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Dilution factor calculation and its contribution to SpinQuest systematic error

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The spin of the nucleon is well established but the contribution to this intrinsic value from its constituent partons is still under intense investigation. As part of a global effort to map out these individual contributions, the SpinQuest experiment at Fermilab aims to add significantly to the level of information available on sea-quarks by measuring their Sivers function. To separate the contributions of $\bar{u}$ and $\bar{d}$ quarks to the Sivers asymmetry, the experiment uses both NH3 and ND3 polarized targets, interacting with an incoming unpolarized 120 GeV/c proton beam. The dimuons from the Drell-Yan process are detected to analyze the azimuthal asymmetry. The incoming proton beam will also interact with other materials that are present in the experimental beam path, such as the target cell walls, the aluminum insert ladder, the microwave horn, liquid helium and nitrogen in the ammonia target. The figure of merit in our extracted Sivers function is directly dependent on both the magnitude of polarization and the interaction rate from these various unwanted materials resulting in a dilution factor. With the use of MCFM (Monte Carlo simulation at femtobarn), a parton distribution based cross-section generator we can analyze the contributions from unmeasured cross-sections from these various materials to find the degree of dilution and the corresponding kinematic sensitivity. This contribution to the experimental systematic error and its management is reviewed in this presentation.

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