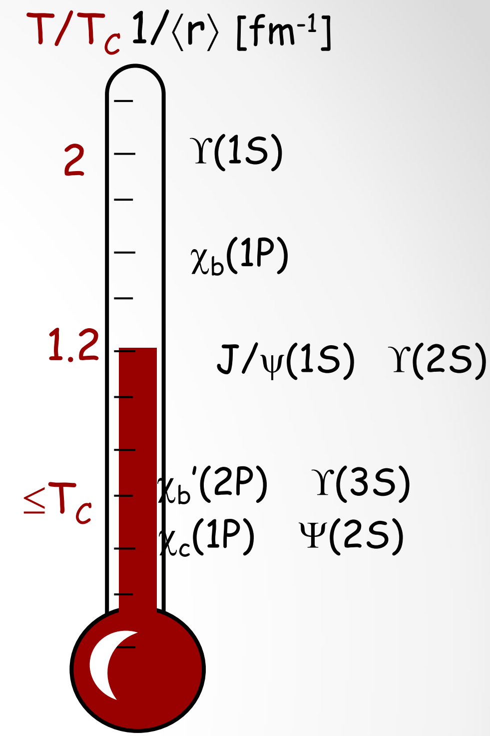
First Measurement of Υ Suppression

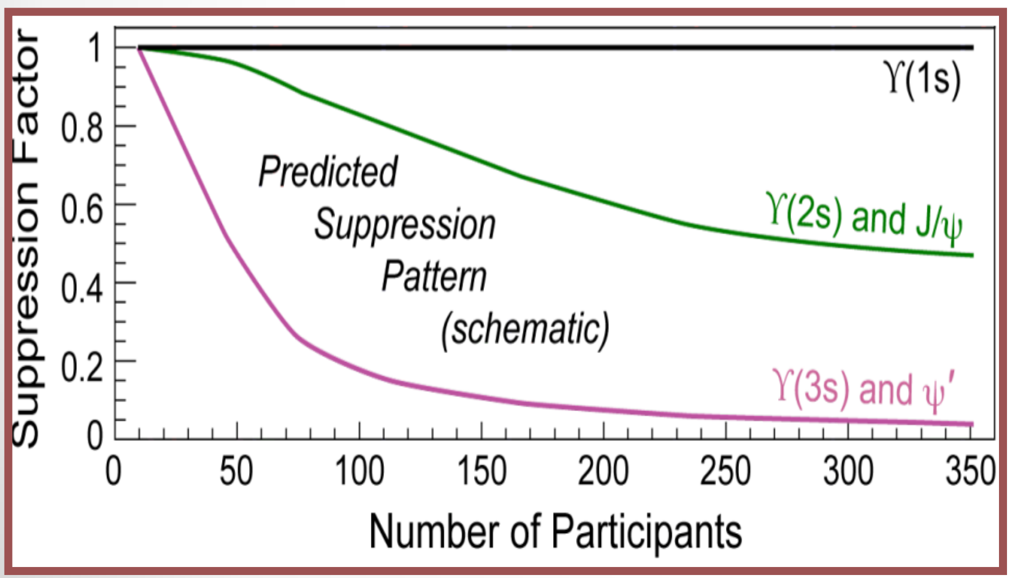
Rosi Reed (UC Davis)
for the STAR Collaboration

Motivations

Sequential suppression of Quarkonium mesons acts as a QGP thermometer.



] *A. Mocsy and P.Petreczky, PRL 99, 211602 (2007)*



Expectation at 200 GeV

ϒ(1S) does not melt

ϒ(2S) is likely to melt

ϒ(3S) will melt

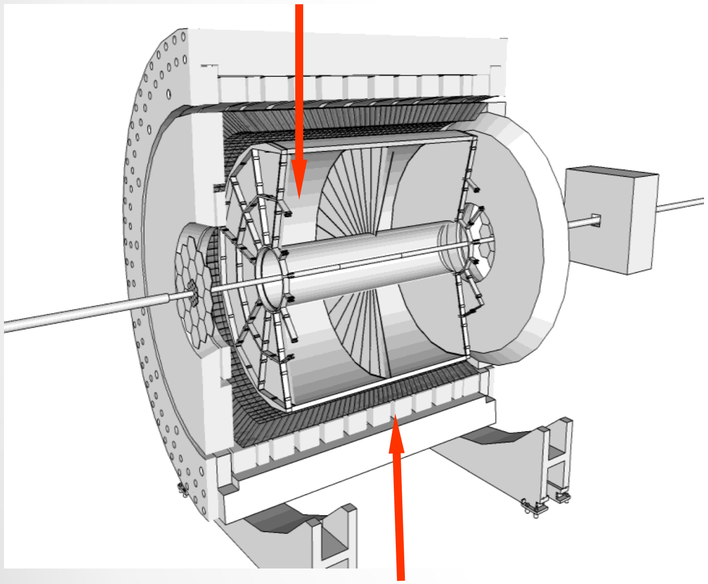
ϒ at STAR

TPC

$|\eta| < 1, 0 < \phi < 2\pi$

Tracking → momentum

dE/dx → electron ID



BEMC

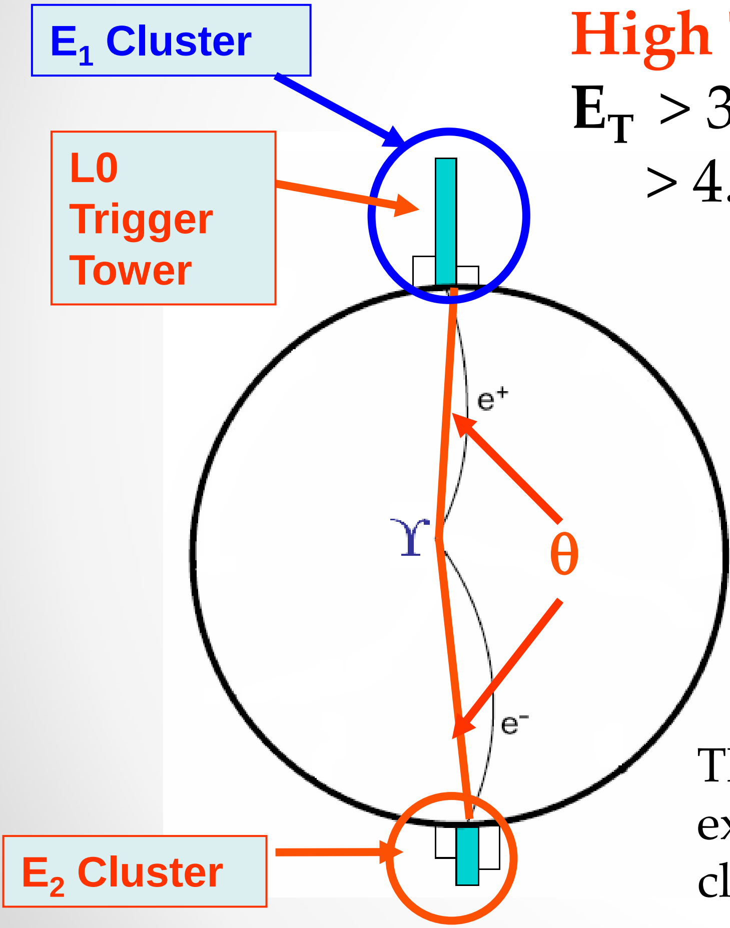
$|\eta| < 1, 0 < \phi < 2\pi$

E/p → electron ID

High-energy tower trigger

- Decay channel: $\Upsilon \rightarrow e^+e^-$
- Pros
  - Small background at M~10 GeV/c^2
  - Co-mover absorption is small at 200 GeV
  - Recombination negligible at 200 GeV
  - Large Acceptance
  - Fast Trigger
- Cons
  - Low rate of 10^{-9} per minbias pp interaction
  - Good resolution needed to separate 3 S-states

Trigger and Analysis



High Tower

E_T > 3.5 GeV (pp)

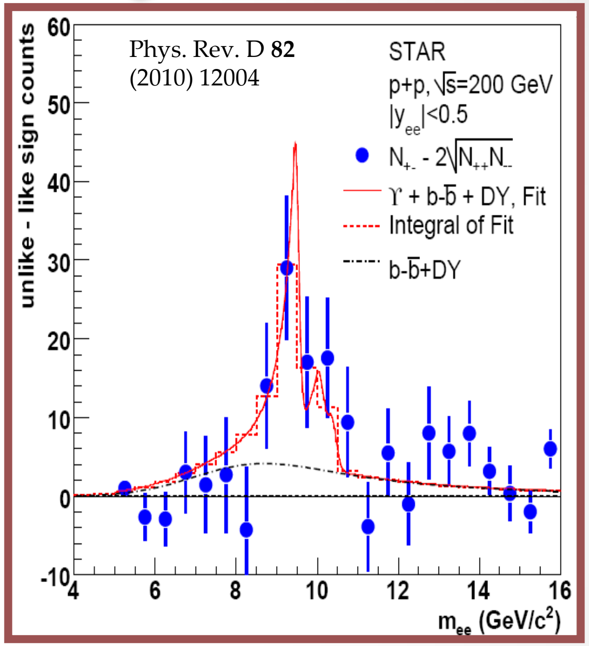
> 4.0 GeV (AuAu)

L2 Parameters (pp only)

E_1 Cluster, E_2 Cluster, Cos(θ), Invariant Mass

TPC tracks are extrapolated to trigger clusters

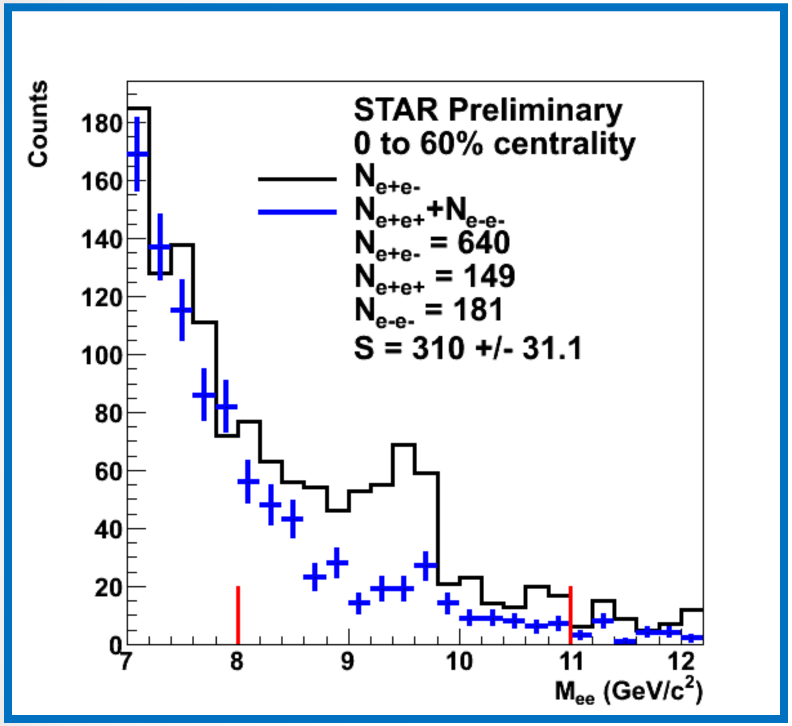
E/p and dE/dx used to select e^+ and e^- tracks

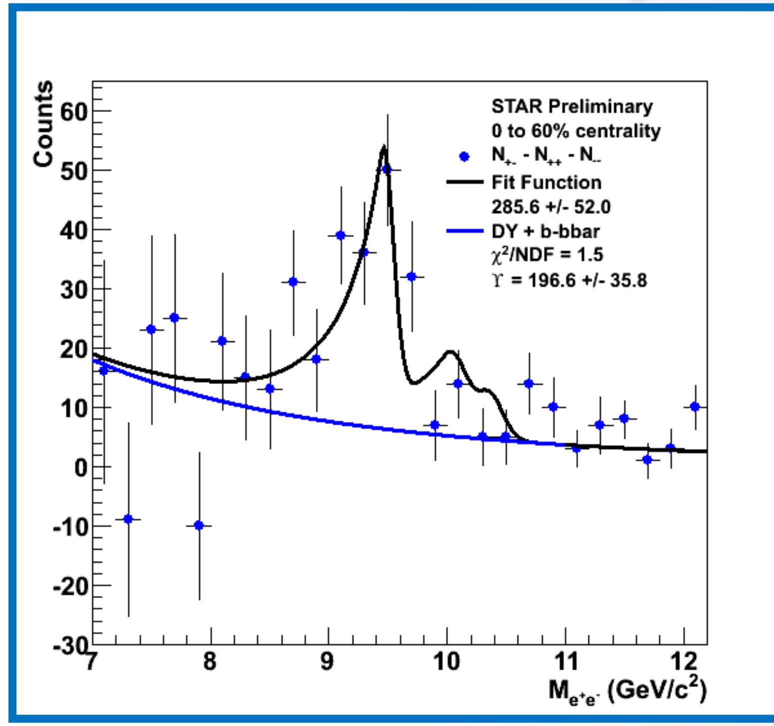


p+p cross-section

$$\sum_{n=1}^{3} \mathcal{B}(nS) \times \sigma(nS) = 114 \pm 38\ ^{+23}_{-24}\ \mathrm{pb}$$

Υ Yield 0-60% Centrality





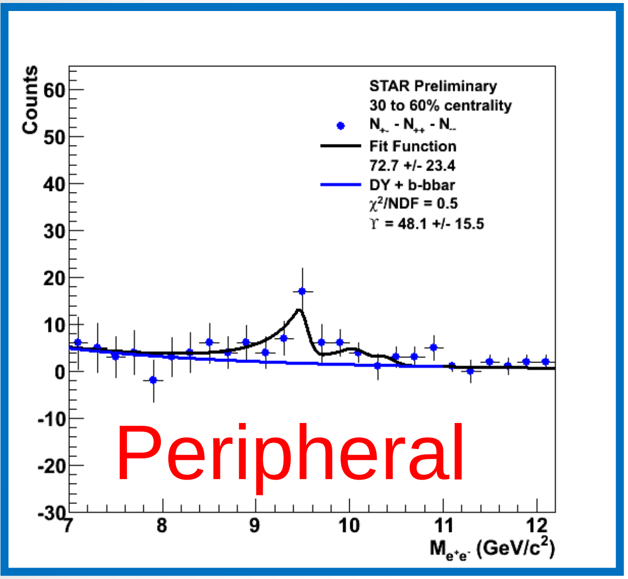
Raw yield of $\Upsilon \rightarrow e^+e^-$ with $|y|<0.5$ = 196.6 ±35.8

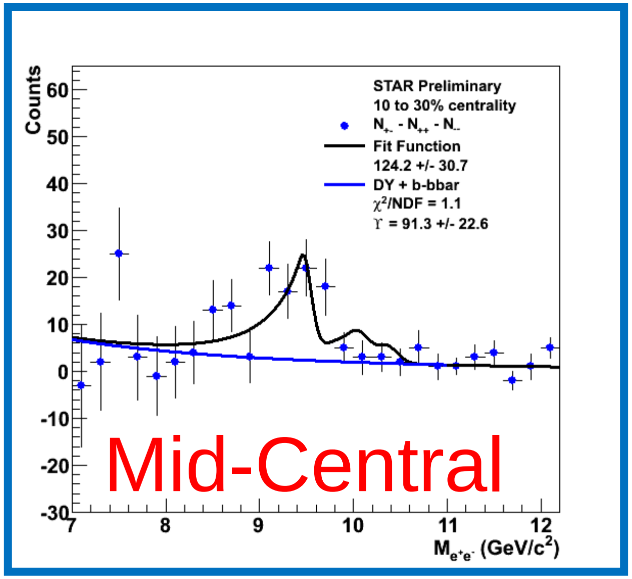
$= N_{+-} - N_{--} - N_{++} - \int DY + b\bar{b}$

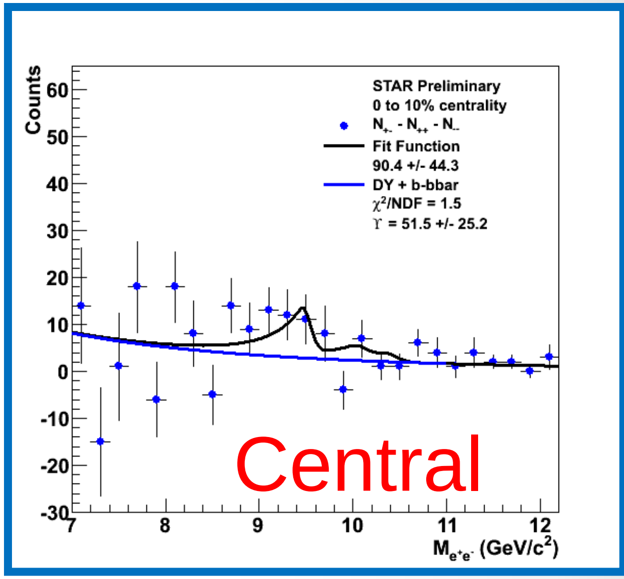
$$\text{Drell-Yan}+b\bar{b} = \frac{A}{(1+\frac{m}{m_0})^n}$$

n = 4.59, m_0 = 2.7

Υ Yield by centrality

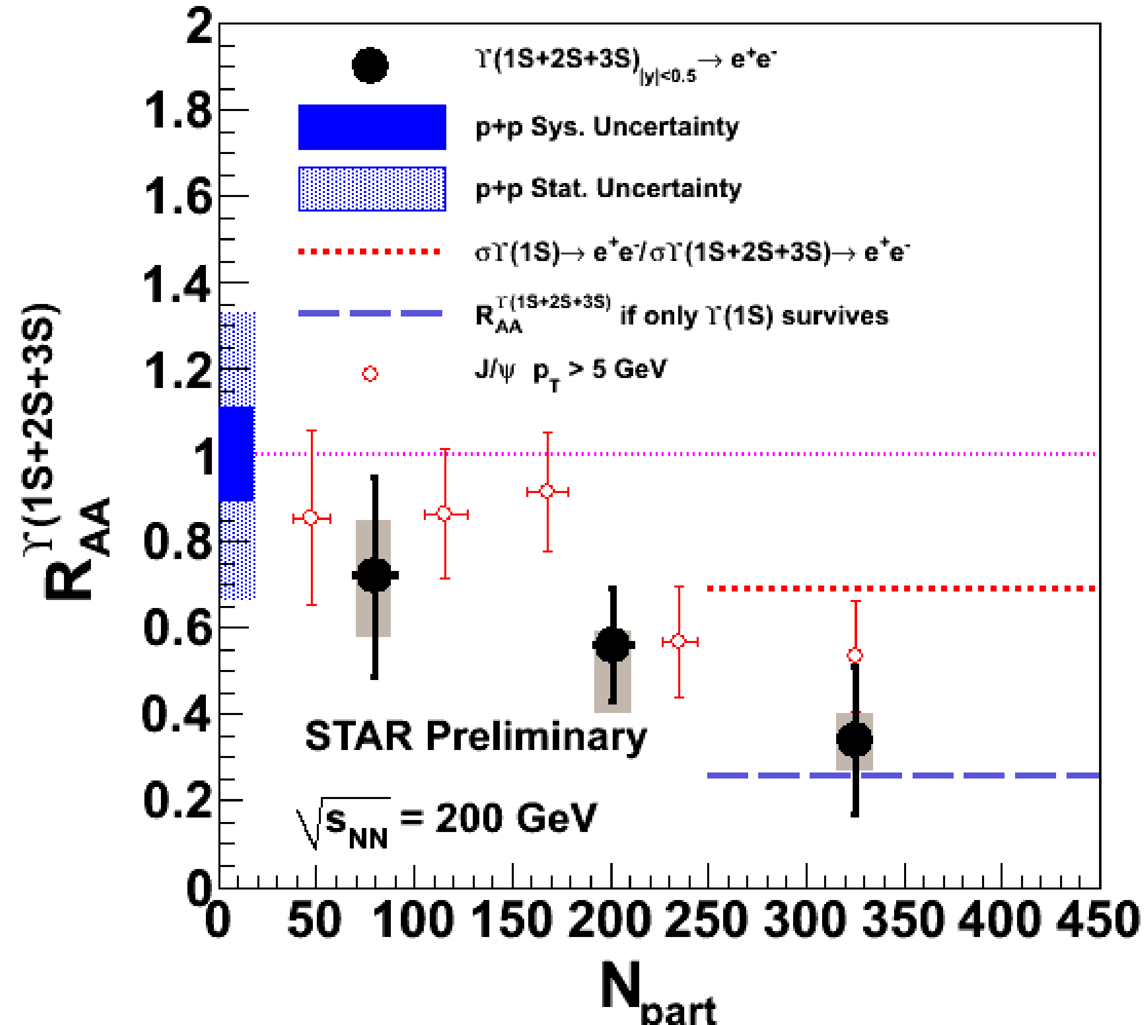






- System uncertainties
  - p+p luminosity and bbc trigger efficiency
  - Υ Line-shape
  - Drell-Yan and $b\bar{b}$ background

$\Upsilon(1S+2S+3S)\ R_{AA}$



Conclusions

- Υ(1S+2S+3S) is suppressed in central collisions! 3σ away from $R_{AA} = 1$
- R_{AA} (0-60%)=0.56$\pm$0.11(stat)+0.02/-0.14(sys)
- R_{AA} (0-10%)=0.34$\pm$0.17(stat)+0.06/-0.07(sys)
  - Additional 33% statistical and 11.4% systematic due to uncertainties on p+p cross-section
- 3x the p+p statistics (run 9) + ~2x the Au+Au statistics (run 11) will decrease the uncertainty