Measurements of heavy-flavour production via electrons in the relativistic heavy-ion collisions with ALICE

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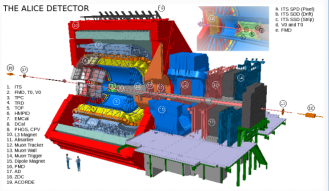
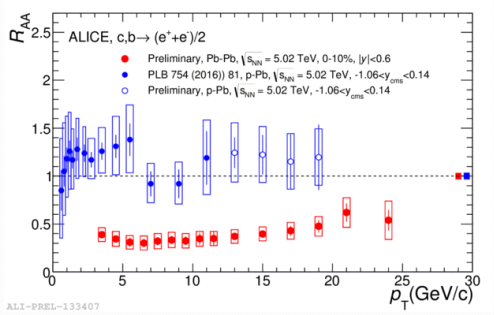
- Heavy quarks (charm and beauty) are produced primarily in the initial hard partonic interactions in heavy-ion collisions
- Propagate through and interact with the hot and dense QCD matter, *i.e.* Quark-Gluon Plasma (QGP) -> Ideal probe to investigate the QGP
- Lose energy by interacting with the medium constituents
  - Radiative energy loss (Djordjevic. *et. al.*, PLB 632 (2006) 81)
    - Gluon bremsstrahlung
    - Smaller energy loss for heavy quarks than for light quarks due to "dead cone" effect (Yu. L Dokshitzer, D. E. Kharzeev, PLB 519 (2001) 199)
    - Energy loss depends on the colour charge and is larger for gluons than for quarks
  - Collisional energy loss (A. Adil, I. Vitev, PLB 649 (2007) 139)
    - Energy loss via elastic scatterings

Heavy-flavour production in Pb-Pb collisions

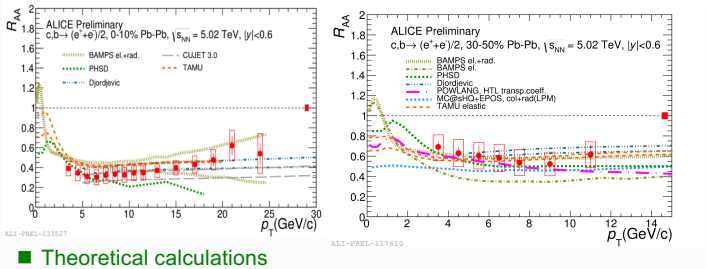
- Heavy-flavour study via electrons
  - Branching ratio: ~10%
  - Charm contribution dominates at low p_T, and beauty contribution dominates at high p_T (~>5 GeV/*c*)
  - High p_T electrons (p_T>3 GeV/*c*) Identified with TPC + EMCal
  - Electrons from background, mainly from neutral meson decays and conversion, are identified by invariant mass of electron pairs



- Strong suppression in 0-10% centrality class
  - No suppression observed in p-Pb collisions at intermediate-high p_T
    - R_{pPb} is consistent with unity : Cold Nuclear Matter effects are small
- Indicate significant energy loss of charm and beauty quarks



- Models reproduce resonably well the measured R_{AA} in different centrality class (0-10% and 30-50%)
  - Increase in suppression with higher collision centrality



- Theoretical calculations
  - pQCD-based energy loss models
    - Djordjevic, MC@sHQ+EPOS, WHDG, Vitev
  - Transport models:
    - BAMPS, Cao, TAMU, PHSD, POWLANG

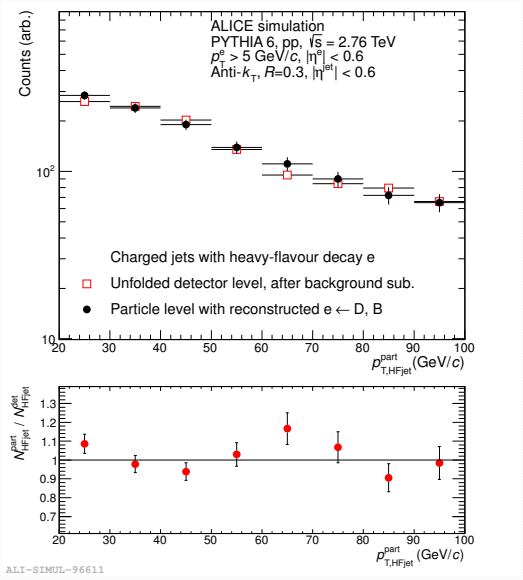
BAMPS: J. Phys. G 38 (2011) 124152., ***POWLANG***: Eur. Phys. J C 71 (2011) 1666, ***UrQMD:*** arXiv:1211.6912, J. Phys. Conf. Ser. 426 012032 2013, ***TAMU***: Phys. Rev. C 86 (2012) 014903, ***WHDG***: J. Phys. G 38, (2011), 124114, ***Aichelin:*** Phys. Rev. C79 2009 044906, J. Phys. G 37 2010 094019, **Cao,Qin, Bass:** arXiv:1308.0617

Heavy-flavour jets reconstruction with electrons from charm and beauty decays

- Jets from heavy flavours
  - Address charm and beauty quark kinematics
    - Align additional information on energy loss mechanism and hadronisation
    - Spatial distribution and kinematic properties of the radiative energy
- Heavy-flavour jet reconstruction with electrons from charm and beauty decays
  - Reconstruct charged jets (FastJet algorigthm, Anti-k_T, R = 0.3)
  - Find electrons in reconstructed jets ($N^{electron}$)
    - momentum matching between electron and track in the reconstructed jets
  - Subtract jets containing photonic electrons (N^{pho})

$$N_{raw}^{HF} = \sum_{p_T^e}\left(N^{electron}(p_T^e) - \left(\frac{1}{\varepsilon(p_T^e)} - 1\right)N^{pho}(p_T^e)\right)$$

    - ε: photonic electron reconstruction efficiency
  - Correct for reconstruction efficiency, unfold p_T spectrum for detector response and background fluctuations
  - Remaining contributions to be subtracted
    - e ← W, residual hadron contamination



- Monte Carlo closure test performed comparing the simulated heavy-flavour jets (at particle level with reconstructed e ← HF) to the reconstructed and corrected ones after background subtraction and unfolding (at detector level)
- Two HF-jet spectra are in good agreement

- Summary & Outlook
  - Measure R_{AA} in different centrality classes in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV
    - Strong suppression observed in central collisions
  - Further study of heavy-flavour energy loss can be performed with jets containing heavy flavours
    - Possible reconstruction by tagging electrons from heavy-flavour decays

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