Common selection criteria

VBSCan COST workshop

28th June, Split, Croatia

VBS→WW→lvlv status

CMS Fiducial x-section (Run-2):

- [ ] leading lepton: p_T > 20 GeV , $|\eta|$ < 2.5
- [ ] trailing lepton: p_T > 20 GeV , $|\eta|$ < 2.5
- [ ] 2 jets: p_T > 30 GeV , $|\eta|$ < 5.0 , AK4 clustering
- [ ] VBS selection: $|\Delta\eta_{jj}|$ > 2.5 , m_{jj} > 500 GeV

ATLAS Fiducial x-section (Run-1):

Inclusive:
- [ ] leading lepton: p_T > 25 GeV , $|\eta|$ < 2.5
- [ ] trailing lepton: p_T > 25 GeV , $|\eta|$ < 2.5
- [ ] 2 jets: p_T > 30 GeV , $|\eta|$ < 4.5 , AK4 clustering
- [ ] $\Delta R(l, j)$ > 0.3 and ΔR_{ll} > 0.3
- [ ] m_{ll} > 20 GeV and $p_{\nu\nu}$ > 40 GeV
- [ ] m_{jj} > 500 GeV

VBS:
- [ ] Same a above
- [ ] $|\Delta y_{jj}|$ > 2.4

CMS Trigger (Run-2):

- [ ] p_T > ~ 20-22   GeV
- [ ] p_T > ~ 10-15 GeV

ATLAS Trigger (Run-2):

- [ ] p_T > ~ 11(di-μ) / 15(di-e) GeV
- [ ] p_T > ~ 11(di-μ) / 15(di-e) GeV

VBS➔WW➔lvlv Common Selection Proposal

Twiki: https://twiki.cern.ch/twiki/bin/view/VBSCan/VbsCanVBSCuts

Near Term Scenario (Before SLHC)

Roughly corresponds to currently existing detectors

	Electrons	Muons	Jets	Photons
eta	<2.5	<2.4	<4.5	<2.5
Pt(leading)	> 25	> 25	> 30	> 25
Pt(subleading)	> 15	> 15		

- ❑ Use $|\eta| < 2.5$ for both leptons
- ❑ What cut for 1st letpon: 20 or 25 GeV ?
- ❑ Raise second lepton p_T cut to 20 GeV ?
- ❑ Should we include m_{jj} and $|\Delta\eta_{jj}|$ cuts ?
- ❑ What about other cuts (from ATLAS) ?
- ❑ Should we specify how leptons are dressed (photons within some ΔR) ?

Long Term Scenario (SLHC)

	CMS	ATLAS
❑ Tracker extension:	$|\eta| < 4.0$	$|\eta| < 4.0$
❑ ECAL extension:	$|\eta| < 3.0$	$|\eta| < 4.0$
❑ Muon extension:	$|\eta| < 2.8$ (?)	$|\eta| < 4.0$

N.B.: These correspond to the maximal scenario of the SCOPE documents

➔ Keep same scenario as above but extended $|\eta|$ to some common values between ATLAS and CMS, so maybe $|\eta| < 3.0$ for electrons and muons
➔ We can ofc have 2 scenario $|\eta| < 3.0$ and $|\eta| < 4.0$
➔ Assume same p_T thresholds as Near Term scenario (according to projections on trigger capabilities from both experiments)

VBS → ZZ → 4l status

CMS Fiducial x-section (Run-2):

- ❑ 4 leptons: p_T > 20,10, 5, 5 GeV , $|\eta|$<2.5
  + momentum of gen level photons which satisfy ΔR(lepton,photon)<0.1
- ❑ 2 jets: p_T > 30 GeV , $|\eta|$ < 4.7 , AK4 clustering
- ❑ m_{jj} >100 GeV

NB: Analysis cuts:

- ❑ pT>20,10,5(7),5(7) GeV for muons(electrons) and |eta|<2.4(2.5) for muons(electrons)
- ❑ jets pT>30 GeV, |eta|<4.7
- ❑ m_{jj}>100 GeV
- ❑ **Signal extracted with a MVA → How to define for theory predictions ?**

ATLAS:

Did not get feedback up to now, can we define something reasonable ~now

Inclusive ZZ at 13 TeV fiducial region:
- ❑ 4 leptons: p_T > 20 GeV and **|eta|<2.7 + ΔR_{ll} > 0.2**
- ❑ momentum of prompt gen level photons which satisfy ΔR(lepton,photon)<0.1
- → Ofc pT cuts are for Z peak, how much can we lower for VBS
- → What about ΔR_{ll} ?

VBS➜ZZ➜4l Common Selection Proposal

❑ Can we start with form CMS cuts for leptons ?

➜ **4 leptons: p_T > 20,10, 5, 5 GeV , |η|<2.5**
➜ **dressed leptons:** momentum of prompt gen level photons which satisfy
ΔR(lepton,photon)<0.1

❑ **2 Jets: p_T > 30 GeV , |η| < 4.7 , AK4 clustering**

❑ **Should we define a tight VBS region ?**

➜ $|\Delta\eta_{jj}|$ > 2.5 , m_{jj} > 500 GeV

➜ Alternative would be to provide a MVA on top of m_{jj}>100 GeV cut to theorist but …

Other VBS channel ?

Up to now, not considering other channels:

- ❑ VBS→WZ→3lv
- ❑ VBS→WW→lvqq
- ❑ VBS→ZZ→2lvv

→ **We can start to add these to the common selection when analysis from ATLAS and/or CMS are ready**

BACKUP SLIDES