Erratum to "Measurement of the Isolated Photon Cross Section in $p\bar{p}$ Collisions at $\sqrt{s} = 1.96$ TeV" published in Phys. Lett. B 639, 151 (2006)

(Dated: June 4, 2007)

The measurement of the inclusive isolated photon cross section published in our recent Letter [1] requires a correction for two effects: an increase in the reported integrated luminosity and an adjustment to the estimation of the energy response of the calorimeter to photons.

The instantaneous luminosity at DØ is measured by counting the number of inelastic collisions that produce charged particles within the acceptance of the luminosity monitor [2]. The determination of the luminosity has recently been improved through studies of the multiplicities observed in the luminosity monitor [3]. These studies indicated that the fraction of observable inelastic collisions was overestimated in our previous analysis [4]. We have also added corrections for the time dependence of the luminosity counter efficiencies. The result of these improvements is to increase the assessment of the total integrated luminosity for this analysis by 16.7% to 380 ± 23 pb^{-1} and to decrease the estimated uncertainty from 6.5% to 6.1%.

The energy response of the calorimeter to photons was calibrated using electrons from Z boson decays. Photons and electrons shower differently in matter, and photon energies needed to be shifted down, as we indicated in the Letter. However, this shift was estimated considering only direct photons. As shown in Fig. 4 of the Letter, the fraction of photons at low p_T that are true direct photons is only $\approx 40\%$. The background photons, primarily from π^0 or η meson decays, have a softer energy distribution than signal photons which results in a smaller reconstructed p_T. The total average p_T shift of the photon candidates with respect to the true photon p_T has been determined by weighting signal and background events according to the photon purity (Fig. 4 of the Letter). As compared with the p_T shift estimated for pure direct photons, the new estimate leads to about 3.6% p_T correction for the first bin with $\langle p_T^\gamma \rangle \simeq 24$ GeV, about 2% at $\langle p_T^\gamma \rangle \simeq 40$ GeV and less than 1% for $p_T^\gamma \geq 60$ GeV.

The inclusive isolated photon cross section has been recalculated including both luminosity and p_T scale corrections. They are presented in Table I and compared with a NLO pQCD calculation [6] in Fig. 1. The new correction factors have similar magnitude but opposite effect at low p_T so the cross section does not change significantly. At high p_T, however, the p_T scale correction is minimal so the average cross section drops by 15%. This results in a stretching of the shape between low and high p_T compared to the measurement published in the Letter.

In general, NLO QCD predictions agree with the data taking into account the total experimental and theoretical uncertainties. However, the data-to-theory ratio has a shape similar to that seen by the UA2 [7] and CDF [8] experiments. It is also suggestive of the shapes expected from extensions to NLO pQCD that incorporate the effects of soft gluon resummation [9–11].

TABLE I: The measured differential cross section for the production of isolated photons, averaged over $|\eta| < 0.9$, in bins of p_T^γ. $\langle p_T^\gamma \rangle$ is the average p_T^γ within each bin. The columns $\delta\sigma_{\rm stat}$ and $\delta\sigma_{\rm syst}$ represent the statistical and systematic uncertainties respectively.

p_T^γ (GeV)	$\langle p_T^\gamma \rangle$ (GeV)	$d^2\sigma/dp_T^\gamma d\eta$ (pb/GeV)	$\delta\sigma_{\rm stat}$ (%)	$\delta\sigma_{\rm syst}$ (%)
23−25	24.1	4.19×10^{2}	0.1	23
25−30	27.1	2.22×10^{2}	0.1	19
30−34	31.8	1.00×10^{2}	0.2	16
34−39	36.1	5.30×10^{1}	0.2	15
39−44	41.2	2.85×10^{1}	0.3	14
44−50	46.7	1.51×10^{1}	0.4	13
50−60	54.2	7.38×10^{0}	0.4	13
60−70	64.3	3.14×10^{0}	0.6	13
70−80	74.4	1.54×10^{0}	0.9	12
80−90	84.4	8.37×10^{-1}	1.3	12
90−110	98.2	3.91×10^{-1}	1.4	12
110−130	118	1.48×10^{-1}	2.3	12
130−150	139	6.76×10^{-2}	3.5	13
150−170	159	2.80×10^{-2}	5.6	13
170−200	183	1.43×10^{-2}	6.5	14
200−230	213	6.27×10^{-3}	9.8	14
230−300	255	1.54×10^{-3}	13	15

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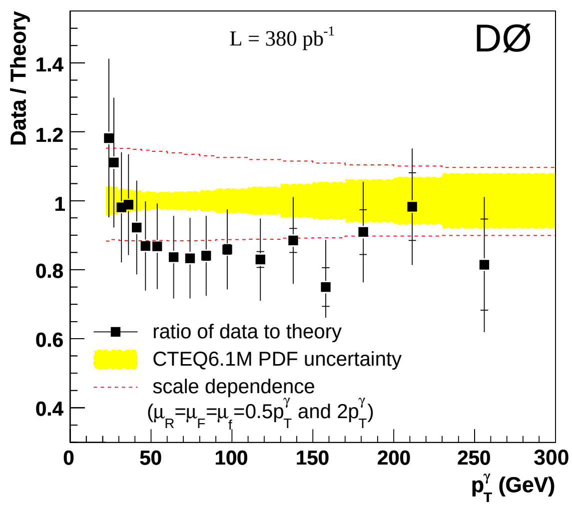

FIG. 1: The ratio of the measured cross section to the theoretical predictions from JETPHOX. The full vertical lines correspond to the overall uncertainty while the inner line indicates just the statistical uncertainty. The dashed lines represent the change in the cross section when varying the theoretical scales by factors of two. The shaded region indicates the uncertainty in the cross section estimated with CTEQ6.1 PDF.

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