J/ψ production in p+p Collisions at 500GeV from STAR

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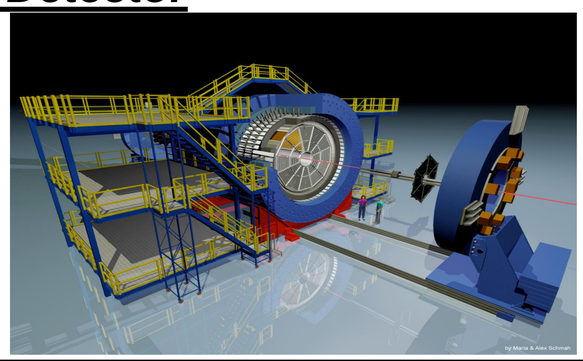
Abstract

Quarkonium production in heavy-ion collisions is an important tool for studying the properties of quark-gluon plasma (QGP). Interpretation of the results in heavy-ion collisions requires a good understanding of the production mechanisms in p+p collisions, which include direct production via gluon fusion, parton fragmentation, and feed down from higher quarkonium states. Despite decades of efforts, the quarkonium production mechanism still remains an open question to date. New quarkonium measurements, especially production at high transverse momentum and spin alignment for various beam energies, are necessary to constrain models.

In this presentation we report on the new measurements of J/ψ and ψ(2s) invariant yields in a broad range of transverse momentum ($4<p_T<20$ GeV/c) at midrapidity ($|y| < 1.0$) in p+p collisions at $\sqrt{s}$ = 500 GeV from STAR.

STAR Detector



STAR has a large acceptance for electron identification:
Large acceptance:
$(0<\phi<2\pi, |\eta|<1)$

- **Time Projection Chamber**
  Tracking – momentum, pathlength
  Ionization energy loss – dE/dx (particle identification)
- **Barrel Electromagnetic Calorimeter**
  electron identification, triggering
- **Time Of Flight detector** $(0<\phi<2\pi, |\eta|<0.9)$
  Timing resolution <100ps

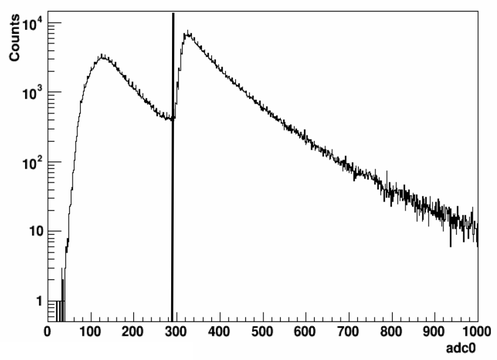
Dataset

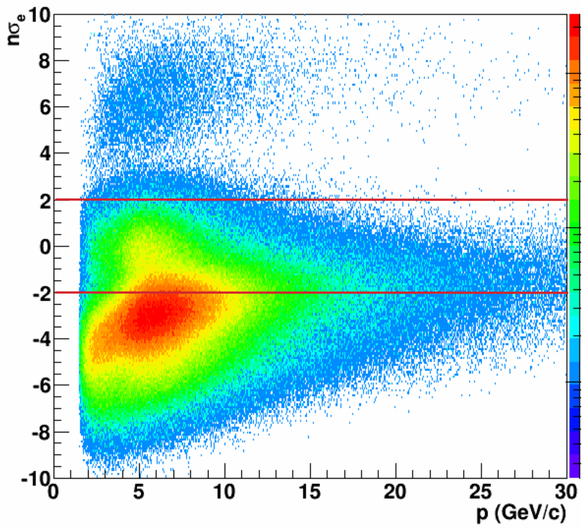
Large BEMC triggered data samples in p+p collisions at $\sqrt{s}$ = 500 GeV from the year of 2011.

Trigger Name	Trigger Threshold	Number of Events	Sampled Luminosity
BHT0	E_T > 2.6GeV	17M	0.63 pb^{-1}
BHT1	E_T > 3.5GeV	170M	22 pb^{-1}
BHT2	E_T > 5.4GeV	39M	26 pb^{-1}

In this poster, only BHT1 data was used

Electron Identification



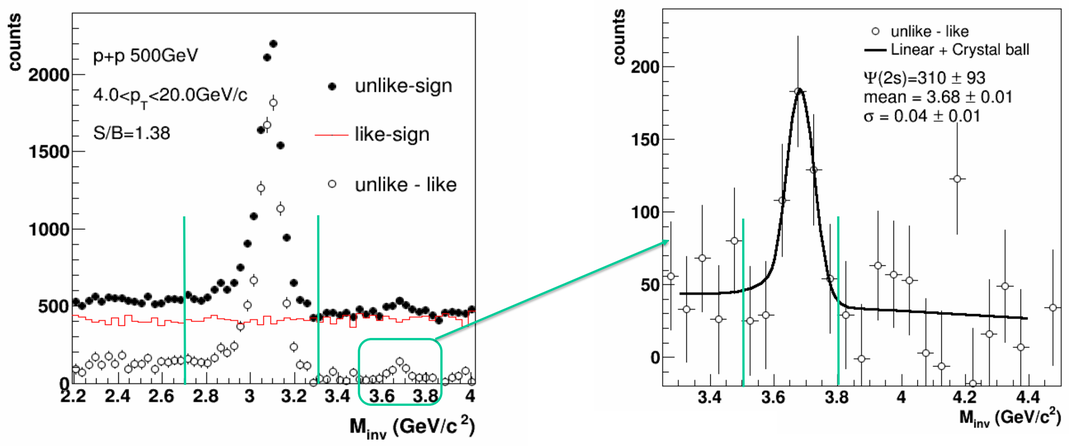


High p_T :
- Online Adc cut (dsmadc>18)
- Offline Adc cut (adc0>290)
- p/E cut (0.3<p/E<1.5)
- dE/dx cut ($-2 < n\sigma_e < 2$)

Low p_T: dE/dx cut ($-2 < n\sigma_e < 2$)

Quarkonium Reconstruction

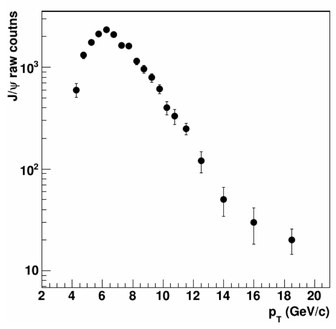
Dielectron invariant mass distribution



$J/\psi \rightarrow e^+e^-$ and $\psi(2s) \rightarrow e^+e^-$channel used for reconstruction.
Combinatorial background reconstruction: Like-sign method ($e^+e^+ + e^-e^-$).
Exponential and linear function are used to describe the J/ψ and ψ(2s) residual background.

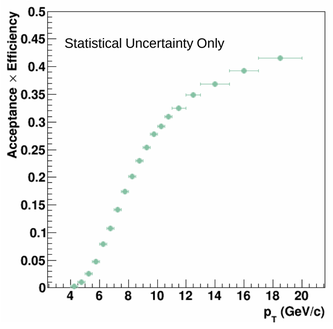
J/ψ Spectrum and Efficiency

J/ψ raw spectrum



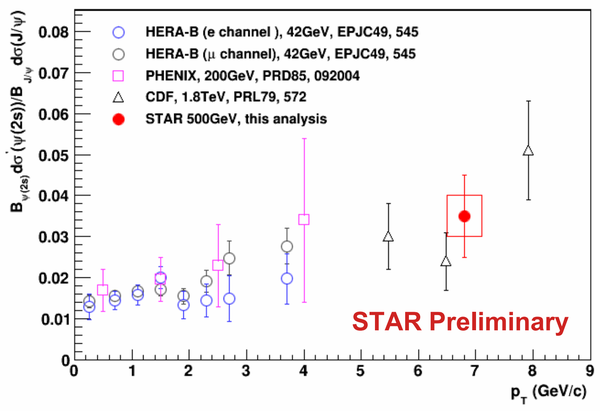
J/ψ raw counts vs. p_T

J/ψ reconstruction efficiency



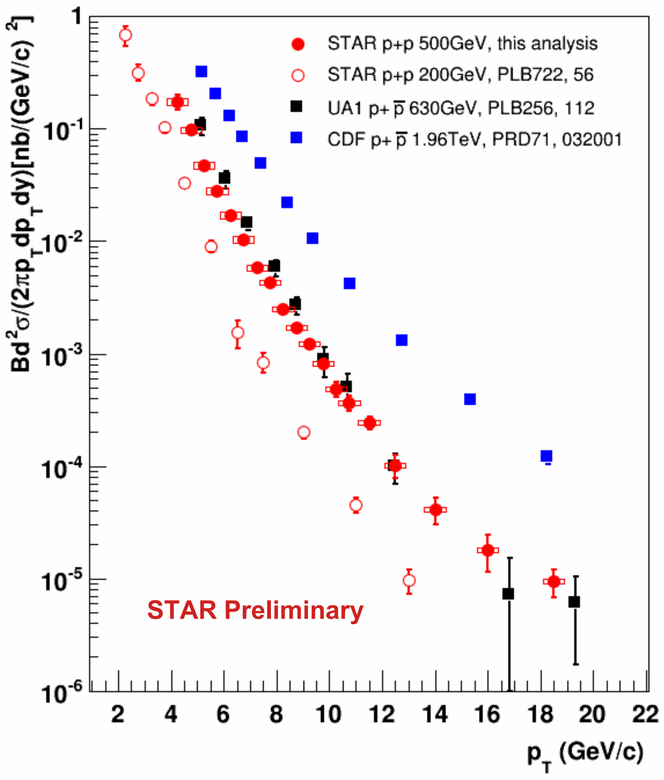
J/ψ reconstruction efficiency is obtained from J/ψ embedding

Ψ(2s) over J/ψ Ratio



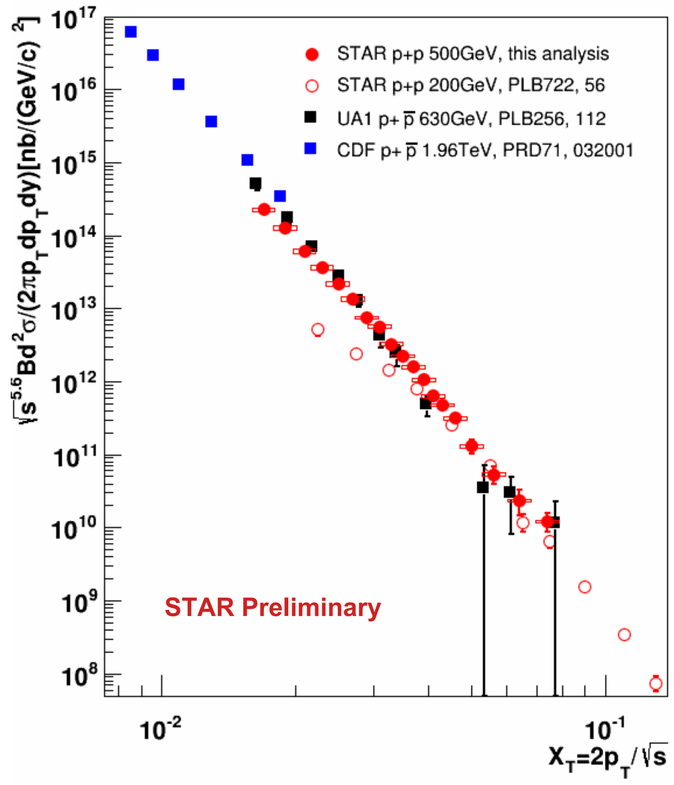
J/ψ production in p+p 500GeV

J/ψ Invariant cross section



Precise measurements of J/ψ in $4<p_T<20$ GeV/c at p+p 500GeV

J/ψ x_T distribution



J/ψ follow the universal trend at high p_T

Summary and Outlook

1) J/ψ production in the p_T range of 4-20 GeV/c in p+p collisions at $\sqrt{s}$ = 500 GeV is measured.
2) J/ψ inclusive production cross sections follows x_T scaling for p_T larger than 4 GeV/c.
3) The measured ratio of ψ(2s) to J/ψ is consistent with previous measurements.

References

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The STAR Collaboration: http://drupal.star.bnl.gov/STAR/presentations