W charge asymmetry studies

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Introduction

"The measurement of W charge asymmetry at 13 TeV with the CMS detector and a global QCD analysis using the CMS and ATLAS data on this asymmetry."
Main steps:

- Repeat calculation of W asymmetry at 8TeV + global fit

- K-factors production at 13 TeV using MCFM-8.0 + mcmf-bridge development
- Calculation of grids of W production at 13 TeV in NNLO approach + global fit
- Global fit using the CMS and ATLAS data on W charge asymmetry + comparison with calculated results

First calculation of the 8 TeV grids

Comparison to published results "Measurement of the differential cross section and charge asymmetry for inclusive $pp \to W^{\pm} + X$ production at $\sqrt{s} = 8$ TeV" arXiv:1603.01803v2

Our input:

- $p_{T_l} > 25$ GeV
- $|\eta_l| < 2.4$
- MCFM-6.8(NLO)+APPLgrid-1.4.70
- CT10 NLO
- mcfm-bridge 0.0.35
- $m_t = 173.0$ GeV
- $m_b = 4.5$ GeV
- $m_c = 1.43$ GeV

Paper input:

- $p_{T_l} > 25$ GeV
- $|\eta_l| < 2.4$
- MCFM-6.8(NLO)+APPLgrid-1.4.56
- HERAPDF 1.5 NLO
- mcfm-bridge 0.0.27
- $m_t = 173.2$ GeV
- $m_b = 4.75$ GeV
- $m_c = 1.5$ GeV

First calculation of the 8 TeV grids : W^+

red is published result
blue is calculated result

$$Ratio = \frac{published}{calculated}$$

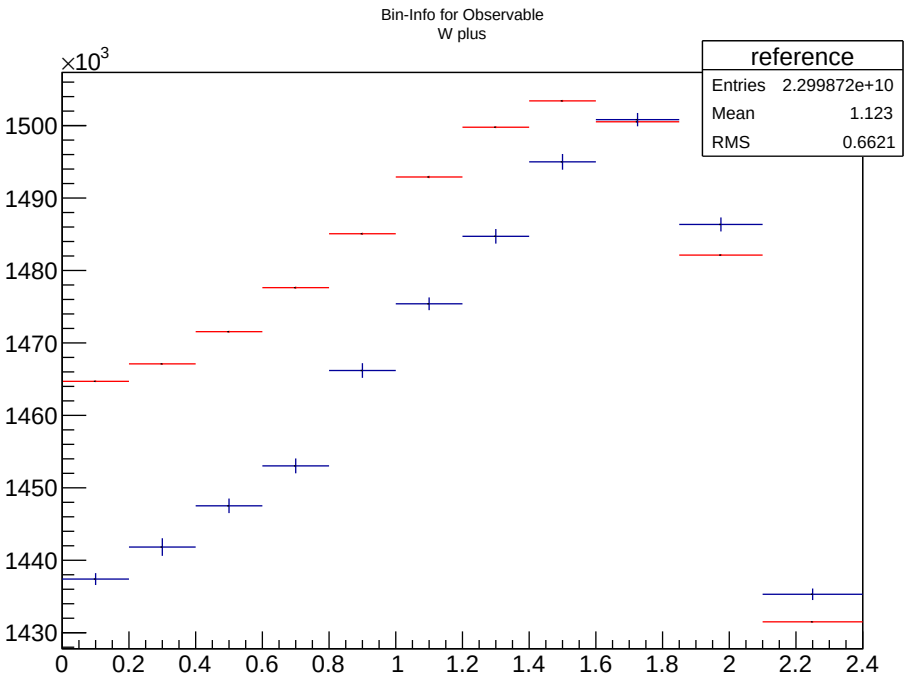


Figure: W^+ comparison

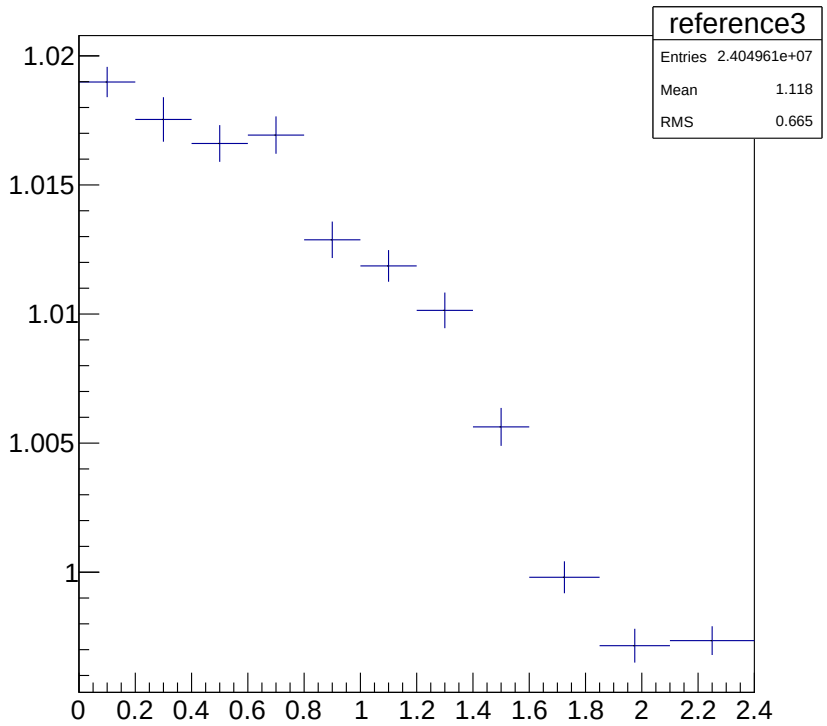


Figure: W^+ ratio

First calculation of the 8 TeV grids : W^-

red is published result
blue is calculated result

$$Ratio = \frac{published}{calculated}$$

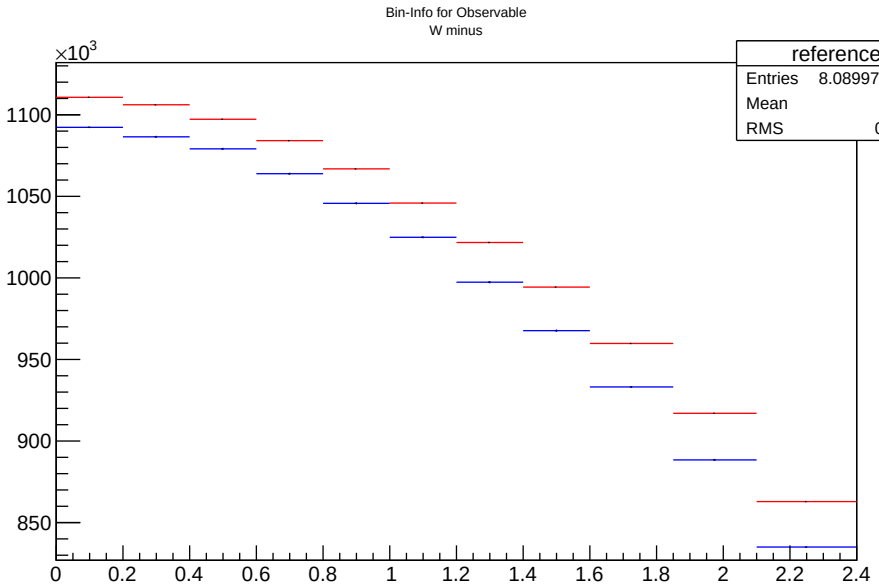


Figure: W^- comparison

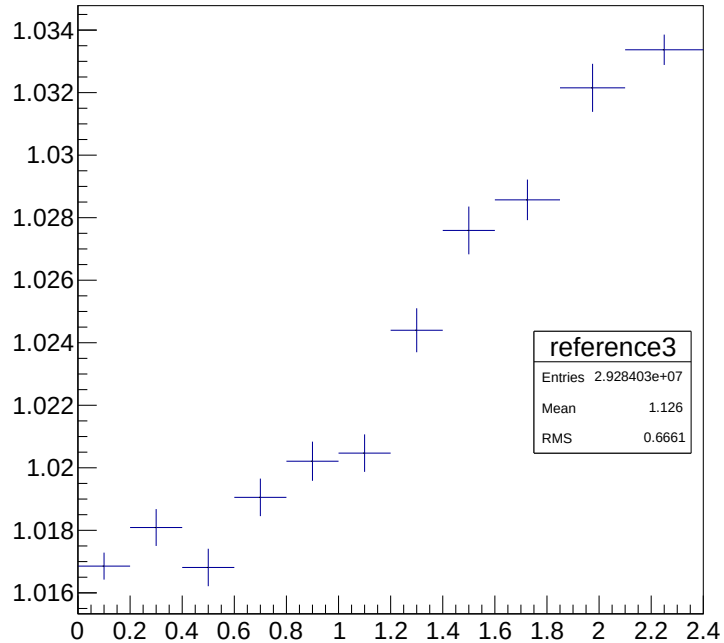
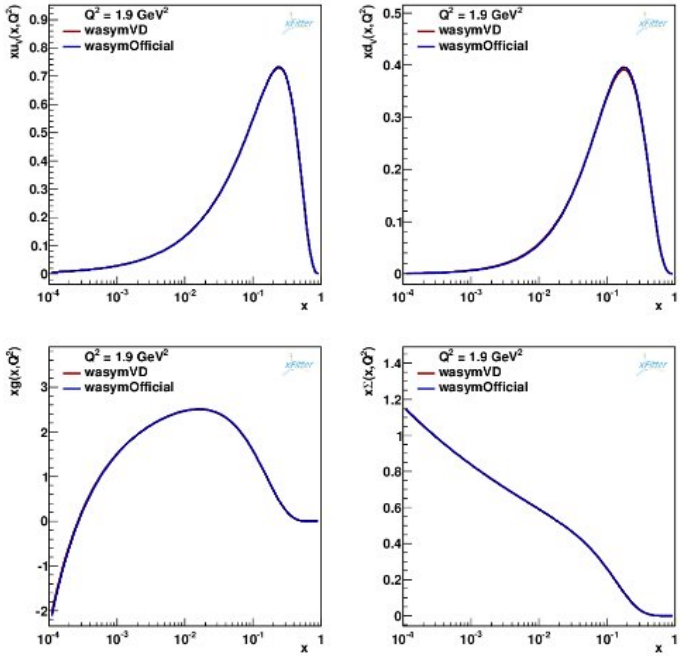


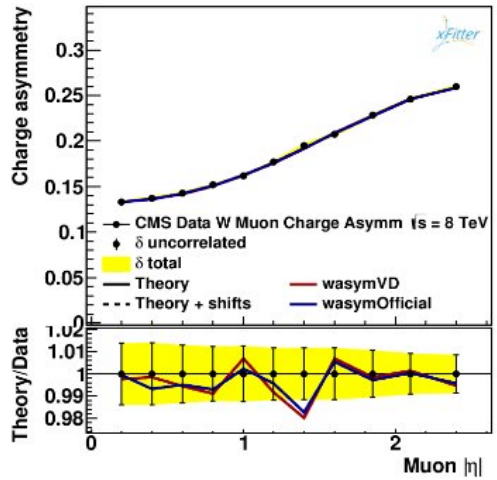
Figure: W^- ratio

Comparison of PDFs with official W asymmetry at 8 TeV@NLO with calculated grid

Dataset	wasymVD	wasymOfficia
HERA1+2 CCep	41 / 39	41 / 39
HERA1+2 CCem	57 / 42	57 / 42
HERA1+2 NCem	217 / 159	217 / 159
HERA1+2 NCep 820	61 / 63	61 / 63
HERA1+2 NCep 920	377 / 332	377 / 332
HERA1+2 NCep 460	203 / 187	203 / 187
HERA1+2 NCep 575	200 / 234	200 / 234
CMS W muon asymmetry 8 TeV	6.4 / 11	4.1 / 11
Correlated χ^2	57	57
Log penalty χ^2	-6.33	-6.49
Total χ^2 / dof	1212 / 1051	1210 / 1051
χ^2 p-value	0.00	0.00



- Results very similar but not identical
- Main difference seen in W asym data
- Needs to be investigated further, of course



Reproduction of the published 8 TeV grids

- MCFM-6.8+APPLgrid-1.4.70
  original was done with APPLgrid-1.4.56
- mcfm-bridge 0.0.35
  original was done with mcmf-bridge 0.0.27
  (Pavel knows...)

same input for W^+ & W^-

- HERAPDF 1.5 NLO
- $m_t = 173.2$ GeV
- $m_b = 4.75$ GeV
- $m_c = 1.5$ GeV

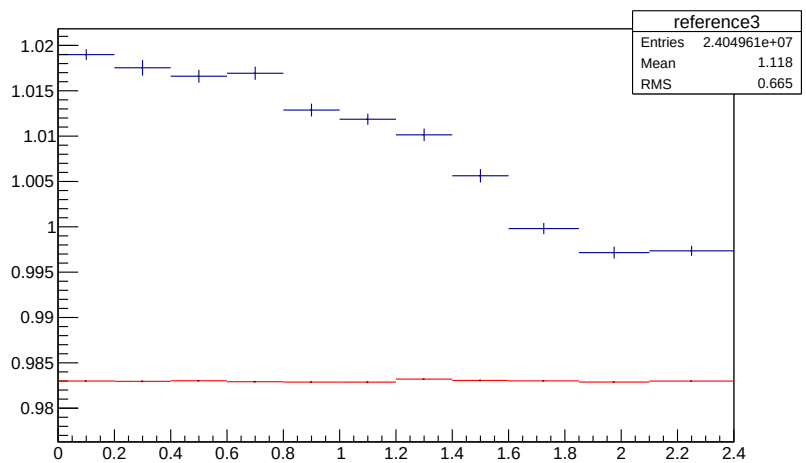


Figure: W^+ ratios

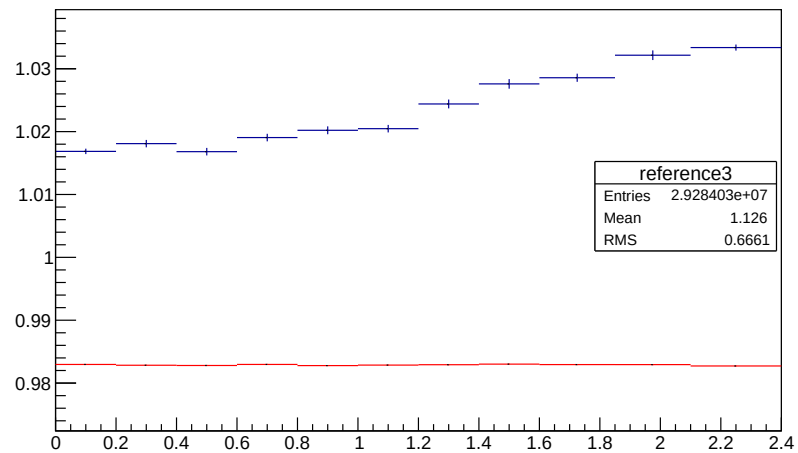
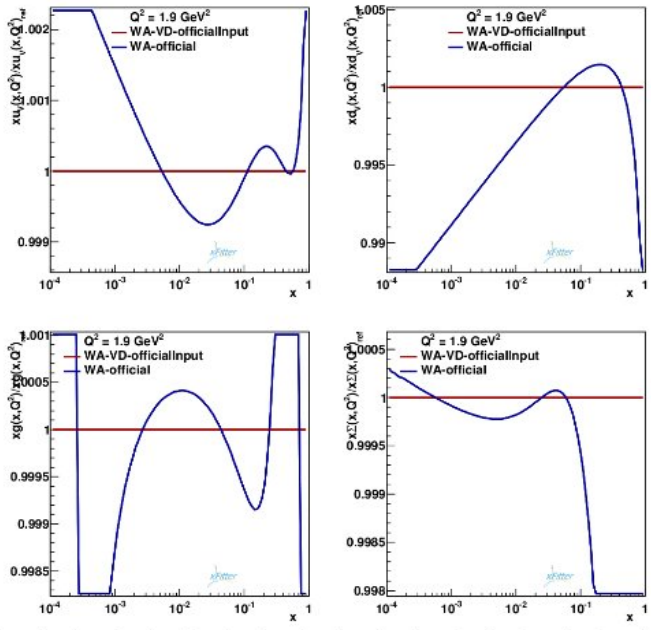


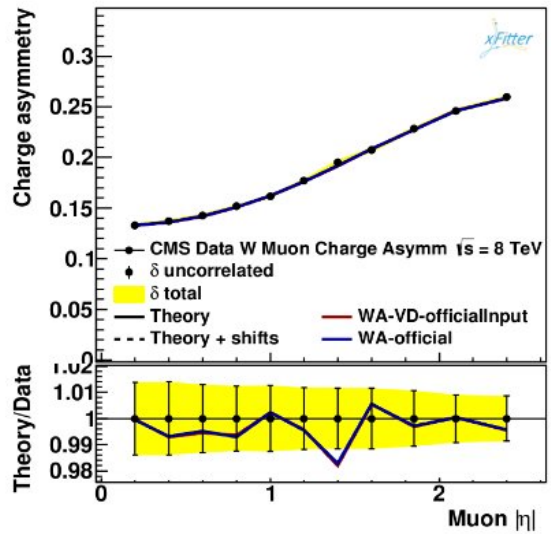
Figure: W^- ratio

Comparison of PDFs with official W asymmetry at 8 TeV@NLO with calculated grid using Ringaile input file

Dataset	WA-VD-officialInput	WA-official
HERA1+2 CCep	41 / 39	41 / 39
HERA1+2 CCem	57 / 42	57 / 42
HERA1+2 NCem	217 / 159	217 / 159
HERA1+2 NCep 820	61 / 63	61 / 63
HERA1+2 NCep 920	377 / 332	377 / 332
HERA1+2 NCep 460	203 / 187	203 / 187
HERA1+2 NCep 575	200 / 234	200 / 234
CMS W muon asymmetry 8 TeV	4.3 / 11	4.1 / 11
Correlated χ^2	57	57
Log penalty χ^2	-6.48	-6.49
Total χ^2 / dof	1210 / 1051	1210 / 1051
χ^2 p-value	0.00	0.00



- Results essentially identical
  - See also next slide
- For PDFs ratios shown to see any difference



W asymmetry

$$A(\eta) = \frac{\sigma_\eta^+ - \sigma_\eta^-}{\sigma_\eta^+ + \sigma_\eta^-}$$

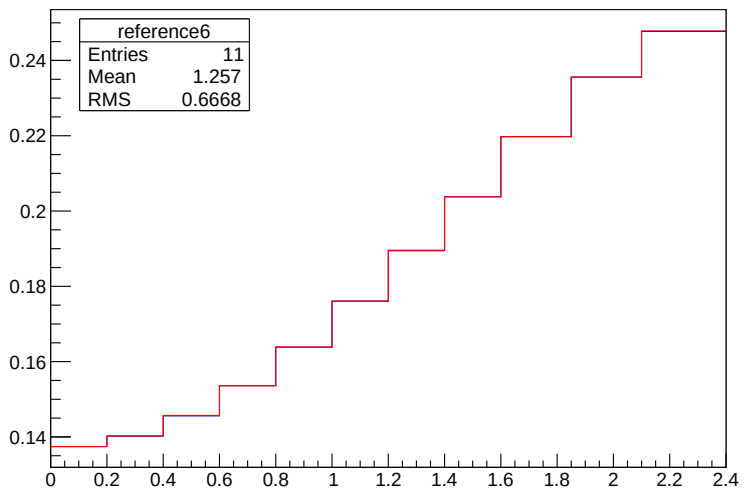


Figure: W asymmetry comparison

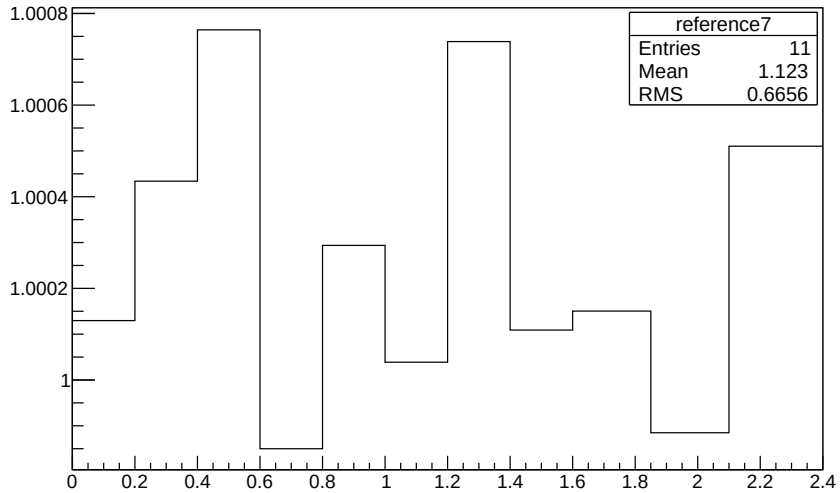


Figure: W asymmetry ratio

- investigation of the difference in σ is ongoing(difference in mcfm-bridges?)..
- calculation of the K-factors in NNLO with MCFM-8.0 being started

"The Truth Is Out There..."

SA F.Mulder