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Boosted tops

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After the discovery of the final missing piece of the Standard Model jigsaw, we have been entered an age of plethora of data. LHC has been reached 300 fb^{-1} since then, but the signs of a new physics yet to be observed. Due to their weak-scale mass, Higgs and top quark are expected to shed light on the electroweak symmetry breaking. With the current centre-of-mass energy of the LHC, we observe over one million tops per inverse femtobarns. The massive production rate of top pair unfolds excruciating amount of background for searches on combinations of jets, leptons and missing-energy final states. However, this also means a plethora of statistical data to analyze top quarks.

There have been many studies which tried to capture geometrical substructure of top decay products. It has been shown that currently, the most reliable tool to identify tops is shower deconstruction method. Recent studies have shown that event deconstruction method has also a significant impact on top identification. However, these methods are based on likelihood analysis with respect to truth level top pair and QCD events, and it is not possible to have a feasible measure of tagging efficiency.

Since the initial attempts, geometrical analysis on the substructure to reconstruct parent objects from decay products has been increasingly studied. Such analyses generally based on a single condition such as Mass-drop, jet filtering, pruning etc. However, it has been shown that the combination of different methodologies improves identification efficiencies drastically. In this report, we will summarize the methodology that HEP-TopTagger has been adapted to combine several substructure analysis techniques. We will discuss the relevant usage to suppress the background and identify boosted tops which are further going to be used in the EFT analysis. Furthermore, we will discuss the effects of detector biases, theoretical errors originated from showering and hadronization models and computational challenges to implementing such tagger in current analysis tools.

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