Dielectron production in p+p and Au+Au collisions at $\sqrt{s_{NN}}$ = 200GeV at STAR

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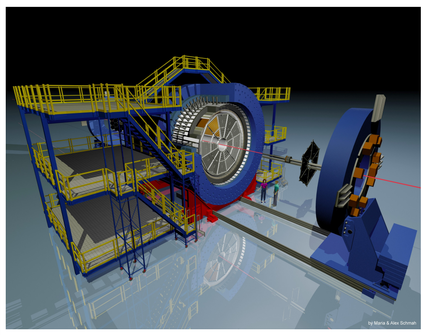
Abstract

We report the newest STAR measurement of dielectron production in p+p and Au+Au collisions at $\sqrt{s_{NN}}$ = 200GeV. The data sets used in the analysis include large samples collected in year 2010 for Au+Au and year 2012 for p+p.

We present the centrality and p_T dependence of dielectron production from low-mass (M_{ee}<1.1 GeV/c^2) and intermediate-mass (1.1<M_{ee}<3 GeV/c^2) regions. The results were measured in the STAR acceptance at midrapidity with full azimuth coverage. The measurements are compared with various models to gain insight of underlying physics.

STAR Detector

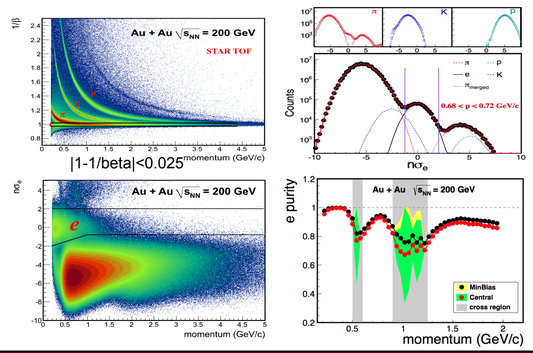


- **Time Projection Chamber** (0<ϕ<2π, |η|<1)
  - *Tracking – momentum*
  - *Ionization energy loss – dE/dx (particle identification)*
- **Time Of Flight detector** (0<ϕ<2π, |η|<0.9)
  - *Timing resolution <100 ps - significant improvement for PID*

Data Set (after event selection):

Run Type	Year	Central	Minbias
AuAu200GeV	2010	150M	270M
pp200GeV	2012	N/A	375M

Electron Identification

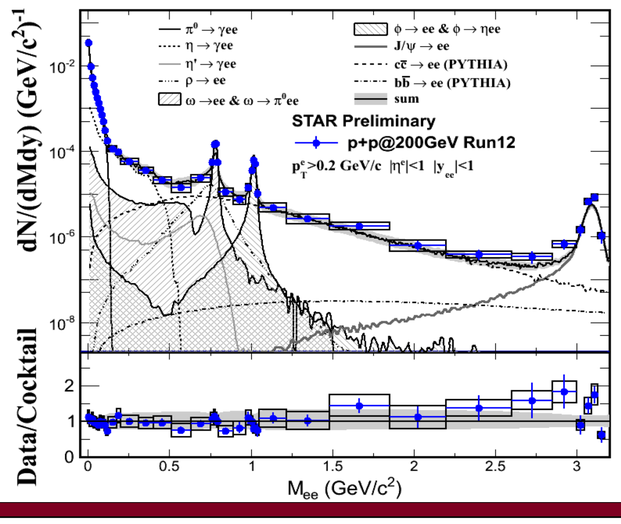


Clean electron PID in p+p and Au+Au collisions with a combination of TPC dE/dx and TOF velocity.

Electron purity: (0.2-2.0GeV/c)

AuAu 200GeV	MinBias	~95%
	Central	~93%
pp 200GeV	MinBias	~98%

pp 200GeV result from year 2012



Photon conversion background are removed.

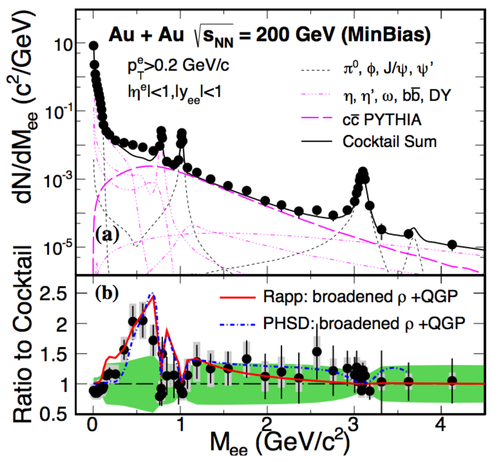
Cocktail is taken from ***[Phys. Rev. C 86, 024906 (2012)]*** with charm cross section changed to 0.797+0.3/-0.36mb ***[Phys. Rev. D. 86, 072013(2012)]***

Within uncertainty, the cocktail simulation reproduces the data very well.

With a full TOF coverage and more data taken, year 2012's result has greatly improved statistics ~ 7 times more than year 2009.

AuAu 200GeV results

Submited to PRL arXiv:1312.7397



Enhancement at ρ like region(0.30-0.76 GeV/c^2):

1.77±0.11(stat.)±0.24(sys.)±0.41(cocktail) in MinBias.

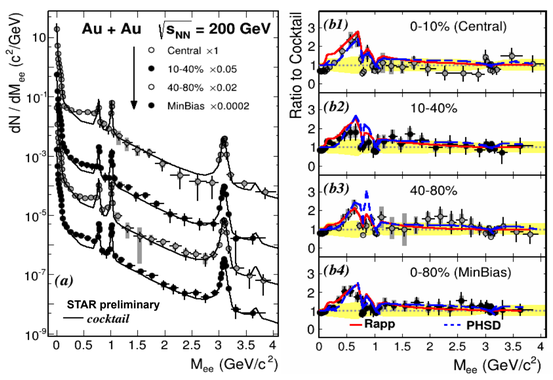
Data is compared with two models both based on a ρ broadening scenario:

1) Model I by Rapp et al. is an effective many-body model.**[*R. Rapp, PoS CPOD2013, 008 (2013)*]**

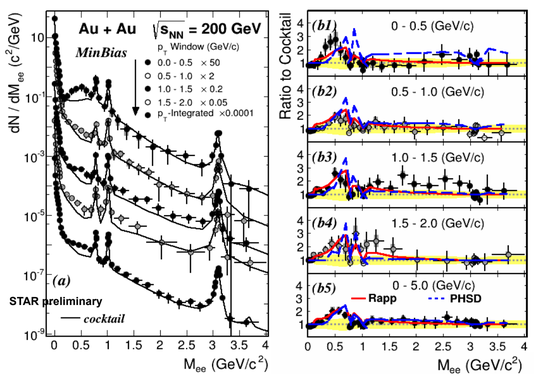
2) Model II is a microscopic transport model – Parton-Hadron String Dynamics (PHSD). **[*O. Linnyk et al., Phys. Rev. C 85, 024910 (2012)*]**

Models show good agreement with data within uncertainty.

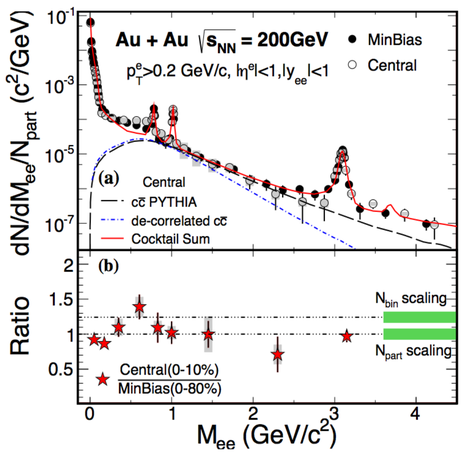
Centrality dependence



p_T dependence



The two model calculations show good agreement with data within uncertainty.



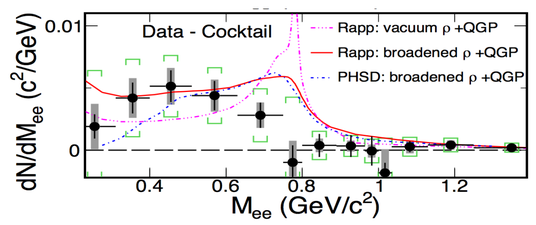
Possible charm de-correlation in IMR

Ratio(*Central/MinBias*) shows 1.8σ deviation from the N_{bin} scaling in 1.8<M_{ee}<2.8GeV/c^2.

Possible charm de-correlation in Au+Au collision or other source from thermal radiation.

arXiv:1312.7397

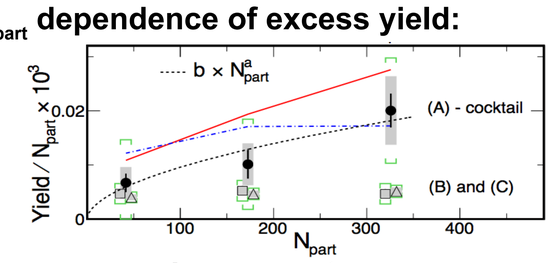
1) Excess in LMR (MinBias) :



Broadened ρ model calculations can explain STAR data within uncertainties.

Our measurements disfavor a pure vacuum ρ model with a $\chi^2/NDF = 25/8$ in 0.3~1 GeV/c^2.

2) N_{part} dependence of excess yield:

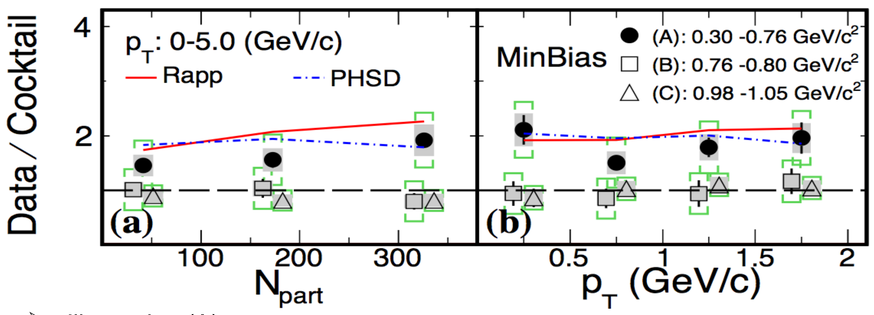


(A) ρ like region : 0.3~0.76GeV/c^2
(B) ω region: 0.76~0.80GeV/c^2
(C) ϕ region: 0.98~1.05GeV/c^2

- ω and ϕ region (B), (C):
  --- Yield shows N_{part} scaling.
- ρ like region (A):
  --- Significant excess. Sensitive to the QCD media dynamics. A power fit shows:

$$Y^{\rho}_{excess} \propto N^{1.54\pm0.18}_{part}$$

3) Low mass enhancement



- ρ like region (A):
  --- The enhancement shows weak dependence on centrality and p_T.
- ω and ϕ region (B), (C):
  --- Cocktail can reproduce the yield.

arXiv:1312.7397

Conclusion:

- **Low-mass region:**
  - ➔An enhancement is observed in LMR, with a data/cocktail ratio about 1.77±0.11(stat.)±0.24(sys.)±0.41(cocktail) in MinBias. The enhancement shows weak centrality and p_T dependence.
  - ➔Within uncertainties, broadening of ρ model calculations can explain the enhancement in data.
- **Intermediate-mass region:**
  - ➔Data gives hint for possible charm de-correlate effect in Au+Au collision.
  - ➔Need more precise measurement to constrain charm and QGP thermal radiation contributions: HFT, MTD!!

Work underway to combine Au+Au at 200GeV statistics of year 2010 and year 2011 (with 480 million minbias events).