DESY THEORY WORKSHOP

Particle Physics Challenges

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Analytic Resummation for multi-differential cross sections at the LHC

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We present work on analytically resummed predictions
for two classes of multi-differential observables at the LHC,
namely (1) the simultaneous measurement of the transverse momentum
of a Drell-Yan pair with event shapes like beam thrust
and (2) 0-jet cross sections with realistic jet selection criteria
that are relaxed beyond a certain jet rapidity cut.
Common to both observables is their intricate all-order structure
in the soft-collinear limit.
This structure is reflected in the multi-scale extensions
of Soft-Collinear Effective Theory (SCET)
which we employ to achieve their resummation.
Generic features that arise in both calculations include
the presence of multi-differential soft and collinear matrix elements
and their refactorization in kinematic limits.
These features make the resummation more challenging
than the single-differential case or the well-known joint resummation
with threshold effects (where the threshold limit simplifies the calculation).
We also discuss technical challenges such as ensuring
that integrals of the double spectrum recover the resummed single-differential result.
We will close by presenting resummed predictions
for the double-differential Drell-Yan spectrum at NNLL
and for 0-jet cross sections with a jet rapidity cut at NLL$'$.

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