

1 Transverse single-spin asymmetries and cross section of  
2 weak bosons in p+p collisions at  $\sqrt{s} = 510$  GeV

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5 **Abstract**

6 The STAR experiment at RHIC has measured transverse single-spin asymmetries of  $W^\pm/Z^0$ -  
7 bosons in proton-proton collisions at a center-of-mass energy  $\sqrt{s} = 510$  GeV (2017 data).  
8 These asymmetries probe correlations between parton motion and the proton spin in the  
9 initial state which are described in terms of transverse momentum dependent parton  
10 distribution functions (TMD), in this case the Sivers function. The Sivers function is of  
11 particular theoretical interest because its process dependence can be linked to underlying  
12 kinematics, namely the gauge link structure of the scattered parton with the nucleon  
13 remnant. This means that the Sivers function is not universal and a sign change is expected  
14 between the asymmetries measured in semi-inclusive deep inelastic scattering compared to  
15 those in hadronic collisions. The new STAR preliminary results with an integrated luminosity  
16 of about  $350 \text{ pb}^{-1}$  improve significantly on previous data from 2011. We will discuss details  
17 of the full reconstruction of the W-boson kinematics which are required for a true TMD  
18 measurement. Comparison with recent global fits will illustrate the potential impact of the  
19 new data. In addition, we will present an improved cross section measurement of  $Z^0$ -bosons  
20 as function of transverse momentum which now comprises an integrated luminosity of about  
21  $700 \text{ pb}^{-1}$ . The STAR data are complementary to existing LHC results and will provide important  
22 input into unpolarized TMD fits.