



Aspects of the W boson pair production in association with one jet at the ATLAS detector

Evangelos Kourlitis — ATLAS Group

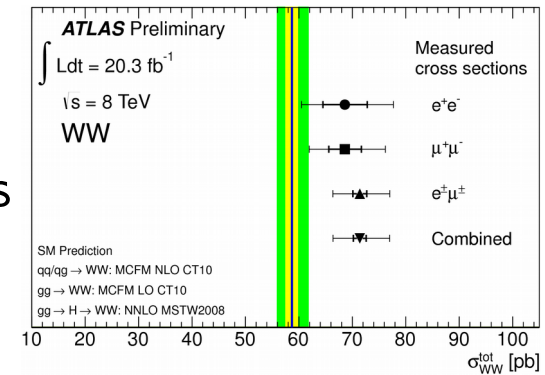
Supervisor: Kristin Lohwasser (*DESY*)

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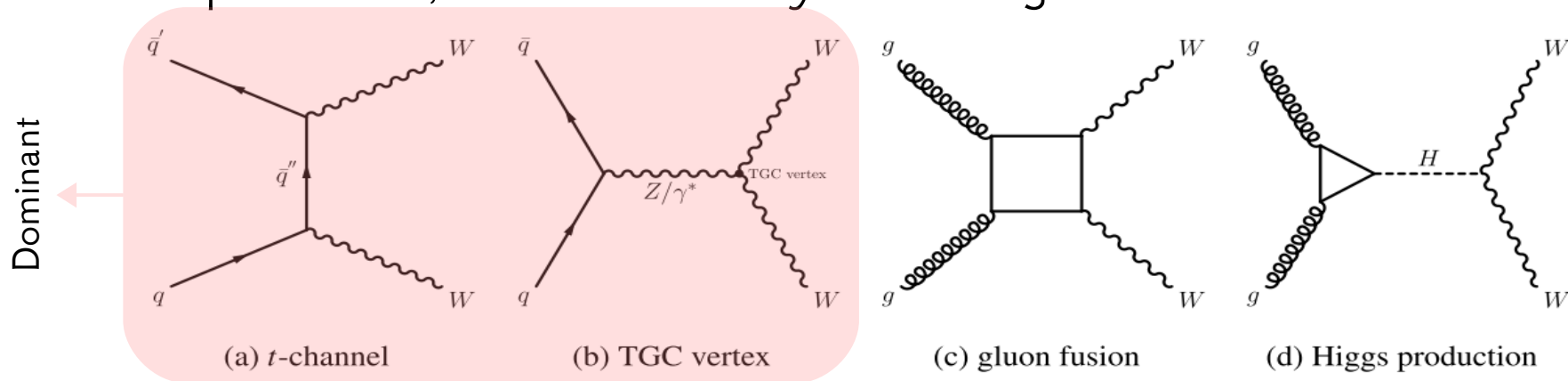
Motives and W^+W^- production at LHC

➤ Motivation – Tests of the Standard Model

- Cross section discrepancies ($\sim 1\sigma$)
- Gauge bosons self-interaction studies / aTGC searches
- Irreducible background to $H \rightarrow W^+W^-$ and SUSY



➤ W^+W^- production, lowest-order Feynman diagrams:



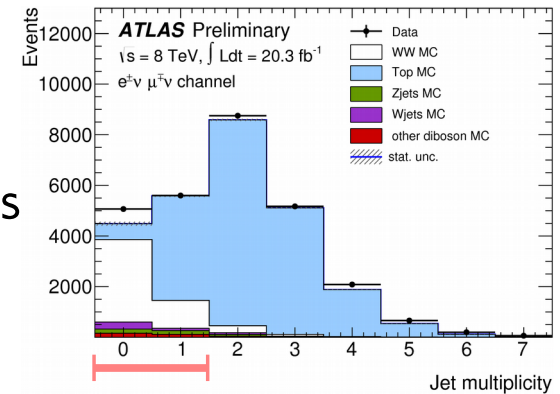
➤ As final states only the purely leptonic decays are studied:

- $W^+W^- \rightarrow l^+\nu_l l^-\bar{\nu}_l$ where l denotes an e or μ $B(W^+W^- \rightarrow l^+\nu_l l^-\bar{\nu}_l) = 4.7\%$
- ν manifest themselves as missing transverse energy (E_T^{miss})

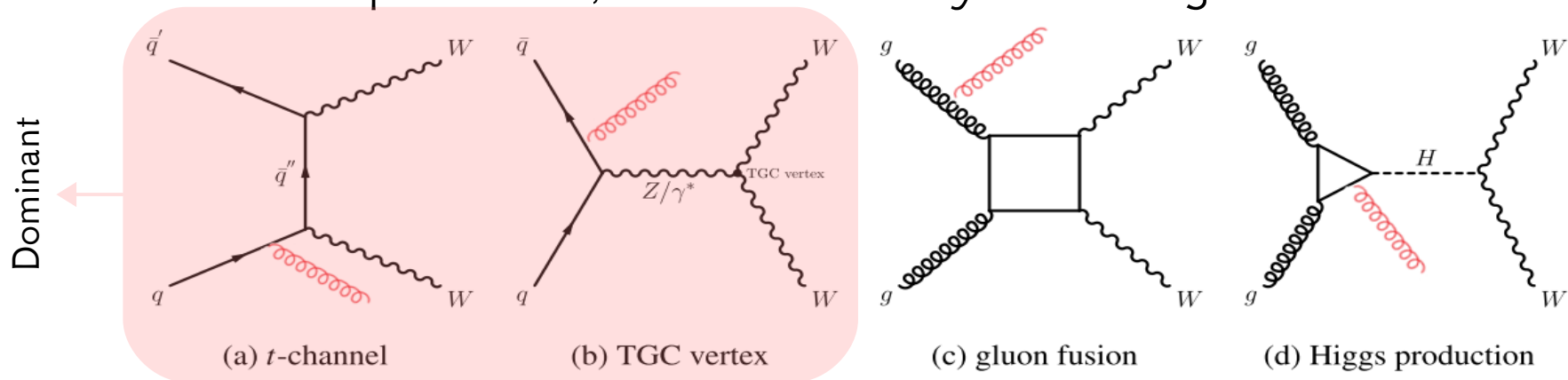
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➤ $W^+W^- + 1\text{Jet}$ production, lowest-order Feynman diagrams:



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Extrapolating the fiducial to total cross section

Fiducial phase space \longrightarrow **Phase space for a trustful measurement** Defined by:

- Kinematic criteria ($|\eta|$, p_T , m_{ll} , ...)
- 0 or 1 Jet!

➤ Total integrated cross section:

$$\sigma(pp \rightarrow WW) = \frac{\sigma_{fid}(pp \rightarrow WW)}{A_{WW} \times B^2(W \rightarrow lv)}$$

➤ The fiducial acceptance factor A_{WW} characterizes the acceptance of the selected phase space.

➤ Estimated by MC simulations and defined as:

$$A_{WW} = \frac{N_{fid}^{WW \rightarrow lvlv}}{N_{gen}^{WW \rightarrow lvlv}}$$

Number of signal events within the fiducial region

Total number of generated signal events

➤ It's **value** and **uncertainty** are crucial for the extrapolation procedure

A_{WW} factor value and uncertainty estimation

- Working **only** on dominant production mechanism (QQ) and on $W^+W^- \rightarrow e^+\mu^- + E_T^{\text{miss}}$ channel:

$$A_{WW} = 0.33$$

- Acceptance's theoretical uncertainty induced by:

- QCD scales choice (μ_r & μ_f)

Scales are varied by a factor 2 or 0.5 to study the impact on acceptance

- PDFs uncertainty

NNPDF2.3, MSTW2008NLO and CT10 PDF sets used and incorporated to produce the final PDF unc.

- Parton showering and Generator choice

Comparison between PowHeg – MC@NLO generators, Pythia8 – Herwig/Jimmy showering

- NLO EW corrections

- Jet-selection uncertainty

Subject to large theoretical uncertainty – introduces another QCD scale