

TMD factorization: formal issues

Discussion session

Wednesday Nov. 21st

Resummation, Evolution, Factorization workshop

(REF 2018)

Institute of Nuclear Physics, Krakow, Poland, 19-23 Nov 2018

- Terminology: can we fix some common language?
 - TMD pdf vs. unintegrated parton distributions vs. low x TMD
 - operator definition of unintegrated parton distributions? Can we fix the relation? What is needed for that?
- How can we relate phenomenological motivated approaches (parton branching, KMR, “unintegrated DGLAP pdf”) to formal definitions of distributions (collinear, soft-collinear TMDs, low x TMDs, ...)
- Can both approaches benefit from each other? Can “theory” deliver something for “pheno” and vice versa?
- Are low x /“unintegrated” distributions sufficiently well defined or is a (low x) theory effort needed? Hybrid formalism?
- TMDs for all x ? Combined low and large x TMDs? Can we get numbers?

- Different **definitions of $f(\mathbf{x}, \mathbf{k}_T)$** : TMDs, uPDFs/CGC, PB-TMDs, ... (more?)
 - Is there **any relation among them** in any kinematical region?
 - **TMDlib**: can it help? How? Is it possible/easy/convenient to include TMDs?
- Are **factorization theorems the *holy grail***?
What to do if factorization does not hold?
- Why do we need **TMDs at the LHC**? Are not PB-TMDs enough?
- **TMD factorization is well-established = less applicability ???**
 k_T -factorization is *less robust* = more applicability ???
- **Applicability/limitations** of each definition/approach
 - Does **TMD factorization fail at small \mathbf{x}** / high energy?
 - **Which $f(\mathbf{x}, \mathbf{k}_T)$ are universal** and why/when?
 - Can **PB-TMDs and uPDFs** handle polarization, distr./frag., etc?
- **TMDs** have a clear relation with **proton 3D/spin structure (tomography)**.
What about the **other $f(\mathbf{x}, \mathbf{k}_T)$** ?
- ...