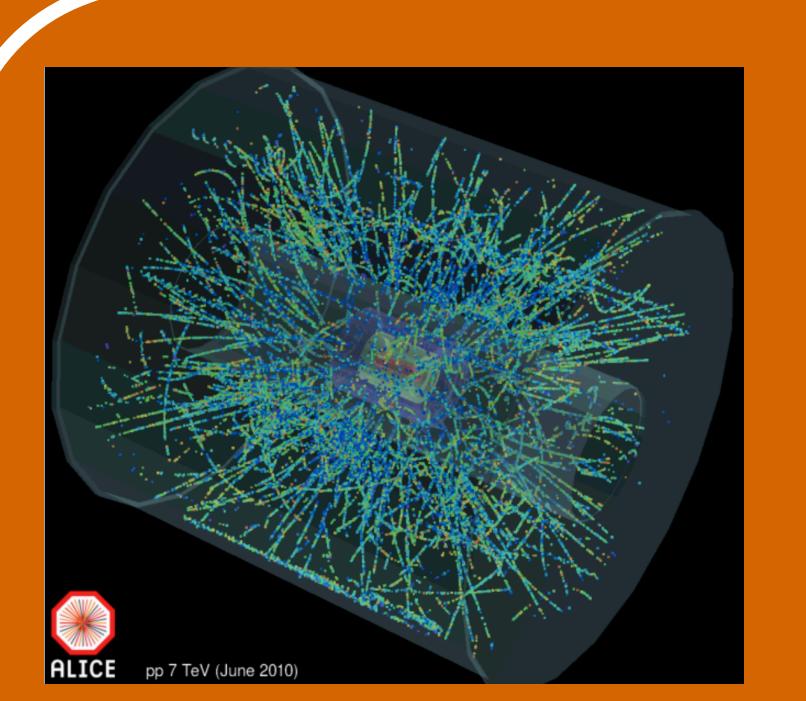


Investigating charm and beauty quark production in and outside of jets using the ALICE detector at the LHC



Josey Wright on behalf of the ALICE Collaboration, Relativistic Heavy Ion Physics Group, UT Austin

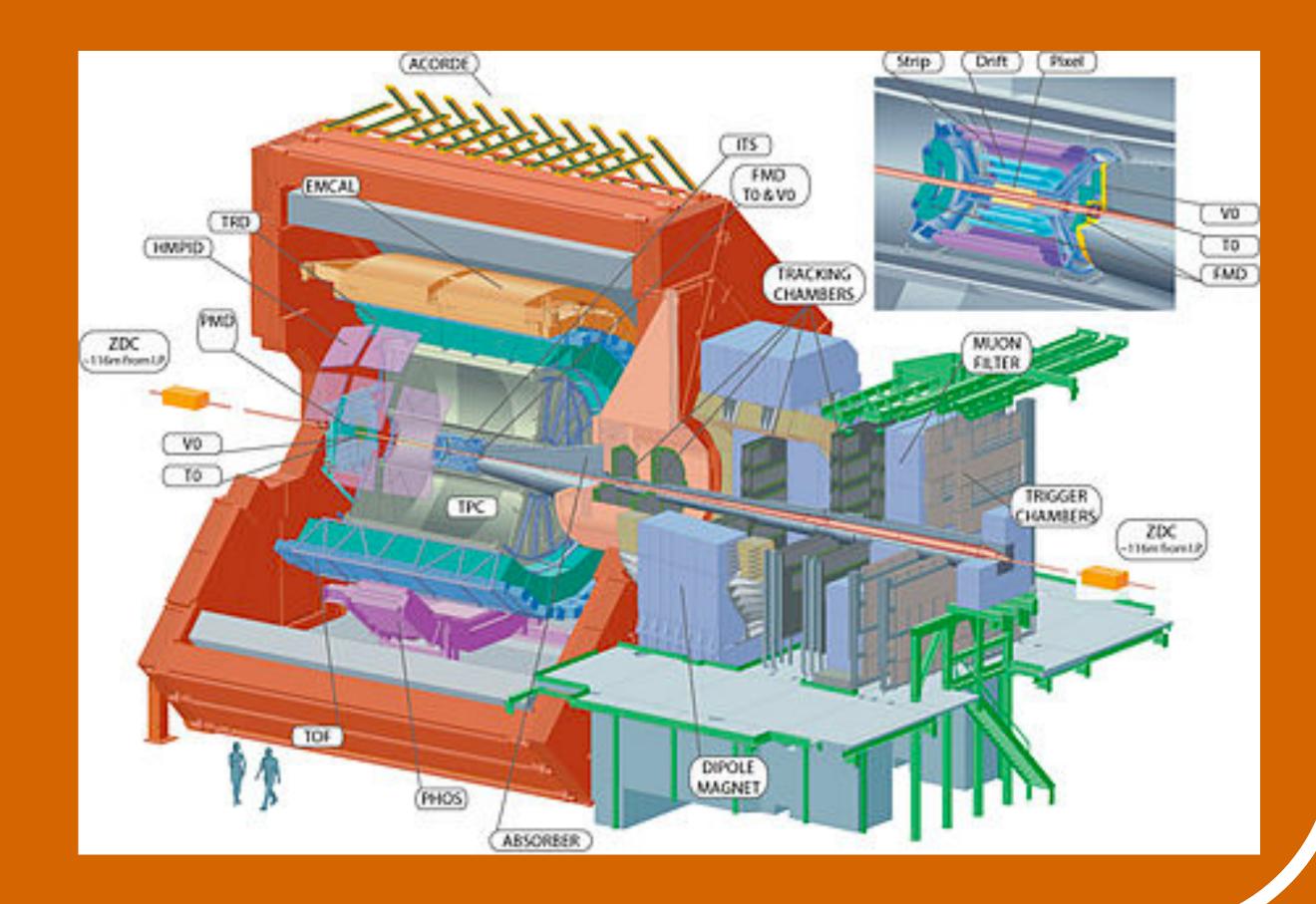


ALICE at the LHC

ALICE (A Large Ion Collider Experiment) is one of the four major experiments at the LHC. It is dedicated to heavy-ion physics, though is also covers pp and p-Pb physics.

ALICE is composed of many subdetectors. Most relevant for my research are:

- •V0
 - Triggering
 - Event characterization
- Time Projection Chamber (TPC)
 - Momentum
 - Particle identification
- Inner Tracking System (ITS)
 - Momentum
 - Vertexing

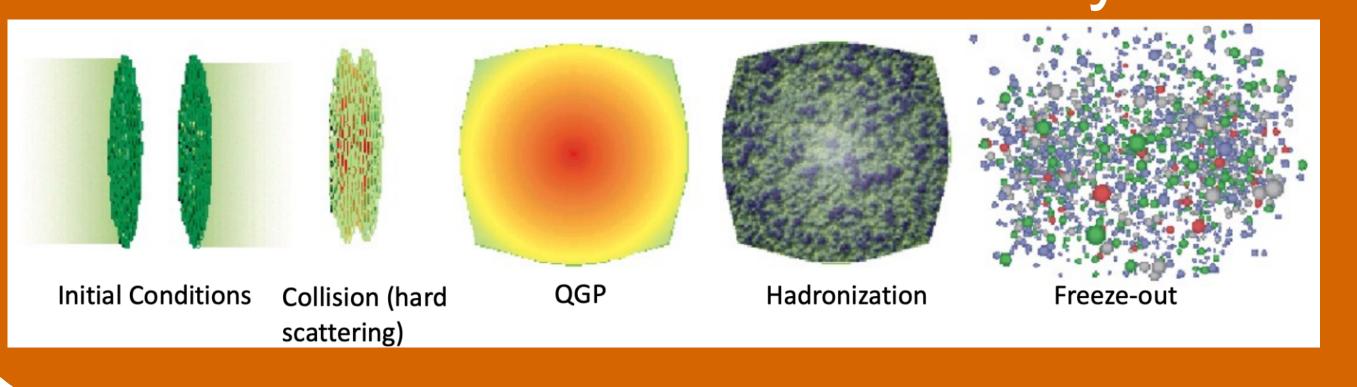


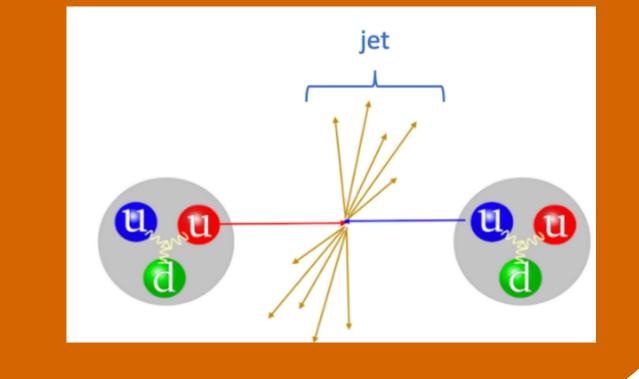
Motivation

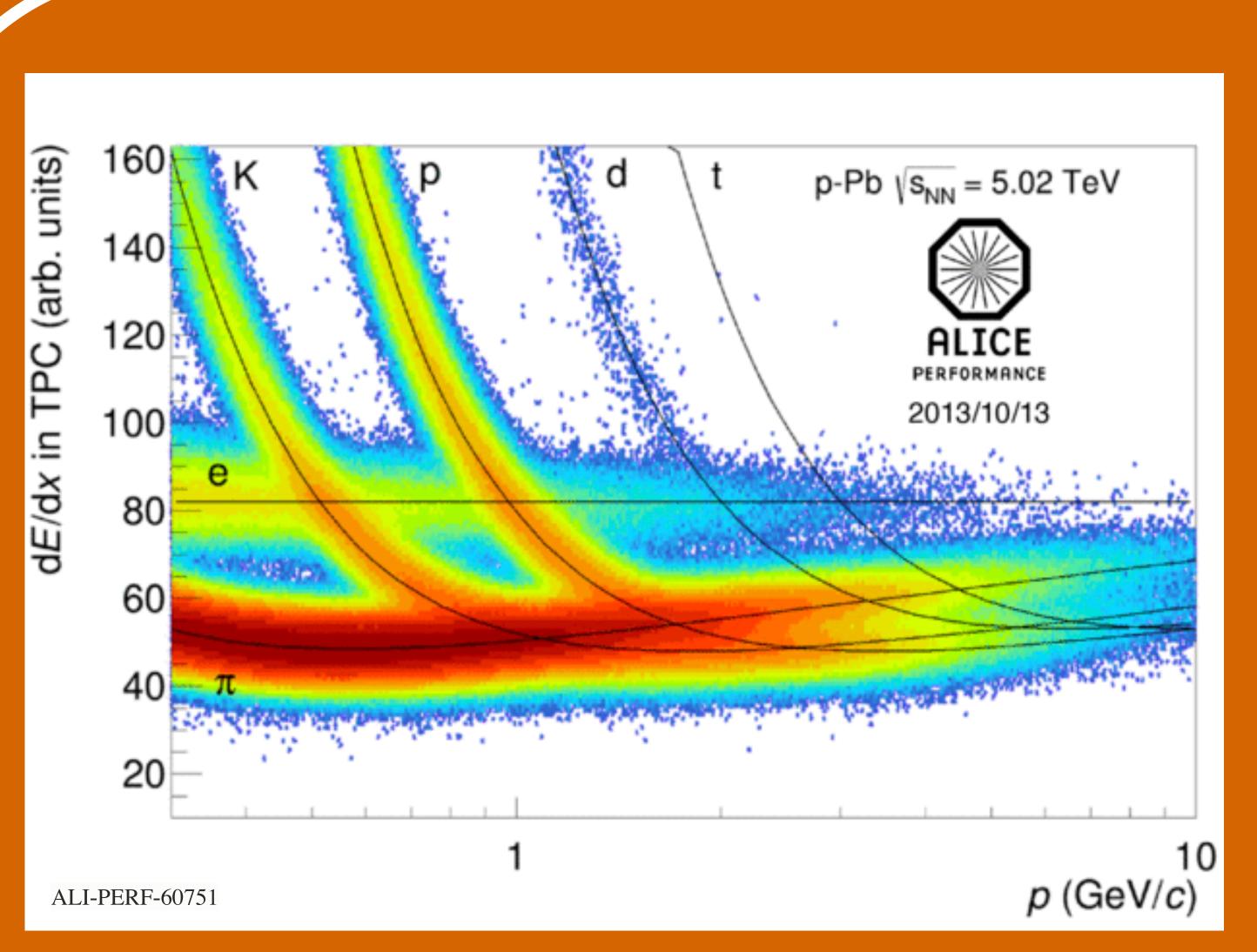
In high multiplicity p–Pb collisions, signatures possibly ascribed to quark-gluon plasma production are observed (for example, collective motion and strangeness enhancement). Heavy-quark production and interaction are being studied as a function of multiplicity in p–Pb collisions via angular correlations. With these correlations, production of heavy quarks in the jet and in the medium can be separated. In particular, heavy-quark production from hard-parton scattering is being studied, which creates jets (streams of hadrons produced by the fragmentation of heavy-quarks).



- Trigger particle selection (hadron)
- Associated particle selection (electron)
- Electron identification and background subtraction
- Correlation analysis



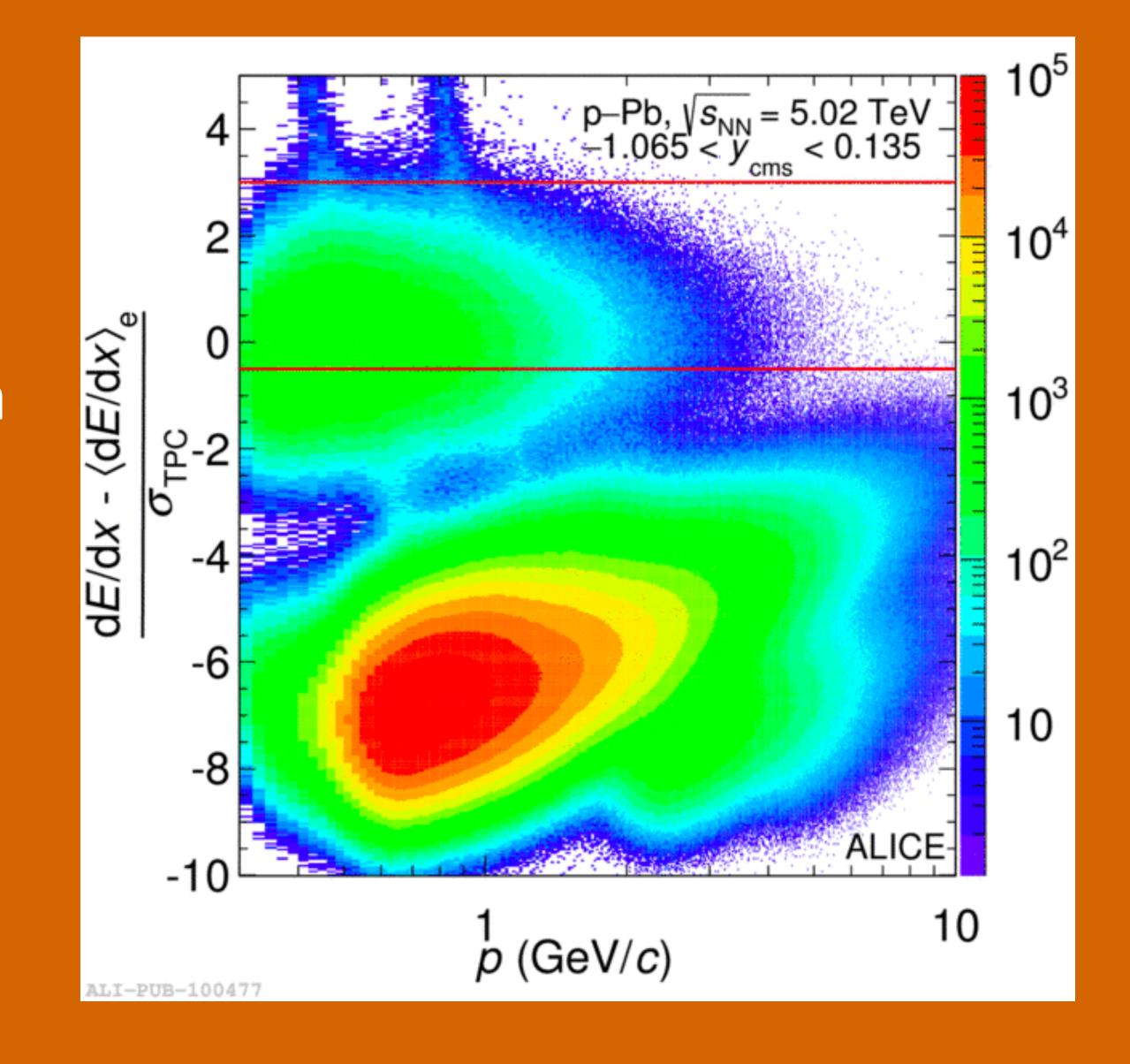




Electron identification

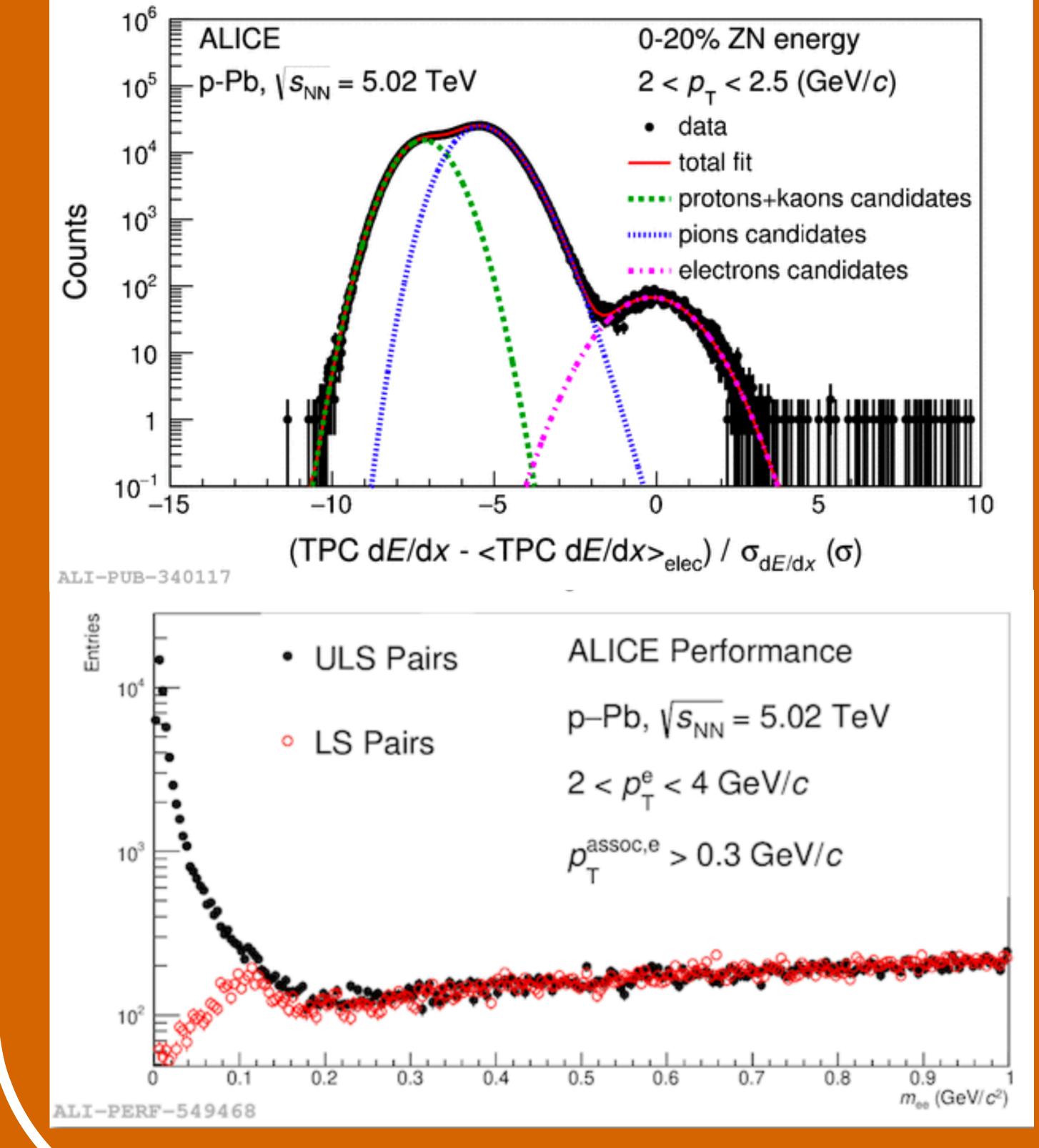
Electrons are identified via the energy loss in the TPC. The Bethe-Bloch curve parameterizes the average specific energy lost by a given particle in the TPC.

$$\langle \frac{dE}{dx} \rangle = -4\pi N_z \rho m_e c^2 z^2 \frac{Z}{A} \frac{1}{\beta} \left[ln \frac{e m_e c^2 \beta^2 \gamma^2}{I_O} - \beta^2 - \frac{\delta(\beta)}{2} \right]$$



Hadron contamination

The selected electron candidate sample is contaminated by pions, protons, and kaons. An optimized cut of $-0.7 \,\sigma$ was made on the difference between the measured dE/dx for a particle with a given momentum, and the expected one under the electron hypothesis, in units of the dE/dx resolution, in order to keep the contamination of hadrons below 10% and an average electron efficiency of 90%.



c, b→ e

 $V \rightarrow e^{-} + e^{+}$

 Π^0 , $\eta \rightarrow e^- + e^+ + \gamma$

Contamination from non-heavy-flavor electrons

In addition to heavy-flavor hadron decays, there are many decay channels of other particles that produce an e⁻ or e⁺. One of particular interest is the photon conversion in the detector material and the Dalitz decay of light neutral meson. The subtraction of photonic electrons from the signal can be performed by building an invariant-mass distribution of the unlike-sign (ULS) and like-sign (LS) electron pairs and determine the amount of electrons from photon decays from the subtracted ULS-LS distribution, as can be seen on the left.

Outlook and Perspectives

After all the background sources have been understood, the correlation functions can be computed in order to study charm and beauty quark production in and outside of jets.