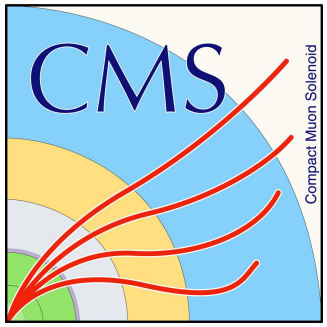

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PRAGUE, CZECH REPUBLIC

Universidad de Oviedo
Universidá d'Uviéu
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Measurements of the pp→WZ **inclusive** and **differential** production cross section and constraints on charged anomalous triple gauge couplings at **13 TeV**

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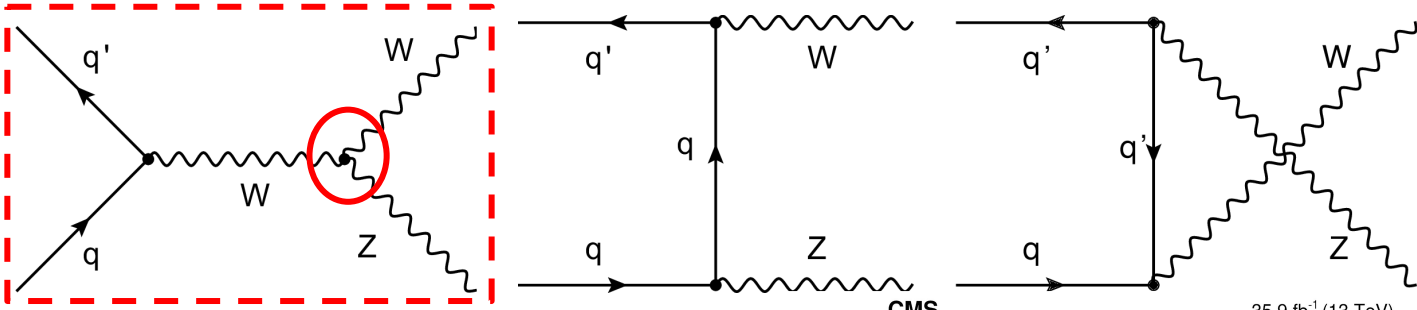
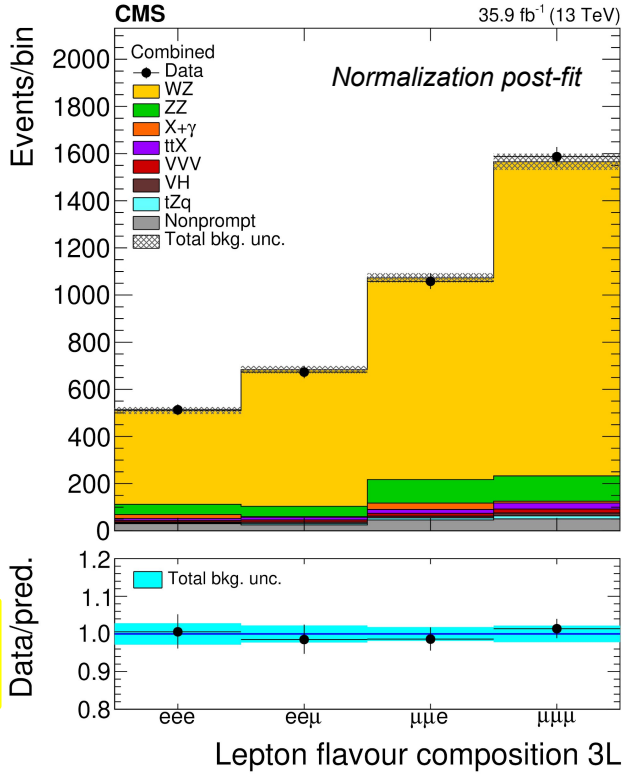
Motivation



- The production process pp→WZ is studied in the **trilepton** final state at **13 TeV**, using the full **2016** data set with a total integrated luminosity of **35.9 fb^{-1}** collected with the CMS detector **Reference:** JHEP 04 (2019) 122
- WZ associated production provides a unique test of the SM predictions for **trilinear** gauge couplings: unique probe of the **charged SM WWZ coupling**
- Deviations from the **SM predictions**, both in the total and differential cross sections, would indicate hints of **new phenomena**

Binned likelihood fit to the 4 flavor categories to extract the signal

Lepton ID is designed to reduce the non-prompt lepton in the selection



Total and fiducial cross section

The **inclusive cross section** is measured to be

$\sigma_{tot}(pp\to WZ)=48.09^{+1.00}_{-0.96}(stat)^{+0.44}_{-0.37}(theo)^{+2.39}_{-2.17}(syst)\pm 1.39\ (lumi)$ pb,

resulting in a total uncertainty of −2.78/+2.98 pb

Category	Fiducial cross section [fb]
eee	$63.7^{+3.8}_{-3.7}\,(stat)^{+0.6}_{-0.6}\,(theo)^{+5.3}_{-4.7}\,(syst)\pm 1.9\,(lumi)$
eeμ	$61.6^{+3.0}_{-2.9}\,(stat)^{+0.6}_{-0.5}\,(theo)^{+3.7}_{-3.3}\,(syst)\pm 1.9\,(lumi)$
e$\mu\mu$	$63.4^{+2.6}_{-2.6}\,(stat)^{+0.6}_{-0.5}\,(theo)^{+3.5}_{-3.2}\,(syst)\pm 1.9\,(lumi)$
$\mu\mu\mu$	$67.1^{+2.1}_{-2.0}\,(stat)^{+0.6}_{-0.5}\,(theo)^{+3.3}_{-3.0}\,(syst)\pm 1.9\,(lumi)$
Combined	$257.5^{+5.3}_{-5.0}\,(stat)^{+2.3}_{-2.0}\,(theo)^{+12.8}_{-11.6}\,(syst)\pm 7.4\,(lumi)$

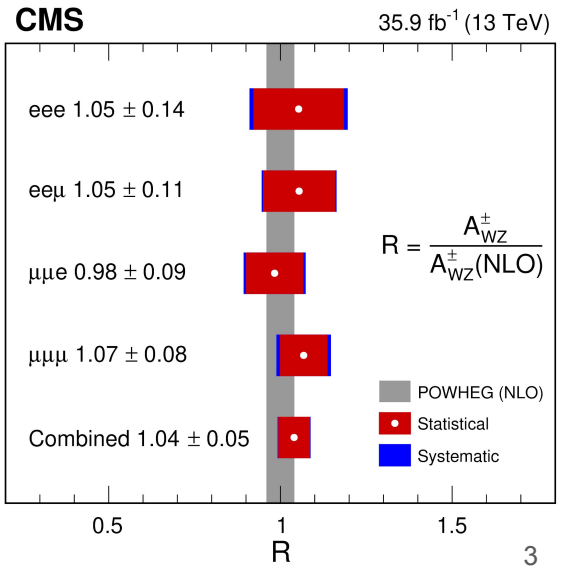
Result dominated by systematic uncertainties

Source	Combined	eee	eeμ	e$\mu\mu$	$\mu\mu\mu$
Electron efficiency	1.9	5.9	3.9	1.9	—
Electron energy scale	0.3	0.9	0.2	0.6	—
Muon efficiency	1.9	—	0.8	1.8	2.6
Muon momentum scale	0.5	—	0.7	0.3	0.9
Trigger efficiency	1.9	2.0	1.9	1.9	1.8
Jet energy scale	0.9	1.6	1.0	1.7	0.8
b-tagging (id.)	2.6	2.7	2.6	2.6	2.4
b-tagging (mis-id.)	0.9	1.0	0.9	1.0	0.7
Pileup	0.8	0.9	0.3	1.3	1.4
ZZ	0.6	0.7	0.4	0.8	0.5
Nonprompt norm.	1.2	2.0	1.2	1.5	1.0
Nonprompt (EWK subtr.)	1.0	1.5	1.0	1.3	0.8
VVV norm.	0.5	0.6	0.6	0.6	0.5
V H norm.	0.2	0.2	0.3	0.2	0.2
$t\bar{t}$ V norm.	0.5	0.5	0.5	0.5	0.5
tZq norm.	0.1	0.1	0.1	0.1	0.1
X+γ norm.	0.3	0.8	< 0.1	0.7	< 0.1
Total systematic	4.7	7.8	5.8	5.4	4.6
Integrated luminosity	2.8	2.9	2.8	2.9	2.8
Statistical	2.1	6.0	4.8	4.1	3.1
Total experimental	6.0	10.8	8.0	7.5	6.3
Theoretical	0.9	0.9	0.9	0.9	0.9

Fiducial results are extrapolated to the total WZ production cross section for **$60 < m_Z^{OSSF} < 120$ GeV**

The result is in good agreement with the **MATRIX NNLO** prediction

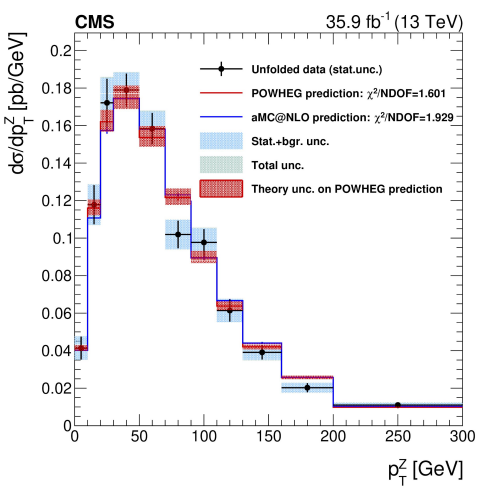
Total cross section can be split in **W^+Z** and **W^-Z** and measure the asymmetry statistically dominated

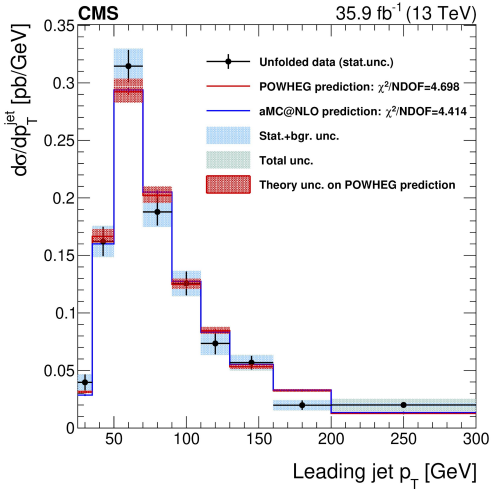


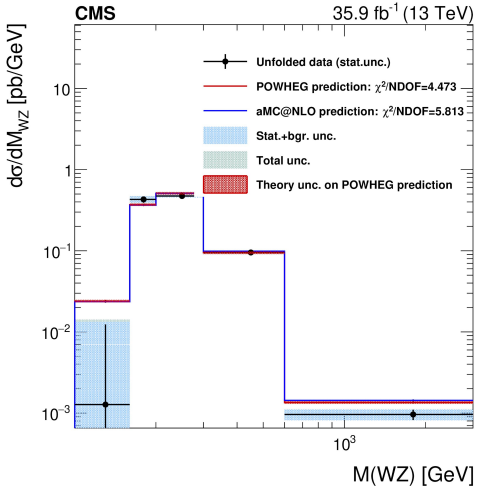
*theoretical prediction with **NNPDF3.0 NLO***

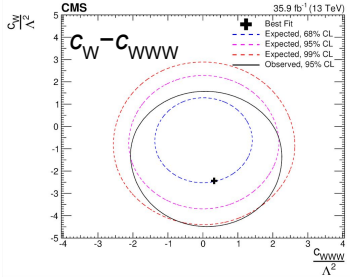
Differential Cross Sections & Anomalous Couplings

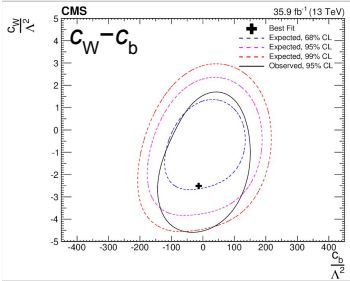
Differential cross sections are measured as a function of p_T^Z, leading jet p_T, and $M(WZ)$
Results are compared with predictions from the **POWHEG** and **MadGraph5_MC@NLO** generators

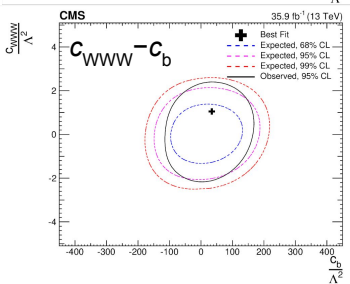












In addition, confidence intervals for anomalous triple gauge boson couplings are extracted for each of the possible one- and two-dimensional combinations of the anomalous couplings parameters, using the *M*(WZ) variable in a maximum likelihood fit

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The confidence intervals obtained represent the most stringent results on the anomalous **WWZ triple gauge coupling** to date