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Measurement of W^\pm single spin asymmetries and W cross section ratio in polarized $p + p$ collisions at $\sqrt{s} = 510$ GeV at STAR

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The STAR experiment at RHIC has provided significant contributions to our understanding of the structure of the proton. The STAR experiment is well equipped to measure $W^\pm \rightarrow e^\pm + \nu$ in $\sqrt{s} = 510$ GeV longitudinally polarized $p + p$ collisions at mid-rapidity ($|\eta| < 1$). W single-spin asymmetries, A_L , measured as a function of decay positron (electron) pseudo-rapidity η for W^+ (W^-) are sensitive to the individual helicity polarizations of u and \bar{d} (d and \bar{u}) quarks. Due to maximal violation of parity, during the production, W bosons couple to left-handed quarks and right-handed anti-quarks and hence offer direct probes of their respective helicity distributions in the nucleon. The published STAR A_L results (combination of 2011 and 2012 data) have been used by several theoretical analyses suggesting a significant impact in constraining the helicity distributions of anti- u and anti- d quarks. In 2013 STAR collected a large sample of data at $\sqrt{s} = 510$ GeV with a total integrated luminosity of $\sim 300 \text{ pb}^{-1}$ with an average beam polarization of $\sim 54\%$. This resulted in an increase of a factor 3 in the figure of merit compared to the dataset used for previous analyses. The status of the analysis of the STAR 2013 $W A_L$ will be presented along with the future plans for final $W A_L$ results by combining both STAR 2012 and 2013 data of total integrated luminosity of about $\sim 400 \text{ pb}^{-1}$.

W cross section ratio (W^+/W^-) measurements at STAR are sensitive to unpolarized u , d , \bar{u} , and \bar{d} quark distributions. At these kinematics, STAR is able to measure the quark distributions near Bjorken- x values of 0.1. The increased statistics will lead to a higher precision measurement of the W^+/W^- cross section ratio as well as allow for a measurement of its η dependence at mid-rapidity. An update of the W cross section ratio analysis from the STAR 2011, 2012 and 2013 runs is presented.

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