

Low- p_T $\mu^+ \mu^-$ pair production in Au + Au collisions at $\sqrt{s_{NN}} = 200$ GeV at STAR

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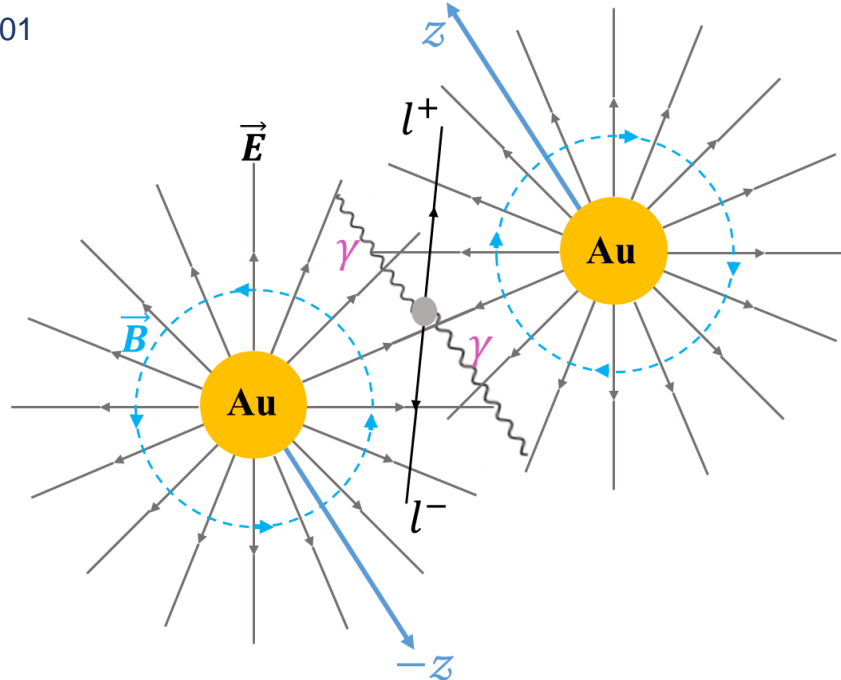
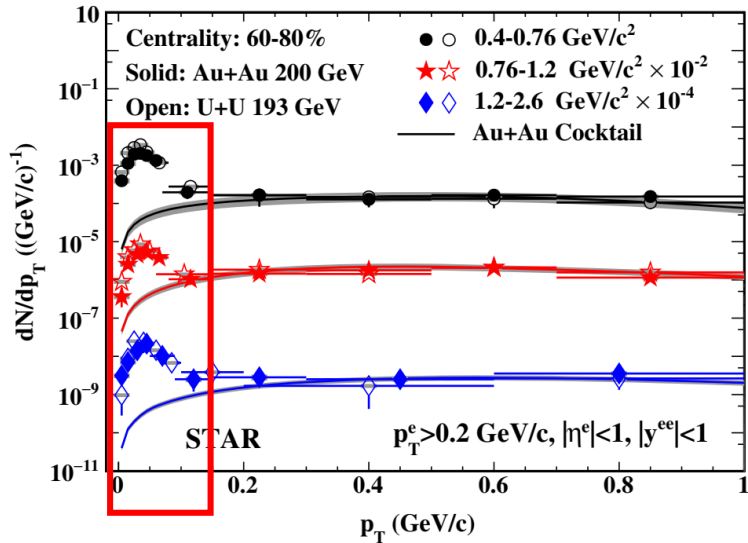
University of Science and Technology of China

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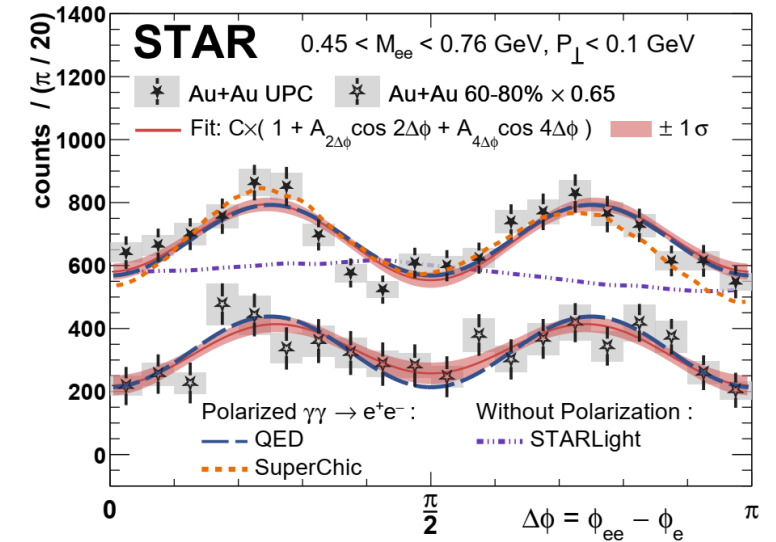


Motivation

J.Adam et al. (STAR) 2018 Phys. Rev. Lett. 121 132301



J.Adam et al. (STAR) 2021 Phys. Rev. Lett. 127 52302.

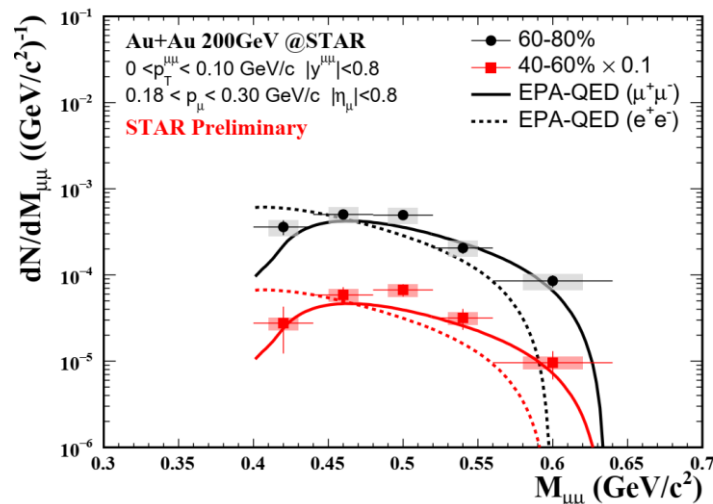
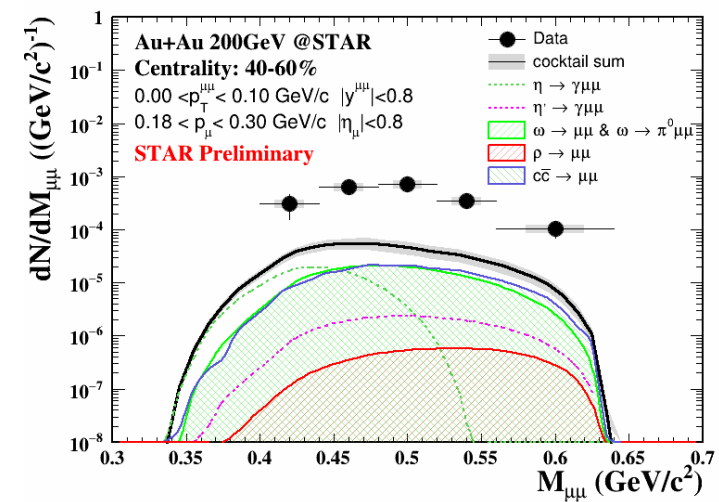
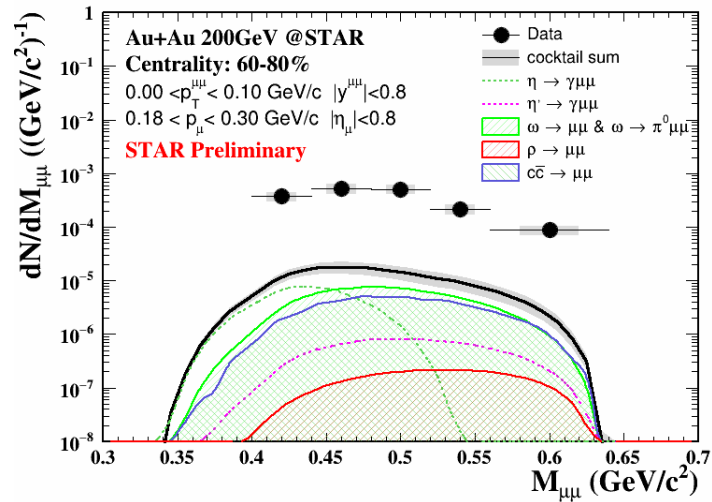
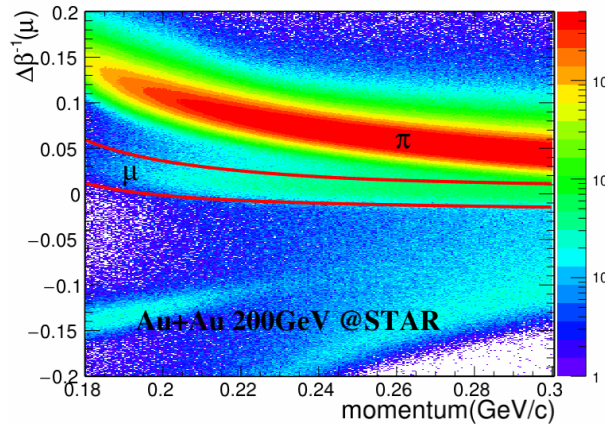


- Excess relative to the hadronic cocktail concentrates below $p_T \approx 0.15$ GeV/c.
 - Evidence of photon interactions in hadronic heavy ion collisions.
- Linearly polarized photon-photon collisions will lead to azimuthal angular modulation which is related to vacuum birefringence.
 - 4th-order azimuthal angular modulation of e^+e^- pairs has been observed by the STAR Collaboration.
 - 2nd-order azimuthal asymmetry is only sizable for $\mu^+\mu^-$ pair production.

-- C.Li et al., 2020 Phys.Rev.D 101, 034015

Invariant mass spectrum

PID cut by TOF



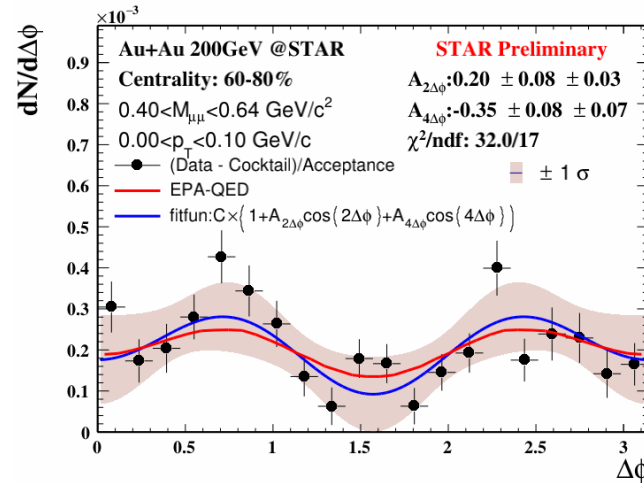
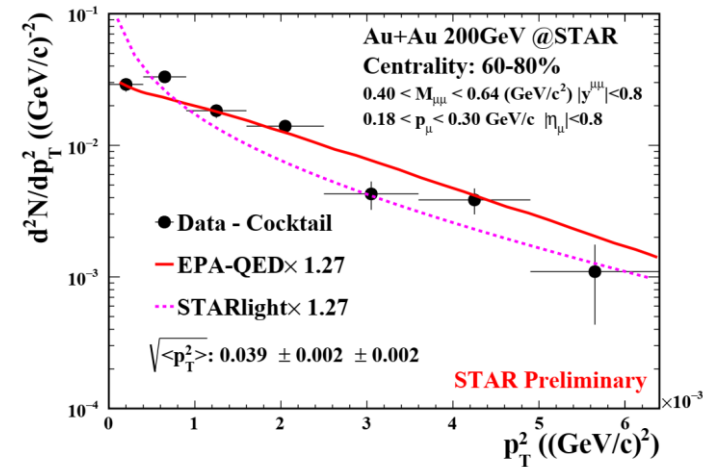
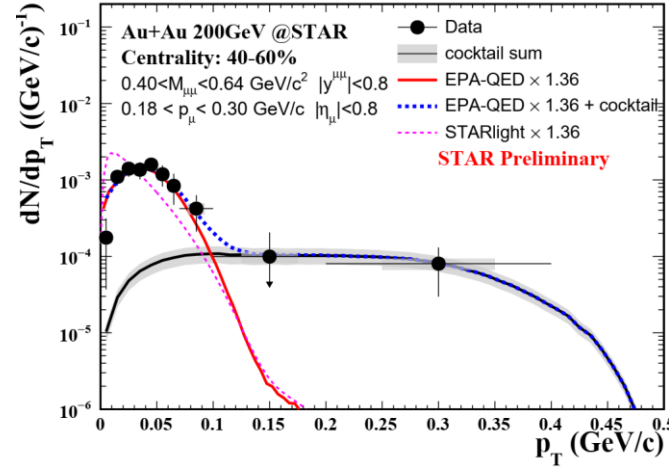
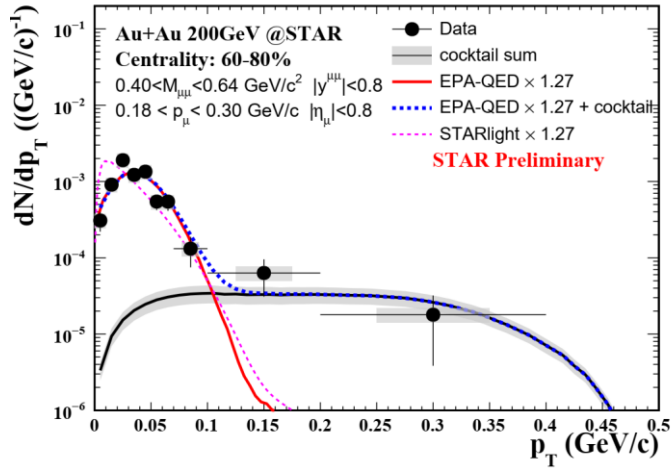
- A significant enhancement with respect to the cocktail.
- η , ω , and $c\bar{c}$ are the main sources of the cocktail.
- Consistent with the EPA-QED calculations in different centralities.

EPA-QED: W.M. Zha et al., 2020 Phys. Lett. B 800 135089

p_T , t , and $\Delta\phi$ distributions

EPA-QED: W.M. Zha et al., 2020 Phys. Lett. B 800 135089

STARlight: S.R. Klein, 2018 Phys. Rev. C 97 054903



- Excesses concentrate below $p_T \approx 0.1$ GeV/c.
- Data in favor of EPA-QED calculation.
- The $\sqrt{\langle p_T^2 \rangle}$ is consistent with the EPA-QED calculation.
- Indication of the 4th-order azimuthal angular modulation of $\mu^+ \mu^-$ pairs.
- The hint of 2nd-order azimuthal angular modulation.



- First cross-section measurements of photo-produced $\mu^+\mu^-$ pair at very low p_T in peripheral heavy-ion collisions.
 - A significant $\mu^+\mu^-$ enhancement w.r.t. cocktail is observed.
 - The p_T and t distributions are consistent with the EPA-QED calculation.
- The hint of the azimuthal angular modulation from the dimuon channel.