

Application of parton branching method to pp processes

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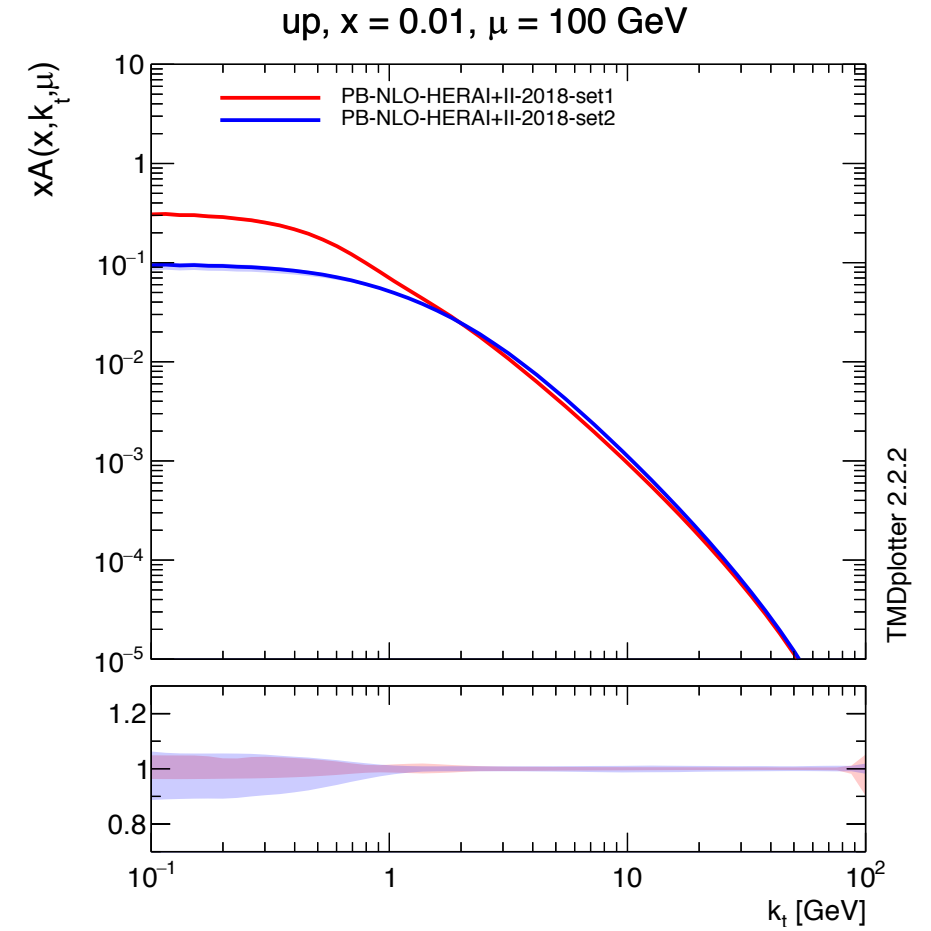


Parton branching method and transverse momentum dependent PDF

Introduction

- Transverse momentum dependent (TMD) PDF
 - Small momentum transfer, small x
- Parton branching (PB) method
 - Iterative method to solve the DGLAP evolution equation:
 - Kinematics of the splitting are known
 - Applicable to determine k_T distribution \Rightarrow TMDs
 - Valid at LO, NLO, and NNLO
- TMD distributions from fit to DIS measurements from HERA
 - $3.5 < Q^2 < 50000 \text{ GeV}^2$, $4 \cdot 10^{-5} < x < 0.65$

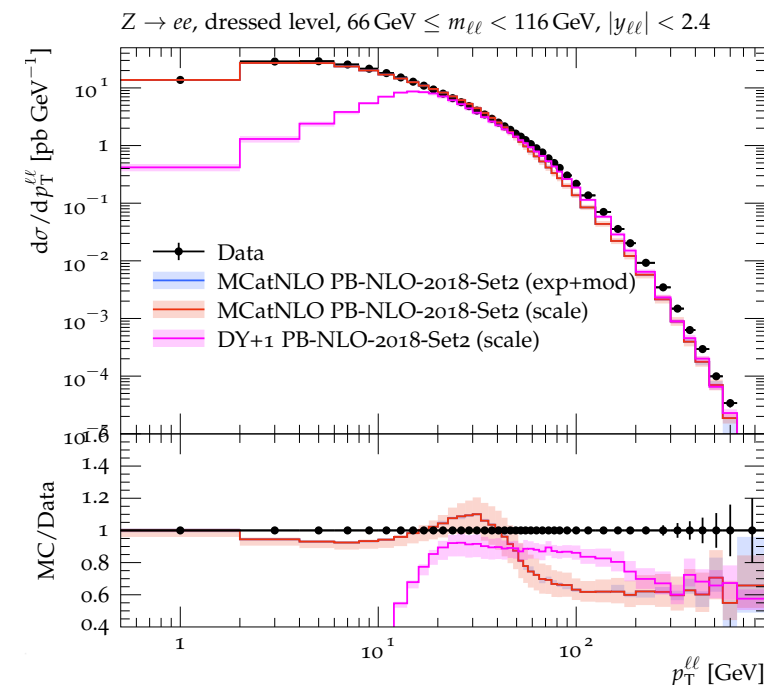
Let's take look on application of PB-TMDs to pp processes



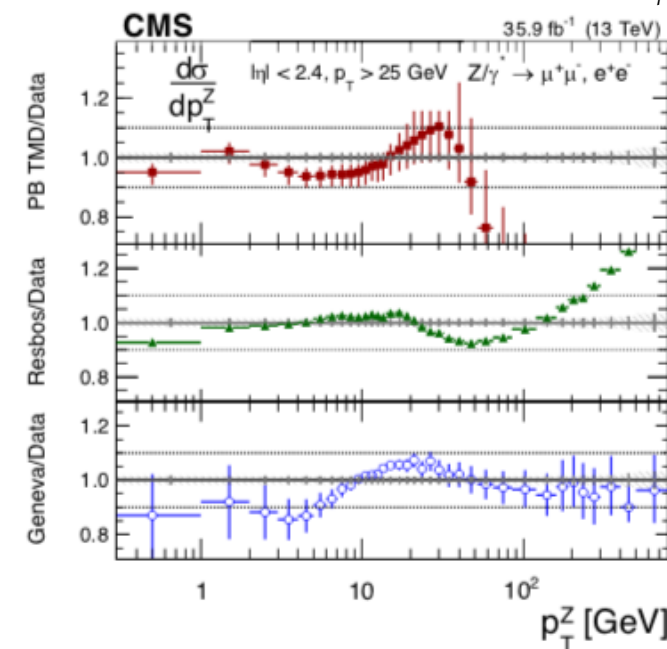
Inclusive Drell-Yan production

Application of PB TMD to pp processes

- DY at LHC: precision test of the SM + constraint on PDFs
- NLO MC predictions with PB-TMD:
 - Matrix element (ME) is calculated by Madgraph5_aMC@NLO (MCatNLO)
 - k_T dependence is included by PB-TMDs
 - Dominate uncertainties: scale in ME (μ_F and μ_R)
- Reasonable agreement with the measurement at the low p_T^Z
 - Competitive with resummed calculations Resbos, Geneva (NNLL accuracy)
 - Higher p_T region requires higher jet multiplicity in ME
- More information:
 - Qun Wang's talk: 30th July; Strong Interactions and Hadron Physics session
 - DY at LHC energies: *Phys.Rev.D* 100 (2019) 7, 074027
 - DY at lower \sqrt{s} : *Eur.Phys.J.C* 80 (2020) 7, 598



Phys.Rev.D 100 (2019) 7, 074027



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Differential Z + jets production

Application of PB TMD to pp processes

- Allows more detailed study
 - E.g.: jet multiplicity, jet p_T spectrum, azim. corr.
- NLO MC predictions with PB-TMD:
 - Z + 1 jet in ME, other jets are from parton shower
- MC/Data disagreement more visible for higher jet contribution
 - Possible impact of missing higher order correction beyond NLO QCD or missing higher jet multipl. in ME
- Z + HF(*b*-,*c*-tagged) jets
 - $\Delta\phi(Zb)$ - decorrelation comes from k_T from initial evolution
 - Reasonable agreement at large $\Delta\phi$, where TMD effects dominate
- More information about multijet merging for PB TMD:
 - Armando Bermudes's talk: 28th July; Strong Interactions and Hadron Physics session

