A new framework on global analysis of fragmentation functions

We present FMNLO, a framework to combine general-purpose Monte Carlo generators and fragmentation functions (FFs).

It is based on a hybrid scheme of phase-space slicing method and local subtraction method, and accurate to next-to-leading order (NLO) in QCD.

The new framework has been interfaced to MadGraph and made publicly available in this work.

We perform a simultaneous global analysis of hadron fragmentation functions (FFs) to various charged hadrons ($\pi^{\pm}$, $K^{\pm}$ and $p/\bar{p}$) at next-to-leading order in QCD.

The world data includes results from electron-positron single-inclusive annihilation, semi-inclusive deep inelastic scattering, as well as proton-proton collisions including jet fragmentation measurements for the first time which lead to strong constraints on the gluon fragmentations.

By carefully selecting hadron kinematics to ensure the validity of QCD factorization and the convergence of perturbative calculations, we achieve a satisfying best fit with $\chi^2/\text{d.o.f.} = 0.90$.

The total momentum of u, d quarks and gluon carried by light charged hadrons have been determined precisely, urging precision determinations of FFs to neutral hadrons for test of fundamental sum rules in QCD fragmentation.

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Session Classification: 分会场一

Track Classification: TeV 物理和超出标准模型新物理