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J/ψ longitudinal double spin asymmetry measurement at forward rapidity in $p+p$ collisions at $\sqrt{s} = 510$ GeV

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The polarized gluon distribution, as described by the polarized parton distribution function $\Delta g(x)$, is an important part of the spin structure of the nucleon; however the current data have very limited constraints on $\Delta g(x)$ for $x < 0.01$. During the 2013 RHIC run, the PHENIX experiment collected 146 pb^{-1} of longitudinally polarized $p+p$ data at $\sqrt{s} = 510$ GeV with an average beam polarization of 52\%. At this energy, J/ψ particles are predominantly produced through gluon-gluon interactions and thus the longitudinal double spin asymmetry, $A_{LL}^{J/\psi}$, is sensitive to the gluon polarization inside the proton. We measure the J/ψ A_{LL} in the rapidity range $1.2 < |\eta| < 2.4$ by detecting the decay $\mu^+\mu^-$ pairs using the PHENIX muon detector arms. In this kinematic range, A_{LL} is sensitive to the polarized gluon distribution at small $x \sim 2 \times 10^{-3}$ as well as at moderate $x \sim 0.05$ where recent RHIC data on jet and π^0 production show possible evidence for significant gluon polarization. Compared to previous measurements in 2005 and 2006, the Run 2013 data set has roughly twenty times more statistics and will allow us to measure $A_{LL}^{J/\psi}$ with a statistical uncertainty at ~ 1\% level. The preliminary result of this analysis will be presented.

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