Analysis of the dielectron continuum in AuAu at 200 GeV with the PHENIX experiment at RHIC

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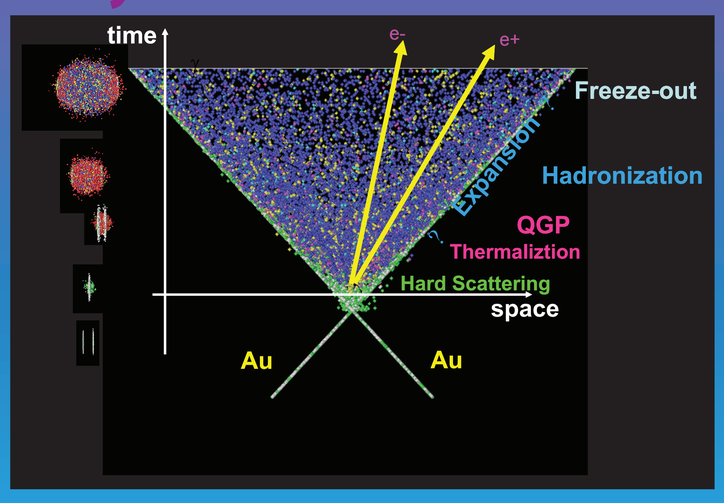
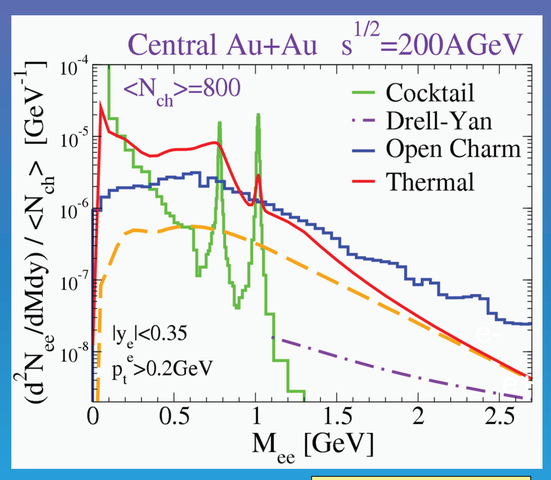
for the PHENIX Collaboration

Physics Motivations



electro-magnetic radiation:
$\gamma, e^+e^-, \mu^+\mu^-$
rare, emitted "any time";
reach detector unperturbed by strong final state interaction
--> probe the full evolution of the collision



R. Rapp nucl-th/0204003

Expected sources

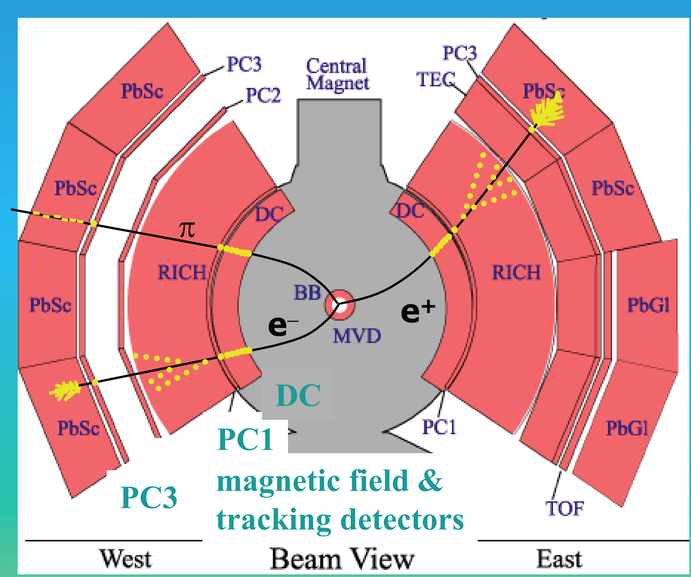
- Light hadron decays
  - Dalitz decays π^0, η
  - Direct decays ρ/ω and ϕ
- Hard processes
  - Charm (beauty) production
  - Important at high mass & high p_T
  - Much larger at RHIC than at the SPS
- Cocktail of known sources
  - Measure π^0, η spectra & yields
  - Use known decay kinematics
  - Apply detector acceptance
  - Fold with expected resolution

Detector & Analysis

PHENIX central arm
optimized for Electron ID

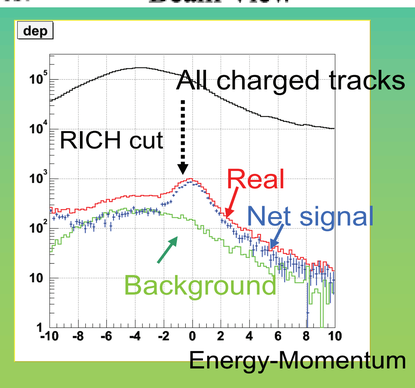
- Track
  - Charged particle tracking:
  - DC, PC1, PC2, PC3 and TEC
  - Excellent mass resolution (1%)
- Cherenkov light RICH
- EM shower EMCAL

Pair cuts to remove hit sharing

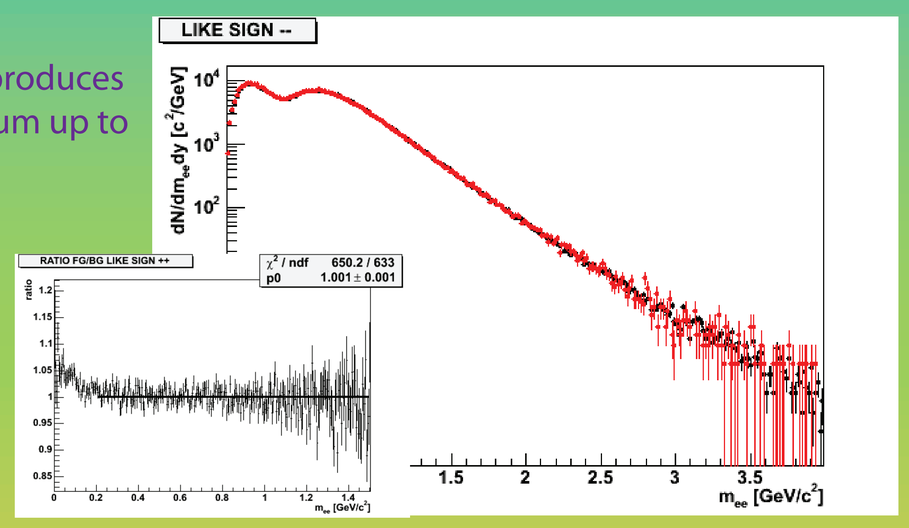


Combinatorial Background

Which belongs to which? Combinatorial Background
$\gamma \to e^+e^-$ $\gamma \to e^+e^-$ $\gamma \to e^+e^-$ $\gamma \to e^+e^-$
$\pi^0 \to \gamma e^+e^-$ $\pi^0 \to \gamma e^+e^-$ $\pi^0 \to \gamma e^+e^-$ $\pi^0 \to \gamma e^+e^-$
PHENIX 2 arm spectrometer acceptance:
$dN_{like}/dm \neq dN_{unlike}/dm \to$ different shape $\to$ need event mixing
like/unlike differences preserved in event mixing
$\to$ Same normalization for like and unlike sign pairs
$\to$ Like sign used as cross-check



Background reproduces like-sign spectrum up to **1%**

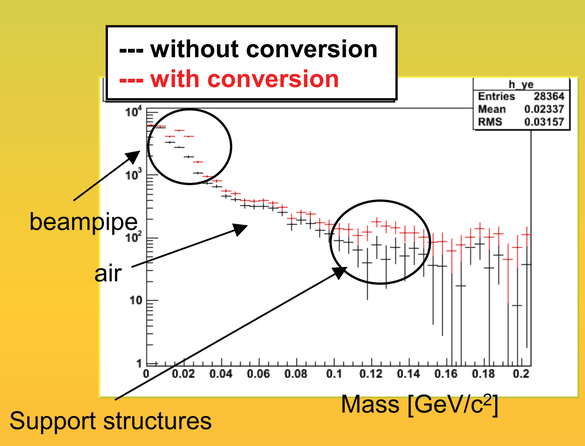


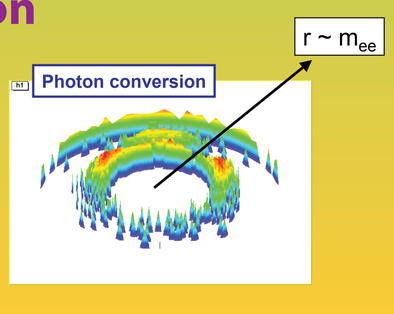
Normalization

Different independent normalizations used to estimate sys error
Measured like sign yield
Event counting: $N_{event} / N_{mixed\ events}$
Poisson assumption: $N\pm = 2\sqrt{N++N--}$
Track counting: $\langle N\pm\rangle = \langle N+\rangle\langle N-\rangle$
All the normalizations agree within 0.5%

Normalization: measured like sign yield
Systematic error: 0.25%

Photon Conversion Rejection



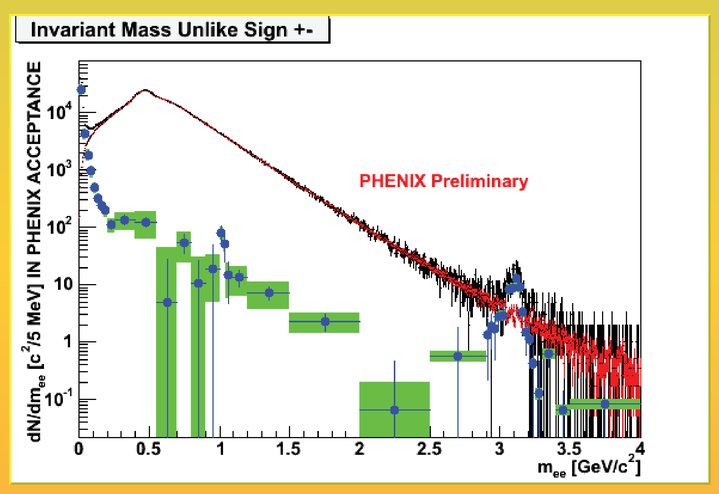


$\gamma \to e^+e^-$ at $r \neq 0$ have $m \neq 0$
(artefact of PHENIX tracking)
effect low mass region
have to be removed

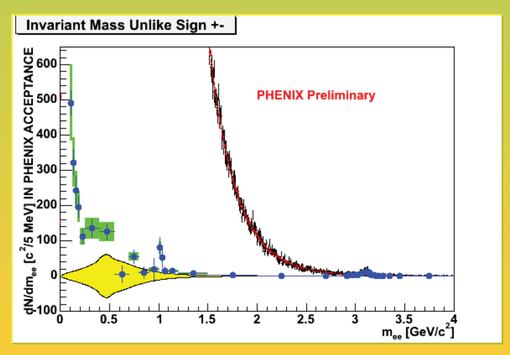
Conversion removed with orientation angle of the pair in the magnetic field

Results

Subtracted Minimum Bias Spectrum

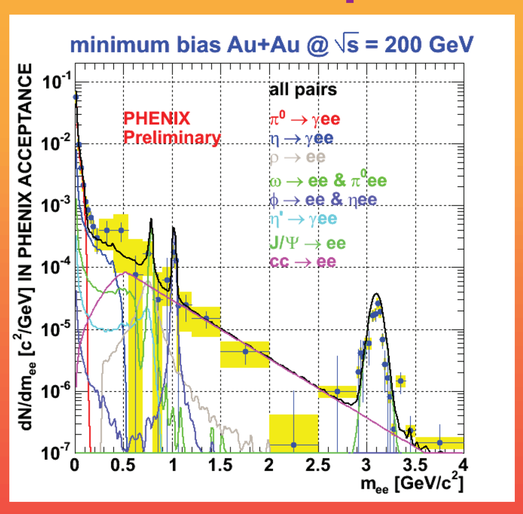


green band: all the systematics



yellow band: error on combinatorix
green band: other systematics

Cocktail Comparison



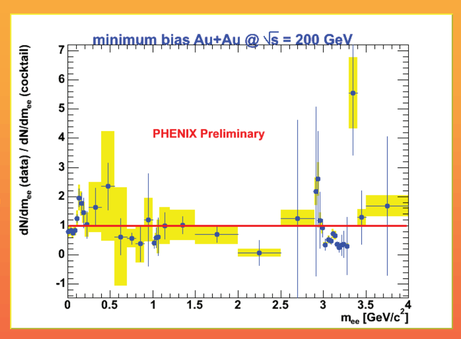
LARGE SYSTEMATICS!

Data and cocktail absolutely normalized

Cocktail from hadronic sources
Charm from PYTHIA
Predictions filtered in PHENIX acceptance
Good agreement in π^0 Dalitz
Continuum: hint for enhancement
not significant within systematics

What happens to charm?
Single e p_T suppression
angular correlation???

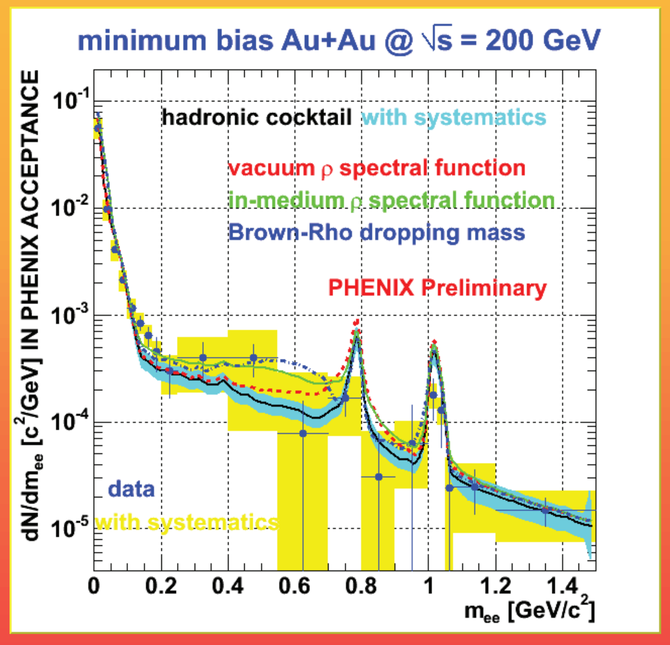
Data / Cocktail Ratio



	Measurement [10^{-5} counts/event]	Predictions [10^{-5} counts/event]
0.15-0.7 GeV/c^2	17.8 ± 3.8 ± 1.50	12.3
1.1-2.5 GeV/c^2	0.67 ± 0.50 ± 0.11	1.16

Comparison with theoretical model

dropping mass
collisional broadening
QGP thermal radiation



We shall not cease from exploration and the end of all our exploring will be to arrive where we started and know the place for the first time. (T.S.Eliot)