The Physics of Dilepton Measurements in A+A

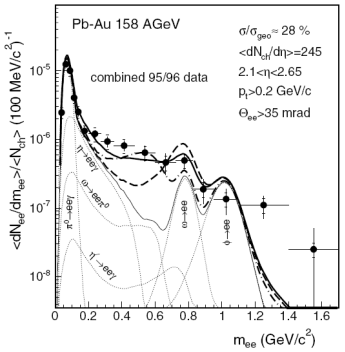
low invariant mass (M_{ee}<1.1GeV/c^2)

- study of ρ meson spectral function: probe of chiral symmetry restoration
- emission rates depend on T, total baryon density, and life time

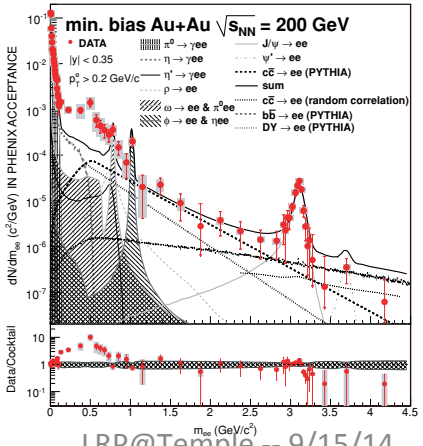
intermediate mass (1.1 < M_{ee} < 3 GeV/c^2)

- slope represents the average temperature of the medium

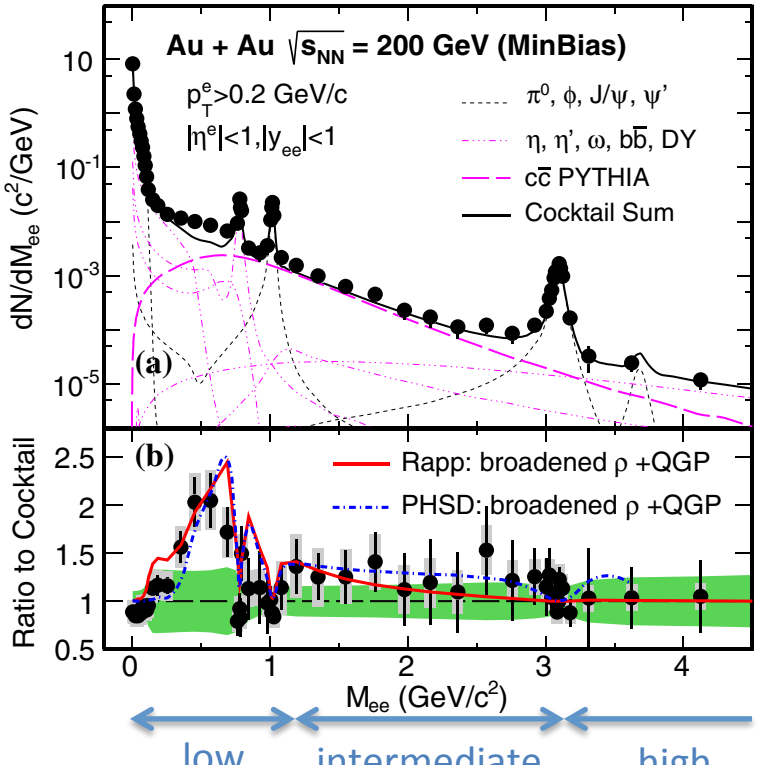
CERES, PLB 666 425 (2005)



PHENIX, PRC 81 034911 (2010)



STAR, PRL 113 022301 (2014)



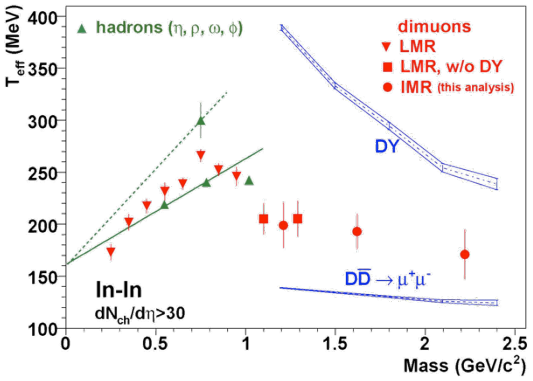
low intermediate high

ρ→e^+e^- π,η,ω,ϕ

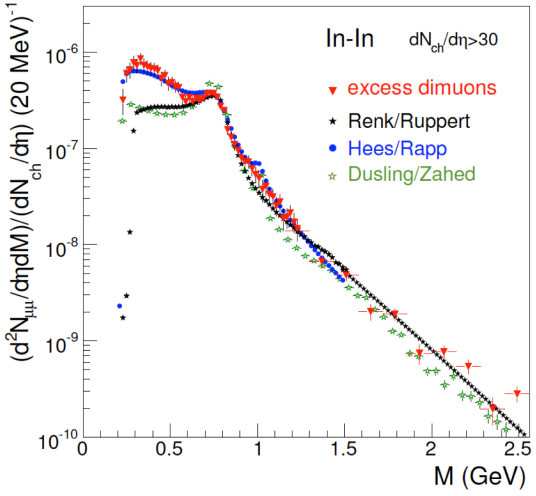
$q\bar{q} \rightarrow l^+l^-$ c → $l^{\pm}$

J/ψ, DY, Υ(1S,2S,3S)

NA60, EPJ C59 (2009) 607



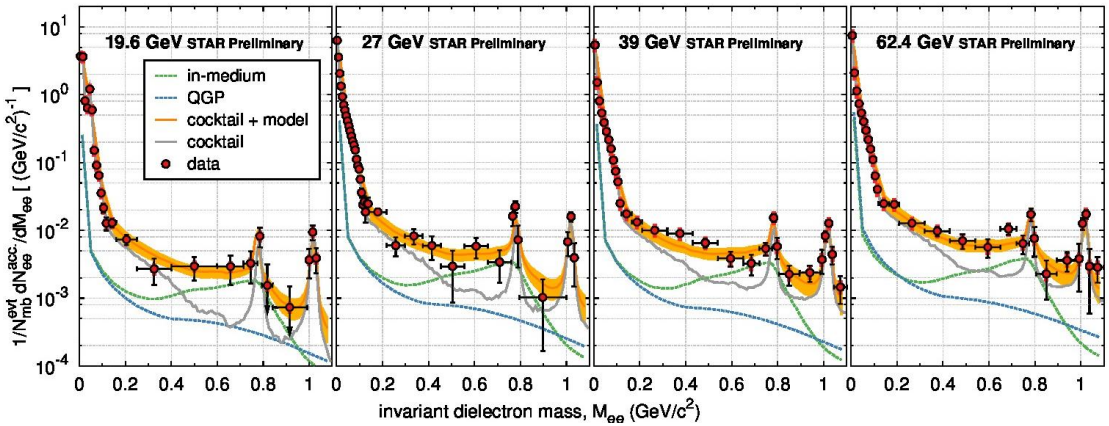
NA60, EPJ C61 (2009) 711



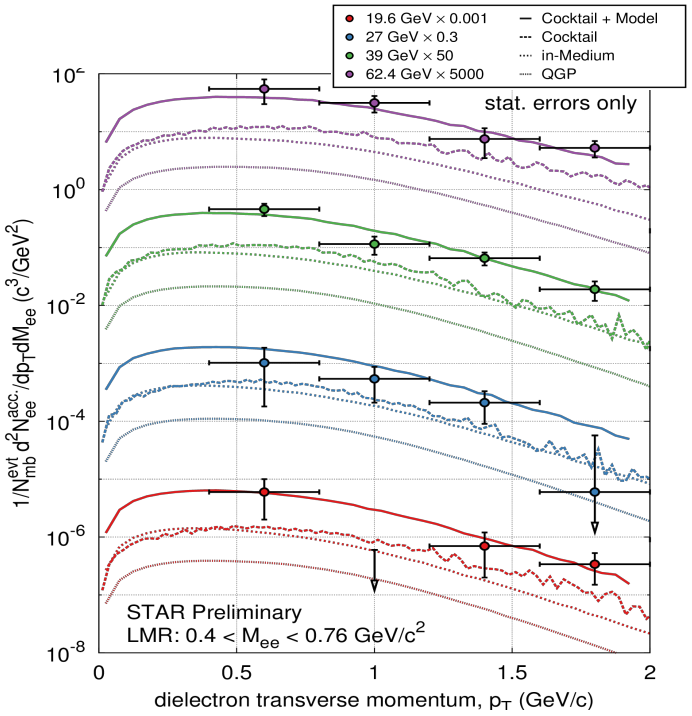
Recent Progress: RHIC Beam Energy Scan

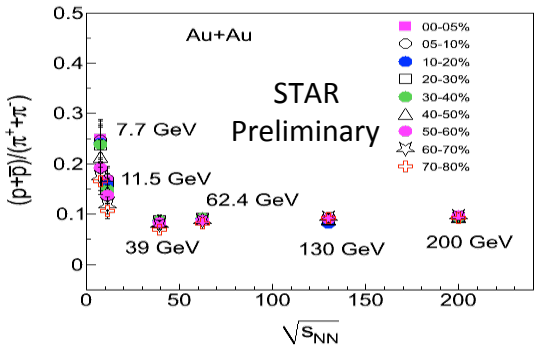
- Temperature dependence of the ρ spectral function
  - Initial state and temperature evolution is different
- broadened spectral function describes e^+e^- excess from top RHIC energy at 200 GeV down to SPS energies at 19.6 GeV
  - beam energy range where final states are similar
- N_{part} dependence as an another knob

STAR @ QM2014

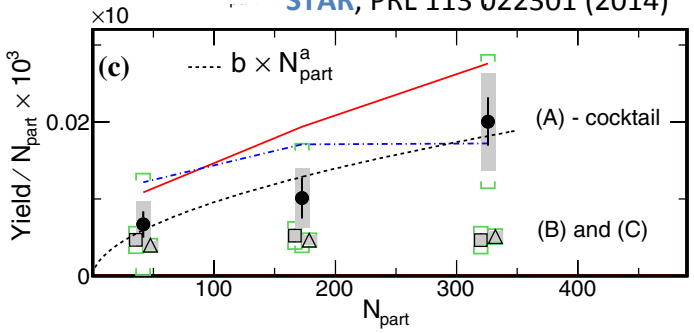


STAR @ QM2014





STAR, PRL 113 022301 (2014)



mass ranges
A= ρ-like
B=ω-like
C=ϕ-like

Future Prospects …

BES Phase 1: 19.6 – 200 GeV

- Dilepton emission dominant in T_C region and constant baryon density

➢ emission proportional to lifetime

BES Phase 2: 7.7 – 19.6 GeV

➢ Probe life time + baryon density dependence of the ρ spectral function

Down to FAIR energies

– CBM, HADES

- probe lifetime, total baryon density, and temperature dependence

At SPS: proposed NA60+

- overlap with RHIC and FAIR

… & Needs

- Include dimuon measurements
- Improve charm measurements
- Improved statistics

➢ RHIC BES Phase-2

Ruan/Rapp at BNL-RIKEN TPD'14