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B-Jet Energy Regression for Di-Higgs Searches

Di-Higgs production (HH), where two Higgs are produced during a proton-proton collision, has yet to be observed at the Large Hadron Collider. This process has an extremely small cross-section and its observation will be one of the main goals of the High-Luminosity LHC. As the cross-section is so small, di-Higgs searches typically look for the case where at least one Higgs decays to the final state with the highest branching fraction, Higgs to $b\bar{b}$ (57%). The invariant mass of jets coming from the bottom quarks (b-jets) is an important observable used in HH searches to discriminate signal from non-resonant background processes. However, b-jets tend to be slightly miscalibrated relative to other jets due to the large fraction of B-Hadron semi-leptonic decays and out-of-cone effects. Here, we investigate a multi-variate regression to correct the b-jet energy and we demonstrate the improvements to the Higgs mass resolution by applying this additional calibration.

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