Global Fits

SV19 = Scimemi, Vladimirov (1912.06532)

Pavia19 = Bachetta, Bertone, Bissolotti, Bozzi, Delcarro, Piacenza, Radici (1912.07550)

Common features:

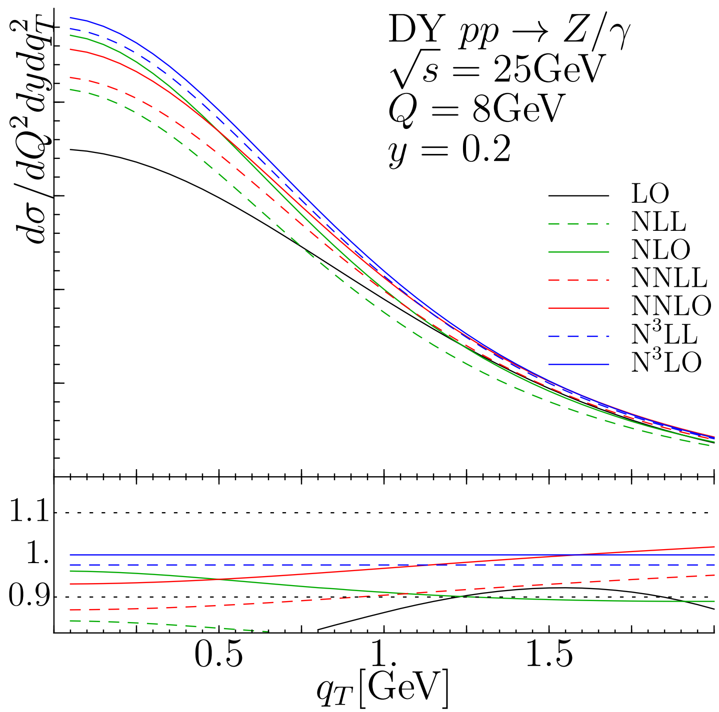
- Unpolarized Data with constraint: $q_T/Q < 0.2 - 0.25$ (4-6% power corrections)
- Perturbative accuracy: N3LL resummation + NNLO matching to PDF
- Neglect small contributions from Boer-Mulders terms (higher twist for pert. b_T)
- Common b_T dependence for all flavors

Global Fits

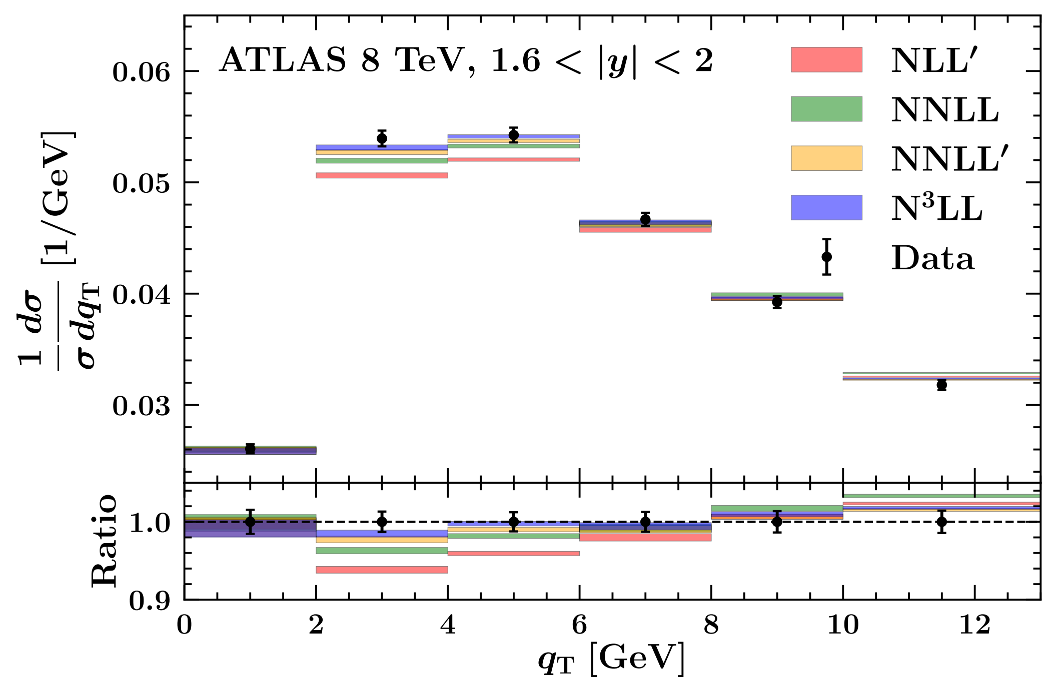
Common features:

Good Perturbative convergence:

SV19



Pavia19



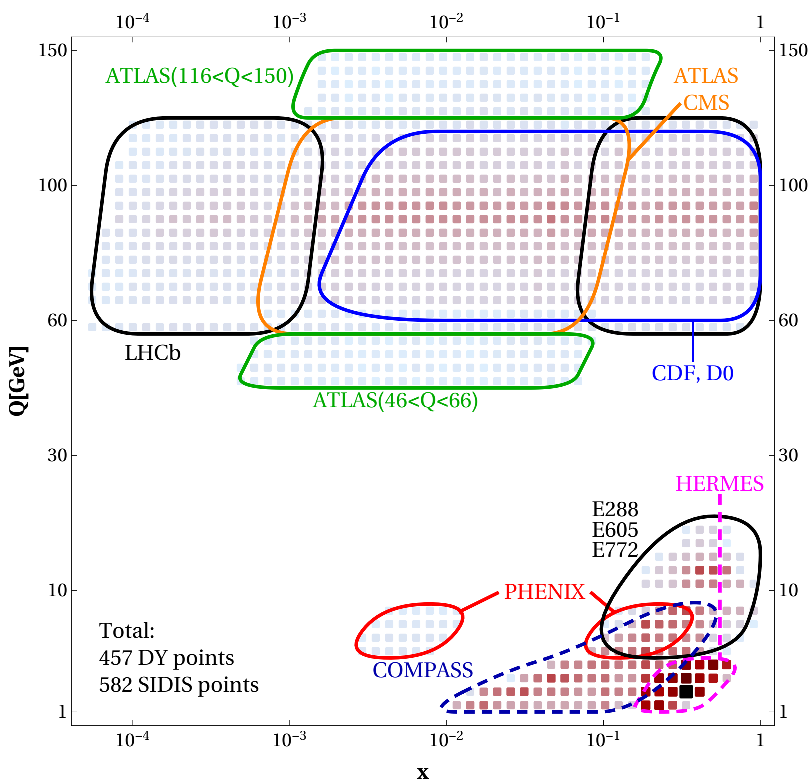
Global Fits

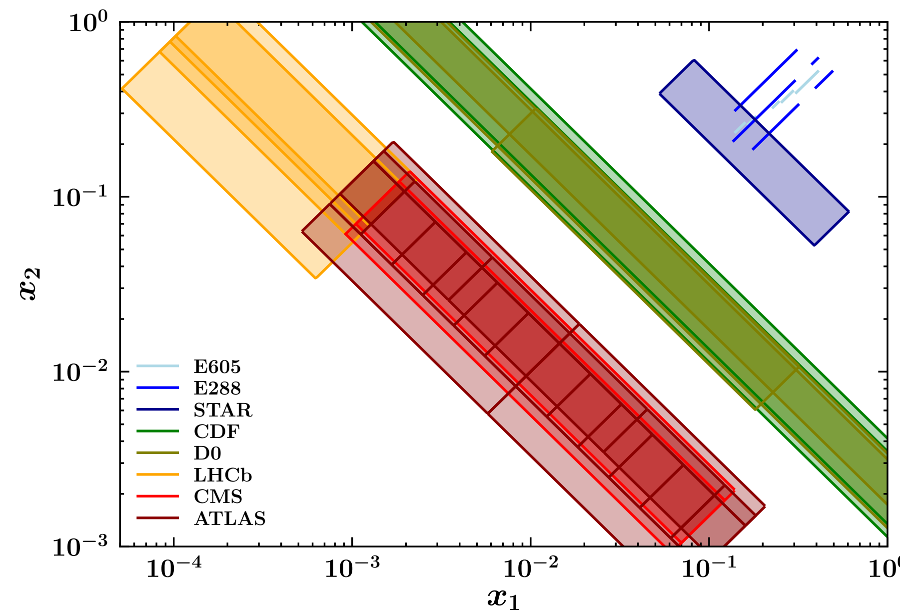
Differences:

Some differences in solution of evolution equations

Datasets used

SV19	Pavia19
Drell-Yan (457 bins)	Drell-Yan (353 bins)
SIDIS (582 bins)	





$$x_1 = Qe^y/\sqrt{s}, \quad x_2 = Qe^{-y}/\sqrt{s}$$

Global Fits

Differences:

Non-perturbative Models

SV19

TMDPDF: 5
TMDFF: 4
CS kernel: 2

$$f_{NP}(x,b) = \exp\left(-\frac{\lambda_1(1-x)+\lambda_2 x + x(1-x)\lambda_5}{\sqrt{1+\lambda_3 x^{\lambda_4}\boldsymbol{b}^2}}\boldsymbol{b}^2\right)$$

$$D_{NP}(x,b) = \exp\left(-\frac{\eta_1 z + \eta_2(1-z)}{\sqrt{1+\eta_3(\boldsymbol{b}/z)^2}}\frac{\boldsymbol{b}^2}{z^2}\right)\left(1+\eta_4\frac{\boldsymbol{b}^2}{z^2}\right)$$

$$\gamma_\zeta^q(\mu,b) = \gamma_\zeta^{q\,\mathrm{pert}}(\mu,b^*) - \frac{1}{2}c_0 b b^*$$

$$b^*(b) = \frac{b}{\sqrt{1+\boldsymbol{b}^2/B_{\mathrm{NP}}^2}}$$

Pavia19

TMDPDF: 7
CS kernel: 2

$$f_{\mathrm{NP}}(x,b_T) = \left[\frac{1-\lambda}{1+g_1(x)\frac{b_T^2}{4}} + \lambda\exp\left(-g_{1B}(x)\frac{b_T^2}{4}\right)\right]$$

$$g_1(x) = \frac{N_1}{x\sigma}\exp\left[-\frac{1}{2\sigma^2}\ln^2\left(\frac{x}{\alpha}\right)\right]$$

$$g_{1B}(x) = \frac{N_{1B}}{x\sigma_B}\exp\left[-\frac{1}{2\sigma_B^2}\ln^2\left(\frac{x}{\alpha_B}\right)\right]$$

$$\gamma_\zeta^q(\mu,b) = \gamma_\zeta^{q\,\mathrm{pert}}(\mu,b_*) - \frac{1}{2}(g_2 b_T^2 + g_{2B} b_T^4)$$

$$b_*(b_T) = b_{\max}\left(\frac{1-\exp\left(-\frac{b_T^4}{b_{\max}^4}\right)}{1-\exp\left(-\frac{b_T^4}{b_{\min}^4}\right)}\right)^{\frac{1}{4}}$$

Note: model form for b* used to split perturbative & non-perturbative parts

Global Fits

Fit Results:

SV19

$$\chi^2/N_{pt} = 1.06$$

NP-parameters			
RAD	$B_{\rm NP} = 1.93 \pm 0.22$	$c_0 = (4.27 \pm 1.05) \times 10^{-2}$	
TMDPDF	$\lambda_1 = 0.224 \pm 0.029$	$\lambda_2 = 9.24 \pm 0.46$	$\lambda_3 = 375. \pm 89.$
	$\lambda_4 = 2.15 \pm 0.19$	$\lambda_5 = -4.97 \pm 1.37$	
TMDFF	$\eta_1 = 0.233 \pm 0.018$	$\eta_2 = 0.479 \pm 0.025$	
	$\eta_3 = 0.472 \pm 0.041$	$\eta_4 = 0.511 \pm 0.040$	

Pavia19

$$\chi^2/N_{pt} = 1.02$$

Parameter	Value
g_2	0.036 ± 0.009
N_1	0.625 ± 0.282
α	0.205 ± 0.010
σ	0.370 ± 0.063
λ	0.580 ± 0.092
N_{1B}	0.044 ± 0.012
α_B	0.069 ± 0.009
σ_B	0.356 ± 0.075
g_{2B}	0.012 ± 0.003

Low and High energy data are well described

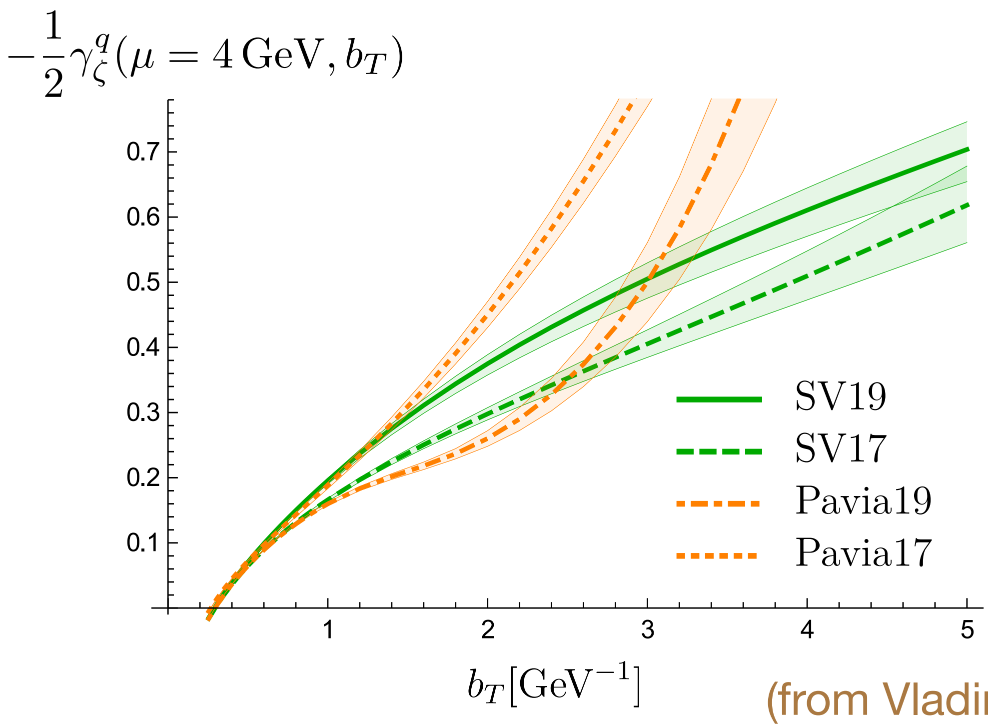
RAD parameters are less sensitive to input PDF set

Universality of RAD satisfied by DY vs. SIDIS data

Global Fits

Fit Results:

Comparison of results for CS Kernel in non-perturbative regime:



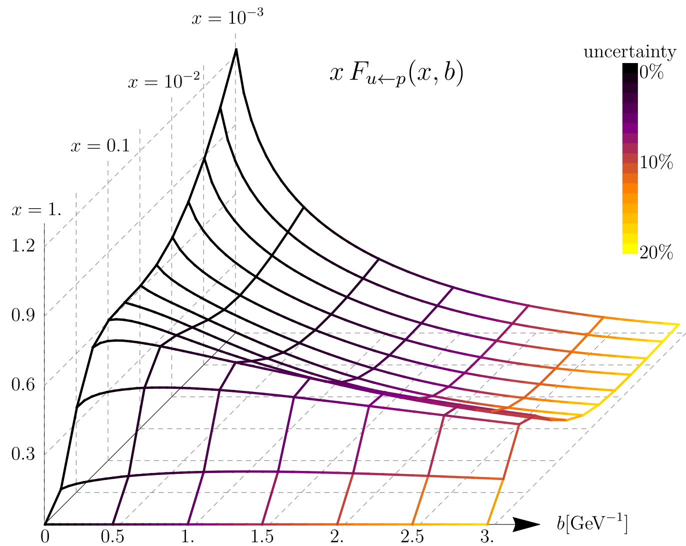
(from Vladimirov, 2003.02288)

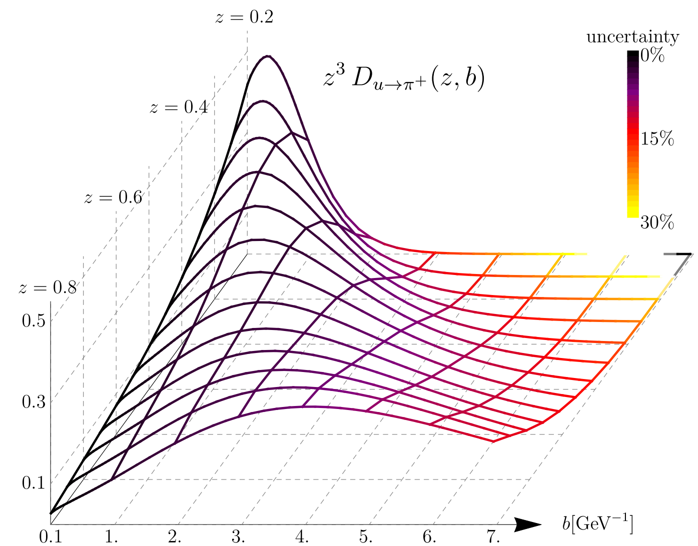
Global Fits

Fit Results:

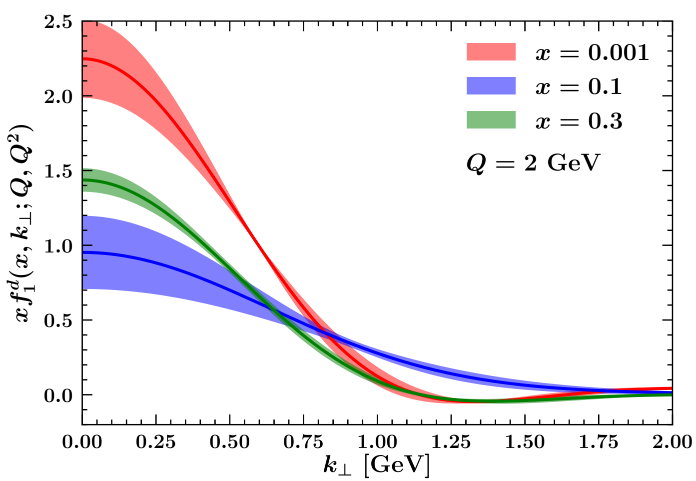
Results for intrinsic TMDPDF (& TMDFF)

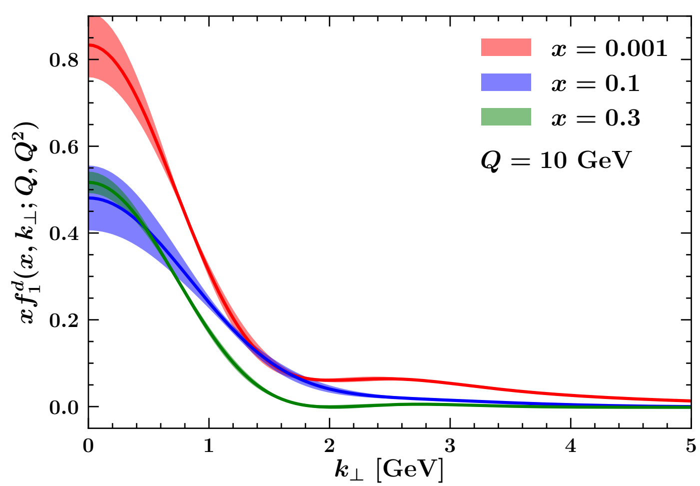
SV19





Pavia19





Quite precise determinations if we assume a given fit form.

Global Fits

Bury, Prokudin, Vladimirov (2012.05135)

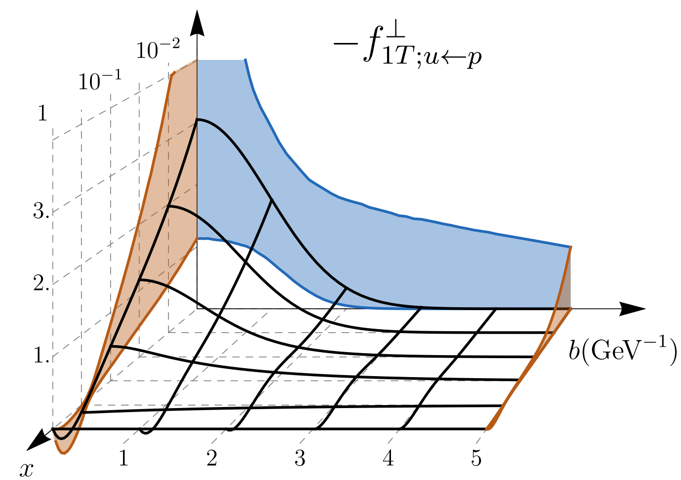
Extraction of Sivers function from global fit to SIDIS, DY, and W/Z data [76 bins: HERMES, COMPASS, Jlab (SIDIS); STAR(W/Z); COMPASS (DY)]

$$f_{1T}^{\perp\,\mathrm{SIDIS}} = -f_{1T}^{\perp\,\mathrm{DY}}$$

N3LL analysis following SV19

Flavor dependent parametrization (no matching)

$$f_{1T;q\leftarrow h}^{\perp}(x,b) = N_q \frac{(1-x)x^{\beta_q}(1+\epsilon_q x)}{n(\beta_q,\epsilon_q)} \exp\left(-\frac{r_0+xr_1}{\sqrt{1+r_2x^2b^2}}b^2\right)$$



Results:

Good global fit: $\chi^2/N_{pt} = 0.88$

Opposite signs for up and down Sivers functions

Data not precise enough to confirm sign flip

$f_{1T}^{\perp\,\mathrm{SIDIS}} = +f_{1T}^{\perp\,\mathrm{DY}}$ **gives** $\chi^2/N_{pt} = 1.0$