

Guskov Alexey

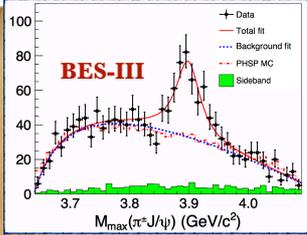
JINR, Dubna

on behalf of the COMPASS collaboration

Search for exclusive photoproduction of $Z_c^\pm(3900)$ at COMPASS



$Z_c^\pm(3900)$



$Z_c^\pm(3900)$ discovered by BES III and Belle in $e^+e^- \rightarrow \pi^+ \pi^- J/\psi$ at 4.26 GeV

	$M, \text{ GeV}$	$\Gamma_{\text{tot}}, \text{ GeV}$
BELLE	$3899.0 \pm 3.6_{\text{stat}} \pm 4.9_{\text{sys}}$	$46 \pm 10_{\text{stat}} \pm 20_{\text{sys}}$
BES-III	$3894.5 \pm 6.6_{\text{stat}} \pm 4.5_{\text{sys}}$	$63 \pm 24_{\text{stat}} \pm 26_{\text{sys}}$

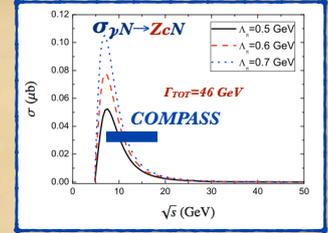
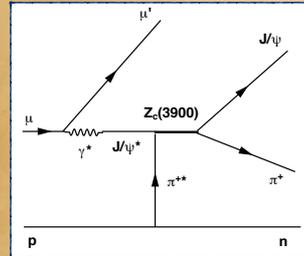
What is the nature of this signal?

Tetraquark?
D*Dbar*?
Cusp?
FSI?
...

Search for direct production of $Z_c(3900)$ could shed light to the nature of this object

Exclusive photoproduction of Z_c^\pm

Q.-Y. Lin et al., Phys. Rev. D 88, 114009 (2013), [arXiv:1308.6345 [hep-ph]].



$N Z_c^- \Phi_p \sigma_{\gamma N \rightarrow Z_c} \Gamma_{J/\psi \pi^-} \Gamma_{\pi^+ \pi^-}^2$, where Φ_p is flux of virtual

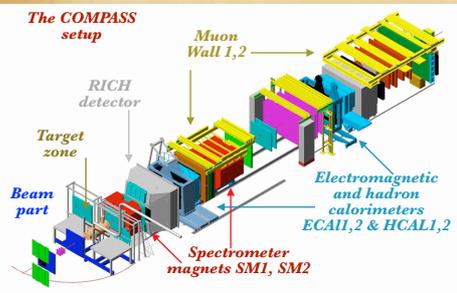
$\mu^+ N \rightarrow J/\psi N$ process with known cross section was used as a reference

$$\mu^+ p \rightarrow Z_c^+ n \rightarrow J/\psi \pi^+ n$$

$$\mu^+ n \rightarrow Z_c^- p \rightarrow J/\psi \pi^- p$$

The COMPASS experiment

COMPASS is a high-energy physics experiment using secondary beams of SPS at CERN. The purpose of this experiment is the study of hadron structure and hadron spectroscopy using intensive muon and hadron beams.



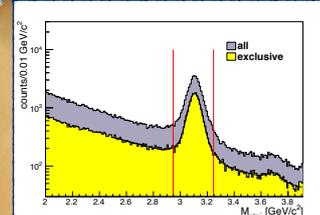
7 years of data taking with muon beam

160 GeV/c and 200 GeV/c μ^+ beam

^6LiD and NH_3 cryogenic targets

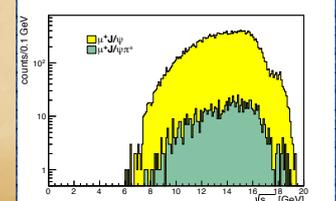
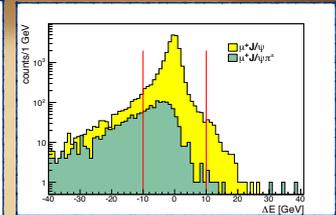
Only tracking system was used in the analysis

Kinematic plots



$\mu^+(\mu^+ \mu^- \pi^\pm)$ in the final state no other tracks
 $P_T > 8 \text{ GeV}/c, P_\pi > 2 \text{ GeV}/c$
Exclusivity: $|E_{J/\psi \mu \pi} - E_0| < 10 \text{ GeV}$

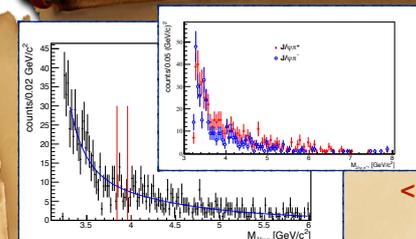
Main background process - production of $\mu^+ J/\psi \pi^\pm$ final state via pomeron exchange



The result

No statistically significant peak in the signal range 3.84-3.96 GeV.

$< 15.1 Z_c^\pm(3900)$ candidates (CL=90%) per 18 200 exclusively produced J/ψ -mesons



$$BR(Z_c^\pm(3900) \rightarrow J/\psi \pi^\pm) \times \sigma_{\gamma N \rightarrow Z_c^\pm(3900) N} \Big|_{(\sqrt{s_{\gamma N}})=13.8 \text{ GeV}} < 3.7 \times 10^{-3}$$

$$BR(Z_c^\pm(3900) \rightarrow J/\psi \pi^\pm) \times \sigma_{\gamma N \rightarrow Z_c^\pm(3900) N} \Big|_{(\sqrt{s_{\gamma N}})=13.8 \text{ GeV}} < 52 \text{ pb.}$$

Model independent result

Assuming the production model Q.-Y. Lin et al., an upper limit for the partial width follows: $\Gamma_{J/\psi \pi} < 2.4 \text{ MeV}$

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COMPASS: new opportunities

COMPASS DVCS run: measurement of GPDs with $\mu^+ p \rightarrow \mu^+ p \gamma$ process

Full set of three electromagnetic calorimeters: effective π^0 rejection, possibility to study $J/\psi \pi^0$ mass spectrum and final states with χ_c mesons

2.5 m long proton target: only $J/\psi \pi^+$ final state is valid. $J/\psi \pi^-$ events can be used for background study

CAMERA - the recoil proton detector: it can be used as veto

Possibility to study production of other charged and neutral charmonium-like XYZ states

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