

Non-prompt D_s mesons production in pp and Pb-Pb collisions with ALICE

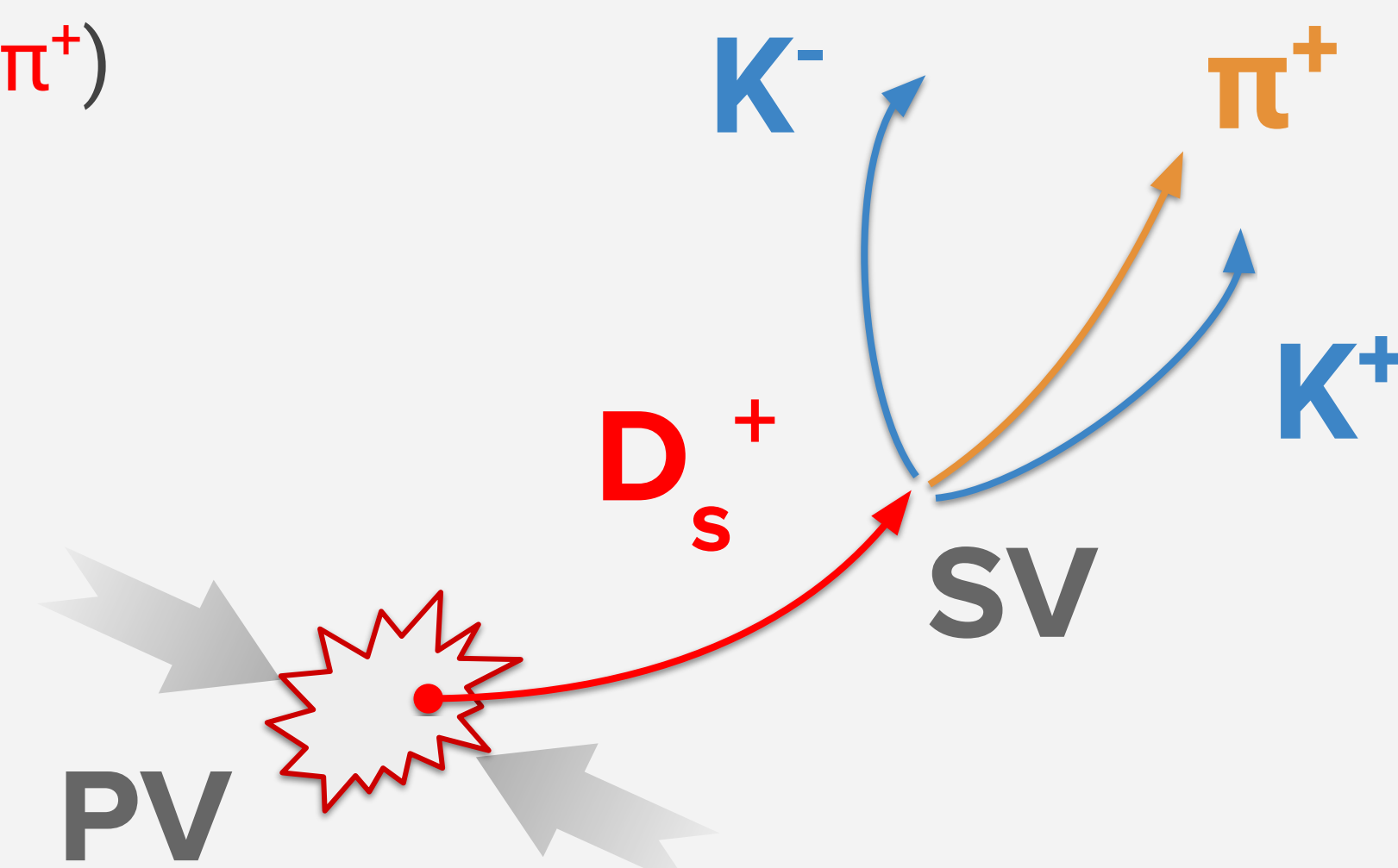
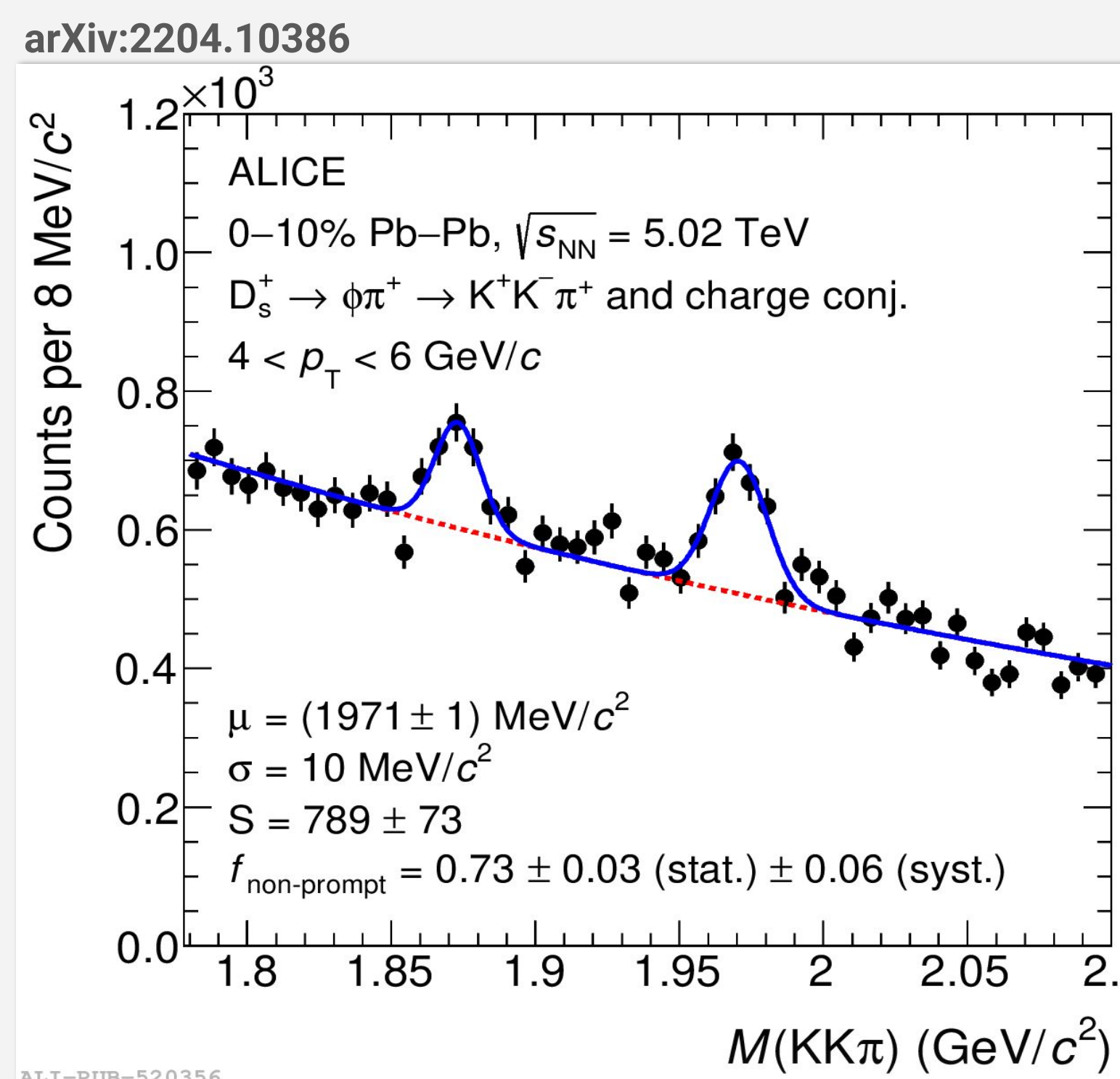
Stefano Politanò on behalf of the ALICE Collaboration, Politecnico and INFN Torino
5 Congresso INFN - Gruppo 3, LNGS - May 2022

Why measure D_s production?

- **proton-proton (pp)** collisions
 - Test pQCD calculations
 - Insights on heavy-flavour hadronisation
 - Reference for Pb-Pb measurements
- **Pb-Pb** collisions
 - Heavy-quarks produced in **shorter time scales** than quark-gluon plasma (QGP) formation
 - Full system evolution
 - Energy loss in the medium
 - Hadronisation mechanism modification (fragmentation, coalescence)
 - Strangeness-enhancement in QGP

How reconstruct D_s in ALICE?

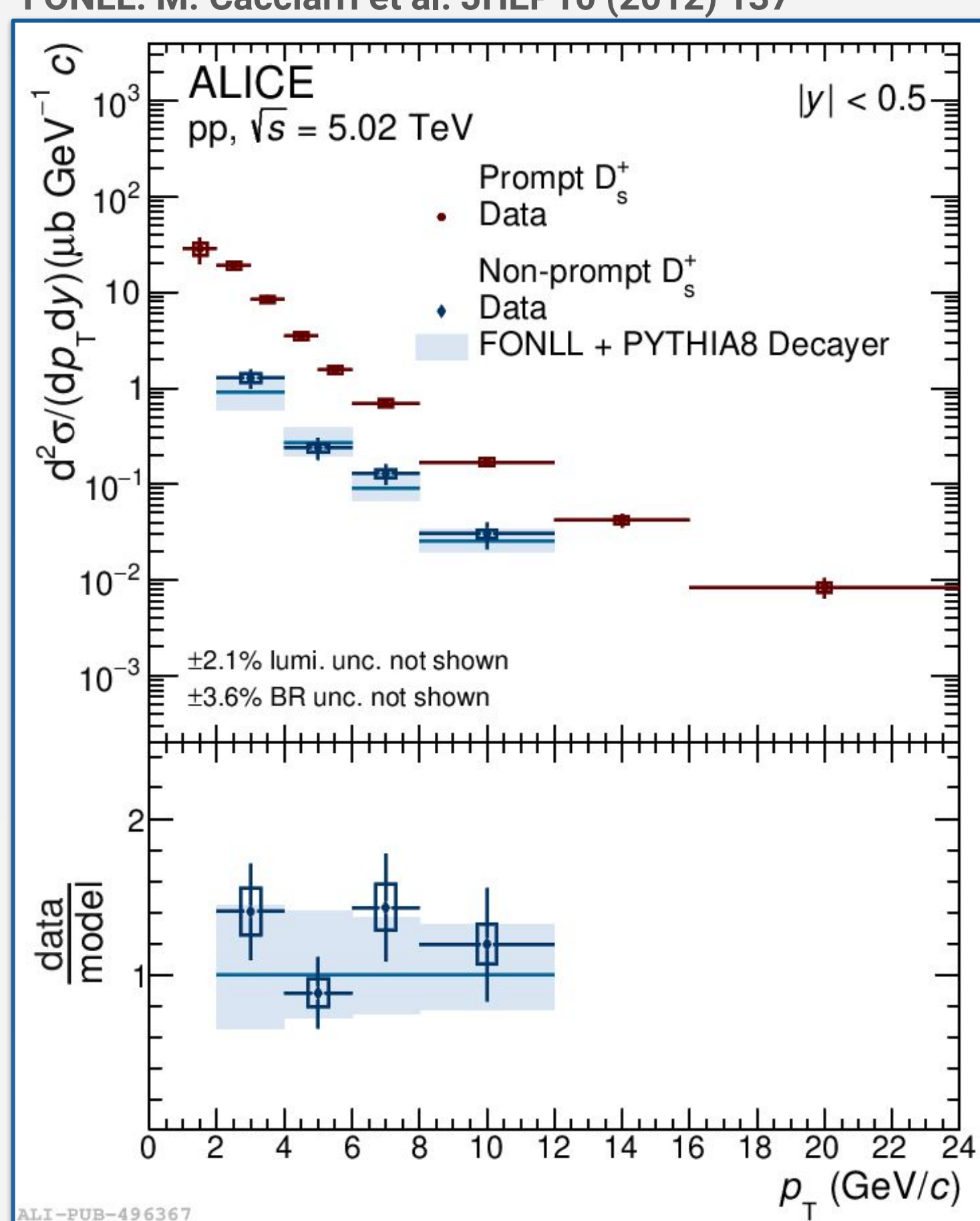
- Full reconstruction of D_s ($c\bar{s}$) decay-vertex topology in the hadronic decay ($D_s \rightarrow \phi\pi^+ \rightarrow K^+K^-\pi^+$)



- Background rejection
 - PID of the tracks
 - Topological and kinematic selections

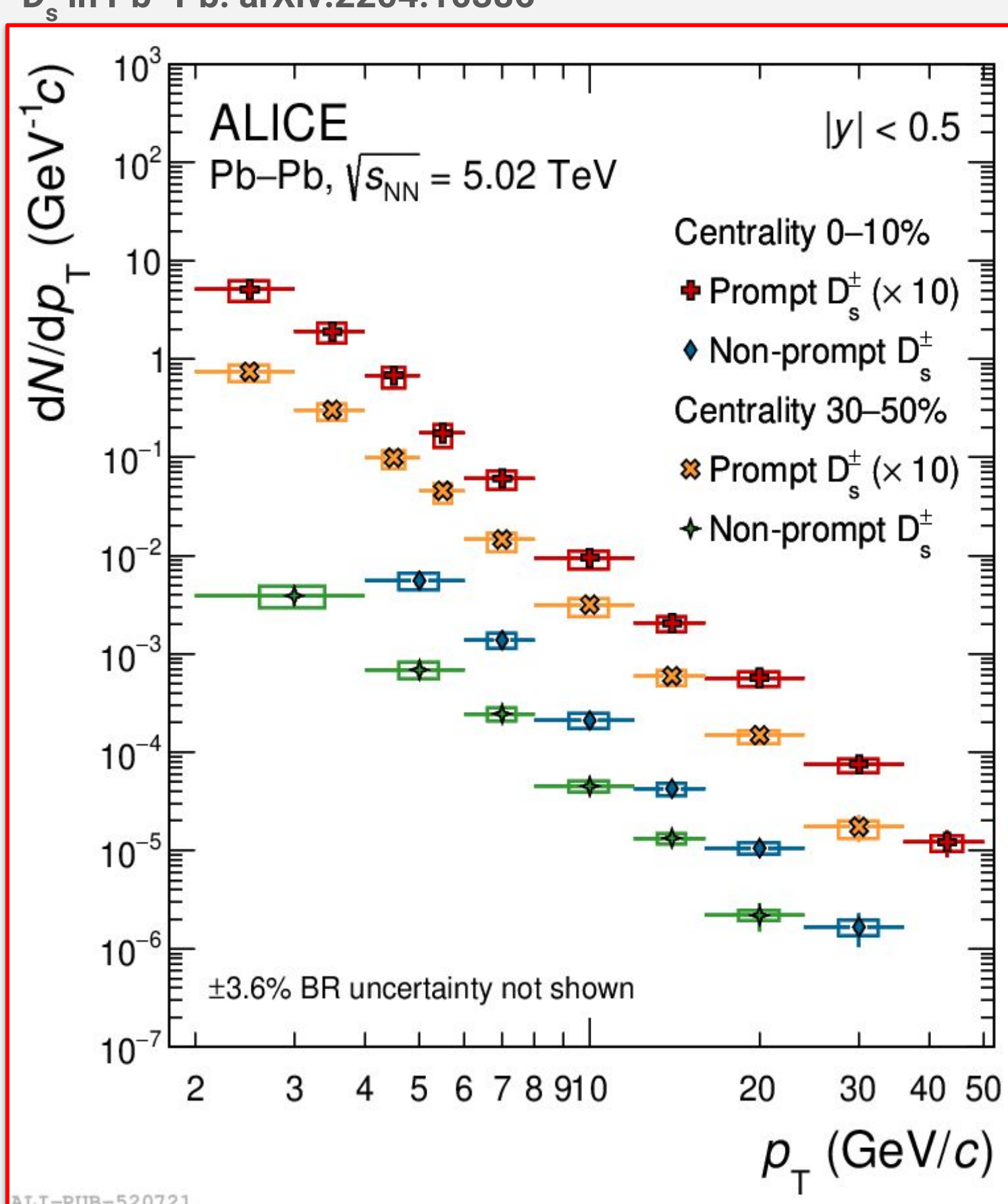
Non-prompt D_s production in small and large colliding systems

D_s in pp: JHEP 05 (2021) 220
FONLL: M. Cacciari et al. JHEP10 (2012) 137



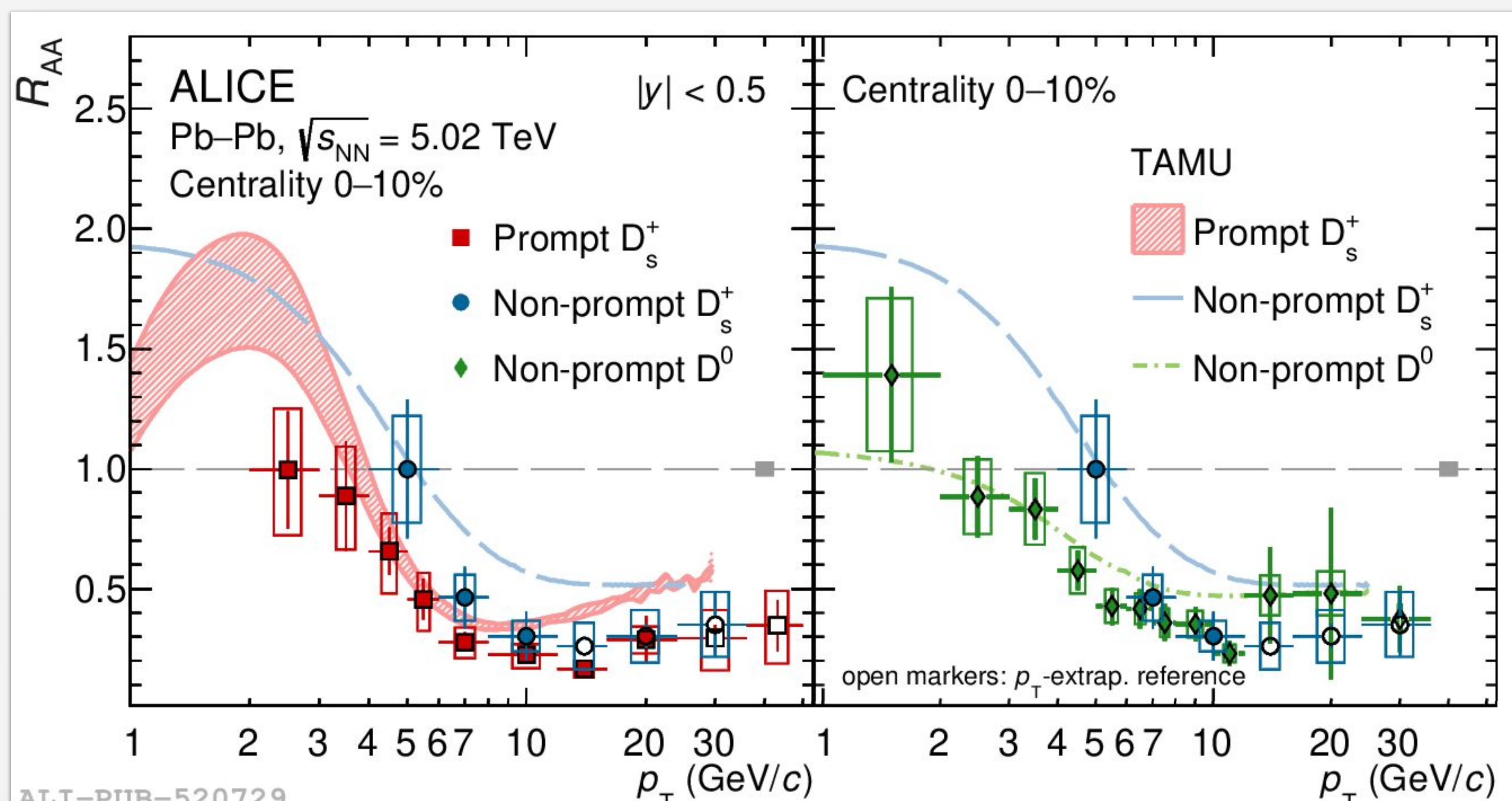
- pp vs FONLL
 - Prompt D_s : predictions not available
 - Non-prompt D_s : predictions compatible with results

D_s in Pb-Pb: arXiv:2204.10386



- Pb-Pb
 - First measurement!
- Non-prompt D_s meson nuclear modification factor (R_{AA})

$$R_{AA} = \frac{1}{\langle N_{coll} \rangle} \frac{dN_{AA}/dp_T}{dN_{pp}/dp_T}$$

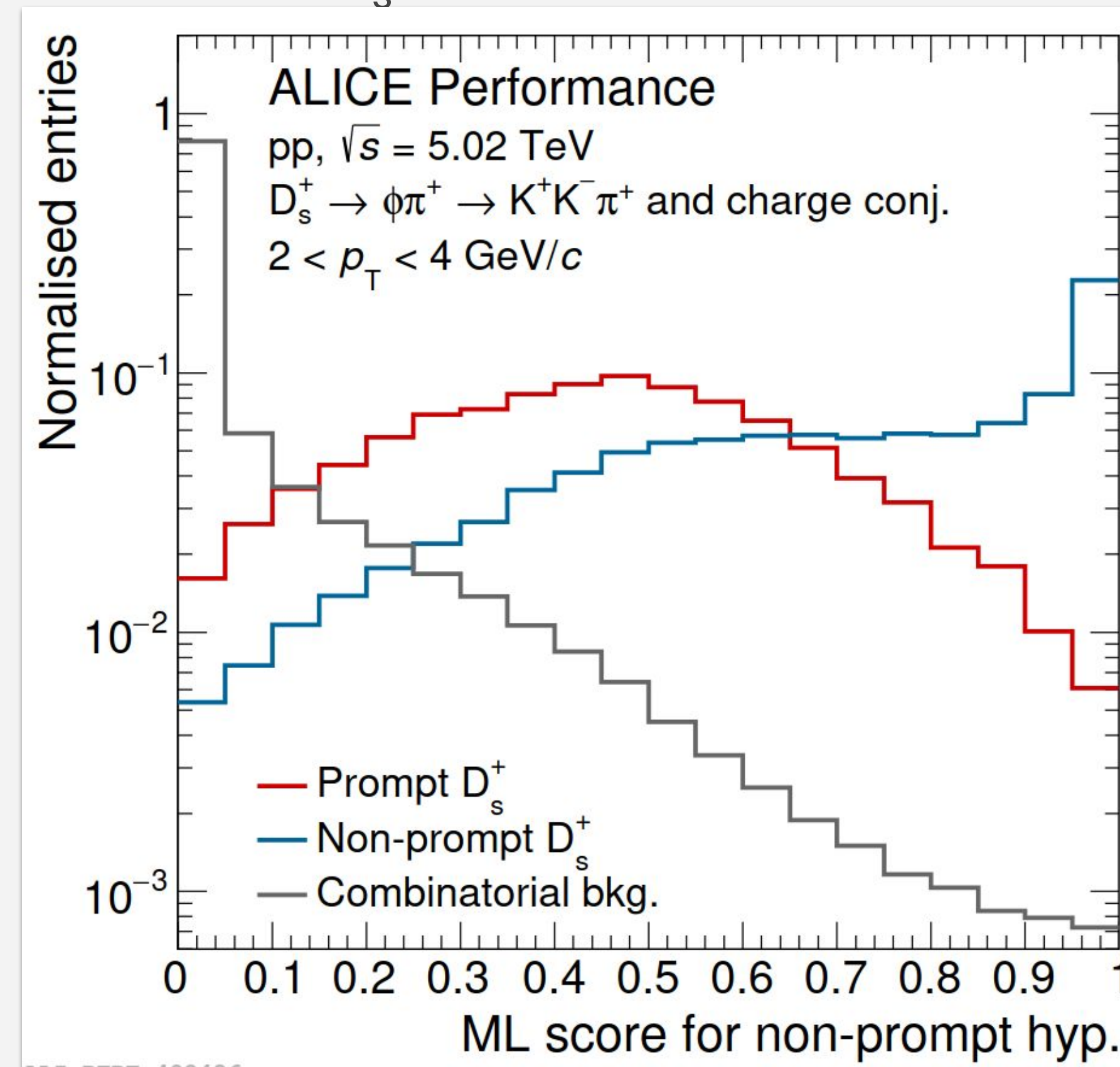


- Non-prompt/Prompt D_s (1.6σ)
 - Different energy-loss between charm and beauty
- Non-prompt D_s/D^0 (1.7σ)
 - Enhanced production of B_s from beauty hadronisation via coalescence
- Transport model implementing coalescence (TAMU) describes the trend within uncertainties

Prompt D_s : PLB 827 (2022) 136986
Non-prompt D_s : arXiv:2204.10386
Non-prompt D^0 : arXiv:2202.00815
TAMU: JHEP 03 081 (2016)

Prompt and non-prompt D_s

- Prompt D_s : sensitive to charm hadronisation
- Non-prompt D_s : sensitive to beauty hadronisation
 - Small fraction produced in nature ($\sim 5\text{-}10\%$)
 - $\sim 50\%$ from B_s^0 decays and $\sim 50\%$ from B^0, B^+



- Disentangle prompt and non-prompt
 - Machine Learning exploiting decay-vertex topologies and PID information

What's next for non-prompt D_s in Run 3 and beyond...

Major upgrades of ALICE ongoing

- ITS: crucial for heavy-flavour measurements
 - ITS2: completely new detector
 - ITS3: innermost layers based on truly cylindrical structure with ultra-thin curved sensor

