Measurement of Transverse Spin Dependent Azimuthal Correlation
Asymmetry and Unpolarized Cross-Section of Oppositely-Charged Pion Pairs in Proton-Proton Collisions at STAR

Bernd Surrow / Babu Pokhrel for the STAR Collaboration
Temple University, Philadelphia, PA, USA

Abstract

The transversity distribution function, \( h_1^q(x) \), describes the transverse quark polarization within a transversely-polarized nucleon, where \( x \) is the longitudinal momentum fraction carried by quark \( q \). Being chiral-odd, \( h_1^q(x) \) can be accessed only when coupled with another chiral-odd function, such as the spin-dependent interference fragmentation function (IFF) via the di-hadron channel (\( \pi\pi, \pi K, KK \), etc., in the final state). In transversely polarized proton-proton collisions (\( p^\uparrow p \)), the di-hadron azimuthal correlation asymmetry, \( A_{UT}^{h_1h_2} \), that originates from the interplay between the spin of the fragmenting quark and the final state di-hadron, can be measured. This \( A_{UT}^{h_1h_2} \) involves the convolution of \( h_1^q(x) \) and IFF. However, this channel requires knowledge not only of IFF but also of the unpolarized parton fragmentation functions (FFs), specifically for gluons. Therefore, obtaining the unpolarized di-hadron cross-section (\( d\sigma_{UU}^{h_1h_2} \)) in \( pp \) is crucial to constrain gluon FF and, consequently, \( h_1^q(x) \). We will present preliminary results on \( A_{UT}^{\pi^+\pi^-} \) using \( p^\uparrow p \) data collected by the STAR experiment at RHIC at center-of-mass energies (\( \sqrt{s} \)) of 200 and 510 GeV from the 2015 and 2017 datasets, with integrated luminosities (\( \mathcal{L}_{\text{int}} \)) of 52 and 350 pb\(^{-1} \), respectively. Additionally, we will present the preliminary result of the \( d\sigma_{UU}^{\pi^+\pi^-} \) using \( pp \) data at \( \sqrt{s} = 200 \) GeV (\( \mathcal{L}_{\text{int}} = 14 \) pb\(^{-1} \)) from 2012 dataset.