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Thesis Title	*Data driven estimation of the H→4l reducible background with the ATLAS detector*
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Summary	This thesis aims to study a method for the data-driven estimation of the reducible background for the process H- >4l. Data collected by the ATLAS detector, through the years 2015 and 2016 from pp collisions at center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 36.1 fb^{-1} are used. The sources of reducible background are the production of a Z boson in association with jets (both heavy flavor and light flavor) and the production of a $t\bar{t}$ pair. The composition of the reducible background depends on the flavor of the subleading lepton pair. The method followed in this thesis is primarily suited for $2\ell 2\mu$ events (i.e. with a subleading muon pair) where the main contribution stems from semileptonic decays of heavy hadrons. Nevertheless, it was also used for the first time in the estimation of $2\ell 2e$ background and the first results are discussed. The method uses the simultaneous unbinned maximum likelihood fit in four control regions that are orthogonal to each other as well as to the signal region (the events that pass all the event selection criteria). The quantities that are used in the definition of the control regions include the lepton impact parameter w.r.t the primary vertex, the lepton isolation w.r.t the rest of the particles in the event and the muon transverse momentum imbalance measurement between the inner detector and the muon spectrometer. The fitted variable is the invariant mass of the leading lepton pair, which is described by different probability density functions to account for the different background components. All the systematic uncertainties are included as constraints in the final fit. In this thesis, apart from the background estimation, the stability of the method is studied w.r.t the lepton impact parameter and the momentum imbalance parameter (which exhibits stronger behavior in the case of π/K in flight decays). Finally, a procedure is presented for the construction of several differential distributions using the data driven background estimation and the invariant mass of the four leptons is given as an example.
Key words	Elementary particles, Higgs boson, LHC, ATLAS, background
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