Azimuthal anisotropy of beauty-decay electrons in Pb–Pb collisions at $\sqrt{s_{NN}}$=5.02 TeV with ALICE

Martin Völkl[1] for the ALICE Collaboration

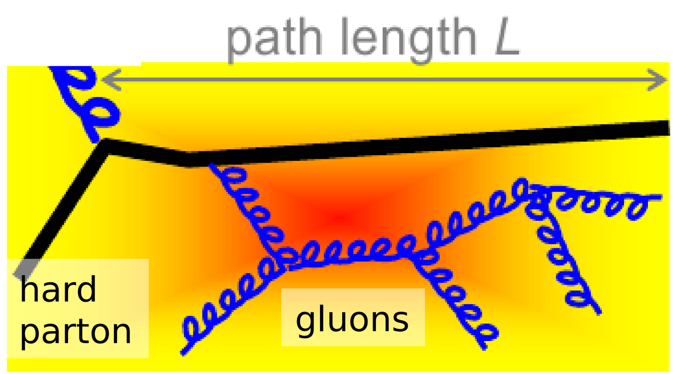
[1] Eberhard–Karls–Universität Tübingen

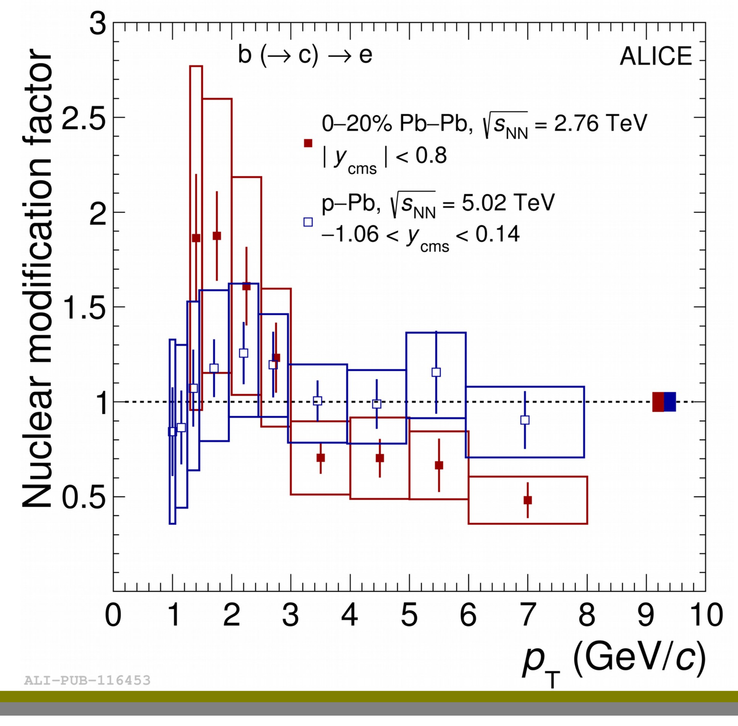
BMBF Forschungsschwerpunkt ALICE Experiment 202

Heavy quarks in the quark-gluon plasma (QGP)

Beauty quarks in the QGP:

- Measurement via beauty-hadron decay electrons
- No significant modification of the production yield found in p–Pb compared to pp collisions
- In Pb-Pb collisions, the nuclear modification factor decreases with rising p_T

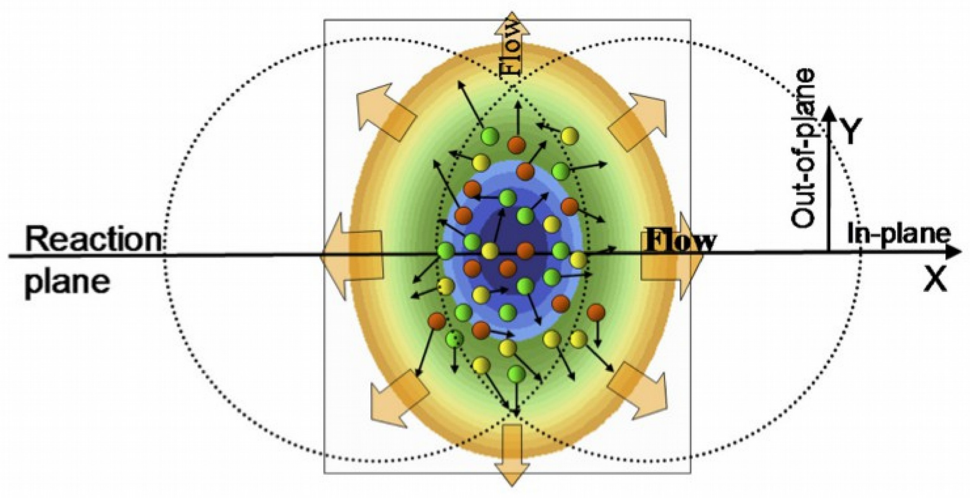




Parton energy loss:

- Radiative and collisional energy loss in medium
- Suppression measured for charm and beauty quarks
- Interaction pushes heavy quarks towards the movement of the surrounding medium
- Quantified by flow measurement

Elliptic flow measurement



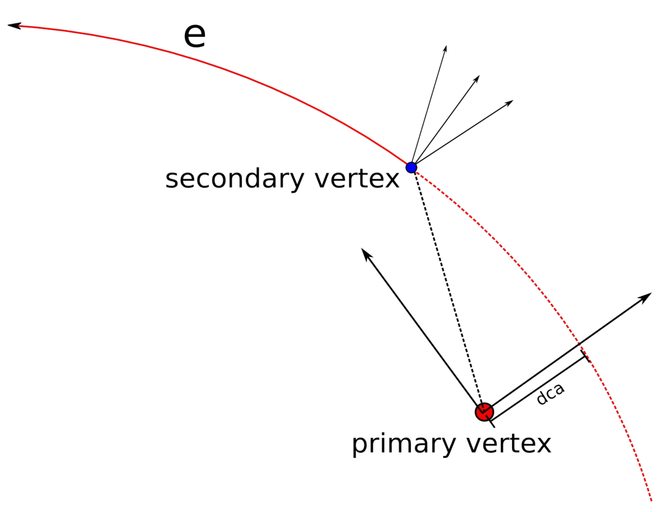
$$v_2(p_T) \approx \frac{1}{R_2}\frac{\pi}{4}\frac{N_{\text{in-plane}} - N_{\text{out-of-plane}}}{N_{\text{in-plane}} + N_{\text{out-of-plane}}}$$

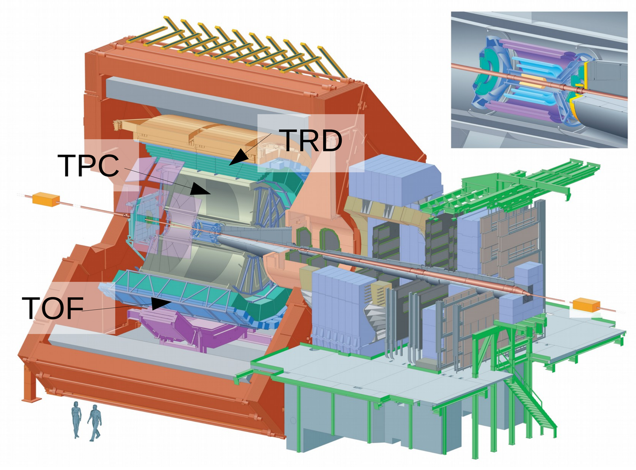
- Elliptic flow due to initial spatial anisotropy
- Quantified by flow coefficient $v_2(p_T)$
- v_2 estimated by classifying beauty-hadron decay electrons in groups according to their azimuthal angle with respect to the event plane: in-plane and out-of-plane

PID and the impact parameter

Basic idea:

1) Apply electron PID
2) From electron candidates, separate beauty contribution via impact parameter





Electron identification:

Time Projection Chamber:

- Measurement of specific energy loss in the gas

Time Of Flight detector

The impact parameter:

- Distance of closest approach (DCA) of reconstructed track to primary vertex
- Large for beauty–hadron decays due to large decay length ($c\tau \approx 500\,\mu m$) → allows for separation ($c\tau_D \approx 123-300\,\mu m$)
- Resolution better than $50\,\mu m$ for p_T > 1.5 GeV/c in Pb–Pb collisions

Separation of the beauty contribution

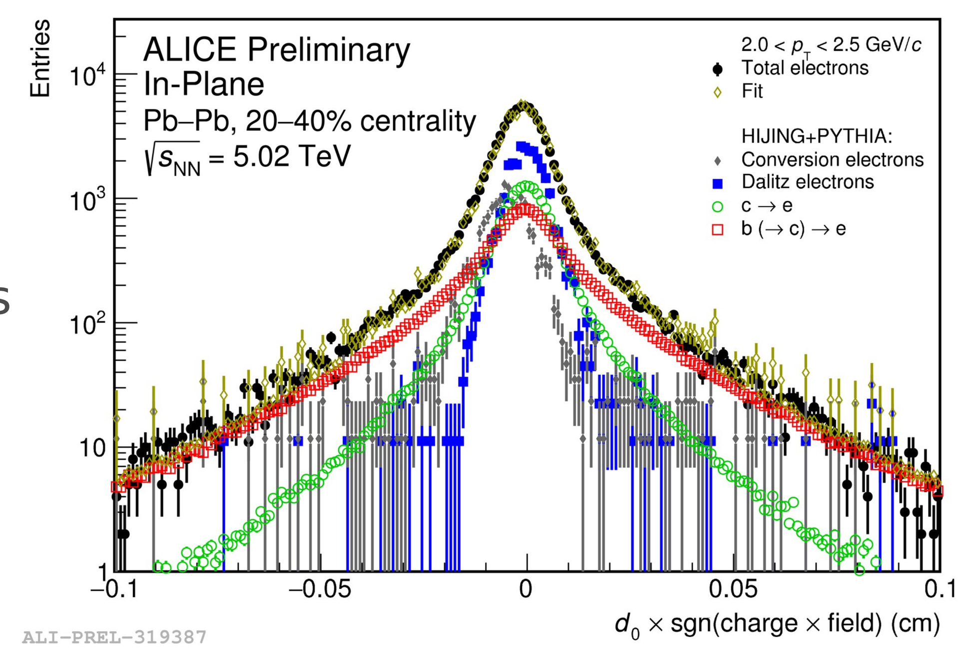
Inclusive electron sample includes contributions from:

- Semi–leptonic beauty–hadron decays
- Semi–leptonic charm–hadron decays
- Electrons from primary vertex (mainly Dalitz decays of light mesons)
- Electrons from photon conversions in the detector material

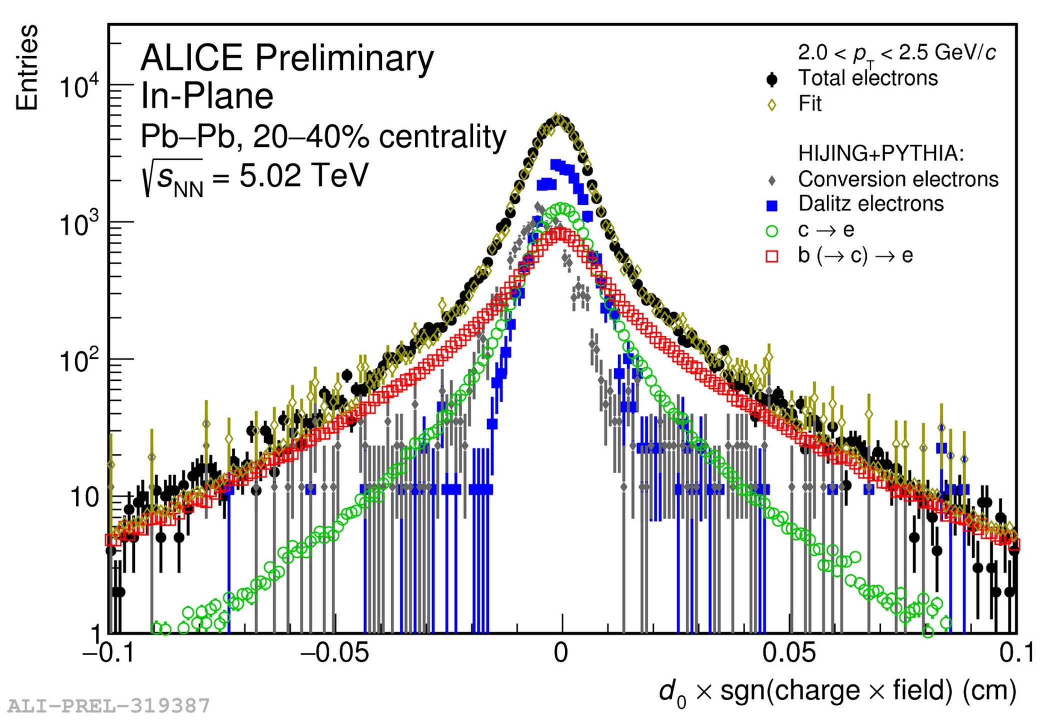
Fitting procedure:

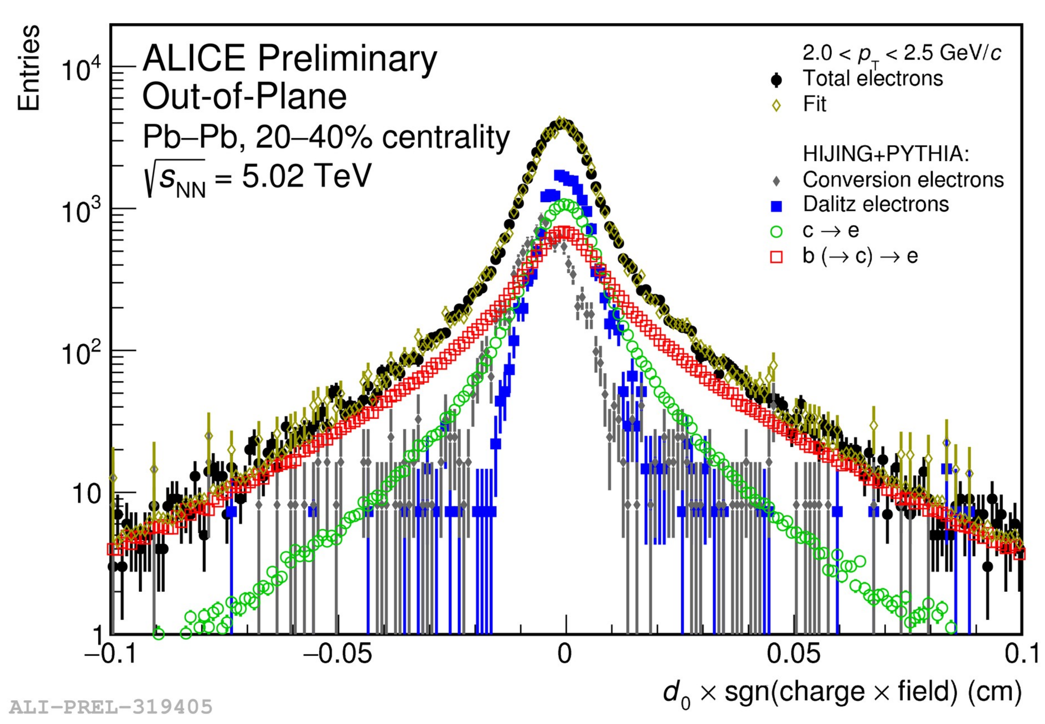
- Global fit of the inclusive electron DCA distribution
- Distributions of individual sources from Monte Carlo with corrections (HIJING/PYTHIA+GEANT3)
- Maximum likelihood–based approach takes into account finite statistics of MC templates

(Based on *Barlow, Beeston, Comp. Phys. Comm. 77 (1993)219*)

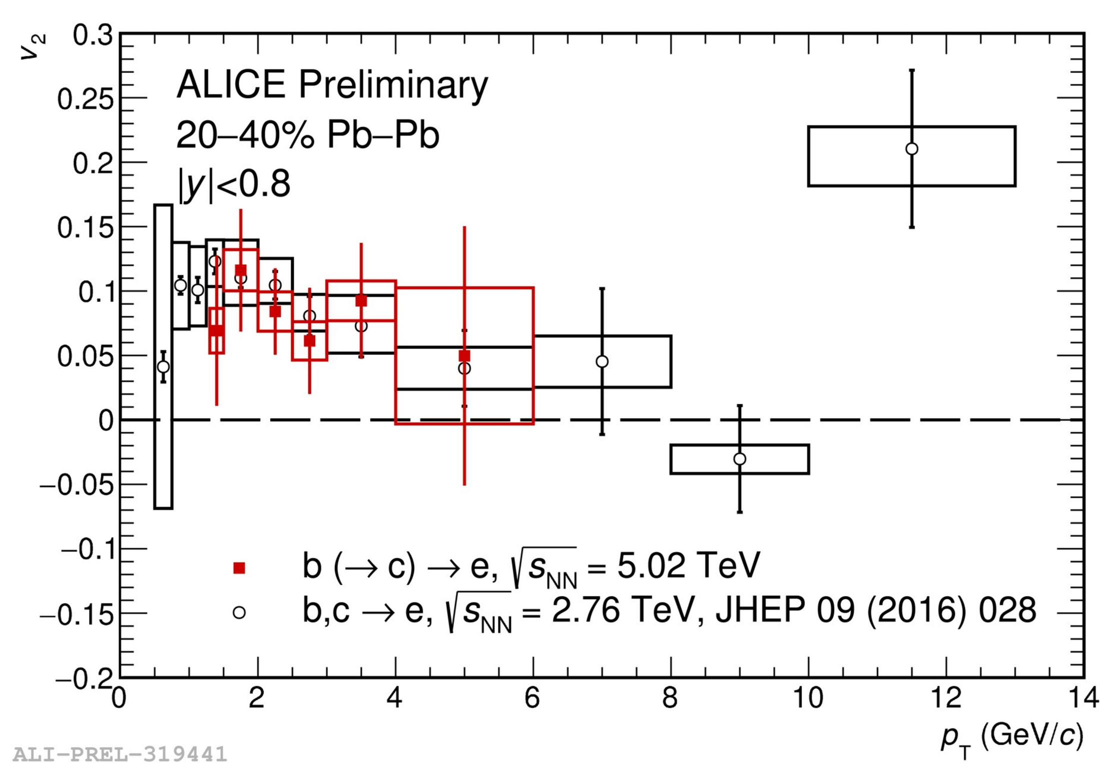


Comparison In-plane/Out-of-plane





Beauty-decay electron v_2



Systematic effects and corrections

- In-plane and out-of-plane charm- and beauty-hadron p_T-distributions
- Impact parameter resolution
- Hadrochemistry
- Occupancy–dependencies of ITS and TOF detectors

Summary

Results:

- A positive low p_T beauty–decay electron v_2 was measured with a significance of 3.45σ
- While attached to relatively large uncertainties, the central values stay below the peaks of those of light and charm mesons