Production of heavy quarks in proton-proton and heavy-ion collisions with CMS

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Why heavy-flavour measurements?
- in pp collisions, they provide an important test for perturbative QCD calculations at LHC energy regimes
- in nucleus-nucleus collisions, they are effective probes to study the effects of in-medium parton energy loss
- proton-nucleus studies provide baseline for PbPb analyses and allow one to study cold nuclear matter effects (e.g. shadowing)

A focus on heavy-ion collisions:
- heavy quarks experience the full evolution of the medium
- once produced, they strongly interact with the deconfined medium via radiative and collisional processes
- Flavour-dependence of radiative energy loss:
  - larger for gluons than for quarks
- dead-cone effect: gluon radiation suppressed at small angles for massive quarks

- CMS results well described by MC@NLO calculations and by PYTHIA

B-meson production cross sections in pp collisions:
- B+, B0, B-, pT and y-differential cross sections measured in pp collisions at 7 TeV with integrated luminosity L=5.8 pb^{-1}
- CMS results well described by MC@NLO calculations and by PYTHIA

BB angular correlation in pp collisions at 7 TeV:
- in the collinear region (small Δφ), where gluon splitting processes expected to be large, theoretical calculations do not describe CMS measurement.

B-meson reconstruction in CMS
- J/ψ reconstruction by vertexing muon pairs with opposite charges using kinematic fits
- B-meson candidates built by associating tracks to reconstructed J/ψ mesons
- Candidate selection based on multivariate cut optimisation procedure

b-jet reconstruction in CMS
- jet reconstruction using anti-k_τ algorithm with ΔR=0.3
- b-jet tagging algorithm based on kinematic variables related to the long lifetime and large mass of b hadrons:
  - selection on the significance of the 3D flight distance

B-meson production cross sections in pPb collisions:
- First measurement of exclusive B-meson production at the LHC in heavy-ion collisions
- pT-differential cross section measurement of B^+, B^0, B^-, and y-differential cross section of B^+ in pPb collisions at 5.02 TeV
- Nuclear modification factors obtained using FONLL predictions to build the proton-proton reference at 5.02 TeV
- R_{pPb}^{FONLL} consistent with unity within uncertainties
- Results compatible with binary scaling hypothesis

B-meson production cross section in PbPb collisions:
- B-meson production cross sections in PbPb collisions at 2.76 TeV
- Evidence of b-jet suppression in central PbPb events
- b-jet R_{AA} favours pQCD models that include strong jet-medium coupling
- R_{AA} of b-jets and inclusive jets compatible within the current uncertainties