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Di-jet production constraining $\Delta g(x)$ at low x in polarized $\vec{\mathbf{p}} + \vec{\mathbf{p}}$ collisions at RHIC BERND SURROW, Temple Univ, STAR COLLABORATION — Polarized $\vec{p} + \vec{p}$ collisions at $\sqrt{s} = 200\,\mathrm{GeV}$ and at $\sqrt{s} = 500\,\mathrm{GeV}$ at RHIC provide a unique way to probe the proton spin structure. Inclusive measurements, such as inclusive jet and hadron production, have so far been the prime focus of various results at $\sqrt{s} = 200\,\mathrm{GeV}$ constraining $\Delta g(x)$. A recent global analysis provides for the first time evidence of a non-zero value of the gluon polarization $\int_{0.05}^{1} \Delta g(x)\,dx\,(Q^2 = 10\,\mathrm{GeV}^2) = 0.20^{+0.06}_{-0.07}$. First results of di-jet production at $\sqrt{s} = 200\,\mathrm{GeV}$ by the STAR collaboration will allow a better constraint of the underlying event kinematics. Forward di-jet production at STAR beyond the current acceptance of $-1 < \eta < +2$, in particular at $\sqrt{s} = 500\,\mathrm{GeV}$, provides access to low x values at the level of 10^{-3} where current uncertainties of $\Delta g(x)$ remain very large. Recent STAR di-jet results constraining $\Delta g(x)$ will be briefly summarized followed by a detailed presentation of the physics case of forward di-jet production at $\sqrt{s} = 500\,\mathrm{GeV}$ for $2.5 < \eta < 4$ requiring an upgrade of the STAR forward detection system, including a discussion of the kinematic coverage and projected uncertainties.

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