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Corrigendum

Corrigendum to “Measurement of electrons from beauty hadron decays in pp collisions at $\sqrt{s} = 7$ TeV” [Phys. Lett. B 721 (1–3) (2013) 13–23] and “Beauty production in pp collisions at $\sqrt{s} = 2.76$ TeV measured via semi-electronic decays” [Phys. Lett. B 738 (2014) 97–108]

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We have identified a bias in the measurement of electrons from beauty-hadron decays in pp collisions at center-of-mass energies $\sqrt{s} = 2.76$ TeV [1] and $\sqrt{s} = 7$ TeV [2]. The efficiency corrections were evaluated using a Monte Carlo simulation, based on PYTHIA as described in [1,2]. When calculating the impact parameter (d_0) cut efficiency for the charm-hadron decay electrons, we did not consider the difference between the impact parameter distributions using the measured D-meson p_T distribution and the one from Monte Carlo.

For weakly decaying hadrons with sufficiently high transverse momentum (p_T), the impact parameter distribution of the daughter particle at a given p_T depends very weakly on the transverse momentum of the mother hadrons. However, at low momentum the impact parameter distribution of the decay particles depends on the momentum distribution of the mother hadrons. Due to the harder p_T spectra of charm hadrons in the Monte Carlo simulation [1,2] compared to the measured ones [3,4], the d_0 cut efficiency of decay electrons was biased towards larger values. Since the background was subtracted from the raw inclusive electron yield after applying the d_0 cut, the charm-hadron decay background was overestimated.

We have now computed the d_0 distribution of electrons from charm-hadron decays using a Monte Carlo and weighting each electron by the ratio $(dN/dp_T)^{\text{measured}}/(dN/dp_T)^{\text{MC}}$. $(dN/dp_T)^{\text{measured}}$ and $(dN/dp_T)^{\text{MC}}$ are the production yields evaluated at the p_T of the mother charm-hadron of the electron, as obtained from data [3,4] and in the Monte Carlo simulations [1,2], respectively. In such a way, the measured mother p_T spectra are propagated to the impact parameter cut efficiency calculation for the daughter electrons.

Table 1
Effect of the corrected treatment of the D-meson p_T distribution on the d_0 cut efficiency for electrons from charm-hadron decays (ϵ_{d_0}) and the resulting yield of signal electrons (dN^{signal}/dp_T).

7 TeV pp collisions			
p_T interval (GeV/c)	1–2	2–3	3–8
$\epsilon_{d_0}^{\text{updated}}/\epsilon_{d_0}^{\text{previous}}$	0.56–0.60	0.60–0.70	0.70–0.85
$(dN^{\text{signal}}/dp_T)^{\text{updated}}/(dN^{\text{signal}}/dp_T)^{\text{previous}}$	1.6–1.4	1.3–1.2	< 1.1
2.76 TeV pp collisions			
p_T interval (GeV/c)	1–2	2–3	3–8
$\epsilon_{d_0}^{\text{updated}}/\epsilon_{d_0}^{\text{previous}}$	0.74–0.77	0.77-0.85	0.85–0.94
$(dN^{\text{signal}}/dp_T)^{\text{updated}}/(dN^{\text{signal}}/dp_T)^{\text{previous}}$	1.4–1.3	1.2–1.1	< 1.1

The new value of the d_0 cut efficiency ($\epsilon_{d_0}^{\text{updated}}$) of electrons from charm-hadron decays is significantly smaller than that previously evaluated ($\epsilon_{d_0}^{\text{previous}}$) as summarized in Table 1.

In Fig. 1, the raw electron yield, as well as the non-beauty electron background yield, which is subtracted in the analysis, are shown after the application of the track selection criteria. Compared to Fig. 3 in [2], the yield of electrons from charm-hadron decays is smaller by the factor $\epsilon_{d_0}^{\text{updated}}/\epsilon_{d_0}^{\text{previous}}$ given in Table 1. The corresponding yield of beauty-signal electrons (dN^{signal}/dp_T) increases as listed in Table 1. For pp collisions at $\sqrt{s} = 2.76$ TeV, where a similar bias was present, the same procedure has been applied and the correct distributions are shown in Fig. 2 (to be compared with Fig. 2 in [1]). Numerical values of the implication for the d_0 cut efficiency are given in Table 1.

The uncertainty on the d_0 efficiency was evaluated by propagating the statistical and systematic uncertainties of the charm-hadron p_T distributions in [3] to the measurements discussed in this corrigendum. The uncertainty was added in quadrature as an independent contribution to the total systematic uncertainty.

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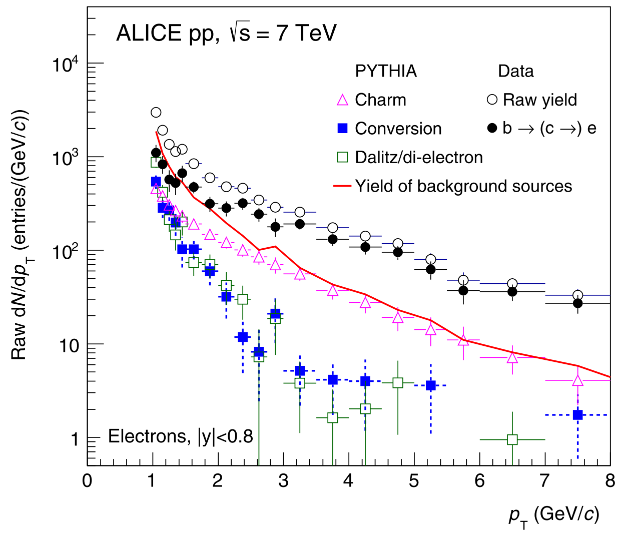

Fig. 1. This figure replaces Fig. 3 from [2]. Caption is the same as Fig. 3 from [2].

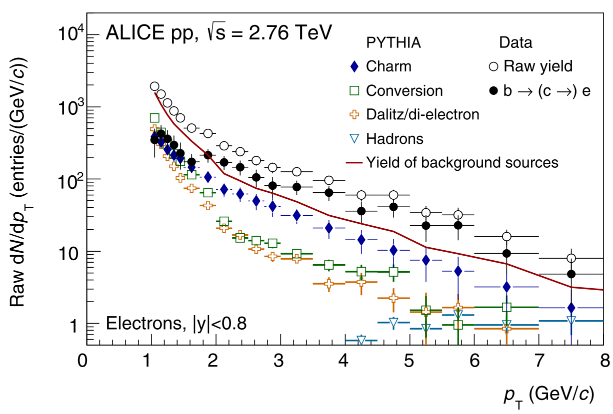

Fig. 2. This figure replaces Fig. 2 from [1]. Caption is the same as Fig. 2 from [1].

Table 2
Summary of the updated cross sections.

Cross sections at 7 TeV pp collisions	
Visible $\sigma_{b\to e}$	9.03 ± 0.50 (stat) $^{+2.72}_{-2.73}$ (sys) ± 0.32 (norm) μb
$d\sigma_{b\bar{b}}/dy$	57.7 ± 3.2 (stat) $^{+17.4}_{-17.4}$ (sys) $^{+1.4}_{-2.3}$ (extr) ± 2.0 (norm) μb
$\sigma_{b\bar{b}}$	383 ± 21 (stat) $^{+116}_{-116}$ (sys) $^{+10}_{-11}$ (extr) ± 13 (norm) ± 13 (br) μb
Weighted $\sigma_{b\bar{b}}$	322 ± 45 (stat) $^{+58}_{-62}$ (sys) $^{+8}_{-9}$ (extr) μb
$d\sigma_{c\bar{c}}/dy$	1.1 ± 0.2 (stat) $^{+0.6}_{-0.7}$ (sys) $^{+0.2}_{-0.1}$ (extr) mb
$\sigma_{c\bar{c}}$	9.7 ± 1.7 (stat) $^{+5.2}_{-5.6}$ (sys) $^{+3.4}_{-0.5}$ (extr) ± 0.4 (br) mb
Cross sections at 2.76 TeV pp collisions	
Visible $\sigma_{b\to e}$	4.33 ± 0.38 (stat) $^{+1.45}_{-1.75}$ (sys) ± 0.08 (norm) μb
$d\sigma_{b\bar{b}}/dy$	29.1 ± 2.6 (stat) $^{+9.8}_{-11.7}$ (sys) $^{+0.6}_{-0.8}$ (extr) ± 0.6 (norm) μb
$\sigma_{b\bar{b}}$	162 ± 14 (stat) $^{+55}_{-65}$ (sys) $^{+4}_{-4}$ (extr) ± 3 (norm) ± 6 (br) μb

The relative systematic uncertainties on the charm-hadron decay background increase by 3% (2%) at $p_T < 1.5$ GeV/c for 7 TeV (2.76 TeV) pp collisions. The change of the systematic uncertainties at higher p_T region is instead negligible. However, the amount of background decreases and as a consequence the total uncertainty on the beauty production measurement decreases.

The production cross sections were also corrected correspondingly. The integrated cross section of electrons from beauty hadron

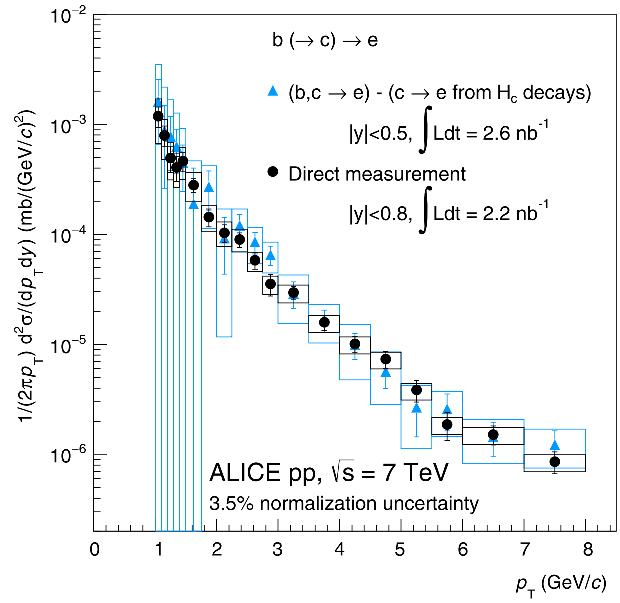

Fig. 3. This figure replaces Fig. 4 from [2]. Caption is the same as Fig. 4 from [2].

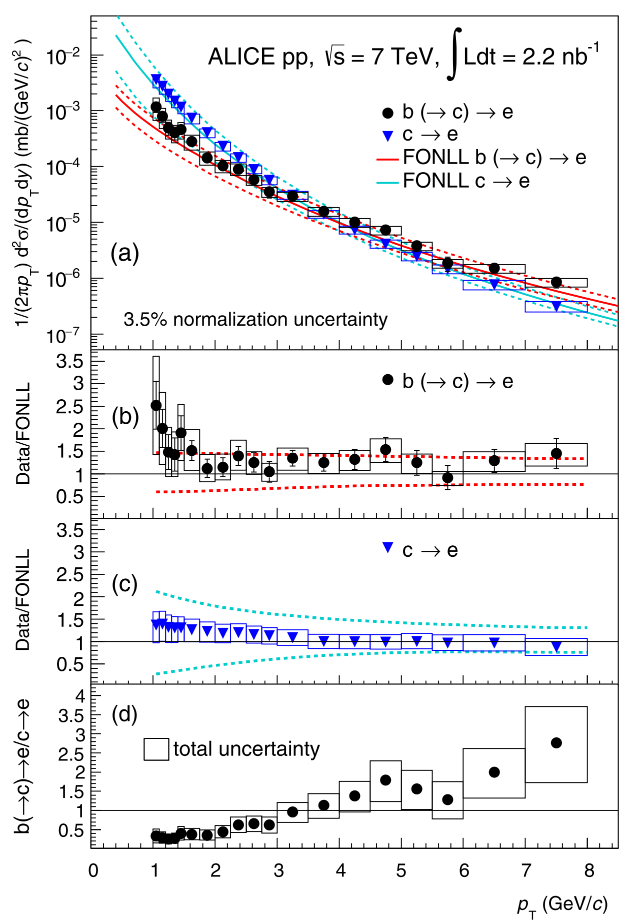

Fig. 4. This figure replaces Fig. 5 from [2]. Caption is the same as Fig. 5 from [2].

decays (visible $\sigma_{b\to e}$), the beauty production cross section per unit rapidity at mid-rapidity ($d\sigma_{b\bar{b}}/dy$) and the total cross section ($\sigma_{b\bar{b}}$) are summarized in Table 2. For 7 TeV pp collisions, the weighted average of this with the result of a previous measurement of

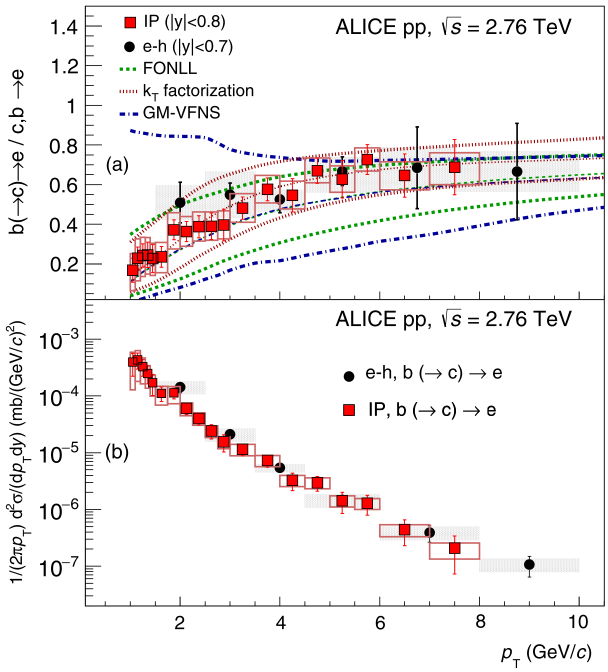

Fig. 5. This figure replaces Fig. 4 from [1]. Caption is the same as Fig. 4 from [1].

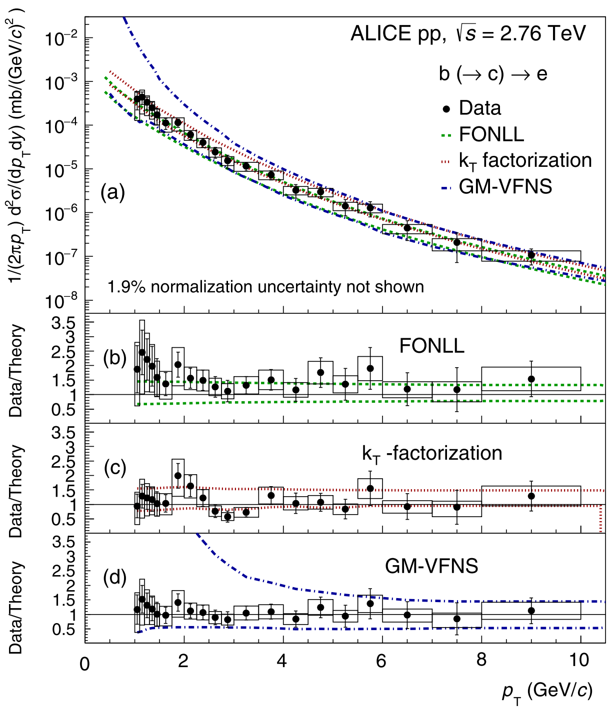

Fig. 6. This figure replaces Fig. 5 from [1]. Caption is the same as Fig. 5 from [1].

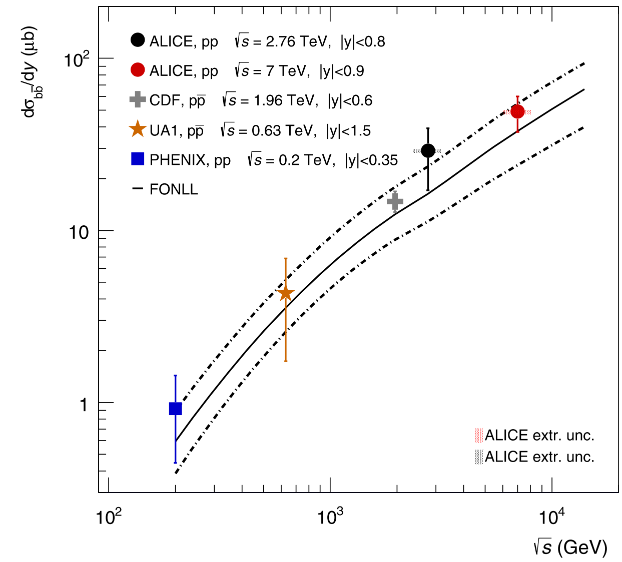

Fig. 7. This figure replaces Fig. 6 from [1]. Caption is the same as Fig. 6 from [1].

J/ψ mesons from beauty-hadron decays [5] is also updated. After subtracting the new cross section of the electrons from beauty-hadron decays from the measured cross section of the electrons from heavy-flavour hadron decays [6], the production cross section of electrons from charm-hadron decays was converted into a charm production cross section. The charm production cross section per unit rapidity at mid-rapidity ($d\sigma_{c\bar{c}}/dy$) and the total cross sections ($\sigma_{c\bar{c}}$) at $\sqrt{s} = 7$ TeV are also updated in Table 2. Since the corresponding quantity at $\sqrt{s} = 2.76$ TeV was not explicitly evaluated in [1], there is no corresponding entry in Table 2. All measured cross sections for 7 TeV (2.76 TeV) have an additional normalization uncertainty of 3.5% (1.9%) [7].

In Figs. 3, 4, 5, 6 and 7, we have updated accordingly the ALICE data points.

The main conclusion of the original papers remains valid: the data and predictions are consistent within the experimental and theoretical uncertainties.

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