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A.A.Akhundov [1], D.Yu.Bardin, Č.Burdík,
P.Ch.Christova, L.V.Kalinovskaja [2]

CONTRIBUTION OF THE RADIATIVE TAIL FROM THE ELASTIC PEAK TO DEEP INELASTIC SCATTERING AT HERA

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1 Institute of Physics, Academy of Sciences of the Azerbaijan SSR, Baku, USSR
2 Gomel Polytechnical Institute, Gomel, USSR

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1. INTRODUCTION

The electron-proton collider HERA is devoted to study neutral and charged current lepton-nucleon interactions in an energy range (E_e=30 Gev, E_p=820 Gev) where both photon and weak boson exchanges are present in a space-like region with comparable strength. In the HERA physical programme [1] an important role will play the study of deep inelastic scattering [2].

In this article we continue our study of various radiative corrections to deep inelastic scattering at HERA started in refs [3]. Here we present some results for the contribution of the radiative tail from the elastic peak. In inclusive-type experiments when only the final lepton is detected, the process:

$$l + N \longrightarrow l + \gamma + N \,, \tag{1}$$

cannot be distinguished from the main reaction

$$l + N \longrightarrow l + X \,, \tag{2}$$

and hence the contribution of the elastic radiative tail (ERT), i.e. of process (1), may be considered as one of the corrections to the main reaction.

For deep inelastic lN - scattering with $Q^2 \ll M_z^2$ the most important QED radiative corrections to the lepton current have been calculated by Mo and Tsai [4] and later by Akhundov et. al [5]. In papers [5a,5c], in particular, exact formulae for the contribution of the ERT in the order α^3 and α^4 to the measured cross section were obtained, using general, model-independent hadronic tensor, but only γ-exchange was taken into account. Recent progress in the theoretical study of the higher-order QED processes in deep inelastic lN- scattering has been achieved in refs [6].

Process (1) was studied also in the literature [7] in connection with the luminosity measurement for HERA accelerator (see [8]). Recently in ref.[9] many distributions in different kinematical variables have been calculated by the Monte-Carlo method for phase space integration.

It is well known that Z-exchange gives a negligible contribution to the cross section of the ERT [9], but this article is just devoted to the calculation of the contribution of the ERT to the measured cross section of deep inelastic lN - scattering taking into account both γ-exchange, Z- exchange and their interference (diagrams in Fig.1). We have realised these, at first sight senseless calculations to develop a proper treatment for subsequent calculations of the inelastic radiative tail, where the Z-exchange will give an essential contribution.

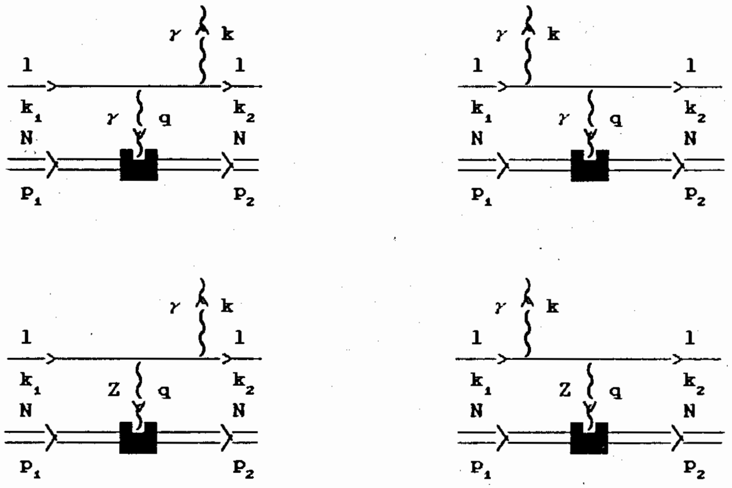

Fig.1. Feynman graphs corresponding to the ERT considered in this paper.

Here ,as usual, we restrict ourselves to the consideration of lepton leg QED corrections as the real photon emission from the lepton line gives the most important contribution. It can amount up to dozens percent of this corrections and even larger at small x and large y with step decrease in the region of large Q^2. This behaviour of leptonic corrections can be understood from the following well-known reasons:

a) large logarithmic terms of the form

$$\frac{\alpha}{\pi}\left[\ln\frac{Q^2}{m^2}-1\right]$$

with m being the lepton (electron) mass, are present due to the radiation of photons collinear with the emitting leptons,

b) the emission of a very energetic photon shifts the momentum in the propagator of the γ-exchange to a value which is essentially smaller than determined from the energy and momentum of the final lepton.

The paper is organized as follows. In sect. 2 we repeat briefly the

kinematics of process (1). In sect. 3 we obtain the formulae for the invariant inclusive cross section of the ERT. applying simple but very effective trick. In sect.4 the results for the contribution of the ERT to the measured cross section at HERA energies are presented and discussed. The last section contains a summary. In Appendix A.we list the set of explicitly calculated integrals.

2.KINEMATICS OF THE PROCESS

Reaction (1) is characterized by five independent invariants which in the problem under consideration are taken as follows [5a]:

$$S = -2p_1k_1, \qquad X = -2p_1k_2,$$

$$Y = (k_1-k_2)^2, \quad t = (p_1-p_2)^2, \quad z_2 = -2k_2k \,. \tag{3}$$

It is convenient to get also the following variable

$$z_1 = -2k_1k = z_2 + t - Y \,. \tag{4}$$

In terms of variables (3) the phase space element of ERT takes the form

$$d\Gamma = \frac{\pi}{4\,(\lambda_s)^{1/2}}\, dX\, dY\, \frac{dt\, dz_2}{(R_z)^{1/2}} \,, \tag{5}$$

where R_z is the positive definite guadratic trinomial (the Gram determinant):

$$R_z = A_2z_2^2 + 2B_2z_2 - C_2 \equiv A_1z_1^2 + 2B_1z_1 - C_1 \,, \tag{6}$$

$$A_2 = -\,(S_x^2 + 4\,M^2Y) \equiv A_1 \equiv -\lambda_Y \,, \tag{7}$$

$$B_2 = -2M^2Yt_Y + X\,t\,V_2 + S\,Y\,(S_x-t) \equiv -\,B_1(\,S \longleftrightarrow -X\,) \,, \tag{8}$$

$$C_2 = [\,Xt-Y(S-t)\,]^2 + 4m^2[\,t(S_x-t)V_2 - M^2t_Y^2\,] \equiv -\,C_1(\,S \longleftrightarrow -X\,) \,, \tag{9}$$

with M being the proton mass, $\lambda_s = S^2-4m^2M^2$, $S_x = S-X$, $V_2 = S_x - Y$, $t_Y = t-Y$.

One can easily obtain [5a] the physical z_2- and t- region :

$$(z_2)_{min,max} = \frac{-B_2 \pm (B_2^2 + A_2C_2)^{1/2}}{A_2} \,, \tag{10}$$

$$t_{max,min} = \frac{1}{2W^2}\left[(W^2 - M^2)(S_x \pm (\lambda_Y)^{1/2}) + 2M^2Y\right] , \tag{11}$$

with

$$W^2 = -(p_1+k_1-k_2)^2 = M^2+S_x-Y. \tag{12}$$

It is useful to introduce two quantities t_1 and t_2 which are arguments of C_1 and C_2, respectively, where they reach minimal values:

$$t_1 = \frac{YS}{X+Y}, \qquad t_2 = \frac{YX}{S-Y}. \tag{13}$$

The t_1 and t_2 always satisfy the inequality:

$$t_{min} < t_1 < Y < t_2 < t_{max}. \tag{14}$$

3. INCLUSIVE CROSS SECTION

The differential cross section of process (1) for the scattering of unpolarized leptons on unpolarized nucleons corresponding to the diagrams of Fig.1 can be represented in a compact form when only one ultrarelativistic approximation is made, i.e. the lepton mass is neglected everywhere possible (for comparision see formulae (36)-(38) of ref.[5a]):

$$d\sigma^{ERT} = \frac{2\alpha^3}{\pi S^2} S(t,z_1,z_2)\, dX\, dY \frac{dt\, dz_2}{t^2 (R_z)^{1/2}}, \tag{15}$$

$$S(t,z_1,z_2) = t\, A_1(t)\, S_1(t,z_1,z_2) + A_2(t)\, S_2(t,z_1,z_2) +$$

$$+ A_3(t)\, S_3(t,z_1,z_2), \tag{16}$$

where three factorized functions $S_1(t,z_1,z_2)$, $S_2(t,z_1,z_2)$ and $S_3(t,z_1,z_2)$ are explicitly calculated expressions:

$$S_1(t,z_1,z_2) = \frac{1}{2}\left(\frac{z_2}{z_1} + \frac{z_1}{z_2}\right) + t^2 \frac{1}{z_2 z_1} - t\left(\frac{1}{z_2} - \frac{1}{z_1}\right) -$$

$$- m^2 t \left(\frac{1}{z_2^2} + \frac{1}{z_1^2}\right), \tag{17}$$

$$S_2(t,z_1,z_2) = -M^2\left(\frac{z_2}{z_1} + \frac{z_1}{z_2}\right) + \frac{1}{z_2 z_1}\Big[t\Big(S(S-t) + X(X+t) -$$

$$- 2M^2 t\Big) + 4m^2 SX\Big] - t\left[\frac{1}{z_2}(X-2M^2) + \frac{1}{z_1}(S+2M^2)\right] -$$

$$- 2m^2 \left[\frac{1}{z_2^2}\Big(S(S-t)-M^2 t\Big) + \frac{1}{z_1^2}\Big(X(X+t)-M^2 t\Big)\right], \tag{18}$$

$$S_3(t,z_1,z_2) = 2t\left[\frac{1}{2}\left(\frac{z_1}{z_2} - \frac{z_2}{z_1}\right] + \frac{t}{z_2 z_1}(S+X) - \frac{1}{z_2}(X+t) + \right.$$

$$\left. + \frac{1}{z_1}(S-t) - \frac{m^2}{z_2^2}(2S-t) - \frac{m^2}{z_1^2}(2X+t)\right]. \tag{19}$$

All elastic form factors describing the nucleon vertex in the diagrams of Fig.1 together with the γ/Z propagator ratio $t/(t+M_z^2)$ can be absorbed in three functions which we call generalized elastic form factors of the nucleon:

$$A_1(t) = \left[F_1+F_2+ \varkappa \frac{t}{t+M_z^2} g_v (F_1^o+F_2^o)\right]^2 +$$

$$+ \varkappa^2 \frac{t^2}{(t+M_z^2)^2}\left[(g_v^2+g_a^2)(F_3^o)^2\left(1+\frac{1}{\tau}\right) + g_a^2 (F_1^o+F_2^o)^2\right], \tag{20}$$

$$A_2(t) = \left[F_1 + \varkappa \frac{t}{t+M_z^2} g_v F_1^o\right]^2 + \tau\left[F_2 + \varkappa \frac{t}{t+M_z^2} g_v F_2^o\right]^2 +$$

$$+ \varkappa^2 \frac{t^2}{(t+M_z^2)^2}\left[(g_v^2+g_a^2)(F_3^o)^2 + g_a^2\left((F_1^o)^2 + \tau (F_2^o)^2\right)\right], \tag{21}$$

$$A_3(t) = 2\varkappa\, g_a F_3^o \frac{t}{t+M_z^2}\left[F_1 + F_2 + \varkappa \frac{t}{t+M_z^2} g_v (F_1^o+F_2^o)\right], \tag{22}$$

Here F_1, F_2 (F_1^O, F_2^O, F_3^O) are electromagnetic (weak) nucleon form factors, g_v and g_a are the vector and axial coupling constants of the lepton to the Z bozon:

$$g_v = 1 - 4\sin^2\vartheta_v \;, \quad g_a = 1$$

(ϑ_v is the weak mixing angle),

$$\varkappa = \frac{G_\mu}{2^{1/2}}\,\frac{M_z^2}{8\pi\alpha} \;, \tag{23}$$

G_μ is the Fermi constant: $G_\mu = 1.16637\cdot 10^{-5}\,\mathrm{GeV}^{-2}$, and $\tau = t/4M^2$. The generalized elastic form factors (20)-(22) are in full accordance with [10].

The elastic form factors $F_{1,2}$, $F^O_{1,2,3}$ contain information about the nucleon structure. The weak form factors F^O_1, F^O_2 were related with proton and neutron electromagnetic form factors $F^{p,n}_{1,2}$ [11] and calculated as F_1, F_2 by using an experimental fit [12].

Integrating over invariant z_2 within limits (10), we derive from (15)-(19) the following expression for the invariant inclusive cross section of the ERT:

$$\frac{d^2\sigma^{ERT}}{dx\,dy} = 2\alpha^2 y \int \frac{dt}{t^2}\, S(t) \;, \tag{24}$$

with x and y being the usual scalling variables.

The S(t) reads

$$S(t) = \frac{1}{\pi}\int \frac{dz_2}{(R_z)^{1/2}}\, S\,(t, z_1, z_2) = t\, A_1(t)\, S_1(t) + A_2(t)\, S_2(t) +$$

$$+ A_3(t)\, S_3(t) \;. \tag{25}$$

The functions $S_i(t)$ are expressed in terms of invariant variables $X = S\cdot(1-y)$, $Y = S\cdot x\cdot y$ and t:

$$S_1(t) = \left\{ \frac{1}{(C_2)^{1/2}} \left[\frac{t_Y}{2} + \frac{tY}{t_Y} \right] - m^2 t\, \frac{B_2}{(C_2)^{3/2}} \right\} -$$

$$- \left\{ S \longleftrightarrow -X \right\} + \frac{1}{(\lambda_Y)^{1/2}} \;, \tag{26}$$

$$S_2(t) = \left\{ \frac{1}{(C_2)^{1/2}} \left[M^2(t+Y) - Xt\right] + \frac{1}{t_Y (C_2)^{1/2}} \left[t\left[S(S-t) + X(X+t) - 2M^2 t\right] + \right.\right.$$

$$\left.\left. + 4m^2 SX \right] - 2m^2 \frac{B_2}{(C_2)^{3/2}} \left[S(S-t) - M^2 t\right]\right\} -$$

$$- \left\{ S \longleftrightarrow -X \right\} - \frac{2M^2}{(\lambda_Y)^{1/2}} \;, \tag{27}$$

$$S_3(t) = t\left\{ (2S - Y - t)\, \frac{1}{(C_2)^{1/2}} + \frac{2}{t_Y (C_2)^{1/2}}\, Y(S+X) - 2m^2 (2S-t)\, \frac{B_2}{(C_2)^{3/2}} \right\} +$$

$$+ \left\{ S \longleftrightarrow -X \right\} . \tag{28}$$

The next step is the integration over the invariant t in limits (11). Inside this region the integrand $S(t)/t^2$ develops two very sharp peaks located at $t = t_1$ and $t = t_2$ which correspond to zeros of C_1 and C_2 in the lepton zero mass limit (the s- and, p-peaks in the Mo and Tsai's terminology [4]). The third peak is near $t = t_{min}$ (the so-called t-peak). These peaks correspond to the situation when most of the photons are radiated in the directions of the insident or scattered lepton, and in the direction of the virtual photon or Z bozon, respectively. Behaviour of peaks of the integrand in (24) is presented in Fig.2. The main contribution to the cross section (24) comes from the vicinities of points t_1, t_2 and t_{min}. To remove the collinear singularities at points t_1 and t_2 in the integrand, let us carry out the trivial identical transformation:

$$\int_{t_{min}}^{t_{max}} dt\, A_1(t)\, \frac{S_1(t)}{t} = \int_{t_{min}}^{Y} dt\left[A_1(t) - A_1(t_1)\right] \frac{S_1(t)}{t} +$$

$$+ A_1(t_1) \int_{t_{min}}^{Y} dt\, \frac{S_1(t)}{t} +$$

$$+ \int_{Y}^{t_{max}} dt\left[A_1(t) - A_1(t_2)\right] \frac{S_1(t)}{t} + A_1(t_2) \int_{Y}^{t_{max}} dt\, \frac{S_1(t)}{t} \;, \tag{29}$$

inequality (14) being essentially used here.

The structure of this transformation of expression (29) is such that the differences made of A_1 have zero instead of peaks at t_1 and t_2 and all of the singularities are entirely in the terms with factorized $A_1(t_1)$ and $A_2(t_2)$. Analogously, we proceed for the rest of terms in equation (24):

$$\frac{S_2(t)A_2(t)}{t^2} \quad \text{and} \quad S_3'(t)A_3'(t),$$

where $S_3'(t) = S_3(t)/t$ and $A_3'(t) = A_3(t)/t$.

After this transformation we arrive at the smooth integrand as is illustrated in Fig.3.

Using transformation (29) we derived from (24) the following expression for the inclusive cross section of the ERT:

$$\frac{d^2\sigma^{ERT}}{dx\,dy} = 2\alpha^3 y \left\{ \int_{t_{min}}^{Y} dt \left[\sum_{i=1}^{3} \left[A_i(t)-A_i(t_1)\right] S_i'(t)\right] + \right.$$

$$+ \int_{Y}^{t_{max}} dt \left[\sum_{i=1}^{3} \left[A_i(t)-A_i(t_2)\right] S_i'(t)\right] +$$

$$\left. + \sum_{i=1}^{3} A_i(t_1) \int_{t_{min}}^{Y} dt\, S_i'(t) + \sum_{i=1}^{3} A_i(t_2) \int_{Y}^{t_{max}} dt\, S_i'(t) \right\}, \quad (30)$$

with $S_1'(t) = \dfrac{S_1(t)}{t}$, $S_2'(t) = \dfrac{S_2(t)}{t^2}$, and for $A_3'(t)$ here we use again the notation $A_3(t)$.

So, our calculations make use of the numerical (first two items) and analytical (the last items) integration methods. It is possible to rewrite the last items as follows:

$$\int_{t_{min}}^{Y} dt\, S_i'(t) = \sum_{j=1}^{19} C_{ij}\, I_j\,, \quad (31)$$

$$\int_{Y}^{t_{max}} dt\, S_i'(t) = \sum_{j=1}^{19} C_{ij}\, \bar{I}_j\,, \quad (32)$$

where I_j and $\bar{I}_j$ are explicitly calculated by our (from (26)-(28)) integrals over t in the intervals $[t_{min}, Y]$ and $[Y, t_{max}]$, respectively (see Appendix A).

4.NUMERICAL RESULTS

Using final formulae (30)-(32), we have performed the numerical calculation of the inclusive cross section of the reaction

$$e + p \longrightarrow e + \gamma + p \quad (33)$$

at $S = 10^5\,GeV^2$. The results are depicted in Fig.4.

For the proton and neutron elastic form factors $F_{1,2}^{p,n}$ we have used there the experimental fit [12], and for the axial form factor F_9^0 - a simple formulae from [11]. As input values for the parameters, we have used $M_Z = 93$ GeV, $\sin^2\theta_W = 0.23$.

As the dominant contribution to integral (24) comes from diagrams with γ -exchange, the result is practically independent of the contribution diagrams with Z-exchange to ERT . It is less than one percent from the full integral (24).

At last, in Fig.5 for the sake of illustrations we present the ratio

$$\delta^{ERT}(x,y) = \frac{d^2\sigma^{ERT}}{dx\,dy} \Big/ \frac{d^2\sigma_0}{dx\,dy}\,, \quad (34)$$

where $d^2\sigma_0/dx\,dy$ is the Born cross section of the main reaction (1) calculated within the quark-parton model with quark distributions from ref.[13].

5.CONCLUSION

In this paper, we have calculated the contribution of the ERT to the deep inelastic ep ---> eX scattering at HERA energies. The simple procedure to smooth integrands is suggested , which is very efficient for ultrahigh energy and light mass of the radiating particle (very small $m_e^2/S \sim 10^{-12}$). We would like to emphasize that this procedure differs essentially from peaking [4] and collinear [14] approximations combining analytic and numerical methods using only the ultrarelativistic approximation, i.e. neglecting terms vanishing with m_e^2/S .

Into our calculations, we included besides γ-exchange, the

Z-exchange too, in spite of its negligible contribution, because we intend to use this procedure and some of formulae for calculating the contribution from the inelastic radiative tail where the Z-exchange is expected to be very important. This work is in progress now.

We wrote FORTRAN codes realising formulae of this paper and computed with their aid numerical results for ERT at HERA energies and, in particular,at small x where it is important.

6.APPENDIX

The expressions for integrals $I_j, \bar{I}_j$ and coefficients C_{ij} of (31) and (32) are presented here.

The first column of table 1 corresponds to integrand, and the next two columns results after integration in the intervals $[t_{min}, Y]$ and $[Y, t_{max}]$.

Table 1. Integrals I_j and $\bar{I}_j$

($S_Y \equiv S-Y$, $X_Y \equiv X+Y$)

		$t_{min} \longrightarrow Y$	$Y \longrightarrow t_{max}$
1	$\frac{1}{(C_1)^{1/2}}$	$\frac{1}{S_Y} \ln \frac{V_2\, S_Y\, Y}{m^2\, W^2\, (t_{max} - t_1)}$	$\frac{1}{S_Y} \ln \frac{S_Y\, (t_{max} - t_1)}{V_2\, Y}$
2	$\frac{1}{(C_2)^{1/2}}$	$\frac{1}{X_Y} \ln \frac{(SX-YM^2)\, V_2}{X_Y W^2 (t_{max} - t_2)}$	$\frac{1}{X_Y} \ln \frac{X_Y^3\, (t_{max} - t_2)}{m_2^2 V\, (SX-YM^2)}$
3	$\frac{1}{t(C_1)^{1/2}}$	$\frac{1}{XY} \ln \frac{X^2 Y\, S_Y (t_1 - t_{min})}{m^2 V_2 t_{min} (SX-YM^2)}$	$\frac{1}{XY} \ln \frac{(SX-YM^2) V_2 t_{min}}{YM^2 S_Y (t_1 - t_{min})}$
4	$\frac{1}{t(C_2)^{1/2}}$	$\frac{1}{SY} \ln \frac{X_Y (t_2 - t_{min})}{t_{min}\, V_2}$	$\frac{1}{SY} \ln \frac{S^2\, t_{min}\, V_2}{m^2 M^2\, X_Y (t_2 - t_{min})}$
5	$\frac{1}{t^2 (C_1)^{1/2}}$	$\frac{1}{XY}\left(\frac{-X-2V_2}{XY} + \frac{1}{t_{min}} \right) + \frac{1}{t_1} I_3$	$\frac{1}{XY}\left(\frac{1}{t_{max}} - \frac{1}{Y} \right) + \frac{1}{t_1} \bar{I}_3$
6	$\frac{1}{t^2 (C_2)^{1/2}}$	$\frac{1}{SY}\left(\frac{1}{t_{min}} - \frac{1}{Y} \right) + \frac{1}{t_2} I_4$	$\frac{1}{SY}\left(\frac{1}{t_{max}} + \frac{2V_2 - S}{SY} \right) + \frac{1}{t_2} \bar{I}_4$
7	$m^2 \frac{B_1}{(C_1)^{3/2}}$	$\frac{1}{V_2}$	0
8	$m^2 \frac{B_2}{(C_2)^{3/2}}$	0	$\frac{1}{V_2}$
9	$m^2 \frac{B_1}{t(C_1)^{3/2}}$	$\frac{1}{t_1\, V_2}$	0
10	$m^2 \frac{B_2}{t(C_2)^{3/2}}$	0	$\frac{1}{t_2\, V_2}$
11	$m^2 \frac{B_1}{t^2 (C_1)^{3/2}}$	$\frac{m^2 (XS_x - 2M^2 Y)}{X^3 Y^2 t_{min}} + \frac{1}{t_1^2\, V_2}$	0
12	$m^2 \frac{B_2}{t^2 (C_2)^{3/2}}$	$\frac{m^2 (SS_x + 2M^2 Y)}{S^3\, Y^2\, t_{min}}$	$\frac{1}{t_2^2\, V_2}$
13	$\frac{1}{t_Y}\left[\frac{1}{(C_2)^{1/2}} - \frac{1}{(C_1)^{1/2}} \right]$	$\frac{1}{Y\, V_2} \ln \frac{Y}{m^2}$	
14	$\frac{t}{(C_1)^{1/2}}$	$\frac{(t_{min} - 2t_1 + Y)}{S_Y} + t_1 \cdot I_1$	$\frac{(t_{max} - Y)}{S_Y} + t_1 \cdot \bar{I}_1$
15	$\frac{t}{(C_2)^{1/2}}$	$\frac{(t_{min} - Y)}{X_Y} + t_2 \cdot I_2$	$\frac{(t_{max} - 2t_2 + Y)}{X_Y} + t_2 \cdot \bar{I}_2$
16	$m^2 \frac{tB_1}{(C_1)^{3/2}}$	$\frac{t_1}{V_2}$	0
17	$m^2 \frac{tB_2}{(C_2)^{3/2}}$	0	$\frac{t_2}{V_2}$

18	$\frac{1}{t}$	$\ln \frac{Y}{t_{min}}$	$\ln \frac{t_{max}}{Y}$
19	$\frac{1}{t^2}$	$\frac{1}{t_{min}} - \frac{1}{Y}$	$\frac{1}{Y} - \frac{1}{t_{max}}$

2.<u>Table 2.</u> Coefficients C_{ij}

j \ i	1	2	3
1	-1/2	0	-Y-2X
2	1/2	0	-Y+2S
3	Y/2	$-M^2-S+(X^2+S^2)/Y$	0
4	-Y/2	$M^2-X-(X^2+S^2)/Y$	0
5	0	$-YM^2+4m^2SX/Y$	0
6	0	YM^2-4m^2SX/Y	0
7	-1	0	-4X
8	-1	0	-4S
9	0	$-2(X-M^2)$	0
10	0	$2(S+M^2)$	0
11	0	$-2X^2$	0
12	0	$-2S^2$	0
13	Y	$-S_x-2M^2+(X^2+S^2)/Y$	2(X+S)/Y
14	0	0	-1
15	0	0	-1
16	0	0	-2
17	0	0	2
18	$\lambda_Y^{-1/2}$	0	0
19	0	$-2M^2\lambda_Y^{-1/2}$	0

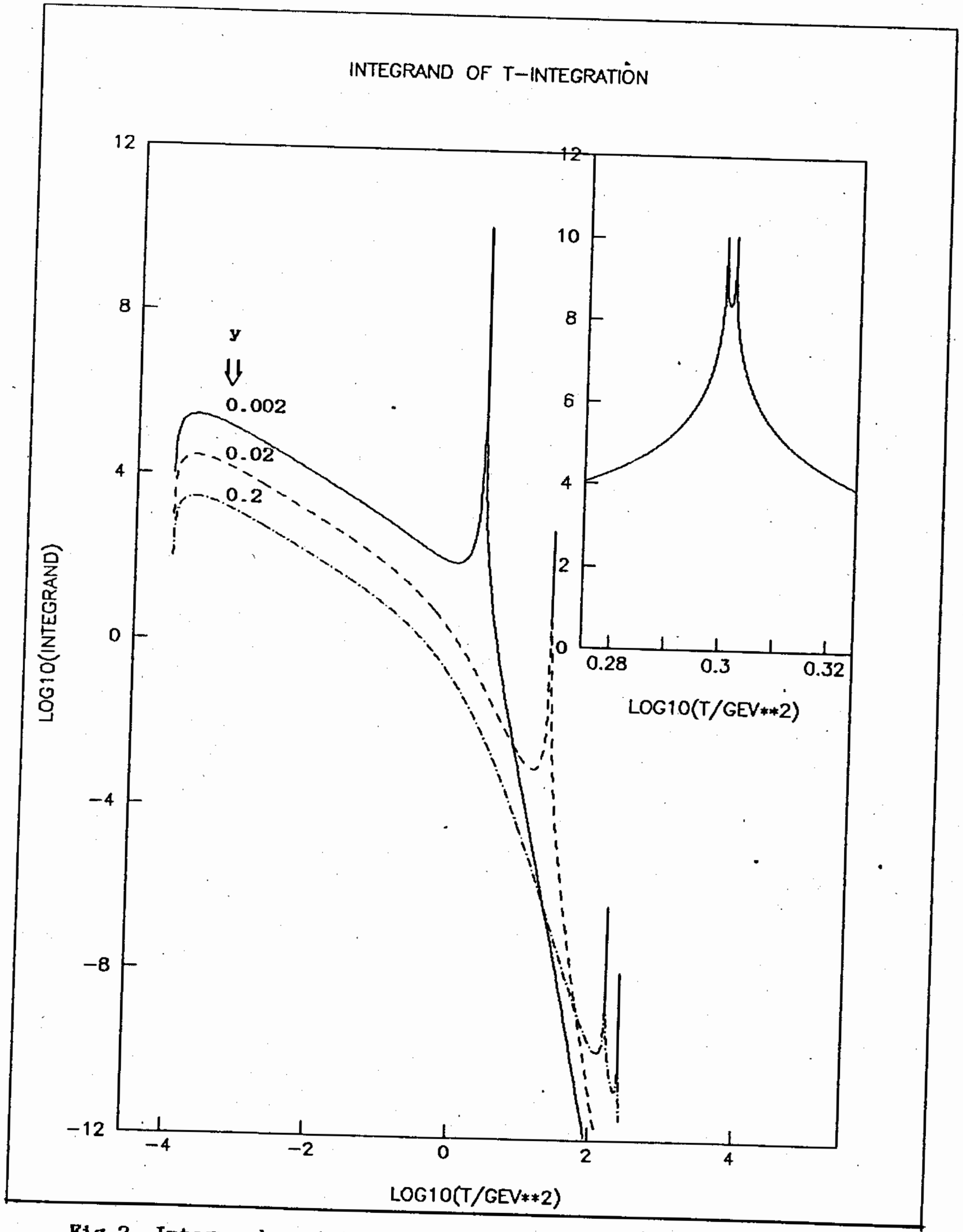

Fig.2. Integrands (in arbitrary units) in Eq.(24) for $e + p \longrightarrow e + \gamma + p$ at $S = 10^5 GeV^2$; $x = 0.01$.

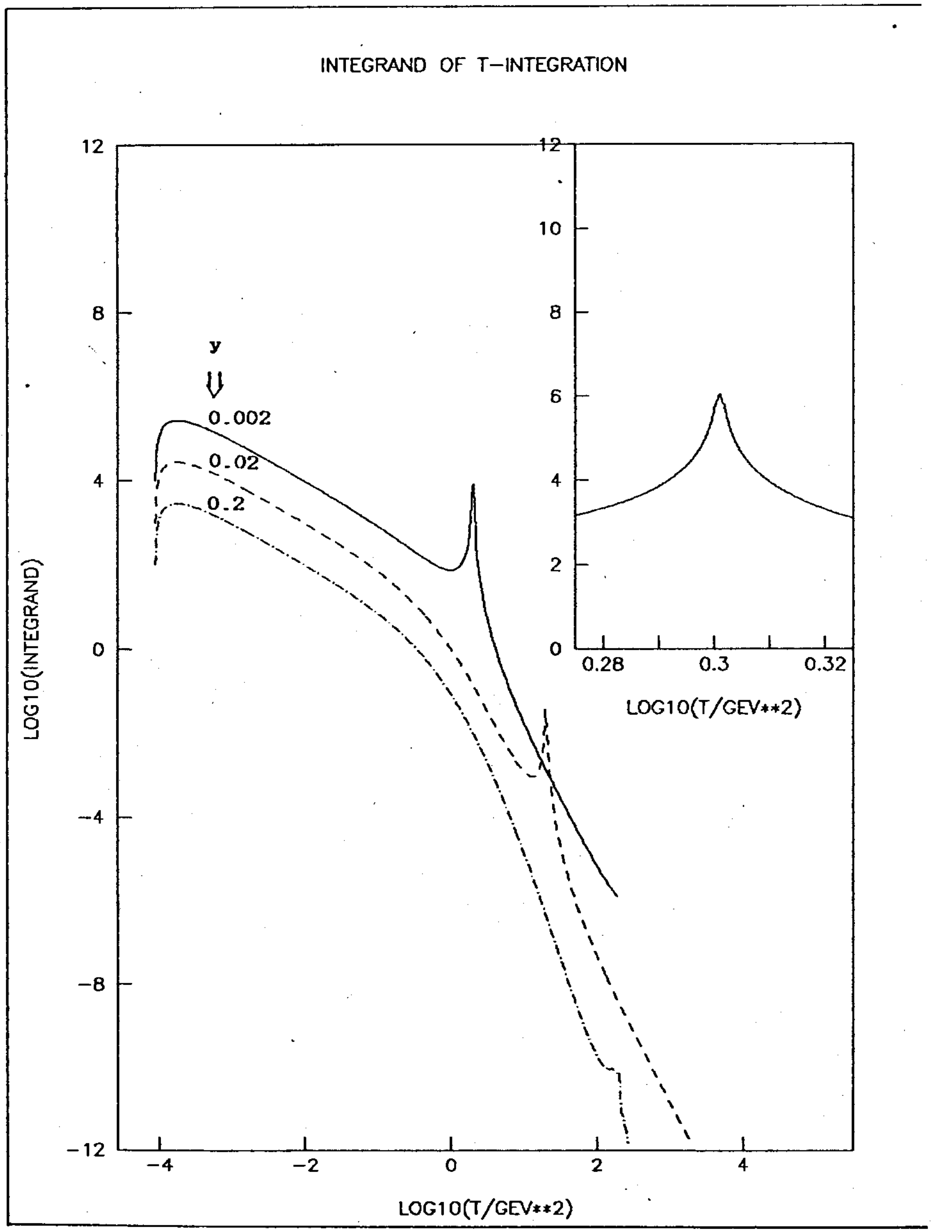

Fig.3. Integrands (in arbitrary units) in Eq.(30) for $e + p \longrightarrow e + \gamma + p$ at $S = 10^5 GeV^2$; $x = 0.01$.

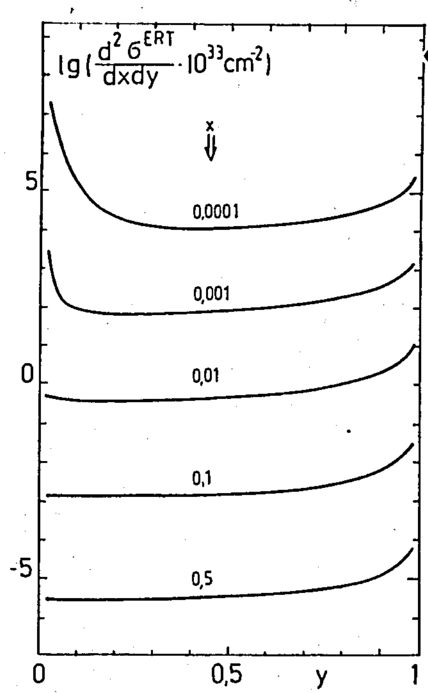

Fig.4. Inclusive cross section of the process $e + p \longrightarrow e + \gamma + p$ at $S = 10^5 GeV^2$.

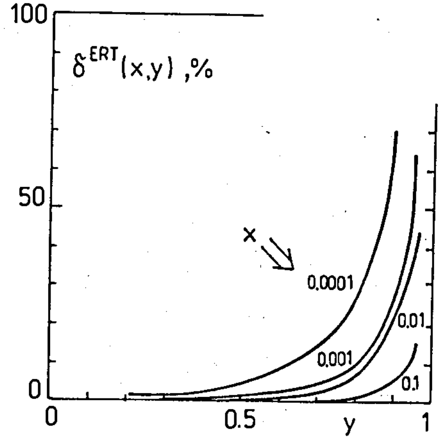

Fig.5. The ERT correction to $e + p \longrightarrow e + X$ at $S = 10^5 GeV^2$.

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Ахундов А.А. и др. E2-89-405
Вклад радиационного хвоста от упругого пика в глубоконеупругое рассеяние на ускорителе HERA

С использованием простой процедуры "сглаживания" подынтегральной функции, получены обобщенные формулы для вклада упругого радиационного хвоста (с учетом обмена фотоном и Z-бозоном) в измеряемое сечение глубоконеупругого $ep \to eX$ рассеяния. Приведены результаты численных расчетов в кинематической области малых x при энергиях ускорителя HERA.

Работа выполнена в Лаборатории теоретической физики ОИЯИ.

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Akhundov A.A. et al. E2-89-405
Contribution of the Radiative Tail from the Elastic Peak to Deep Inelastic Scattering at HERA

The formulae for the contribution of the elastic radiative tail (photon- and Z-bozon exchange are included) to the measured cross section of deep inelastic $ep \to eX$ scattering are derived, using a simple procedure of smoothing the integrand. The numerical results in the kinematical region of small x at HERA energies are presented.

The investigation has been performed at the Laboratory of Theoretical Physics, JINR.

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