

## All-Hadronic search for Vector-Like Quarks using the BESTagger with $137 fb^{-1}$ of $\sqrt{s} = 13$ TeV proton-proton collisions collected by CMS

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We present the status of our all-hadronic analysis in search of pair-produced Vector-Like Quarks (VLQs) using the Boosted Event Shape Tagger (BEST) with the CMS detector using  $137 fb^{-1}$  of  $\sqrt{s} = 13$  TeV proton-proton collisions at the LHC. VLQs are motivated by models which predict compositeness of the scalar Higgs boson, and which avoid increasing constraints from Higgs measurements. In the all-hadronic channel, this analysis is sensitive to all possible VLQ decay modes:  $T(B) \rightarrow t(b)H/t(b)Z/b(t)W$ , capturing the highest branching fraction of each process. The high mass of the VLQs produce highly boosted objects in the final state which can be reconstructed as anti-kt  $R=0.8$  jets and identified as either QCD/b/W/Z/H/t using the BESTagger. The tagger boosts jet constituents into various rest frames and uses neural networks to find correlations between event shape variables, such as Fox-Wolfram moments and sphericity, to determine the category of identification. We define signal regions by the classification of the highest four jets in  $p_T$ . We estimate our QCD-dominant background with a data-driven 3-jet control region, then fit its normalization simultaneously with simulations of well-modeled sub-dominant background such as  $t\bar{t}$  and  $W/Z$ +jets. The HT (scalar sum  $p_T$ ) of the event is scanned for an excess of signal in 120 of 126 possible combinations, and the least 6 signal-rich combinations are used as validation regions for the QCD estimation. The analysis is in progress and plans to be completed soon.

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