Inclusive J/ψ and ψ(2S) production in pp collisions at $\sqrt{s} = 7$ TeV at forward rapidity with ALICE at LHC

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The ALICE detector is described in detail in [1]. The Muon Spectrometer of ALICE is designed to measure the ψ and Υ states (J/ψ,ψ(2S) and Υ(1S),Υ(2S),Υ(3S)) in the forward pseudo-rapidity interval of $-4 \leq \eta \leq -2.5$.

The present analysis uses pp collisions data at $\sqrt{s} = 7$ TeV. The data were recorded in 2011 with a trigger defined by the coincidence of a minimum bias trigger with the detection of two opposite sign muons reconstructed in the trigger chambers of the muon spectrometer. A total of 4 million events were analysed, corresponding to an integrated luminosity $\mathcal{L}_{int} = 1.35$ pb^{-1} (with 5% systematic uncertainty). In order to improve the purity of the muon tracks the following selection criteria were applied: (1) both muon tracks match with trigger tracks above the 1 GeV/c p_T threshold, (2) both muon tracks in the pseudo-rapidity range $-4 \leq \eta \leq -2.5$, (3) transverse radius coordinate of the track at the end of the absorber (longitudinal position of absorber from interation point (IP) is $-5.0 \leq z \leq -0.9$ m) in the range $17.6 \leq R_{abs} \leq 89.5$ cm. (4) dimuon rapidity in the range $2.5 \leq y \leq 4.0$. (5) dimuon p_T in the range $0 \leq p_T \leq 20$ GeV/c.

Fig. 1 shows the invariant mass spectra fitted with two Extended Crystal Ball functions (Crystal Ball function with a non gaussian tail on both sides) for two signals and a variable width gaussian function (a gaussian function with a width varying linearly with the mass) for the background.

We present here inclusive production of J/ψ and ψ(2S). Inclusive measurements contain, on top of the direct production, contributions from the decay of higher excited states as well as contributions from non-prompt pro-
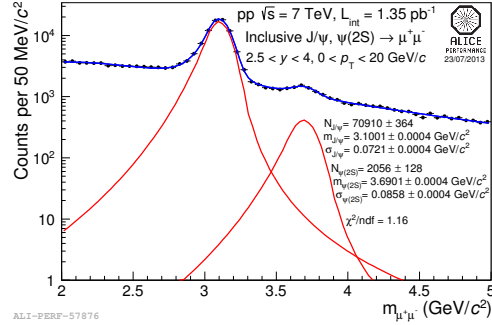
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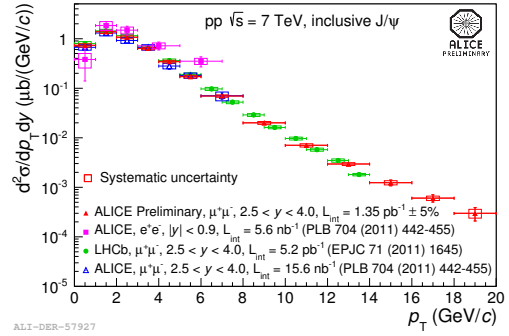FIG. 1: Opposite sign dimuon invariant mass spectra, integrated over y ($2.5 \leq y \leq 4.0$) and p_T ($0 \leq p_T \leq 20$ GeV/c).
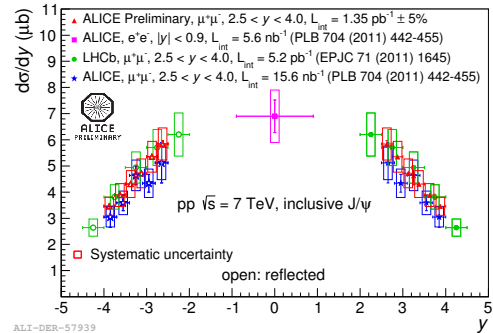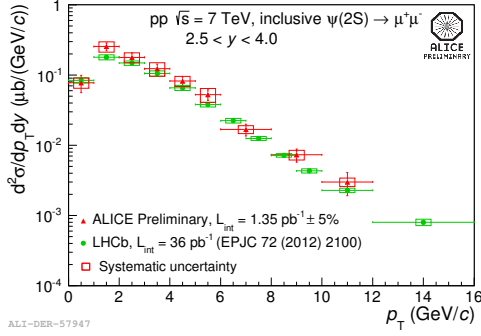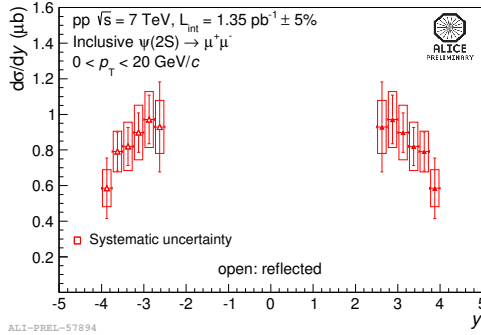

FIG. 2: p_T differential cross section of J/ψ.

FIG. 3: y differential cross section of J/ψ.

duction. The production cross sections of J/ψ

FIG. 4: p_T differential cross section of $\psi(2S)$.

FIG. 6: $\psi(2S)/J/\psi$ ratio as a function of p_T.

FIG. 5: y differential cross section of $\psi(2S)$.

FIG. 7: $\psi(2S)/J/\psi$ ratio as a function of y.

and $\psi(2S)$ were determined by normalizing the production yields (the measured yields from the fits to the invariant mass spectra were corrected by the acceptance times efficiency factor) with the branching ratio and the integrated luminosity. The systematic uncertainties on the cross sections arise due to signal extraction, MC parametrization, trigger and tracking efficiency, matching efficiency and luminosity determinations.

The measured production cross sections of J/ψ and $\psi(2S)$, integrated in the y and p_T range are:

$\sigma_{J/\psi} = 6.76 \pm 0.04$ (stat.) ± 0.64 (syst.) μb.

$\sigma_{\psi(2S)} = 1.28 \pm 0.08$ (stat.) ± 0.21 (syst.) μb.

Fig. 2 and Fig. 3 show the differential production cross section of J/ψ in thirteen p_T bins and in six y bins, respectively. This result is consistent with the previous ALICE result [2] and also with the measurement performed by the LHCb collaboration [3]. This measurement extends J/ψ cross section to 20 GeV/c in p_T at forward rapidity.
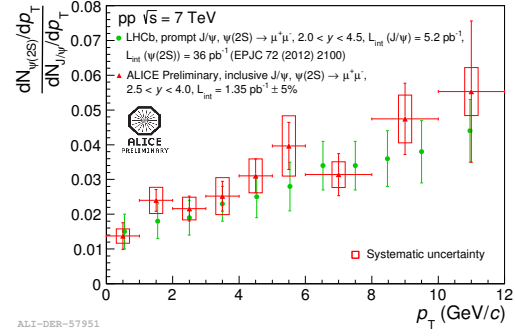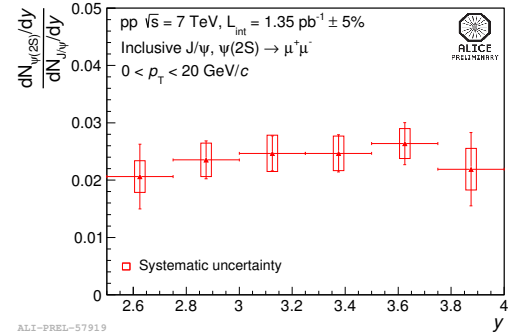
Fig. 4 shows the differential production cross section of $\psi(2S)$ in nine p_T bins. The result is consistent with LHCb measurement [4] in the same rapidity interval. Fig. 5 shows the differential production cross sections of $\psi(2S)$ in six y bins. This is the first $\psi(2S)$ measurement in pp collisions at ALICE.

The inclusive $\psi(2S)/J/\psi$ ratio, integrated over p_T and y is 0.024 ± 0.002 (stat.) ± 0.003 (syst.). The $\psi(2S)/J/\psi$ ratio were measured as a function of p_T and y as shown in Fig. 6 and Fig. 7 and a clear p_T dependence can be observed, in consistent with LHCb [4]. No strong y dependence is visible, in the y range covered by the ALICE muon spectrometer.

References

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[2] K. Aamodt *et al.*, (ALICE collaboration) *Phys. Lett.* B704, 442-455 (2011).

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[4] R. Aaij *et al.*, (LHCb collaboration) *Eur.Phys.J.* C72, 2100 (2012).