Status update VBS section

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17.02.2022

Status

Ready for iterations and discussions

Experimental review

- First draft complete (22 pages)
- Summary of all currently available VBS measurements
- Dedicated comparisons of systematics tables

Theory review

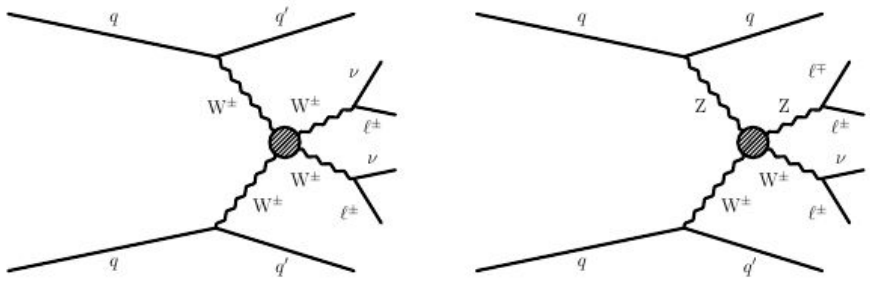
- First draft complete (3 pages)

–> Section rearranged to fit other section (discussed during last meeting)

Experimental review

Covering the following channels:

- fully leptonic:
  - $\mathrm{W}^{\pm}\mathrm{W}^{\pm} \to \ell^{\pm}\nu\ell^{\pm}\nu$
  - $\mathrm{W}^{\pm}\mathrm{W}^{\mp} \to \ell^{\pm}\nu\ell^{\mp}\nu$
  - $W^{\pm}Z \to 3\ell\nu$
  - $ZZ \to 4\ell/2\ell 2\nu$
- semi-leptonic/hadronic:
  - $\mathrm{WW/WZ} \to \ell\nu jj$
  - $\mathrm{ZW}/ZZ \to \ell\ell\mathrm{jj}$
  - $ZZ/\mathrm{WW} \to \mathrm{jjjj}$
  - $ZZ/\mathrm{WZ} \to \mathrm{jj}\nu\nu$
- photonic:
  - $\mathrm{Z}\gamma \to \ell^{\pm}\ell^{\mp}\gamma/\nu\nu\gamma$
  - $\mathrm{W}\gamma \to \ell\nu\gamma$



General introduction into VBS

Given the relatively large backgrounds, multivariate (MVA) techniques are commonly used to better separate signal and backgrounds [24]. Different MVA implementations are pursued, e.g., Boosted Decision Trees (BDTs), Deep Neural Nets (DNNs), ans Artifitial Neural Nets (ANNs). The MVA output is usually used as final discriminant variable in the signal region (SR). There are typical three set of variables used as input in VBS analyses:

- related to dijet system (m_{jj}, $|\Delta\eta_{\mathrm{jj}}|$, $\Delta\phi_{\mathrm{jj}}$, $p_{\mathrm{T}}^{\mathrm{j1}}$, $p_{\mathrm{T}}^{\mathrm{j2}}$...);
- related to diboson system (p_{T}^{ℓ}, m_{VV}, $p_{\mathrm{T}}^{\mathrm{miss}}$...);
- related to jet-boson system ($\Delta R_{\mathrm{j1,Z}}$, $|\eta^{\ell} - \frac{\eta^{\mathrm{j_1}} + \eta^{\mathrm{j_2}}}{2}|/|\Delta\eta_{\mathrm{jj}}|$...).

Experimental review

– Short description of each measurement

– Comparison of systematics side-by-side (converted into percent)

– Prospects for HL-LHC

Source of uncertainty	ATLAS	CMS
Integrated luminosity	2.4	1.5
Lepton measurement	1.4	2.1
Jet energy scale and resolution	3.2	1.5
Pileup	1.6	0.1
B-jet tagging	2.1	1.0
Background rate	3.4	3.5
Limited sample size	3.2	2.6
Theory	5.5	1.9
Total systematic uncertainty	8.9	5.7
Statistical uncertainty	17	8.9
Total uncertainty	20	11

Theory review

Brief review of state of the art of:

- Higher-order corrections
- Polarised predictions
- Availability in public Monte Carlo

Theory review

Recommendations and good practice

- Present results for full process (QCD+int+EWK) as well as for separate contributions. On theory side, beyond LO, how the separation is handled should be clearly explained/stated.
- Be aware that VBS approximation (QCD correction in VBS) might not work well if measurements become more precise or for special phase space
- Use phase space that makes sense beyond LO (e.g. keep in mind real radiation that might spoil simple Born picture)
- Use state-of-the-art predictions in experiments as far as possible
- Use proper VBS settings for PS (upon using right settings, central jet vetoes are safe)
- Be very explicit about all cuts (esp. delta R (l,j), (l,l) …) to ease comparison with theory calculations

Thank you!

First drafts available

Some polishing still needs to be done but iteration ready!

General content is there