

Future Measurements of Generalized Parton Distributions at COMPASS

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The concept of “Generalized Parton Distribution” (GPD) has been recently developed to obtain a more complete description of the nucleon structure. Compared to the usual parton density distributions depending on the longitudinal parton momentum only, the GPDs give a description of the parton distribution over a “3D-like” nucleon, built from the parton momentum and, in addition, its transverse position. Different predictions on GPDs based on lattice QCD calculations, as well as other predictions, have been published and could be tested by experiments. In particular, handbag diagram events in lepton-nucleon scattering, like deeply virtual Compton scattering (DVCS) or hard exclusive meson scattering, give an access to the GPDs.

The COMPASS experiment could contribute significantly to the GPDs measurement. A physics program dedicated to GPDs measurements is studied inside the COMPASS collaboration, it could take place from 2010 as soon as the current program will be finished. COMPASS is well fitted for these GPD studies. The only necessary upgrades include a new liquid hydrogen target, a recoil detector for the scattered protons, and a large angle electromagnetic calorimeter. Several features can be exploited for the GPD studies, like the fact that either positive or negative polarized muon beams can be used, or the relative amplitude of DVCS cross section and the DVCS - Bethe Heitler interference (which both give different views on the GPD) which can be tuned using the beam energy. With 100 GeV positive and negative muon beams and 150 days of data taking, a clear distinction can be obtained between two different models^{1,2} of the GPD $H(x, \xi, t)$. In an other hand, the hard exclusive meson production is already under study with the present COMPASS data³, and will be improved by a better calorimetry in the 2006 data taking. This study will also take advantage of the new detectors foreseen for the DVCS studies.

After an overview of the Generalized Parton Distribution concept and the application to the DVCS and the hard exclusive meson production, the principle of the GPDs measurements planed by COMPASS will be described, as well as the detector upgrades foreseen for this goal. Last the expected performances will be shown.

¹Vanderhaegen et al., Phys. Rev. D 60, 094017 (1999)

²Goeke et al., Prog. Part. Nucl. Phys. 47, 401 (2001)

³see the corresponding abstract