2) \} + \frac{2}{9} S_K^s(x_1) S_p(x_2) \quad (5c)$$

where  $\alpha = 1/137$  is a fine-structure constant,  $M = \sqrt{x_1 x_2 S}$  and  $x = x_1 - x_2$  respectively are effective mass and longitudinal momentum of a lepton pair,  $\sqrt{S}$  is invariant energy of the

$K_p$  -interaction,  $x_1$  and  $x_2$  are longitudinal momenta (in  $\sqrt{S}/2$  units), respectively for a kaon quark (antiquark) and proton antiquark (quark) participating in the process of annihilation into a lepton pair;  $x_{1,2} = \frac{x}{2} \left( \sqrt{1 + \frac{4M^2}{x^2 S}} \pm 1 \right)$

The kaon strange and nonstrange (anti)quark distributions are described by  $S_K^v(x)$  and  $U_K^v(x)$  functions, while the strange and nonstrange sea (anti)quark distributions are described by  $U_K^s(x)$  and  $S_K^s(x)$  functions (we assume  $U_K^s(x) = \bar{U}_K^s(x) = d_K^s(x) = \bar{d}_K^s(x)$ ,  $S_K^s(x) = \bar{S}_K^s(x)$ );  $U_p^v(x)$ ,  $d_p^v(x)$  and  $U_p^s(x)$  are the known distribution functions of nonstrange valence quarks and sea (anti)quarks in a proton (we assume  $U_p^s(x) = \bar{U}_p^s(x) = d_p^s(x) = \bar{d}_p^s(x)$ );  $S_p(x) = \bar{S}_p(x)$  is the strange sea (anti)quark distribution in a proton.

The difference between the (4) and (3) cross sections

$$\left( \frac{d^2\sigma}{dx dM} \right)^- - \left( \frac{d^2\sigma}{dx dM} \right)^+ = K \frac{4}{9} U_K^v(x_1) U_p^v(x_2) \quad (6)$$

contains apart from the distribution function  $U_K^v(x)$  also a well-known function  $U_p^v(x)$  and a weakly dependent on kinematical variables factor  $K$  (which also can be determined from (6)). Following from the known proton structure functions [1,2,21], it can be readily estimated that the term proportional to  $U_K^v(x_1) U_p^v(x_2)$  represents the main ( $\sim 50\%$  and more)

fraction of cross section (4) up to  $x_2 \approx 0.02$ . Therefore the exact measurement of  $U_K^V(x_1)$  in a wide range over  $x_1$  (in real experiments  $x_1 \gtrsim 0.1 + x_2$ ) is quite a realizable problem; whereas in the region of small  $x_1 \lesssim 0.12$ , where the measurement of structure functions in the Drell-Yan processes is somewhat complicated,  $U_K^V(x_1)$  can be restored using the conventional parametrization of structure functions of valence quarks in mesons (see, e.g. [13,14,17]).

The knowledge of function  $U_K^V(x)$  offers a principal possibility to obtain a direct information on strange sea quark distribution function in proton. Indeed, let us consider expression (3). At sufficiently large values  $x_1 > 0.2$  only the first two terms contribute to it (it is assumed that sea quark distributions  $U_K^S(x_1)$ ,  $S_K^S(x_1)$  in a kaon, similarly to a proton and pions, have a behavior drastically falling with increasing  $x_1$ ); note that the second term prevails over the first one up to values of variable  $x_1$  not very close to 1. However at  $x_1 \rightarrow 1$  we expect  $U_K^V(x_1)/S_K^V(x_1) \sim (1-x_1)^{0.4}$  (see, e.g. [13,14,17,18]), and in the region  $x_1 > 0.95$ , where  $S_K^V(x_1) > 4U_K^V(x_1)$ , the contribution of the first term that contains the distribution function of the proton strange sea quark  $S_p(x_2)$  becomes compatible with the contribution of the second (known) term. Therefore, from the comparison with experimental data we'll be able to isolate the first term contribution and determine (up to normalization) the shape of function  $S_p(x_2)$  using here, say, a parametrization

$S_p(x_2) \sim (1-x_2)^{\pi_p^S}$ . Note that the establishment of difference or closeness of  $\pi_p^S$  to a similar exponent for

nonstrange sea quarks in a proton will play a significant role for a more profound understanding of the mechanism of occurrence of quark-antiquark hadron sea.

As to the distribution function of the kaon strange valence quark  $S_K^V(x_1)$ , its experimental measurement in the inclusive aspect is possible only in a very narrow range of values of a variable  $x_1$  close to 1 ( $0.95 < x_1 \leq 1$ ). To measure it in a wide range over  $x_1$ , it is necessary to consider more complex semi-inclusive processes of lepton pair production accompanied by a fast "tagged" pion.

## 2. Semi-Inclusive Processes of Drell-Yan Lepton Pair Production Accompanied by a Pion

Return back to the consideration of processes (1),  $K^\pm p \rightarrow \pi^\pm(\mu^+\mu^-)X$ . Their differential cross sections have a form:

$$\begin{aligned} (d^3\sigma/dxdMdz)^+ &= K\xi \left\{ f_1^+(x,M)D_u^{\pi^+}(z) + \right. \\ &\left. + f_2^+(x,M)D_s^{\pi^+}(z) + f_3^+(x,M)D_{u\bar{s}}^{\pi^+}(z) \right\} \end{aligned} \quad (7)$$

$$\begin{aligned} (d^3\sigma/dxdMdz)^- &= K\xi \left\{ f_1^-(x,M)D_{\bar{u}}^{\pi^-}(z) + \right. \\ &\left. + f_2^-(x,M)D_s^{\pi^-}(z) + f_3^-(x,M)D_{\bar{u}s}^{\pi^-}(z) \right\} \end{aligned} \quad (8)$$

where  $z = x_\pi/(1-x_1)$  indicates a share presented by a final pion longitudinal momentum relative to total longitudinal momentum of a multi-parton system produced in the fragmentation

region of an incident kaon after annihilation of one of its (anti)quarks in a target. The functions  $D_u^{\pi^+}(z) = D_{\bar{u}}^{\pi^-}(z)$ ,  $D_s^{\pi^+}(z) = D_s^{\pi^-}(z)$  and  $D_{u\bar{s}}^{\pi^+}(z) = D_{\bar{u}s}^{\pi^-}(z)$  describe the fragmentation of such multi-parton system into a pion (the subscript denotes the kaon valence quarks that did not participate in the annihilation).

It should be emphasized that expressions (7) and (8) were obtained under the assumption on independence of two subprocesses in reactions (1): a hard process of lepton pair production and a soft process of multi-parton system hadronization described by the fragmentation functions independent of lepton pair characteristics. Experimental data [22] support this assumption. However a quantitative estimation of its fulfilment can be obtained by measuring the difference between the cross sections (8) and (7):

$$\begin{aligned} & (d^3\sigma/dxdMdZ)^- - (d^3\sigma/dxdMdZ)^+ = \\ & K \xi \frac{4}{9} U_K^v(x_1) U_p^v(x_2) D_s^{\pi^+}(z) \end{aligned} \quad (9)$$

which at known functions  $U_K^v(x)$ ,  $U_p^v(x)$  and  $K$ -factor gives a direct measurement of a fragmentation function  $D_s^{\pi^+}(z)$  in a wide range over variable  $z$ . The independence of  $D_s^{\pi^+}(z)$  on variables  $x_1$  and  $x_2$  will serve as an experimental check of the above-made assumption. For the present, in this work we'll consider that expressions (7)-(9) are factorized sufficiently exactly. It should be emphasized that the mentioned method to determine  $D_s^{\pi^+}(z)$  apparently is a unique possibi-

lity for direct measurement of fragmentation function of strange quark (or multi-parton system containing a strange quark as a valence one).

Now, after it has been shown that the second term in expression (7) is amenable to direct measurement by studying differences in differential cross sections (4), (3) and (8), (7) in  $K^-$  and  $K^+$  meson beams, let us consider a possibility to measure the first term  $(1/9)S_K^V(x_1)S_P(x_2)D_u^{\pi^+}(z)$  that contains other functions of interest. Meanwhile we'll consider a region of sufficiently large  $x_1$  (approximately  $x_1 \gtrsim 0.2$ ), where the third term contribution in (7) can be neglected.

The function  $D_S^{\pi^+}(z)$  describing the fragmentation into  $\pi^+$ -meson of a multi-parton system that does not contain a valence quark common with  $\pi^+$  meson has a shape rapidly falling with increasing  $z$ , as distinct from the function  $D_u^{\pi^+}(z)$  that describes fragmentation of a multi-parton system containing a valence  $u$ -quark. So, for example, from data on deep-inelastic  $\nu(\bar{\nu})p$ -scattering we know [23] that the ratio of function of  $u$ -quark fragmentation into a "like" ( $\pi^+$ ) and "unlike" ( $\pi^-$ ) mesons behaves as  $\sim 1.3/(1-z)$  (see Fig.1). There are no direct experimental data for the function of  $S$ -quark fragmentation into pions. One may, however, expect that the corresponding fragmentation functions with increasing  $z$  fall off more rapidly than in the case of  $u$ -quark into  $\pi^-$  meson, since the leading effect for a heavier quark is more pronounced (for example, pion production in a two-step process  $\bar{S} \rightarrow K(890) \rightarrow \pi K$  leads to a softer

spectrum for a pion than for an unlike pion in the process  $u \rightarrow \rho^0 \rightarrow \pi^- \pi^+$  (owing to the difference between pion and kaon masses). We come to the same conclusion when considering multi-parton system fragmentation into pions in the framework of recombination model [24]; calculations done by this model show (see Section 3) that the ratio  $D_u^{\pi^+}(z)/D_S^{\pi^+}(z) > 5$  already at  $z \geq 0.6$  and  $> 10$  at  $z \geq 0.8$  (see Fig.1). Thus, if in the cross section of inclusive process (3) the contribution of the first term that contains the searched function  $S_K^V(x)$  does not exceed on the average (5-10)%, then in the cross section of semi-inclusive process (7) this contribution at relevant values of variable  $z$  can achieve some tens per cent or even become basic. The relative contribution of the first term in (7) increases also at  $x_1 \rightarrow 1$ . All these allow to claim that there exists a possibility to determine experimentally the shape of  $S_K^V(x)$  and  $D_u^{\pi^+}(z)$  functions at minimal model assumptions. Further, the use of a usual parametrization of  $S_K^V(x)$  function allows to estimate from a joint analysis of cross sections (3) and (7) also normalizations of  $D_u^{\pi^+}(z)$  and  $S_p(x)$  functions, though, with a relatively poor accuracy.

The above-cited qualitative consideration shows a principal possibility to obtain a new required information on kaon and proton structure functions as well as on fragmentation functions of complex multi-parton systems. A quantitative analysis based on the assumption on a recombination mechanism of semi-inclusive Drell-Yan hadroproduction processes on the example of reaction (1a)  $K^+p \rightarrow \pi^+(\mu^+\mu^-)X$  is given in the

next section.

### 3. Differential Cross Sections of Semi-Inclusive

$$K^+ p \rightarrow \pi^+(\mu^+ \mu^-) X \quad \text{Process}$$

In the calculation of differential cross section (7) we used the following parametrization for proton structure functions:

$$xU_p^v(x) = 2x^{\alpha_p}(1-x)^{\beta_p} / B(\alpha_p, \beta_p + 1) \quad (10a)$$

$$xd_p^v(x) = x^{\alpha_p}(1-x)^{\beta_p+1} / B(\alpha_p, \beta_p+2) \quad (10b)$$

$$xU_p^s(x) = g_p(1-x)^{n_p^u} \quad (10c)$$

$$xS_p(x) = \lambda_p g_p(1-x)^{n_p^s} \quad (10d)$$

at the known values [21] of parameters  $\alpha_p = 0.55$ ,  $\beta_p = 3.2$ ,  $n_p^u = 8$ ; the unknown parameter  $n_p^s = n_p^u$  was also fixed; the parameter  $\lambda_p$  was varied in most probable (obtained from various experiments) limits  $0.2 < \lambda_p < 0.5$ ;  $g_p = 0.35$  at  $\lambda_p = 0.2$  and  $g_p = 0.31$  at  $\lambda_p = 0.5$  (average longitudinal gluon momentum in proton is 50% [2,21]);  $B(x,y)$  is the Euler beta function.

The kaon structure functions were parametrized in a similar way:

$$xU_k^v(x) = x^{\alpha_k^u}(1-x)^{\beta_k^u} / B(\alpha_k^u, \beta_k^u + 1) \quad (11a)$$

$$xS_K^v(x) = x^{\alpha_K^s} (1-x)^{\beta_K^s} / B(\alpha_K^s, \beta_K^s + 1) \quad (11b)$$

$$xU_K^s(x) = g_K (1-x)^{n_K^u} \quad (11c)$$

$$xS_K^s(x) = \lambda_K g_K (1-x)^{n_K^s} \quad (11d)$$

For parameters that refer to kaon valence quarks the results of Refs [9,12] were used:  $\alpha_K^u = 0.45$ ,  $\alpha_K^s = 0.9$ ,  $\beta_K^u = 1.37$ ,  $\beta_K^s = 0.92$ . For parameters referring to sea quarks it was assumed that their values were close to experimental estimates [11] of parameters of distribution function of sea quarks in a pion obtained from the Drell-Yan processes:  $n_K^u = 8.4$ ,  $g_K = 0.11$  at  $\lambda_K = 0.2$ ; it was also assumed that  $n_K^s = n_K^u$  and the average longitudinal gluon momentum in a K-meson just like in a proton and pion is  $\sim 50\%$ . Note, however, that uncertainties in distribution functions of kaon sea quarks affect the expression for differential cross section (7) only in a limited region of  $x_1$  variation ( $x_1 < 0.2$ ).

To calculate fragmentation functions  $D_u^{\pi^+}(z)$ ,  $D_{\bar{s}}^{\pi^+}(z)$  and  $D_{u\bar{s}}^{\pi^+}(z)$ , we made use of the assumption on a recombination mechanism of the multi-parton quark-gluon system hadronization process [24] suggested earlier to describe inclusive hadron spectra with low transverse momenta in the soft hadron-hadron interactions [19,20] and used to estimate parameters of kaon structure functions from experimental data on fragmentation processes of high-energy kaons into vector mesons [17]. In the framework of such an approach the fragmenta-

tion functions of interest have a form [24] :

$$z D_u^{\pi^+}(z) = 0.24 z^{1-\alpha_p(0)} (1-z)^{-1+\gamma} / B(1-\alpha_p(0), \gamma) + 0.06 (1-z)^{\gamma-\alpha_p(0)} \quad (12a)$$

$$z D_s^{\pi^+}(z) = 0.06 (1-z)^{\gamma-\alpha_p(0)} \quad (12b)$$

$$z D_{u\bar{s}}^{\pi^+}(z) = 0.24 z^{1-\alpha_p(0)} (1-z)^{\gamma-\alpha_p(0)} / B(1-\alpha_p(0), 1-\alpha_p(0)+\gamma) + 0.06 (1-z)^{1-\alpha_p(0)-\alpha_p(0)+\gamma} \quad (12c)$$

where  $\alpha_p(0)=0.5$ ,  $\alpha_\varphi(0)=0.1$  are intercepts of  $\rho$  and  $\varphi$  trajectories,  $\gamma=1.63$  [17] .

Note that functions (12) describe fragmentation of multiparton systems into "direct" pions, i.e. without account of a contribution from resonance decays; therefore in what follows we shall restrict ourselves to a region of large  $z \gg 0.5-0.6$  where this contribution is small. Note also that within the recombination models [19,20] the function  $z D_{u\bar{s}}^{\pi^+}(z)$  is none other than an invariant inclusive spectrum of the "direct"

$\pi^+$ -mesons in  $K^+p$ -interactions in the kaon fragmentation region [24] ; the results of calculations (to be published) of these spectra where also a contribution from meson resonance decays is taken into account show a satisfactory agreement with the experiment.

The ratio of fragmentation functions  $D_u^{\pi^+}(z) / D_s^{\pi^+}(z)$  versus  $z$  is shown in Fig.1. Figs 2 show the dependence of the ratio of cross sections (7) and (3)  $R(x, M, z) = (d^3\sigma/dx dM dz)^+ / (d^2\sigma/dx dM)^+$  on one of variables

$x$ ,  $M$  or  $z$  at fixed values of two others. The calculations are performed for initial momentum of  $K^-$  meson 300 GeV/c and at above-cited values of parameters of structure functions of proton (10) and kaon (11).

In Fig.2 separately are shown contributions of three terms of expression (7); one can see that in the region of large  $z$  ( $z \geq 0.5-0.7$ ) the first term of interest begins to play a noticeable role in the summary cross section, hence it can be determined from the comparison of calculations with experiment.

The presented curves are calculated at a value  $\lambda_p = 0.2$ . At larger values of  $\lambda_p$  a relative contribution of the diagram with annihilation of the kaon strange antiquark to the summary cross section of the semi-inclusive process enhances and correspondingly the expected accuracy of measurements of  $S_K^V(x)$ ,  $S_p(x)$ ,  $D_u^{\pi^+}(z)$  functions is improved.

#### 4. Conclusion

We'd like to formulate the basic conclusion of this work. The joint study of inclusive and semi-inclusive (accompanied by a "tagged" pion) processes of the Drell-Yan pair production in  $K^+p$  and  $K^-p$  interactions as well as the analysis of the obtained experimental data based on expressions (3), (4), (7) and (8) allow one at minimal model representations to measure: distribution functions of strange sea in the proton  $S_p(x)$ , those of nonstrange and strange valence quarks  $U_K^V(x)$  and  $S_K^V(x)$  in the kaon;  $D_S^{\pi^+}(z)$  and  $D_u^{\pi^+}(z)$  functions of multi-parton systems fragmentation into pions.

Such measurements may be carried out on high-energy proton accelerators available.

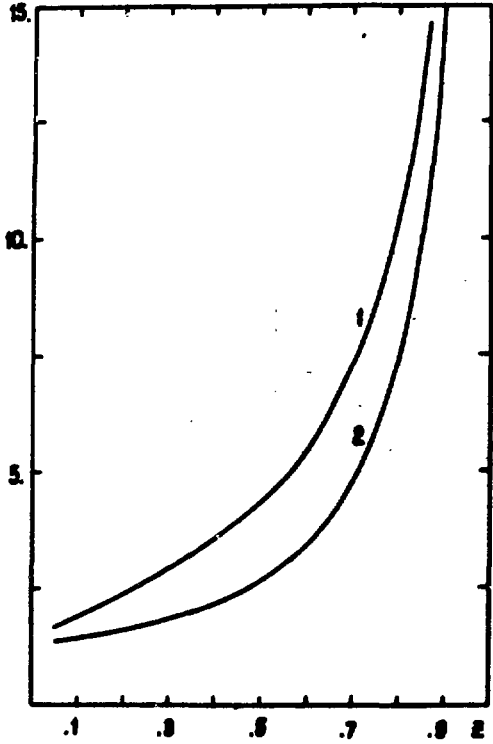


Fig. 1

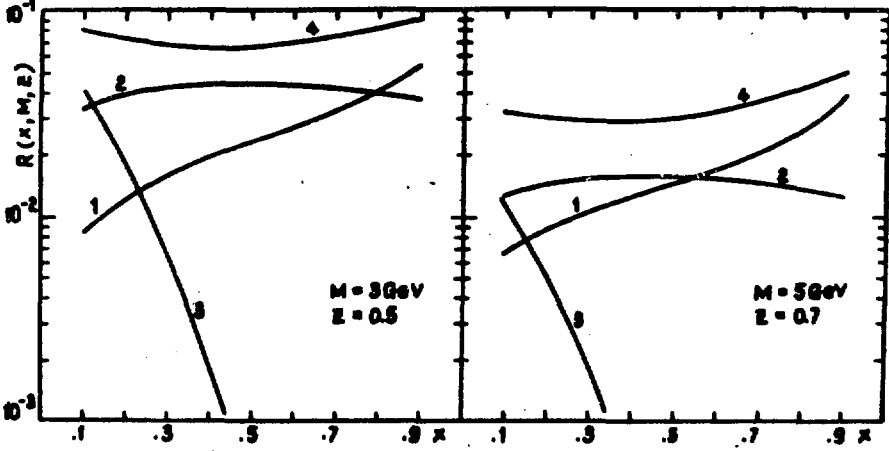


Fig. 2a

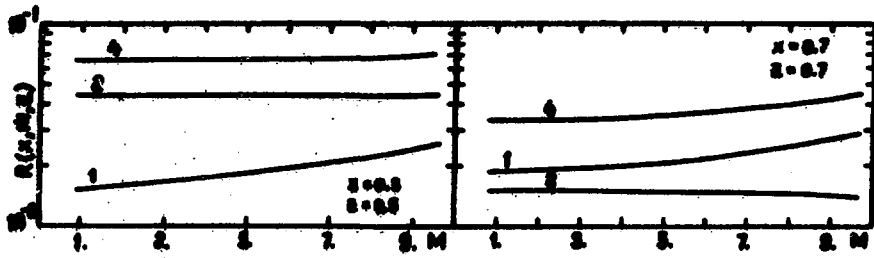


Fig. 2b

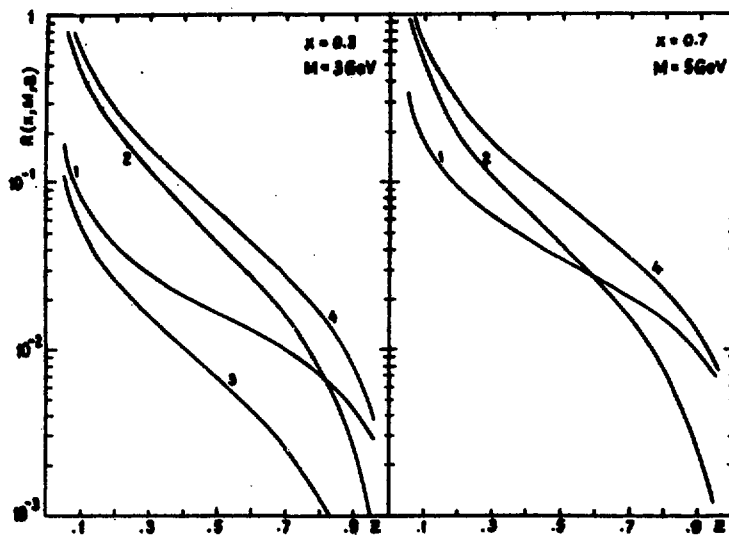


Fig. 2c

FIGURE CAPTIONS

Fig.1. The ratio of fragmentation functions  $D_u^{\pi^+}(z)/D_S^{\pi^+}(z)$  obtained as based on expressions (12) (curve 1) and  $D_u^{\pi^+}(z)/D_u^{\pi^-}(z)$  (curve 2) from Ref.[23] versus  $z$ .

Fig.2. The dependence of  $R(x, M, z)$  on  $x$  at  $M = 3$  GeV,  $z = 0.5$  and  $M = 5$  GeV,  $z = 0.7$  (a); on  $M$  at  $x = 0.3$ ,  $z = 0.5$  and  $x = 0.7$ ,  $z = 0.7$  (b); on  $z$  at  $x = 0.3$ ,  $M = 3$  GeV and  $x = 0.7$ ,  $M = 5$  GeV (c) for the value  $\lambda_p = 0.2$ .  
Curves 1, 2, 3 are contributions of diagrams respectively with annihilation of strange valence, nonstrange valence and sea (anti)quarks of kaon;  
4 -  $R(x, M, z)$ .

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О ВОЗМОЖНОСТИ ИЗМЕРЕНИЯ РАСПРЕДЕЛЕНИЯ СТРАННОГО ВАЛЕНТНОГО  
КВАРКА КАОНА И СТРАННОГО МОРЯ ПРОТОНА В ПРОЦЕССАХ ДРЕЛЛА-ЯНА

(на английском языке, перевод Э.Н.Асланян)

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