ABSTRACT

The thesis deals with the measurement of charge asymmetry using the full Run 2 data set collected by the ATLAS detector. For the first time, data from single-lepton and dilepton $t\bar{t}$ decay channels are combined. The main technique used in the analysis is fully Bayesian unfolding. Charge asymmetry is unfolded from the full data set, but also using partial data sets corresponding to specific regions of a differential observable. Charge asymmetry is studied as a function of invariant mass of $t\bar{t}$ pair ($m_{t\bar{t}}$), longitudinal boost of $t\bar{t}$ pair along the beam axis ($\beta_z^{t\bar{t}}$) and transverse momentum of $t\bar{t}$ pair ($p_T^{t\bar{t}}$).

In the presented thesis, the whole analysis chain is outlined. Various techniques used to deal with the systematic uncertainties, like bootstrap method, de-correlation technique and truth-based/NNLO-based re-weighting, are described. Numerous correlation scenarios of systematic-uncertainties in combination of single-lepton and dilepton systematic uncertainties are inspected. The total uncertainties on the measured charge asymmetry values are determined.

Additionally, leptonic charge asymmetry is measured in dilepton channel. The inclusive and differential measurements as a function of invariant mass of $\ell\bar{\ell}$ pair ($m_{\ell\bar{\ell}}$), longitudinal boost of $\ell\bar{\ell}$ pair along the beam axis ($\beta_{z,\ell\bar{\ell}}$) and transverse momentum of $\ell\bar{\ell}$ pair ($p_{T,\ell\bar{\ell}}$) are performed.

Charge asymmetry and leptonic charge asymmetry values are found to be consistent with the latest Standard Model prediction. Unfolded results of inclusive and $m_{t\bar{t}}$ differential charge asymmetry measurements are exploited to derive bounds on Wilson coefficients corresponding to the operators in effective field theory. Complementarity of energy asymmetry and charge asymmetry measurements in their EFT interpretation is utilized.