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DRESDEN concept

Constraining new physics from electro-weak measurements

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Electroweak measurements

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Standard Model Electroweak measurements are good reinterpretation candidates:

- Gauge boson self-interactions can be used as tools to search for nonstandard BSM effects
- Sensitivity to New Physics effects possible in the high energy tails → Differential cross sections are very sensitive
- BSM contributions to the electroweak gauge bosons interactions can be modelled by Effective Field Theory (EFT) frameworks. This model-independent approach allows to describe the effects of some new physics with a mass scale Λ much larger than the electroweak scale.

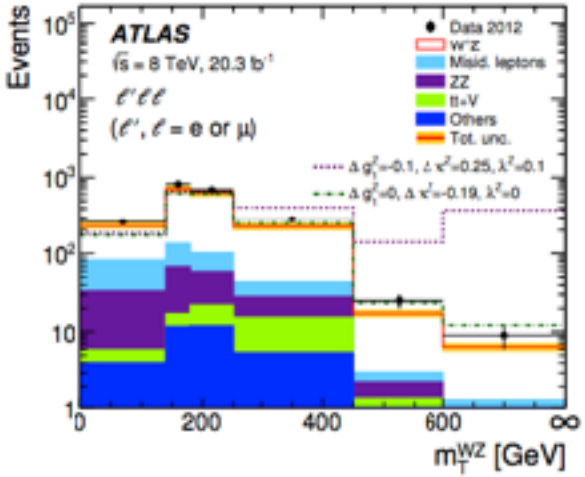
Current Standard Model Electroweak results already cover :

- Fiducial and total cross sections
- Unfolded distributions of many kinematic variables
- Some BSM interpretations :
  - Limits on anomalous triple and quartic couplings
  - Limits on specific BSM models (i.e ssWW to probe the double charged higgs)

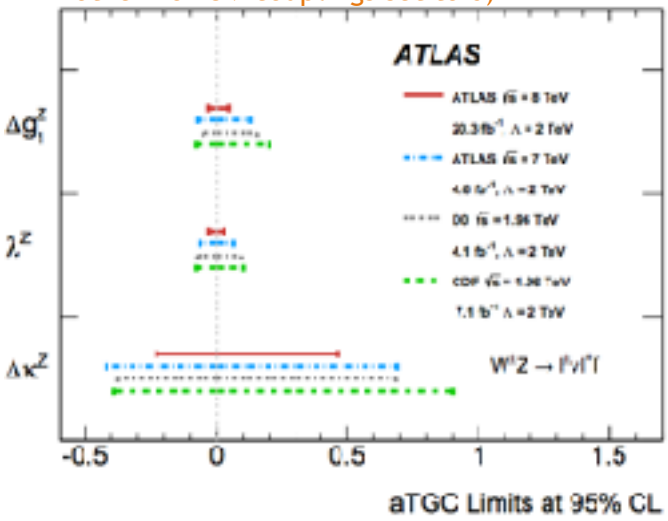
The idea

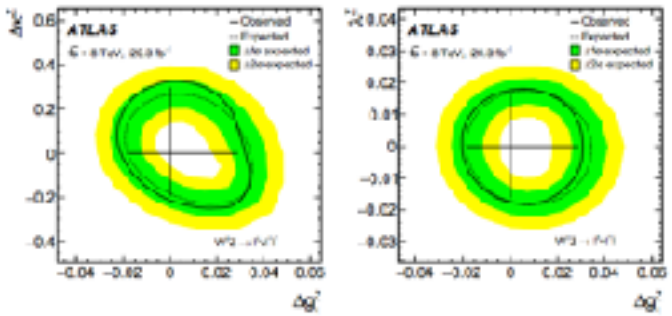
Data → (set constrains) → **aGC limits** ⇄ (match to the EFT / interprent bounds) ⇄ **Theories**

WZ 8 TeV paper as example



1D limits (1 free parameter on the fit, other non SM couplings set to 0)





2D limits (2 free parameter on the fit, other non SM couplings set to 0)

I. Brivio slides

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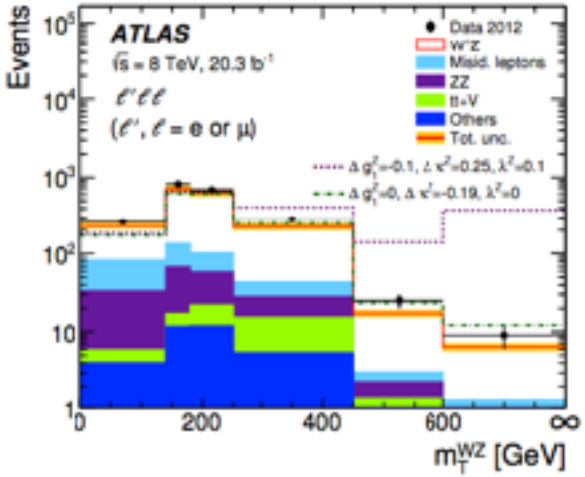
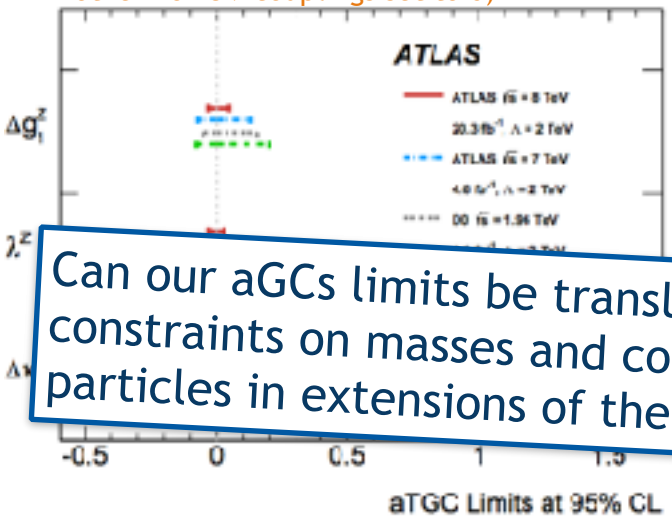
Data → (set constrains) → **aGC limits** ⇄ (match to the EFT / interprent bounds) ⇄ **Theories**

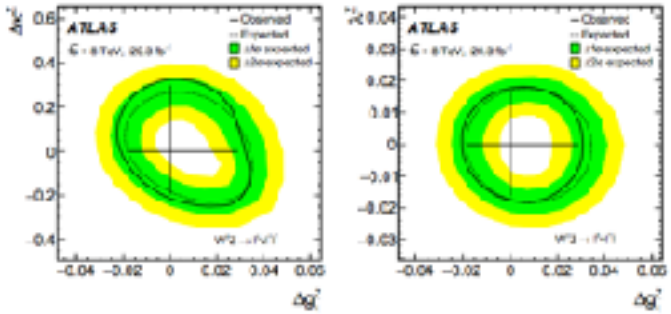
WZ 8 TeV paper as example



1D limits (1 free parameter on the fit, other non SM couplings set to 0)



Can our aGCs limits be translated into constraints on masses and couplings of new particles in extensions of the SM?

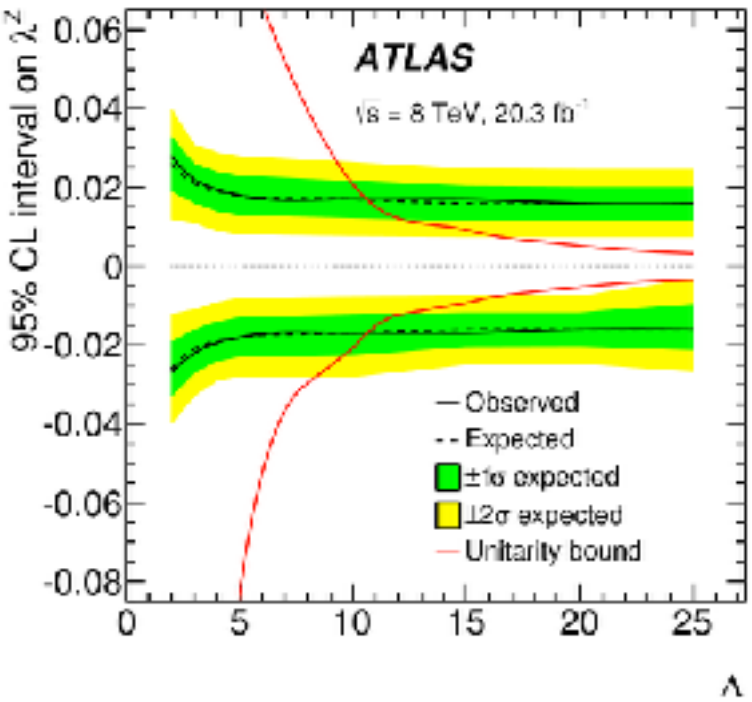


2D limits (2 free parameter on the fit, other non SM couplings set to 0)

I. Brivio slides

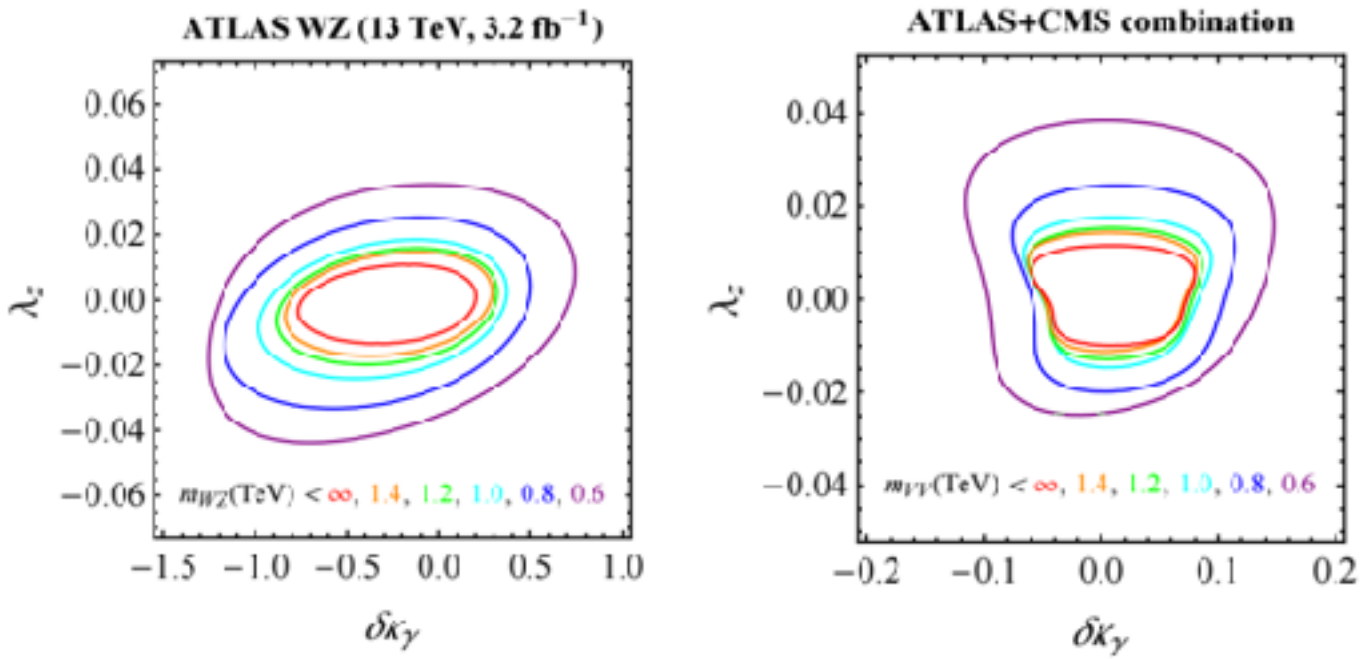
Can our aGCs limits be translated into constraints on masses and couplings of new particles in extensions of the SM?

- The EFT provides a good approximation of the underlying UV theory at energy scales E<<Λ.
- For an specific model the chosen cut-off scale used to derive our limits might not be the appropriated leading to weaker or tighter limits.
- Another technical issue to consider is that current aTGC limits fits are done with either 1 or 2 free couplings, the rest of the non SM couplings are set to 0



Electroweak results reinterpretation

- Falkowski et al in this paper arXiv:1609.06312 already did the test!
  - ATLAS and CMS results on the WW and WZ (8 and 13 TeV) were used to recast our limits.



- They used our figures and extract the information from them, no correlations on the systematics considered (No information on hepdata available)

What do we need to provide to allow our measurements to be widely/easily and correctly used?

Physics point of view

- Dibosons system invariant mass when posible
- Angular distributions
- Set limits on anomalous couplings with as many as free couplings as possible (i.e without assuming SM values to the others)
- Evaluate if the quadratic terms are important (for aTGC)
- Clearly state the energy scale we are probing while setting the limits
- Avoid form factors (ATLAS aGC task force recommendations)
- Agree on the EFT base to provide results (ATLAS aGC task force recommendations)

and technically

- Data measurements (some already available in hepdata)
  - Uncertainties and correlations
  - Theory uncertainties
- Rivet analysis routine
- Likelihoods of the fits

Is this enough?

- If we want to recalculate limits or combine results?
- Do we have a common strategy on what we want to make public? Data format? frameworks to use?

Backup