Measurement of electrons from charm and beauty-hadron decays in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV with ALICE at the LHC *

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The characterisation of the Quark-Gluon Plasma (QGP), the deconfined state of strongly-interacting matter produced in high-energy heavy-ion collisions, is the main purpose of ALICE at the LHC. Because of their large masses, charm and beauty quarks are mostly produced in initial hard partonic interactions and thus can be used to probe the medium created in such collisions. The p_{T} differential heavy-flavour yield is sensitive to the energy loss of heavy quarks in the hot and dense medium. Also, the presence of cold nuclear matter in the initial state may affect the production of heavy-flavour hadrons. With a measurement of the nuclear modification factor $\mathrm{R_{pPb}}$ in p–Pb collisions, the initial-state effects can be quantified. Because of large branching ratios to semi-leptonic decay channels, heavy-flavour production can be studied via an inclusive electron measurement.

The electron identification strategy involves a combination of the Time Projection Chamber (TPC) and the Time-of-Flight detector (TOF). In the TPC charged particles are identified via their specific energy loss $\mathrm{d}E/\mathrm{d}x$ in the drift gas. Due to overlapping $\mathrm{d}E/\mathrm{d}x$ bands from kaons, protons and deuterons, a large hadron contamination is persistent. At low momentum ($p < 2\,\mathrm{GeV}/c$), TOF is used to separate nearly massless electrons from kaons and protons by their time of flight to the detector. In Fig. 1 the $\mathrm{d}E/\mathrm{d}x$ in the TPC, relative to the expected $\mathrm{d}E/\mathrm{d}x$ for electrons, is shown. The kaon and proton bands, visible in the top left of the plot, are suppressed due to the use of the TOF information.

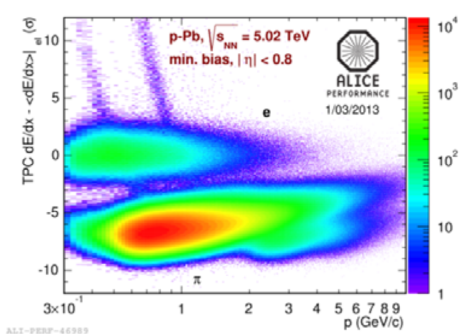

Figure 1: TPC $\mathrm{d}E/\mathrm{d}x$ as deviation from the expected energy loss of electrons, normalized by the $\mathrm{d}E/\mathrm{d}x$ resolution, after TOF selection of charged particle tracks.

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Electrons from background sources have to be subtracted from the inclusive electron spectrum to obtain the heavy-flavour electron spectrum. The main sources of these background electrons are Dalitz decays of π^0 and η mesons or conversions of photons in the detector material. This background can be calculated based on the measured pion spectrum or measured by reconstructing electrons from photonic sources (γ conversions, π^0, η) using the invariant mass of $\mathrm{e^+e^-}$ pairs. Corrections for detector efficiency and acceptance are estimated with a full detector simulation.

In order to obtain a pp reference the cross section measured at $\sqrt{s_{\mathrm{NN}}}$ = 7 TeV [1] was scaled to 5.02 TeV based on a FONLL perturbative QCD calculation [2]. Fig. 2 shows the $\mathrm{R_{pPb}}$ measured with ALICE for electrons from heavy-flavour hadron decays together with predictions from pQCD calculations including shadowing effects from cold nuclear matter, calculated on the base of the EPS09 parametrization [3]. The ALICE result is consistent with this calculation and with unity within the current substantial uncertainties of the measurement, indicating that cold nuclear matter effects are small.

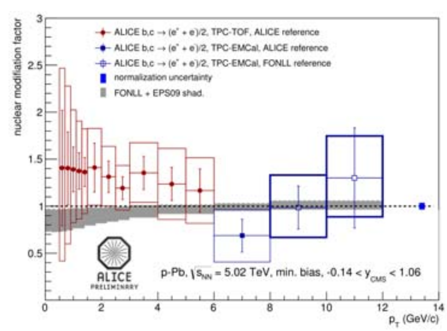

Figure 2: $\mathrm{R_{pPb}}$ of electrons from heavy-flavour decays with shadowing predictions calculated on the base of the EPS09 parametrization [3].

References

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