



J/ψ production in Au+Au and Cu+Cu collisions at $\sqrt{s_{NN}} = 200$ GeV at STAR

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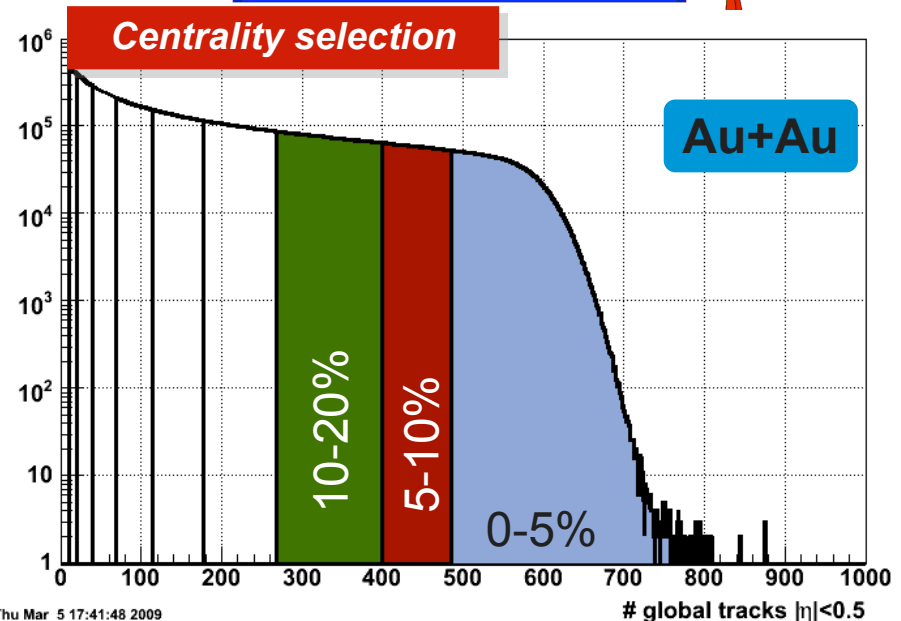
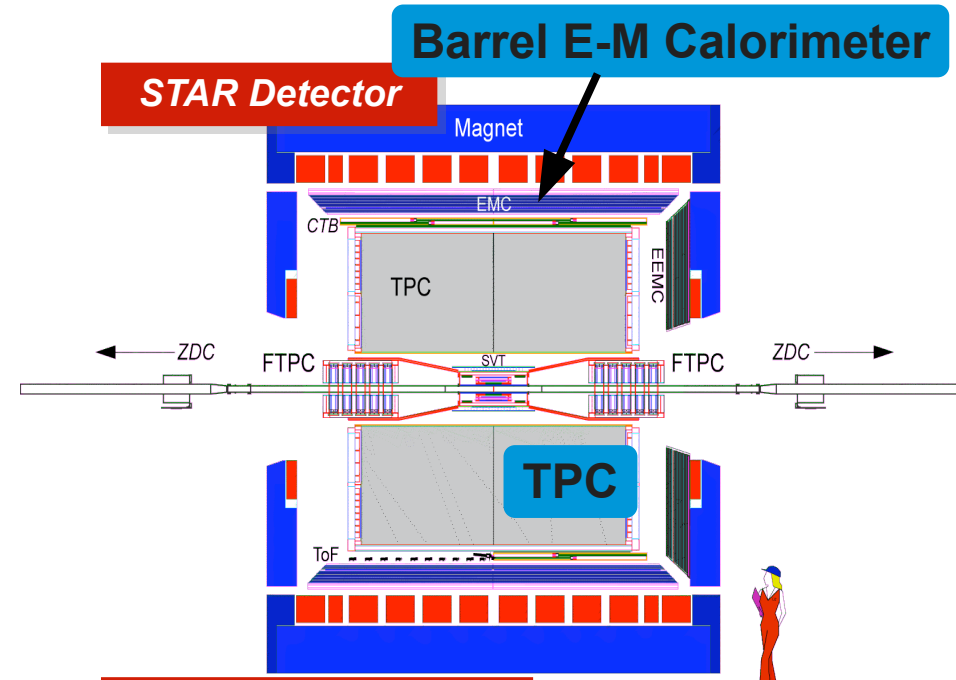
- Motivation
- Electron identification & J/ψ reconstruction
- Results
- Summary & outlook

Why J/ψ ?

- Charm quarks
 - large mass \rightarrow produced in the initial hard parton-parton interactions
 - excellent tool to study properties of the hot and dense matter created in A+A 200GeV collisions
- J/ψ suppression – classic QGP signature T. Matsui, H. Satz, Phys. Lett. B178, 416 (1986).
- J/ψ suppression in mid-rapidity at RHIC similar to one at SPS
 - suppression vs. regeneration? P. Braun-Munzinger and J. Stachel, Phys. Lett. B490, 196 (2000); L. Grandchamp and R. Rapp, Phys. Lett. B523, 60 (2001); M. I. Gorenstein et al., Phys. Lett. B524, 265 (2002); R. L. Thews, M. Schroedter, and J. Rafelski, Phys. Rev. C63, 054905 (2001); Yan, Zhang and Xu, Phys.Rev.Lett.97, 232301 (2006);
 - sequential melting of charmonia states? F. Karsch, D. Kharzeev and H. Satz, PLB 637, 75 (2006); B. Alessandro et al. (NA50), Eur. Phys. J. C 39 (2005) 335; H. Satz, Nucl. Phys. A (783):249-260(2007)
 - ...

J/ψ measurement

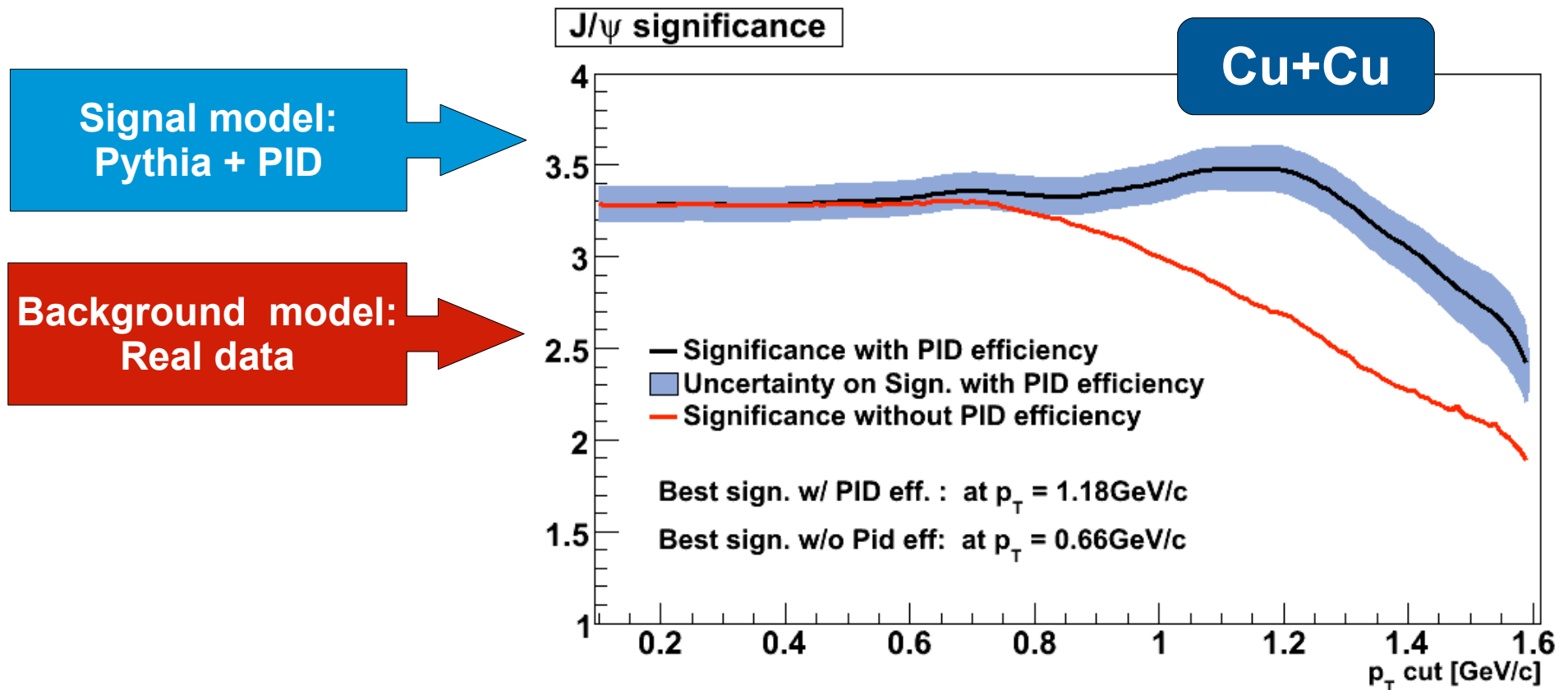
- Dataset:
 - Min-bias Cu+Cu (0-60%), 27M
 - Min-bias Au+Au (0-80%), 64M
 - $\sqrt{s}=200$ GeV
- Di-electron decay channel:
 - $J/\psi \rightarrow e^+e^-$ (6%)
- J/ψ reconstruction
 - Electron identification:
 - Cu+Cu – dE/dx (TPC)
 - Au+Au – dE/dx (TPC) + p/E (BEMC)
 - Background estimated by event mixing



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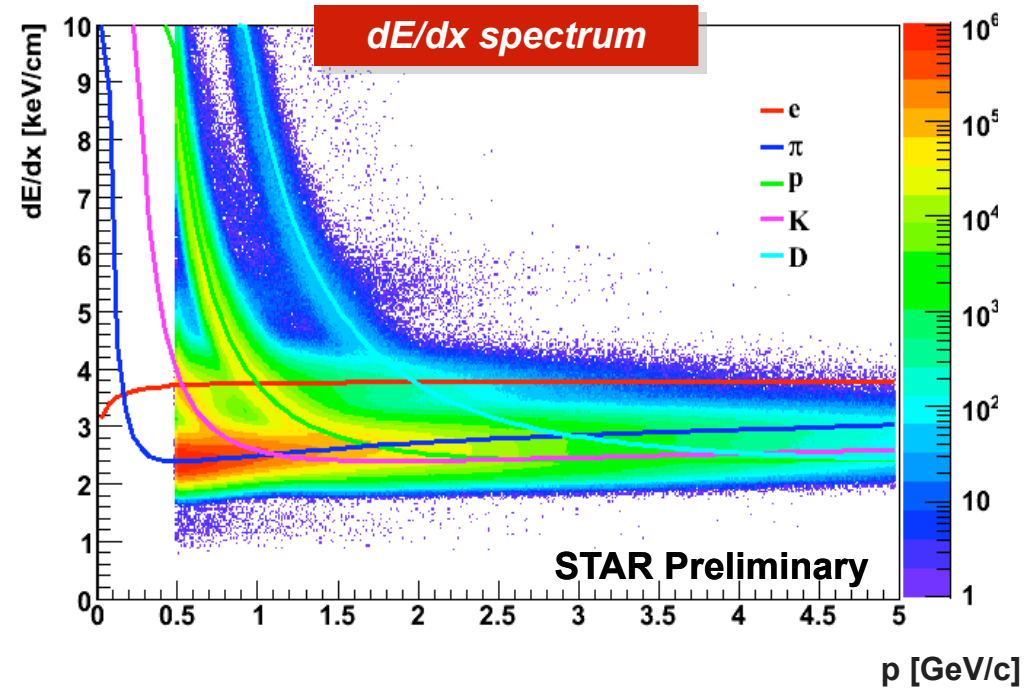
Every Little Bit Counts...

- Limited statistics, rare process, combinatorial background
- Optimal cuts \rightarrow Multivariate analysis using Pythia and also full TPC simulation
- Best results: p_T cut $\sim 1.1\text{--}1.2$ GeV/c



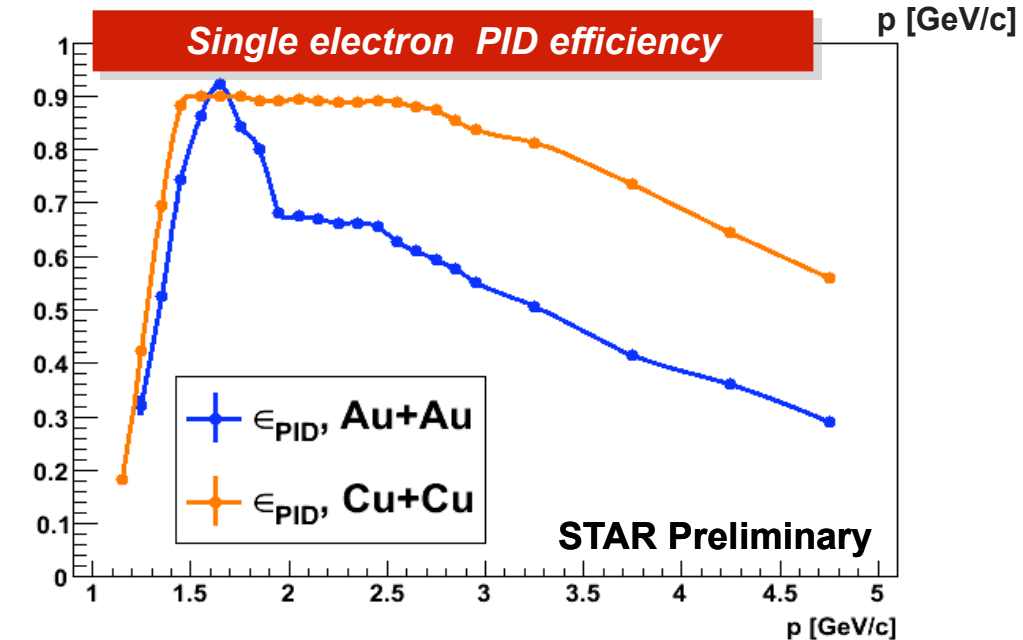
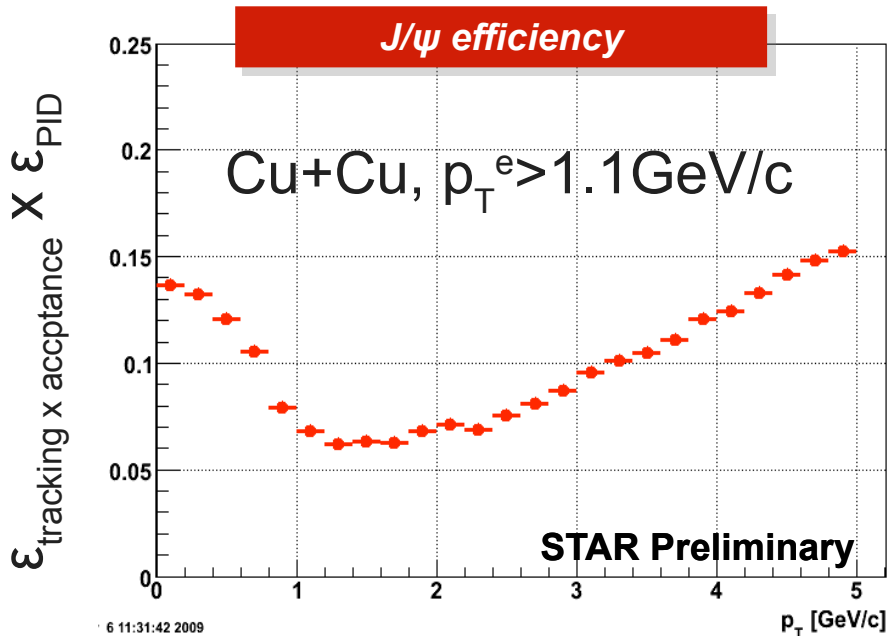
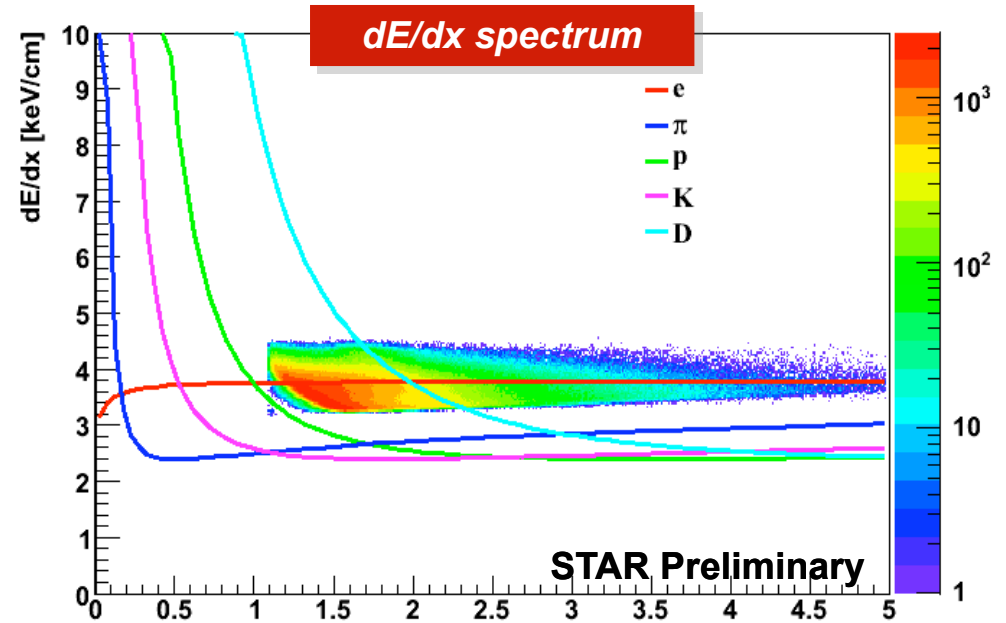
Electron identification

- Single electron p_T cut:
 - Au+Au: $p_T > 1.2$ GeV/c
 - Cu+Cu: $p_T > 1.1$ GeV/c



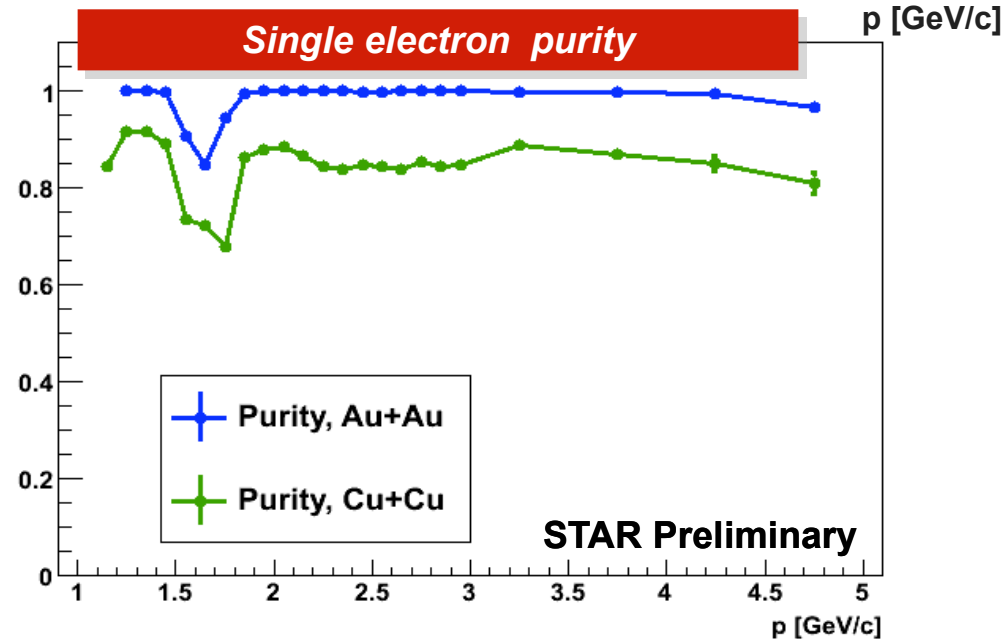
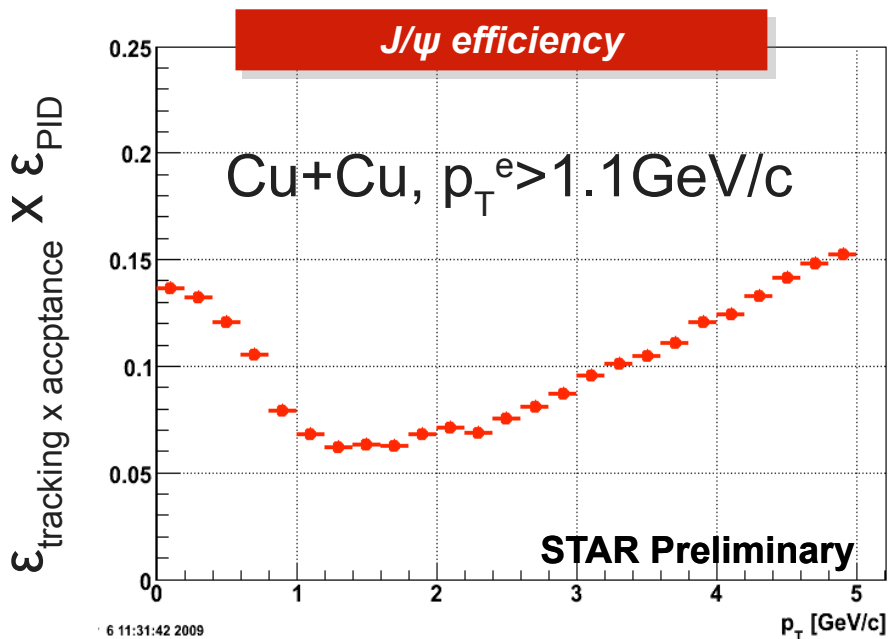
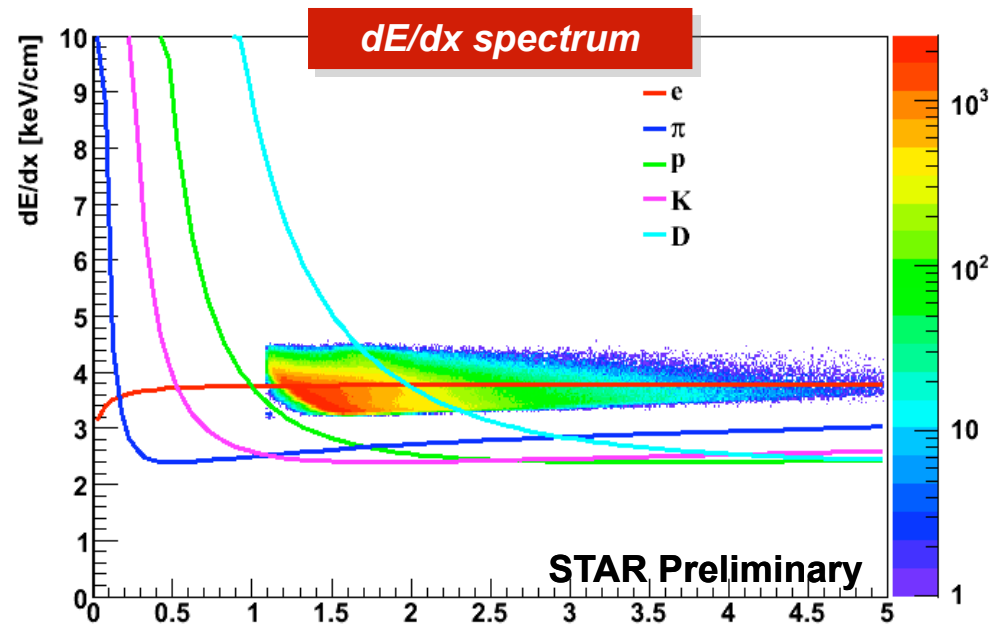
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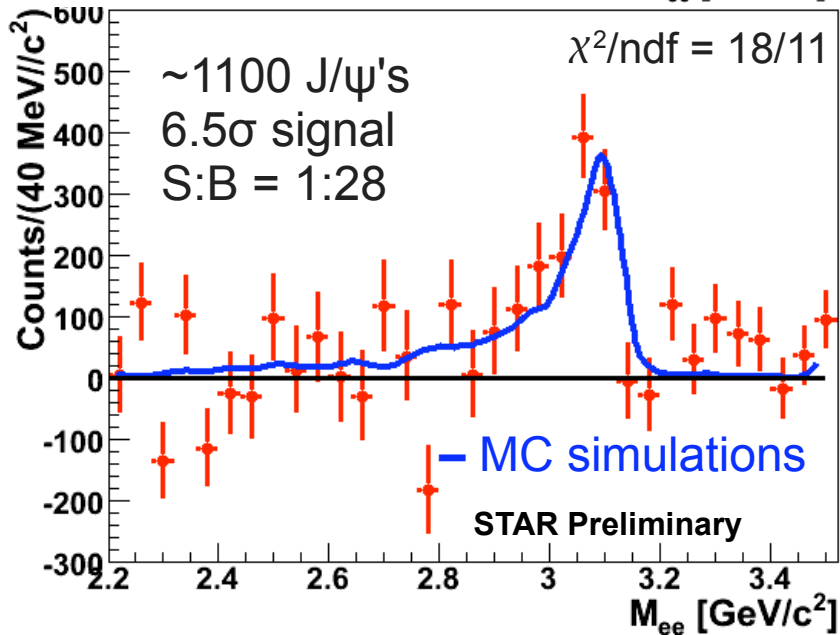
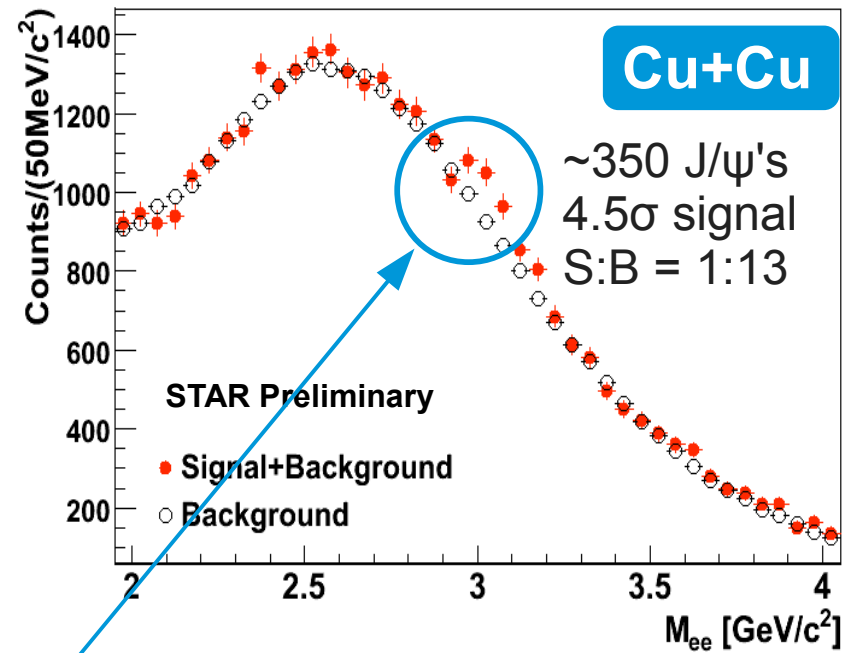
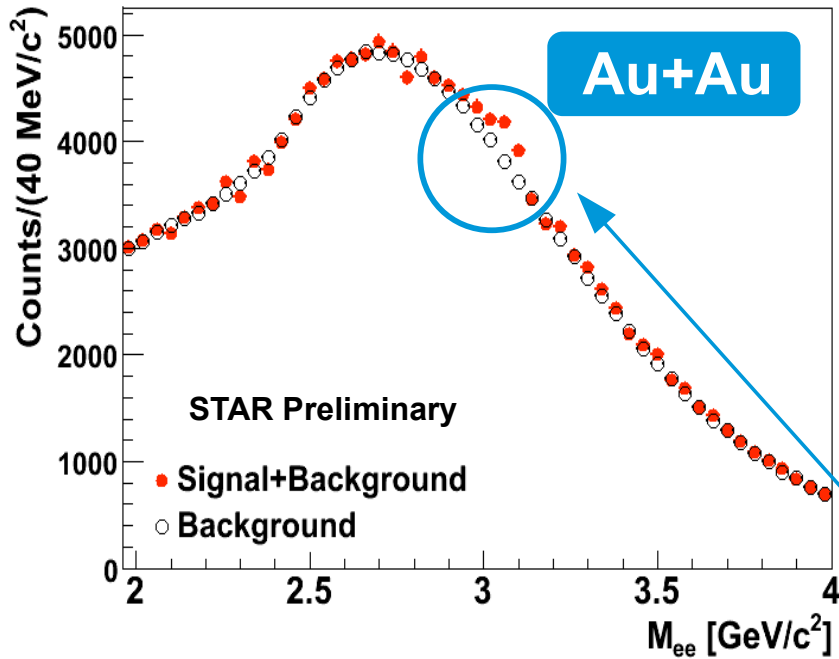


Electron identification

- Single electron p_T cut:
 - Au+Au: $p_T > 1.2$ GeV/c
 - Cu+Cu: $p_T > 1.1$ GeV/c
- Au+Au – clean sample
 - Purity $\sim 100\%$ for $p > 2$ GeV/c

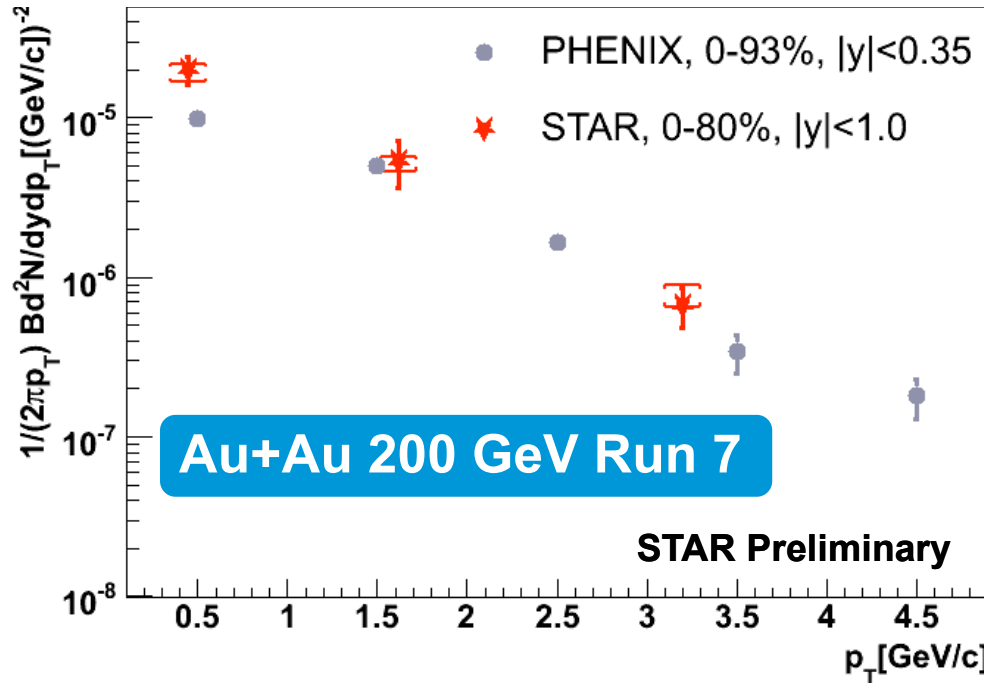


J/ ψ signal

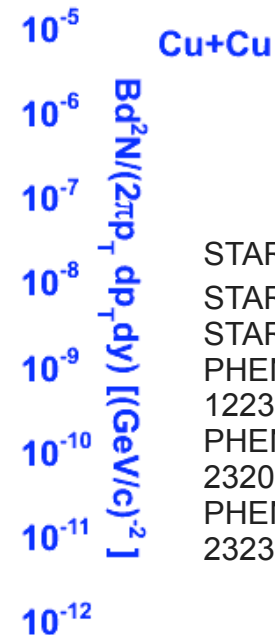
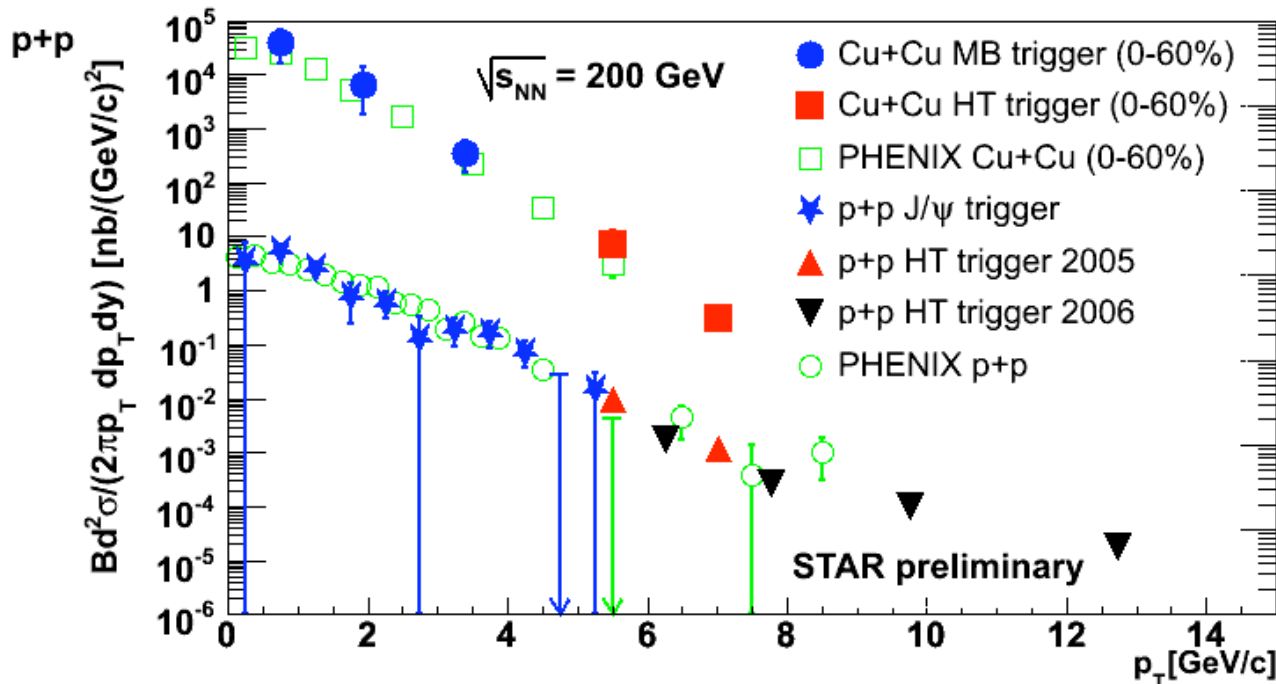


- Signal visible even without background subtraction
- Background estimated by event mixing
- Agreement with simulated J/ ψ line shape

J/ψ p_T spectrum

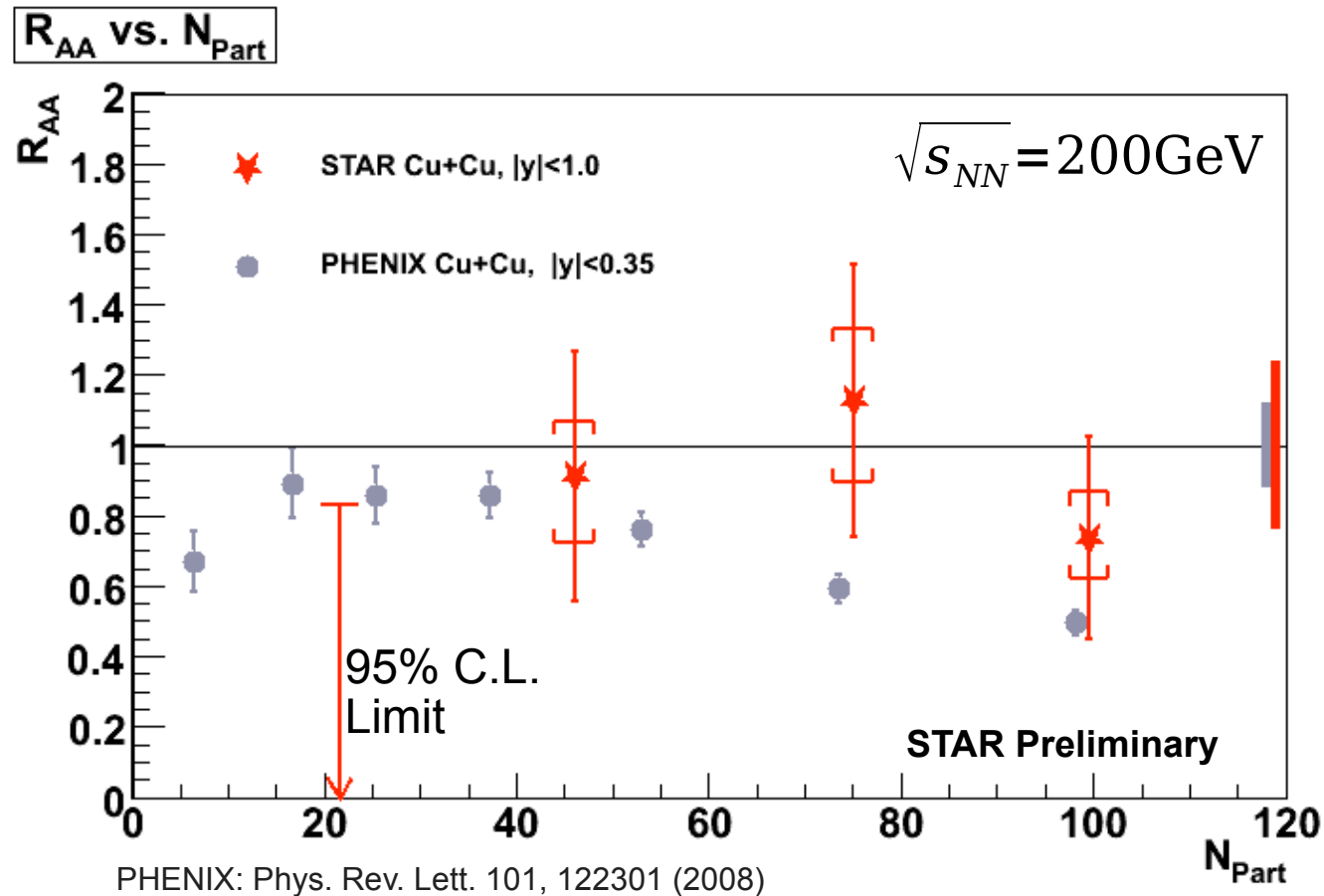


- STAR – ability to measure J/ψ from low- to high- p_T
- PHENIX – better precision
- STAR – wider rapidity coverage



STAR high- p_T J/ψ: arXiv:0904.0439
 STAR Cu+Cu: arXiv:0907.4458v2
 STAR p+p: arXiv:0806.0347v1
 PHENIX Cu+Cu: Phys. Rev. Lett. 101, 122301 (2008)
 PHENIX p+: Phys. Rev. Lett. 98, 232002 (2007)
 PHENIX Au+Au, Phys. Rev. Lett. 98, 232301 (2007)

Cu+Cu - R_{AA} vs. centrality

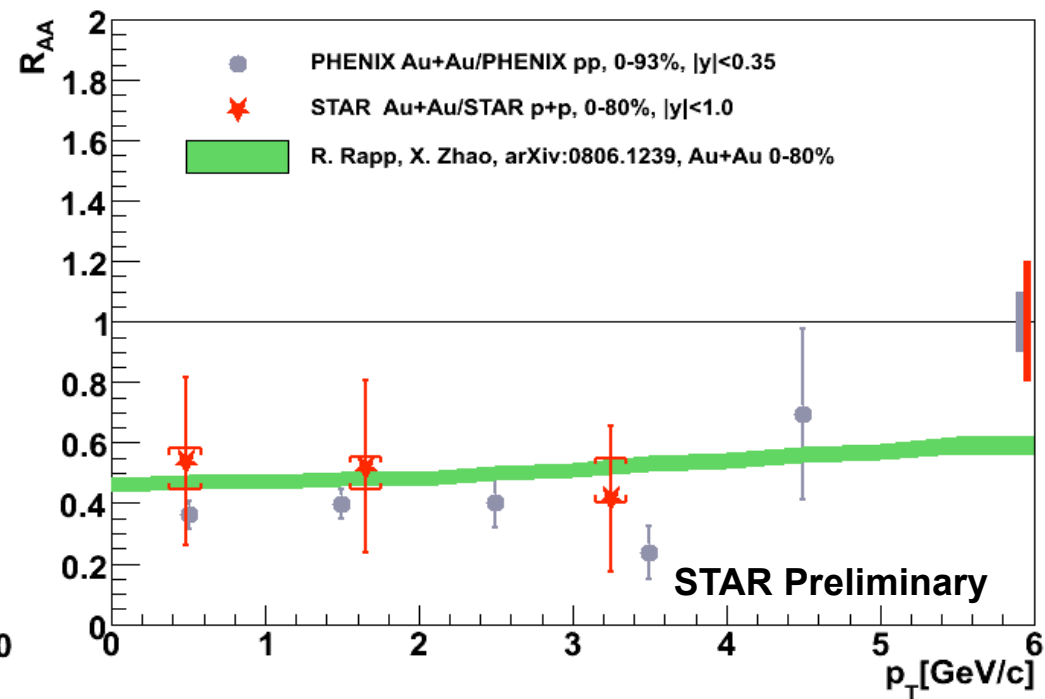
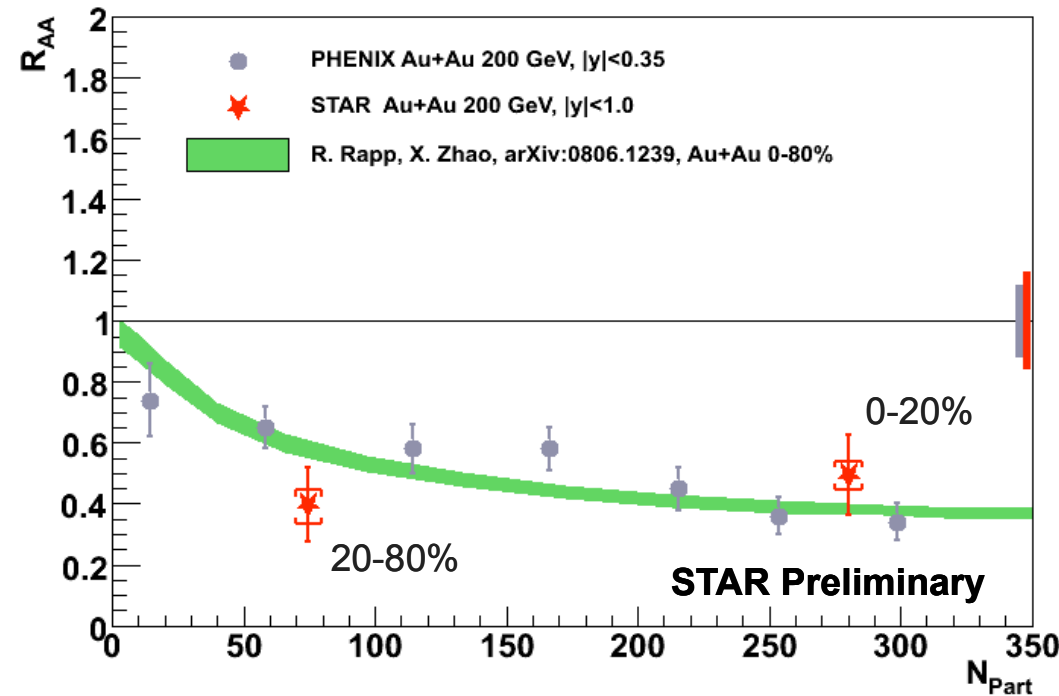


bars - stat. errors
brackets - syst. errors

Modest statistics → limited discrimination power

Au+Au RHIC Run 7 - R_{AA}

- Au+Au run 7 - Higher statistics data

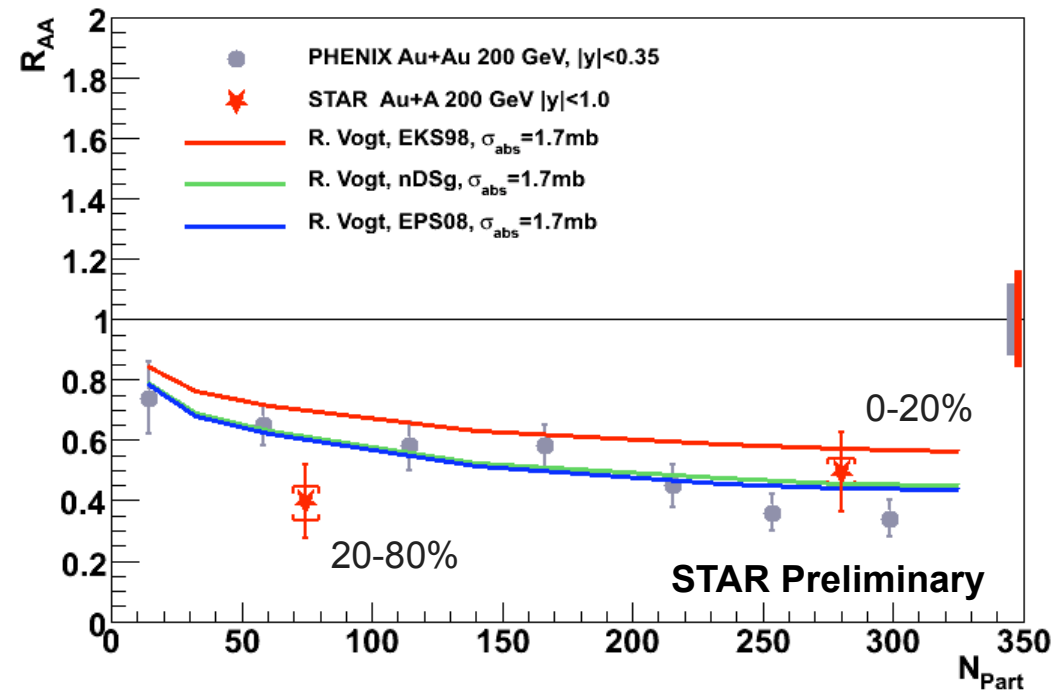


- Model: color screening in QGP, dissociation in hadronic phase, statistical recombination, $B \rightarrow J/\psi$ feed-down and formation time effects

PHENIX: Phys. Rev. Lett. 98, 232301 (2007)

Au+Au RHIC Run 7 - R_{AA}

- Au+Au run 7 - Higher statistics data

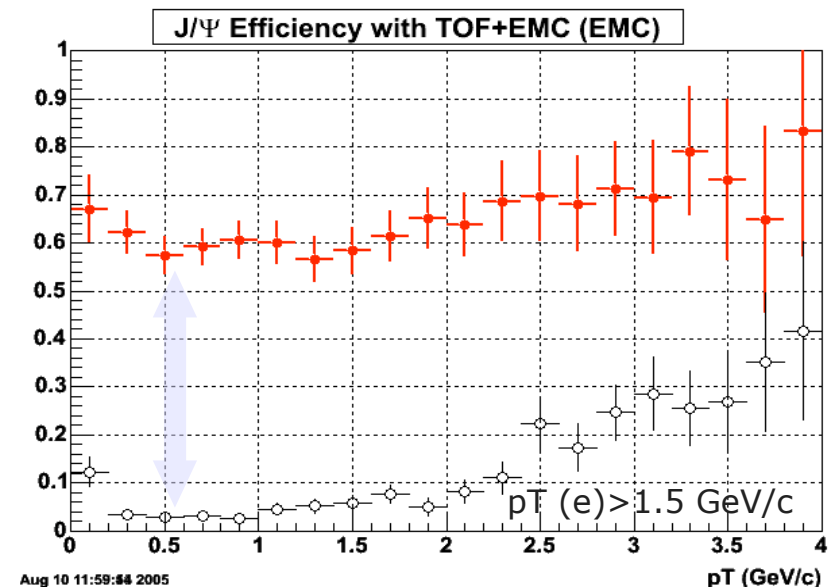


Model: only cold matter effects:

- shadowing
 - nuclear absorption
- Additional precise measurements needed to distinguish between different scenarios

Summary and outlook

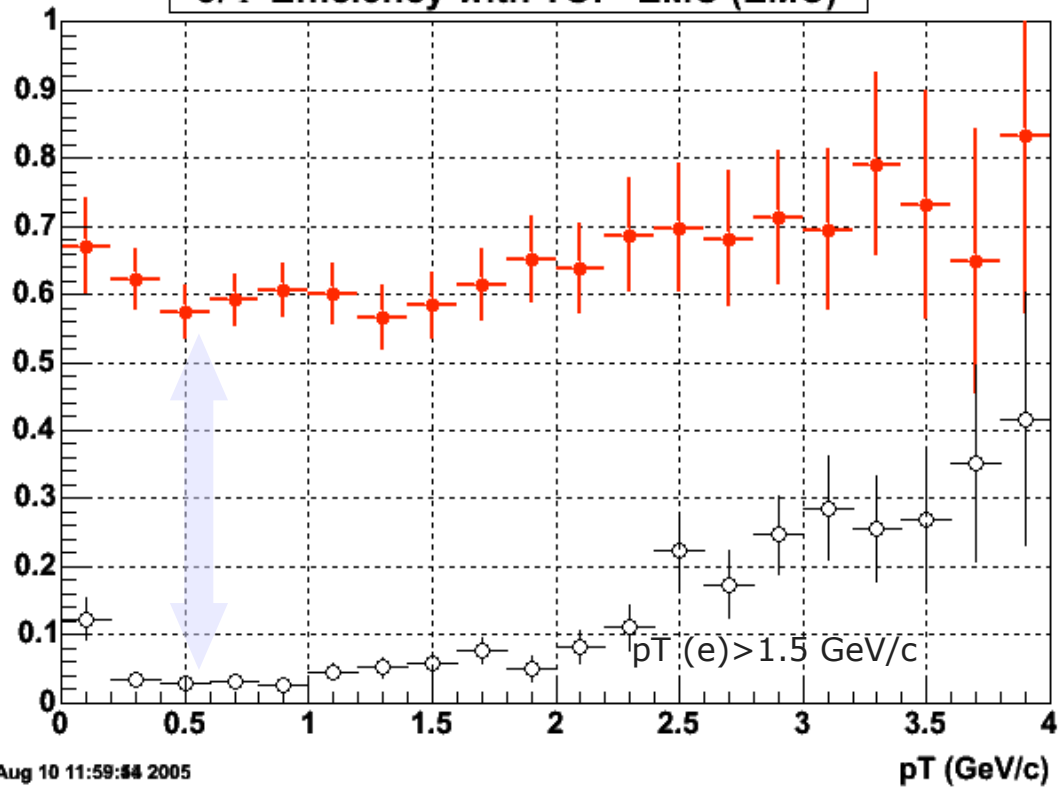
- Preliminary J/ψ p_T spectra and R_{AA} in Au+Au and Cu+Cu are presented.
- Results can be explained by models with different physical origins
- Additional precise measurements needed to distinguish between different scenarios
- Outlook
 - TOF + DAQ1000 + EMC = dramatic improvement of low- p_T J/ψ measurements
 - Au+Au RHIC run 10 \rightarrow J/ψ v_2 study



Backup

TOF + BEMC + DAQ1000

J/ψ Efficiency with TOF+EMC (EMC)



Aug 10 11:59:44 2005

