Presentation of Experimental Results for PDF Fits
Comparison (and combination) of $W+$ charm

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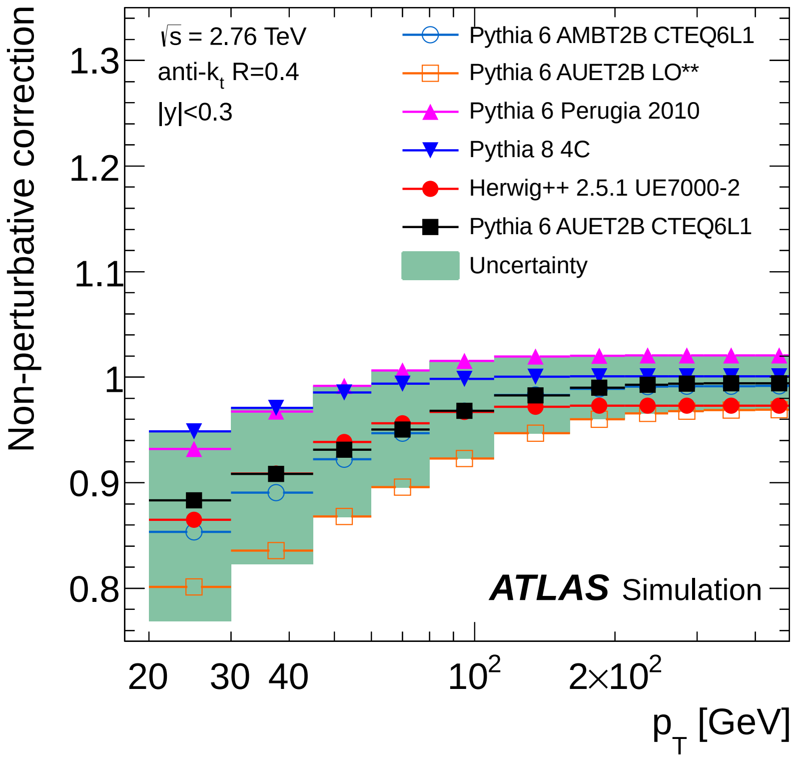
Experimental Measurements and Corrections.

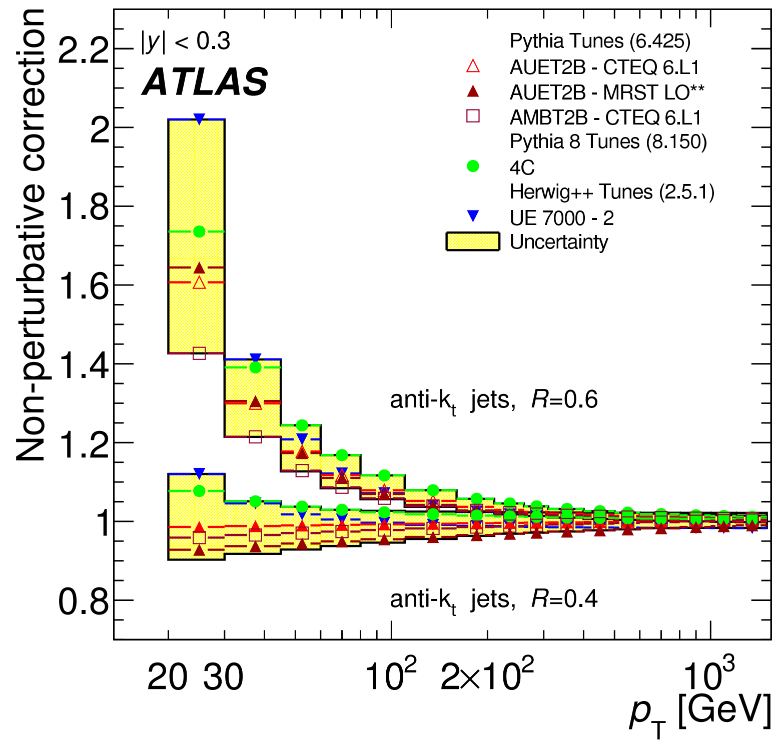
There are a variety of experimental results which can be used to constrain PDFs coming from the LHC. Many are of much the same form from ATLAS and CMS and some match smoothly on to LHCb.

In principle it would be nice to have them presented as direct constraints (e.g. data points) on PDFs - sometimes attempted in the past. Never in practice possible in anything like an unambiguous manner.

However, PDF fits cannot in practice use actual experimental measurement. Must meet someway between the two. For hadron collider data there are various isues to be addressed and choices made.

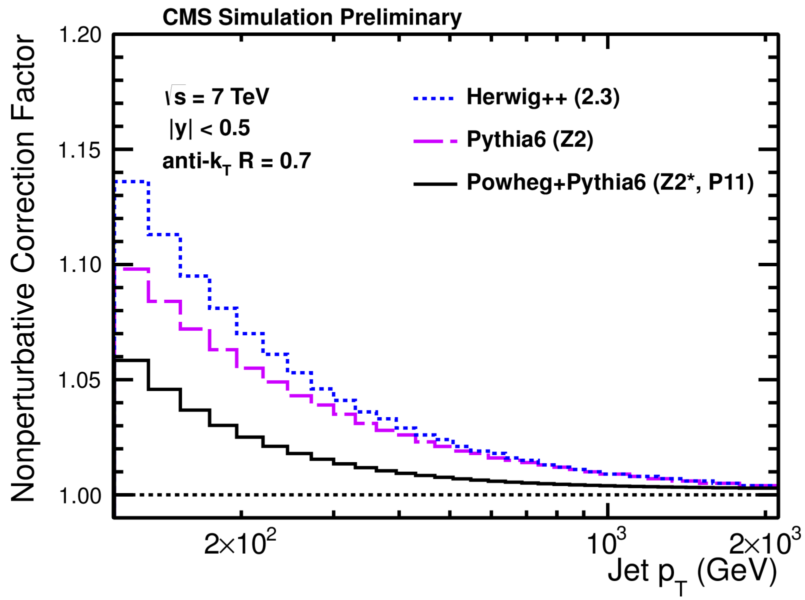
Inclusive (and dijet) data corrected for final state hadronisation, underlying event, etc., i.e. nonperturbative corrections. Essentially a form of (multiplicative) correlated uncertainty.

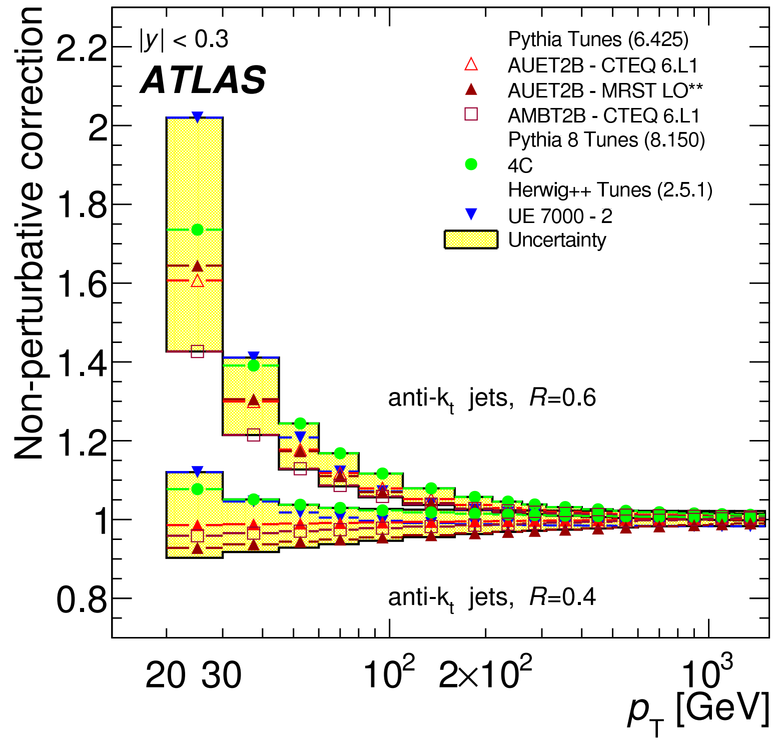




However, correlated between different measurements. For example, ATLAS $2.76\mathrm{TeV}$ and $7\mathrm{TeV}$ runs, corrections assumed to be 100% correlated.

Degree of correlation between CMS and ATLAS?





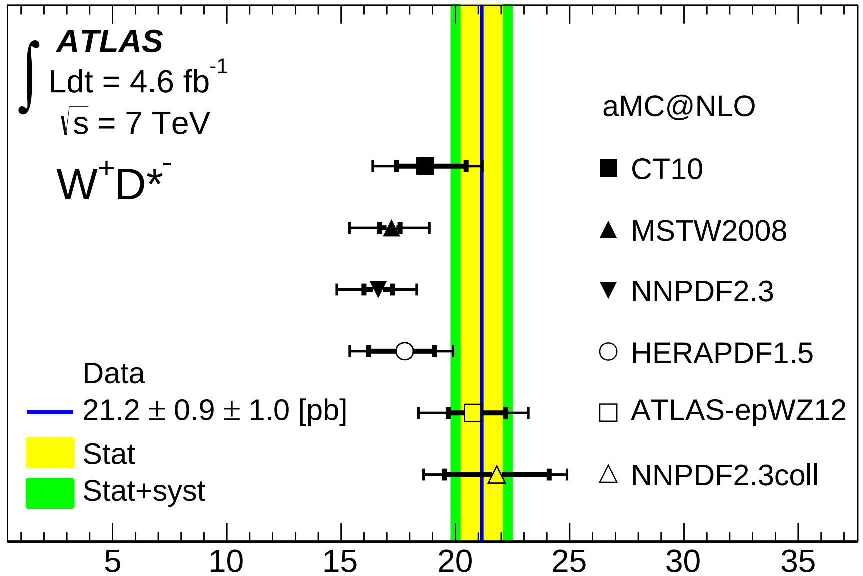
If R a similar values likely large correlation, rather less is R rather different?

Not really an issue in global fits for the results currently used, but will be in future.

$W^{\pm} + c(\bar{c})$ measurements.

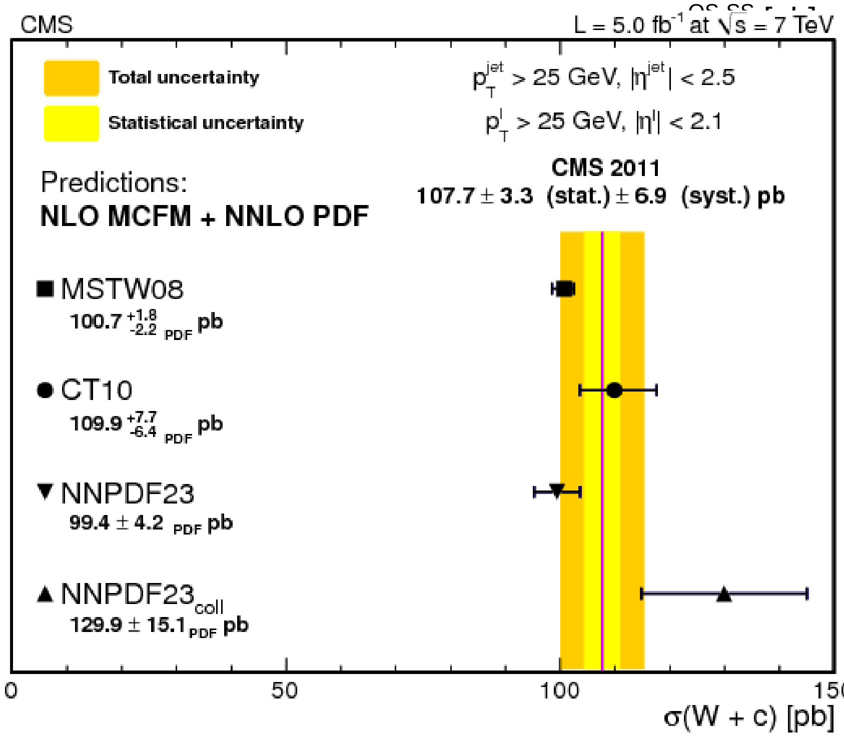
In principle simpler than jets - possible test case for combination?

In practice Some discrepancies with current strange quark distributions.

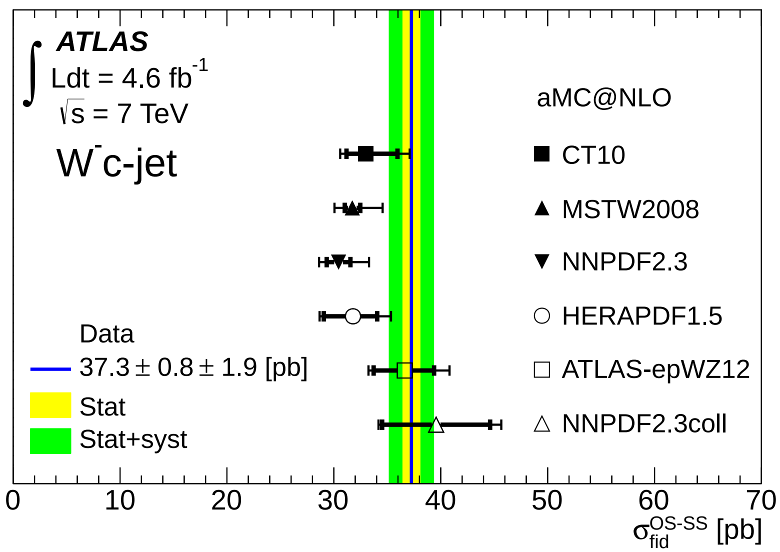


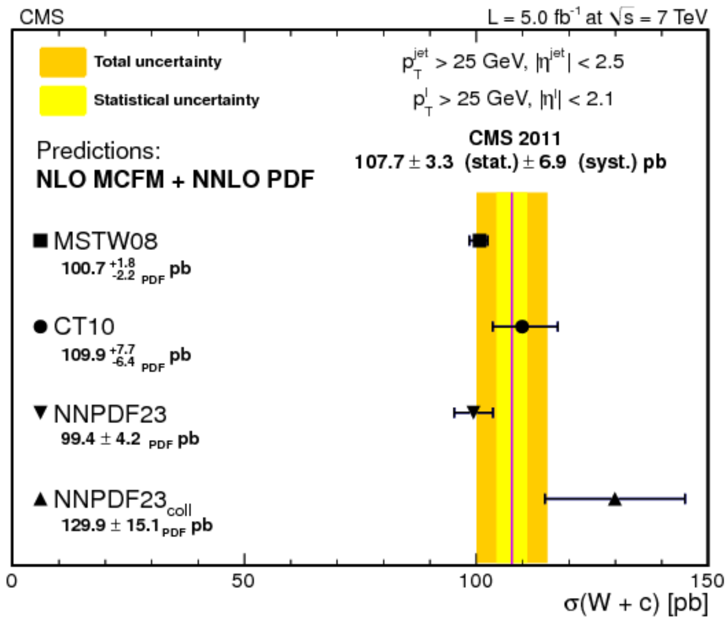
Also some discrepancies between ATLAS and CMS.

But PDF and both measurements three quite different things.



Some attempt to present them as similar measurements – but not that similar e.g. $R = 0.4$ (ATLAS) $R = 1.0$ (CMS)





Some issues in the relative manner in which fragmentation is treated (however, only source of $\sim 2\%$ uncertainty.

Some of the correlated uncertainties must be correlated across experiments – to some degree.

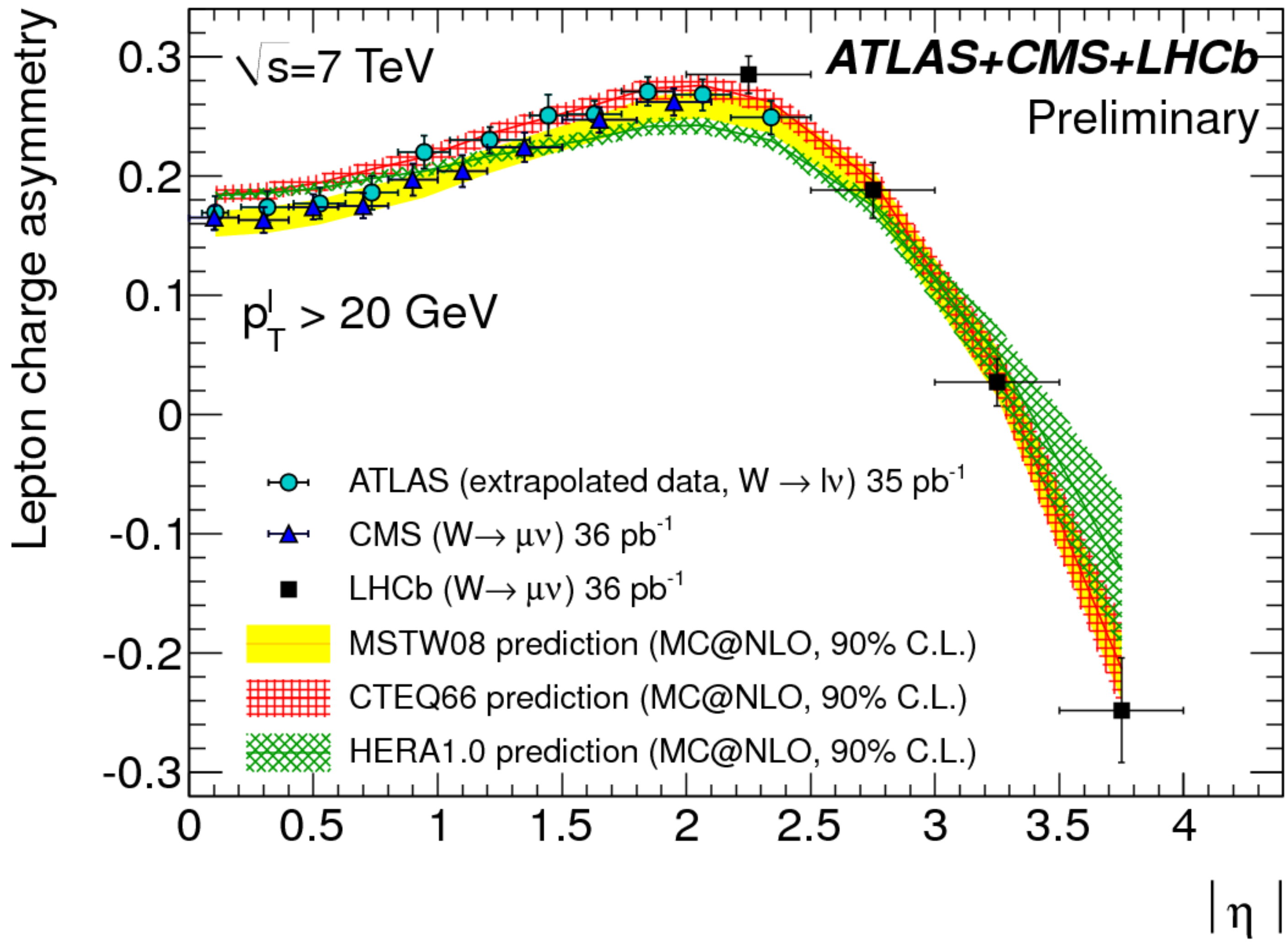
Relative systematic uncertainty in %	$W(e\nu)c$-jet	$W(\mu\nu)c$-jet
Lepton trigger and reconstruction*	0.7	0.8
Lepton momentum scale and resolution*	0.5	0.6
Lepton charge misidentification	0.2	-
Jet energy resolution*	0.1	0.1
Jet energy scale	2.4	2.1
E_T^{miss} reconstruction*	0.8	0.3
Background yields	4.0	1.9
Soft-muon tagging	1.4	1.4
c-quark fragmentation	2.0	1.6
c-hadron decays	2.8	3.0
Signal modelling	0.9	0.2
Statistical uncertainty on response	1.4	1.4
Integrated luminosity*	1.8	1.8
Total	6.5	5.3

Source	$p_T^\mu > 25\,\text{GeV}$ $\Delta_{syst}[\%]$	$p_T^\ell > 35\,\text{GeV}$ $\Delta_{syst}[\%]$
$\mathcal{B}(c \to D^\pm \to K^\mp\pi^\pm\pi^\pm)$	1.5	1.5
$\mathcal{B}(c \to D^{*\pm}(2010) \to D^0 \to K^\mp\pi^\pm)$	0.7	0.6
$\mathcal{B}(c \to \mu)$	2.6	2.7
Vertex reconstruction	1.8	1.7
Pileup	0.9	0.8
Jet energy scale	3.0	1.7
E_T^{miss}	2.0	2.0
Lepton efficiency, resolution	0.8	1.5
Muon efficiency in charm decay	1.4	1.5
Drell–Yan background	1.4	0.9
MC statistics ($\mathcal{C}$ stat. uncert.)	1.6	1.3
ISR and renormalization/ factorization scales	0.2	0.2
Fragmentation function	0.8	0.6
Other theoretical uncertainties	0.8	0.7
Luminosity	2.2	2.2
Total	6.3	5.7

Would be nice to combine.

Do differences in measurement make “floating” points, as in HERA combinations, implausible?

Example of lepton asymmetry data presented (but not published) with a common set of cuts in early running.



In this case extrapolation seemed possible.

Conclusions

Measurements will always be presented as some compromise between what is measured and what is easy to interpret as theory.

Both sides must make it as clear as possible what has been done in order to obtain "theory" result and "experimental measurement".

Where different experiments are measuring similar quantities it would be ideal to be able to compare them as directly as possible.

Combination is the perfect way to fully appreciate correlations between different experimental measurements – HERA combined data an excellent model for this.