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Extraction of Drell-Yan Angular Parameters in pp Collisions with a 120 GeV Beam Energy Using a Deep-Learning Unfolding Algorithm

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Dilepton production in pp collisions through the Drell-Yan process provides a crucial tool for studying the internal quark-gluon structure of the nucleon. By precisely measuring the $\cos 2\phi$ asymmetry, where ϕ represents the azimuthal angle of the l^+l^- pair in the Collins-Soper frame, we can gain valuable insights into the proton's structure and the transverse momentum (q_T) dependence of the $\cos 2\phi$ asymmetry. SeaQuest, a fixed-target Drell-Yan experiment at Fermilab, involved an unpolarized proton beam colliding with unpolarized LH_2 and LD_2 targets. Measurements obtained from experiments typically require corrections for detector inefficiencies, smearing, and acceptance. Traditionally, these corrections involve "unfolding" the detector-level measurements through matrix operations. However, in higher-dimensional phase space, these conventional methods fail to scale effectively. To overcome these limitations, we employ an unbinned unfolding method that utilizes deep neural networks for unfolding higher-dimensional phase space. In this presentation, we will explain the design of the neural network architecture, our training strategies, and outline our plans to achieve conclusive results. This work was supported in part by US DOE grant DE-FG02-94ER40847.

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