

# Proton parton distribution functions using ATLAS data<sup>[1]</sup>



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on behalf of the ATLAS collaboration

## Technicalities

**Datasets**

HERA combination<sup>[2]</sup> Wide  $x$ ,  $Q^2$  range

ATLAS Data set	$\sqrt{s}$ [TeV]
Inclusive $W, Z/\gamma^*$	7
$t\bar{t}$	8
$W^\pm$ + jets	8
$Z$ + jets	8
Inclusive $Z/\gamma^*$	8
Inclusive $W$	8
Inclusive isolated $\gamma$	8, 13
$t\bar{t}$	13
Inclusive jets	8

For input data refs, see [1]

Medium-high  $x$ ,  $Q^2$ , quark flavour separation, high- $x$  gluon sensitivity

**Scales**

$Q^2_0 = 1.9 \text{ GeV}^2$  starting scale evolved with DGLAP

$\alpha_s(m_z) = 0.118$

$Q^2_{\text{min}} = 10 \text{ GeV}^2$  (avoid region with poor HERA  $\chi^2$ , more sophisticated small- $x$  treatment needed)

**Analysis**

NNLO in QCD performed using **xFitter**<sup>[3]</sup>

**Parameterisation**

$xf(x) = Ax^B(1-x)^C(1+Dx+Ex^2+Fx^3)$   
(extra gluon term:  $-A'_g x^{B'_g}(1-x)^{C'_g}$ )

→ 21 free parameters

Constraints: sum rules

**Uncertainties**

Relative uncert.

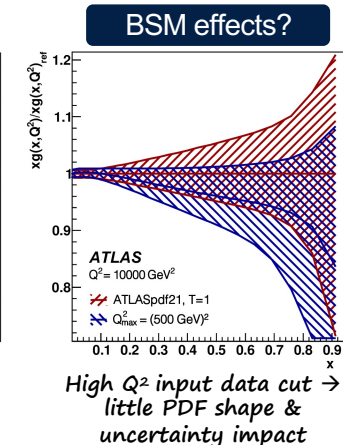
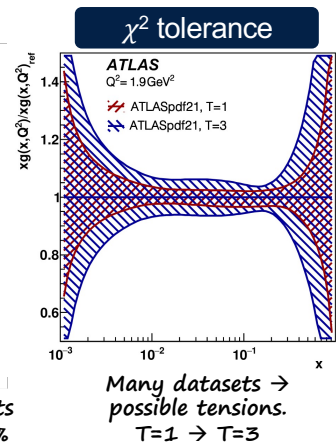
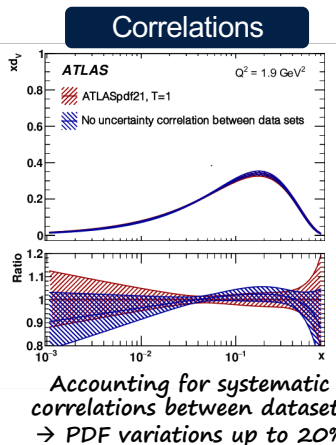
ATLAS  $Q^2 = 1.9 \text{ GeV}^2$  ATLASpdf21,  $T=1$

- exp. unc.
- exp.+mod.unc.
- exp.+mod.+par.unc.

Add extra D, E, F parameters (low- $x$  sea)

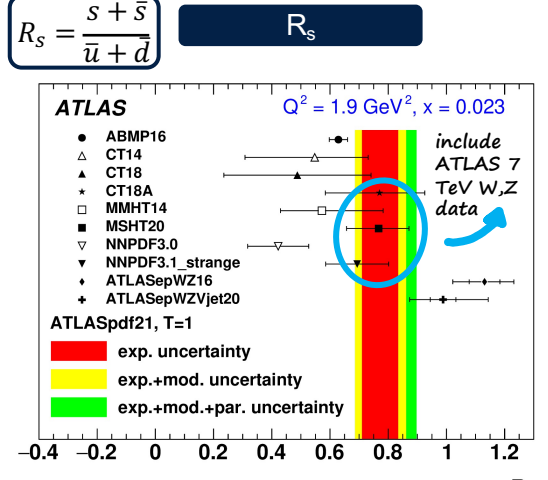
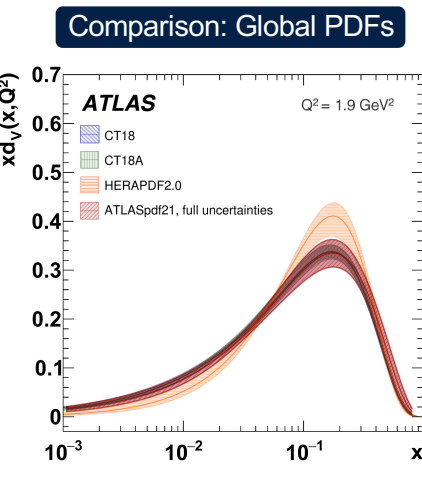
Vary theoretical assumptions:  $Q^2_{\text{min}}$ ,  $Q^2_0$ , heavy quark masses etc.

## Highlights



ATLASPDF21 fit total  $\chi^2/\text{NDF} = 2010/1620 (1.24)$  Lower for these data than the global fitters

## Results



$d_v, d_{\bar{b}}$ : More like global fitters than HERAPDF<sup>[4]</sup> → Replicating features of Tevatron, DIS etc.

$R_s$  still unsuppressed at low- $x$  but less tension with global fitters than previous ATLAS fits<sup>[5][6]</sup>