



Contribution ID: 131

Type: not specified

k_T factorization approach and J/ψ production at Electron Ion collider

In this work we calculate the differential cross section for the J/ψ production in electron proton scattering. We use the k_T factorization approach with unintegrated gluon distribution function. We present distributions in transverse momentum and rapidity for COMPASS, JLab, HERMES and Electron Ion Collider centre of mass energies. Our results are compared with the experimental data for J/ψ production at electron-proton scattering experiments. We predict the total and differential cross section for the future Electron-Ion Collider (EIC) experiment. Our study is based on the off-shell photon-gluon fusion subprocess, where non-zero transverse momentum of the gluon is considered. We use parton level monte carlo event genrator KATIE for off-shell matrix element. We use different unintegrated parton distribution function (uPDFs) driven by the Ciafaloni–Catani–Fiorani–Marchesini (CCFM) evolution equation at low x . We study the production of J/ψ and its decay to $\mu^+ \mu^-$ considering kinematical constraints. We use improved color evaporation model to consider the non-perturbative evolution of $c\bar{c}$ pair into J/ψ . This study will be important to understand the unintegrated gluon distribution function and role of transverse momentum of gluons. The k_T factorization approach together with offshell matrix element give a good description of experimental data.

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Track Classification: Small-x, Diffraction, and Vector Mesons