Outcome of the WG: W&Z precision measurements

Katharina Müller
on behalf of the LHC W&Z precision measurement WG

Compact Muon Solenoid experiment at CERN's LHC

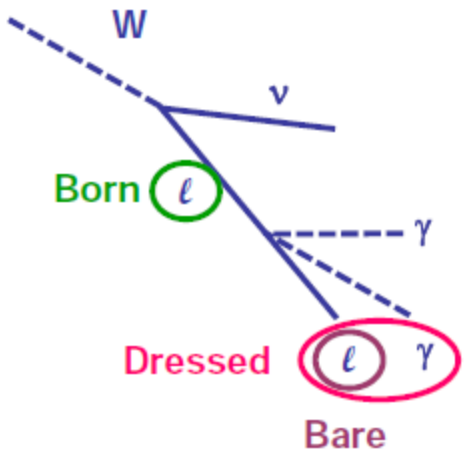
University of Zurich[UZH]
Physics Institute

Proposal of how to achieve a better comparison

- Concentrate on comparisons between the three experiments, not on combination
- No extrapolation to the full phase space
- Each experiment defines the fiducial volume which is best suited
- Results are presented with full covariance matrices
- Agreed procedure of evaluation of theoretical uncertainties in acceptance correction
- 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): muons: 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
    How to evaluate the uncertainties?

- So far experiments presented for
  - ATLAS: Born, bare and dressed leptons
  - CMS: bare and born leptons (PYTHIA)
  - LHCb: Born and bare (FSR calculated with PHOTOS)

- Every experiment provides correction factors in the fiducial 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:
  - Lepton charge asymmetry vs η
  - W+ and W^- cross section vs η
  - Z cross section vs rapidity (ATLAS and CMS)
  - Not yet foreseen to compare Z pt distribution

- Each experiment extrapolates to the fiducial range of the other experiments
  - No extrapolation in pseudorapidity
  - By changing the appropriate cuts
  - Or determine correction factors with MC, taking into account theoretical uncertainties

		p_T [GeV/c]	M [GeV/c^2] Z analysis	M^T,E_T^{miss} W analysis
ATLAS	$\|\eta\|<2.5$	20 (25 $W \rightarrow e\nu$)	66-116	
CMS	$\|\eta\|<2.5$	25-30	60-120	
LHCb	$2<\eta<4.5$	>20,25,30	60-120	>40, >25

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

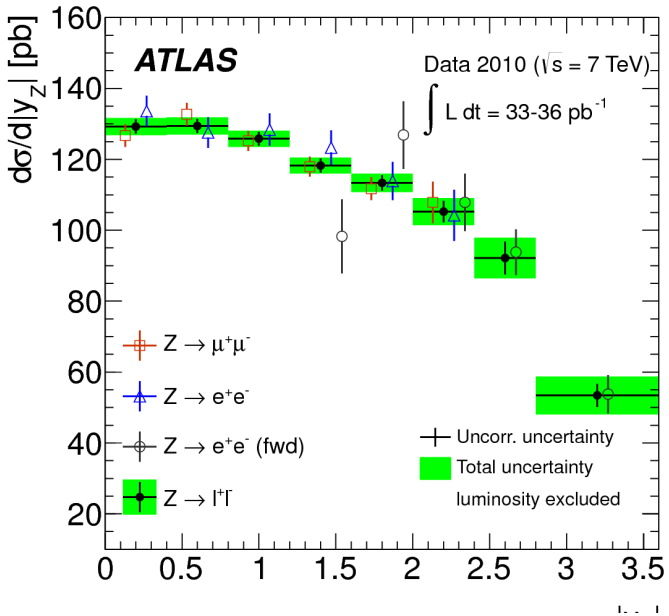
Roadmap for a comparison between the experiments

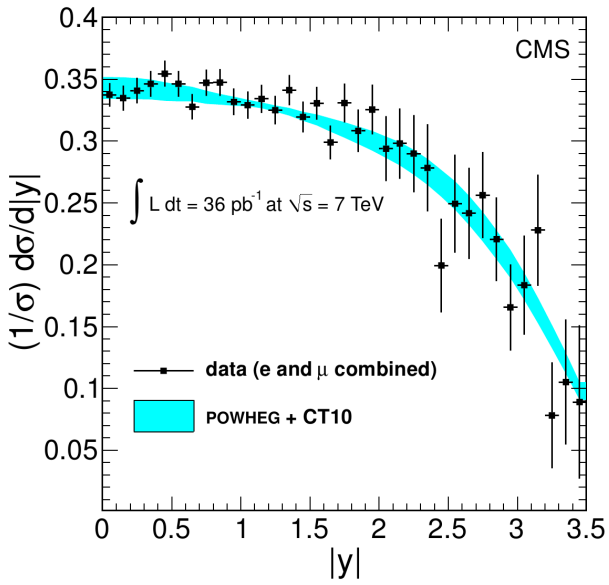
- Each experiment provides correction factors in fiducial range of the other experiments
  - Born to bare leptons
  - Bare to dressed leptons
  - → Important cross check of determination of correction factors

- Each experiment is responsible for the overlay plots with their best measurement

- Questions:
  - are these the best plots for the comparison?
    - Lepton charge asymmetry vs η
    - W+ and W^- cross section vs η
    - Z cross section vs rapidity
  - Is there interest in measurements with dressed photons?

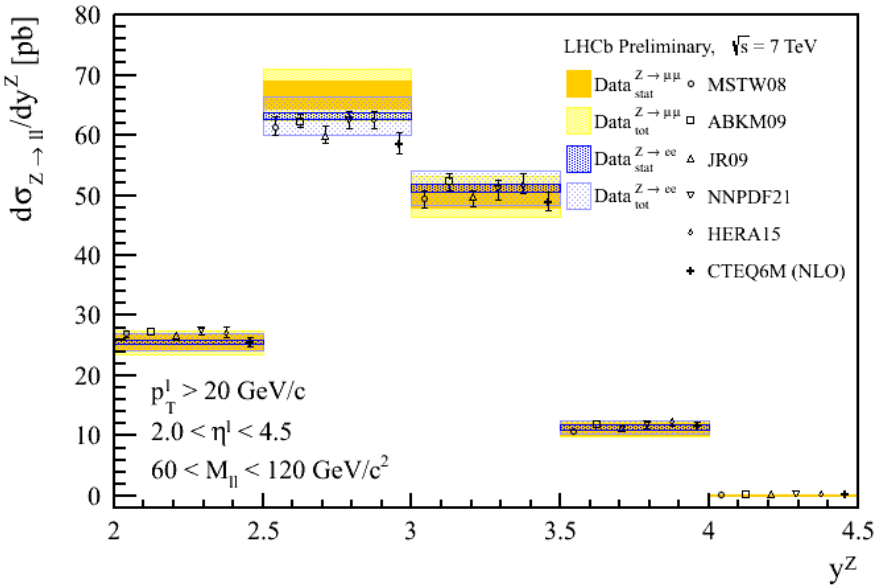
Proposed plots Z production



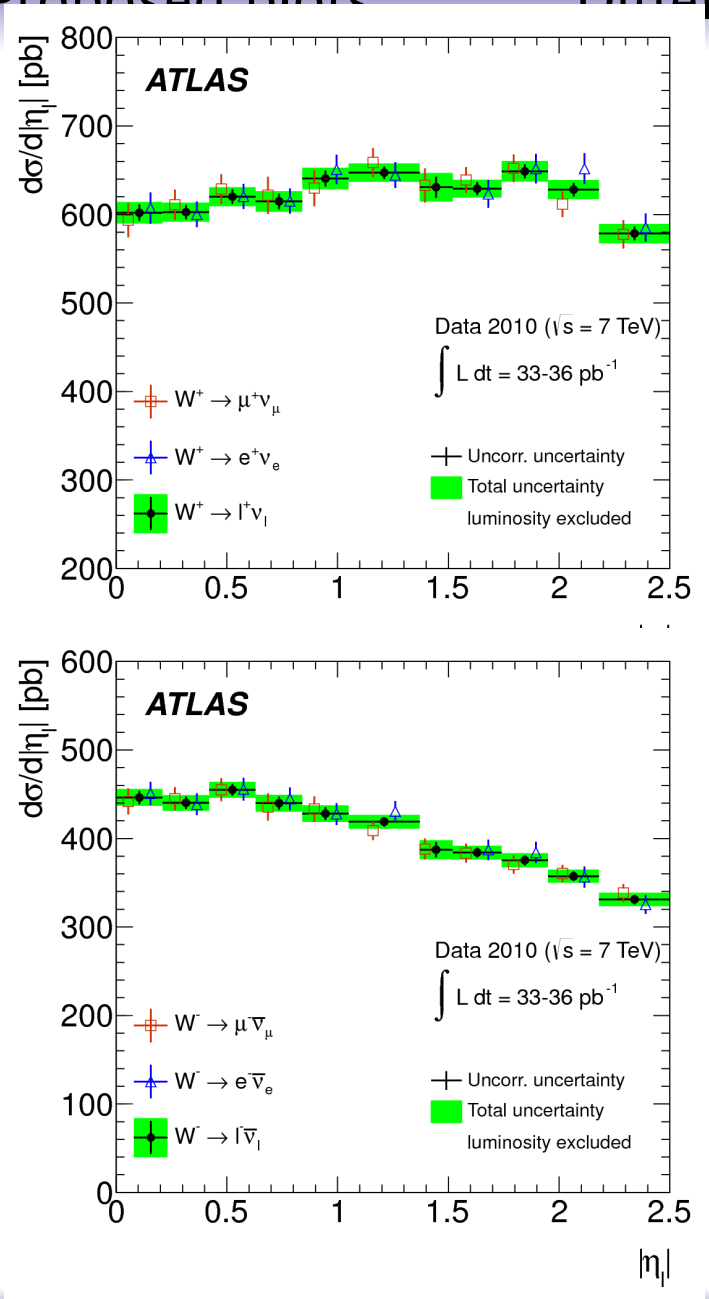


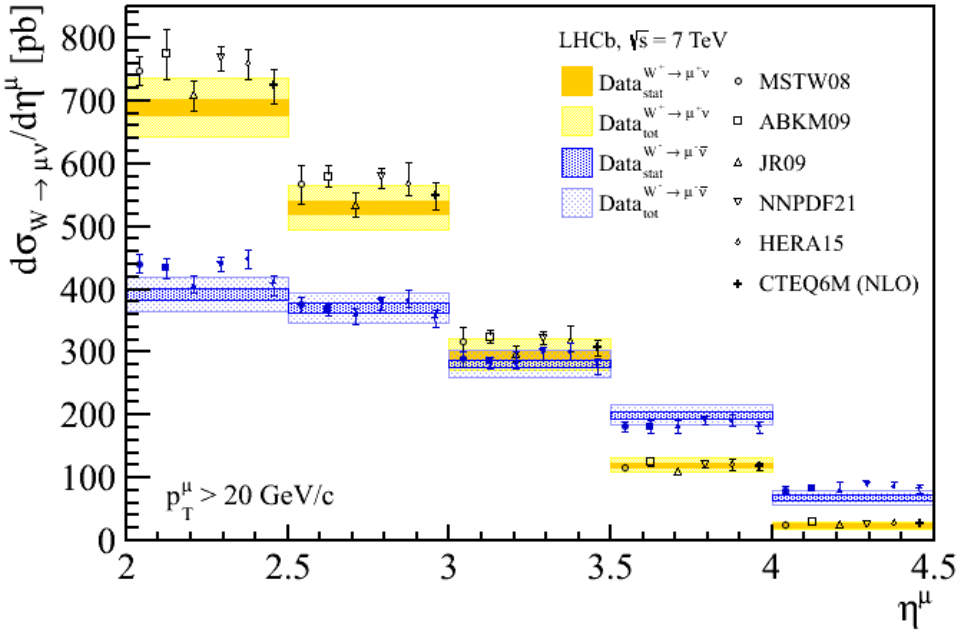
Comparison ATLAS/CMS with LHCb not yet defined

ATLAS/CMS: |(ηlepton)|<2.5
LHCb: 2< η < 4.5



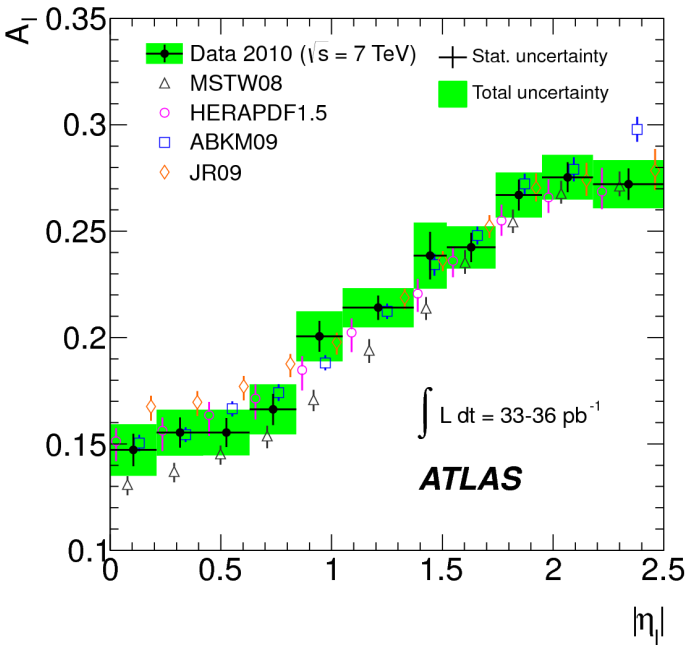
Proposed plots Differential W cross section

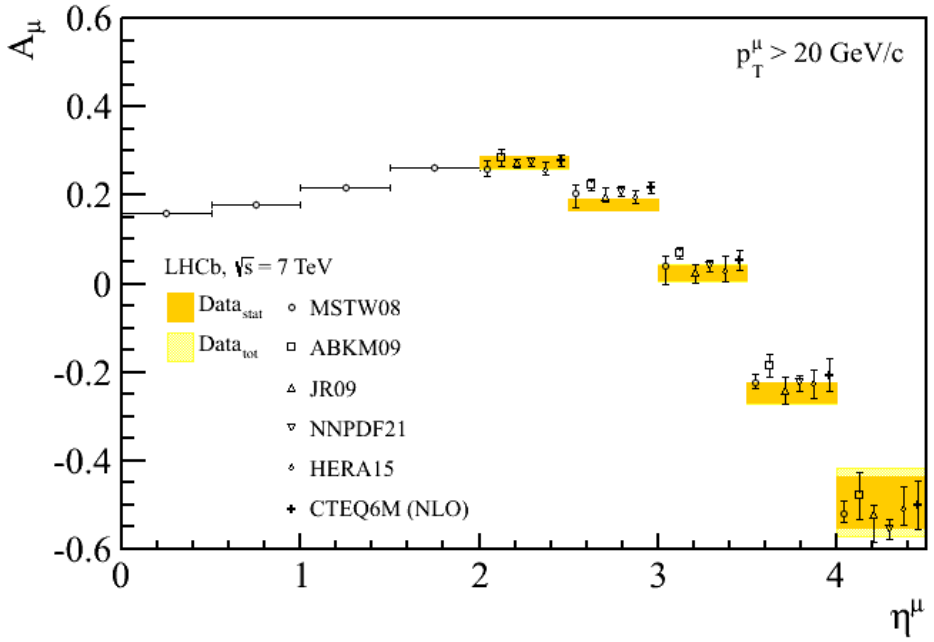




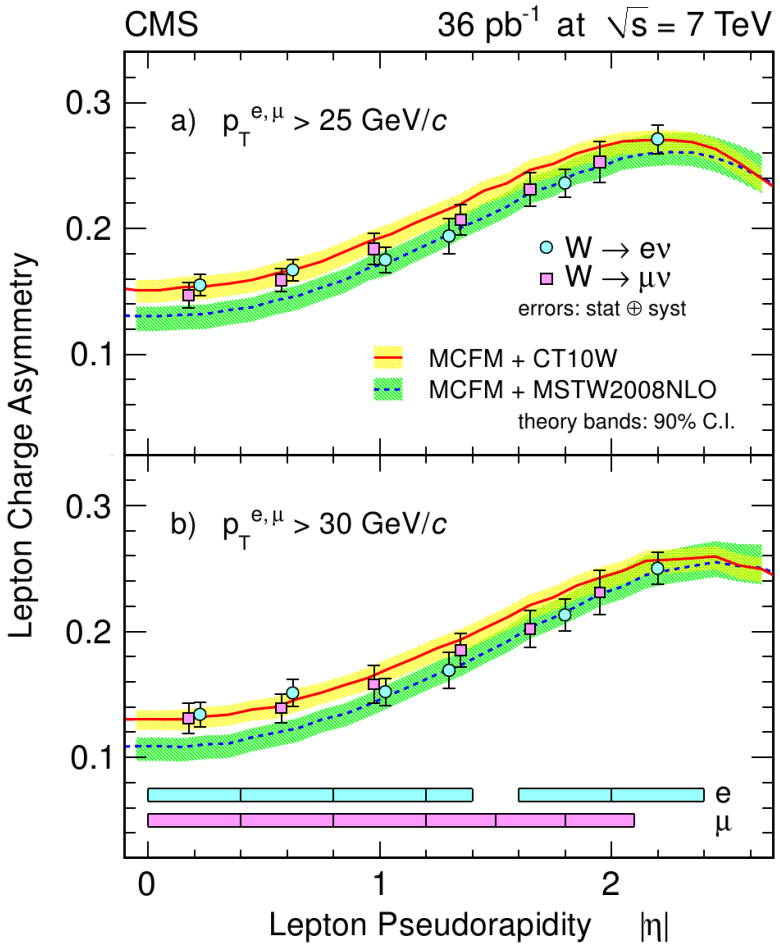
Proposed plots Lepton charge asymmetry

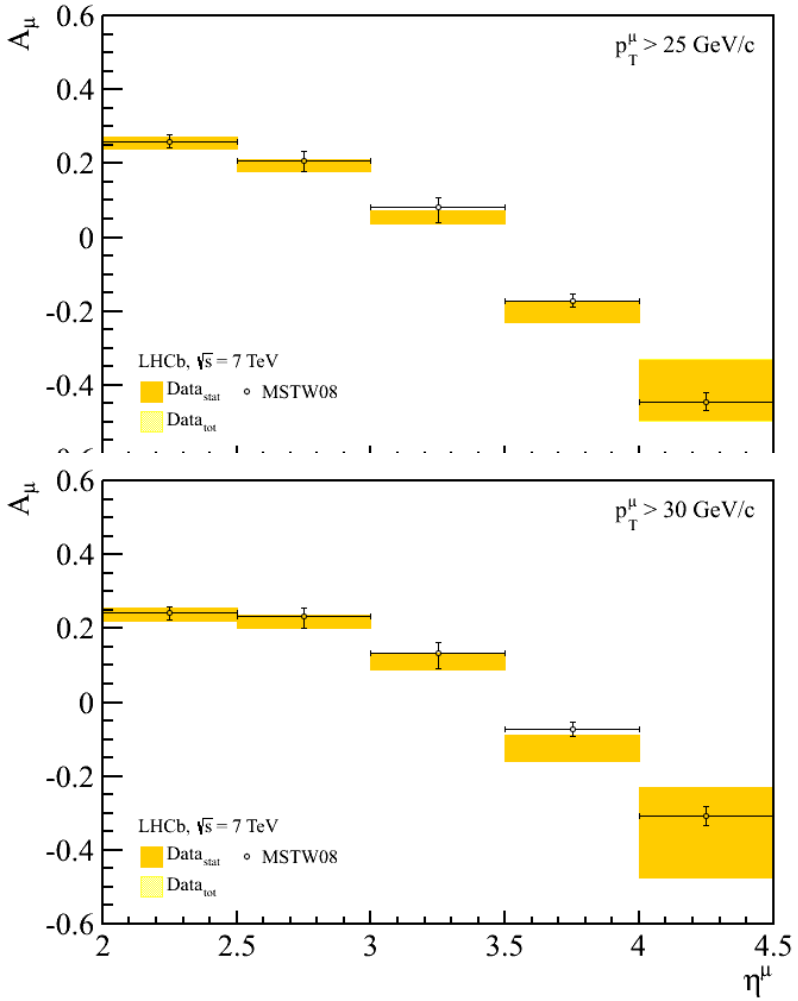
$$A_\mu = \frac{\sigma(W^+ \to \mu^+ \nu_\mu) - \sigma(W^- \to \mu^- \bar{\nu}_\mu)}{\sigma(W^+ \to \mu^+ \nu_\mu) + \sigma(W^- \to \mu^- \bar{\nu}_\mu)}$$





Proposed plots Lepton charge asymmetry





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 in pseudorapidity foreseen
- Overlay plots in fiducial volume of each experiment