Impact of EIC on TMDs

Status report and preliminary studies

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(work done mainly by Chiara Bissolotti, Valerio Bertone, Andrea Signori, Filippo Delcarro)

Caveat: preliminary results, mainly to discuss the strategy together

Starting points

- Pseudodata generated by Ralf and available on

  https://github.com/VladimirovAlexey/EIC_YR_TMD

  For the moment, we used Data4_cut, with ACC_opt5

- Grids of SIDIS F_{UUT} structure function based on PV17 fit and available on

  https://github.com/vbertone/NangaParbat

Our grids

- The structure of our grid files was already described by Chiara Bissolotti in May (https://indico.bnl.gov/event/8415/). We will be happy to provide explanations and assistance for their use.

- We provide grids for:
  - unpolarized TMD PDFs,
  - unpolarized TMD FFs,
  - structure function $F_{UU,T}$
  - Sivers structure function $F_{UT,T}^{\sin(\phi_h - \phi_S)}$

- The idea is to put them also on TMDlib, together with SV sets and others

Ralf’s pseudodata

https://github.com/VladimirovAlexey/EIC_YR_TMD

Name	unpol.5x100_pip_ACC_opt5_cut
Comment	Ralf's pseudo data for EIC.
Reference	Ralf
Process type	SIDIS
Number of points	4410
Number of uncorr.errors	2
Number of corr.errors	0
Number of norm.errors	1
List of norm.errors (relative)	0.03
Total cross-section nomalized	False

List of points

From this file, we took the **average kinematic variables** of each point and the **relative uncertainty** on the observable

“Our pseudodata”

- Using our grids, we took the value of F_{UUT} for 200 replicas at the kinematics of Ralf’s data.

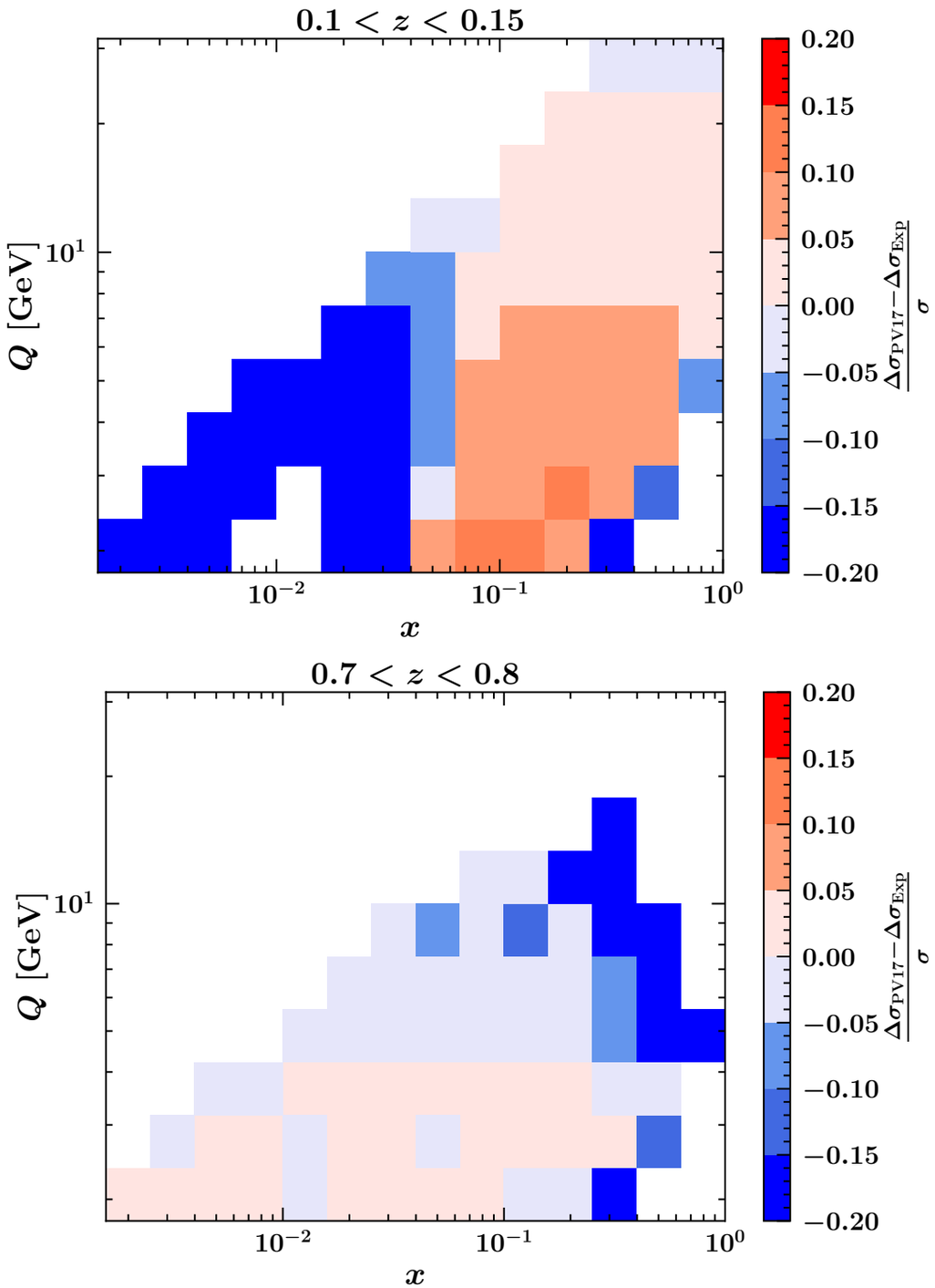
  To interpolate the grids, we used interpolation routines provided by NangaParbat, but the study can be done with other interpolators

- We used as pseudodata the **average of our 200 replicas** and we assigned to it the **relative uncertainty of Ralf’s projections**

Areas of higher sensitivity

$\frac{\Delta\sigma_{\mathrm{PV17}}-\Delta\sigma_{\mathrm{Exp}}}{\sigma}$

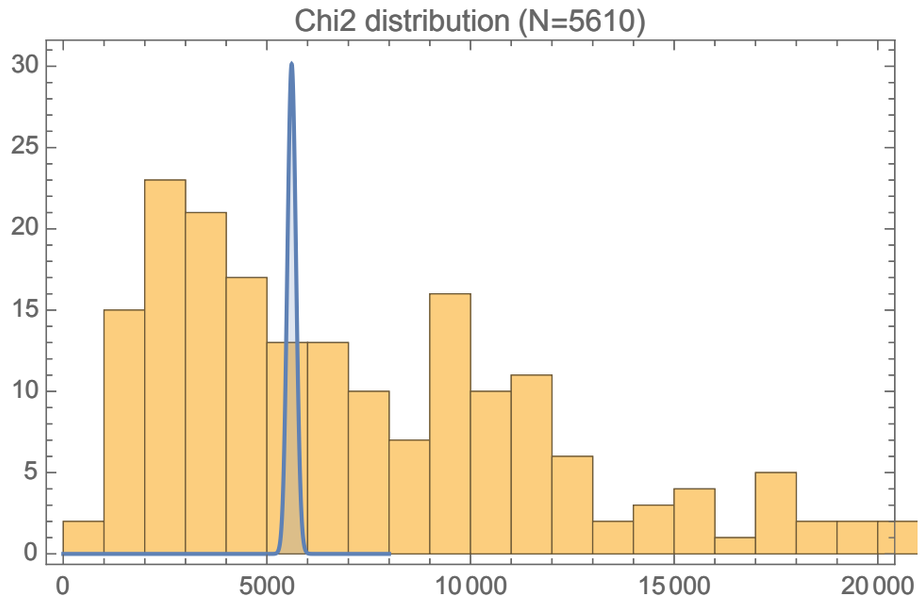
For specific z bins, summing over all the PT bins



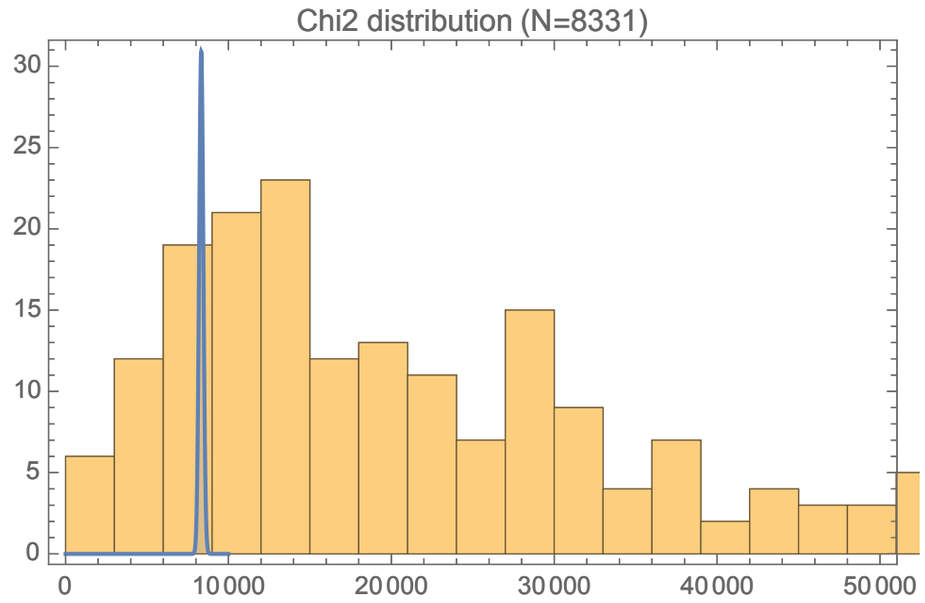
Note: the results are influenced by the PV17 model.
For instance, the model has moderate flexibility (and thus relatively small uncertainties) at low x.

Chi2

We compare the predictions based on our 200 replicas with our pseudodata. For the moment, we constrained the comparison to $0.15 < z < 0.7$, because the original PV17 fit was done in a similar range.



Example: 5x100 option



Example: 18x275 option

Reweighing

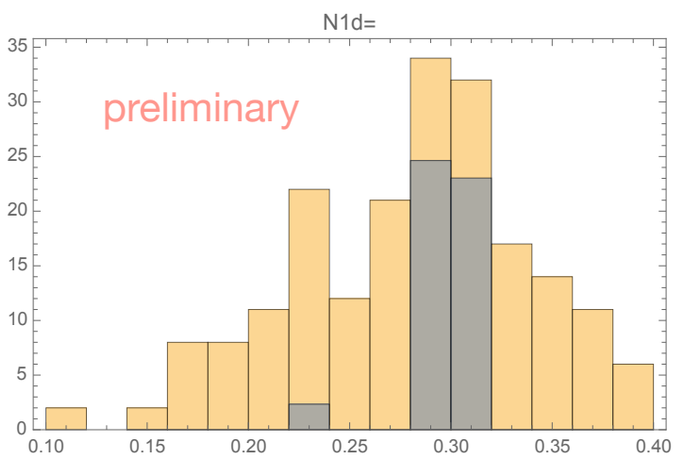
http://arxiv.org/abs/1108.1758v2, Eq. (11)

$$w_k \propto \mathcal{P}(f_k|\chi_k) \propto \chi_k^{n-1} e^{-\frac{1}{2}\chi_k^2}$$

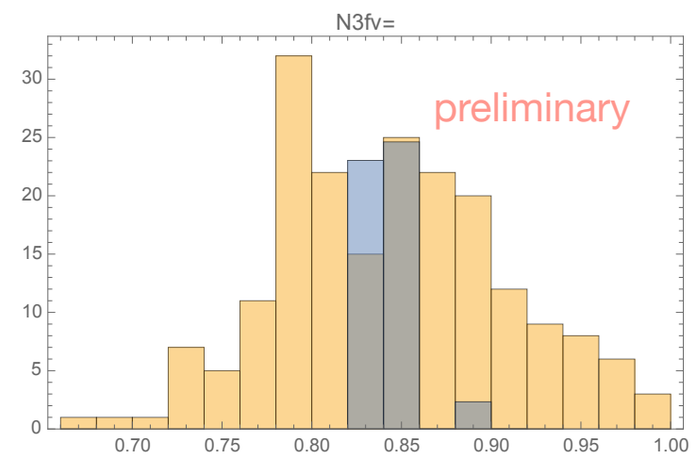
A few replicas receive a weighing much higher than all the others
Possible issue: the “surviving” replicas are too few.

Impact on nonperturbative parameters

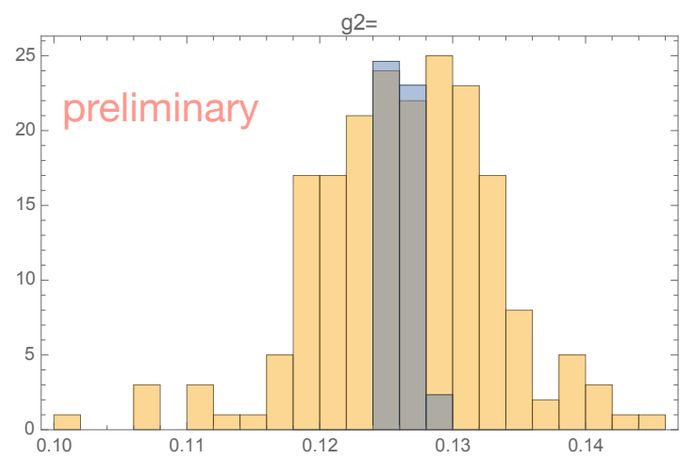
18x275 configuration (0.15 < z < 0.7)



Width of TMD PDF



Width of TMD FF



Nonperturbative evolution

before reweighing

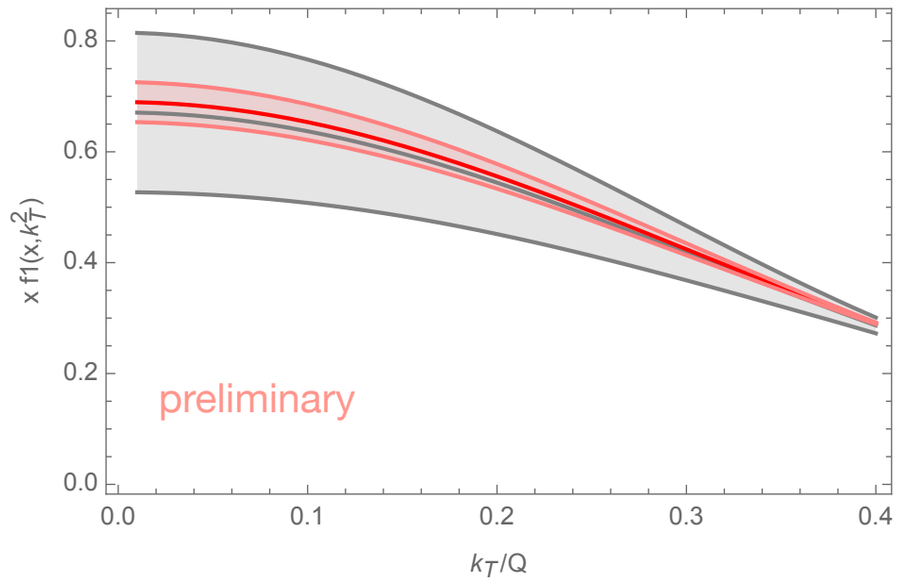
after reweighing

CAVEAT: as said before, only a few replicas survive and drive the result

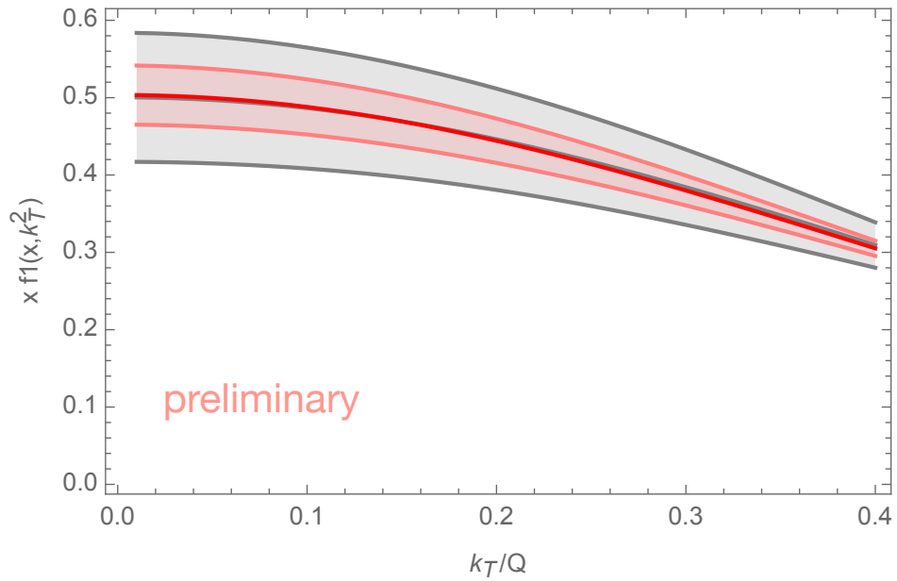
Impact on TMDs

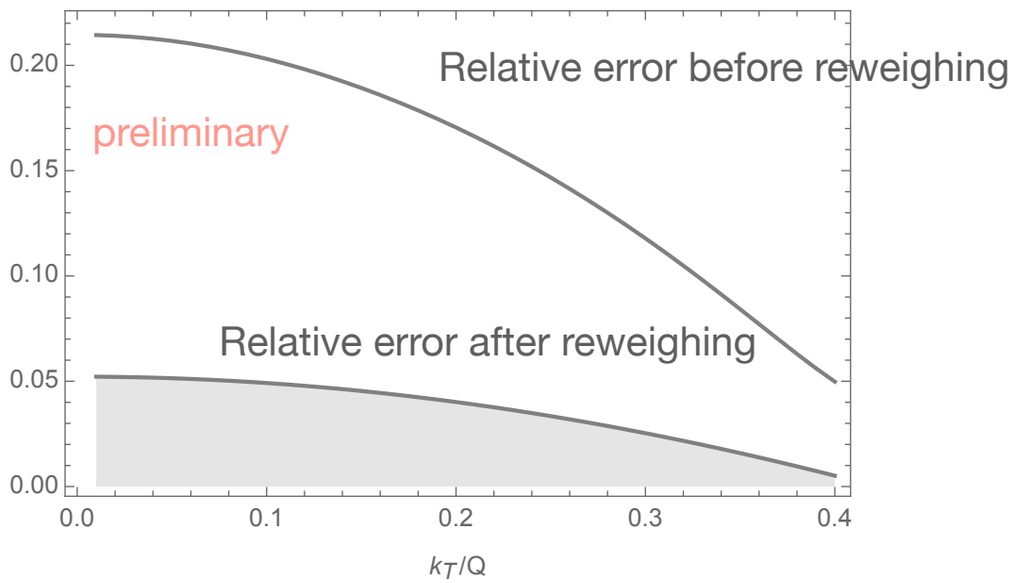
18x275 configuration (0.15 < z < 0.7)

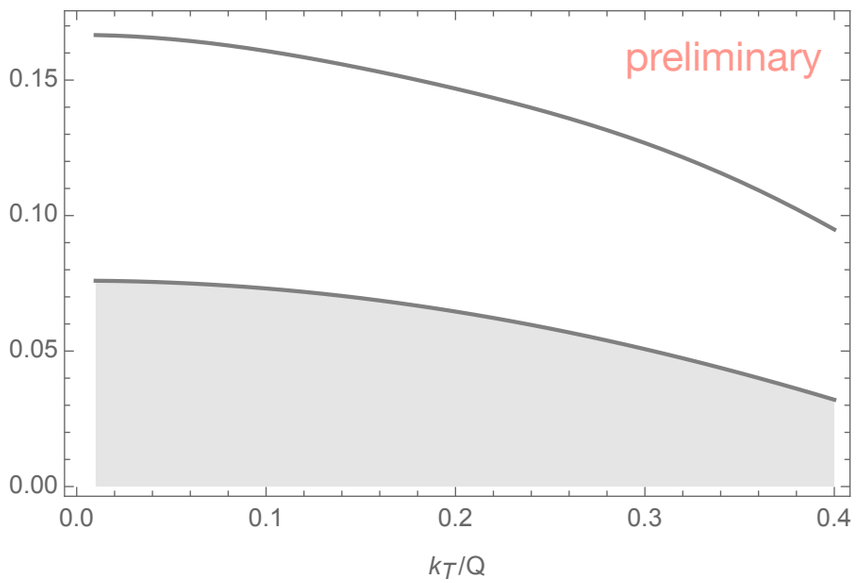
x=0.001, Q=1 GeV



x=0.1, Q=1 GeV







Partial phase space approach

Instead of taking ALL data, we consider only some parts (selected Q range, selected z range…)

In this way, more replicas survive reweighing and we are more confident about the reliability of the results.