

Abstract

The exclusive processes, such as hard exclusive meson production (HEMP) and deeply virtual Compton scattering (DVCS) are an excellent tool for studying generalised parton distributions (GPD). GPDs provide a novel and relatively unexplored view into the structure of nucleon and expand the knowledge given from parton distribution functions (PDF) and parton densities to a more complex, three-dimensional picture. While the golden channel of GPD parametrisation is DVCS, the exclusive meson production gives access to complementary GPDs, provides information of flavour dependence of GPDs, and in case of exclusive π^0 production in particular, also represents the main background process of DVCS, hence it is essential to constrain it. The theoretical formalism of GPD and HEMP description is outlined in the first part of the thesis. The measurement of exclusive processes represents an important part of COMPASS-II programme. The dedicated GPD programme commenced with a 4-weeks-long pilot run in 2012, followed by the main data taking in 2016–2017, using 160 GeV/c muon beams and a liquid hydrogen target, equipped with a recoil proton detector. The COMPASS spectrometre and its configuration for the GPD programme is described in the second section. The exclusive processes require a perfect performance of the electromagnetic calorimeters. The third part explains in detail the principle of operation of the two COMPASS electromagnetic calorimetres used in this analysis and describes their calibration. In the fourth section, we present the procedure of inspecting the data quality, the steps of the analysis, and the selection of the events. The fifth part describes the procedure of extraction of the differential cross-section of the exclusive π^0 production as a function of the four-momentum transfer $|t|$ and the azimuthal angle ϕ . The results and systematic effects are discussed.

Key words

Generalised Parton Distributions, GPD, Hard exclusive meson production, HEMP, Exclusive π^0 production, COMPASS