

# Outcome of the WG: W&Z precision measurements

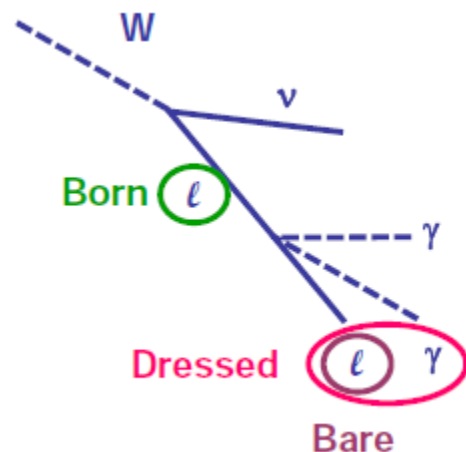
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on behalf of the LHC WG: W&Z precision measurements



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# Proposal of how to achieve a better comparison

- Concentrate on comparisons between the three experiments, not on a combination
- No extrapolation to the full phase space
- Each experiment defines the fiducial volume which is best suited for their measurements
- Results are presented with full covariance matrices
- Agreed procedure of evaluation of theoretical uncertainties in acceptance correction (see Uta's talk)
- Keep same fiducial volumes to allow direct comparison to 2010/2011
  
- Presentation of results
  - Born level: for comparison with NNLO calculations (DYNNLO, FEWZ)
  - Bare leptons (after FSR): closer to the measured quantity
  - Dressed leptons: closer to the measured quantity, for comparisons with MC predictions
    - Dressed leptons include all FSR photons in cone  $\Delta R=0.1$ , partially corrects for FSR
  
- So far experiments presented results for
  - ATLAS: Born, bare and dressed leptons
  - CMS: Born and bare leptons (PYTHIA)
  - LHCb: Born and bare (FSR calculated with PHOTOS)
  
- First step: each experiment provides correction factors in the volume of the measurements for (based on MC)
  - Born to bare leptons
  - Born to dressed leptons



# Roadmap for a comparison between the experiments

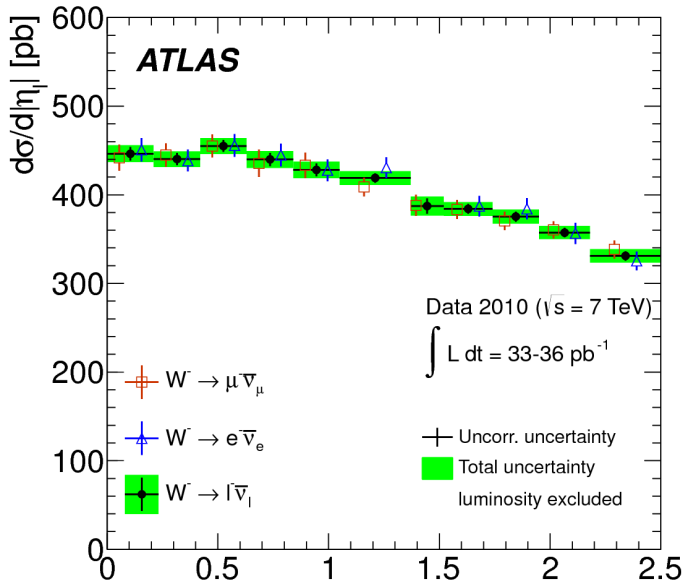
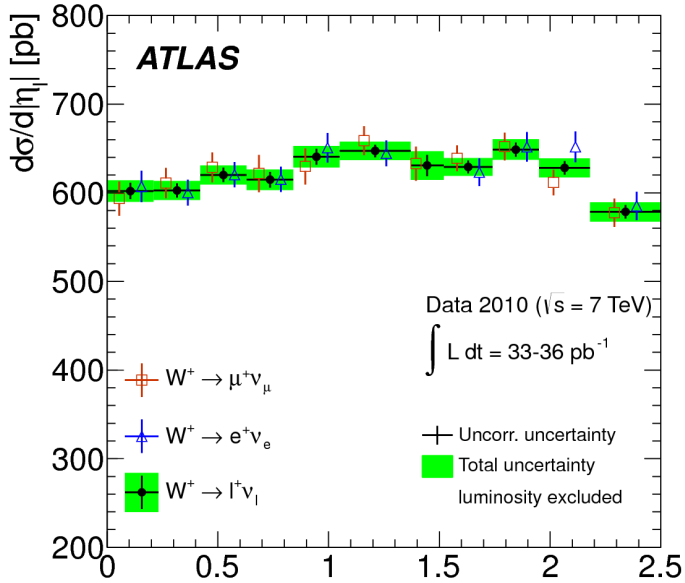
- Proposed plots for a comparison:
  - W-lepton charge asymmetry vs  $\eta$
  - $W^+$  and  $W^-$  cross section vs  $\eta$
  - Z cross section vs rapidity (ATLAS and CMS)
  - Not yet foreseen to compare Z or W  $p_T$  distribution
- Each experiment extrapolates to the fiducial range of the other experiments
  - by changing the appropriate cuts
  - or by determining correction factors with MC, taking into account theoretical uncertainties
  - no extrapolation in pseudorapidity from LHCb to ATLAS/CMS
- Examples of cuts: (2010) W-lepton asymmetry, W cross section vs  $\eta$

		$p_T$ [GeV/c]	$m_T, E_T^{\text{miss}}$
ATLAS	$ \eta  < 2.5$	20	$>40, >25$
CMS	$ \eta  < 2.5$	25, 30	
LHCb	$2 < \eta < 4.5$	20, 25, 30	

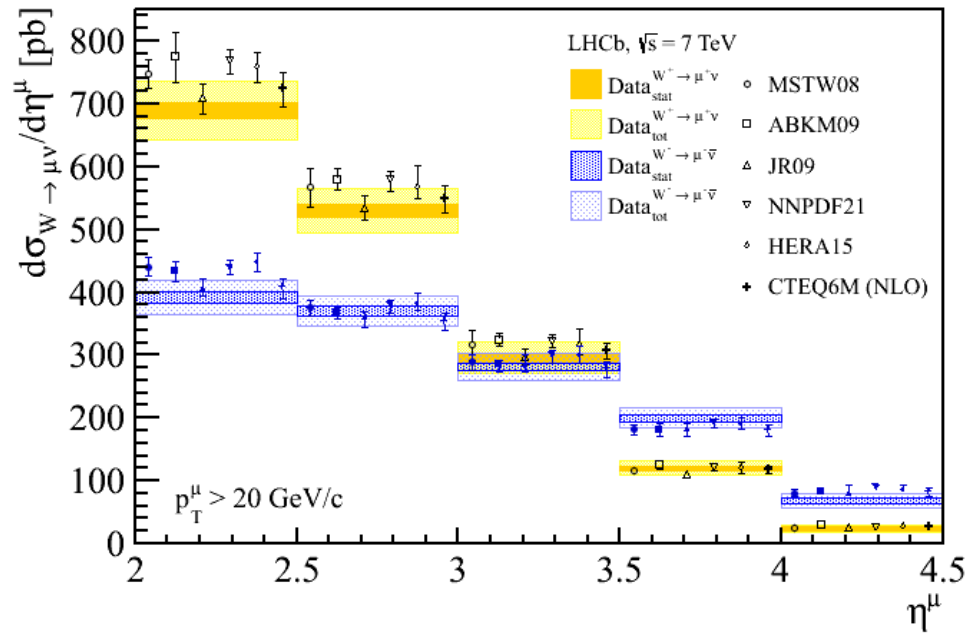
LHCb can measure for  $p_T > 20, 25, 30$  GeV/c; allows to check the extrapolation in  $p_T$   
2011 comparison  $p_T > 25$  GeV/c, 2012 not yet decided

# Proposed plots

# Differential W cross section

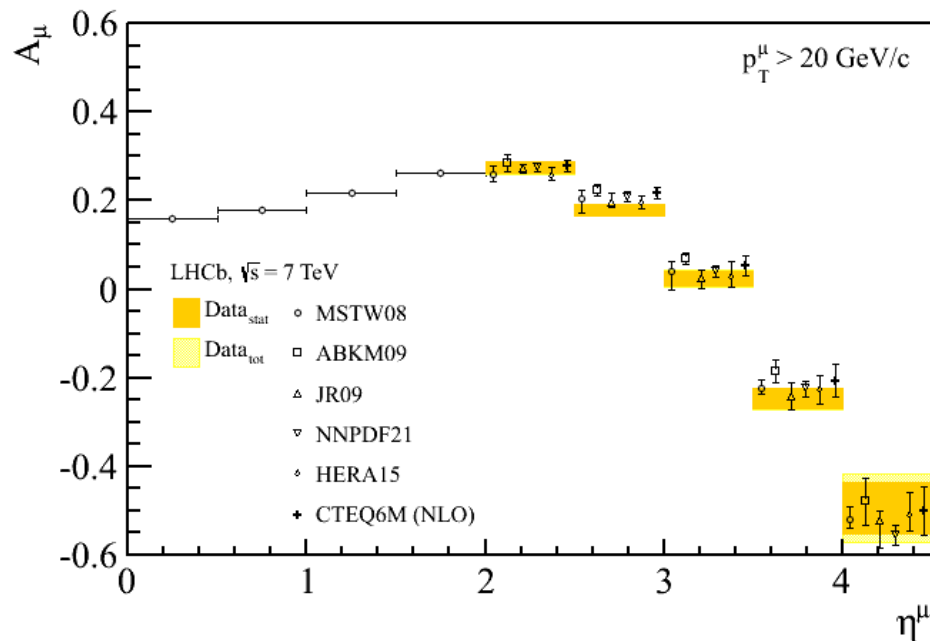
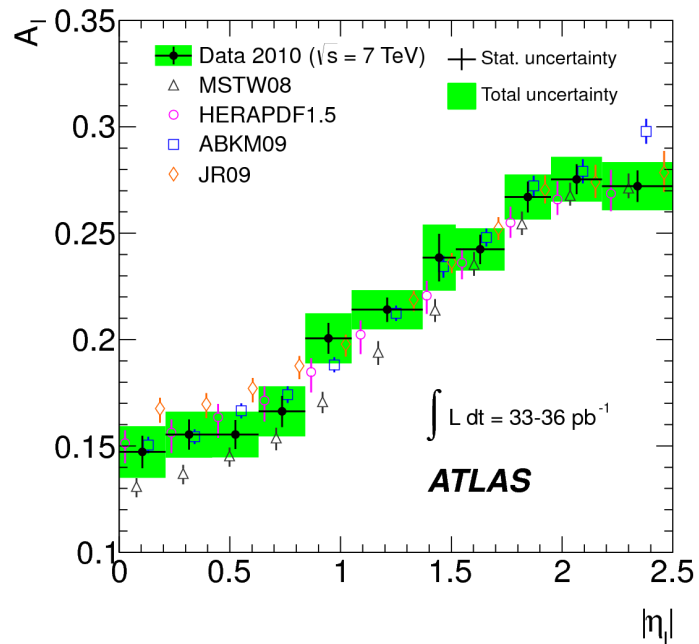


Difference:  $m_T, E_{\text{miss}}^T$  cut for ATLAS  
 CMS: higher  $p_T$  threshold  
 Overlap region 2-2.5

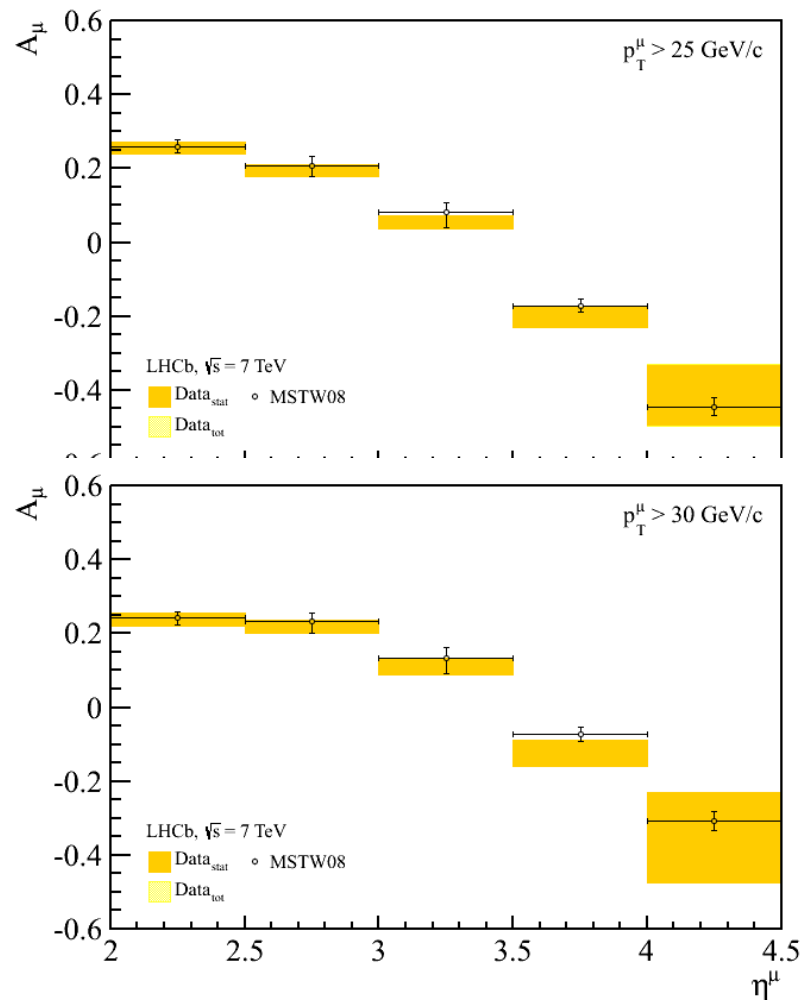
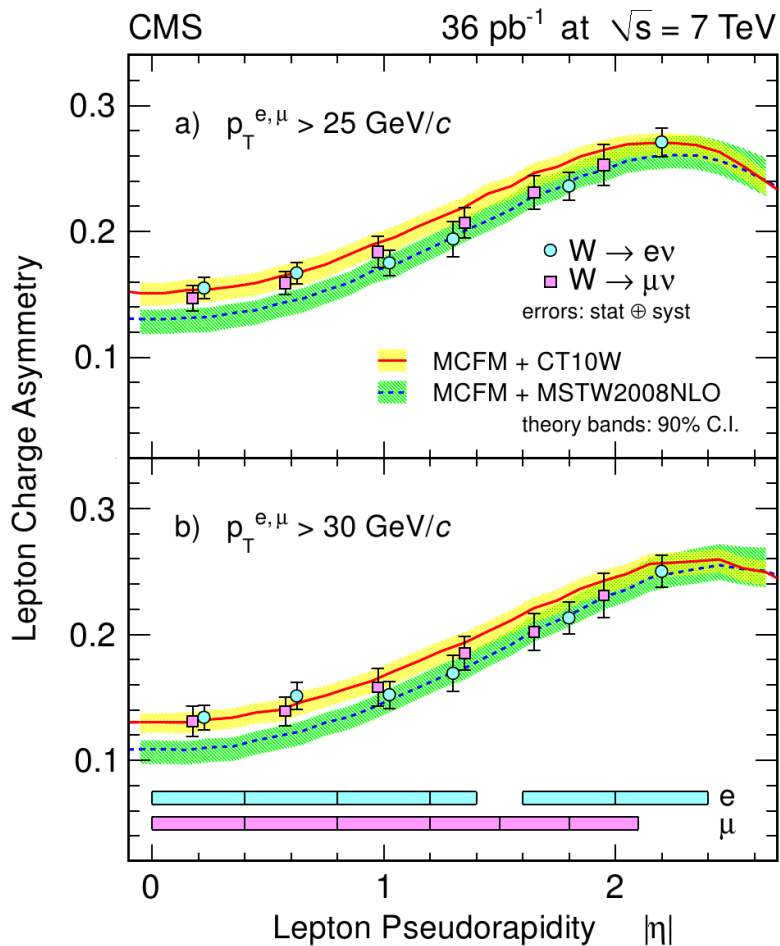


$$A_\mu = \frac{\sigma(W^+ \rightarrow \mu^+ \nu_\mu) - \sigma(W^- \rightarrow \mu^- \bar{\nu}_\mu)}{\sigma(W^+ \rightarrow \mu^+ \nu_\mu) + \sigma(W^- \rightarrow \mu^- \bar{\nu}_\mu)}$$

Difference:  $m_T, E_{\text{miss}}^T$  cut for ATLAS  
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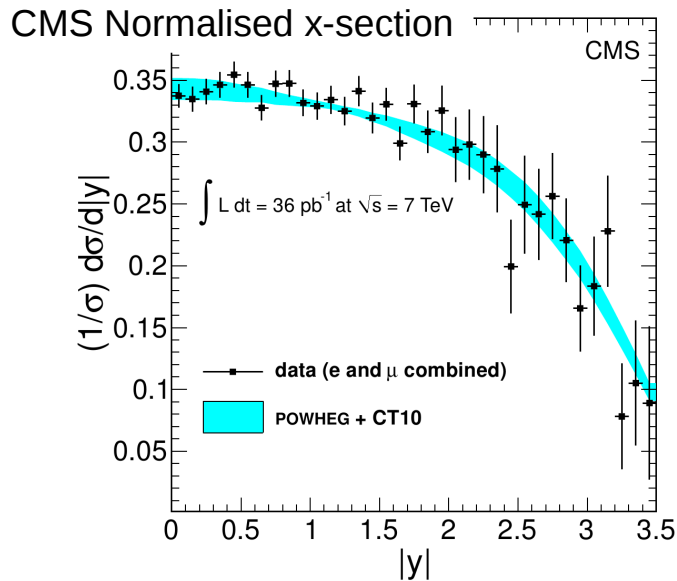
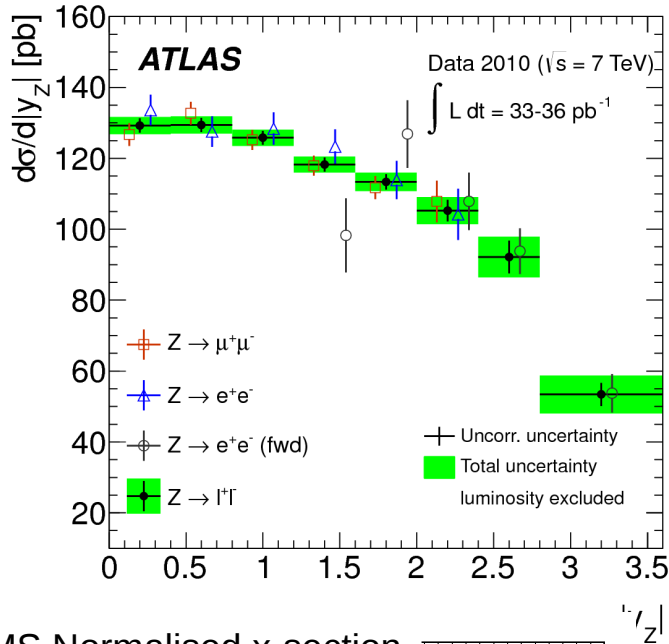


CMS muons  $|\eta| < 2.1$ , electrons:  $|\eta| < 2.4$   
 LHCb  $2 < \eta < 2.5$



# Proposed plots

# Z production



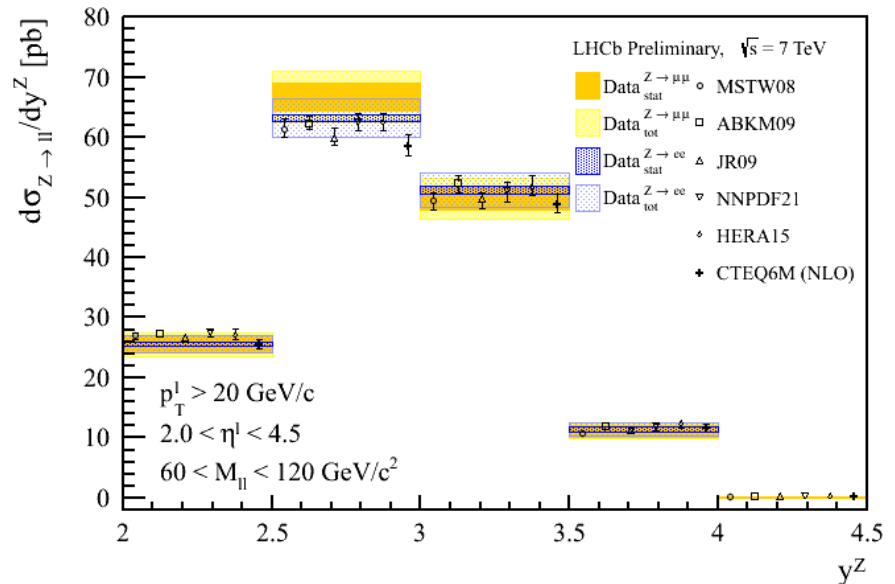
Differences:

ATLAS:  $66 < M_{||} < 116 \text{ GeV}/c^2$

CMS/LHCb:  $60 < M_{||} < 120 \text{ GeV}/c^2$

Comparison ATLAS/CMS with LHCb not yet defined, needs studies of extrapolation in  $\eta$

LHCb:  $2 < \eta < 4.5$



# Roadmap for a comparison between the experiments

- Each experiment determines correction factors for/  $\sigma$ -sections in the fiducial volume of the other experiments
- Each experiment provides correction factors in fiducial range of the other experiments
  - Born to bare leptons
  - Bare to dressed leptons
  - Important cross check of determination of correction factors
- Each experiment is responsible for the overlay plots with their best measurement
- Questions:
  - Other plots of interest for the comparison of the experiments?
  - Is there interest in measurements with dressed photons?



# Conclusion

Agreed on

- Method for the evaluation of theoretical uncertainties in acceptance correction
- Set of plots we want to show for comparison of the three experiment
- Extrapolation into fiducial volumes of ATLAS/CMS/LHCb
- No extrapolation to full phase space
- Concentrate on: overlay plots in fiducial volume of each experiment