

Coherent low transverse momentum e^+e^- pair production in hadronic Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV and U+U collisions at $\sqrt{s_{NN}} = 193$ GeV at STAR



Shuai Yang, for the STAR Collaboration
Brookhaven National Laboratory

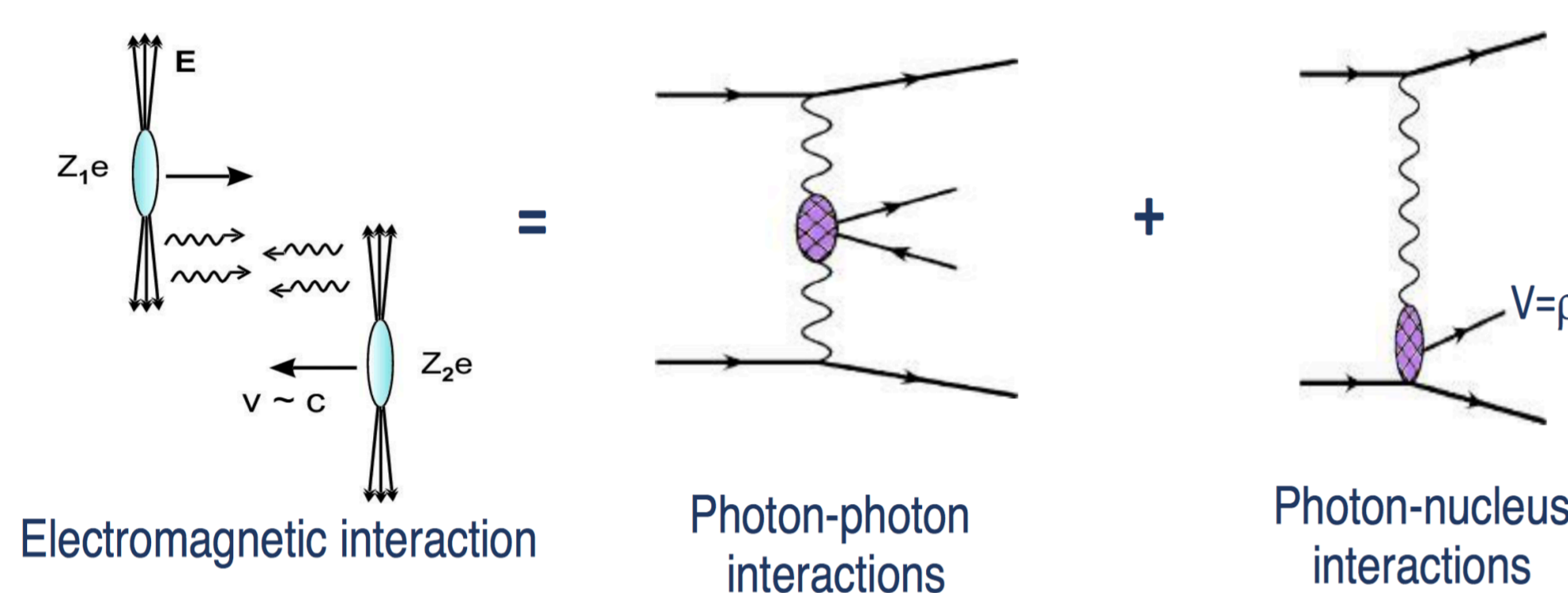


Abstract

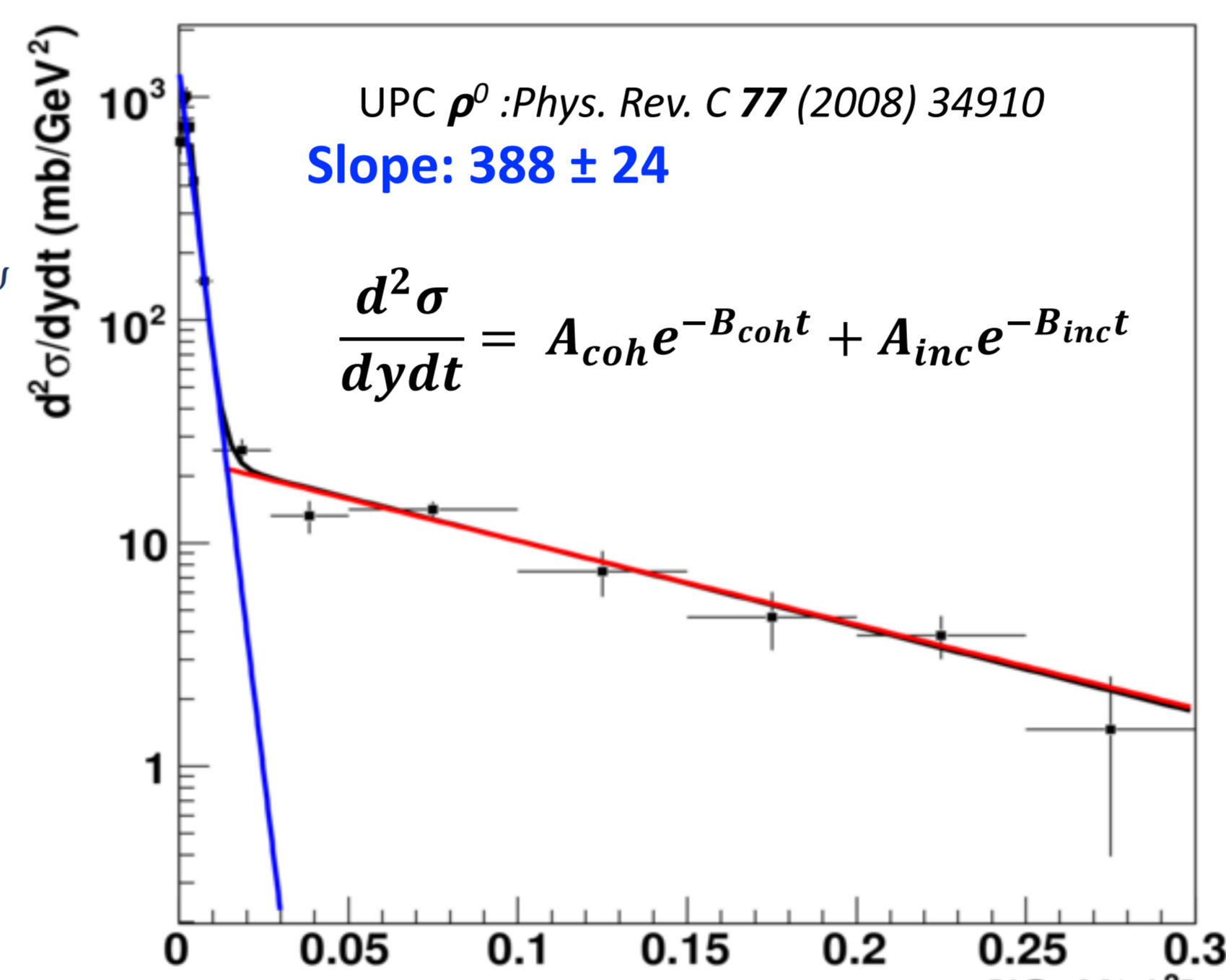
Dileptons (l^+l^-) are produced in all the stages of the heavy-ion collisions, and escape with minimum interaction with the strongly interacting medium. Thus, l^+l^- pair measurements play an essential role in the study of hot and dense nuclear matter, created in heavy-ion collisions. Recently, a significant excess of J/ψ yield at very low transverse momenta ($p_T < 0.3$ GeV/c) was reported by the ALICE [1] and STAR collaborations in peripheral A+A collisions. These observations may point to evidence of coherent photoproduction of J/ψ in hadronic interactions which conflicts with traditional knowledge of the coherent photoproduction mechanism. It is interesting to investigate the e^+e^- pair production in a wider invariant mass region ($M_{ee} < 4$ GeV/c²) at very low p_T in heavy-ion collisions for different centrality bins in order to study the production mechanism.

In this poster, we will present e^+e^- spectra with various invariant mass and p_T differentials in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV and U+U collisions at $\sqrt{s_{NN}} = 193$ GeV. The structure of the t ($t = p_T^2$) distributions of these mass regions will be shown and compared with the same distributions in ultra-peripheral collisions.

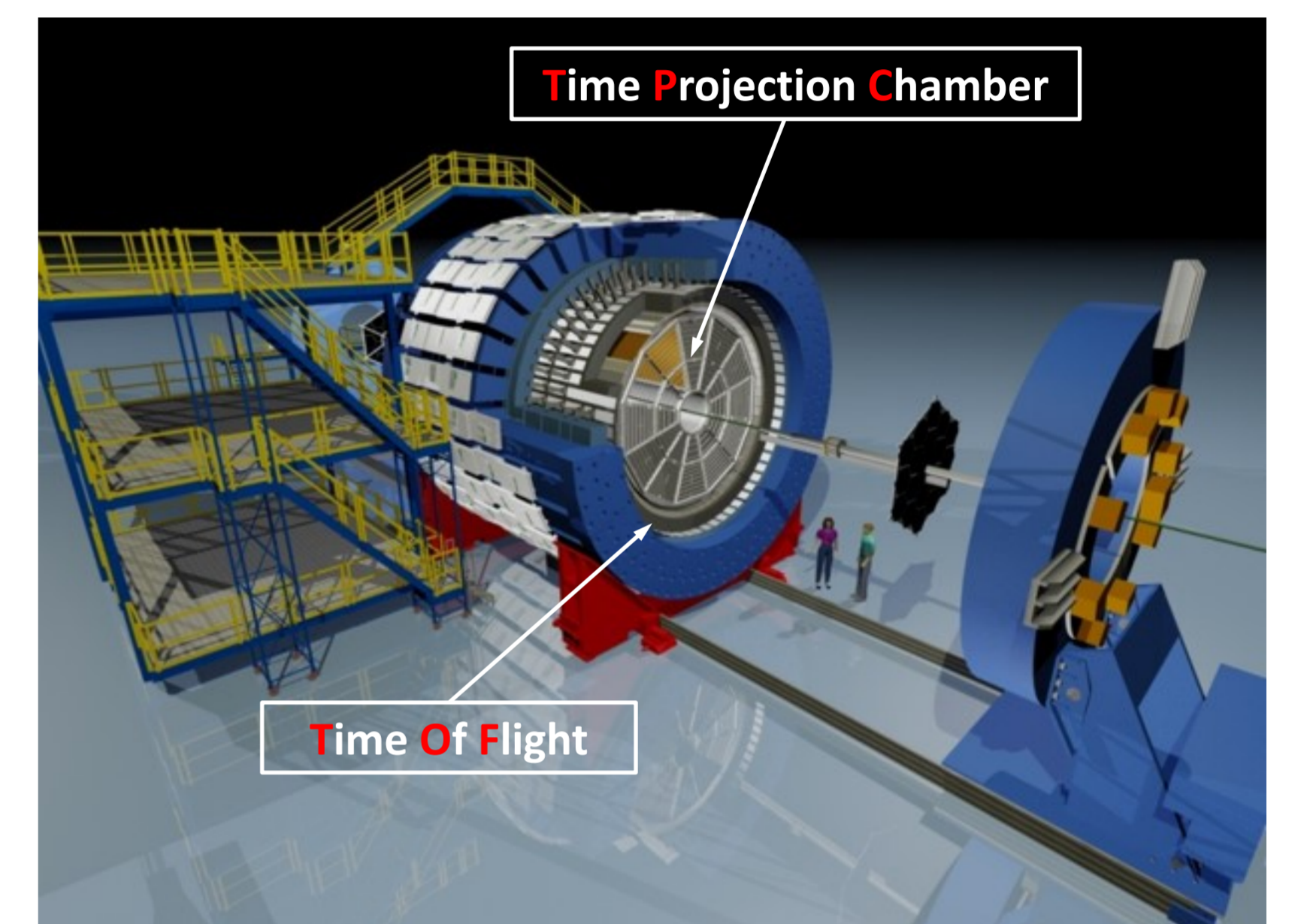
Photon interaction in ultra-peripheral A+A collisions [2]



- Photon-photon interaction
- Photon-nucleus interaction
- ✓ Coherent photoproduction
 - Restricts the final states to low transverse momenta
 - Significant destructive interference for $p_T \ll 1/b$
- ✓ Incoherent photoproduction

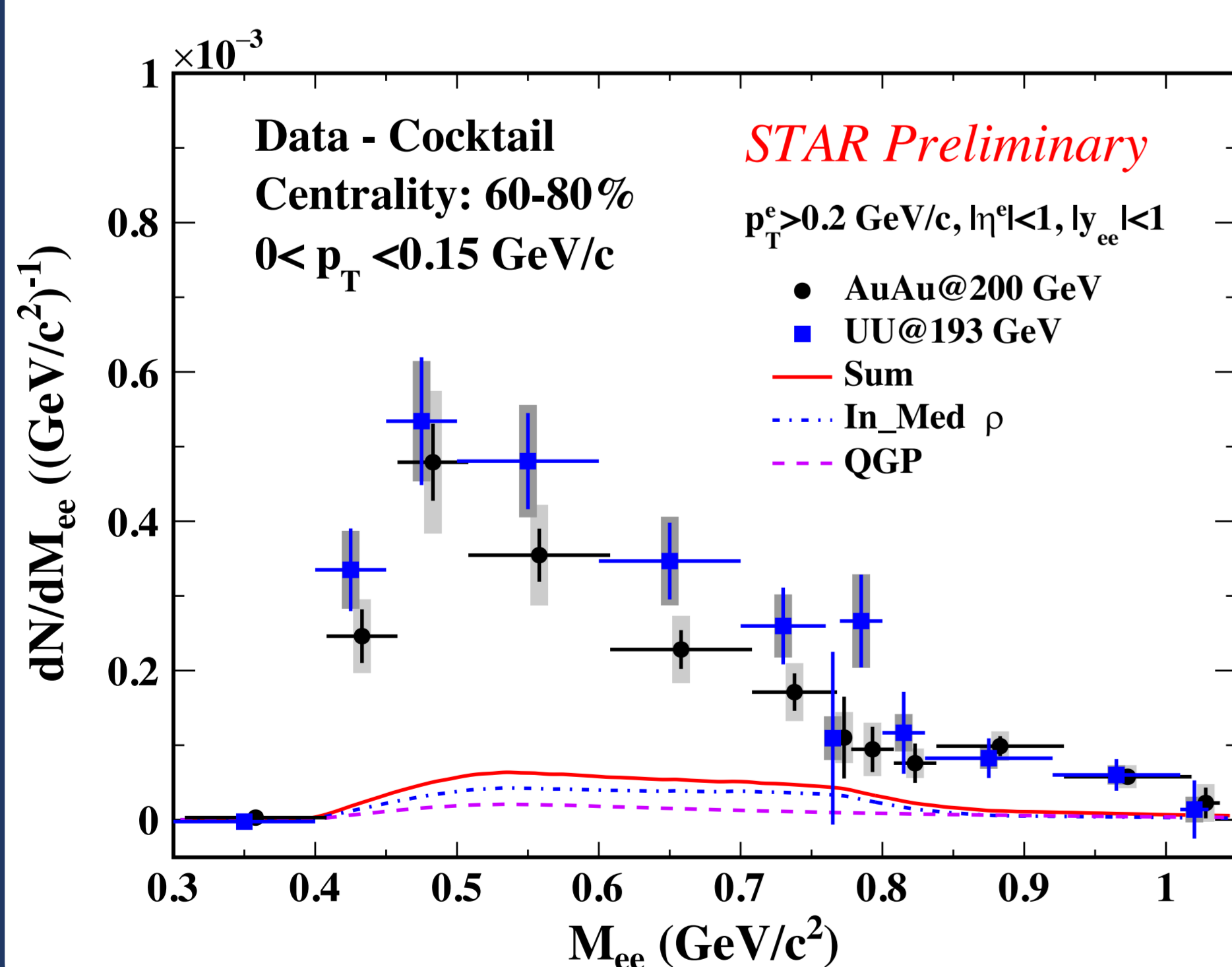
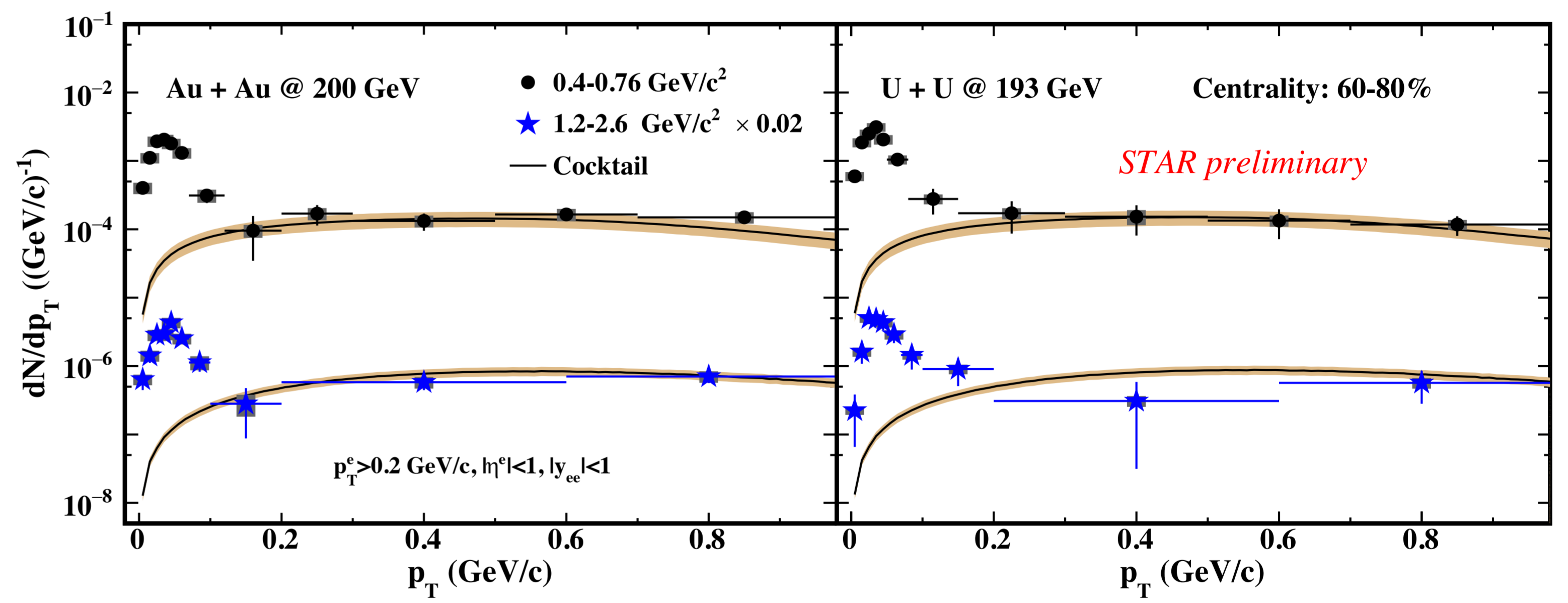
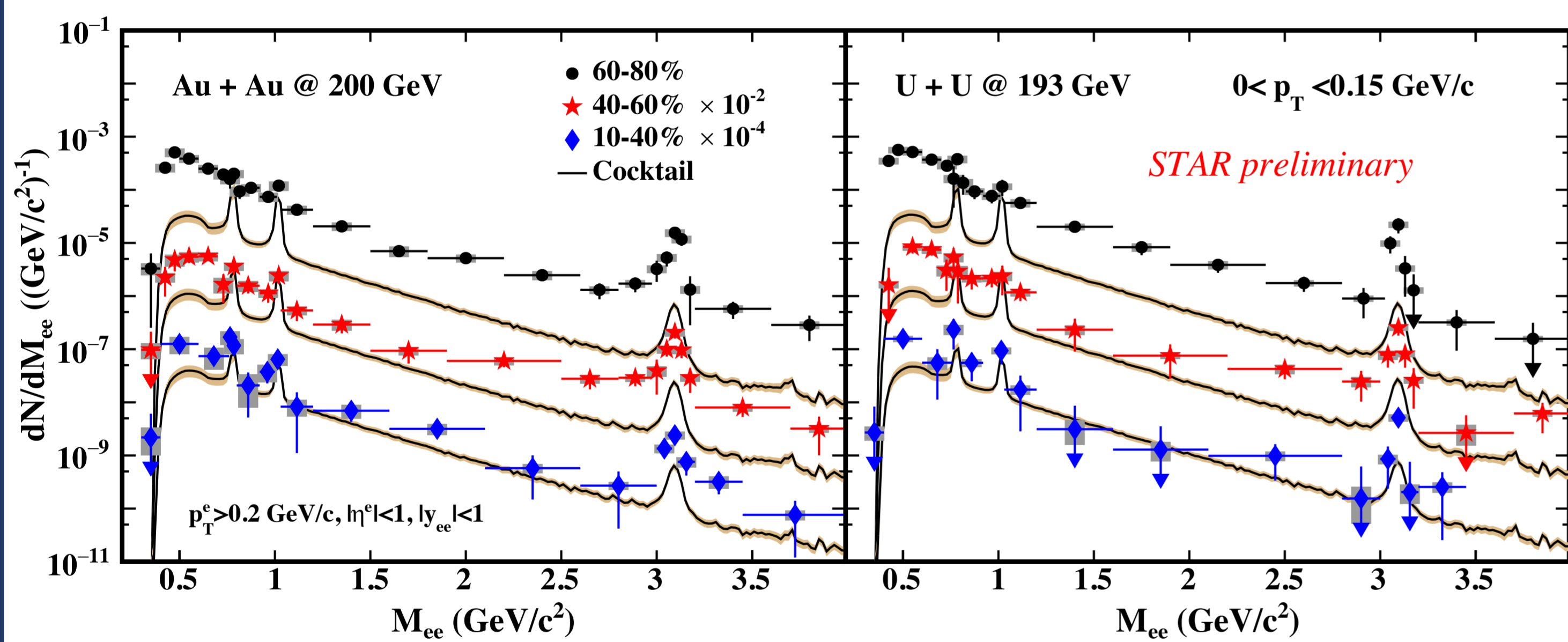


STAR experiment



- TPC: tracking, momenta, and energy loss measurement
- TOF: rejects slow hadrons and enables clean electron identification up to 3 GeV/c

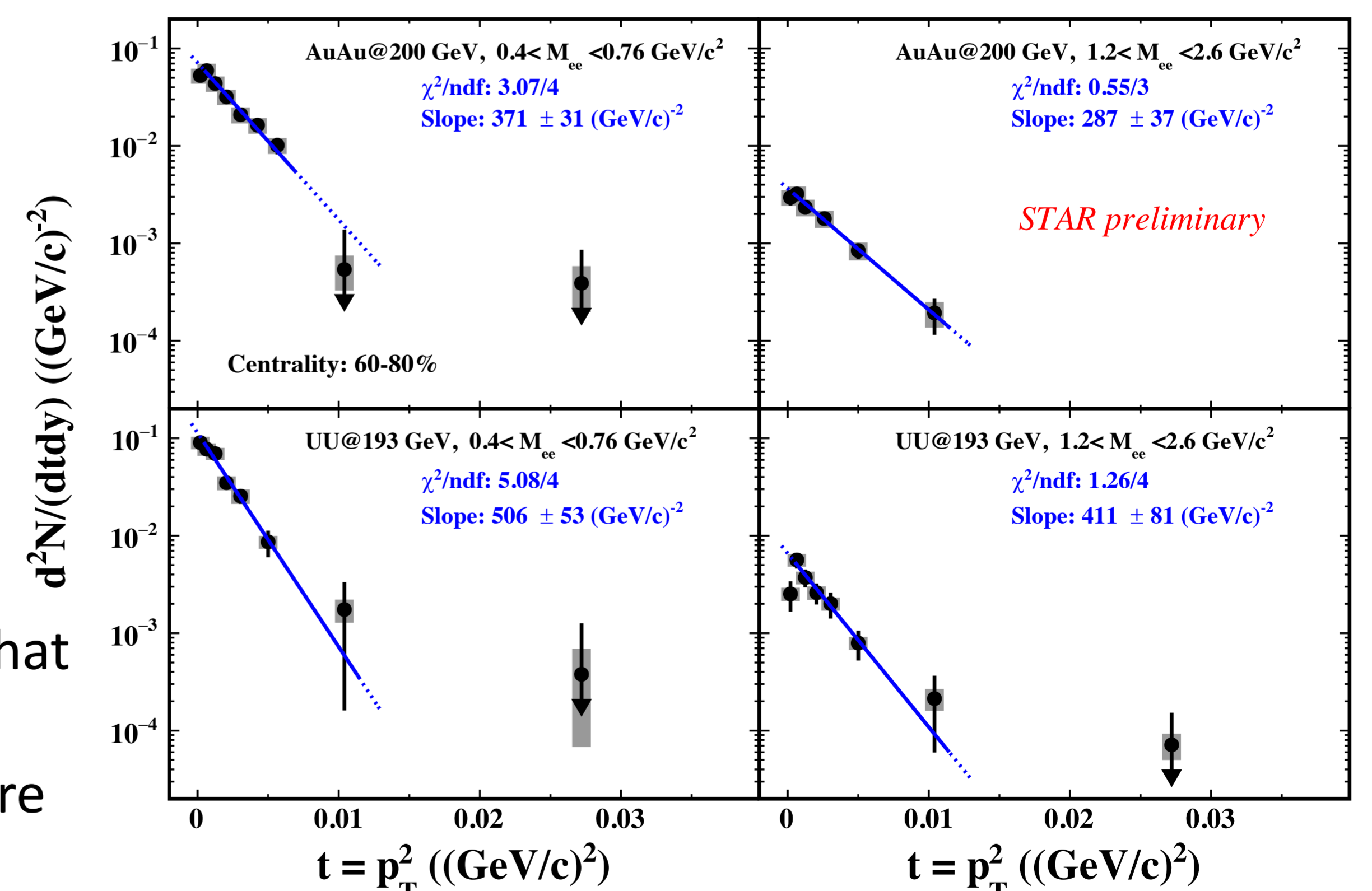
Physics results



- Enhancement can not be described by broaden ρ model calculation [3]
- Need additional source(s)

We observed Similar structure to that in ultra-peripheral collisions (UPC)

- Indication of interference structure
- Similar slope parameter



Summary

- Significant enhancement at very low p_T in the most peripheral collisions is observed in the entire mass region for the first time
- The enhancement at very low p_T has a similar structure to that in UPC

References

- [1] J. Adam *et al.* (ALICE Collaboration), Phys. Rev. Lett. 116 (2016) 222301
- [2] C. A. Bertulani, S. R. Klein, and J. Nystrand, Annu. Rev. Nucl. Part. Sci. 55 (2005) 271
- [3] R. Rapp, Adv. High Energy Phys. 2013 (2013) 148253