D meson production in heavy-ion collisions with CMS

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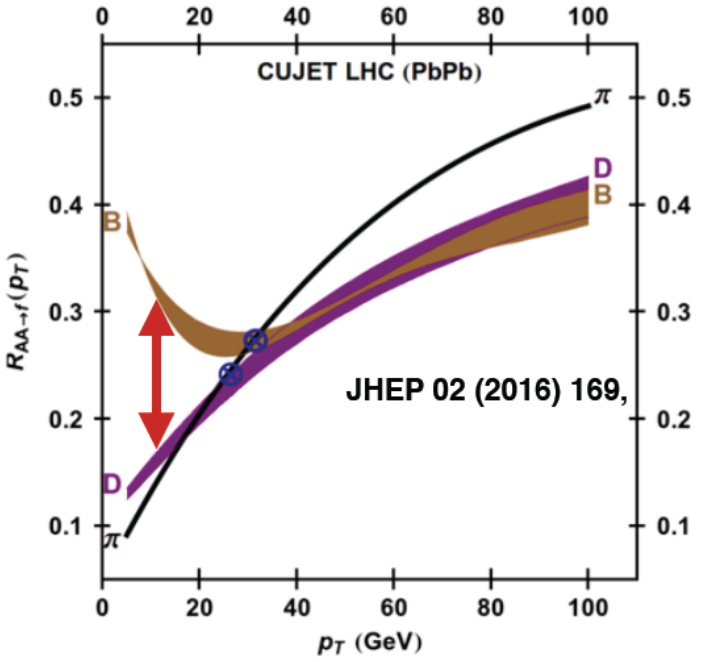
Motivation

- **Heavy quarks (such as charm and bottom) are produced at initial stage of the collisions**
- **Go through the hot and dense matter, can be used as probe of Quark Gluon Plasma**
- **Expected flavor dependent energy loss by**
  - Casimir factor
  - Dead cone effect : radiation suppressed at small angles

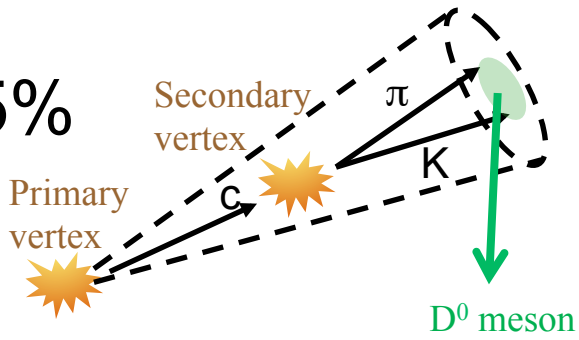
R_{AA} : Nuclear modification factor
larger R_{AA} → smaller energy loss



$\Delta E_{gluon} > \Delta E_{u,d,s} > \Delta E_{charm} > \Delta E_{bottom}$

Analysis procedure

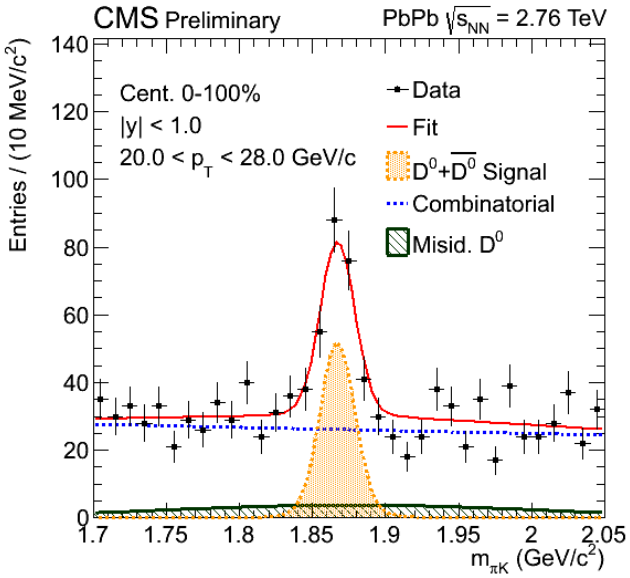
- **Decay channel : $D^0 \rightarrow K^- \pi^+$**
  - Invariant mass : 1.865 GeV
  - Branching fraction = 3.88±0.05%
  - $c\tau(D^0)$ = 122.9 μm



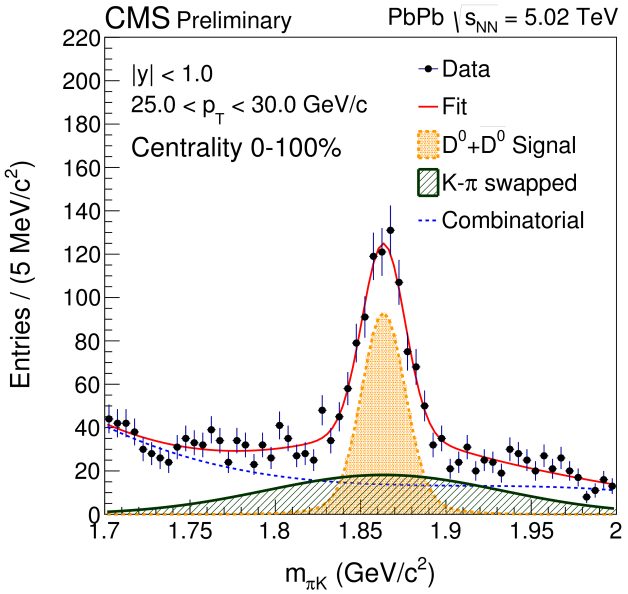
- **No PID (Particle identification)**
  - For one charged track pair, two mass assignment are applied ($K^+ \pi^-$ and $\pi^+ K^-$)
  - Use opposite-signed charged track pair
- **Tracks with $|\eta| < 1.1$ and $p_T > 1$ GeV/c**

Signal extraction

2.76 TeV



5.02 TeV



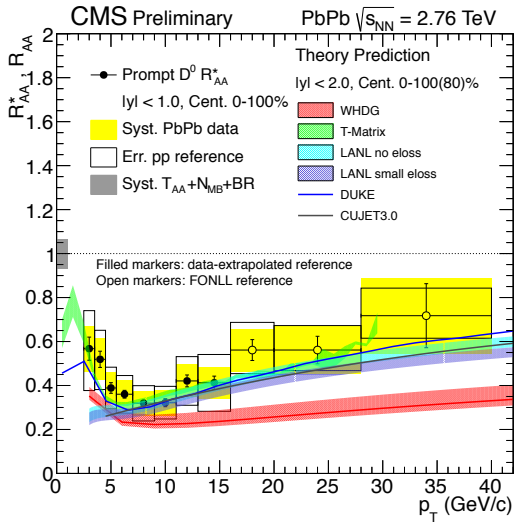
- **Fitting functions**
  - Signal : double Gaussian
  - Misidentified D^0 by swapped K-π mass : single Gaussian
  - Combinatorial background
    - 2.76 TeV : exponential
    - 5.02 TeV : third order polynomial

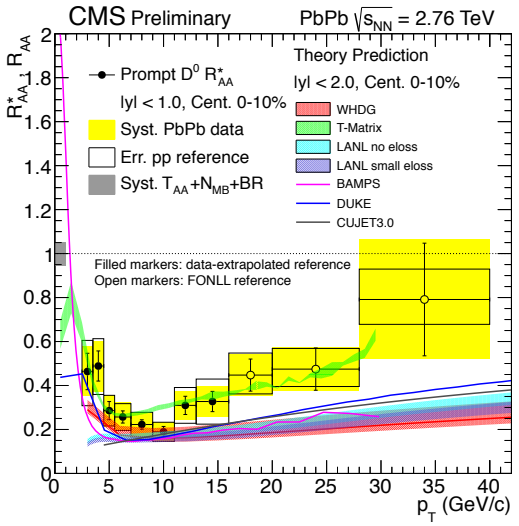
Nuclear modification factor (R_{AA})

Centrality inclusive (0-100%)

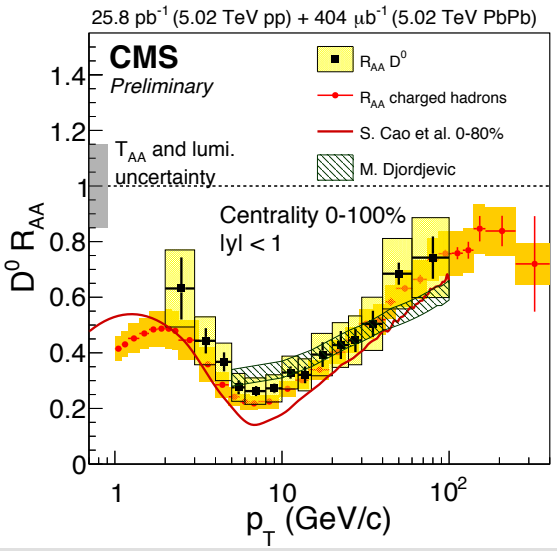
Head-on collision (0-10%)

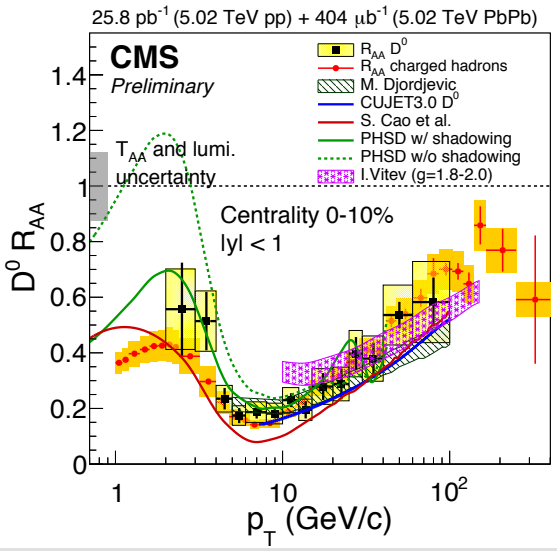
2.76 TeV





5.02 TeV





pp reference

- 2.76 TeV : rescaled ALICE 7 TeV pp data by 2.76 TeV pp FONLL calulation (p_T < 16 GeV/c) + 2.76 TeV FONLL calculation (p_T > 16 GeV/c)
- 5.02 TeV : 5.02 pp TeV data (agree with FONLL calculation within uncertainties)

Cover wider p_T range for D^0 meson

- 2.76 TeV : 2.5 – 40 GeV/c
- 5.02 TeV : 2 – **100** GeV/c

Similar trends between 2.76 and 5.02 TeV measurement

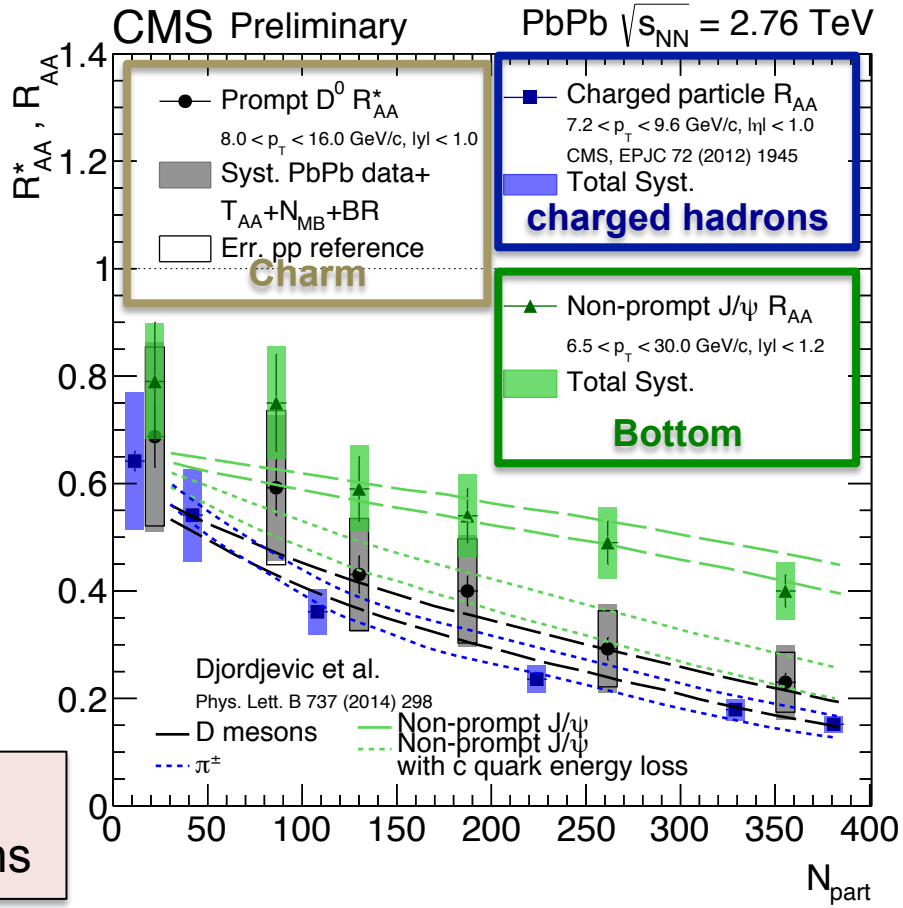
- R_{AA} going down for p_T < 10 GeV/c and going up
- No significant dependence on centrality within uncertainties
- Some model describe the result well
- Consistent with charged particle R_{AA}

Summary and outlook

- **Hint of order of energy loss**

$$\Delta E_{\text{charged hadrons}} \approx ? \ \Delta E_{\text{charm}} > \Delta E_{\text{bottom}}$$

- **Stay tuned to coming results at HardProbes in Wuhan!**



Kisoo Lee (Korea University) will show the B meson analysis results in pPb collisions

Reference (https://twiki.cern.ch/twiki/bin/view/CMSPublic/PhysicsResultsHIN)

CMS-PAS-HIN-15-005 : Nuclear Modification Factor of prompt D^0 in PbPb Collisions at $\sqrt{(s_{NN})}$ = 2.76 TeV

CMS-PAS-HIN-16-001 : D^0 meson nuclear modification factor in PbPb collisions at $\sqrt{(s_{NN})}$ = 5.02 TeV

Thank you for your attention

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