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Vertex Reconstruction with Transformers

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The identification of heavy-flavour jets (tagging) remains a critical task at hadron colliders. A key signature of such jets is the displaced decay vertices left by boosted b- and c-hadrons. While existing tagging algorithms leveraged manually designed algorithms to identify and fit vertices, they were succeeded by edge-classification based Graph Neural Networks (GNNs) that, despite identifying vertices, fell short of reconstructing their properties. We propose the use of a transformer architecture for vertex reconstruction inside jets. Using reconstructed tracks, our approach is able to simultaneously identify the decay of heavy-flavour hadrons, assign tracks to the respective decay vertices, and determine each vertex's properties, overcoming a key limitation of previous ML-based approaches to vertex reconstruction.

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