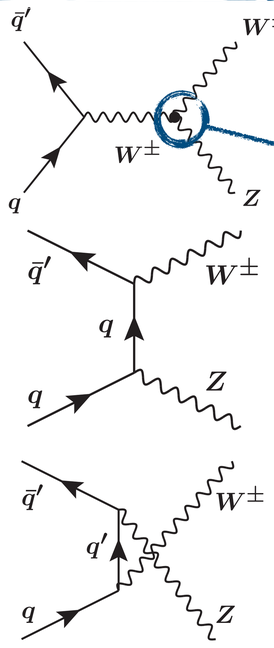
Measurement and interpretations of $W^{\pm}Z$ cross-sections in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector

Léo Boudet (LAPP, CNRS)

$W^{\pm}Z$ inclusive production



Important test of the Standard Model, probing the **triple gauge coupling (TGC)**.

Precision measurement with leptonic decays, full Run 2 dataset (140 fb^{-1}).

Comparison with **state-of-the art Monte Carlo predictions** and theoretical calculations.

$W^{\pm}Z \to \ell\nu\ell\ell$ event selection

Final state electrons and muons selection in **three steps**:

Baseline leptons → Loose selection, $p_T > 5$ GeV

Z-leptons → Tighter ID cut, $p_T > 15$ GeV

W-leptons → Tighter ID and isolation cuts, $p_T > 20$ GeV

- **Signal region**: 3 baseline leptons (≥1 W-lepton and 2 Z-leptons with SF, OS and $|m_{\ell\ell} - m_Z| \leq 10$ GeV)
- **ZZ control region**: ≥4 baseline leptons
- **ttV control region**: 2 tagged b-jets
- **Misidentified leptons**: Data-driven computation of fake factors

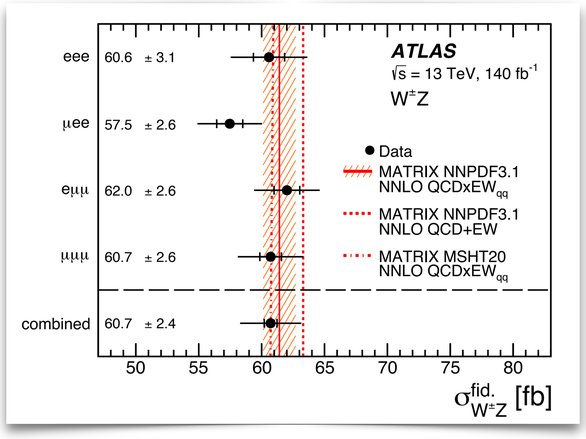
→ Electroweak WZjj considered as background

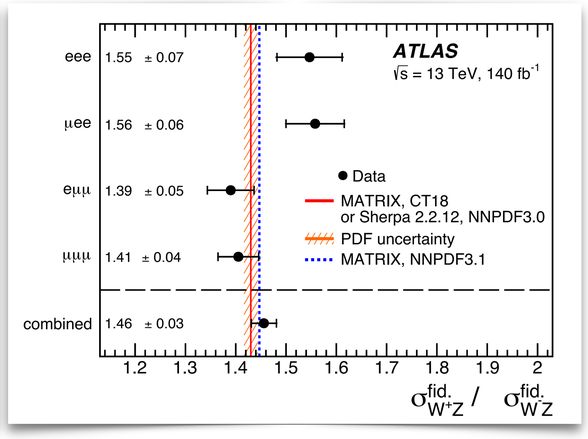
Inclusive cross-section measurement

Signal events — Remove τ contribution

$$\sigma^{fid}_{W^{\pm}Z\to\ell\nu\ell\ell} = \frac{N_{obs} - N_{bkg}}{\mathcal{L} \cdot C_{WZ}} \times \left(1 - \frac{N^{\tau}_{MC,rec}}{N^{all}_{MC,rec}}\right)$$

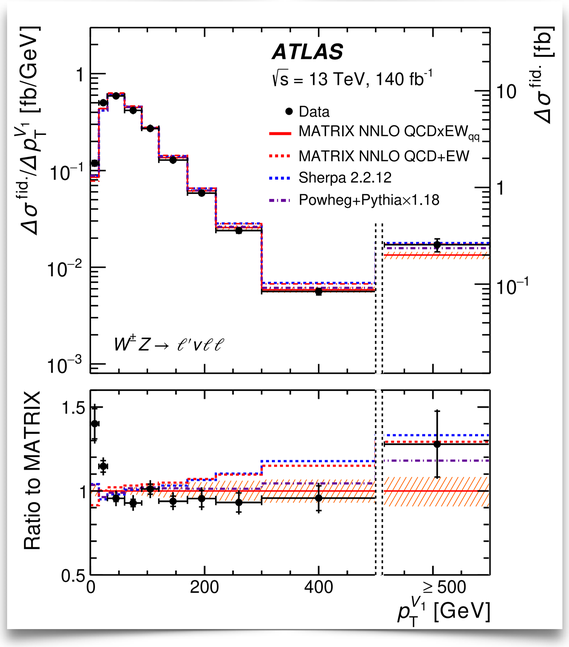
Luminosity — Correction $C^{\ell,\ell'}_{WZ} = \frac{N_{MC,reco}}{N_{MC,gen}}$



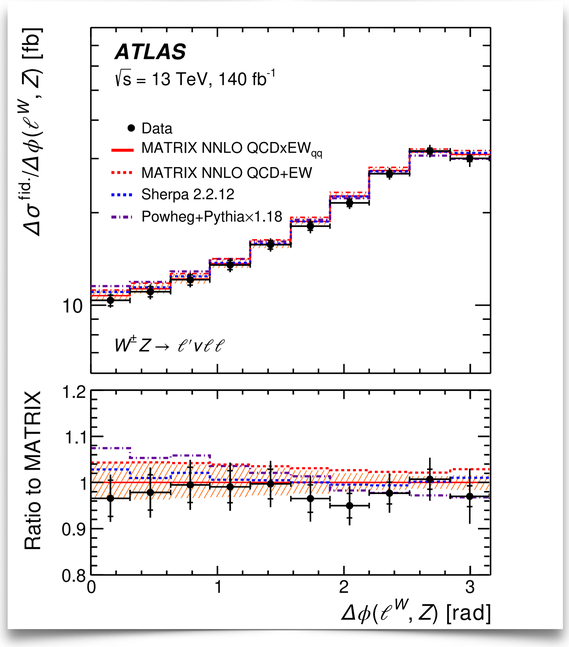


- **4.0% uncertainty** (0.8% stat. + 3.4% syst. + 1.0% lumi.)
- **2.3% uncertainty** on the **MATRIX prediction** (NNLO QCD x NLO EW).

Differential cross-sections measurements



Differential cross-sections sensitive to **NLO EW corrections** in the high energy tails.



MC generators: better measurement description by Sherpa multijet-merged prediction.

EFT interpretation

$$\mathcal{L}_{SMEFT} = \mathcal{L}_{SM} + \sum_{n\geq 5}\sum_{i} \frac{c_i^{(n)}}{\Lambda^{n-4}}\mathcal{O}^{(n)}$$ → Neglect dimension 5 (L violation)

$$|\mathcal{M}|^2 = |\mathcal{M}_{SM}|^2 + \frac{2c_i}{\Lambda^2}\mathrm{Re}\{\mathcal{M}^*_{SM}\mathcal{M}_6\} + \frac{c_i^2}{\Lambda^4}|\mathcal{M}_6|^2$$

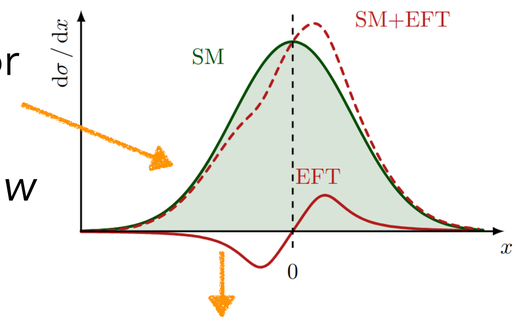
SM-EFT interference

- **CP-conserving operators**:

Fit on **diboson transverse mass** m_T^{WZ} sensitive to EFT effects in high energy tail.

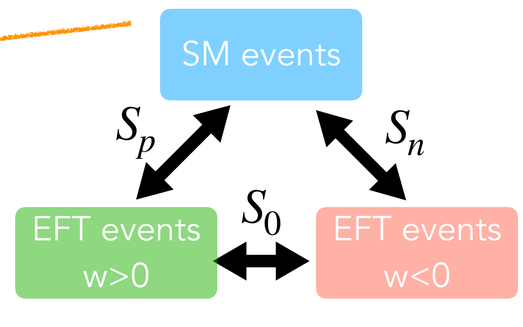
- **CP-violating operators**:

Interference term **asymmetric** for CP-odd variables, MC events generated with negative weight *w*

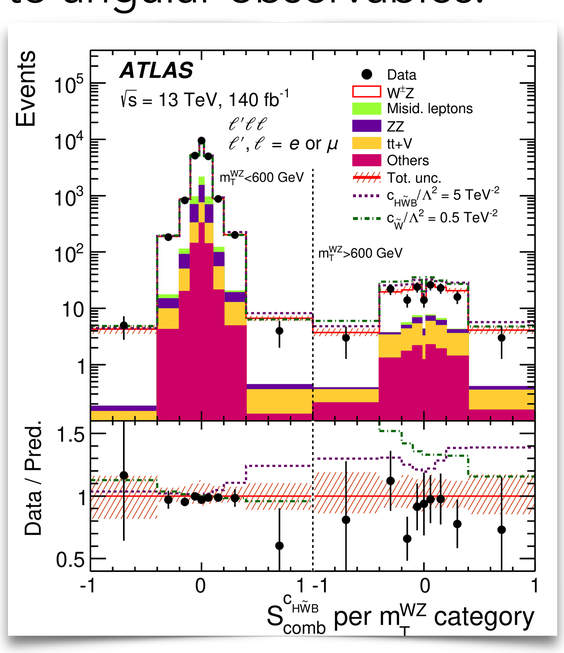


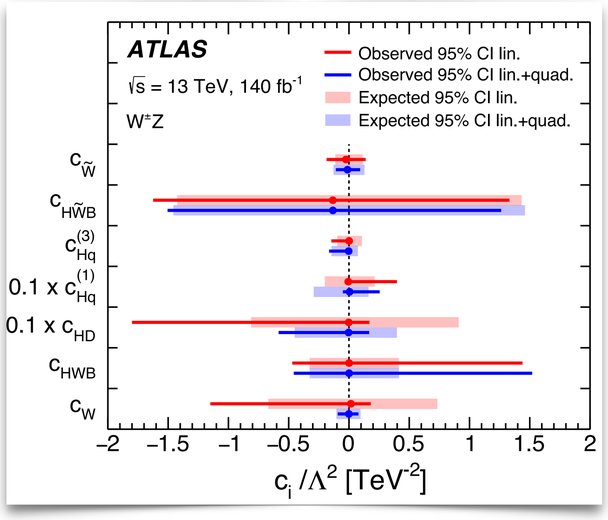
Combined BDT score:

$$S_{\mathrm{comb}} = S_0 \times \frac{1+S_p}{2} \times \frac{1+S_n}{2}$$



Limits on CP-odd Wilson coefficients improved by up to a **factor 3** with respect to angular observables.





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