TMD splitting kernels project

L. Keersmaekers[1], F. Hautmann[12], M. Hentschinski[3], H. Jung[4], A. Kusina[5], K. Kutak[5], A. Lelek[1]

[1]University of Antwerp, [2]University of Oxford, [3]Universidad de las Americas Puebla, [4]DESY [5]IFJ PAN

January 9, 2020

Universiteit Antwerpen

Earlier work

We want to implement TMD splitting functions in the PB method. Why?

- Correct treatment of kinematics at each branching
- Connection with small-x
- Reproduces Kernels of different evolution equations in different limits

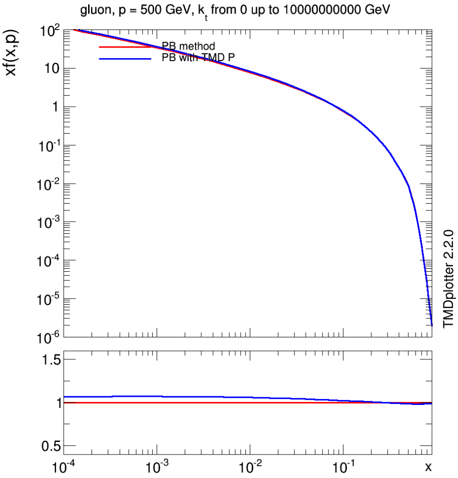
First implementation:
TMD splitting functions in the PB equation, but still collinear splitting functions in the Sudakov $\rightarrow$ because Sudakov form factor depends on $k_\perp$: can not been taken from table

Integrated TMDs

- Dynamical z_M, $q_0 = 1$ GeV
- Starting distribution: QCDNUM

Implementation with:

- PB method (LO)
- PB with TMD Splitting functions



Integrated TMDs

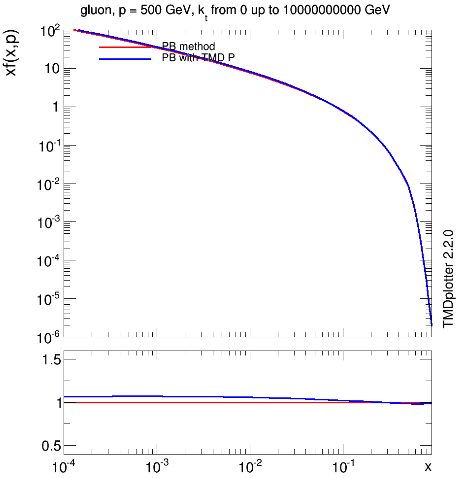
- Dynamical z_M, $q_0 = 1$ GeV
- Starting distribution: QCDNUM

Implementation with:

- PB method (LO)
- PB with TMD Splitting functions

Integrated TMDs:

- Gluon: Increase for large range of x



Integrated TMDs

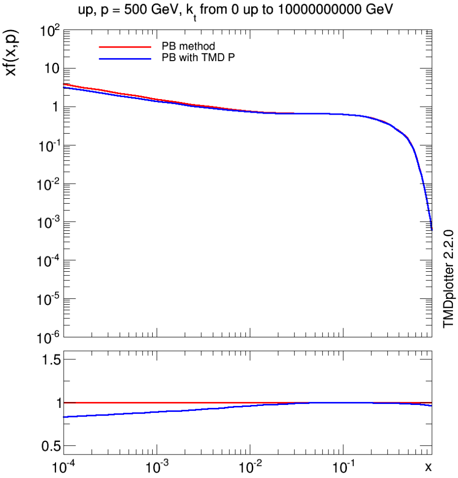
- Dynamical z_M, $q_0 = 1$ GeV
- Starting distribution: QCDNUM

Implementation with:

- PB method (LO)
- PB with TMD Splitting functions

Integrated TMDs:

- Gluon: Increase for large range of x
- Quarks: Decrease for low and intermediate x

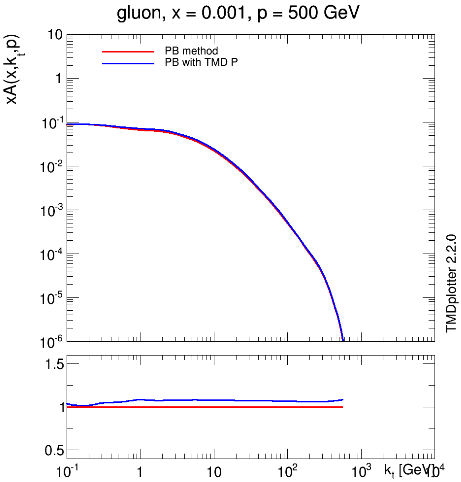


TMDs vs $\mathbf{k}_\perp$

- PB method (LO)
- PB with TMD Splitting functions

Small x:

- Gluon: increase in large region of $\mathbf{k}_\perp$

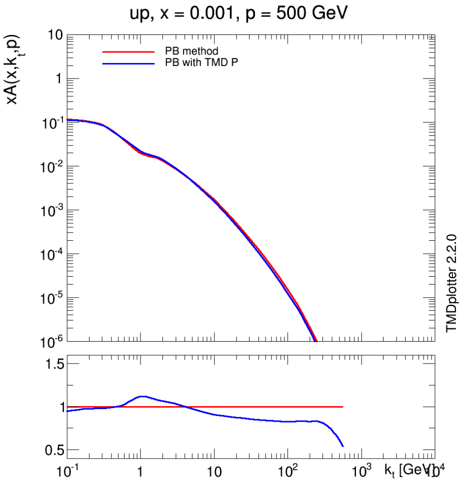


TMDs vs $\mathbf{k}_\perp$

- PB method (LO)
- PB with TMD Splitting functions

Small x:

- Gluon: increase in large region of $\mathbf{k}_\perp$
- Quarks: decrease for middle and high $\mathbf{k}_\perp$, drop for very large $\mathbf{k}_\perp$



TMDs vs $\mathbf{k}_\perp$

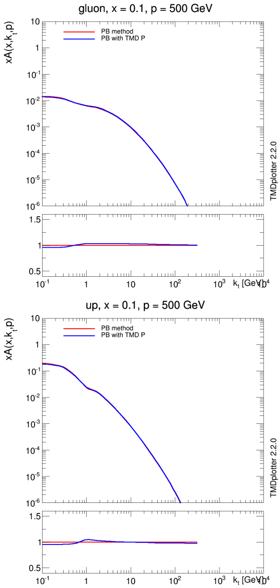
- PB method (LO)
- PB with TMD Splitting functions

Small x:

- Gluon: increase in large region of $\mathbf{k}_\perp$
- Quarks: decrease for middle and high $\mathbf{k}_\perp$, drop for very large $\mathbf{k}_\perp$

Large x:

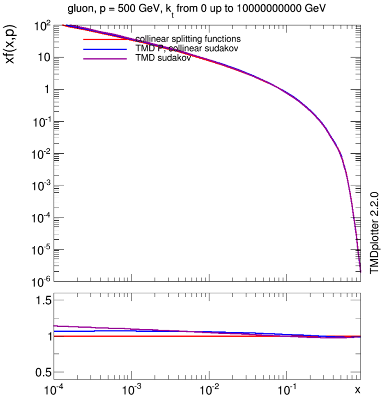
- Only small effects

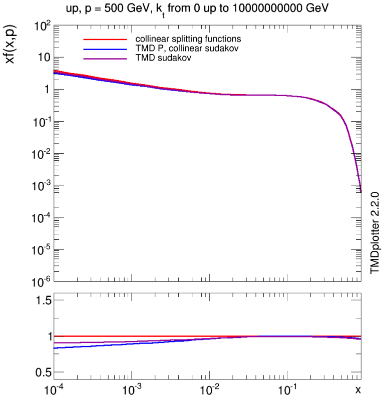


New results

Implementation including $k_\perp$-dependent Sudakov form factor, based on veto-algorithm

Still needs cross-checks

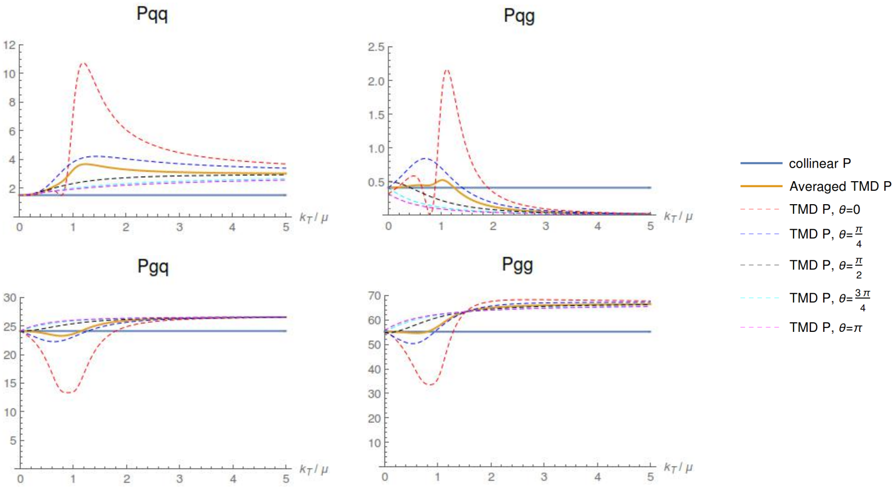




iTMDS: With TMD sudakov: increase in small-x compared to collinear sudakov

$k_\perp$-dependence of TMD splitting functions

Splitting functions (except P_{qg}) rise for large $k_\perp$



$z = 0.1,\ \mu = \frac{p_\perp}{1-z}$ with $p_\perp$ transverse momentum of the emitted parton

New results (2)