Open Heavy Flavor Production at Forward Rapidity in \( \sqrt{s_{NN}} = 200 \) GeV Cu+Cu Collisions

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Abstract
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1. Baseline measurements in p+p collisions

Heavy flavor measurements in p+p collisions provide a necessary baseline measurement for constructing the nuclear modification factor. They also serve as a cross check of pQCD.

PHENIX has measured both non-photonic electron spectra at mid-rapidity [1], and single muon spectra at forward/backward rapidities [2]. In each case, for calculating the total charm cross section at a given rapidity, measured \( p_T \) spectra are extrapolated to \( p_T = 0 \) GeV/c using a spectral shape derived from FONLL prediction [3]. Fig. 1 shows the PHENIX measurements of the charm cross section, \( dN_{c\bar{c}}/dy \), at mid and forward rapidities compared to FONLL predictions. Within the systematic uncertainties, the measured data points agree with theory. However, the exact rapidity evolution cannot be precisely verified due to large systematic uncertainties. The total charm cross section extracted from \( \frac{dN_{c\bar{c}}}{dy} \bigg|_{y=0} \) value is \( \sigma_{c\bar{c}} = 567 \pm 57(\text{stat}) \pm 224(\text{sys}) \mu b \). This result is in good agreement with another PHENIX charm cross section measurement, derived from electron-positron pair correlation (di-electron) analysis [4], \( \sigma_{c\bar{c}} = 544 \pm 39(\text{stat}) \pm 142(\text{sys}) \pm 200(\text{model}) \mu b \). The STAR non-photonic electron and subsequent charm cross section measurements [5] are about a factor of 2 above those of PHENIX. Joint efforts involving both experiments are underway to understand and reconcile this difference.

By triggering on non-photonic electrons, PHENIX was also able to measure the charm to bottom ratio via partial \( D^0/\bar{D}^0 \rightarrow e^+K^-X \) (\( K \) unidentified) reconstruction [6]. This ratio is then used to extract the total bottom cross section, which is measured at \( \sigma_{b\bar{b}} = 3.2 \pm 1.2(\text{stat}) \pm 1.4(\text{sys}) \mu b \). Independently, the cross section of bottom quark production was extracted from a di-electron analysis, where \( \sigma_{b\bar{b}} = 3.9 \pm 2.5(\text{stat}) \pm 3(\text{sys}) \mu b \).
Figure 1: Measured charm cross sections, $dN_{c\bar{c}}/dy$, at $y = 0$, and ±1.65 compared to a FONLL prediction.

Acknowledgments

This is where one places acknowledgments for funding bodies etc., if needed. For the large collaborations, this is listed once and for all, together with the author lists etc. in the proceedings back-material.

References

6. A. Adare et al., [arXiv:0903.4851]