



Preliminary figures request

J/ψ elliptic flow measurement
in isobar collisions

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Contact information

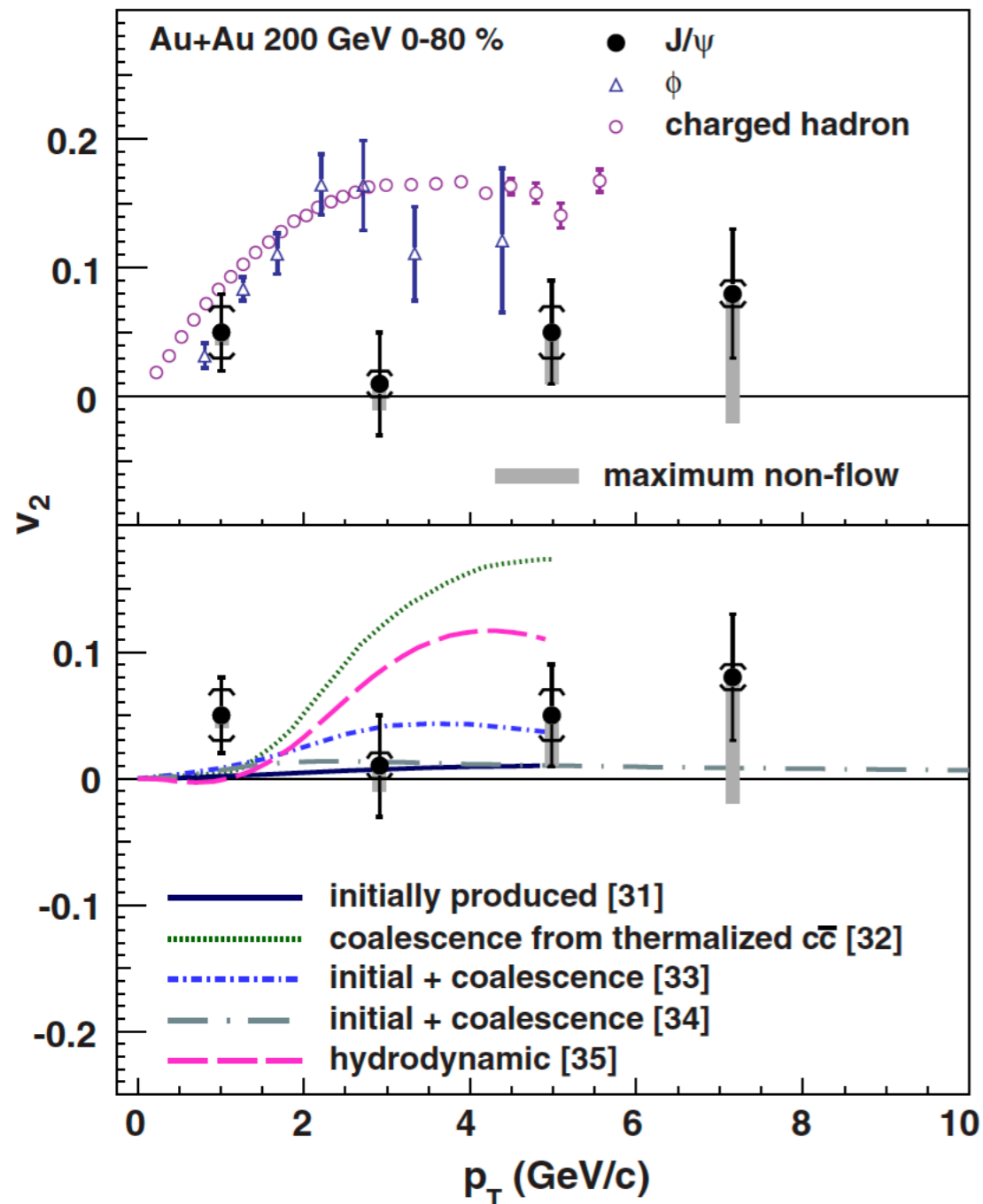
The logo for STAR, featuring the word "STAR" in bold blue capital letters centered within a circular, starburst-like pattern of blue lines.

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Physics motivation



- At RHIC energy, J/ψ elliptic flow is consistent with zero but with large non-flow contribution in Au+Au system
 - Indication of small regeneration contribution
- In a smaller A+A collision system, like isobar system, the regeneration is expected to be smaller.
 - Does J/ψ flow in isobar system?
 - Needs to suppress non-flow contribution

Dataset



- DataSet: production_isobar_2018
- Year: 2018
- Production tag: P20ic
- Triggers used: MB Trigger: 600001, 600011, 600021, 600031



Bad run list

19086038	19114007	19127047	19126043
19086050	19114022	19083050	19088051
19086052	19116035	19084032	19097057
19089047	19120047	19084033	19110051
19090019	19120048	19085039	19117036
19090021	19122054	19086016	19120021
19093042	19124025	19086026	19120025
19093043	19126015	19088052	
19095061	19127045	19088053	
19096002	19128002	19088055	
19096005	19084053	19089005	
19096006	19084055	19095031	
19098005	19086060	19097001	
19098017	19086061	19097005	
19098018	19086062	19097040	
19098020	19086063	19097046	
19102020	19086064	19100054	
19102023	19086066	19102055	
19103041	19087038	19103007	
19104012	19087042	19103022	
19107045	19110015	19107002	
19111038	19116002	19115020	
19111051	19125044	19117030	
19112012	19125049	19122004	
19112029	19126008	19122005	
19113030	19126011	19122010	

Event level and Track level cuts



Event level:

Vpdmb-30 (600001, 600011, 600021 and 600031)

$|V_r| < 2 \text{ cm}$

$-35 < V_z < 25 \text{ cm}$

$|V_z^{TPC} - V_z^{VPD}| < 3 \text{ cm}$

Track quality:

$nHitsFit \geq 20$

$nHitsFit/nHitsPoss \geq 0.52$

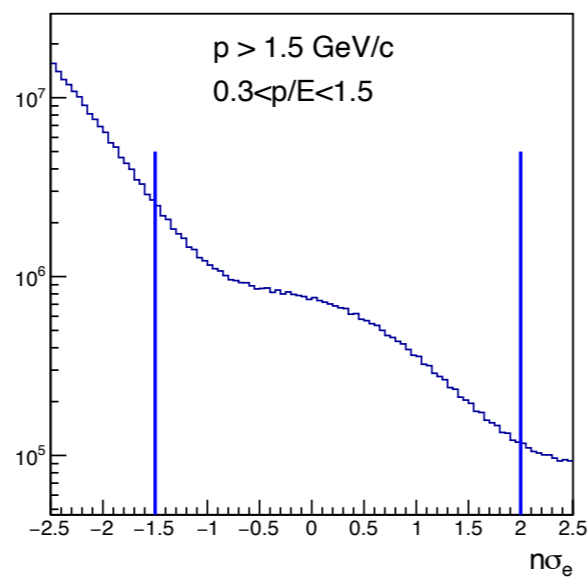
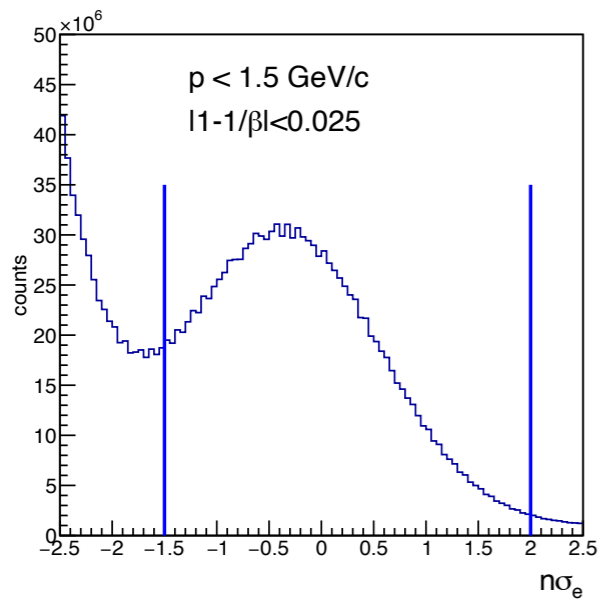
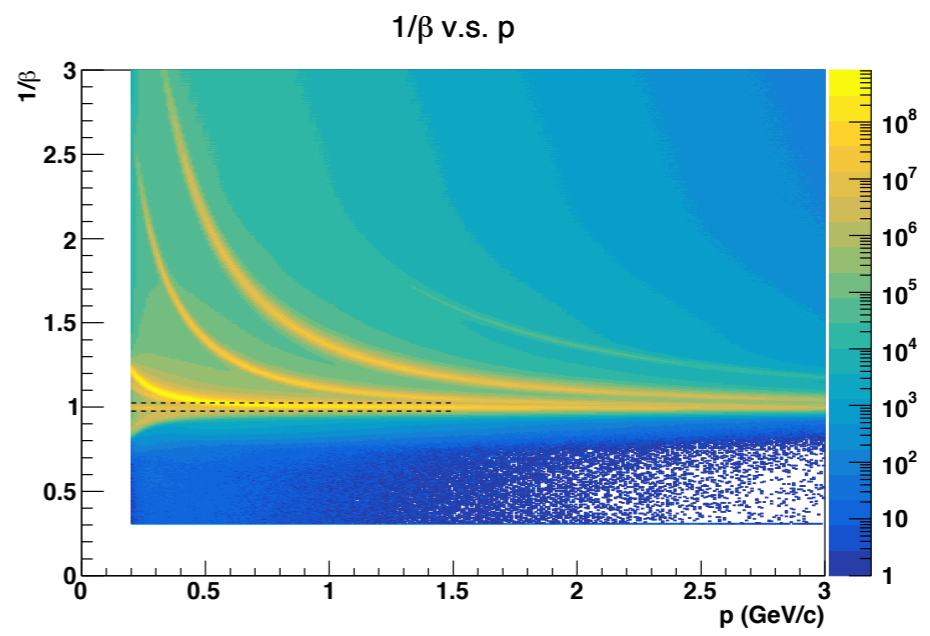
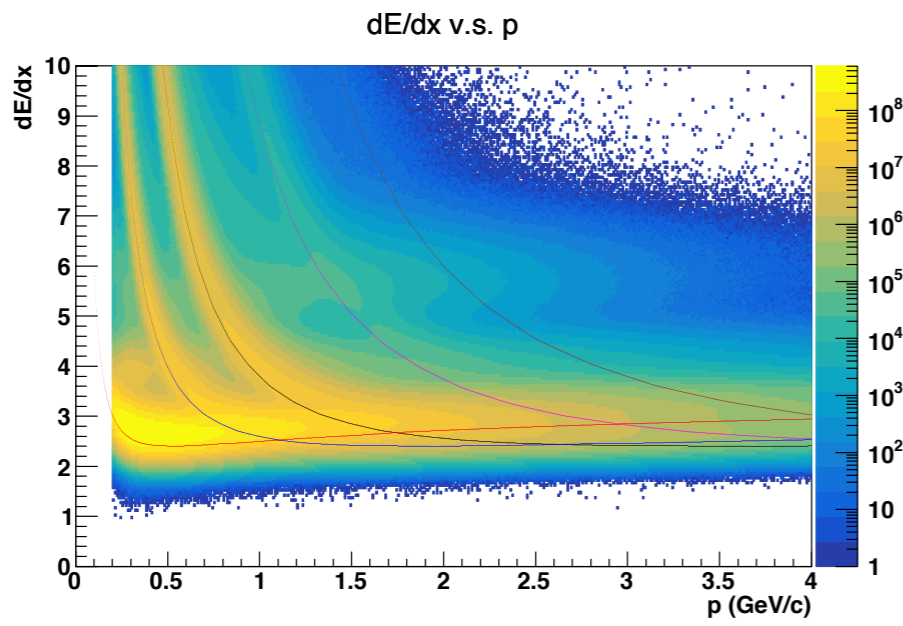
$nHitsDedx \geq 15$

$dca < 0.75 \text{ cm}$

$|\eta| < 1.0$



PID cuts



Electron identification:

- $-0.75 \leq n\sigma_e \leq 2.0$
- $p < 1.5 \text{ GeV}/c$
- $|1 - 1/\beta| \leq 0.025$
- $p \geq 1.5 \text{ GeV}/c$
- $0.3 \leq p/E \leq 1.5$

J/psi pT	0.3 - 1 GeV/c	1 - 2.5 GeV/c	2.5 - 4 GeV/	4 - 6 GeV/c
Electron pT	0.4 GeV/c	0.6 GeV/c	0.6 GeV/c	0.8 GeV/c



Analysis procedure

$$\vec{Q}_n \equiv (|Q_n| \cos(n\Psi_n), |Q_n| \sin(n\Psi_n)) = |Q_n| e^{in\Psi_n}$$

$$|Q_n| \cos(n\Psi_n) = \frac{1}{\sum \omega_j} \sum \omega_j \cos(n\phi_j) \quad |Q_n| \sin(n\Psi_n) = \frac{1}{\sum \omega_j} \sum \omega_j \sin(n\phi_j)$$

TPC:

Charged particles, $0.4 < p_T < 3 \text{ GeV}/c$

EPD west with additional weight:

Hits on tile: $2.1 < \eta < 5.1$, $\omega = n_{MIP}$ or 2

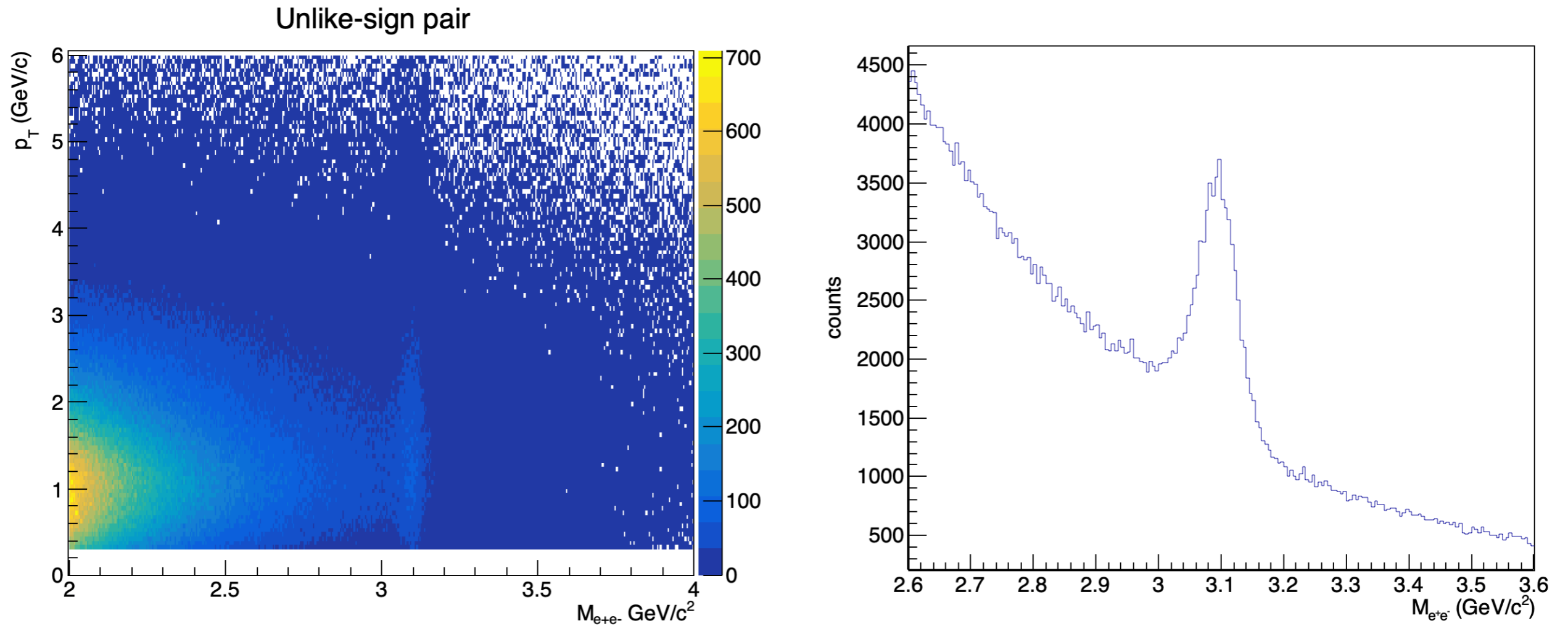
EPD east with additional weight:

Hits on tile: $-5.1 < \eta < -2.1$, $\omega = n_{MIP}$ or 2

POI:

Unlike-sign pair (e^-e^+), $-1.0 < y < 1.0$, $p_T > 0.3 \text{ GeV}/c$

Analysis procedure



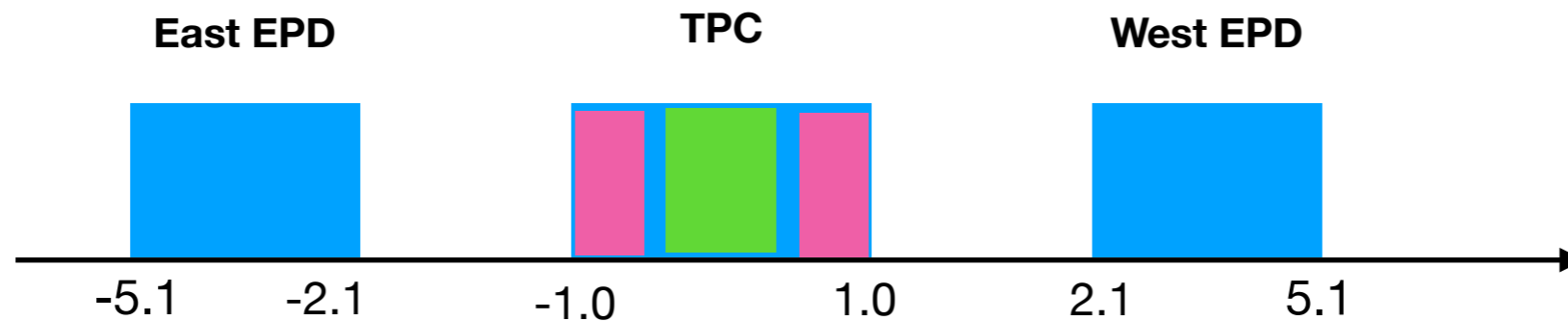
- Clear J/ψ peak around 3.1 GeV/c² in p_T range
- S/B is around 0.45 in J/ψ mass range



Analysis procedure

$$v_2^{obs} = \frac{\langle Q_{2,POI} Q_{2,EPD}^* \rangle}{\sqrt{\frac{\langle Q_{2,EPD} Q_{2,TPCW}^* \rangle \langle Q_{2,EPD} Q_{2,TPCE}^* \rangle}{\langle Q_{2,TPCW} Q_{2,TPCE}^* \rangle}}} = \frac{\langle Q_{2,POI} Q_{2,EPD}^* \rangle}{\sqrt{\frac{\langle Q_{2,EPD} Q_{2,TPCW}^* \rangle \langle Q_{2,EPD} Q_{2,TPCE}^* \rangle}{\langle Q_{2,TPCW} Q_{2,TPCE}^* \rangle}}}$$

Q vector from reference detector



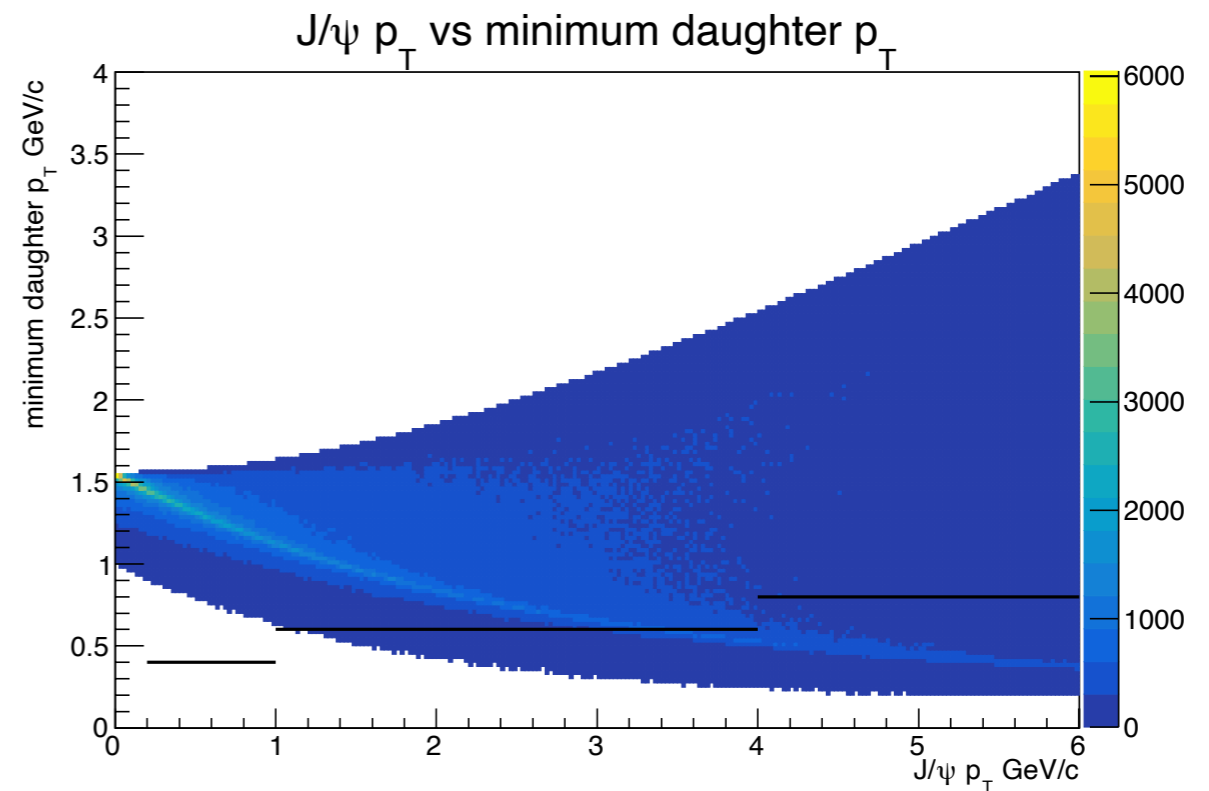
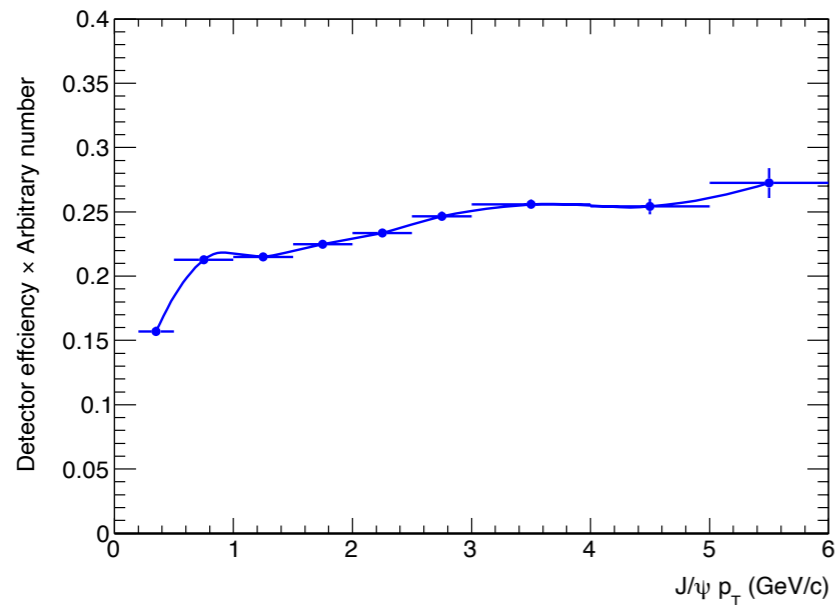
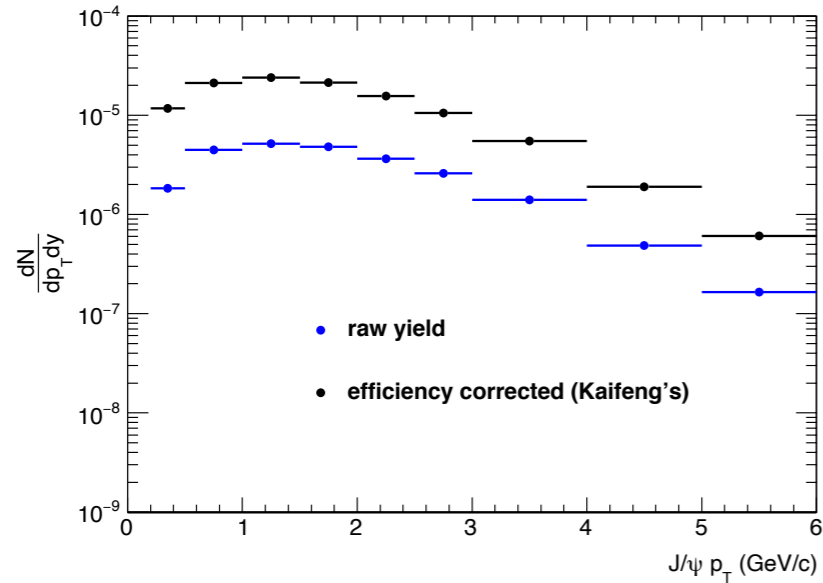
Reference detector:
EPD (West+East)

- Denominator: West TPC and East TPC with a η gap of 0.9



Analysis procedure

- Efficiency obtain by divide the raw yield by “truth” spectrum which is from R_{AA} analysis



- Different p_T cuts on daughter p_T shown limited impact on efficiency due to a wide p_T distribution of electron



Analysis procedure

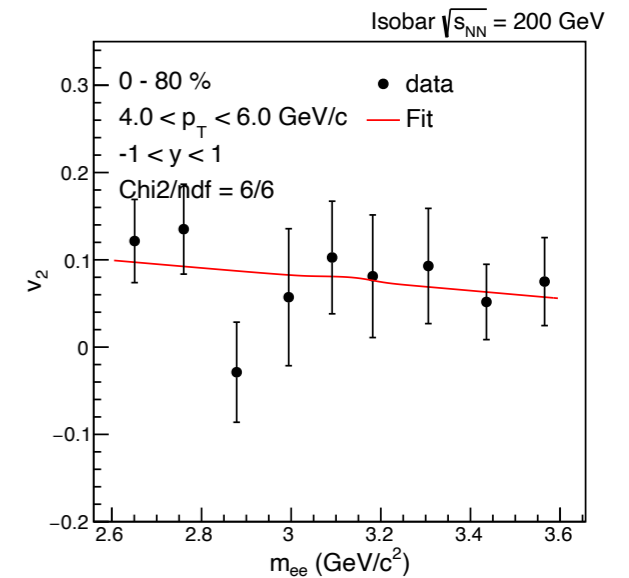
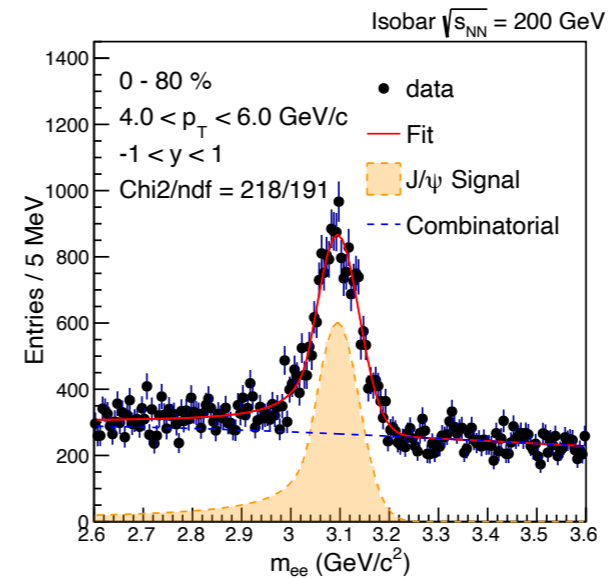
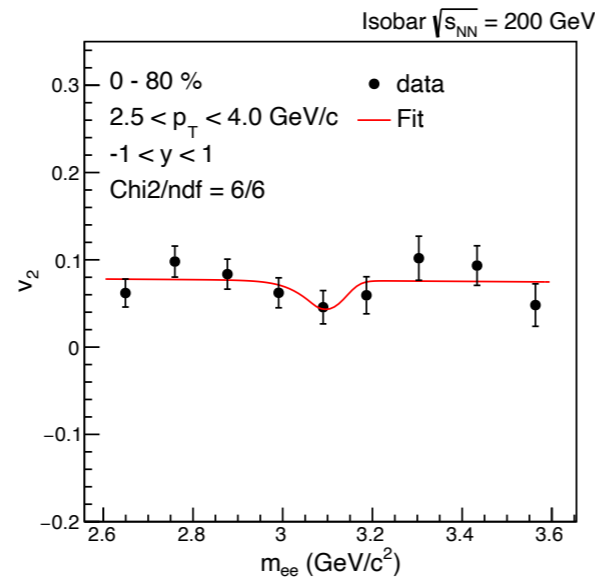
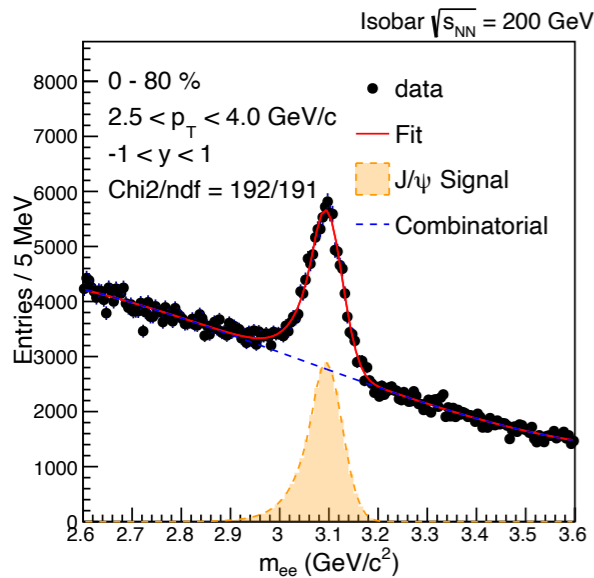
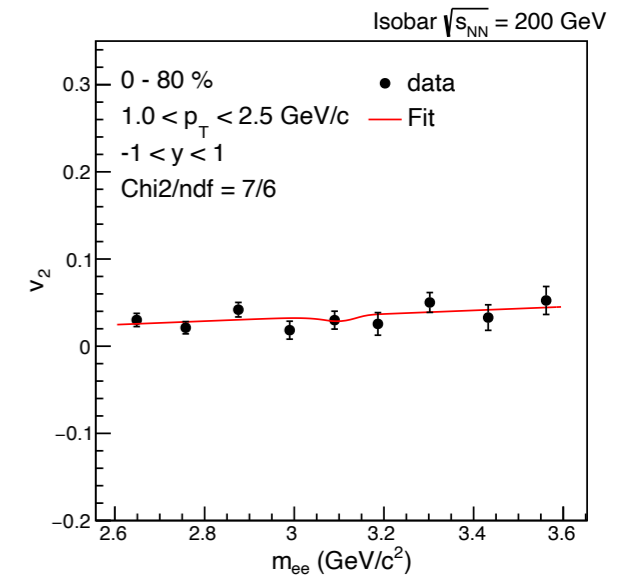
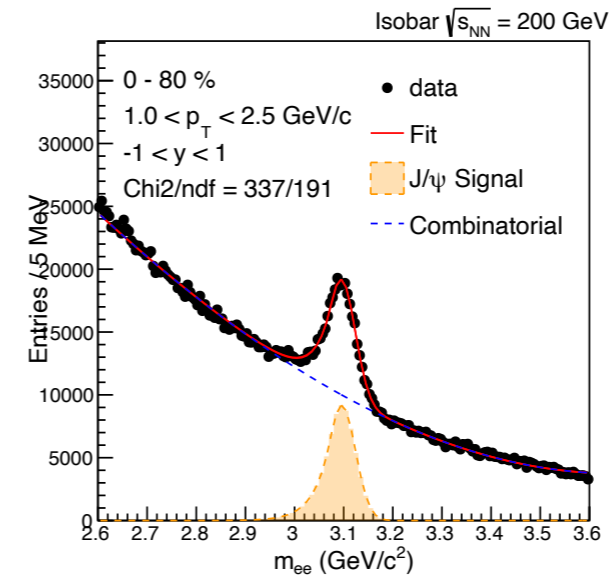
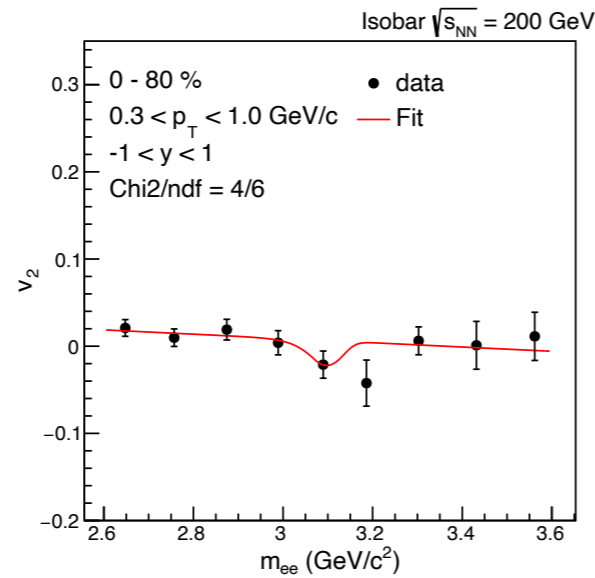
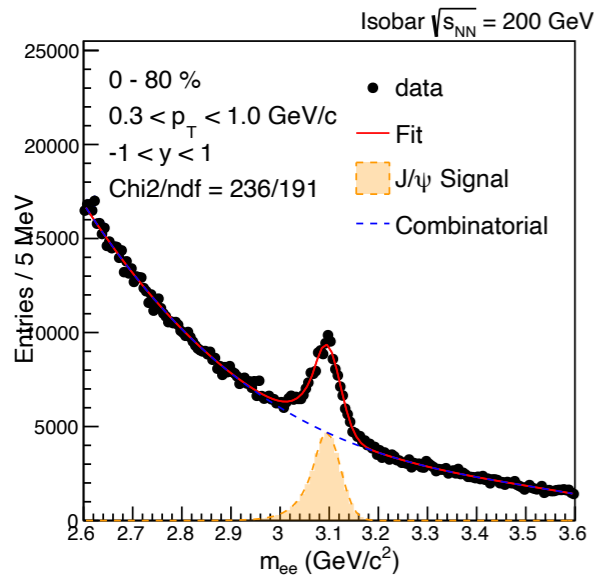
- Crystal-ball function for J/psi mass distribution
- Polynomial 3 for combinatorial background mass distribution
- Combinatorial background v2: $a + b \cdot \text{mass}$

$$v_2^{S+B}(m_{inv}) = f(m_{inv})v_2^S + [1 - f(m_{inv})]v_2^B(m_{inv})$$

$$f(m_{inv}) = \frac{S(m_{inv})}{S(m_{inv}) + B(m_{inv})}$$



Analysis procedure



Systematic uncertainty source



- **J/psi reconstruction**
 - **Dca: 0.75 (default) to 1cm**
 - **nHitsFit: 20 (default) to 25**
 - **Electron pT: increased and decreased by 0.2 GeV/c in each J/psi pT bin**
- **V2 extraction**
 - **V2 background function: linear function to exponential function**
 - **TPC reference: $|\eta| < 0.5$ to $0.45 < |\eta| < 0.95$**



Systematic uncertainties

Systematic	0.3 - 1	1 - 2.5	2.5-4	4-6
Electron p_T	0.00077	0.0078	0.023	0.053
Dca	4.84E-06	0.0029	4E-05	0.00065
nHitsFit	4.12E-05	0.0028	2.14E-05	0.00069
V2 background shape	4.59E-05	0.0029	1.96E-05	8.75E-05
Reference detector	2.74E-05	0.0028	3.52E-08	3.35E-06
Total	0.00077	0.0097	0.023	0.053



Figure 1

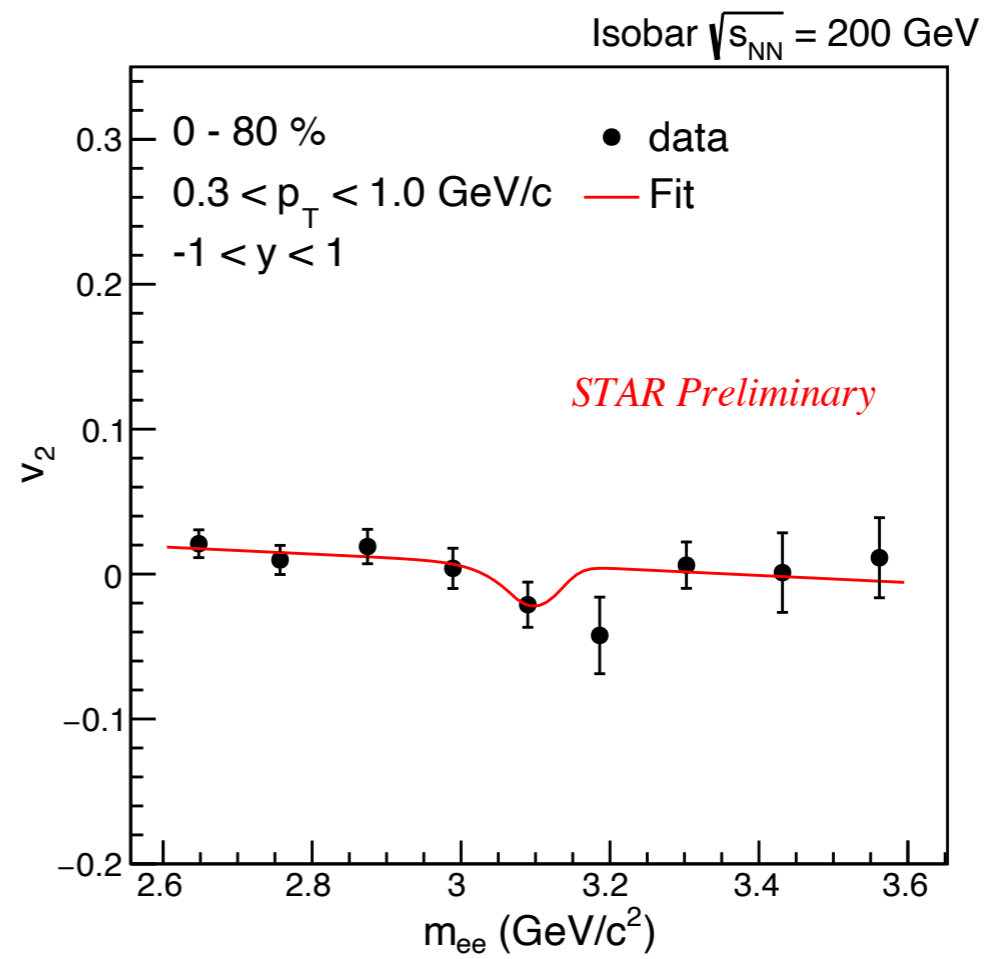
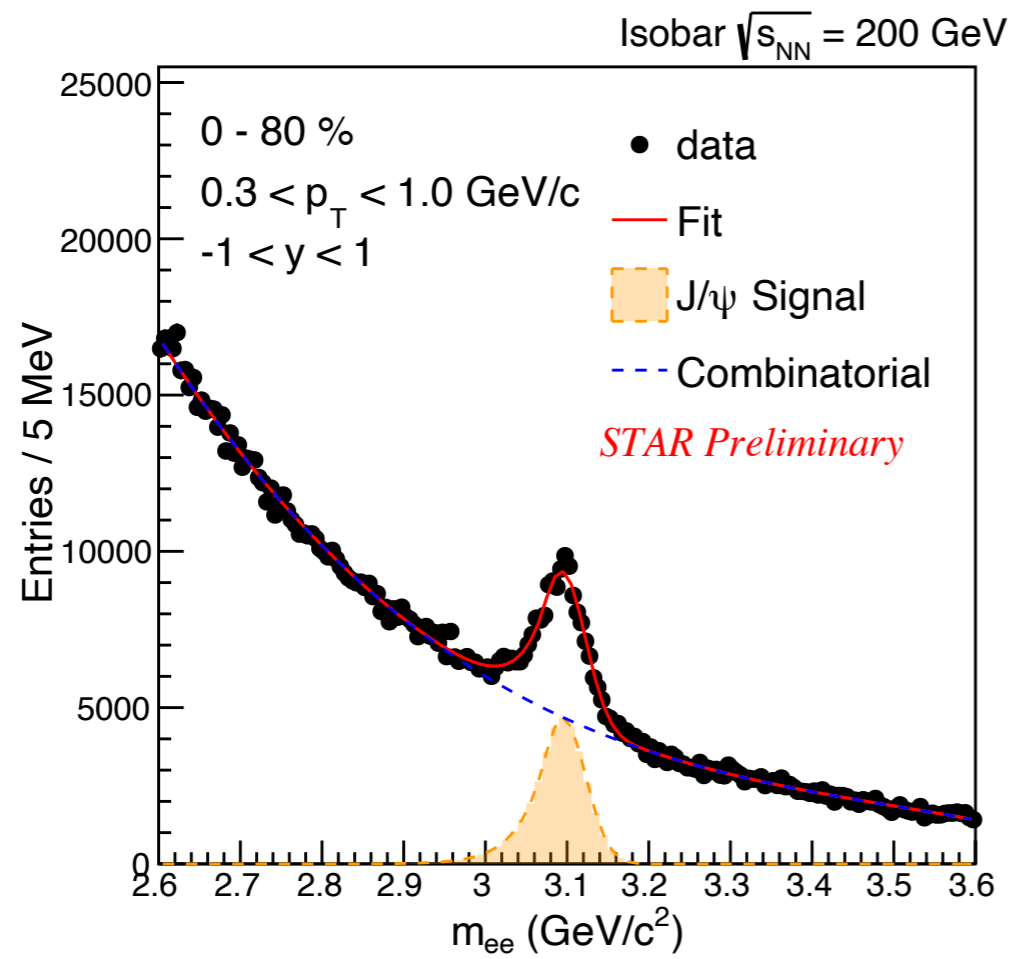




Figure 2

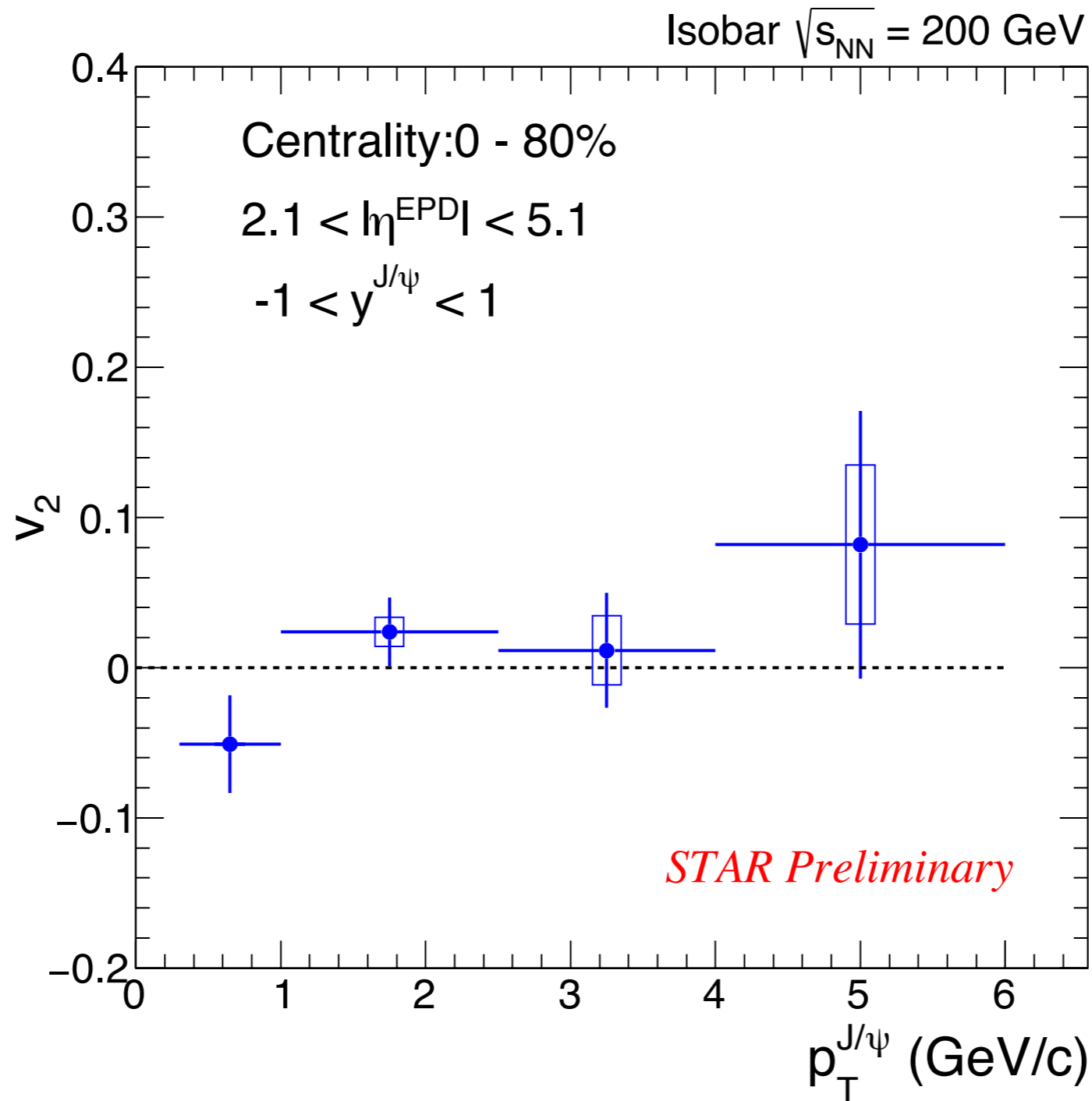




Figure 3

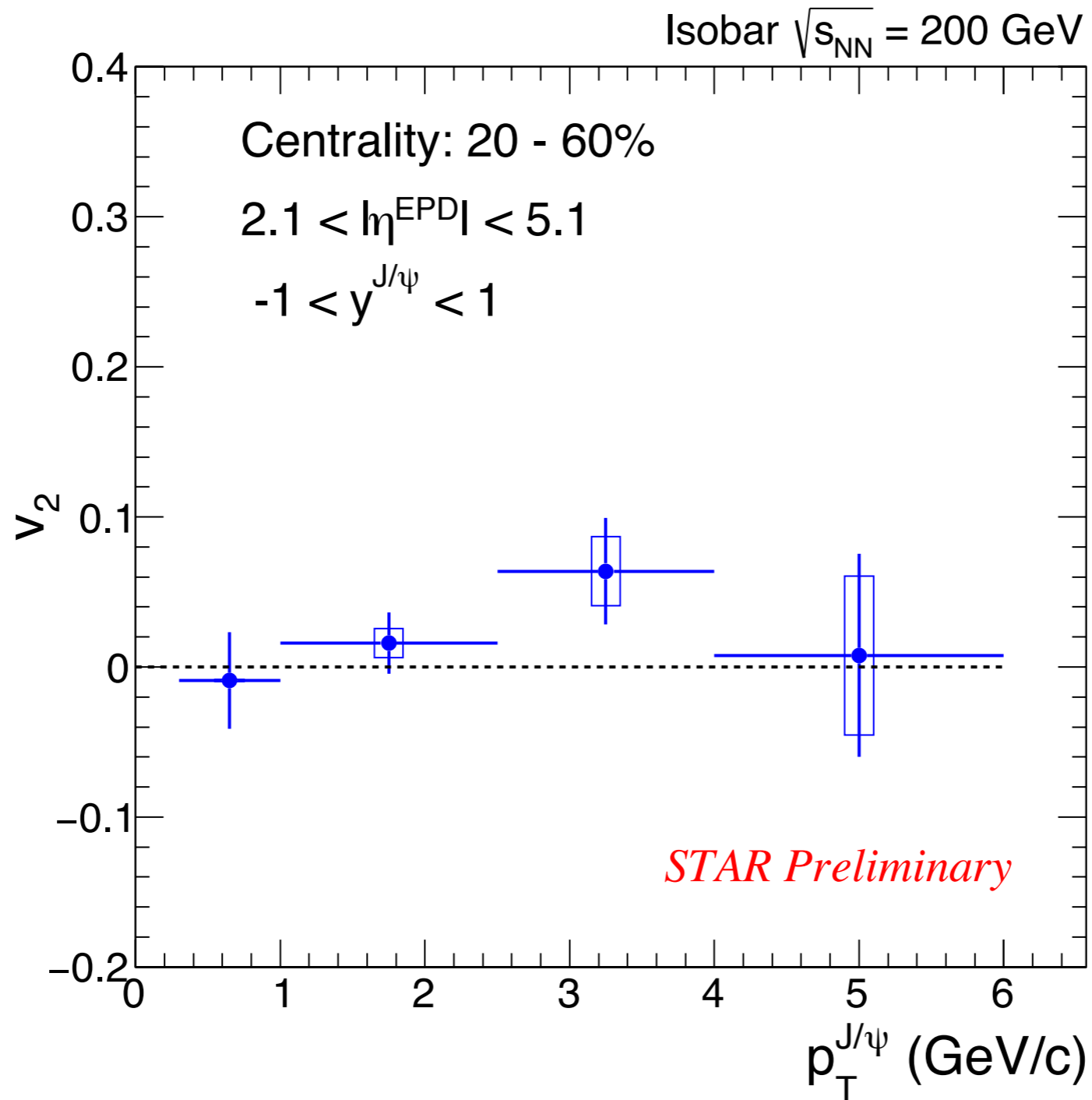




Figure 4

