Measurement of the production cross section ratio of $X(3872)$ and $\psi(2S)$ in decays to $J/\psi\pi^+\pi^-$ in pp collisions at $\sqrt{s} = 7TeV$

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1 Introduction

The discovery of the X(3872) resonance in the decay channel $J/\psi\pi^+\pi^-$ by the Belle experiment in 2003 [2], and its subsequent confirmation by BaBar, CDF and D0 [2], opened up a new chapter in studies of QCD and spectroscopy. Here, the first observation of the X(3872) signal by the Compact Muon Solenoid (CMS) Experiment at the LHC is presented. The analysis is based on an integrated luminosity of 40 pb^{-1} of proton-proton collisions at 7 TeV, recorded in 2010. Also a measurement of the ratio of the production cross sections for the X(3872) and the $\psi(2S)$ resonances is presented. The resonances are reconstructed in their decays to $J/\psi\pi^+\pi^-$ and with the subsequent decay of the J/ψ candidates to two muons The ratio of the cross sections times the branching fractions for these decay channels in the kinematic region $p_t(X) > 8(GeV)$ and $|y(X)| < 2.2$ is measured to be $R = 0.087 \pm 0.017(stat.) \pm 0.009(syst.)$.

2 Data Selection and Anlysis

The J/ψ selection borrows heavily from the techniques developed in the previous CMS measurement of the J/ψ production cross section. Events are triggered by requiring two muons without an explicit requirement on the muon momentum. The two identified muons are required to lie within the CMS detector acceptance for the reconstruction[1]. For the reconstruction of the $J/\psi\pi^+\pi^-$ system, the J/ψ meson candidates are combined with pairs of oppositely charged pion track candidates. To suppress this background, several track quality and selection criteria are applied, and the four final state tracks are refitted, assuming that the particles come from one common vertex and constraining the mass of the muon pair to that of the J/ψ. After all the selection an unbinned log-likelihood fit invariant mass spectrum 1.

The ratio of production cross sections R, is determined from the ratio of the numbers of X(3872) and $\psi(2S)$ candidates as given by the un-binned log likelihood

fit, $N_{X(3872)} = 548 \pm 104(stat.)$ and$N_{\psi(2S)} = 7346 \pm 155(stat.)$., applying the global correction factor for the acceptance and efficiency of 0.872, as described in PAS [1].

$$R = \frac{\sigma(pp \to X(3872) + anything) \times BR(X(3872) \to J/\psi\pi^+\pi^-)}{\sigma(pp \to \psi(2S) + anything) \times BR(\psi(2S) \to J/\psi\pi^+\pi^-)} \quad (1)$$

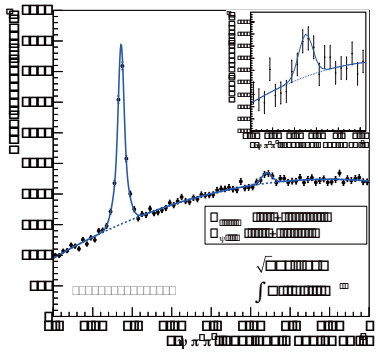

Figure 1: Plan of the magnet used in the Mesmeric studies.

3 Conclusion

A measurement of the cross section ratio of the production cross sections for the X(3872) and $\psi(2S)$ resonances has been performed using the data recorded at the CMS experiment in 2010. A clear X(3872) signal is observed. The yields for the X(3872) and the $\psi(2S)$ are determined in the decay channel to $J/\psi\pi^+\pi^-$ and are corrected for differences in the acceptance and efficiencies for $J/\psi$and $\pi^+\pi^-$ reconstruction.

References

[1] CMS Collaboration "Measurement of the production cross section ratio of $X(3872)$ and $\psi(2S)$ in decays to $J/\psi\pi^+\pi^-$ in pp collisions at $\sqrt{s} = 7TeV$" CMS PAS BPH-10-018

[2] Phys. Rev. Lett. 91 (2003) 262001. Phys. Rev. D71 (2005) 071103, Phys. Rev. Lett. 93 (2004) 072001, Phys. Rev. Lett. 93 (2004) 162002.