Unitarity

VBS/multiboson discussion

June, 2022

Unitarity issues

- EFT validity and unitarity
  - Use VBF@NLO utility to calculate the √s of VV->VV process at which tree-level unitarity would be violated without a form factor for a given Wilson coefficient
  - https://www.itp.kit.edu/vbfnlo/wiki/doku.php?id=download:formfactor
- The unitarity effects will become more pronounced when we add the limits for the 10 TeV and 30 TeV collider scenarios
  - We only considered 6 TeV scenario for the Snowmass paper

- As discussed we can also provide another set of limits where we 'clip' the signal aQGC events with diboson masses (at gen level) above the energy at which the tree-level unitary would be violated

Unitarity issues

- Calculated the energy at which the tree-level unitarity would be violated for our bounds in the WWnunu channel (third column in the table)

WW$\nu\nu$	Limits (TeV^{-4})	Unitarity bound (TeV)
$f_{M,0}/\Lambda^4$	$[-0.032, 0.035]$	$[5.5, 5.4]$
$f_{M,1}/\Lambda^4$	$[-0.088, 0.065]$	$[6.1, 6.5]$
$f_{M,7}/\Lambda^4$	$[-0.12, 0.17]$	$[6.7, 6.1]$
$f_{S,0}/\Lambda^4$	$[-0.22, 0.20]$	$[4.4, 4.4]$
$f_{S,1}/\Lambda^4$	$[-0.14, 0.14]$	$[4.0, 4.0]$
$f_{T,0}/\Lambda^4$	$[-0.0062, 0.0030]$	$[5.8, 6.0]$
$f_{T,1}/\Lambda^4$	$[-0.0082, 0.0031]$	$[6.1, 6.7]$
$f_{T,2}/\Lambda^4$	$[-0.0096, 0.0046]$	$[6.8, 7.0]$

- For S0, S1, M0, T0 the limits would get worse when we 'clip' the events above this energy at gen level for the aQGC samples
  - On the other hand it seems for the M1, M7, T1, and T2 limits we quote we don't violate the unitarity for a 6 TeV collider