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Erratum

Erratum to "Rapidity and transverse momentum dependence of inclusive J/ψ production in pp collisions at $\sqrt{s} = 7$ TeV" [Phys. Lett. B 704 (5) (2011) 442] ☆

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We have identified a bias in the calculation of the cross section of J/ψ production measured in the e^+e^- channel at central rapidity ($|y| < 0.9$) [1]. The acceptance and efficiency corrections were evaluated using a Monte Carlo simulation, based on PYTHIA [2,3], which did not include the radiative decays of J/ψ (J/$\psi \to e^+e^-\gamma$). In these decays the reconstructed dielectron invariant mass, $m_{e^+e^-}$, is biased towards smaller values than the nominal J/ψ mass, since the photon contribution is neglected. As a consequence, the fraction of signal events in the $m_{e^+e^-}$ range 2.92–3.16 GeV/c^2 was overestimated by about 10%. Moreover, the requirement of the transverse momentum of the daughter electrons being larger than 1 GeV/c is more selective for radiative than non-radiative J/ψ decays. Therefore, the J/ψ acceptance was also overestimated by about 5%.

We have now evaluated the acceptance and efficiency corrections with a simulation where the decay of the J/ψ particles is handled by the EvtGen package [4], and where the final state radiation is described using PHOTOS [5,6]. The new acceptance times efficiency value ($A \times \epsilon$) after all analysis cuts is a factor 1.155 smaller than that previously evaluated, independently of p_T. Neglecting the effect of radiative decays therefore results in underestimating both the p_T-integrated and the differential cross sections by 15.5%.

For the dimuon channel, where no invariant mass cut is applied and the occurrence of final state radiation is reduced (by about a factor of three [7]), the differences in the $A \times \epsilon$ values obtained with the new and previous simulations are about 1–2%, well within the systematic uncertainty associated with the signal extraction.

We have further verified that in the dielectron channel the procedure used to derive the p_T-differential cross section, which is based on the computation of the $A \times \epsilon$ values, produces a result fully compatible with that obtained by applying an unfolding correction procedure (see, e.g., review [8]), even when considering the radiative decays.

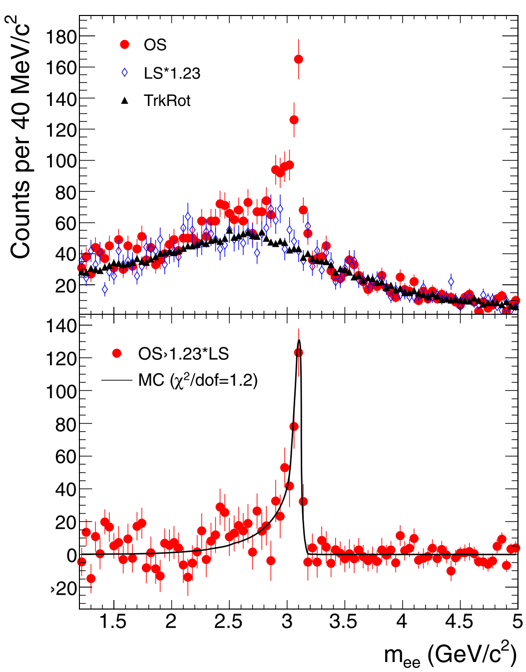

Fig. 1. Top panel: invariant mass distributions for opposite-sign (OS) and like-sign (LS) electron pairs ($|y| < 0.9$, all p_T), as well as for pairs obtained with one track randomly rotated (TrkRot). Bottom panel: the difference of the OS and LS distributions with a fit to the Monte Carlo (MC) signal superimposed.

In Fig. 1 the invariant mass distributions of electron pairs are shown. In particular, in the bottom panel the new Monte Carlo line shape is superimposed on the difference of the opposite and like sign distributions. The fraction of the signal within the invariant mass range 2.92–3.16 GeV/c^2 estimated using this Monte Carlo

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Table 1
Summary of the results on the J/ψ differential cross sections.

p_T (GeV/c)	$N_{J/\psi}$	$A \times \epsilon$	$d^2\sigma_{J/\psi}/dp_T\,dy$ (μb/(GeV/c))	Systematic uncertainties			
				Correl. (μb/(GeV/c))	Non-correl. (μb/(GeV/c))	Polariz., CS (μb/(GeV/c))	Polariz., HE (μb/(GeV/c))
$\lvert y\rvert < 0.9$							
[0; 1]	50 ± 17	0.122	0.68 ± 0.24	0.02	0.21	$+0.16, -0.18$	$+0.08, -0.12$
[1; 2]	86 ± 17	0.076	1.87 ± 0.37	0.07	0.31	$+0.42, -0.50$	$+0.28, -0.39$
[2; 3]	79 ± 13	0.069	1.89 ± 0.31	0.08	0.23	$+0.33, -0.43$	$+0.35, -0.44$
[3; 5]	75 ± 13	0.086	0.72 ± 0.13	0.02	0.09	$+0.06, -0.08$	$+0.16, -0.13$
[5; 7]	50 ± 9	0.104	0.40 ± 0.07	0.01	0.05	$+0.001, -0.005$	$+0.06, -0.08$
y			$d\sigma_{J/\psi}/dy$ (μb)	(μb)	(μb)	(μb)	(μb)
[−0.9; 0.9]	352 ± 32	0.085	6.90 ± 0.62	0.28	0.96	$+0.9, -1.3$	$+1.0, -1.5$

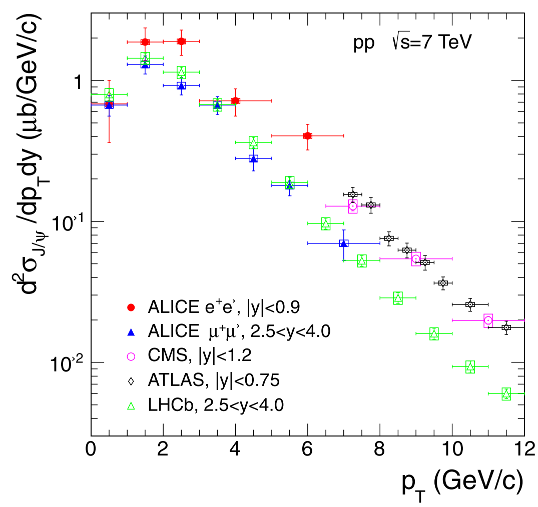

Fig. 2. Double differential J/ψ production cross section as a function of p_T for the midrapidity range and for the forward rapidity data, compared with results from the other LHC experiments [10–12], obtained in similar rapidity ranges. The error bars represent the quadratic sum of the statistical and systematic errors, while the systematic uncertainties on luminosity are shown as boxes. The symbols are plotted at the center of each bin.

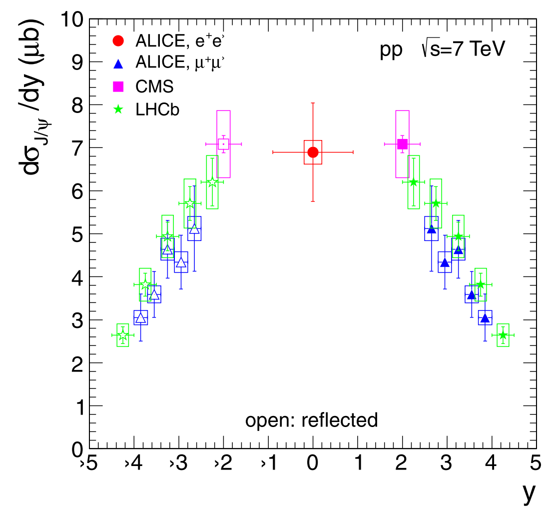

Fig. 3. J/ψ cross section as a function of rapidity, compared with results from the other LHC experiments [10–12]. The error bars represent the quadratic sum of the statistical and systematic errors, while the systematic uncertainties on luminosity are shown as boxes. The symbols are plotted at the center of each bin.

is $66.8 \pm 1.9\%$. The main contribution to the uncertainty on this quantity comes from the accuracy of the description of the detector material, as discussed in [1]. A smaller contribution (1%, in terms of the relative error) is attributed to the small discrepancies between the invariant mass distribution as provided by QED at next to leading order [9] and by the event generator (EvtGen + PHOTOS); the latter contribution remains even after taking into account the detector resolution.

The corrected value of the production cross section is $\sigma_{J/\psi}(|y| < 0.9) = 12.4 \pm 1.1$ (stat.) ± 1.8 (syst.) $+ 1.8$ ($\lambda_{HE} = 1$) $- 2.7$ ($\lambda_{HE} = -1$) μb. In Table 1 the resulting differential cross sections are summarized. Finally, in Figs. 2 and 3 we have updated accordingly the ALICE data points at central rapidity.

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