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# Search for Vector-Like-Quarks T/B in Same-Sign Dilepton and Multi-lepton Final States at $\sqrt{s} = 13$ TeV

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The discovery of a Higgs boson with mass near 125 GeV in 2012 marked one of the most important milestones in particle physics. The low mass of this Higgs boson with diverging loop corrections adds motivation to look for new physics Beyond the Standard Model (BSM). Several BSM theories introduced new heavy quark partners, called vector-like quarks (VLQ), with mass at the TeV scale. In particular, the vector-like top quark (T) can cancel the largest correction due to the top quark loop, which is one of the main contributions to the divergence, and stabilize the scalar Higgs boson mass. This analysis searches for pair production of vector-like T or B quarks with charge 2e/3 and e/3 in proton-proton collisions at 13 TeV at the LHC. Theories predict 3 decay modes for T and B, respectively : bW, tZ , tH and tW, bZ, bH. The branching ratios vary over different theoretical models. We focus on events where bosons decays leptonically and result in a final state with a same-sign (SS) di-lepton pair and a final state with multiple (3 or more) leptons. We analyze data collected by the CMS detector in the LHC in 2017 and 2018 with integrated luminosities of 41.5 and 59.7 fbˆ{-1}. Besides Standard Model (SM) processes with the same final states, lepton misidentification contributes a significant part of the background to both SS dilepton and multilepton channel and is estimated by a data-driven method. In addition, charge mis-identification is another source of background for SS dilepton channel, which is also estimated by a data-driven method. Comparing the estimated background with data, and considering uncertainties, we determine an upper limit on the TT or BB production cross section. We calculate limits at different mass points of T and B and different branching fraction combinations.

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**Primary authors:** USAI, Emanuele (Brown University (US)); Ms WONG, Jess (Brown University (US)); HOGAN, Julie; NARAIN, Meenakshi (Brown University (US)); SYARIF, Rizki (Brown University (US)); SAGIR, Sinan (Brown University (US)); HEINTZ, Ulrich (Brown University (US))

**Presenter:** Ms WONG, Jess (Brown University (US))

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