

Modelling Z -> tau tau processes in ATLAS with tau-embedded Z -> mu mu data

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Abstract

This paper describes the concept, technical realisation and validation of a largely data-driven method to model events with Z - GT tau tau decays. In Z - GT mu mu events selected from proton-proton collision data recorded at $\sqrt{s} = 8$ TeV with the ATLAS experiment at the LHC in 2012, the Z decay muons are replaced by tau leptons from simulated Z - GT tau tau decays at the level of reconstructed tracks and calorimeter cells. The tau lepton kinematics are derived from the kinematics of the original muons. Thus, only the well-understood decays of the Z boson and tau leptons as well as the detector response to the tau decay products are obtained from simulation. All other aspects of the event, such as the Z boson and jet kinematics as well as effects from multiple interactions, are given by the actual data. This so-called tau-embedding method is particularly relevant for Higgs boson searches and analyses in tau tau final states, where Z - GT tau tau decays constitute a large irreducible background that cannot be obtained directly from data control samples. In this paper, the relevant concepts are discussed based on the implementation used in the ATLAS Standard Model H - GT tau tau analysis of the full dataset recorded during 2011 and 2012..