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

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The STAR experiment at RHIC has been contributing to understand the structure of the proton to a great extent. The STAR experiment is well equipped to measure $W^{\pm} \to e^{\pm} + \nu$ in $\sqrt{s} = 510$ GeV of longitudinally polarized $p+p$ collisions at mid-rapidity ($|\eta| < 1$). W single-spin asymmetry, A_L, measured as a function of decay lepton (positron) pseudo-rapidity η for $W^+(W^-)$ are sensitive to the individual helicity polarizations of u / d quarks and anti-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 the STAR experiment has collected a large sample of data at $\sqrt{s} = 510$ GeV resulting total integrated luminosity of $\sim$300 pb^{-1} which is more than 3 times larger than the previous years, with an average beam polarization of $\sim$54%, comparable to run 2012. The preliminary results of the STAR 2013 W A_L analysis will be presented along with the future plans for final W A_L results by combing both STAR 2012 and 2013 data of total integrated luminosity of about $\sim$400 pb^{-1}. W cross section ratio (W^+/W^-) measurement at STAR is sensitive to unpolarized u, d, u, and 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.