

Measurement of J/ψ Elliptic Flow in Au+Au Collisions at $\sqrt{s_{NN}}=200$ GeV in STAR



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for the STAR Collaboration

Abstract

J/ψ elliptic flow (v_2) is sensitive to the J/ψ production mechanism and the collective motion of heavy quarks. It is predicted that J/ψ produced through direct nucleon-nucleon process have very limited v_2 , and J/ψ produced by the recombination of c and \bar{c} pairs could carry finite v_2 , depending on the interaction between charm quarks and the medium. We present STAR's J/ψ $v_2(p_T)$ measurement from 200 GeV Au+Au collisions. Considering errors of the measurement, the results are found to be consistent with zero, thus disfavor the case that J/ψ is produced dominantly by coalescence of thermalized charm quarks.

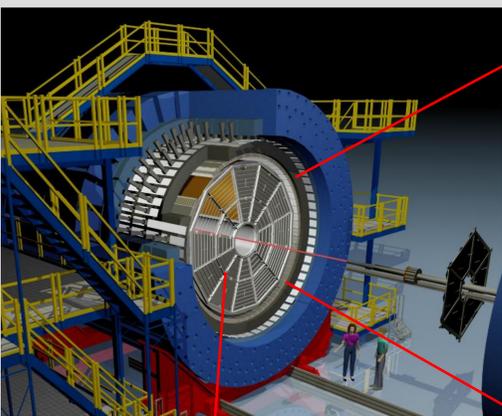
Motivation

J/ψ elliptic flow (v_2) can be used to probe its production mechanism.

- Direct pQCD production \rightarrow Limited v_2
- Produced by coalescence of thermalized charm quarks \rightarrow Large v_2

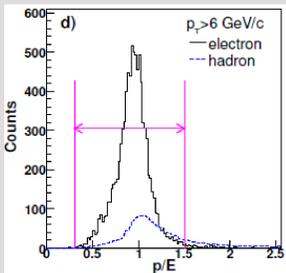
J/ψ Identification

$J/\psi \rightarrow e^+e^-$ decay branching ratio 5.9 %

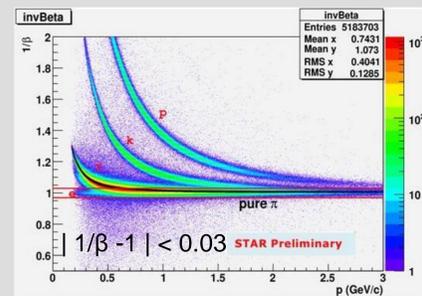


Barrel Electro-Magnetic Calorimeter (BEMC)

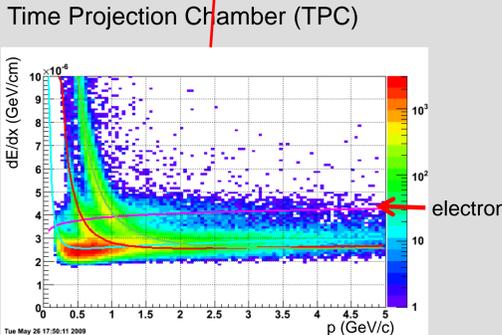
$0.3 < p/E < 1.5$
Equal entries for e vs. h.



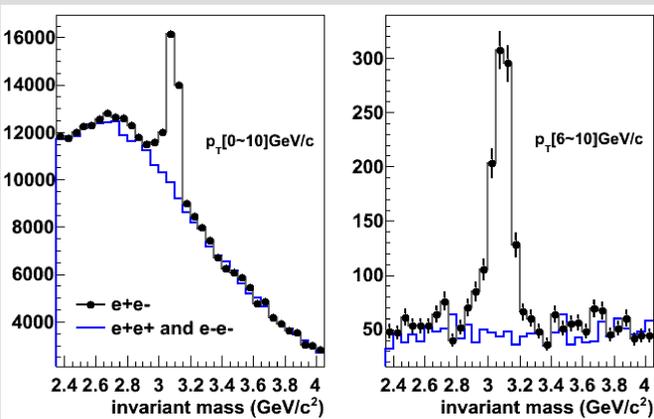
Time Of Flight (TOF) detector



$\beta = \text{path length} / \text{TOF} / c$

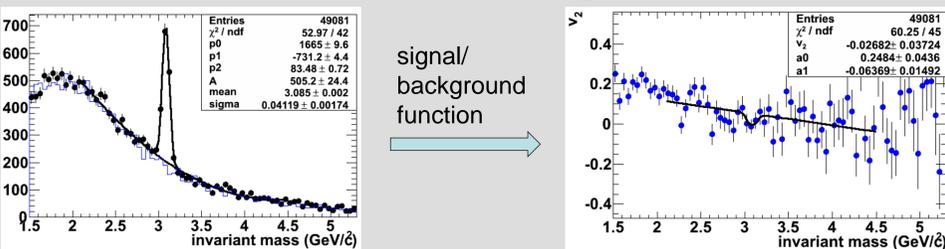


J/ψ Signal



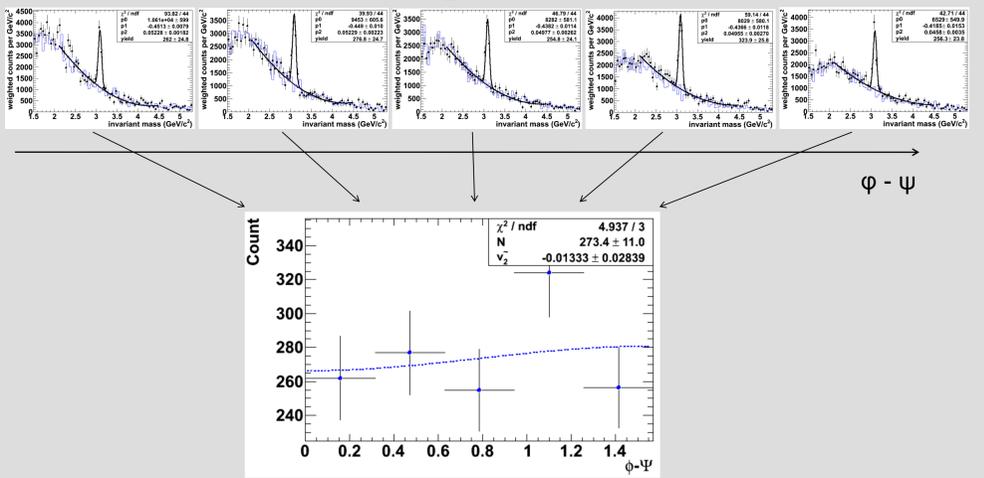
- > 14000 J/ψ s identified
- > prominent signal for $p_T > 6$ GeV/c region.

Invariant mass method to calculate v_2

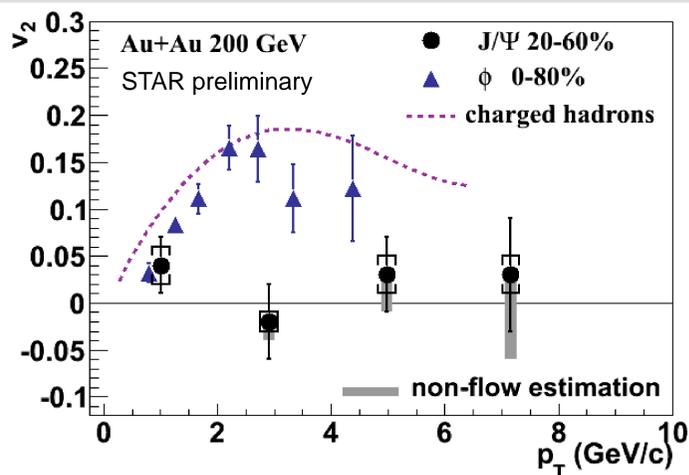


$$v_{2_overall}(m) = (v_{2_J/\psi} * s(m) + v_{2_background}(m) * b(m)) / (s(m) + b(m))$$

$\phi - \Psi$ method to calculate v_2



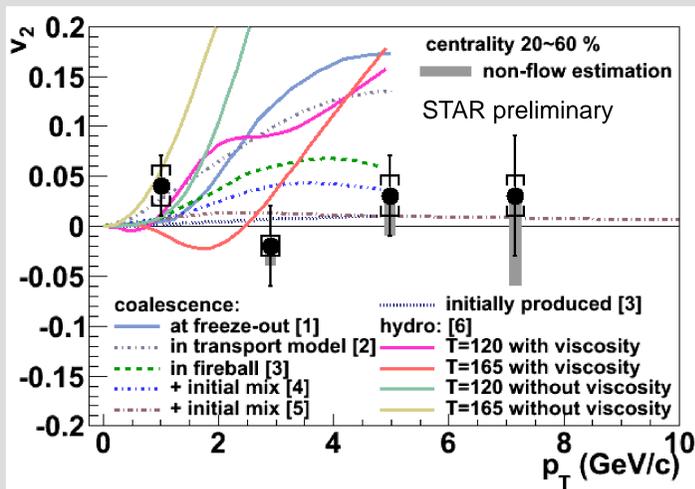
Results



Showing on the left is v_2 as a function of transverse momentum for J/ψ as well as light flavor particles. Unlike charged hadrons and ϕ , J/ψ $v_2(p_T)$ is found consistent with zero considering errors of the measurement.

The color bands represents the non-flow effect estimated from J/ψ -hadron correlation in p+p collisions. The brackets are systematic errors estimated from different methods and cuts. The mean value of p_T for each p_T bin is used.

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This plot shows the same J/ψ $v_2(p_T)$ comparing with different theoretical calculations. The data disfavors the case that J/ψ is produced dominantly by coalescence of thermalized charm quarks. More statistics (x2) are expected from the current RHIC run.

- [1] V. Greco, C.M. Ko, R. Rapp, PLB 595, 202.
- [2] L. Ravagli, R. Rapp, PLB 655, 126.
- [3] L. Yan, P. Zhuang, N. Xu, PRL 97, 232301.
- [4] X. Zhao, R. Rapp, 24th WWND, 2008.
- [5] Y. Liu, N. Xu, P. Zhuang, Nucl. Phys. A, 834, 317.
- [6] U. Heinz, C. Shen, private communication.

Summary

Considering errors of the measurement, J/ψ elliptic flow measured by STAR is found to be consistent with zero, which disfavors the case that J/ψ is produced dominantly by coalescence of thermalized charm quarks. More statistics (x2) in Au+Au collisions are expected from the current RHIC run.

