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Erratum

Erratum to: Determination of the integrated luminosity at HERA using elastic QED compton events

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The calculation of the QED Compton (QEDC) cross sections in a recent H1 publication [1] is based on the COMPTON22 event generator [2,3]. The cross sections for elastic, quasi-elastic and inelastic QEDC are all proportional to $(\hbar c)^2\alpha^3/s$, where α is the fine-structure constant, s is the centre-of-mass energy squared measured in GeV^2 and the factor $(\hbar c)^2$ is a conversion factor, in units of [pb GeV^2]. It was found that incorrect numerical values have been programmed in the FORTRAN code used to calculate the cross sections, namely $(\hbar c)^2 = (6.20087)^2 \times 10^7$ pb GeV^2 and $\alpha = 1/137$. These numbers are corrected to $(\hbar c)^2 = 0.389379 \times 10^9$ pb GeV^2 and $\alpha = 0.00729735$, thus enhancing the predicted QEDC cross sections by 1.19 %.

Furthermore, the running of the electromagnetic coupling as a function of the virtuality t of the exchanged photon is neglected in [2,3]. For the reanalysis of [1], a running fine-structure constant $\alpha(t)$ is implemented. The cross sections predicted by COMPTON22 are scaled by a factor $(\alpha(t)/\alpha)^2$ prior to integrating over t. The running coupling $\alpha(t)$ is evalu-

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Table 1 Updated table of background fractions obtained from the reanalysis of [1]

	No $\|\vec{P}_T^{\text{miss}}\|$ cut		$\|\vec{P}_T^{\text{miss}}\| < 0.3$ GeV	
	In Ref. [1] (%)	This analysis (%)	In Ref. [1] (%)	This analysis (%)
Quasi-elastic QEDC	6.84	6.93	2.93	2.96
Inelastic QEDC	7.02	7.15	1.51	1.52
Elastic DVCS	2.10	2.06	1.26	1.24
Quasi-elastic DVCS	0.55	0.54	0.16	0.15
$ep \to ep\, e^+e^-$	1.15	1.12	1.31	1.28
Diffractive DIS	2.78	2.72	0.53	0.52
Non-diffractive DIS	0.02	0.02	0.01	0.01
Diffractive ρ^0	2.05	2.00	0.15	0.15
Diffractive ω	0.43	0.42	0.03	0.03
Diffractive ϕ	0.29	0.28	0.02	0.02
Diffractive J/ψ	0.20	0.20	0.05	0.05
Diffractive ψ'	0.17	0.17	0.08	0.08
Diffractive Υ	0.02	0.02	0.01	0.01

ated using the `alphaQED` code [4,5]. This change increases the predicted cross sections in the analysis phase space [1] by (0.83 ± 0.04) %, where the uncertainty is related to the number of generated events.

Taking both effects together, the predicted elastic QEDC cross section in the analysis phase space is increased by 2.0 %. The corrected cross sections in the generated phase space is $\sigma_{\text{gen}} = 55.9$ pb, where the estimated uncertainty on the QEDC theory of 1.1 % is unchanged. Similarly, the visible cross section is increased to $\sigma_{\text{vis}} = 37.1$ pb. The background fractions also change slightly, as shown in Table 1. Background from quasi-elastic and inelastic QEDC processes increases, because the t dependence is different from that of the elastic QEDC process. The relative fractions of the other background sources are reduced, because their predicted absolute cross sections do not change.

In addition to the above changes in the cross section prediction, a small inefficiency in the data handling has been identified. After correcting this technical problem, 21 additional data events are recovered for the luminosity measurement, now derived from a total of 14,298 candidate events.

The overall HERA luminosity in the data taking period from 2003 to 2007, measured from counting QED Compton events, is found to be $345.3 \pm 7.9\,\text{pb}^{-1}$. As compared to [1] it is lower by 1.8 %. The cross section measurements performed in three H1 papers [6–8], based on the data collected in the years 2003–2007 at a proton energy of 920 GeV, are normalised using the integrated luminosity measurement of [1]. For this reason they are affected by the change in the measured luminosity discussed above, such that their cross sections are to be scaled up by 1.8 %. It is worth to note that these changes are fully covered by the total uncertainty of the luminosity measurement of 2.3 %. The measurements of beauty production at threshold [6] and of elastic and proton-dissociative J/ψ production [8] have systematic uncertainties which are much larger than the correction discussed above and are not updated. In contrast, the measurements of inclusive neutral and charged current cross sections [7] reach a level of precision where the 1.8 % correction may be of relevance. Furthermore, the combined data tables 29–32, 45–48 and 51–52 in [7], cannot be derived using a simple scale factor, because other datasets, not affected by the problems discussed above, are included in the averaging procedure. The corrected data tables of [7] are available [9].

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