Erratum: Supercollider physics [Rev. Mod. Phys. 56, 579 (1984)]

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Since the publication of this paper, we have detected several misprints and errors. We correct them here, in the order in which they appear in the original paper.

Equation (2.40) should read

$$\beta=[1-4zM_q^2/Q^2(1-z)]^{1/2} . \quad (2.40)$$

Equation (2.46) should read

$$x\mathscr{F}_3(x,Q_0^2)=1.49x^{0.374}(1-x)^{3.31}(1+5.86x) . \quad (2.46)$$

A programming error led to too slow a growth in the population of heavy flavors. At the largest values of Q^2, our structure functions underestimate the heavy quark content of the proton by about a factor of 2. We remark that near threshold the results are sensitive to the (rather arbitrary) choice of threshold behavior. We are grateful for discussions with Keith Ellis, John Collins, and Wu-Ki Tung which led to the discovery of this error. A perhaps better estimate, but one we do not completely endorse, is given by Collins and Tung (1986). The underestimate of the number of heavy quarks has very little effect on the rates in EHLQ. To illustrate the consequences we will discuss the two most sensitive observables.

The production of a conventional or new charged intermediate boson W^+ proceeds via the elementary reactions

$$u\bar{d},c\bar{s},t\bar{b}\rightarrow W^+ .$$

At small masses, the relevant values of $\hat{s}=M_W^2$ and hence x are small, so the process is dominated by sea quarks. Since the published structure functions have underestimated the $c\bar{s}$ and $t\bar{b}$ fluxes, we must expect that the production cross section has been underestimated. At larger masses, relevant to the search for new intermediate bosons, $\hat{s}$ and x are correspondingly larger and the $u\bar{d}$ initial state becomes more important since valence u quarks tend to dominate the u distribution. Figure A shows the cross section for intermediate boson production given by Set 2 of the EHLQ structure functions compared with the cross section given by corrected structure functions. At $\sqrt{s}=40$ TeV, the cross section is increased by about 12% for the conventional "100 GeV/c^2" intermediate boson. For new gauge boson masses greater than about 1 TeV/c^2, the change is imperceptible.

A quantity which is more dramatically affected by this error is the estimate of Higgs production via quark-antiquark fusion (see Fig. 143). The dominant contribution comes from top-antitop annihilation since the Higgs

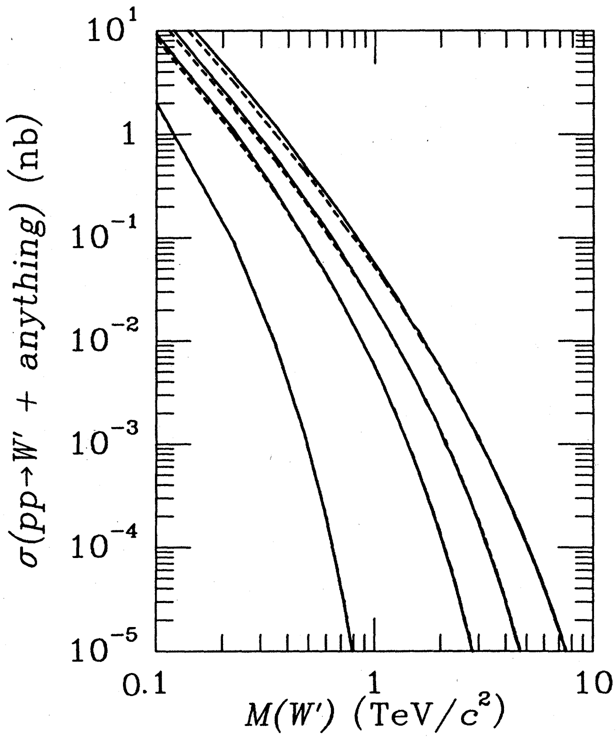

FIG. A. Integrated cross sections for the production of W'^+ with rapidities $|y_{W'}|<1.5$ in proton-proton collisions at $\sqrt{s}=2$, 10, 20, and 40 TeV. The solid curves are calculated using the revised structure functions. Dashed curves refer to the published Set 2.

quark coupling is proportional to the quark mass. Consequently the rates in Fig. 143 should be increased by as much as a factor of 4. However the rates are still far smaller than either the gluon fusion or the W-fusion rates so that the total Higgs production rates shown in Figs. 151–155 are unchanged.

This estimate of Higgs production using quark-antiquark fusion illustrates a general pitfall in the use of heavy partons. The calculation just described is really an estimate of the process

$$p+p \to H+t+\bar{t}+\text{anything}\ ,$$

where the t and $\bar{t}$ are fragments of the incoming beams. The approximation is valid in the region where $M_H \gg m_t$. When this approximation is not valid, a better estimate of the cross section is obtained by considering the partonic process

$$g+g \to H+t+\bar{t}$$

(Kunszt, 1984). The cross section for this process contains a term proportional to $\ln(M_H/m_t)$. Quark-antiquark fusion gives a good approximation to the physical cross section only when this logarithm is large. For the range of Higgs masses shown in Fig. 143, the $t\bar{t}$-fusion mechanism overestimates the true rate. Indeed the numerical results given by Kunszt are closer to the values given in our published Fig. 143 than they are to the revised estimate based on a richer population of heavy quarks. It is clear that caution should be exercised when using the heavy-quark distributions for processes of scale Q when Q is not very much bigger than the quark mass.

The estimates of charged Higgs production given in the Snowmass paper of Eichten *et al.* (1984) also are affected by this error. In the $q\bar{q}$-fusion approximation the rates, which are dominated by $t\bar{b}$ fusion, are underestimated in the Snowmass report by a factor of 4 or so. Again it is very likely that the $q\bar{q}$-fusion approximation significantly overestimates the true rate for Higgs masses of interest, so the published estimates provide sensible guidance.

In summary, the most serious consequence of the defective treatment of heavy flavors is in the prediction of the production rate for the standard W, which is underestimated by $\simeq 12\%$ at $\sqrt{s}=40$ TeV. The effects on all other rates shown in EHLQ are much smaller than this.

An improved treatment of heavy flavors will be incorporated in a new edition of the structure functions, now in preparation, based on new information from deeply inelastic scattering. In the meantime, revisions with the proper heavy flavor content are available from us upon request.

There are two misprints in Table I (p. 609).

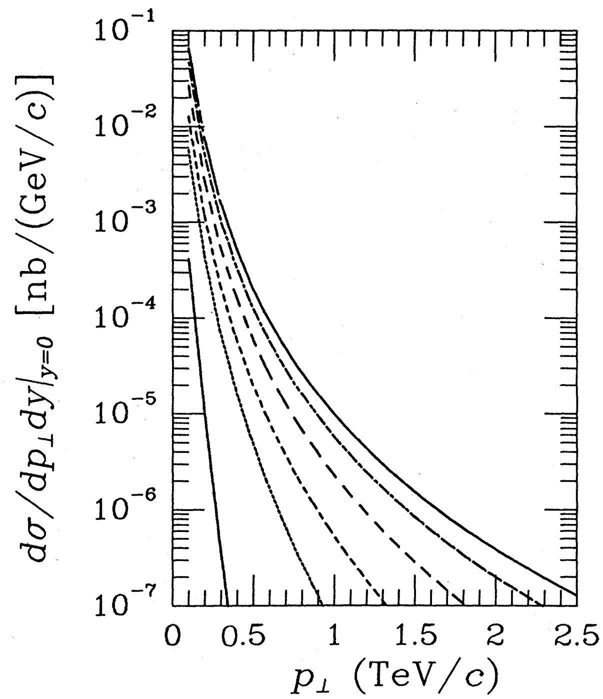

FIG. 118. Differential cross section $d\sigma/dp_\perp dy\,|_{y=0}$ for the production of a $W^\pm$ as a function of the $W^\pm$ transverse momentum ($p_\perp$), at $\sqrt{s}=2$, 10, 20, 40, 70, and 100 TeV. Set 2 of distributions was used.

Line 1: $F(p_i,p_j,p_i,p_2,p_3)$ should read $F(p_i,p_j,p_1,p_2,p_3)$.

Line 3: $F(p_i,p_2,-p_1,-p_j,p_3)$ should read $F(p_i,-p_2,p_1,-p_j,p_3)$.

The computation of the transverse momentum distribution for $W^\pm$ presented in Fig. 118 is slightly in error. A corrected figure is included. The changes do not affect any conclusions.

In Eqs. (4.52), (4.55), and (4.56), β, should read β_W, and Eq. (4.53) is redundant. In addition, in Eq. (4.56) y_{boost} should read $|y_{\text{boost}}|$.

Equations (4.60) and (4.64) were improperly transcribed. In Eq. (4.60), first line, $(8x_W-6)$ should read $(8x_W-6)/4$. Below (4.60), replace "The cross section ..." and (4.61) by "The expression for the cross section to produce a $W^\pm Z^0$ pair of mass $\mathcal{M}=\sqrt{s\tau}$ such that both intermediate bosons lie in the rapidity interval $(-Y,Y)$ is complicated because of the unequal masses of W and Z. It has the form

$$\frac{d\sigma(ab\to W^\pm Z^0+\text{anything})}{d\mathcal{M}}=\frac{2\mathcal{M}}{s}\sum_{i,j}\int_{-Y}^{Y}dy_{\text{boost}}[f_i^{(a)}(x_a,\mathcal{M}^2)f_{\bar{j}}^{(b)}(x_b,\mathcal{M}^2)I_{i\bar{j}}(y_{\text{boost}})+i\leftrightarrow\bar{j}]\ . \tag{4.61}$$

For $W^\pm Z^0$ production with $y_{\text{boost}}>0$, the integrated elementary cross section is

$$I_{i\bar{j}}(y_{\text{boost}})=\int_{-z_1}^{z_0} dz \frac{d\sigma(q_i\bar{q}_j\to W^{\pm}Z^0)}{dz} ,$$

where . . . ."

Replace (4.64) by

$$\int_{-z_1}^{z_0} dz\frac{d\sigma}{dz}=\frac{\pi\alpha^2\beta\,|U_{ij}|^2}{6x_W^2\hat{s}}\left\{\frac{1}{8(1-M_W^2/\hat{s})^2}\left[\frac{(9-8x_W)\beta^2(z_0+z_1-z_0^3/3-z_1^3/3)}{4}+(8x_W-6)\varepsilon'(z_0+z_1)\right]\right.$$
$$+\frac{1}{1-M_W^2/\hat{s}}\left[\frac{\varepsilon'+M_W^2M_Z^2/\hat{s}^2}{\beta}(L_j\,\mathbb{L}_{10}-L_i\,\mathbb{L}_{01})+(L_i-L_j)\frac{1-\varepsilon'}{4}(z_0+z_1)\right.$$
$$\left.-(L_i+L_j)\frac{\beta(z_0^2-z_1^2)}{8}\right]$$
$$-\frac{1}{8(1-x_W)}\left[L_j^2\left[(z_0+z_1)-\frac{2(1-\varepsilon')}{\beta}\,\mathbb{L}_{10}+\frac{4M_W^2M_Z^2(z_0+z_1)/\hat{s}^2}{(1-\varepsilon'-\beta z_0)(1-\varepsilon'+\beta z_1)}\right]\right.$$
$$\left.+L_i^2\left[(z_0+z_1)-\frac{2(1-\varepsilon')}{\beta}\,\mathbb{L}_{01}+\frac{4M_W^2M_Z^2(z_0+z_1)/\hat{s}^2}{(1-\varepsilon'-\beta z_1)(1-\varepsilon'+\beta z_0)}\right]\right]$$
$$\left.+\frac{L_iL_j\varepsilon'(\mathbb{L}_{10}+\mathbb{L}_{01})}{2(1-x_W)\beta(1-\varepsilon')}\right\}. \quad (4.64)$$

Equation (4.65) should read

$$\varepsilon'=(M_W^2+M_Z^2)/\hat{s} . \quad (4.65)$$

Replace (4.66) by

$$\mathbb{L}_{10}=\ln\left|\frac{1-\varepsilon'+\beta z_1}{1-\varepsilon'-\beta z_0}\right| ,$$
$$\mathbb{L}_{01}=\ln\left|\frac{1-\varepsilon'+\beta z_0}{1-\varepsilon'-\beta z_1}\right| . \quad (4.66)$$

In (4.67), replace y_{boost} by $|y_{\text{boost}}|$, and add the definitions

$$z_1=\min(1,(1/\beta_Z)\tanh(Y-|y_{\text{boost}}|) ,$$
$$(1/\beta_W)\tanh(Y+|y_{\text{boost}}|)) ,$$
$$\beta_Z=\beta\Big/\left|1+\frac{M_Z^2-M_W^2}{\hat{s}}\right| .$$

In (4.74), replace y_{boost} by $|y_{\text{boost}}|$.

Equations (4.86) and (4.87) should be multiplied by a factor $(1-4m^2/M_H^2)^{1/2}$.

On page 637, column 2, line 3, "factor of 4" should read "factor of 1.2."

The limits given in Sec. V.A are appropriate in case the mass of one member of an $SU(2)_L$ doublet is negligible with respect to the mass of its partner. The general case is treated by Chanowitz, Furman, and Hinchliffe (1979).

Equation (5.2) should read

$$e_i^2\to\frac{\beta^3}{4}\left[e_i^2+\frac{e_iM^2(M^2-M_Z^2)(1-2x_W)(L_q+R_q)}{4x_W(1-x_W)[(M^2-M_Z^2)^2+M_Z^2\Gamma_Z^2]}\right.$$
$$\left.+\frac{M^4(1-2x_W)^2(L_q^2+R_q^2)}{32x_W^2(1-x_W)^2[(M^2-M_Z^2)^2+M_Z^2\Gamma_Z^2]}\right] . \quad (5.2)$$

Some brackets are missing in Eq. (5.17):

$$3(\hat{t}-M_Q^2)(\hat{u}-M_Q^2)+M_Q^2(\hat{u}-\hat{t})$$

should read

$$3[(\hat{t}-M_Q^2)(\hat{u}-M_Q^2)+M_Q^2(\hat{u}-\hat{t})] .$$

On page 645, column 2, above Eq. (5.27), the kinematical suppression factor quoted is correct only for the vector part of the interaction, and does not apply for the axial vector couplings of the virtual Z^0. The Drell-Yan cross section for production of a pair of heavy leptons is given by (4.12), with

$$e_i^2 \to \frac{\beta(3-\beta^2)}{2}\left[e_i^2 - \frac{e_i M^2(M^2-M_Z^2)(L_e+R_e)(L_q+R_q)}{8x_W(1-x_W)[(M^2-M_Z^2)^2+M_Z^2\Gamma_Z^2]}\right] + \frac{\beta M^4(L_e^2+R_e^2)[(3-\beta^2)(L_q+R_q)^2+2\beta^2(L_q-R_q)^2]}{256x_W^2(1-x_W)^2[(M^2-M_Z^2)^2+M_Z^2\Gamma_Z^2]},$$

where

$$\beta=(1-4M_L^2/M^2)^{1/2}$$

(Willenbrock and Dicus, 1985), which reduces to (4.14) in the limit $\beta \to 1$. This results in a reduction of the cross sections shown in Figs. 166 and 167 by about 30%, to the values shown in the corrected figures. We thank Scott Willenbrock and Duane Dicus for informing us of this blunder. The same misstatement appears on page 621, column 1, first paragraph. This error does not affect the quoted discovery limits for heavy leptons, which are controlled by the process

$$p+p \to L+N+\text{anything},$$

as discussed on p. 647.

On page 655, column 1, above Eq. (6.34) $g_{\rm ETC} \to G_{\rm TC}$ should read $G_{\rm ETC} \to G_{\rm TC}$.

On page 657, column 1, the second entry in Eq. (6.40) should read $M(P_8) = \cdots$, not $M(P_3) = \cdots$. In Eq. (6.42), the second entry should read $\bar{q}\,\bar{q} + \cdots$.

Some of the curves in Figs. 242—249 are improperly labeled. In Figs. 242 and 246,

$$10 \to 7.5,$$

$$15 \to 10,$$

$$20 \to 15.$$

In Figs. 243 and 247, 7.5→10; in Figs. 244 and 248, 10→15; in Figs. 245 and 249, 15→20. We thank Jack Gunion for calling these to our attention. The "reach" figures 250 and 251 are unchanged. In the caption to Fig. 250, $\bar{p}p$ should read pp. In Fig. 251, the ordinate label 60 should read 50.

The changes in the treatment of heavy flavors discussed above lead to changes in the parametrizations of structure functions given in the Appendix:

11.4283 becomes 11.5528

8.06604 becomes 8.1905

Revised Tables XIII—XVI appear below.

It will be observed that the coefficients for the light flavors, u_v, d_v, u_s, G, and s_s have changed slightly from the values given in the original publication. There are two reasons for this. Changes in the heavy-quark distribution have some small effect on the gluon distribution and the

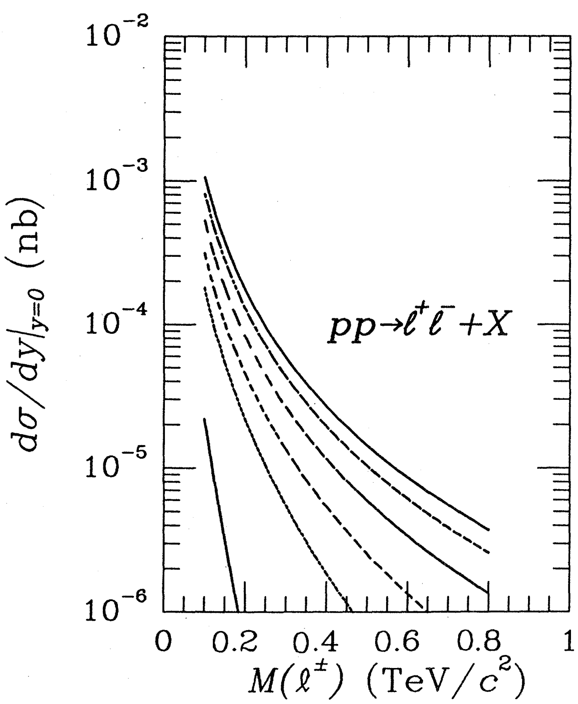

FIG. 166. Cross section $d\sigma/dy|_{y=0}$ for the production of (L^+L^-) heavy-lepton pairs in pp collisions. The contributions of both γ and Z^0 intermediate states are included, and the calculation is carried out using the parton distributions of Set 2.

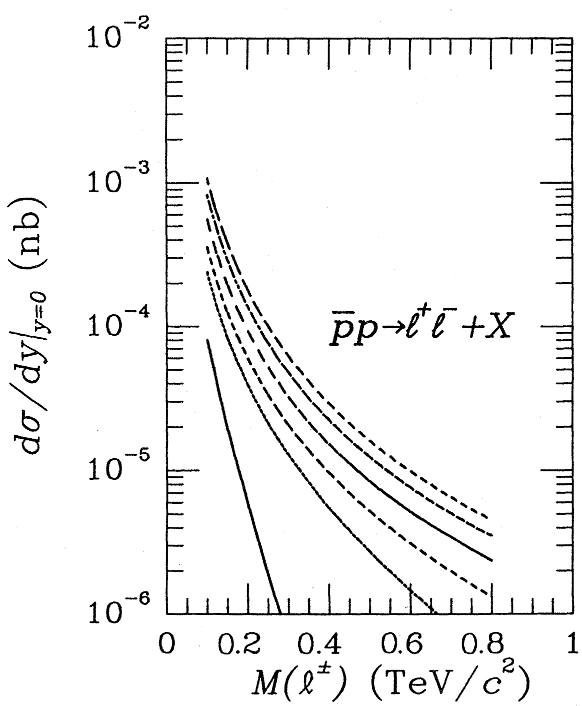

FIG. 167. Cross section $d\sigma/dy|_{y=0}$ for the production of (L^+L^-) heavy-lepton pairs in $\bar{p}p$ collisions. Calculational details are as for Fig. 166.

TABLE XIII. Coefficients c_{ij} for expansion (A2) for the parton distributions of Set 1 with $\Lambda=200$ MeV.

	$j\backslash i$	0	1	2	3	4	5
u_v	0	0.76772	-0.20874	-0.33026	-0.02517	-0.01570	-0.00010
	1	-0.53259	-0.26612	0.32007	0.11918	0.02434	0.00762
	2	0.21618	0.18812	-0.08375	-0.06515	-0.01743	-0.00504
	3	-0.09211	-0.09952	0.01373	0.02506	0.00877	0.00255
	4	0.03670	0.04409	0.00096	-0.00796	-0.00342	-0.00105
	5	-0.01549	-0.02026	-0.00306	0.00222	0.00124	0.00041
d_v	0	0.38130	-0.08090	-0.16336	-0.02185	-0.00843	-0.00062
	1	-0.29475	-0.14348	0.16650	0.06638	0.01473	0.00408
	2	0.12518	0.10422	-0.04722	-0.03683	-0.01038	-0.00286
	3	-0.05478	-0.05678	0.00890	0.01484	0.00534	0.00152
	4	0.02220	0.02567	-0.00003	-0.00497	-0.00216	-0.00065
	5	-0.00953	-0.01204	-0.00151	0.00151	0.00083	0.00027
u_s	0	0.06870	-0.06861	0.02973	-0.00540	0.00378	-0.00097
	1	-0.01802	0.00014	0.00649	-0.00854	0.00122	-0.00175
	2	-0.00465	0.00148	-0.00593	0.00060	-0.00103	-0.00008
	3	0.00644	0.00257	0.00283	0.00115	0.00071	0.00033
	4	-0.00393	-0.00254	-0.00116	-0.00077	-0.00036	-0.00019
	5	0.00234	0.00193	0.00053	0.00037	0.00016	0.00009
G	0	0.94819	-0.95779	0.10085	-0.10510	0.03456	-0.03054
	1	-0.96265	0.53790	0.33684	-0.09525	0.01488	-0.02051
	2	0.43004	-0.08306	-0.33719	0.04902	-0.00916	0.01041
	3	-0.19249	-0.01790	0.21830	0.00749	0.00414	-0.00186
	4	0.08183	0.01926	-0.10718	-0.01944	-0.00277	-0.00052
	5	-0.03884	-0.01234	0.05410	0.01879	0.00335	0.00104
s_s	0	0.04968	-0.04173	0.02102	-0.00327	0.00324	-0.00067
	1	-0.00615	-0.01294	0.00674	-0.00689	0.00090	-0.00151
	2	-0.00858	0.00505	-0.00490	-0.00016	-0.00094	-0.00015
	3	0.00784	0.00151	0.00222	0.00140	0.00070	0.00035
	4	-0.00441	-0.00222	-0.00089	-0.00085	-0.00036	-0.00020
	5	0.00252	0.00184	0.00041	0.00039	0.00016	0.00009
c_s	0	0.00927	-0.01817	0.00959	-0.00639	0.00169	-0.00154
	1	0.00571	-0.01188	0.00609	-0.00465	0.00124	-0.00131
	2	-0.00396	0.00710	-0.00359	0.00184	-0.00039	0.00034
	3	0.00112	-0.00196	0.00112	-0.00048	0.00010	-0.00004
	4	0.00004	-0.00003	-0.00018	0.00009	-0.00005	-0.00002
	5	-0.00042	0.00073	-0.00016	0.00005	0.00005	0.00005
b_s	0	0.00901	-0.01401	0.00715	-0.00413	0.00126	-0.00104
	1	0.00628	-0.00932	0.00478	-0.00289	0.00091	-0.00082
	2	-0.00293	0.00409	-0.00189	0.00076	-0.00023	0.00014
	3	0.00039	-0.00120	0.00044	-0.00025	0.00002	-0.00002
	4	0.00026	0.00014	-0.00008	0.00010	0.00001	0.00001
	5	-0.00026	0.00032	0.00001	-0.00001	0.00001	-0.00001
t_s	0	0.00441	-0.00748	0.00377	-0.00258	0.00073	-0.00071
	1	0.00384	-0.00605	0.00303	-0.00203	0.00058	-0.00059
	2	-0.00088	0.00166	-0.00075	0.00047	-0.00010	0.00010
	3	-0.00008	-0.00015	0.00012	-0.00009	0.00003	0.00000
	4	0.00013	-0.00022	-0.00002	-0.00002	-0.00002	-0.00002
	5	-0.00007	0.00019	-0.00004	0.00002	0.00000	0.00000

TABLE XIV. Coefficients d_{ij} for expansion (A6) for the parton distributions of Set 1 with $\Lambda = 200$ MeV.

	$j\backslash i$	0	1	2	3	4	5
u_v	0	0.23946	0.29055	0.09778	0.02149	0.00344	0.00050
	1	0.01751	-0.00609	-0.02687	-0.01916	-0.00797	-0.00275
	2	-0.00576	-0.00504	0.00108	0.00249	0.00153	0.00075
	3	0.00174	0.00196	0.00030	-0.00034	-0.00029	-0.00018
	4	-0.00053	-0.00064	-0.00017	0.00004	0.00006	0.00004
	5	0.00017	0.00022	0.00008	0.00001	-0.00001	-0.00001
d_v	0	0.12613	0.13542	0.03958	0.00824	0.00166	0.00045
	1	0.00389	-0.01159	-0.01625	-0.00961	-0.00371	-0.00126
	2	-0.00191	-0.00056	0.00159	0.00159	0.00084	0.00039
	3	0.00064	0.00049	-0.00015	-0.00029	-0.00018	-0.00010
	4	-0.00020	-0.00019	0.00000	0.00006	0.00004	0.00003
	5	0.00007	0.00008	0.00002	-0.00001	-0.00001	-0.00001
u_s	0	1.01386	-1.10585	0.33739	-0.07444	0.00885	-0.00087
	1	0.92334	-1.28541	0.44755	-0.09786	0.01419	-0.00112
	2	0.04888	-0.12708	0.08606	-0.02608	0.00478	-0.00060
	3	-0.02691	0.04887	-0.01771	0.00162	0.00025	-0.00006
	4	0.00704	-0.01113	0.00159	0.00070	-0.00020	0.00000
	5	-0.00171	0.00229	0.00038	-0.00035	0.00004	0.00001
G	0	29.47734	-39.02468	14.63570	-3.33516	0.50538	-0.05915
	1	25.58960	-39.54527	16.61420	-4.29861	0.69036	-0.08243
	2	-1.66291	1.17624	1.11844	-0.70986	0.19481	-0.02404
	3	-0.21679	0.81705	-0.71688	0.18507	-0.01924	-0.00325
	4	0.20880	-0.43547	0.22391	-0.02446	-0.00362	0.00191
	5	-0.09097	0.16009	-0.05681	-0.00250	0.00258	-0.00047
s_s	0	0.92351	-1.08483	0.34642	-0.07210	0.00914	-0.00091
	1	0.93146	-1.27376	0.45122	-0.09775	0.01380	-0.00131
	2	0.04739	-0.12960	0.08482	-0.02642	0.00476	-0.00057
	3	-0.02653	0.04953	-0.01735	0.00175	0.00028	-0.00006
	4	0.00694	-0.01132	0.00148	0.00065	-0.00021	0.00000
	5	-0.00168	0.00234	0.00042	-0.00034	0.00005	0.00001
c_s	0	0.80983	-1.04168	0.33980	-0.06824	0.00876	-0.00090
	1	0.89606	-1.21708	0.43386	-0.09287	0.01304	-0.00129
	2	0.03058	-0.10402	0.07604	-0.02415	0.00460	-0.00050
	3	-0.02451	0.04432	-0.01651	0.00143	0.00012	-0.00010
	4	0.01122	-0.01457	0.00268	0.00058	-0.00012	0.00003
	5	-0.00773	0.00733	-0.00076	-0.00024	0.00001	0.00000
b_s	0	0.80288	-1.07532	0.37920	-0.07843	0.01007	-0.00109
	1	0.79033	-1.09887	0.41532	-0.09301	0.01317	-0.00141
	2	-0.01704	-0.01130	0.02882	-0.01341	0.00304	-0.00036
	3	-0.00072	0.00723	-0.00516	0.00108	-0.00005	-0.00004
	4	0.00305	-0.00461	0.00166	-0.00013	-0.00001	0.00001
	5	-0.00436	0.00523	-0.00161	0.00020	-0.00002	0.00000
t_s	0	0.66233	-0.92481	0.35193	-0.07930	0.01110	-0.00118
	1	0.63797	-0.90619	0.35816	-0.08479	0.01265	-0.00139
	2	-0.02581	0.02125	0.00419	-0.00498	0.00149	-0.00021
	3	0.00071	0.00053	-0.00127	0.00039	-0.00005	-0.00001
	4	0.00385	-0.00506	0.00186	-0.00035	0.00004	0.00000
	5	-0.00353	0.00446	-0.00150	0.00027	-0.00003	0.00000

TABLE XV. Coefficients c_{ij} for expansion (A2) for the parton distributions of Set 2 with $\Lambda=290$ MeV.

	$j\backslash i$	0	1	2	3	4	5
u_v	0	0.72374	-0.21888	-0.29951	-0.01909	-0.01477	0.00025
	1	-0.53139	-0.24246	0.32831	0.11193	0.02223	0.00707
	2	0.22891	0.18904	-0.09859	-0.06900	-0.01747	-0.00508
	3	-0.10415	-0.10839	0.02108	0.02975	0.00983	0.00283
	4	0.04394	0.05116	-0.00141	-0.01055	-0.00423	-0.00127
	5	-0.01991	-0.02539	-0.00278	0.00343	0.00172	0.00055
d_v	0	0.35776	-0.08622	-0.14799	-0.01840	-0.00782	-0.00045
	1	-0.29250	-0.13038	0.16959	0.06243	0.01353	0.00375
	2	0.13182	0.10408	-0.05486	-0.03872	-0.01038	-0.00285
	3	-0.06162	-0.06143	0.01303	0.01740	0.00594	0.00167
	4	0.02643	0.02957	-0.00149	-0.00645	-0.00263	-0.00077
	5	-0.01218	-0.01497	-0.00126	0.00224	0.00112	0.00035
u_s	0	0.10077	-0.07100	0.01973	-0.00571	0.00293	-0.00099
	1	-0.05271	-0.01823	0.01792	-0.00658	0.00175	-0.00155
	2	0.01220	0.01763	-0.00869	-0.00088	-0.00116	-0.00021
	3	-0.00119	-0.00718	0.00236	0.00189	0.00077	0.00041
	4	-0.00091	0.00204	-0.00031	-0.00105	-0.00040	-0.00024
	5	0.00119	-0.00017	-0.00020	0.00042	0.00017	0.00010
G	0	2.36660	0.44530	0.36600	0.09467	0.13412	0.01661
	1	-3.16964	-1.79481	0.03313	-0.28736	-0.09827	-0.07119
	2	1.82343	1.45736	-0.24652	0.03739	0.00609	0.01814
	3	-1.03315	-0.98274	0.21364	0.11686	0.05001	0.01684
	4	0.51327	0.52594	-0.11727	-0.11388	-0.04988	-0.02021
	5	-0.28808	-0.31452	0.05667	0.09161	0.04568	0.01951
s_s	0	0.06478	-0.04537	0.01643	-0.00349	0.00271	-0.00067
	1	-0.02223	-0.02126	0.01247	-0.00629	0.00112	-0.00144
	2	-0.00134	0.01362	-0.00613	-0.00079	-0.00090	-0.00020
	3	0.00508	-0.00361	0.00170	0.00183	0.00068	0.00040
	4	-0.00358	0.00006	-0.00026	-0.00105	-0.00038	-0.00023
	5	0.00242	0.00093	-0.00010	0.00045	0.00017	0.00011
c_s	0	0.00998	-0.01945	0.01055	-0.00687	0.00186	-0.00156
	1	0.00570	-0.01203	0.00625	-0.00486	0.00131	-0.00137
	2	-0.00449	0.00799	-0.00417	0.00205	-0.00044	0.00033
	3	0.00147	-0.00248	0.00146	-0.00057	0.00012	-0.00001
	4	-0.00009	0.00015	-0.00032	0.00012	-0.00006	-0.00004
	5	-0.00042	0.00076	-0.00014	0.00004	0.00007	0.00005
b_s	0	0.00898	-0.01459	0.00751	-0.00441	0.00131	-0.00107
	1	0.00597	-0.00944	0.00480	-0.00302	0.00091	-0.00085
	2	-0.00305	0.00444	-0.00210	0.00085	-0.00024	0.00014
	3	0.00053	-0.00130	0.00056	-0.00027	0.00003	-0.00002
	4	0.00020	0.00014	-0.00011	0.00010	0.00000	0.00000
	5	-0.00026	0.00032	0.00000	-0.00003	0.00001	-0.00001
t_s	0	0.00426	-0.00753	0.00383	-0.00268	0.00076	-0.00073
	1	0.00364	-0.00605	0.00303	-0.00209	0.00059	-0.00060
	2	-0.00092	0.00171	-0.00082	0.00050	-0.00012	0.00010
	3	-0.00005	-0.00016	0.00013	-0.00009	0.00003	0.00000
	4	0.00013	-0.00021	-0.00001	-0.00002	-0.00002	-0.00001
	5	-0.00008	0.00018	-0.00005	0.00002	0.00000	0.00000

TABLE XVI. Coefficients d_{ij} for expansion (A6) for the parton distributions of Set 2 with $\Lambda = 290$ MeV.

	$j \backslash i$	0	1	2	3	4	5
u_v	0	0.24099	0.28839	0.09369	0.01900	0.00253	0.00024
	1	0.01765	-0.00922	-0.03037	-0.02085	-0.00844	-0.00281
	2	-0.00645	-0.00526	0.00172	0.00311	0.00183	0.00087
	3	0.00212	0.00232	0.00026	-0.00049	-0.00039	-0.00023
	4	-0.00069	-0.00082	-0.00020	0.00007	0.00009	0.00006
	5	0.00024	0.00031	0.00011	0.00000	-0.00002	-0.00002
d_v	0	0.12633	0.13341	0.03732	0.00707	0.00126	0.00034
	1	0.00366	-0.01357	-0.01795	-0.01031	-0.00388	-0.00128
	2	-0.00210	-0.00036	0.00205	0.00192	0.00098	0.00044
	3	0.00077	0.00054	-0.00024	-0.00039	-0.00024	-0.00013
	4	-0.00026	-0.00023	0.00002	0.00009	0.00006	0.00004
	5	0.00009	0.00010	0.00002	-0.00002	-0.00002	-0.00001
u_s	0	1.08105	-1.18897	0.38685	-0.08617	0.01115	-0.00118
	1	0.99169	-1.39649	0.49978	-0.11585	0.01674	-0.00172
	2	0.05099	-0.13384	0.09173	-0.02885	0.00589	-0.00065
	3	-0.03178	0.05703	-0.02070	0.00244	0.00011	-0.00009
	4	0.00897	-0.01392	0.00205	0.00065	-0.00023	0.00002
	5	-0.00234	0.00301	0.00050	-0.00039	0.00006	0.00001
G	0	30.35544	-40.62373	15.77920	-3.69929	0.60204	-0.07031
	1	26.99749	-41.67159	17.69848	-4.80436	0.78620	-0.10596
	2	-1.90878	1.35687	1.12665	-0.71813	0.22324	-0.02481
	3	-0.24877	0.97811	-0.81272	0.20935	-0.02997	-0.00471
	4	0.25061	-0.54273	0.26717	-0.03103	-0.00180	0.00287
	5	-0.11277	0.20870	-0.06972	-0.00248	0.00263	-0.00084
s_s	0	0.98680	-1.17126	0.39398	-0.08459	0.01124	-0.00125
	1	1.00058	-1.38342	0.50438	-0.11521	0.01658	-0.00183
	2	0.04928	-0.13678	0.09021	-0.02935	0.00580	-0.00066
	3	-0.03133	0.05785	-0.02023	0.00263	0.00016	-0.00008
	4	0.00884	-0.01416	0.00190	0.00058	-0.00025	0.00001
	5	-0.00230	0.00308	0.00055	-0.00037	0.00007	0.00001
c_s	0	0.86983	-1.13053	0.38364	-0.08111	0.01048	-0.00130
	1	0.96262	-1.32081	0.48537	-0.10910	0.01583	-0.00170
	2	0.03057	-0.10878	0.08022	-0.02676	0.00559	-0.00056
	3	-0.02845	0.05164	-0.01918	0.00221	-0.00004	-0.00015
	4	0.01311	-0.01751	0.00331	0.00051	-0.00012	0.00005
	5	-0.00859	0.00838	-0.00092	-0.00026	0.00001	-0.00001
b_s	0	0.86718	-1.17370	0.42652	-0.09252	0.01244	-0.00146
	1	0.85004	-1.19366	0.46304	-0.10831	0.01614	-0.00183
	2	-0.02241	-0.00563	0.02815	-0.01425	0.00352	-0.00043
	3	-0.00073	0.00803	-0.00578	0.00138	-0.00013	-0.00004
	4	0.00346	-0.00538	0.00196	-0.00021	0.00001	0.00001
	5	-0.00485	0.00595	-0.00189	0.00026	-0.00003	0.00000
t_s	0	0.71455	-1.00730	0.39320	-0.09246	0.01366	-0.00154
	1	0.68561	-0.98276	0.39768	-0.09795	0.01540	-0.00179
	2	-0.03053	0.02758	0.00215	-0.00488	0.00164	-0.00025
	3	0.00092	0.00042	-0.00134	0.00046	-0.00008	-0.00001
	4	0.00423	-0.00566	0.00214	-0.00043	0.00006	0.00000
	5	-0.00389	0.00500	-0.00174	0.00033	-0.00004	0.00000

light-quark sea distributions. We have also improved the accuracy of our numerical solution of the Altarelli-Parisi equations. The resulting changes in these distributions are $\lesssim 2\%$. The changes in the coefficients for the distributions c_s, b_s, and t_s are more significant.

The bibliography entry for Arnison *et al.*, 1983e, was omitted; it should read

Arnison, G., *et al.*, 1983e, Phys. Lett. B **132**, 223.

The reference to Duke and Owens, 1984 should read

Duke, D. W., and J. F Owens, 1984, Phys. Rev. D **30**, 49.

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REFERENCES

Collins, J. C., and Wu-Ki Tung, 1986, Report No. Fermilab-Pub-86/39-T.

Eichten, E., I. Hinchliffe, K. Lane, and C. Quigg, 1984, in *Proceedings of the 1984 Summer Study on the Design and Utilization of the Superconducting Super Collider,* edited by R. Donaldson and J. Morfín (Fermilab, Batavia, Illinois), p. 99.

Kunszt, Z., 1984, Nucl. Phys. B **247**, 339.

Willenbrock, S., and D. Dicus, 1985, Phys. Lett. B **156**, 429.