



# DNP2020

Fall Meeting of the Division of Nuclear Physics  
of the American Physical Society

Oct. 29 – Nov. 1, 2020 *Now Virtual Meeting!*

~~Hyatt Regency Hotel, New Orleans, LA~~



## $J/\psi$ production in Au+Au collisions at $\sqrt{s} = 54.4$ GeV

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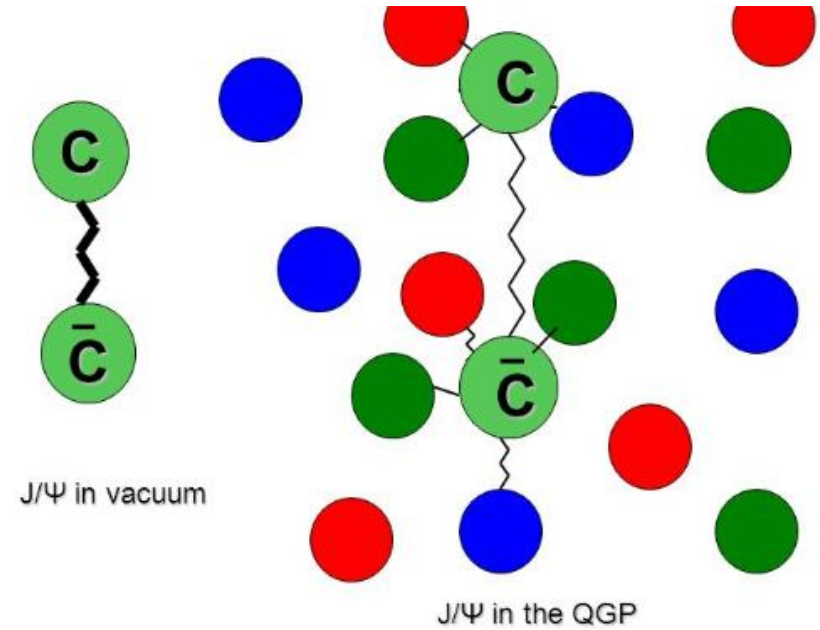
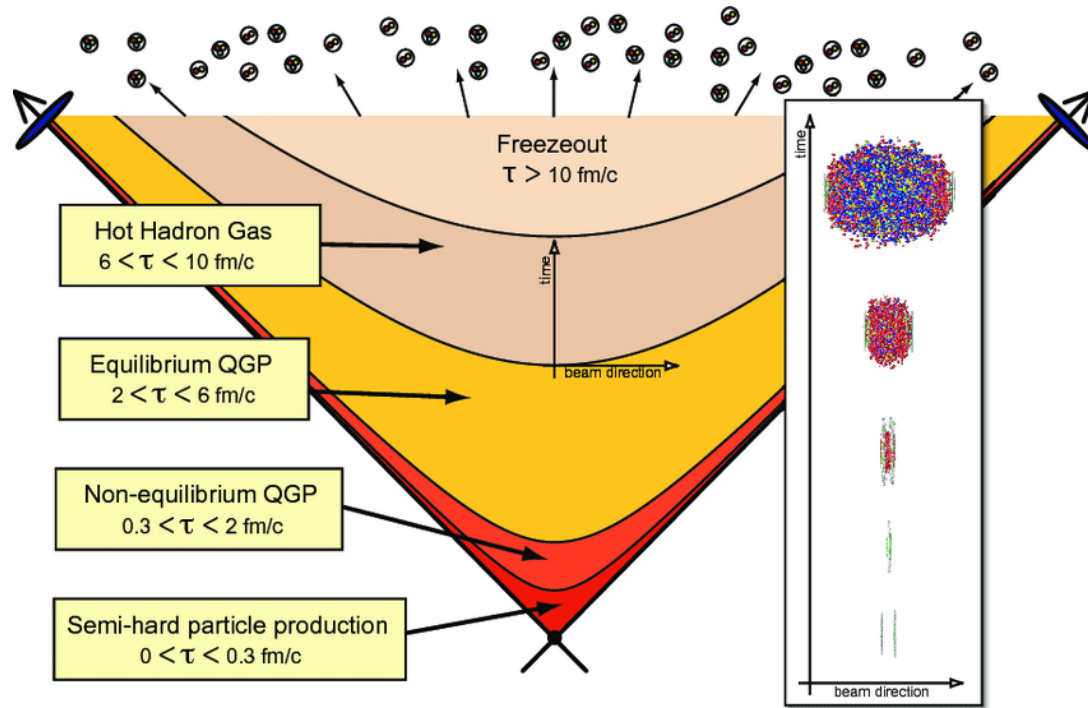
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(for the STAR collaboration)

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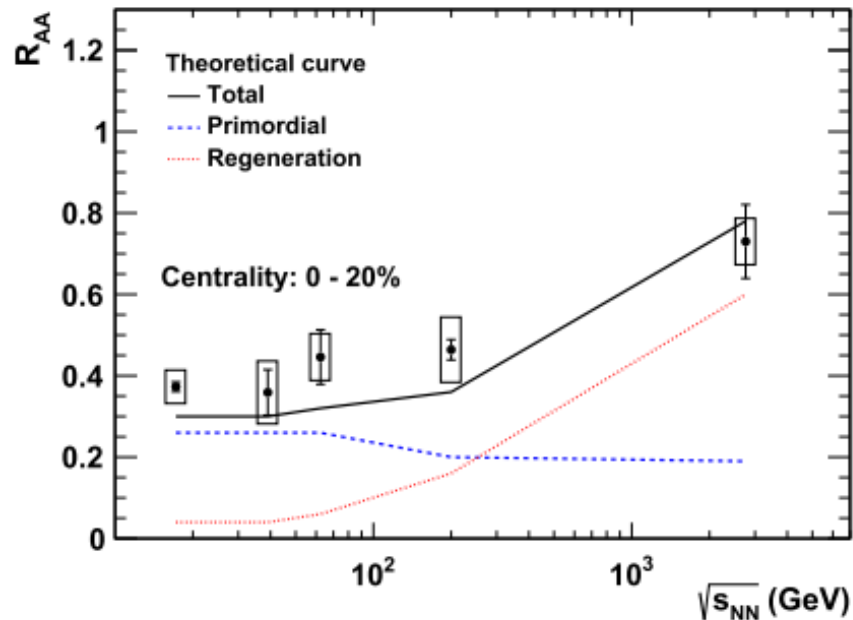


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# $J/\psi$ production in heavy ion collisions



- $J/\psi$  produced from partonic hard scatterings will pass through the QGP
- In the QGP, because of the color screening effects, the  $J/\psi$  will be suppressed, which can be used to study QGP.
- There are also modifications from charm quark regeneration, cold nuclear matter effects, and other final state effects

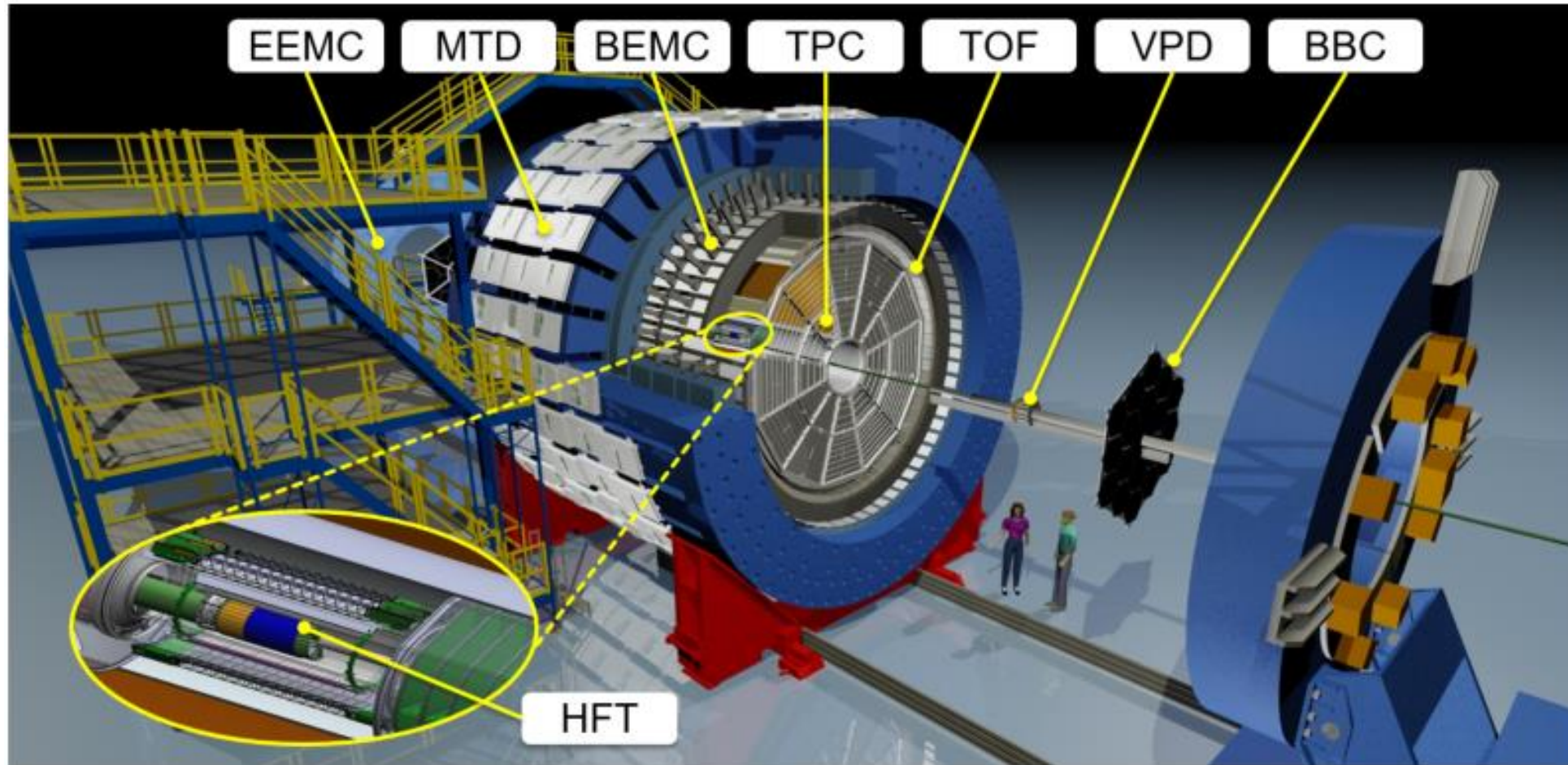


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- The J/ $\psi$  production has been measured in 39, 62.4 and 200 GeV Au+Au at RHIC, 17.2 GeV Pb+Pb at SPS, and 2.76 TeV Pb+Pb at LHC
- No significant energy dependence of nuclear modification factor is found within uncertainties at  $\sqrt{s_{NN}} \leq 200$  GeV
  - Interplay of color screening, cold nuclear matter effects and regeneration effects
- ~10x more statistics in 54 GeV now compared to 62.4 GeV, and this will help to study the energy dependence of J/ $\psi$  suppression



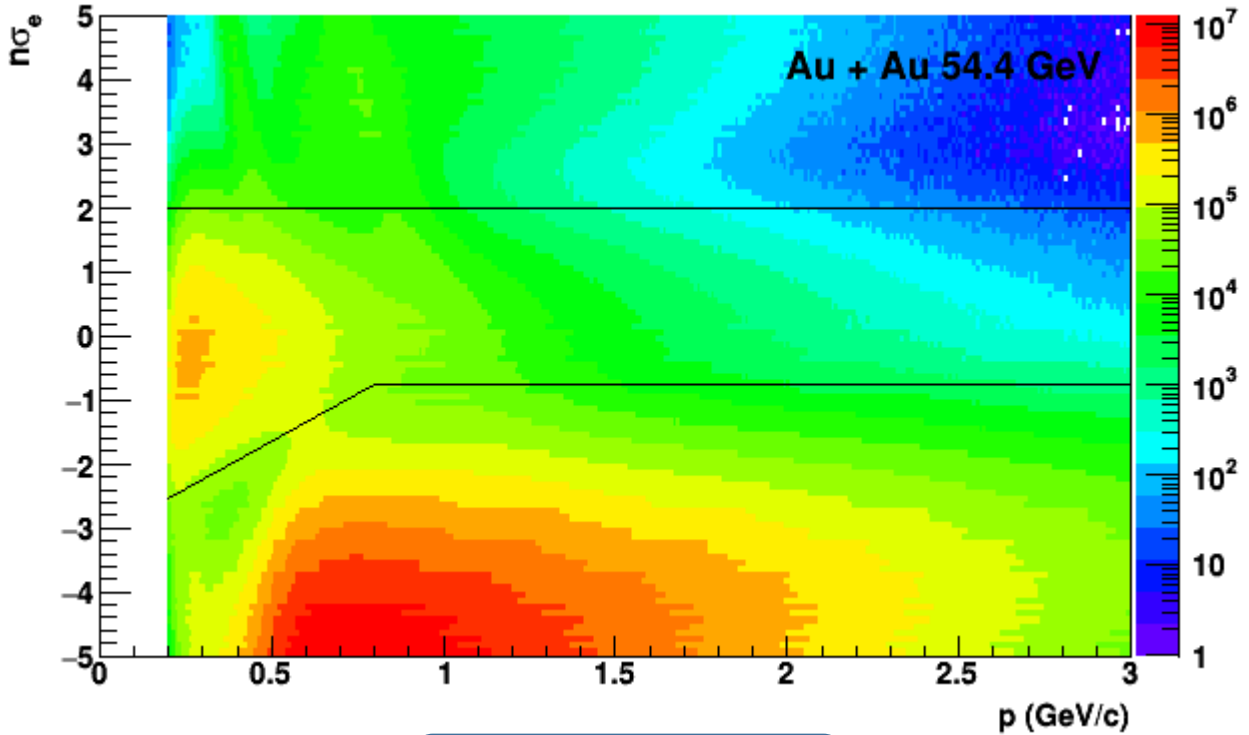
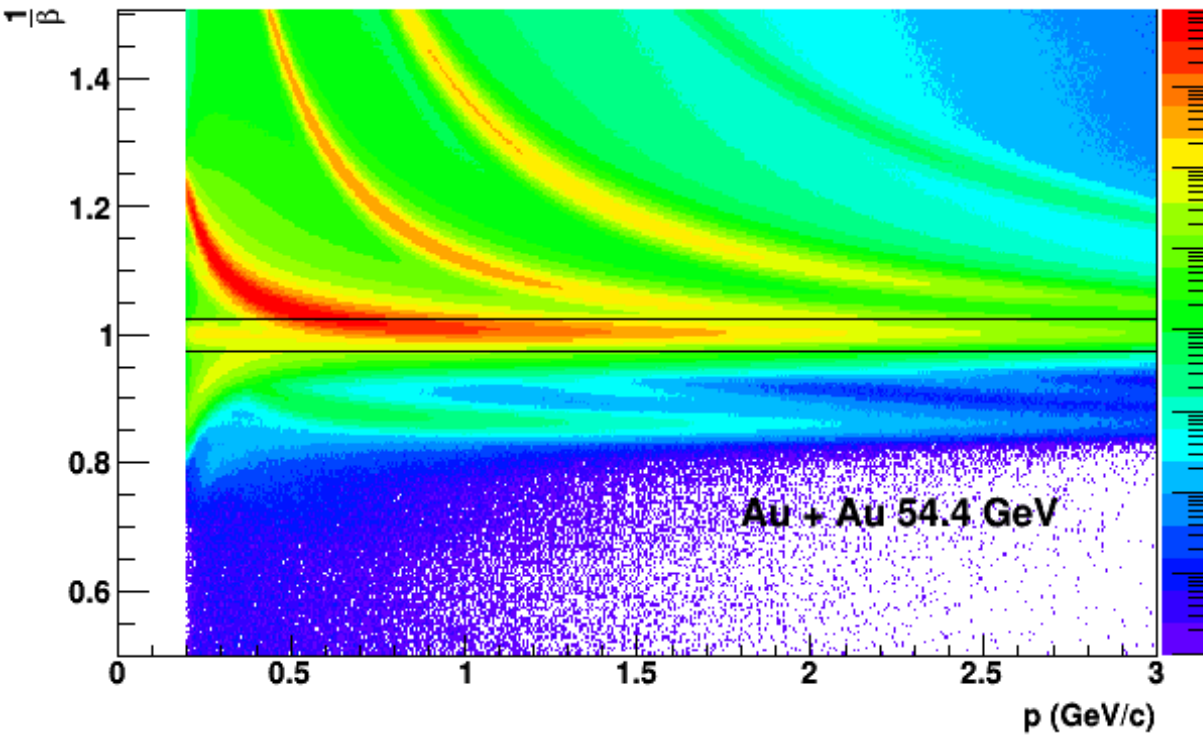
# The Solenoidal Tracker At RHIC



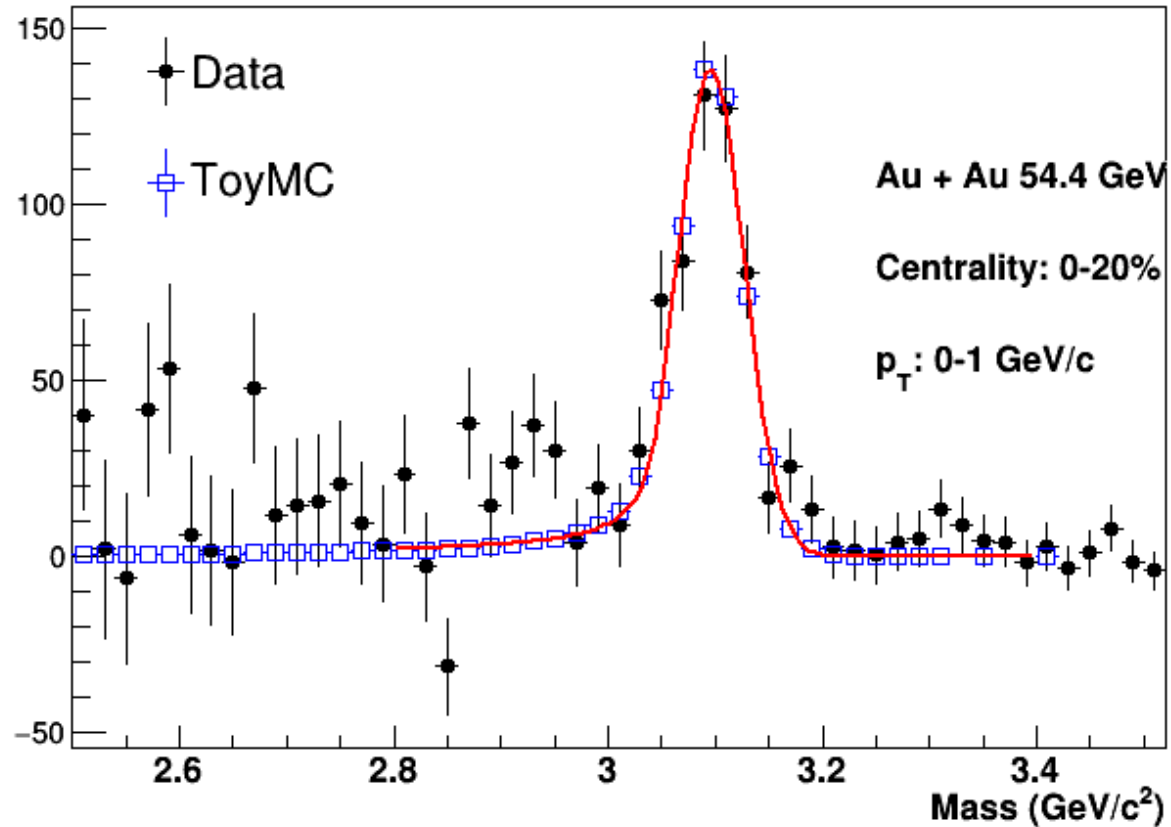
- ✓ TPC: tracking, momentum and energy loss
- ✓ TOF: time of flight

- ✓ BEMC: E/p, improves electron purity, not used now in this analysis

# Electron identification

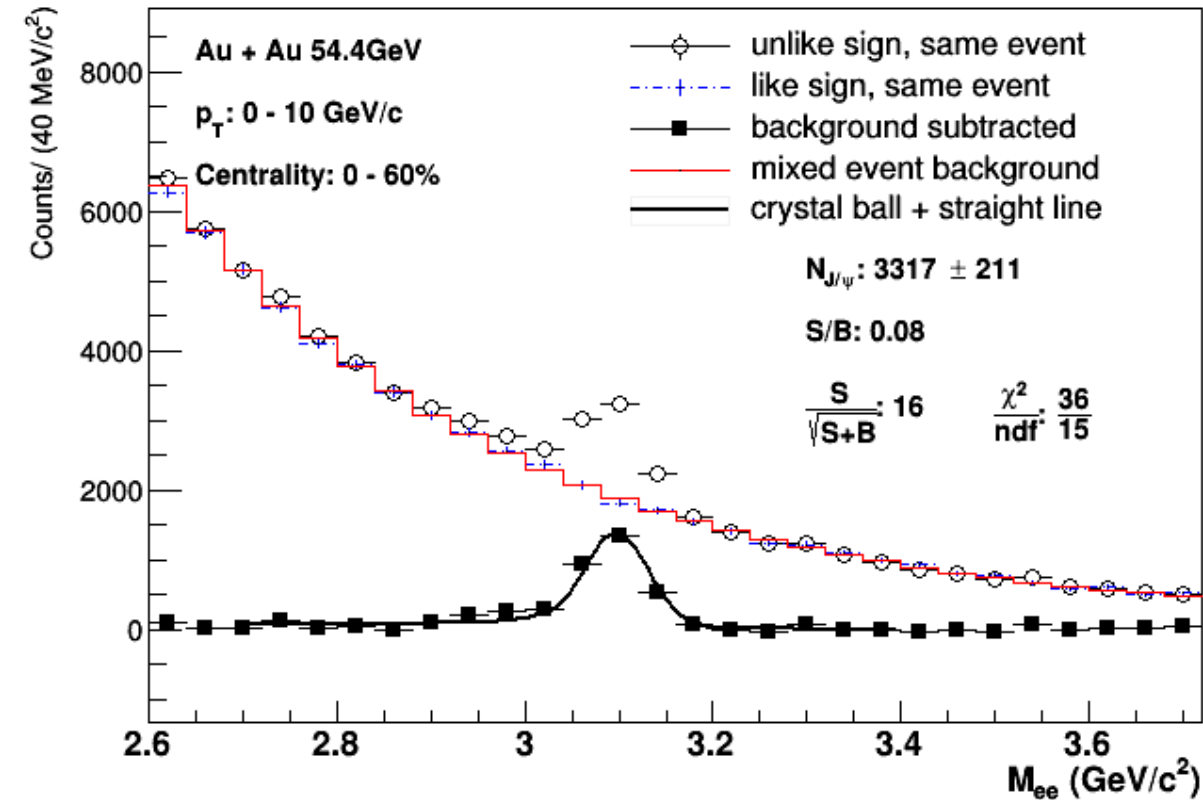


$$\left| \frac{1}{\beta} - 1.0 \right| < 0.025$$



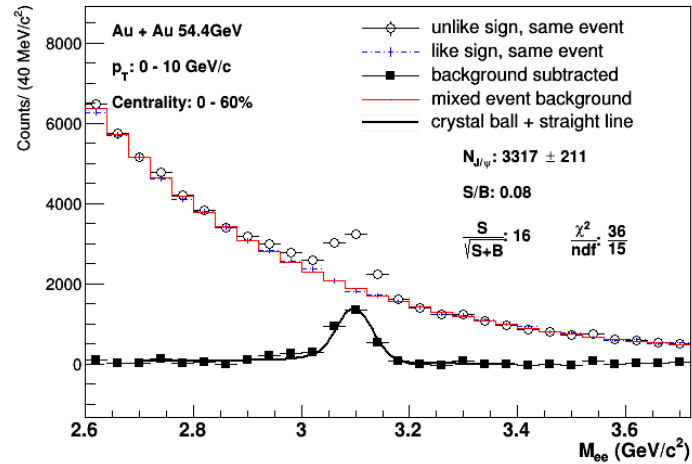
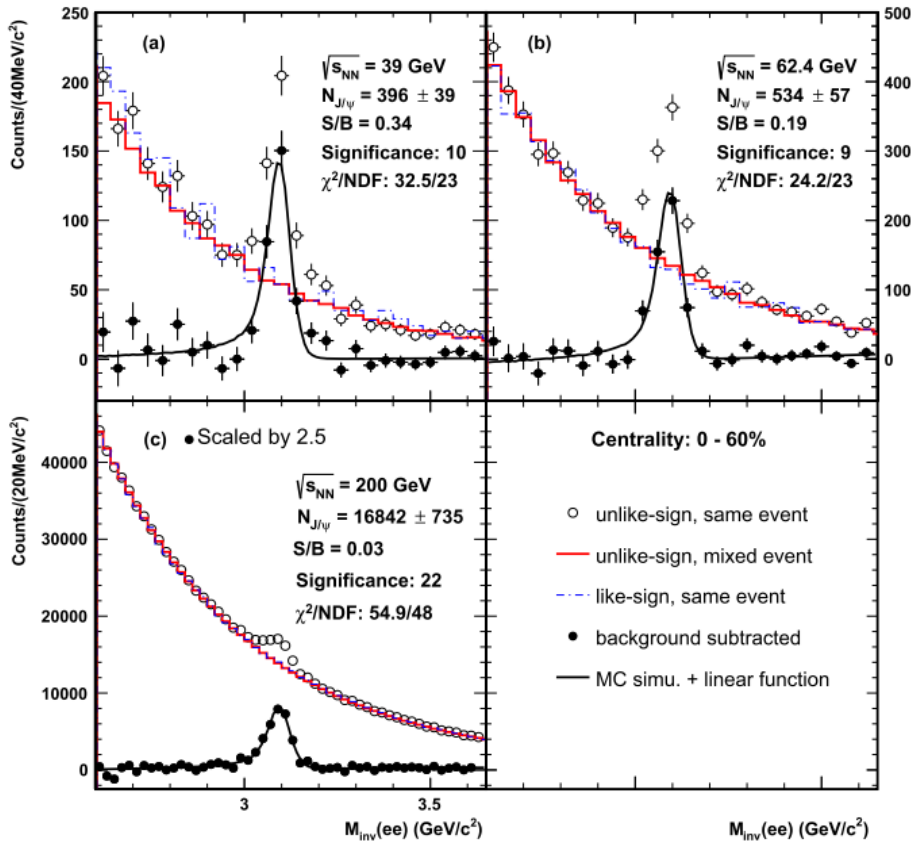
- The  $J/\psi$  line-shape from embedding and additional momentum smearing matches data well
- The distribution is fitted by Crystal-ball function
- Fix the shape of the Crystal-ball function from ToyMC when fitting the  $J/\psi$  raw signal from real data

# J/ψ raw signal



- The mixed event background is used
- Fit function: Crystal-ball function + straight line
- The counts from bin-counting method are used as the default J/ψ yield in the mass range from 2.7 to 3.2 GeV/c<sup>2</sup>

# J/ψ raw signal



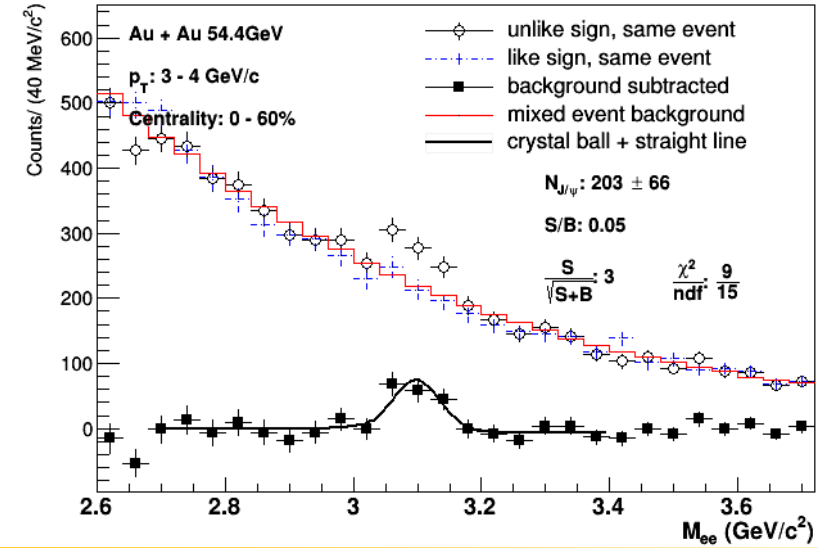
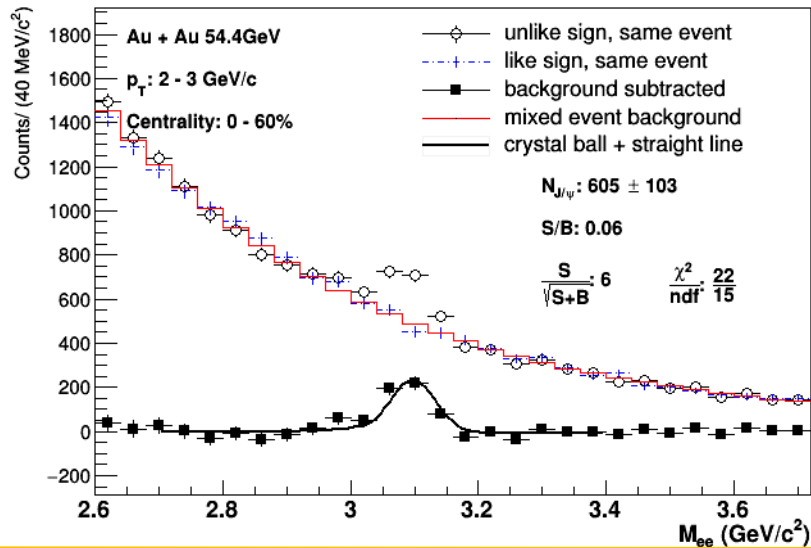
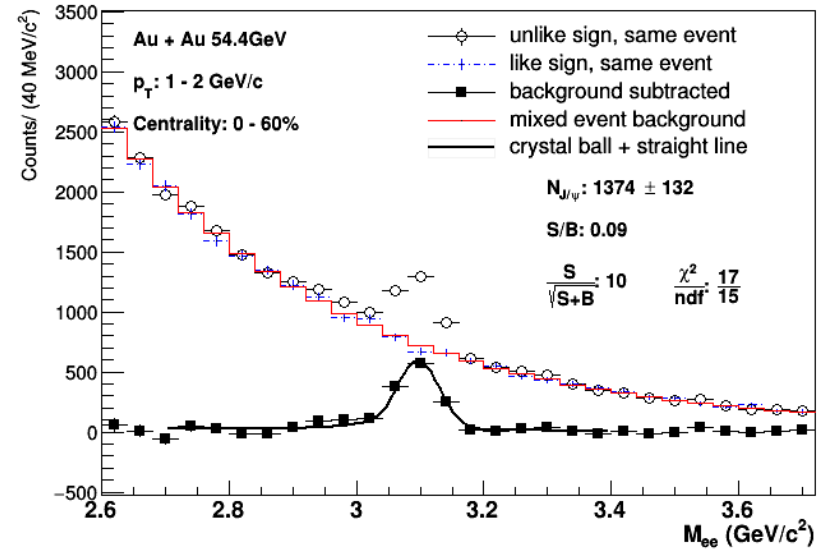
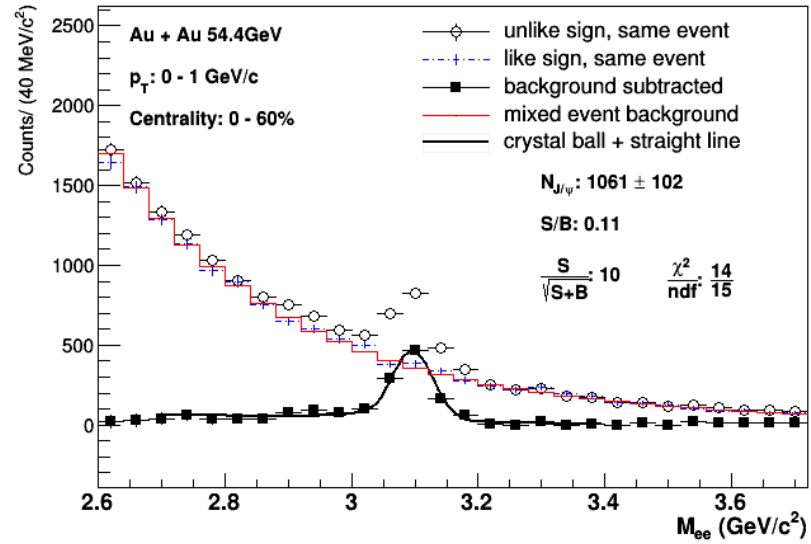
	Significance
39 GeV	10
62 GeV	9
54 GeV	16
200 GeV	22

- The significance is higher than 39 and 62 GeV, but lower than 200 GeV
- With BEMC used in the future analysis, the S/B and significance at 54.4 GeV will be improved

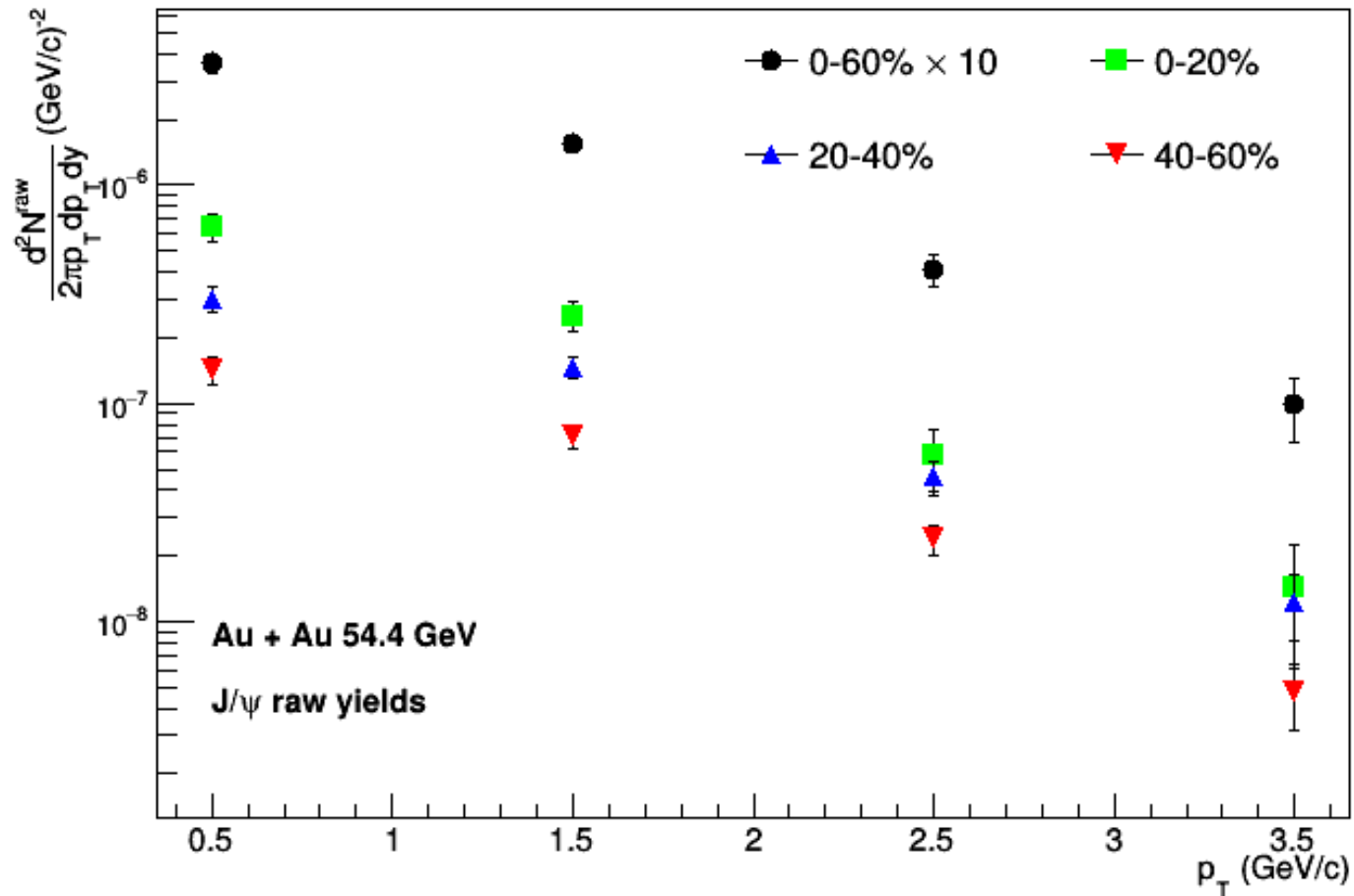
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# J/ψ raw signal



# J/ψ raw yield vs $p_T$ and centrality



The efficiency and acceptance correction is ongoing

## Summary:

- The 54.4 GeV data provide a good opportunity for energy dependent  $J/\psi$  suppression study between SPS and RHIC top energy
- $J/\psi$  significance is better than those in the 39 and 62.4 GeV data
- The significance will be improved with BEMC information

## Outlook:

- Analysis of dataset with BEMC is ongoing
- Efficiency correction and systematic uncertainty estimation
- Nuclear modification factor calculation