

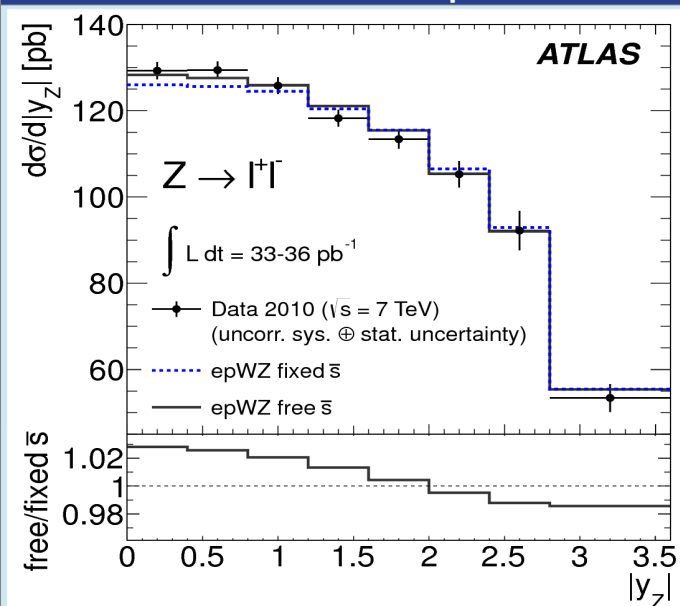
LHCP 2014, New York, 2-7 June 2014

Impact of ATLAS data on parton density functions

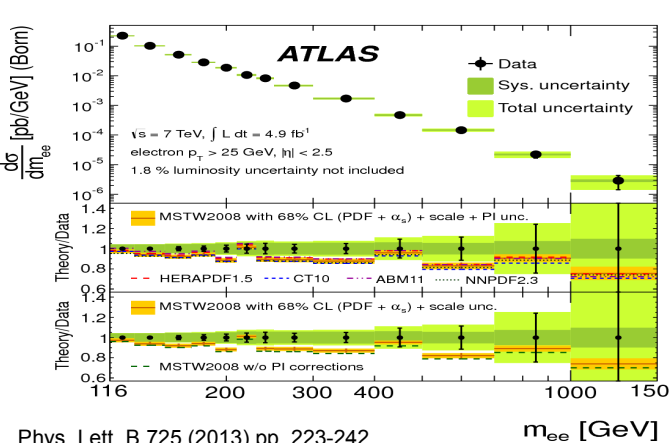
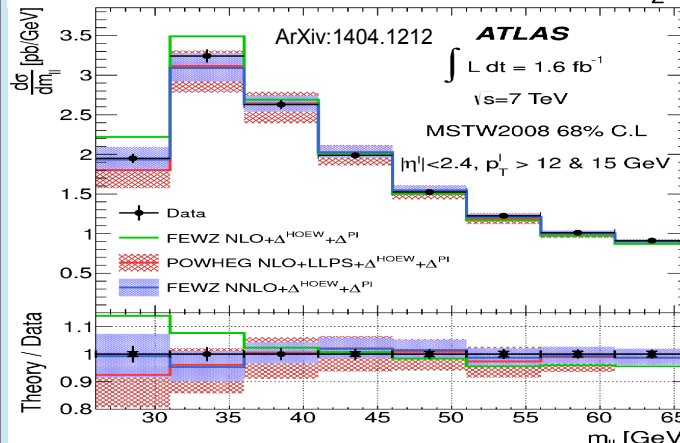
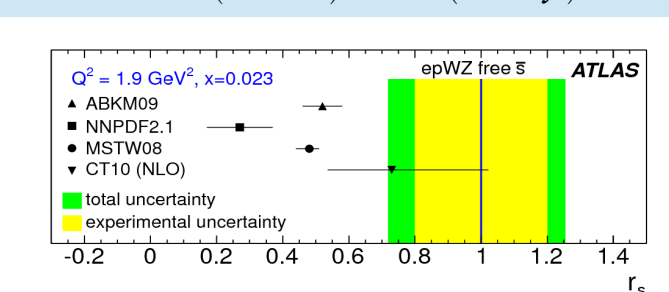
Introduction

- Precise knowledge of proton parton density functions is vital for new physics searches and for Higgs boson studies
- PDFs are determined mainly from DIS experiments
- ATLAS measurements of Standard Model processes provide complementary information on PDFs with respect to DIS data, especially at high momentum fraction x and scale Q

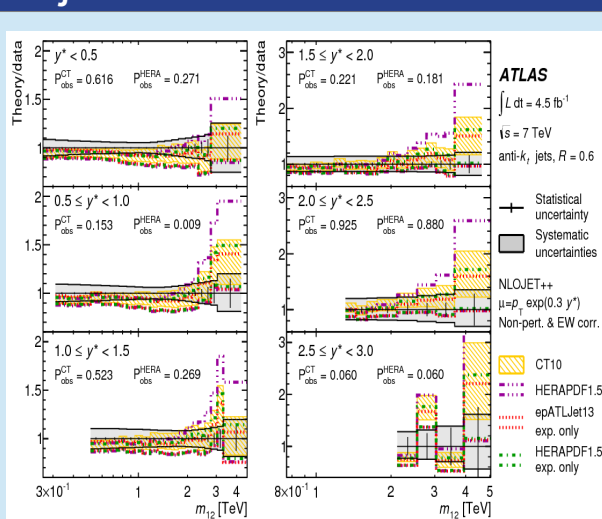
Inclusive W and Z/γ^* cross sections Phys.Rev.Lett. 109 (2012) 012001



Fit W/Z to ratio $r_s=s/d$ at $x \sim 0.1$
 Significantly larger strange quark density than in other PDFs
 $r_s = 1.00 \pm 0.20 (\text{exp})_{-0.07}^{+0.06} (\alpha_s)_{-0.15}^{+0.10} (\text{param}) \pm 0.07 (\text{model}) \pm 0.08 (\text{theory})$



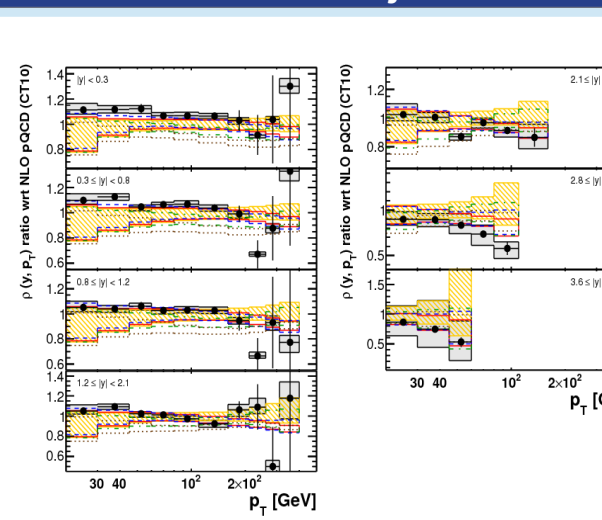
Dijet cross sections measurement JHEP05(2014)059



- Good agreement using the CT10, NNPDF2.1 and MSTW 2008 PDFs
- Disagreement at high dijet mass using HERAPDF 1.5
- Even stronger disagreement using the ABM11 PDF

PDF set	y^* ranges	mass range (full/high)	$R = 0.4$	$R = 0.6$
CT10	$y^* < 0.5$	high	0.742	0.785
	$y^* < 1.5$	high	0.080	0.066
	$y^* < 1.5$	full	0.324	0.168
HERAPDF1.5	$y^* < 0.5$	high	0.688	0.504
	$y^* < 1.5$	full	0.025	0.007
	$y^* < 1.5$	full	0.137	0.025
MSTW 2008	$y^* < 0.5$	high	0.328	0.533
	$y^* < 1.5$	high	0.167	0.183
	$y^* < 1.5$	full	0.470	0.352
NNPDF2.1	$y^* < 0.5$	high	0.405	0.568
	$y^* < 1.5$	full	0.431	0.242
	$y^* < 0.5$	high	0.024	$< 10^{-3}$
ABM11	$y^* < 1.5$	high	$< 10^{-3}$	$< 10^{-3}$
	$y^* < 1.5$	full	$< 10^{-3}$	$< 10^{-3}$

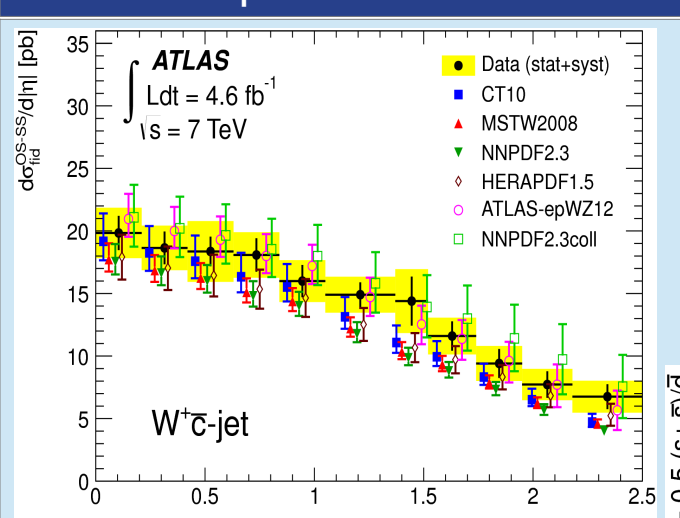
Ratio of inclusive jet cross sections EPJC(2013)73, 2509



- $\sqrt{s} = 7 \text{ TeV}$
- $\sqrt{s} = 2.76 \text{ TeV}$

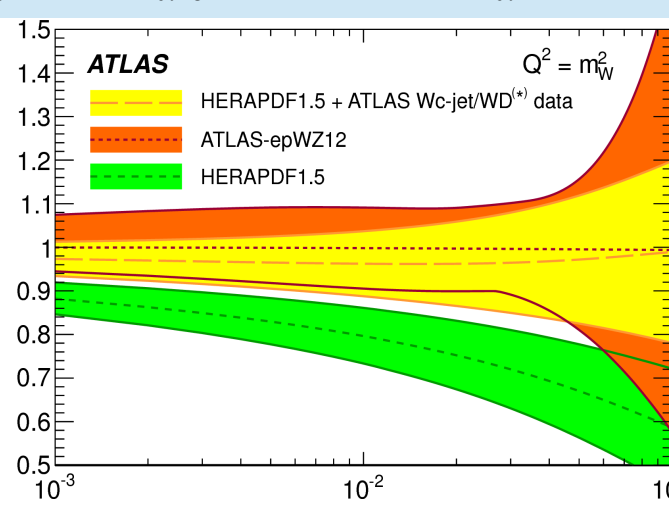
Consistent treatment of correlated systematic uncertainties

W+charm production CERN-PH-EP-2014-007



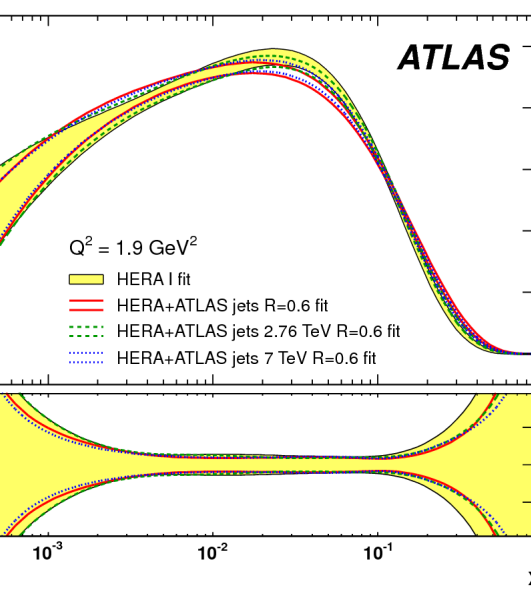
- Direct probe of the strange content of the proton
- Data prefer PDFs with $r_s \sim 1$ confirmation of enhanced strangeness

$$r_s = 0.96_{-0.18}^{+0.16} (\text{exp+theory})_{-0.24}^{+0.21} (\text{scale})$$



HERA-I dataset is used as a reference

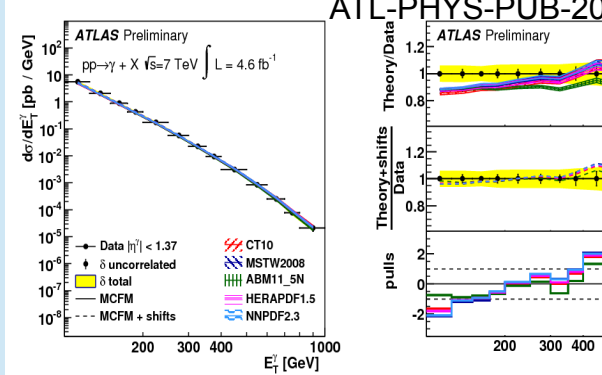
Harder gluon density at high x and reduction of its uncertainty is obtained after adding ATLAS jet data



Summary

- ATLAS has published new precise measurements of the jets, W/Z, photon, Drell-Yan, W+charm, $p_T(Z)$, top pair productions
- Experimental precision is comparable to the theoretical accuracy
- New data provide complementary information on parton density functions with respect to DIS data
- Higher order corrections and accurate modeling of non-perturbative effects are vital for the PDF determination from LHC data

Prompt photon production Phys. Rev. D 89, 052004 (2014)



- Direct probe of gluon density
- NNLO predictions are needed for PDF extraction

	Excluding PDF uncertainties			Including PDF uncertainties		
	$\mu_r = \mu_f = E_T^\gamma$	Envelope		$\mu_r = \mu_f = E_T^\gamma$	Envelope	
CT10	49.1	34.7 - 63.1		29.8	20.0 - 38.4	
MSTW2008	39.9	27.2 - 52.7		32.0	21.3 - 42.3	
ABM11_5N	16.2	9.2 - 25.5		15.7	8.9 - 24.9	
HERAPDF1.5	28.7	19.0 - 38.9		23.6	15.7 - 32.0	
NNPDF2.3	33.5	22.6 - 44.7		27.6	18.7 - 36.9	