

Separation of electrons from charm- and beauty-hadron decays in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV with ALICE



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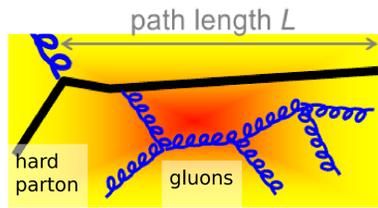
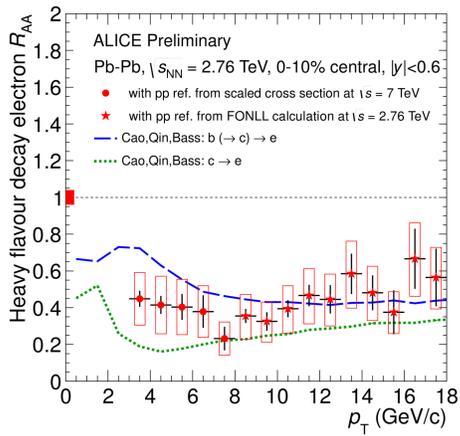
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Heavy quark energy loss

Heavy quark measurement:

- Charm measurement via reconstruction of D mesons
- Heavy flavor decay leptons



Induced Gluon Radiation

Parton energy loss:

- Radiative and collisional energy loss in medium
- Parton energy loss depends on Casimir color factor and quark mass
- Beauty quark energy loss expected to be lower than for lighter quarks and gluons (Dokshitzer, Kharzeev, PLB 519 (2001) 199)

PID and the impact parameter

Basic idea:

- Measure beauty indirectly via beauty-hadron decay electrons
- 1) Apply electron PID
- 2) From electron candidates, separate beauty contribution via impact parameter

Electron identification:

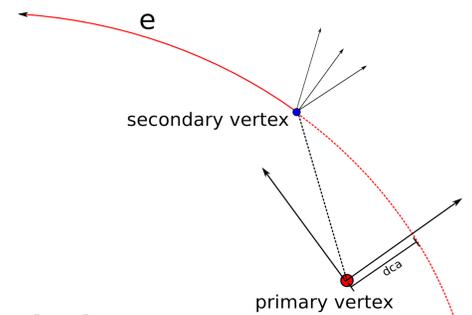
Time Projection Chamber:

- Measurement of specific energy loss in the gas
- Cut along center of Bethe-Bloch-band

Time Of Flight detector:

- Cut at 3 sigma around electron hypothesis

Transition Radiation Detector (future measurements at high p_T)



The impact parameter:

- Distance of closest approach (dca) of reconstructed track to primary vertex
- Large for beauty-hadron decays due to large decay length ($c\tau \approx 500 \mu\text{m}$) \rightarrow allows for separation
- Resolution better than $50 \mu\text{m}$ above p_T of 1.5 GeV/c in Pb-Pb

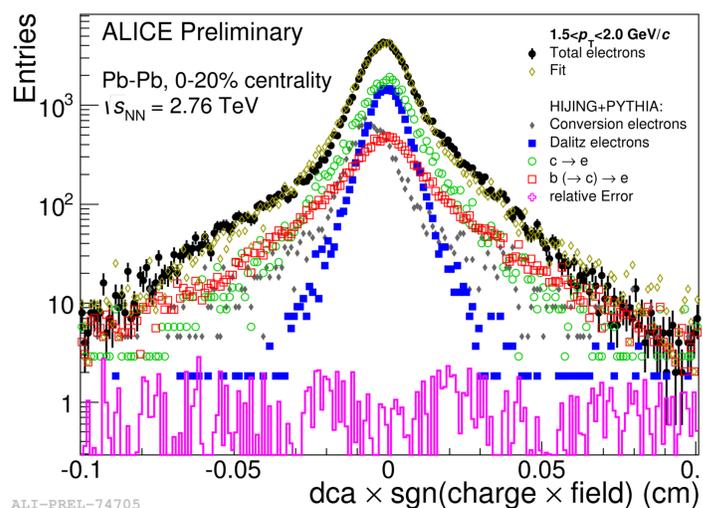
Separation of beauty-decay electrons

Inclusive electron sample includes contributions from:

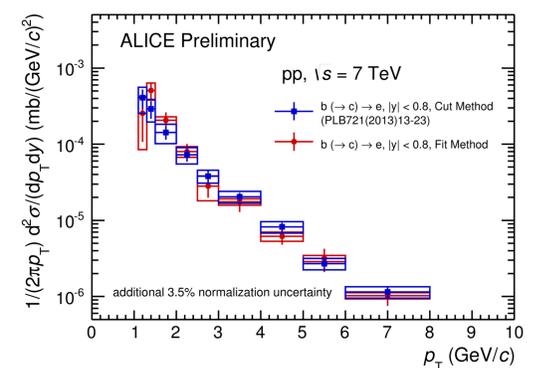
- Semi-leptonic beauty-hadron decays
- Semi-leptonic charm-hadron decays
- Electrons from primary vertex (e.g. Dalitz decays of light mesons)
- Electrons from photon conversions in the detector material

Fitting procedure:

- Global fit of the inclusive electron dca distribution
- Distributions of individual sources taken from Monte Carlo (HIJING/PYTHIA+GEANT3)
- Maximum likelihood-based approach (Based on Barlow, Beeston, Comp. Phys. Comm. 77 (1993) 219)
- Take into account finite statistics of MC templates
- Likelihood has expectation values of MC templates in all bins as nuisance parameters

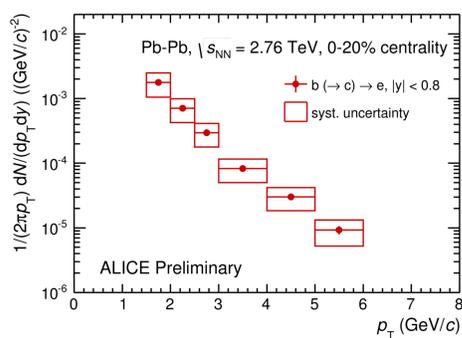


Results from pp collisions



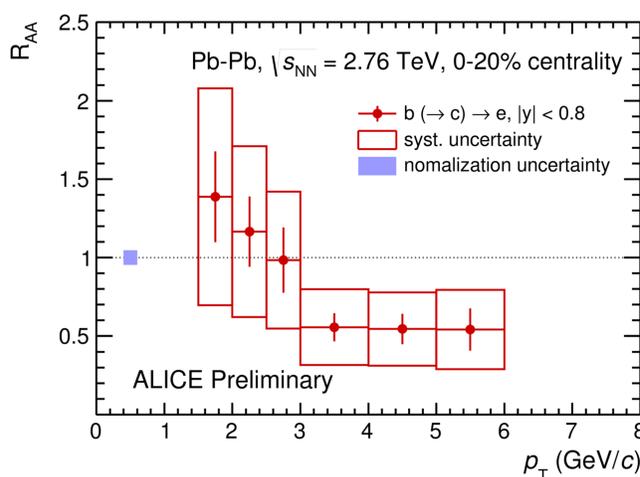
- Previous measurement in pp using cut on impact parameter
- Cut increases S/B for subtraction of electrons from other sources
- Results consistent within uncertainties
- Scaled result used as reference for R_{AA}

Yield in Pb-Pb collisions



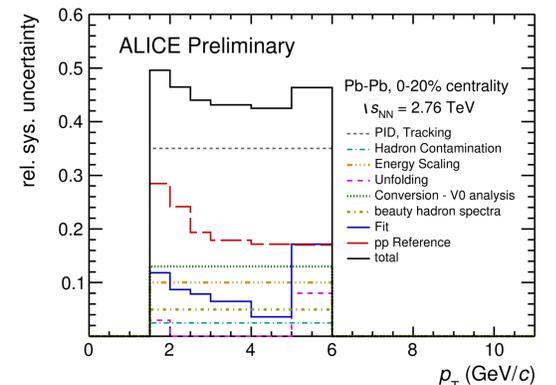
- p_T range determined by increasing contamination by protons (lower limit) and pions (upper limit)

Beauty-decay electron R_{AA}



- Hint of suppression at intermediate p_T

Systematic uncertainties



- Dominated by PID cut efficiency due to strong cuts
- Significant contribution also from pp reference

Summary

Results:

- First observation of beauty-decay electrons in central Pb-Pb collisions
- Nuclear modification factor shows a hint for suppression

Benefits of this type of analysis:

- Does not require subtraction of residual background components
- Allows for cross checks with inclusive heavy flavor electron measurements, other D and B measurements