Measurement of $J/\psi \rightarrow e^+ e^-$ in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV at RHIC-PHENIX

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For the PHENIX collaboration

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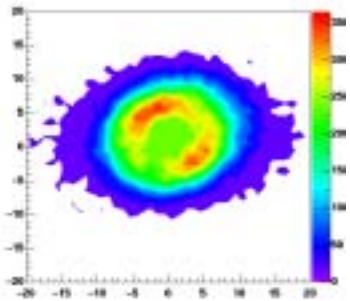
Physics Motivation

- Observe and measure the phase transition from hadronic matter to a plasma of deconfined quarks and gluons (Quark Gluon Plasma(QGP)).
- One of the signals of the formation of QGP.
  - J/ψ Suppression was predicted by Matsui and Satz (Phys. Lett. B178, 416 (1986))
  - Debye colour screening will lead to suppression of charmonium production in heavy ion collisions
- PHENIX can measure J/ψ decay yields to ee and μμ for pp, pA and AA collisions

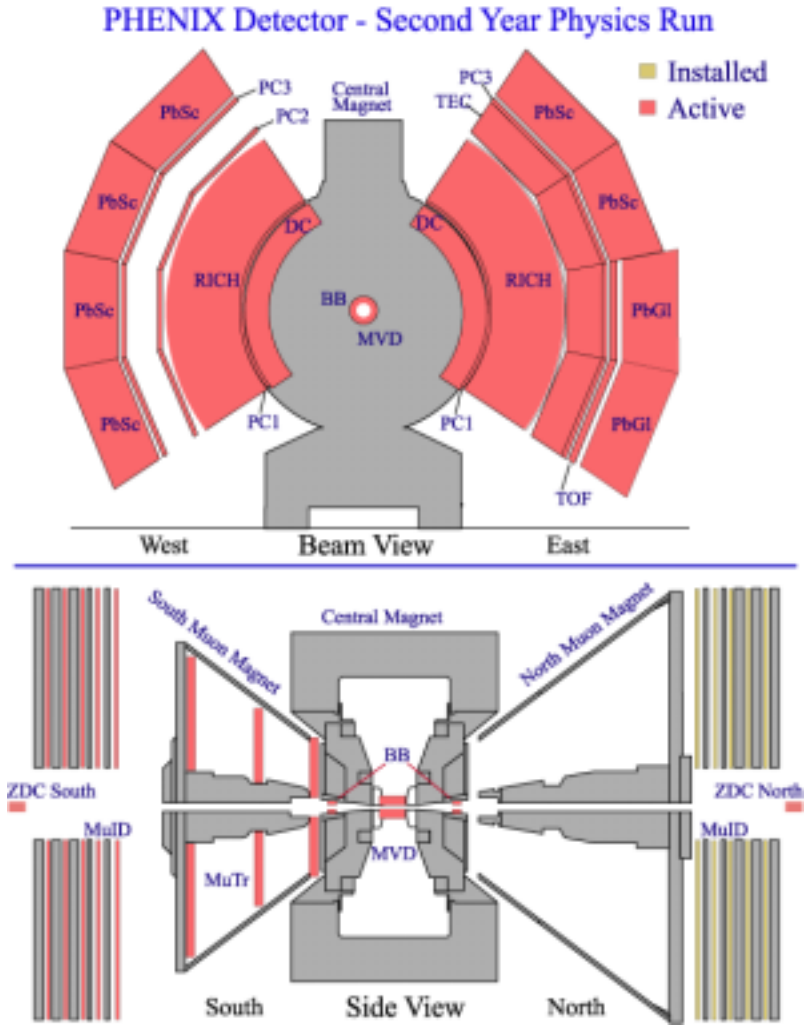
First results from PHENIX for J/Ψ production at **$\sqrt{s}$ = 200A GeV** in **AuAu** collisions will be presented in this talk.

PHENIX Experiment

- Events trigger
  - Beam Beam Counter
  - Zero Degree Calorimeter
- Electrons ($|\eta| < 0.35$)
  - Charged Tracks
    - Drift Chamber,
    - Pad Chambers
  - Ring Image Cherenkov Counter

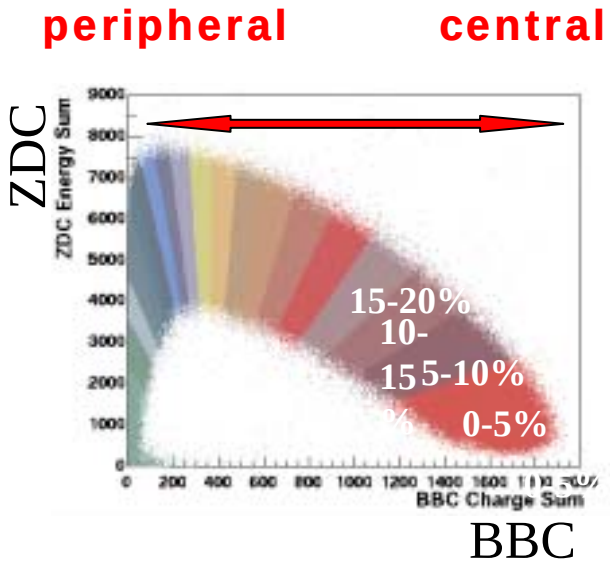


  - EM Calorimeter

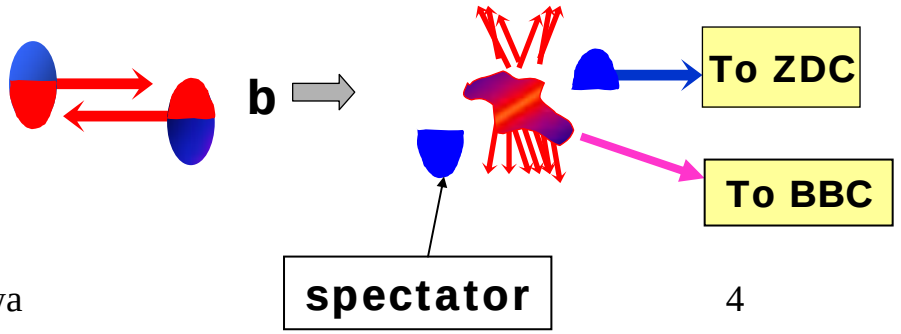


Measurements with the PHENIX detector

- Event characterization in terms of impact parameter (b) in Au + Au collisions.
- Coincidence between BBC and ZDC
  - Determine collision geometry
- Extract variables using Glauber Model
  - Number of participant (N_part)
    - Represent centrality
  - Number of binary collisions (N_binary)
    - Incoherent sum of N-N collisions becomes a base line for A-A collisions.

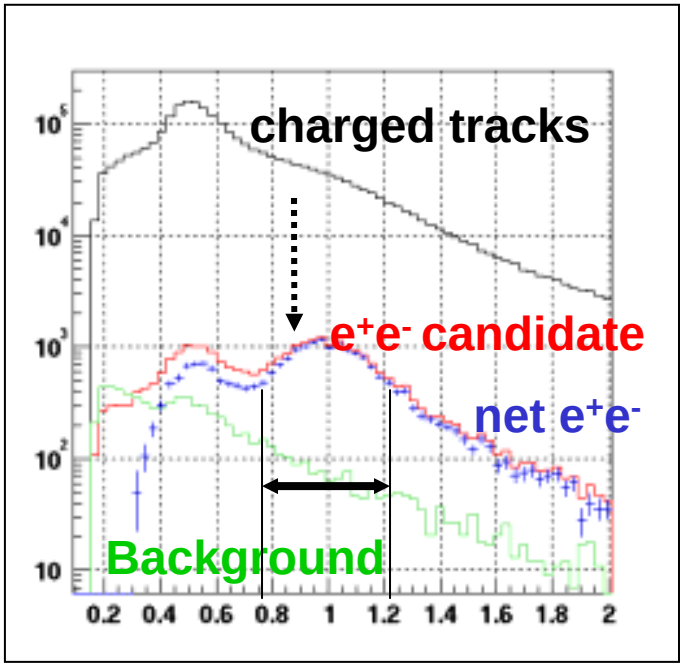


Measure the J/ψ yield per N_binary as a function of N_part and discuss J/ψ suppression.



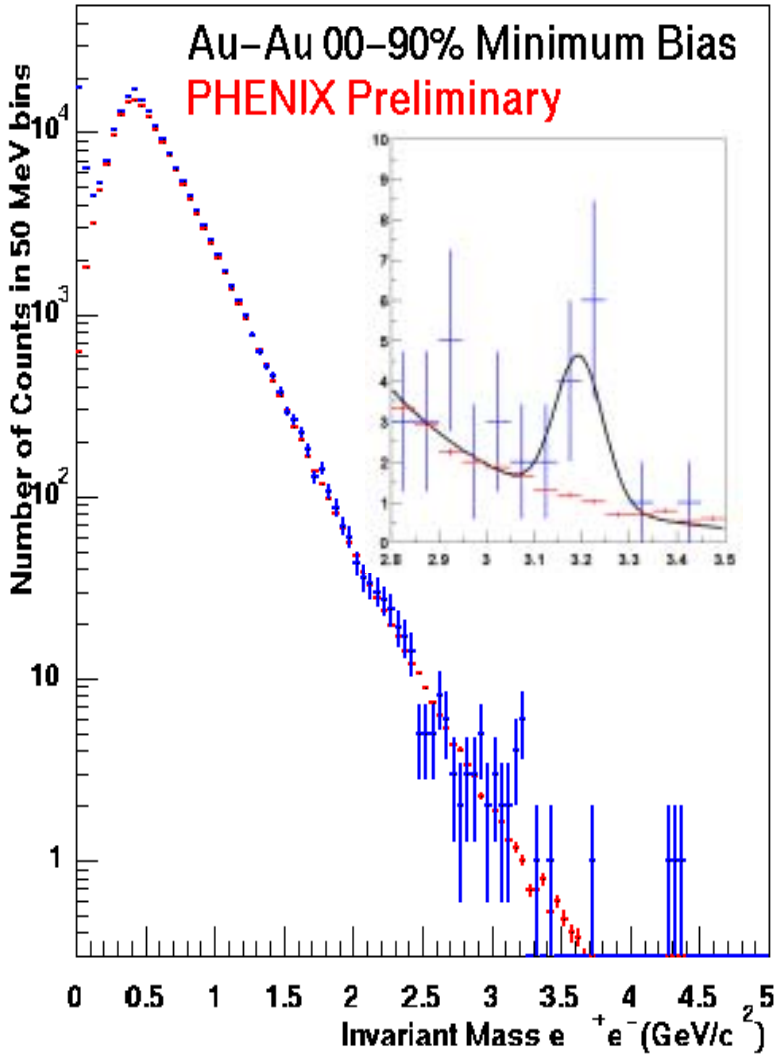
Analysis

- Event selection
  - Minimum Bias trigger and Offline vertex cut
  - Each BBC has at least 2 hits and |Z position| < 30 cm
  - Good runs are selected
  - 25 M events are analyzed
    - LVL-2 triggered events are not used
- Electron Identification
  - Associate with RICH Rings
  - Require matching of energy and momentum
- Make Invariant Mass of electron positron pairs and measure J/ψ yields for 3 centralities.
  - 0-20%, 20-40%, 40-90%

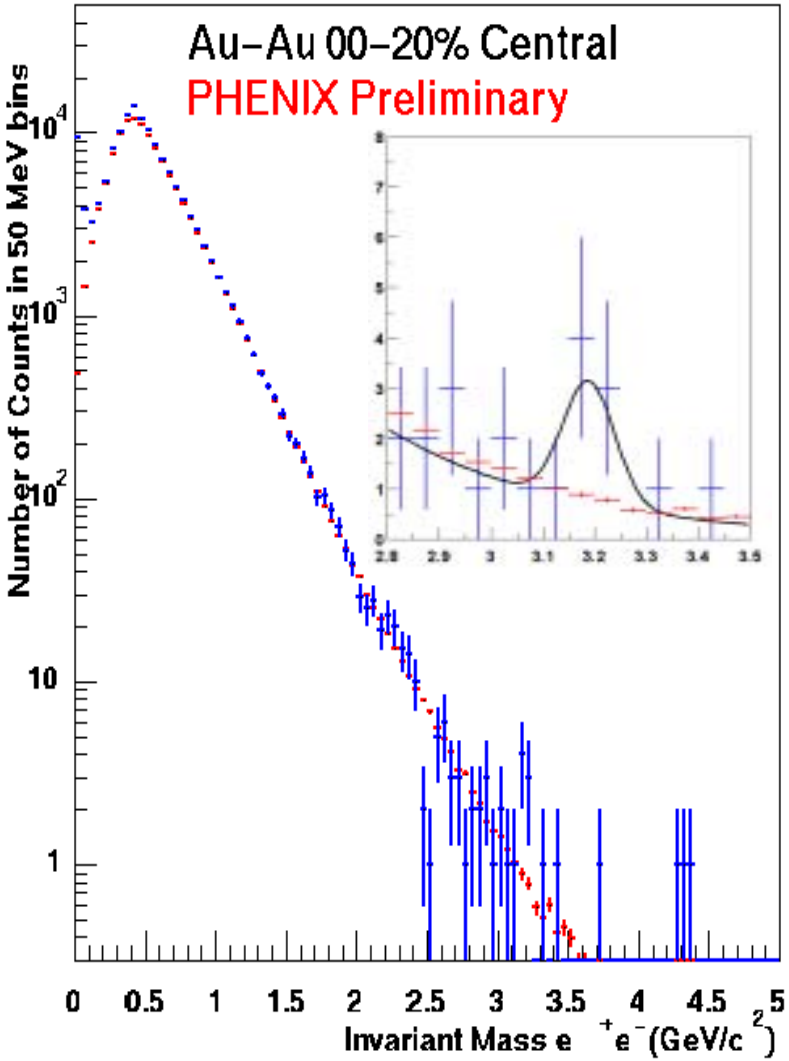


Invariant mass spectra

$N_{J/\Psi}$ = 10.8 ± 3.2 (stat) + 3.8 - 2.8 (sys)

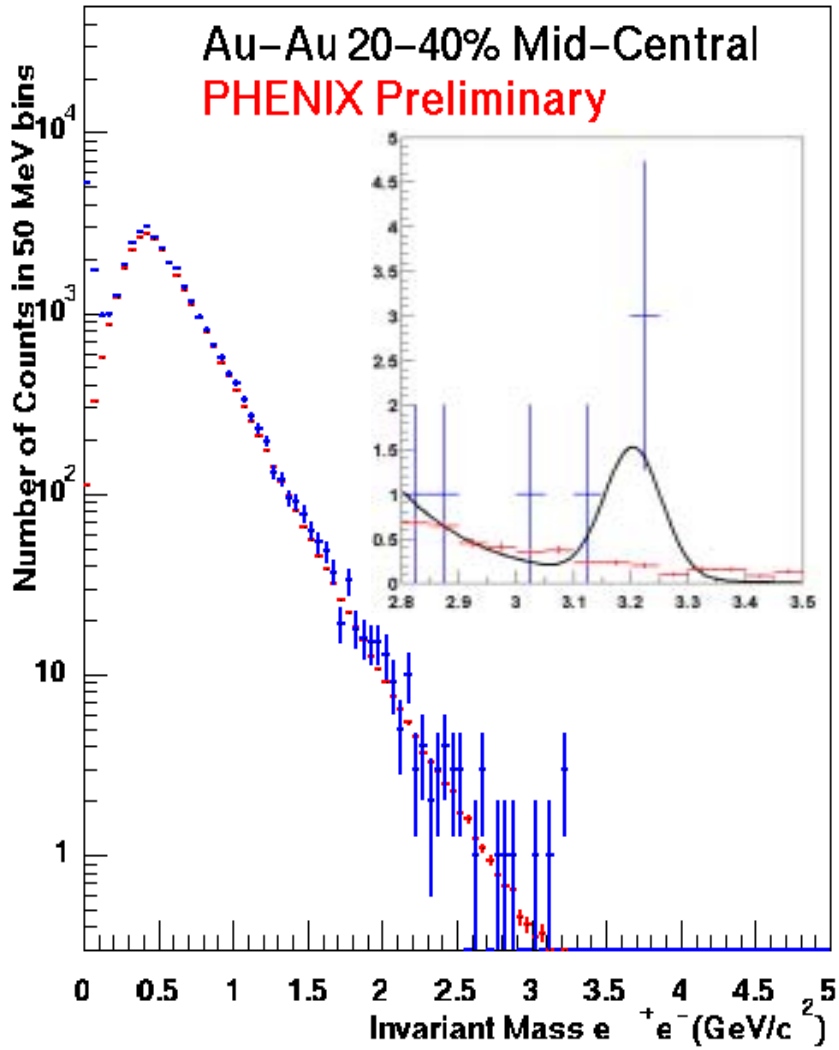


$N_{J/\Psi}$ = 5.9 ± 2.4 (stat) ± 0.7 (sys)

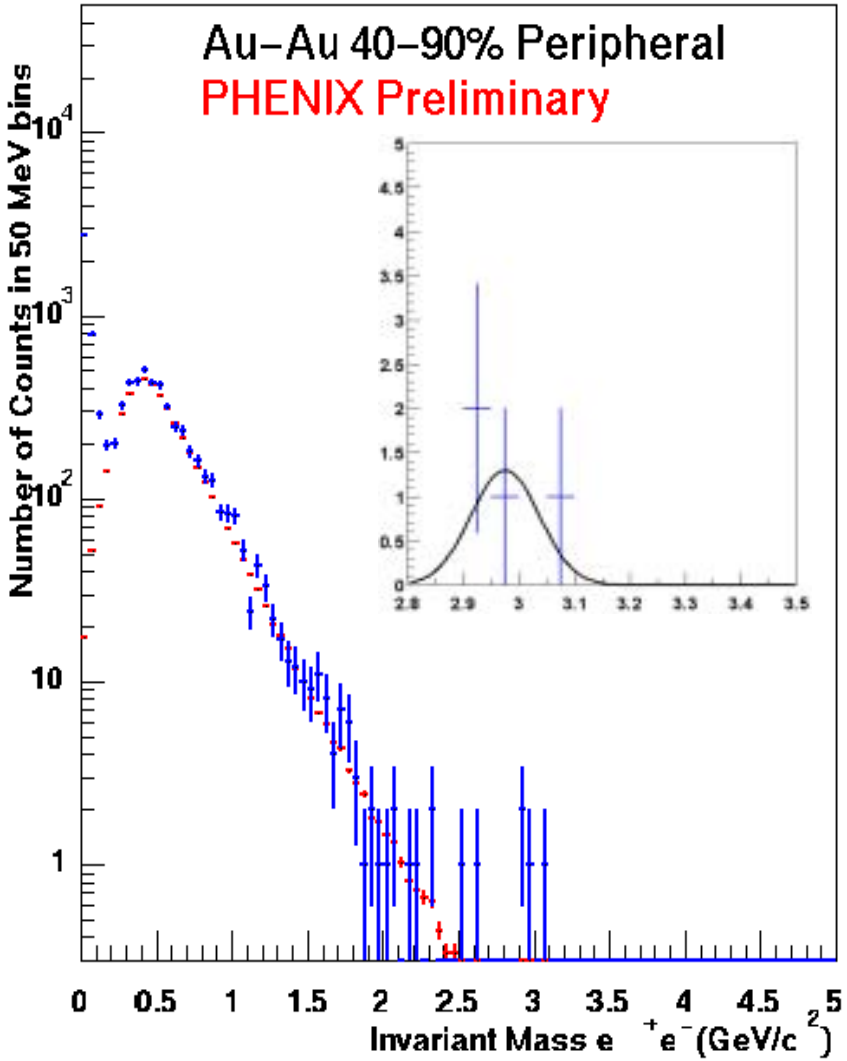


Invariant mass spectra

$N_{J/\Psi} = 4.5 \pm 2.1\ (stat) \pm 0.5\ (sys)$



$N_{J/\Psi} = 3.5 \pm 1.9\ (stat) \pm 0.5\ (sys)$



Analysis for B-dN/dy

$$B_{ee}\, dN/dy_{|y=0} = \frac{N_{J/\Psi}}{N_{events}\, A\, \varepsilon\, \varepsilon_{centrality}\, dy}$$

- dy A ε = acceptance * J/ψ reconstruction eff.

  0.00407 ± 0.0009

  $\varepsilon_{centrality}$: centrality dependent efficiency

  0.65 ± 0.07 (00-20%)

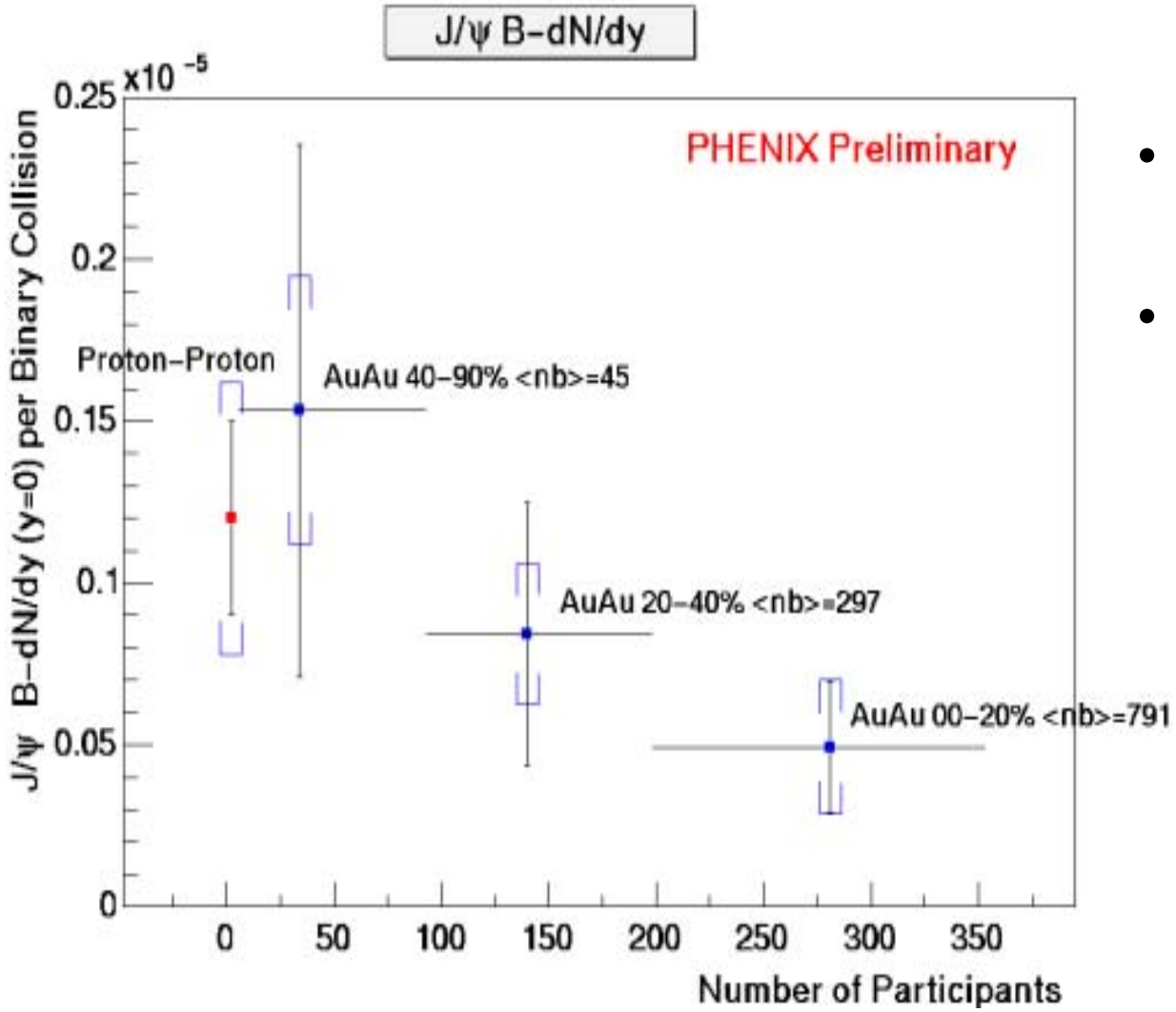
  0.76 ± 0.08 (20-40%)

  0.86 ± 0.09 (40-90%)

- N_{events} : minbias events in the centrality bin

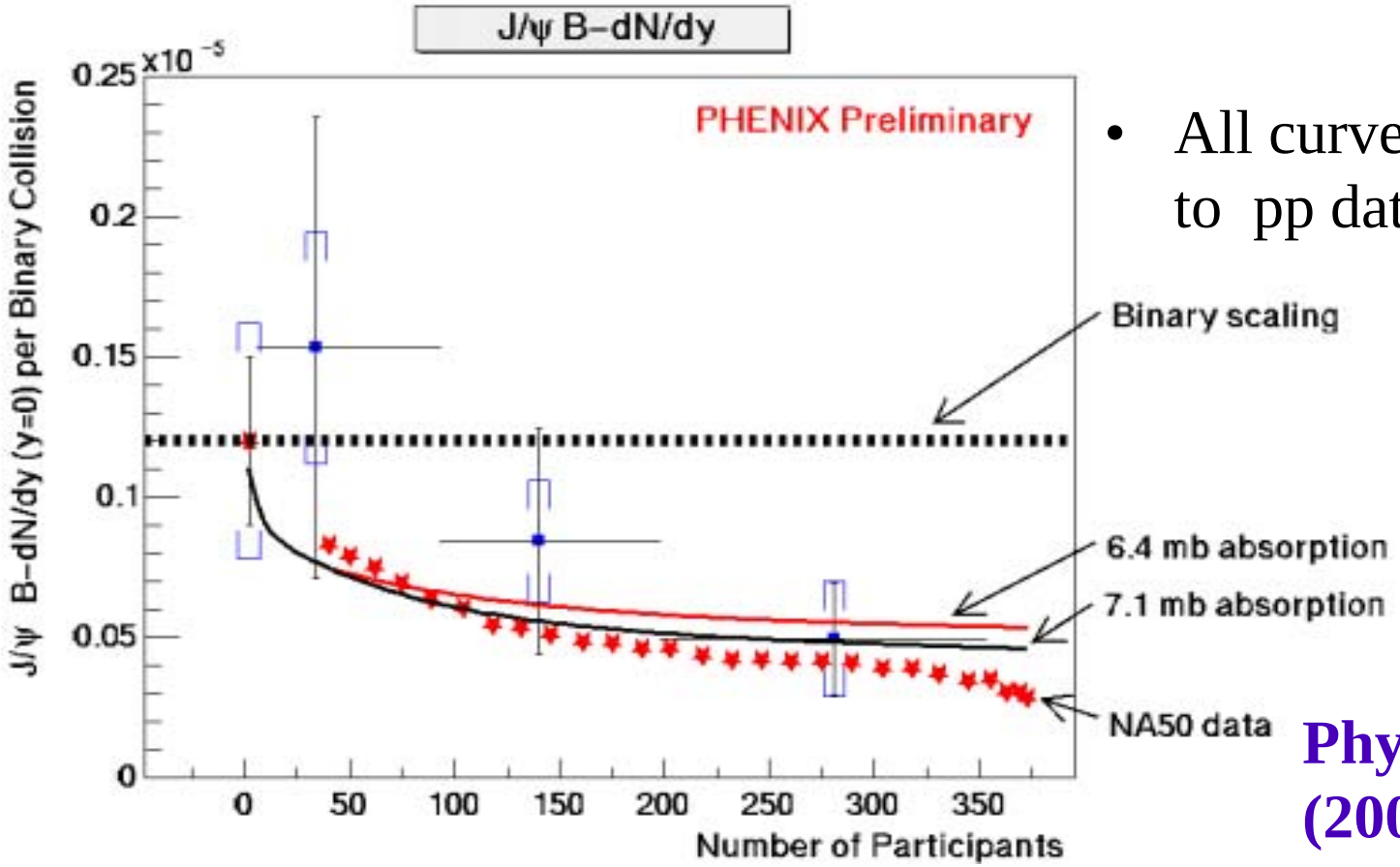
  $N_{J/\Psi}^{measured}$ extracted using 7 different fitting procedures to establish systematic errors

J/ψ B-dN/dy per binary collision



- Statistical errors are **standard deviations**
- Systematic errors are **maximum plausible systematic spreads in values**

Comparison



- All curves normalized to pp data point

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We can not discriminate between scenarios, given our present statistical accuracy

Summary

PHENIX has measured J/Ψ -> ee yields at $\sqrt{s}$ = 200A GeV for **AuAu** collision in **$-0.35 < \eta < +0.35$**

Preliminary results were presented here from an analysis of about **1/2 of the AuAu data**

We will need improved statistics to draw any conclusions about J/Ψ suppression at RHIC