

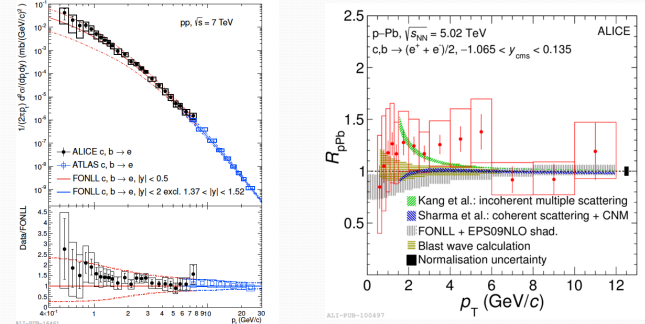
# Measurement of the nuclear modification factor of electrons from heavy-flavour hadron decays in Pb-Pb collisions with ALICE



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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
  - A good probe to investigate the hot and dense QCD matter
  - Loss energy in the hot and dense matter
- Energy loss mechanism
  - Radiative energy loss (Djordjevic, et al., PLB 632 (2006) 81)
    - Glulon 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 study via electrons
  - Branching ratio: ~10%
  - Charm contribution dominates at low  $p_T$ , and beauty contribution dominates at high  $p_T$
  - Main background: electrons from  $\gamma$  conversions and neutral meson decays are statistically subtracted

## Heavy-flavour production in pp and p-Pb collisions

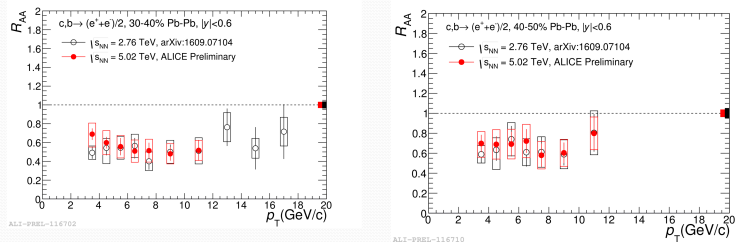
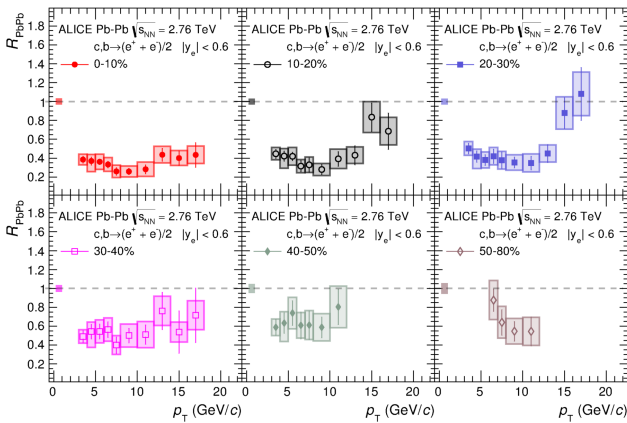


- pp at  $\sqrt{s} = 7$  TeV: consistent with FONLL QCD calculations
  - PRD 86 (2012) 112007
- p-Pb at  $\sqrt{s_{NN}} = 5.02$  TeV: cold nuclear matter effects are very small
  - PLB 708 (2012) 265

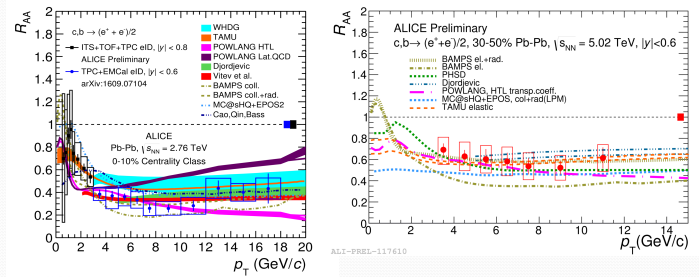
## Heavy-flavour production in Pb-Pb collisions

- Electrons from heavy-flavour hadron decays in Pb-Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV (arXiv:1609.07104)
  - Strong suppression in 0-10% centrality
    - Not observed such suppression in p-Pb collisions
    - Indicate significant energy loss of charm and beauty quarks
  - Suppression gets smaller from central to peripheral collisions

- Energy dependence of heavy-flavour production
  - Comparison of  $R_{AA}$  at  $\sqrt{s_{NN}} = 2.76$  TeV and 5.02 TeV
  - Similar suppression in semi-central collisions (30-40% & 40-50%) in two different energies
  - Indicate no significant energy dependence of energy loss



- Models reproduce reasonably well the measured  $R_{AA}$  in different energies and centralities



- 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, UQM: 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

- Outlook
  - Measure  $R_{AA}$  in most-central collisions in Pb-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV
  - Extend  $p_T$  reach in Pb-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV
    - Low  $p_T$  and high  $p_T$  (with EMCal trigger)
  - Separate electrons from charm and beauty quarks

- Rapidity dependence of heavy-flavour production
  - Electrons  $|y| < 0.6$  (mid-rapidity) and muons  $2.5 < y < 4$  (forward rapidity)
  - Similar suppression between mid- and forward rapidities
  - Indicate no significant rapidity dependence of energy loss

