On the line shape of W bosons in the POWHEG tW simulation

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ATLAS POWHEG tW sample (410646)



W mass cut at ~+-40 GeV in top decay Narrow width approx for associated W

What it is supposed to look like?



to very high values

W mass in top decay regulated by top mass. mW<160 GeV

What is the impact on analyses?

Analyses looking for final states including top and invisible particles in final states with 1 and 2 leptons rely on transverse mass variables for rejection of ttbar and tW:

g yeg

g Soo

MT: limited from above by the W mass

1-lepton analysis

MT2. limited from above by the larger of the two W masses

2-lepton analysis

What about alternative samples?

ATLAS MG5atNLO sample 412002



For both legs cut at +-15 widths in MG5 \rightarrow better, but still not enough tails

Private benchmark sample

Need tW MC sample with correct mW distributions to study effect on MT2 and MT

Run MG5 with process string

generate $p p > t l - vl \sim$, (t > w + b, w + > l + vl)add process $p p > t \sim l + vl$, $(t \sim > w - b \sim, w - > l - vl \sim)$

For extra W generate directly decay product to guarantee no bounds on the W mass

set bwcutoff 50

To ensure that the mass of the W from top decay saturates the available phase space

Compare MG5 and POWHEG: M and MT



Typical analysis cut is MT>150 GeV: large effect if lepton is from accompanying W

Compare MG5 and POWHEG:MT2



Analysis cuts typically between 120 and 150 GeV. Completely different distribution in SR-like region



Conclusion: SHERPA samples seem to implement correct line shapes and we may proceed to further tests in view of using them for the background estimate in tW analysis