Thesis abstract F. Glaser

« Search for B^+_(c) → μ^+ ν_μ γ decays with the LHCb experiment and upgrade of the electromagnetic calorimeter »

Knowledge of the internal structure of the B meson is crucial for precise theory predictions of B meson decays. In particular, the first inverse moment of the B-meson light-cone distribution amplitude (LCDA) is a key ingredient in QCD factorisation schemes. Inferring the value of the first inverse moment from theory models is very challenging and often limits the precision of theory predictions. Instead, it is proposed to infer its value from experimental data.
The radiative leptonic decay B→μνγ is considered the golden mode to probe the internal structure of the B meson, as its branching fraction is sensitive to the first inverse moment of the B-meson LCDA. Studies of radiative leptonic decays of Bc mesons, on the other hand, allow to infer the dynamics in the bound Bc meson system.
This thesis presents the simultaneous search for B→μνγ and Bc→μνγ decays using data recorded with the LHCb experiment in proton-proton collisions at a centre-of-mass energy of 13 TeV from 2016 to 2018, corresponding to an integrated luminosity of 5.4 fb-1. The decays are reconstructed from photons converting to di-electron tracks in the detector material, which provide three tracks and a displaced decay vertex. The main challenge is to identify and suppress background events from π0→γγ decays, for which novel techniques are developed. The study aims to improve the current best limit on the branching fraction for B→μνγ decays and set the first limit on the branching fraction for Bc→μνγ decays. The expected limits on the branching fractions for radiative leptonic decays are of the order of 10^-6 for decays of B+ mesons and 10^-4 for the decay of Bc+ mesons.
With the LHCb experiment aiming to collect data at higher instantaneous luminosities in future runs, the detector is upgraded. This thesis reports on the organisation of the cabling of the electromagnetic calorimeter and presents performance studies of the particle identification system for Run 4 for different upgrade scenarios.