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

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Abstract

Extracting particle-level information from detector measurements (unfolding) often relies on matrix methods, which become computationally expensive in high-dimensional phase spaces. We propose an unbinned unfolding approach using deep neural networks to tackle this challenge. This method is applied to the precise measurement of the $\cos 2\phi$ asymmetry in the Drell-Yan process with SeaQuest data, where ϕ is the azimuthal angle of the $\mu^+\mu^-$ pair in the Collins-Soper frame. SeaQuest, a fixed-target Drell-Yan experiment at Fermilab, scattered unpolarized protons with unpolarized LH_2 and LD_2 targets. This measurement offers valuable insights into the proton's structure and the transverse momentum (q_T) dependence of the $\cos 2\phi$ asymmetry. In this presentation, we will discuss the design of our neural network architecture, training strategies, and plans to achieve definitive results. This work was supported in part by US DOE grant DE-FG02-94ER40847.