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Techniques for hadronic decays of ultra-heavy resonances decaying to vector-like quark pairs

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Decays of ultra-heavy resonances of masses up to 8 TeV represent some of the heaviest particles that could be produced at the Run II LHC. Many such models describe these heavy resonances decaying to pairs of vector-like quarks (VLQs) with the fully-hadronic channels generally having the largest branching fraction. While giving the largest event yield, the extreme level of jet collimation and complex final states of fully-hadronic decays pose a substantial challenge to reconstructing the underlying resonance and daughter pair. To study these types of decays, a jet sorting algorithm has been developed that uses event geometry and a series of Lorentz boosts to reconstruct the daughter pair for these fully hadronic events. The application of this technique on simulations of a model containing a scalar diquark decaying to VLQ pairs is shared.

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