Beauty hardon production in Pb-Pb collisions with Bayesian unfolding

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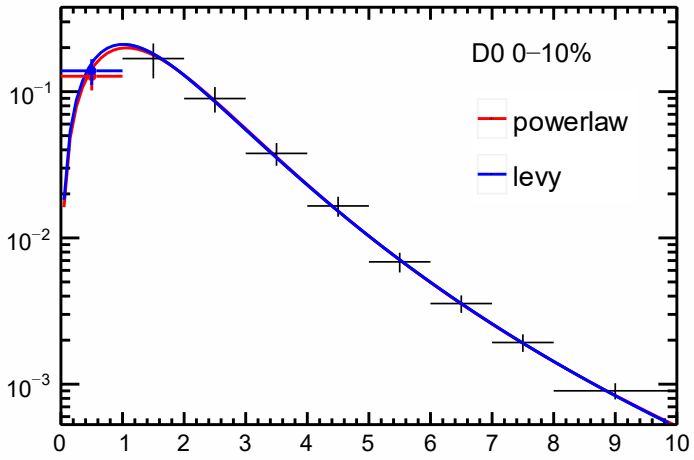
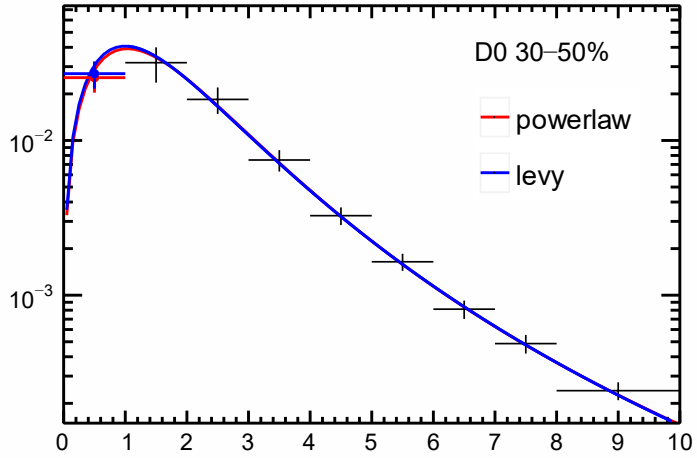
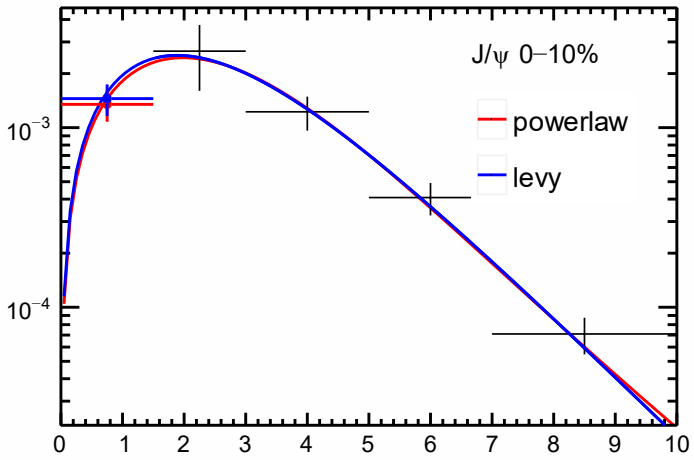
Outline

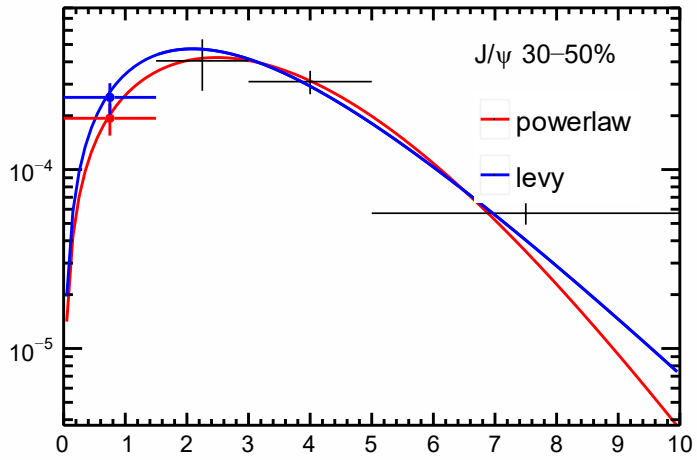
- Extrapolation
- B p_T reweight
- Difference between D0 and Jpsi channel
- Propagation of syst. uncertainty
- p_T-intergrated $b\bar{b}$ production

Extrapolation

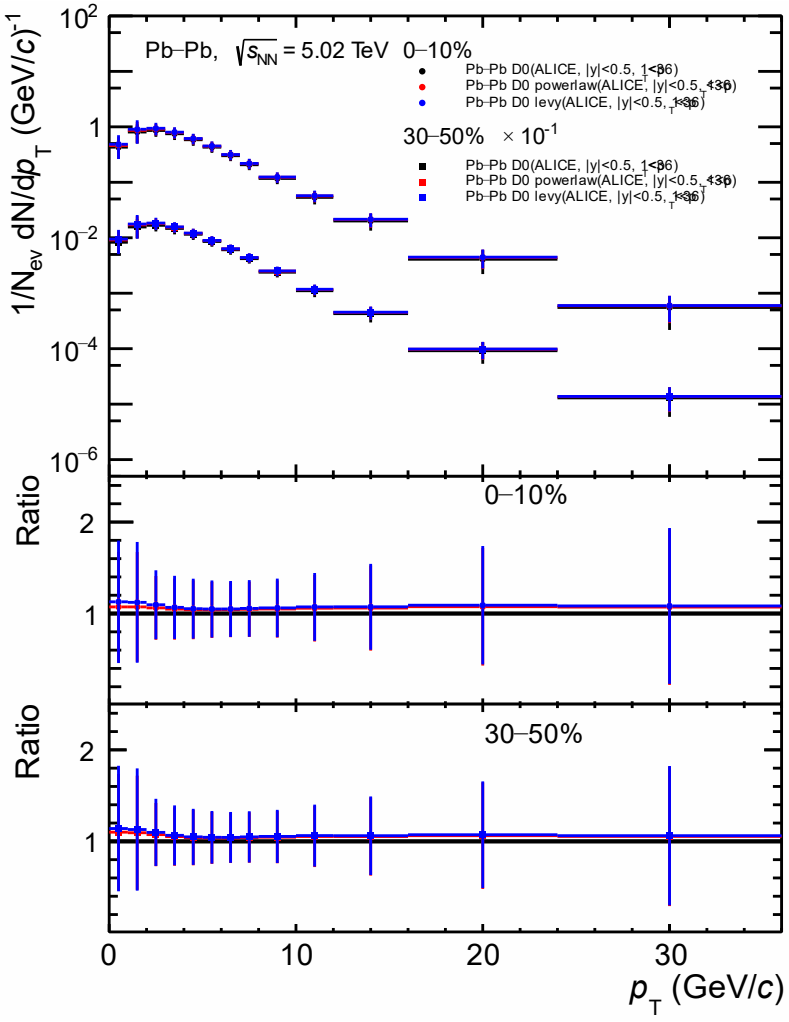


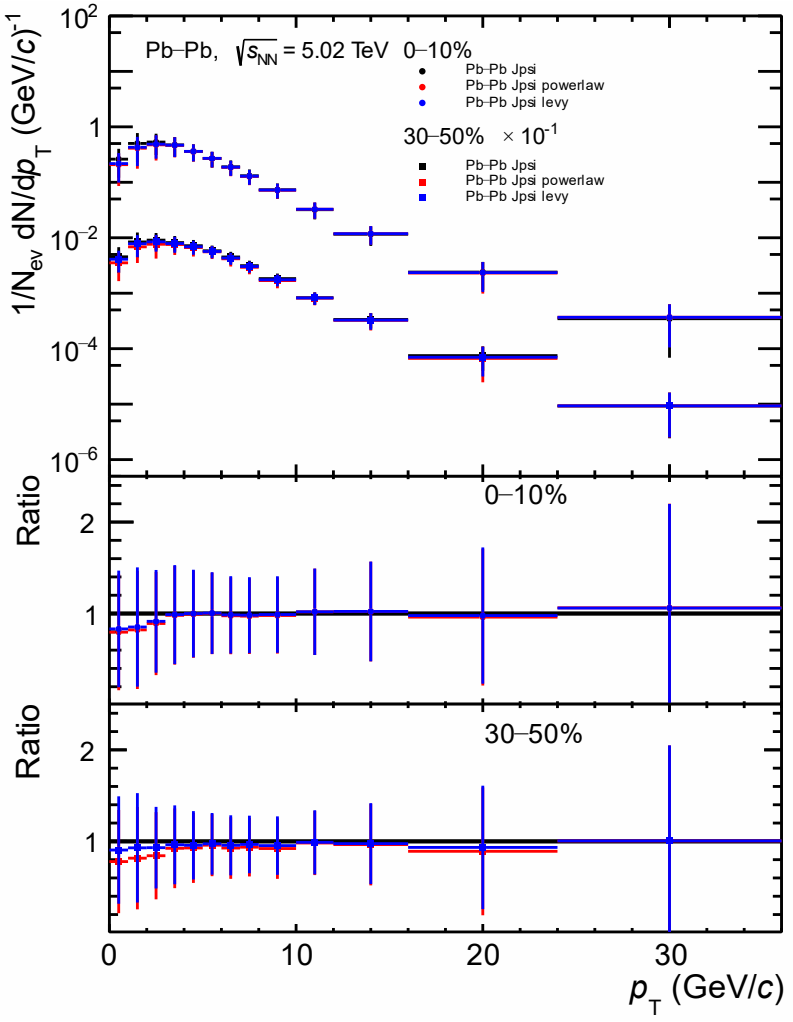




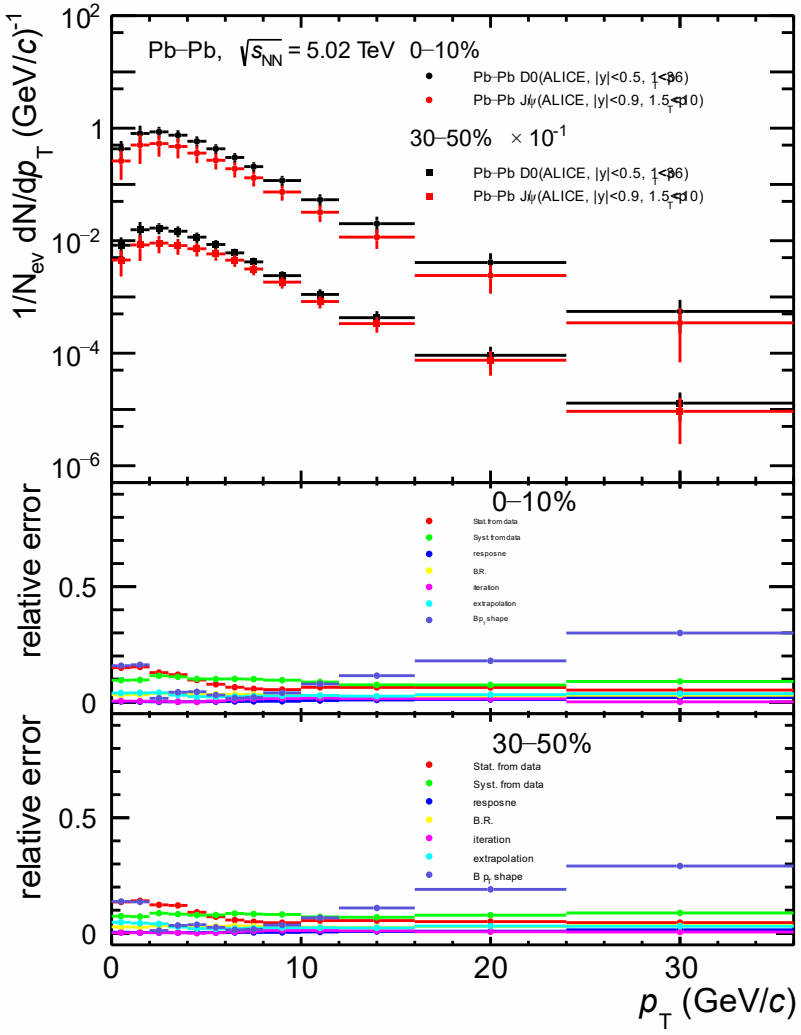


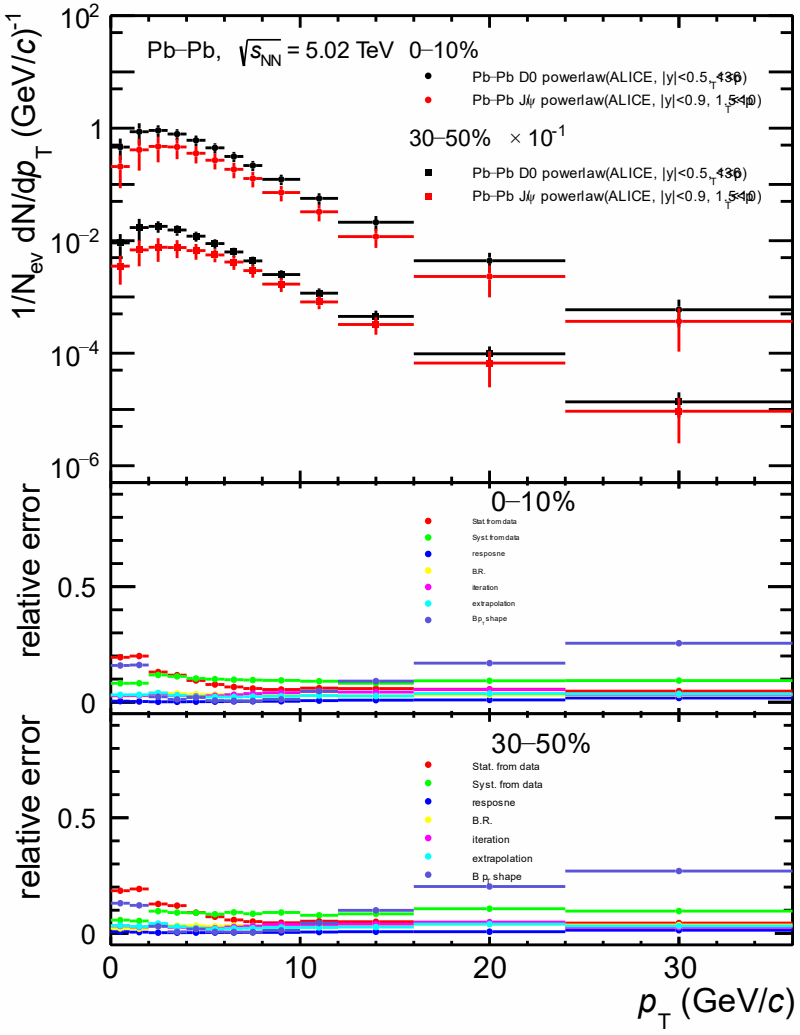
Ratio of $b\bar{b}$ production from extrapolation

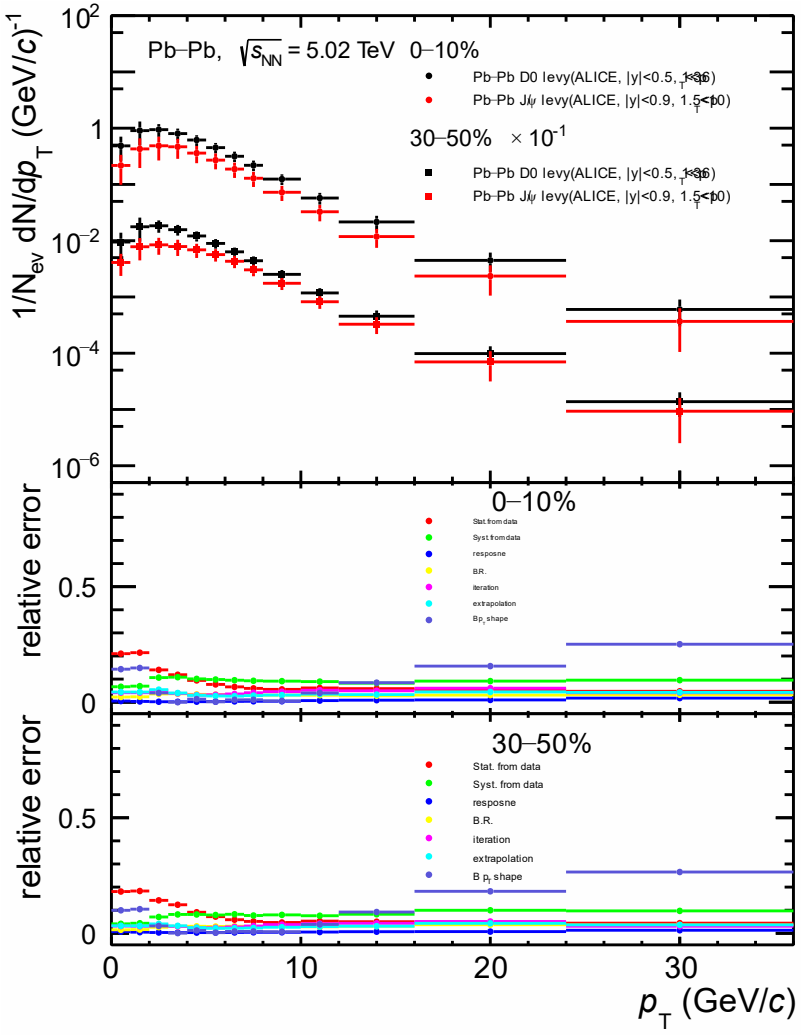




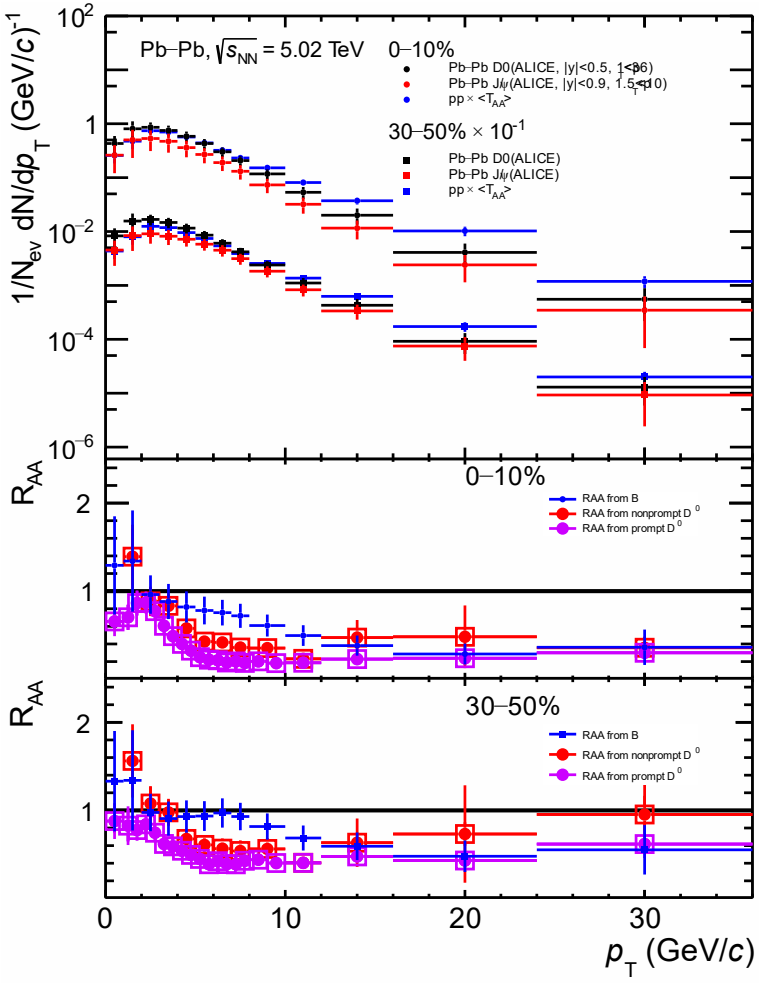
Uncertainties analysis from extrapolation

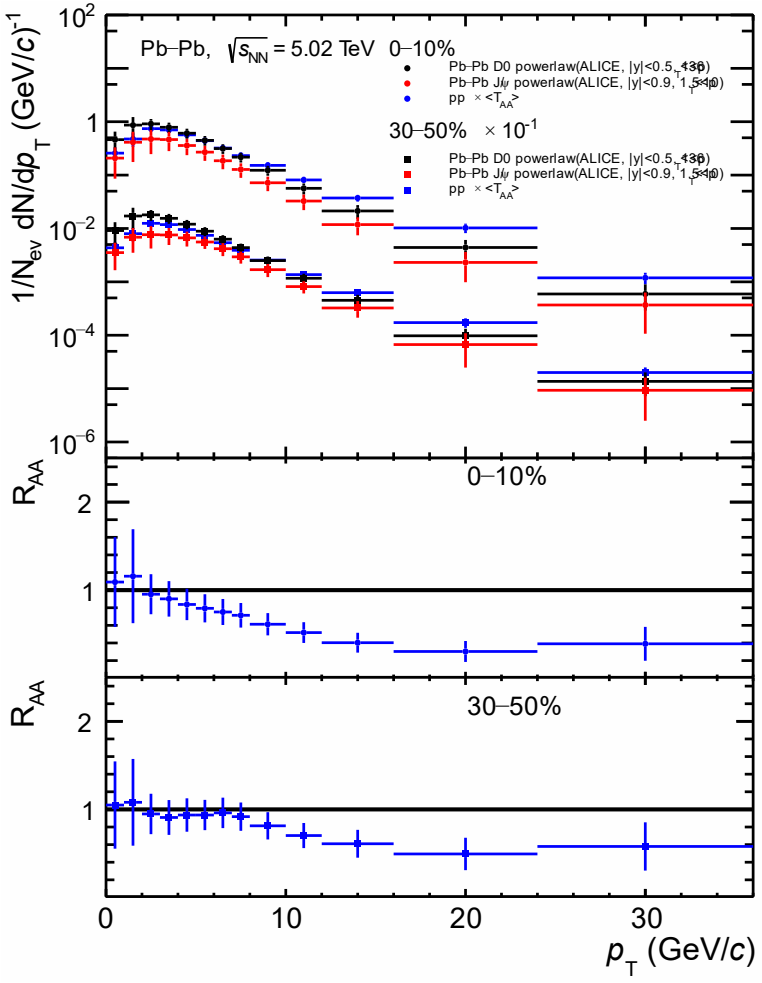


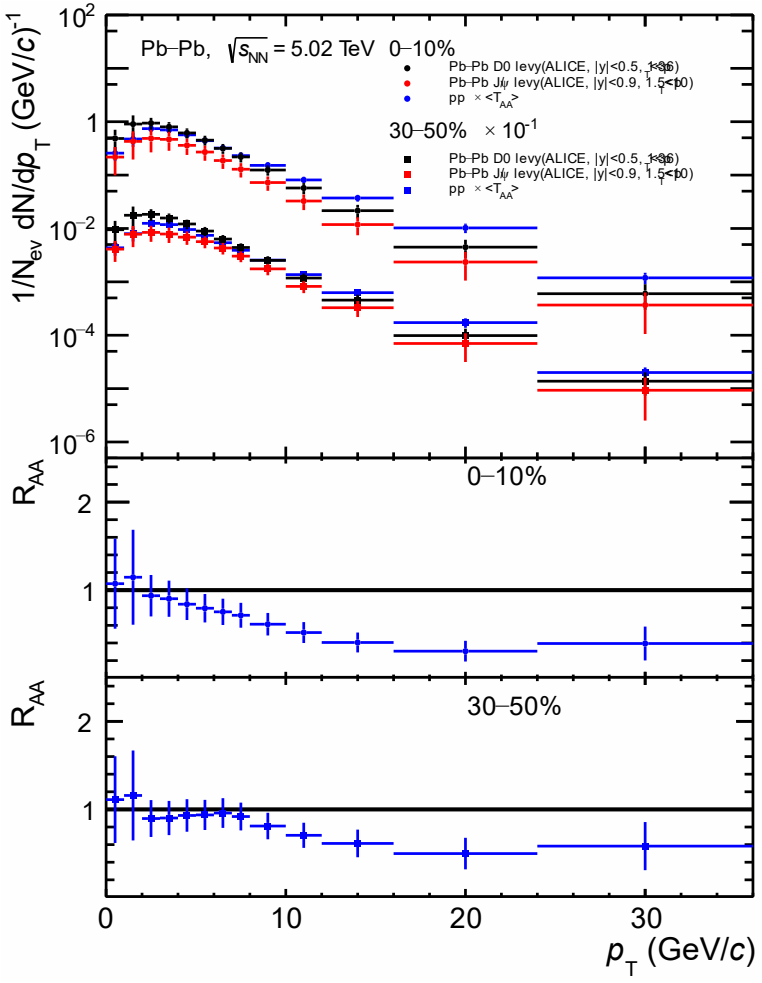




RAA from extrapolation

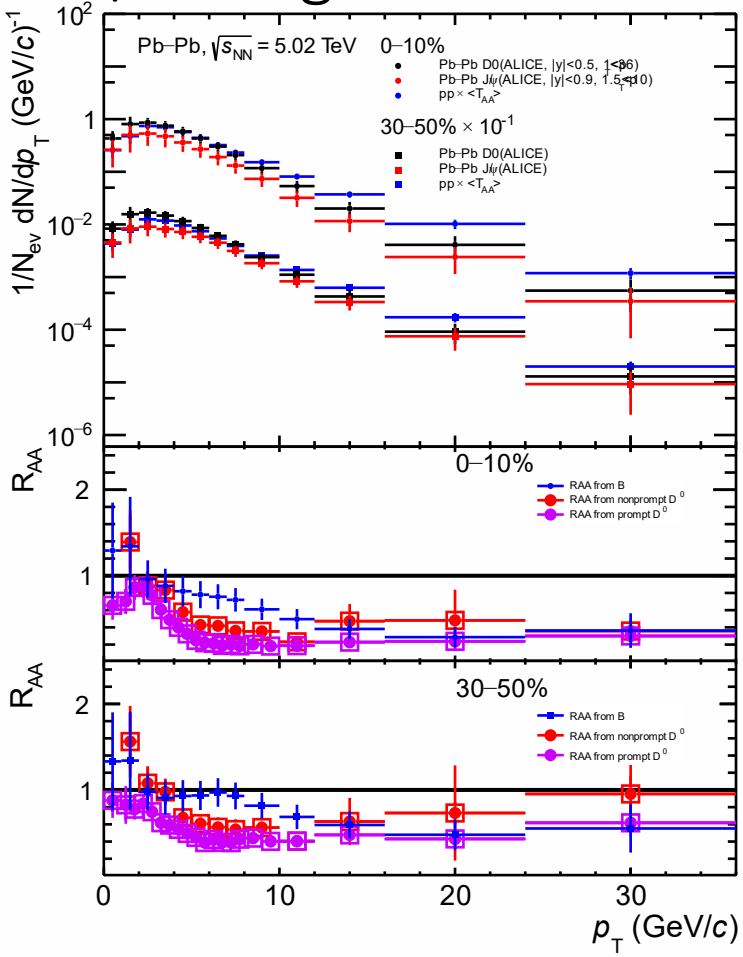




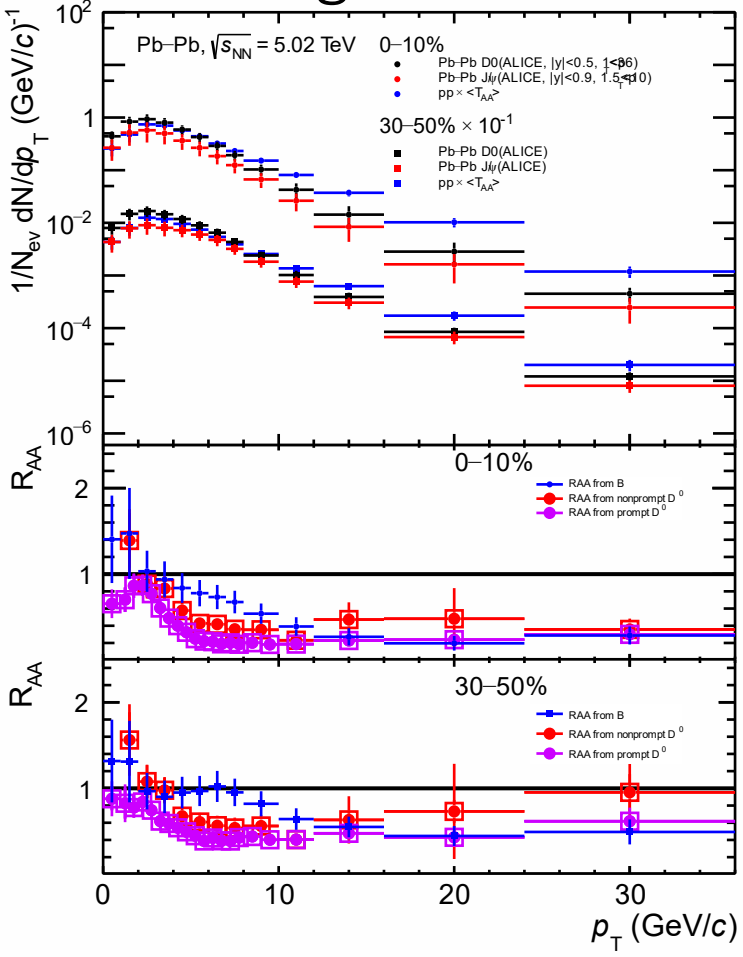


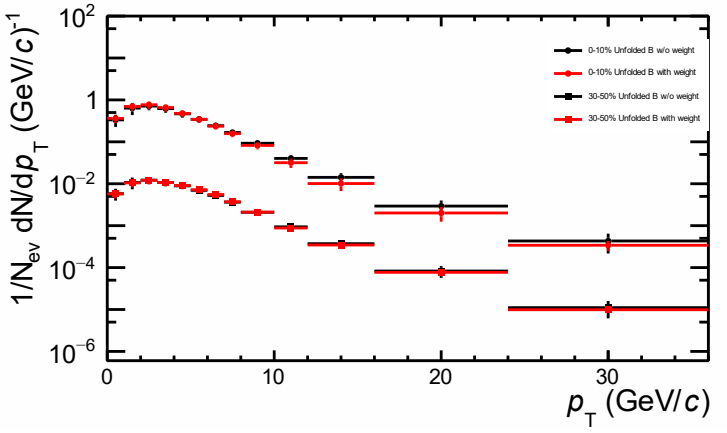
B p_T reweight

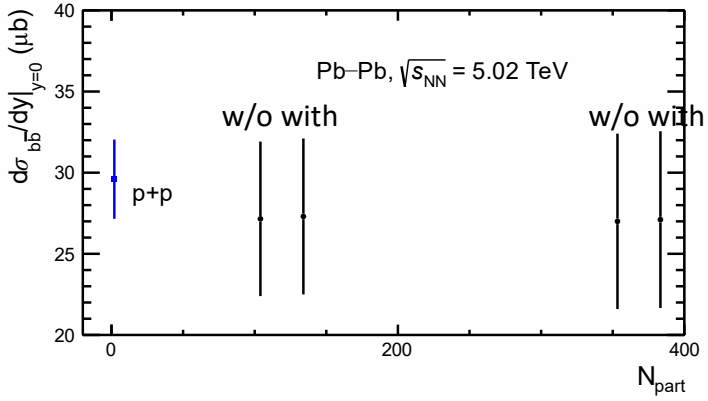
w/o weight



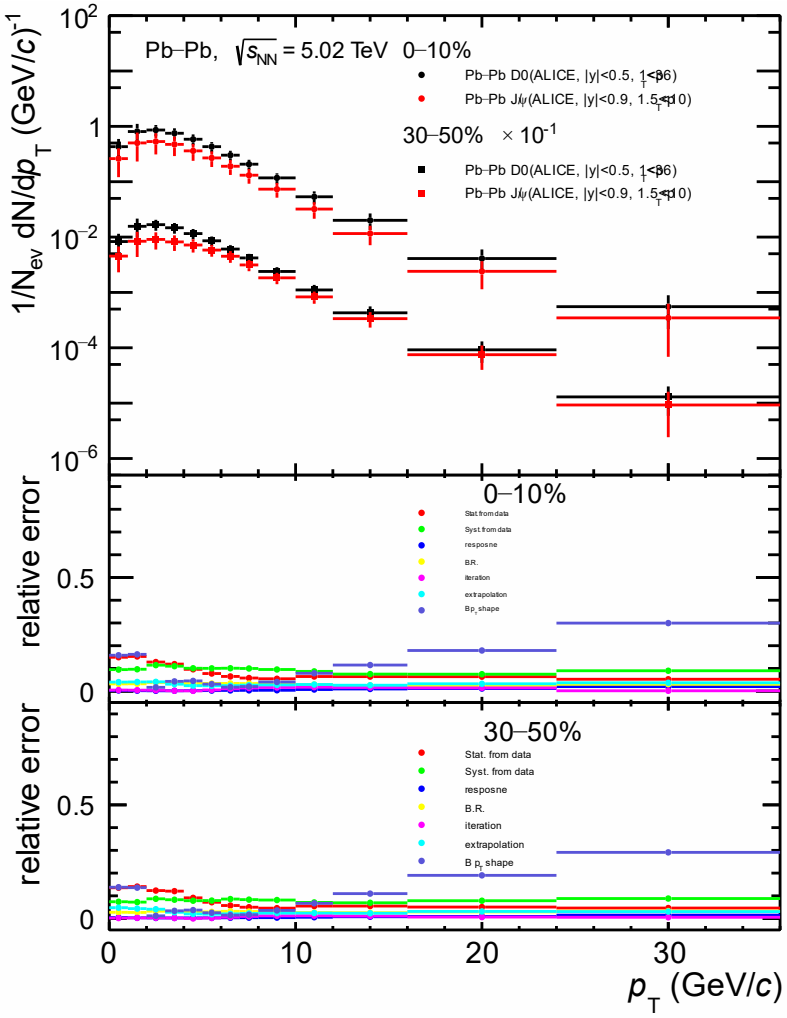
with weight

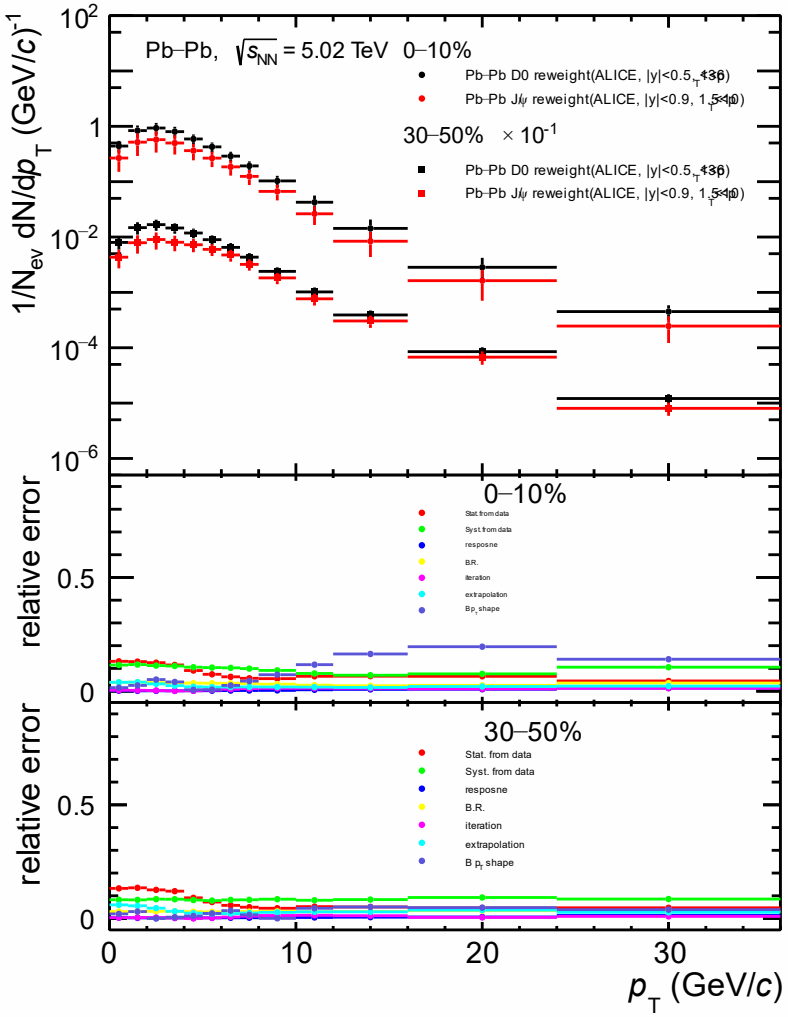




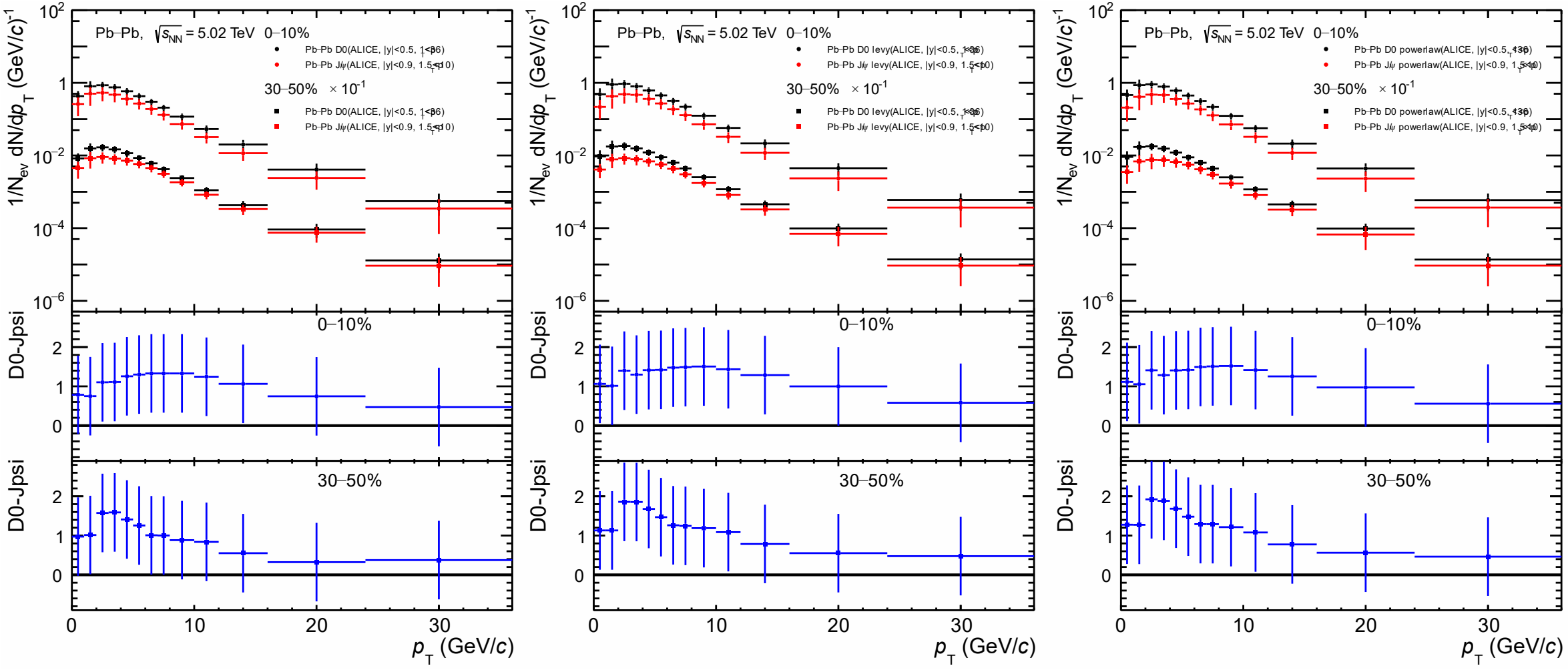


Uncertainties analysis from reweight

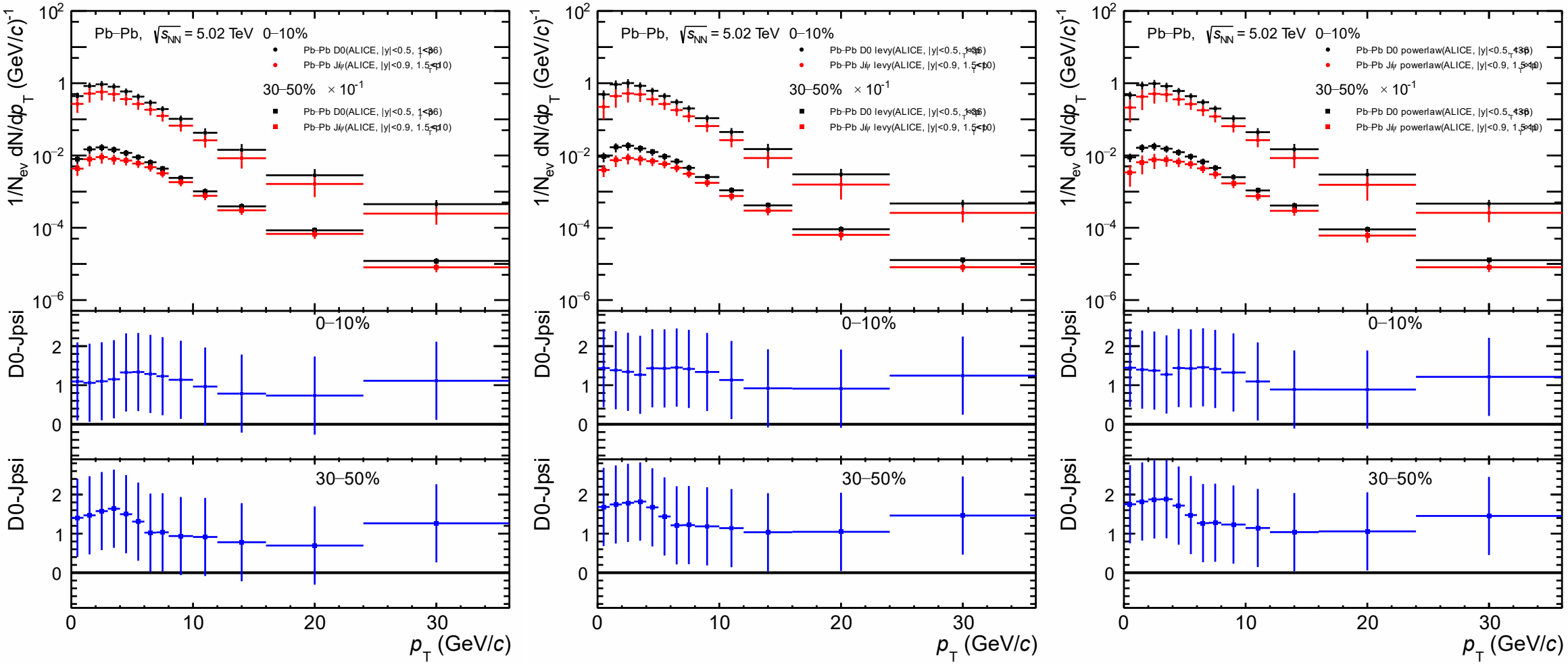




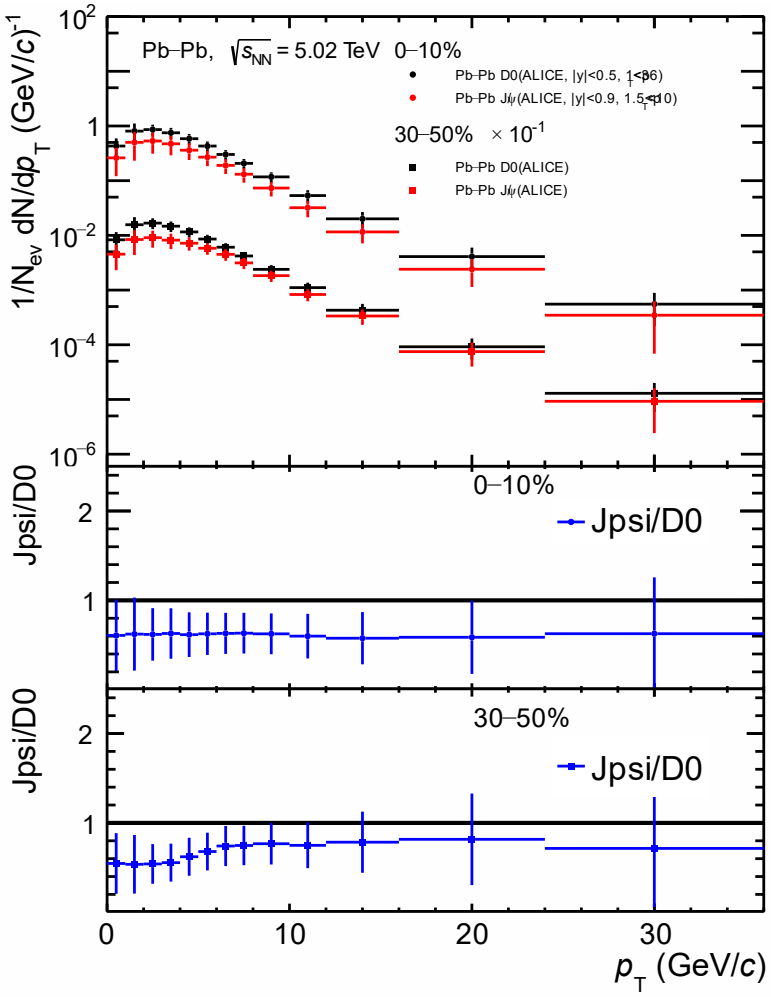
Difference between D0 and Jpsi channel (w/o weight)



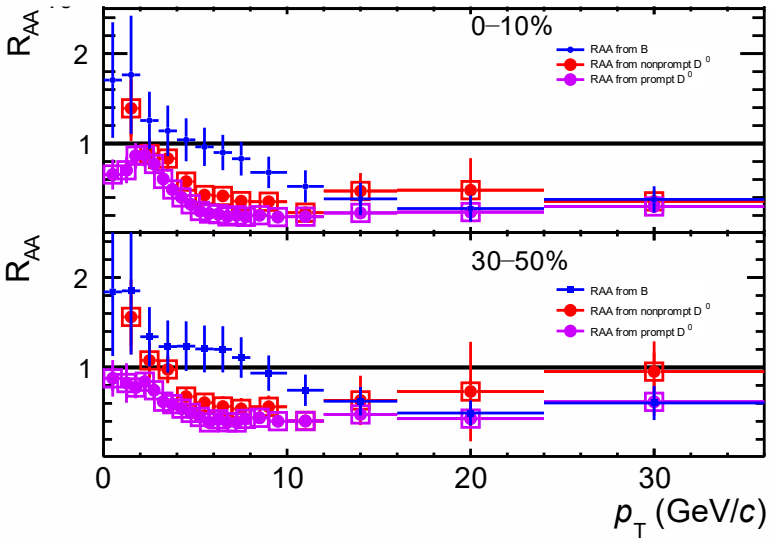
Difference between D0 and Jpsi channel (with weight)



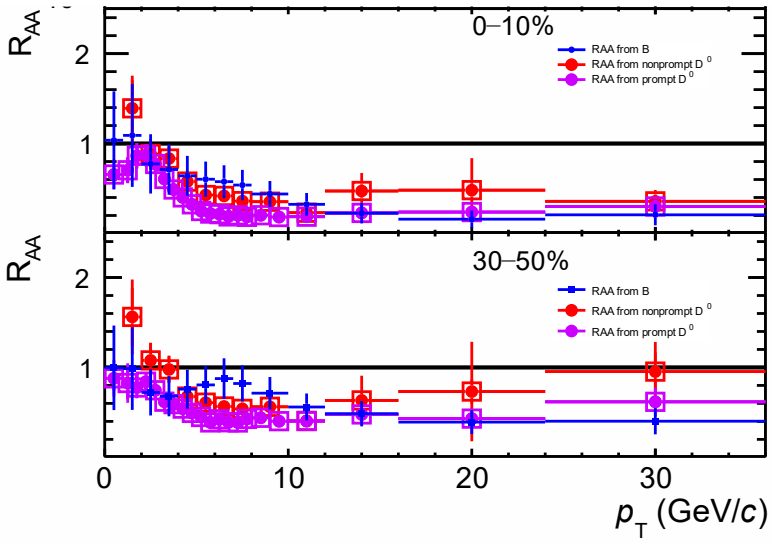
Jpsi /D0 and RAA from different channel



unfolded from D0

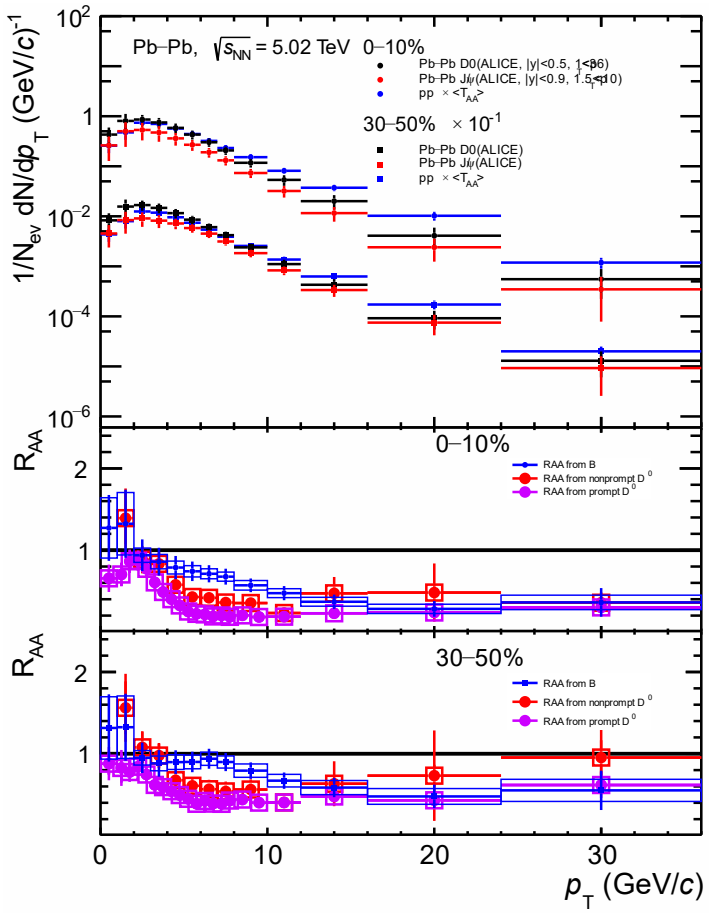


unfolded from Jpsi



Propagation of syst. uncertainty

propagation separately similar as stat. uncertainty



Syst. Error matrix (fully correlated)

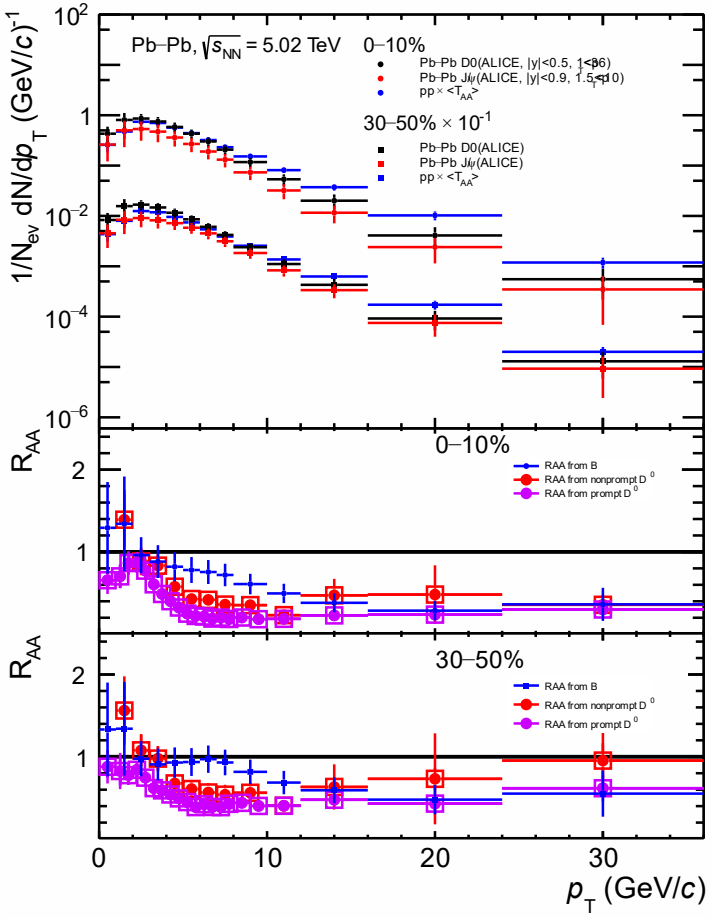
$$\begin{pmatrix} \sigma_{1,syst}^2 & \cdots & \sigma_{1,syst}\sigma_{n,syst} \\ \vdots & \ddots & \vdots \\ \sigma_{1,syst}\sigma_{n,syst} & \cdots & \sigma_{n,syst}^2 \end{pmatrix}$$

Add up syst. Error matrix from every source

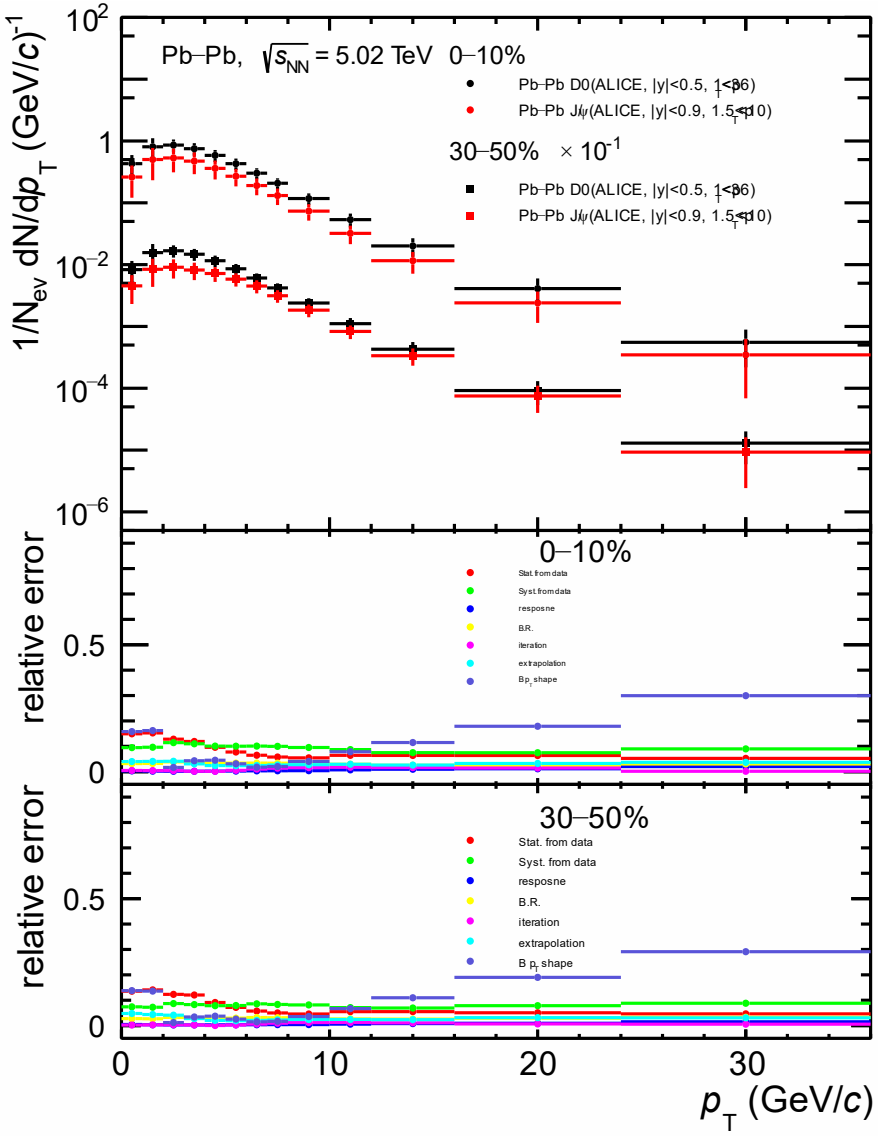
Stat. Error matrix

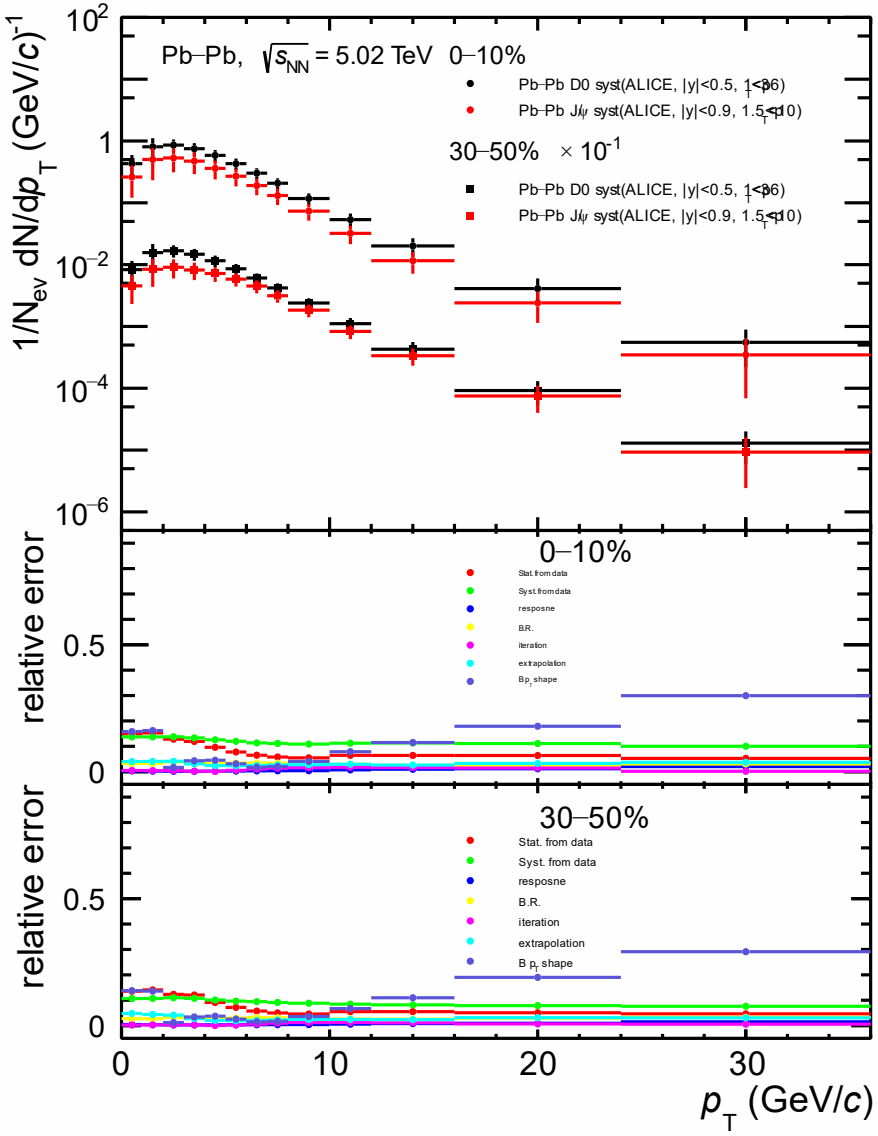
$$\begin{pmatrix} \sigma_{1,stat}^2 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \sigma_{n,stat}^2 \end{pmatrix}$$

treat as global uncertainty $\frac{\sum \sigma_i}{\int dN/dp_T}$

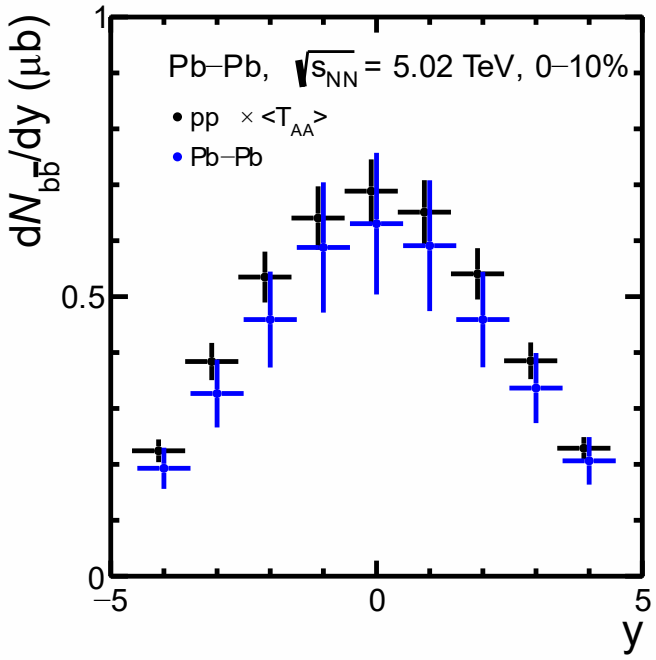


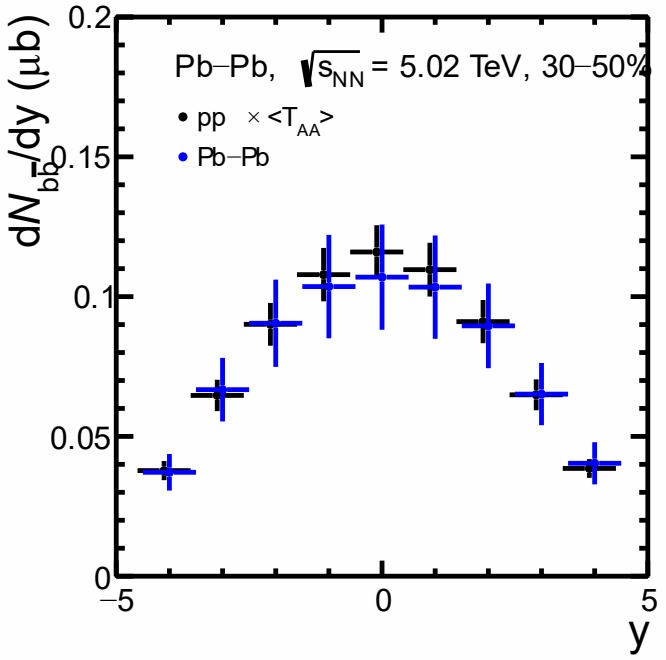
Uncertainties analysis from different syst. propagation

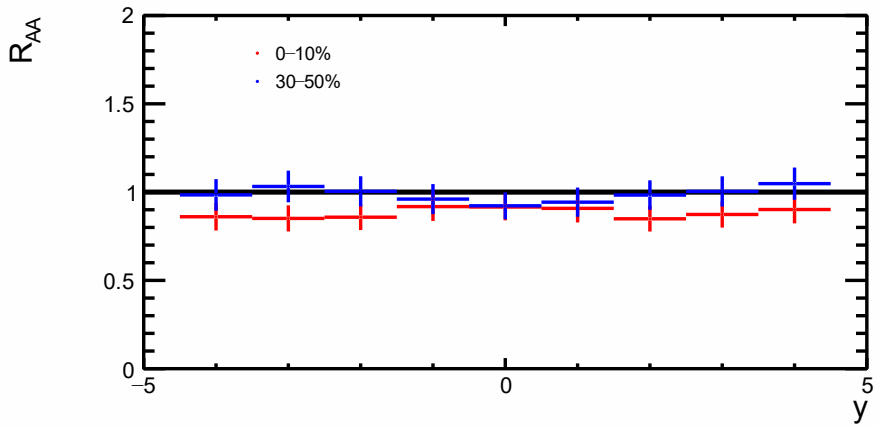




p_T-intergrated $b\bar{b}$ production







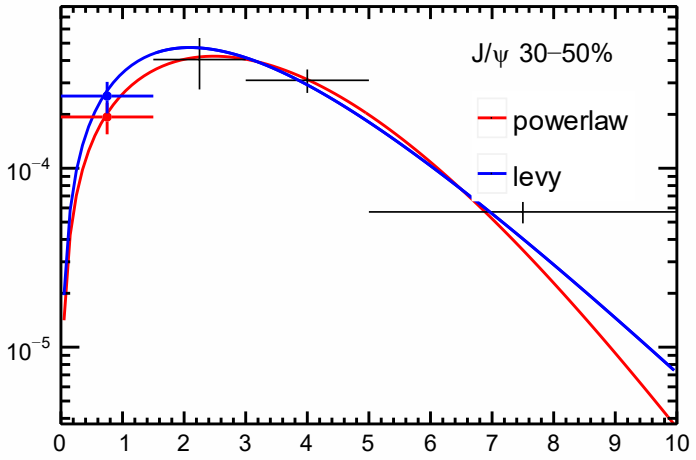
0-10%: 0.88±0.02

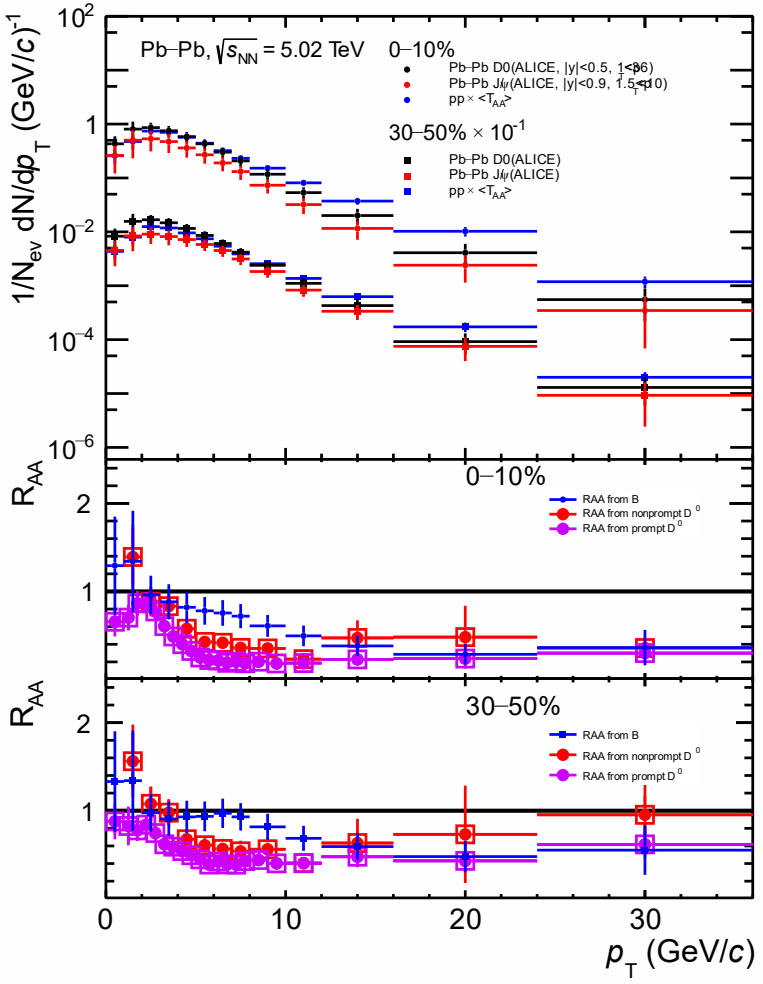
30-50%: 0.98±0.03

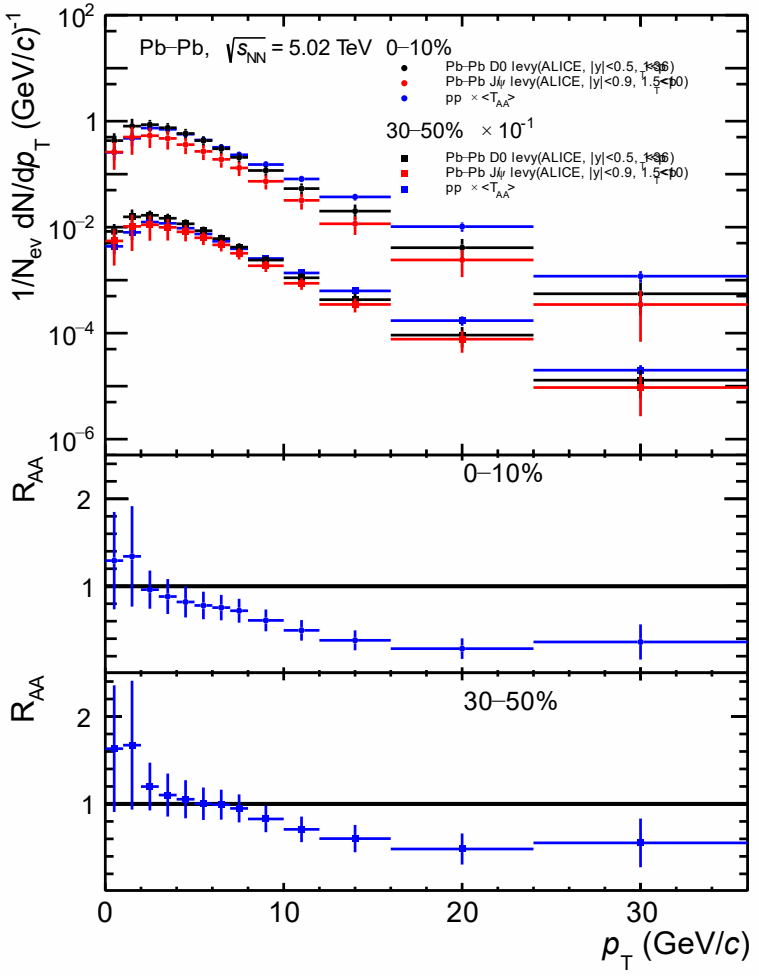
Branching ratio

$\Lambda_b \to D^0$	(6.65±0.68)×10−4
$\Lambda_b \to J/\psi$	(5.8±0.8)×10−5
$B_s \to D^0$	(38±10) %
$B_s \to J/\psi$	<5.57×10−3
$B_c \to D^0$	<4.48×10−3
$B_c \to J/\psi$	seen

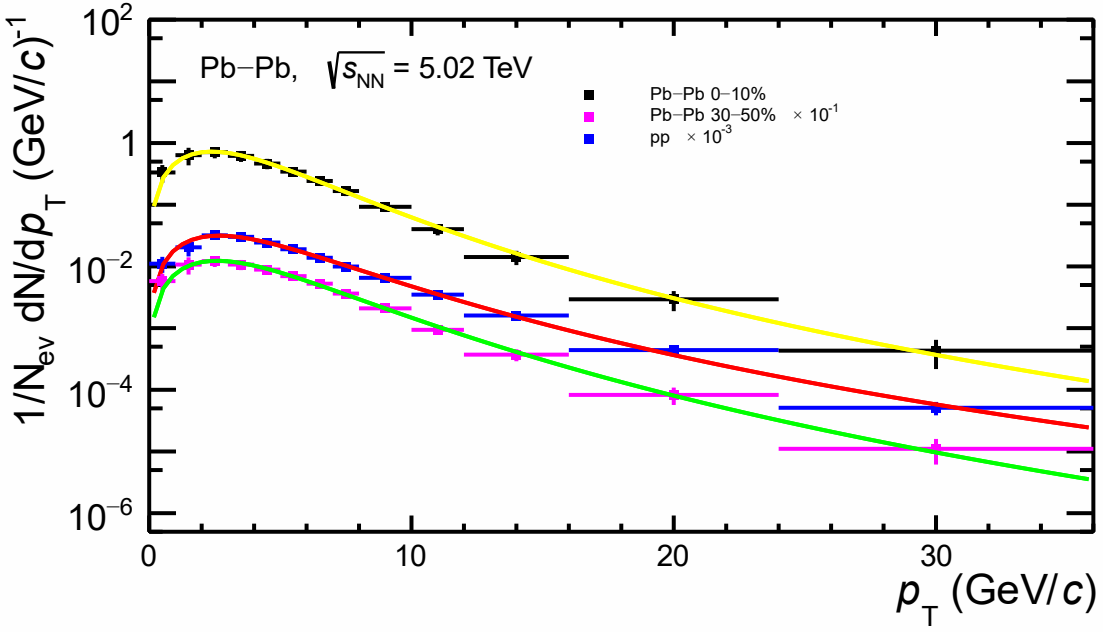
let the [1.5-3] point times 1.1
(relative statistical error is about 10%)

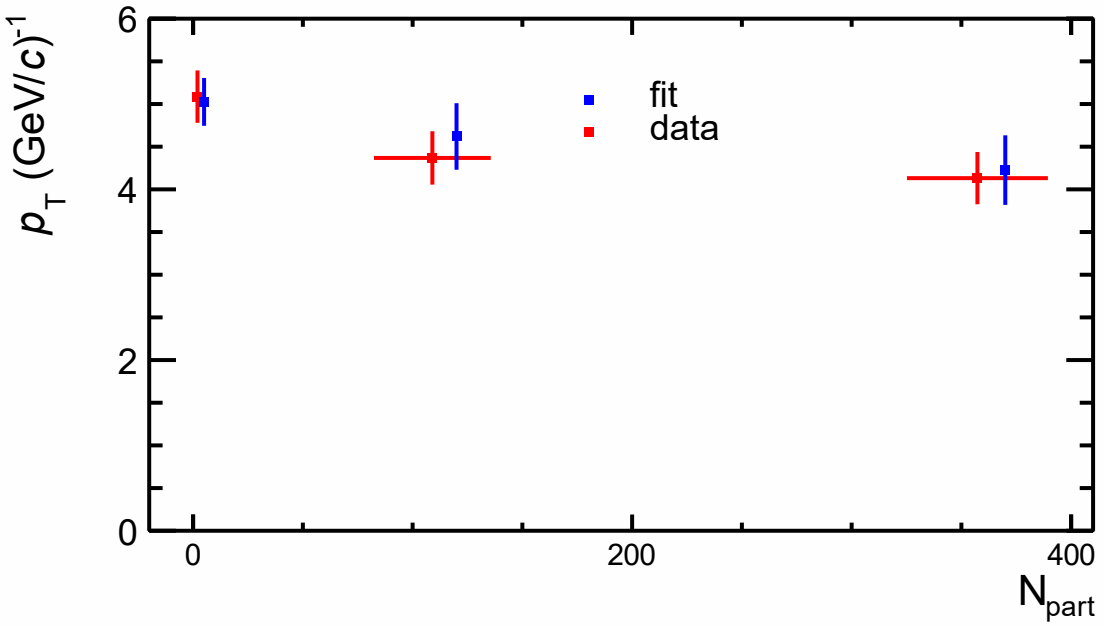


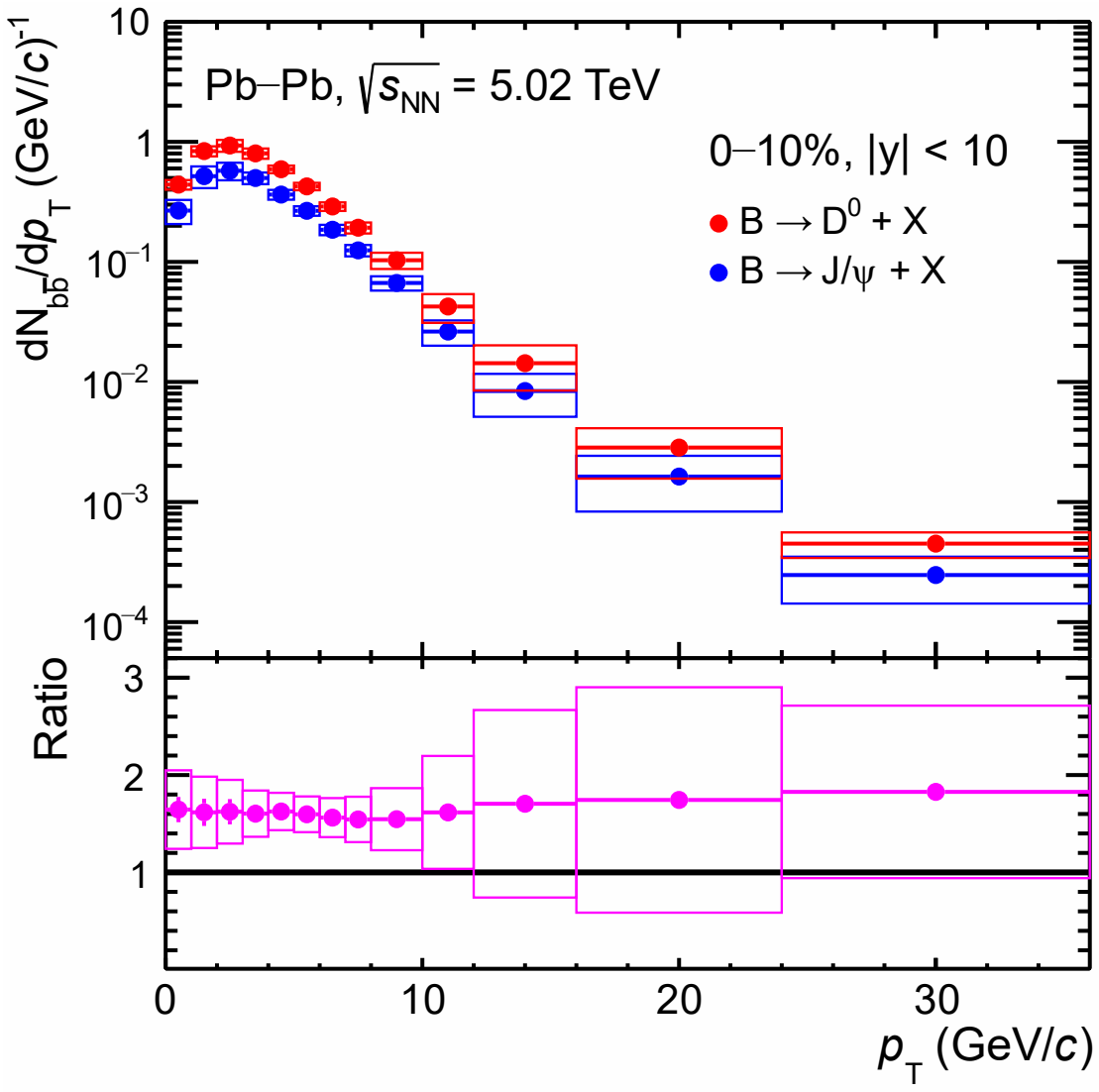


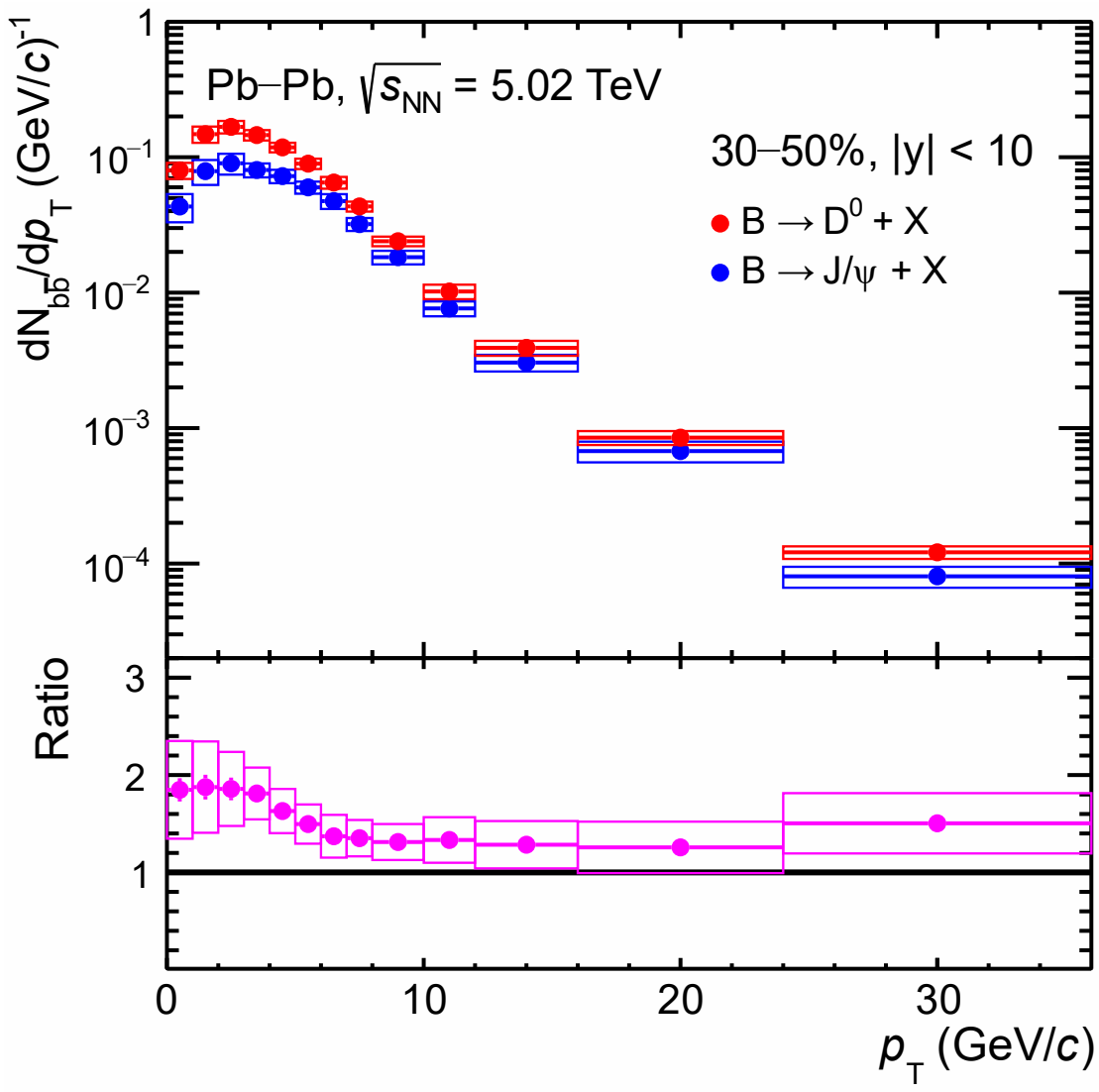


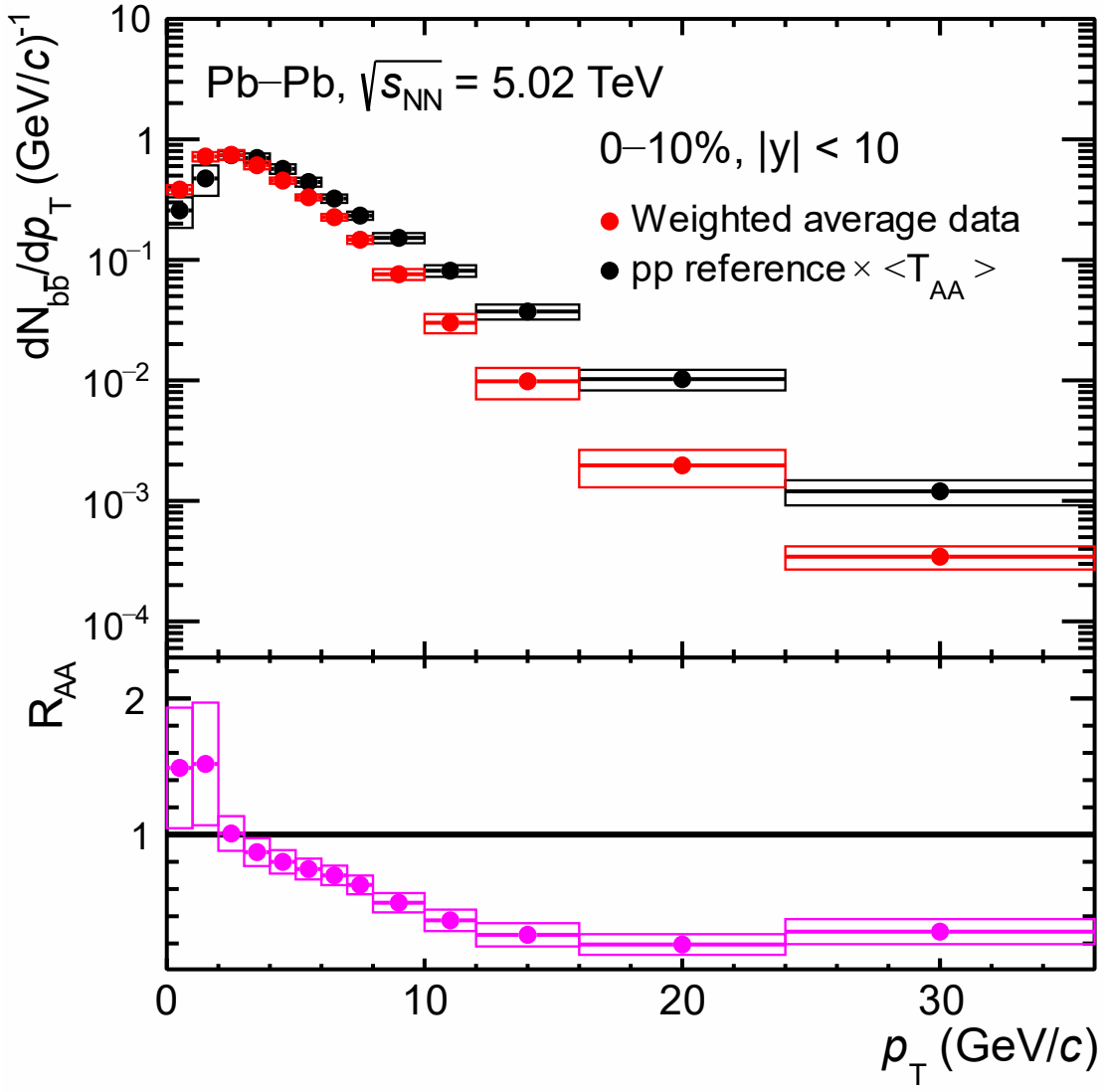
Mean Pt

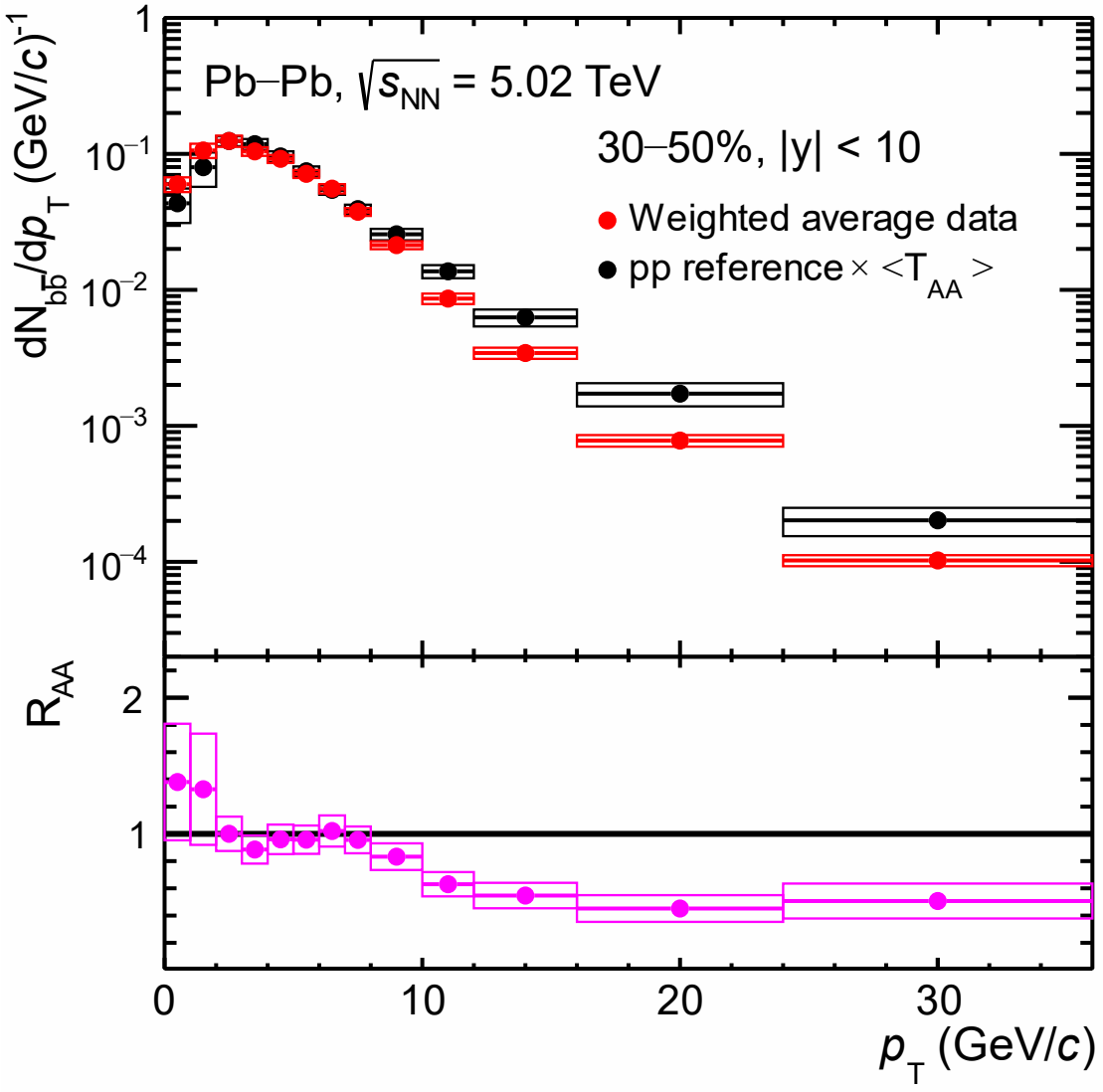

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
Pb–Pb 0–10%
Pb–Pb 30–50% × 10^{-1}
pp × 10^{-3}
$1/N_{ev}\ dN/dp_T\ (GeV/c)^{-1}$
p_T (GeV/c)

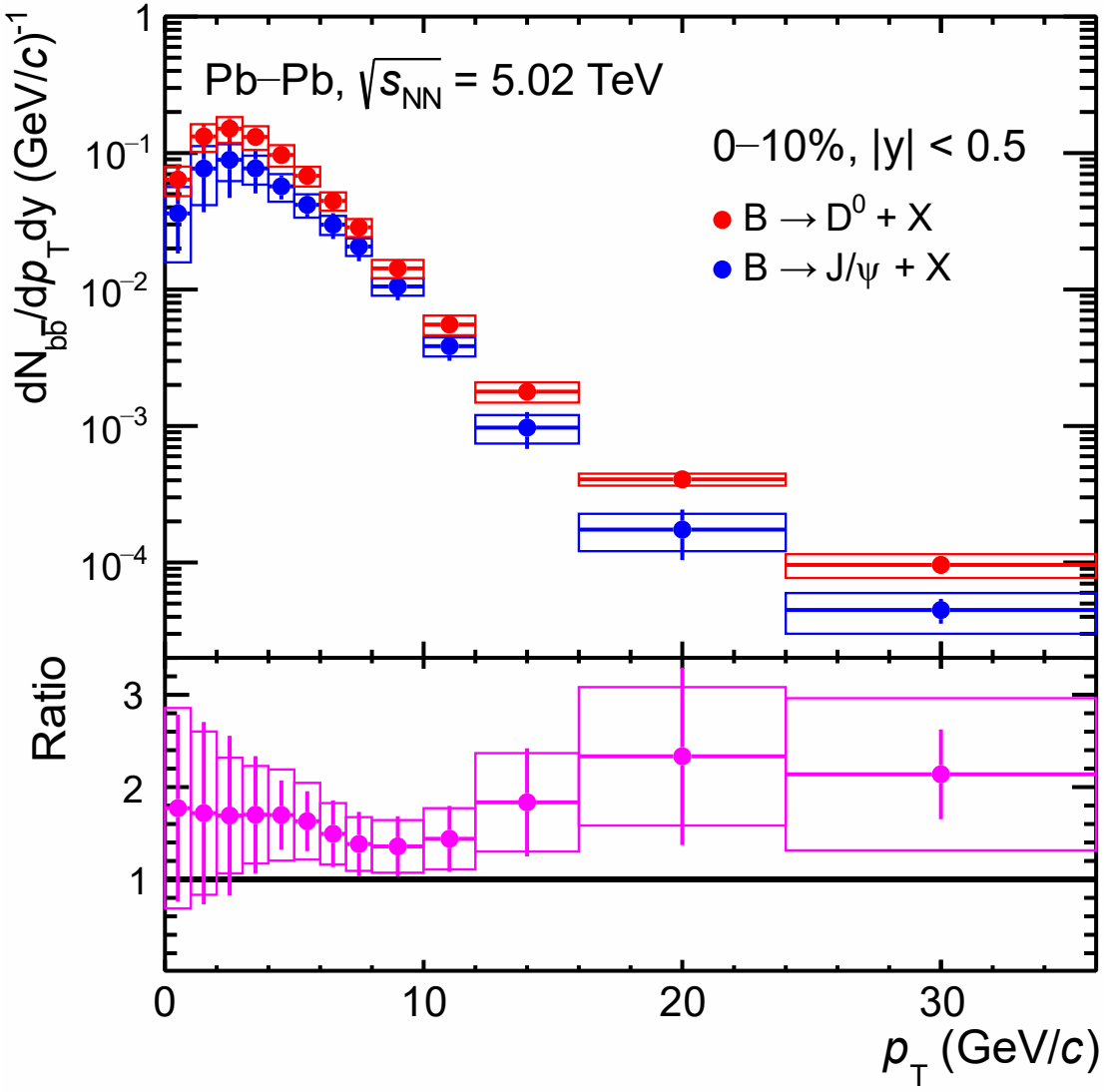

fit
data
p_T (GeV/c)$^{-1}$
N_{part}

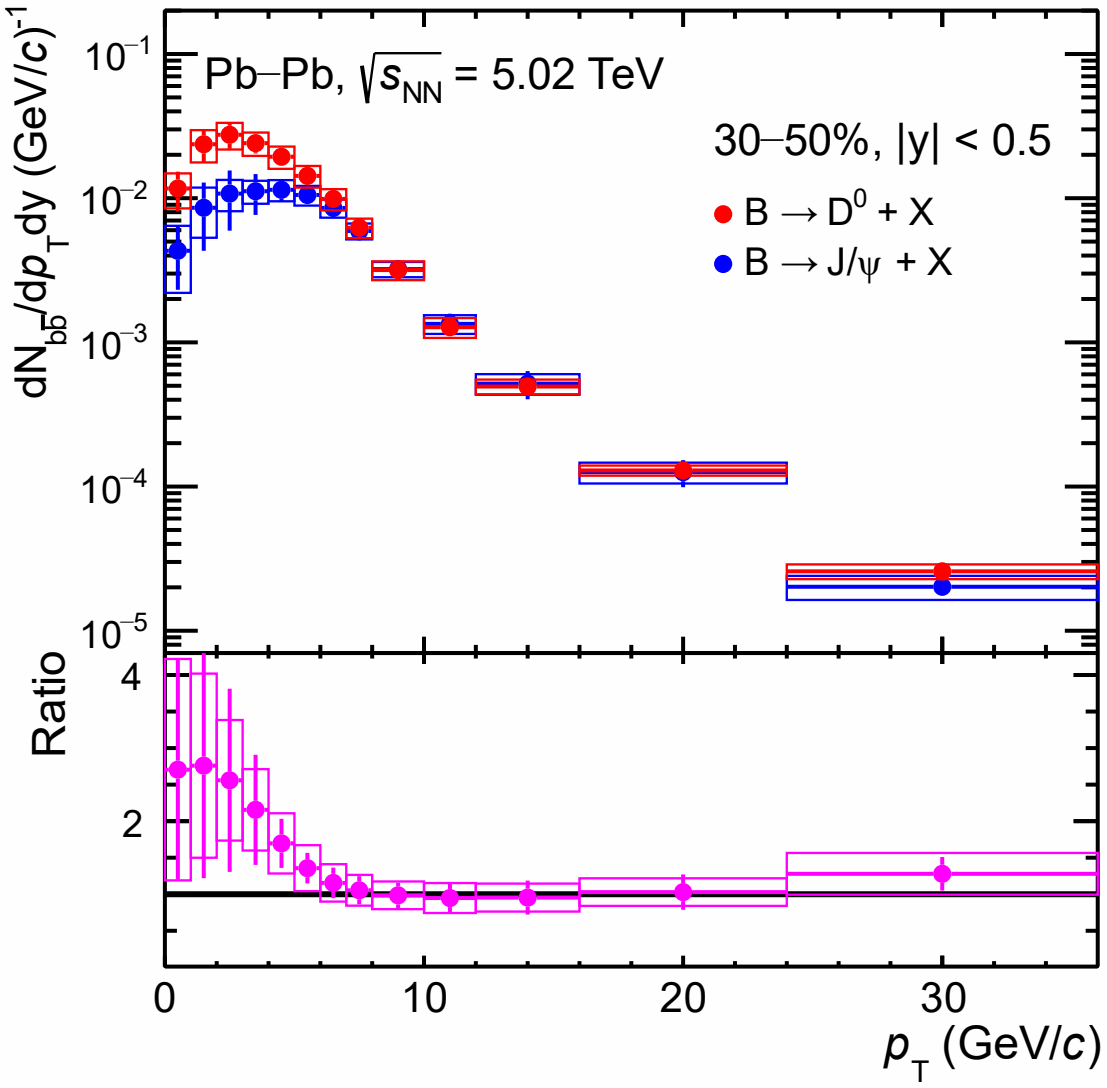

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
0–10%, |y| < 10
B → D^0 + X
B → J/ψ + X
$dN_{b\bar{b}}/dp_T$ (GeV/c)$^{-1}$
Ratio
p_T (GeV/c)

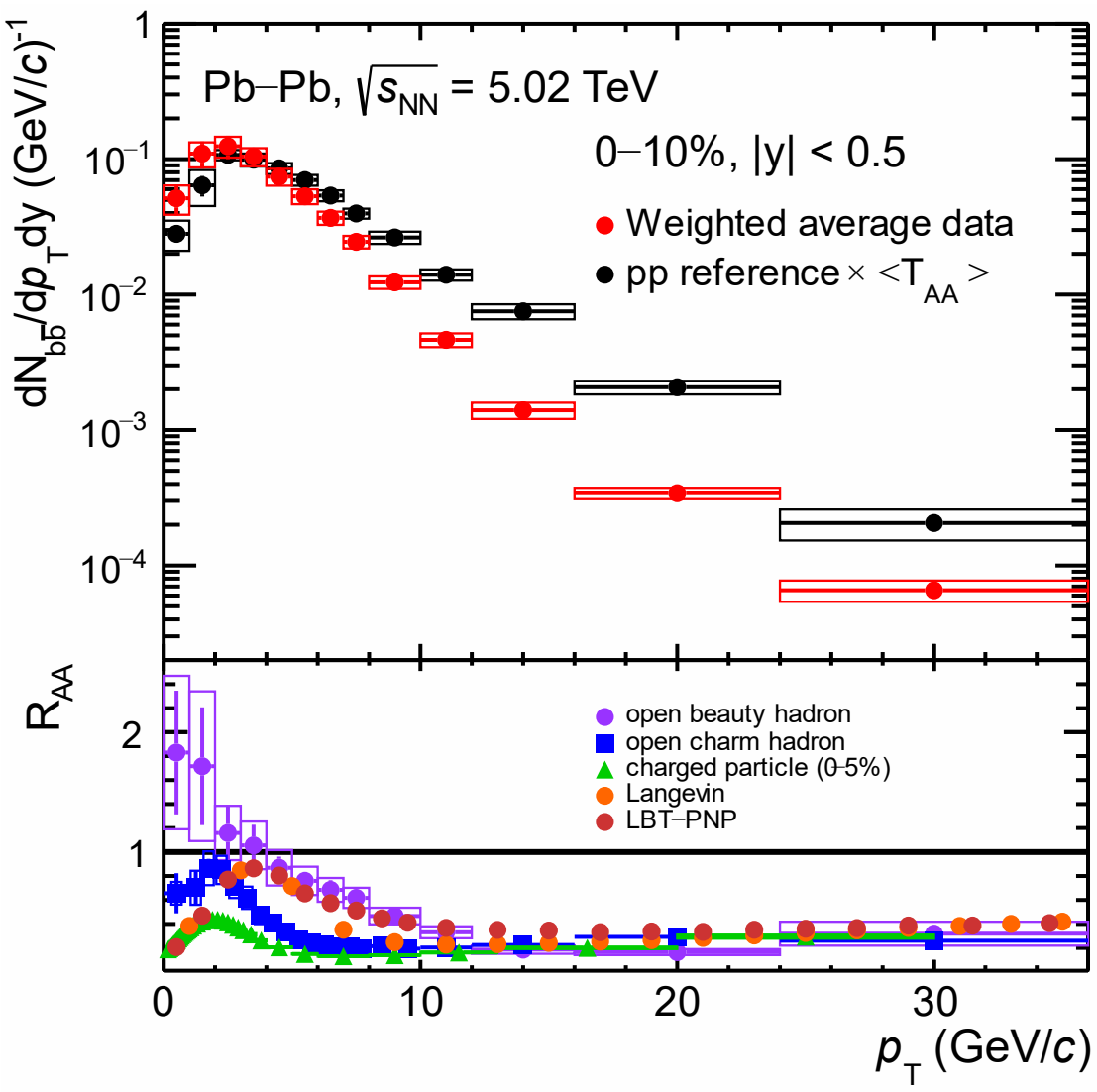

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
30–50%, |y| < 10
B → D^0 + X
B → J/ψ + X
$dN_{b\bar{b}}/dp_T$ (GeV/c)$^{-1}$
Ratio
p_T (GeV/c)

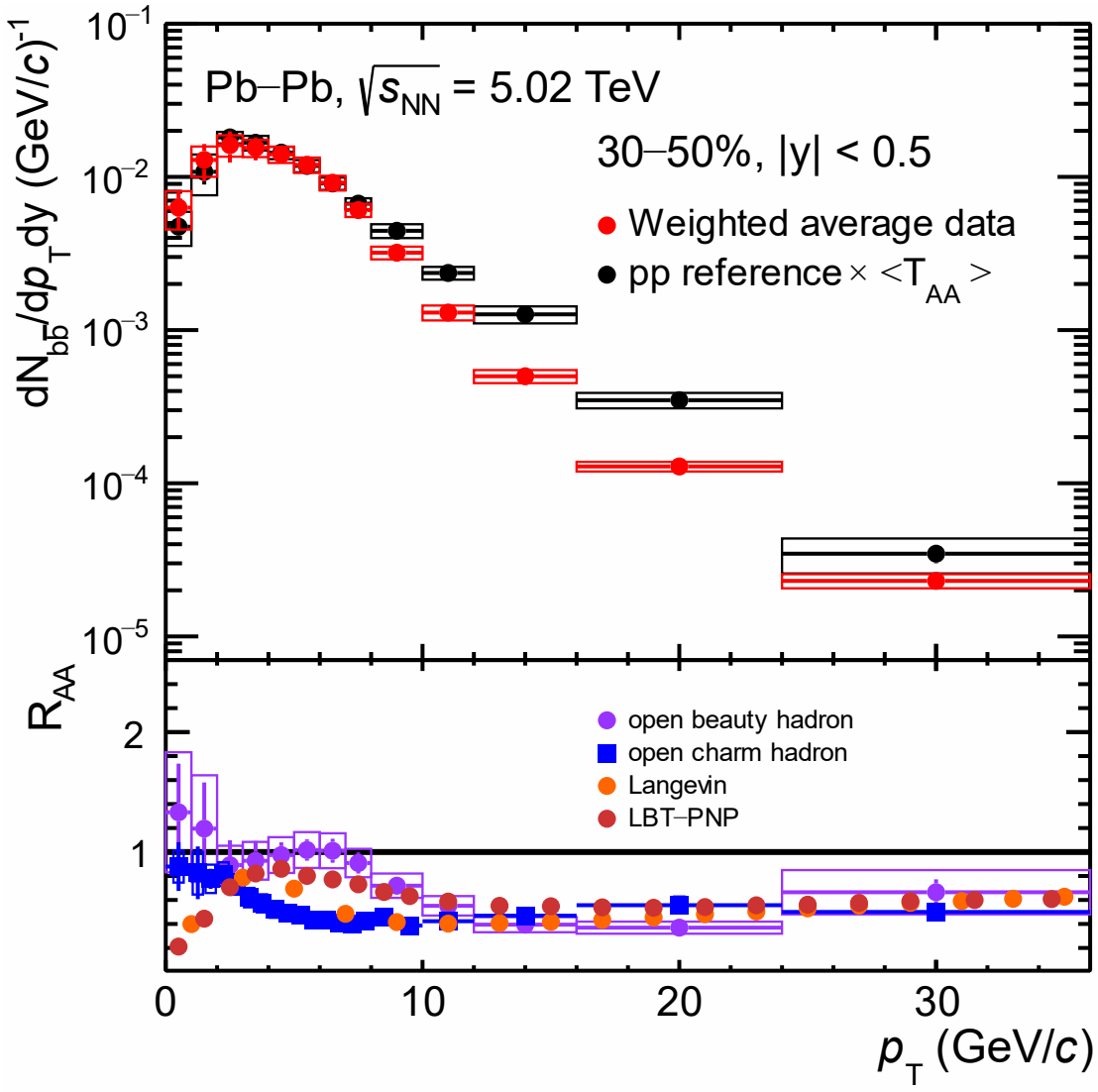

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
0–10%, |y| < 10
Weighted average data
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dp_T$ (GeV/c)$^{-1}$
R_{AA}
p_T (GeV/c)

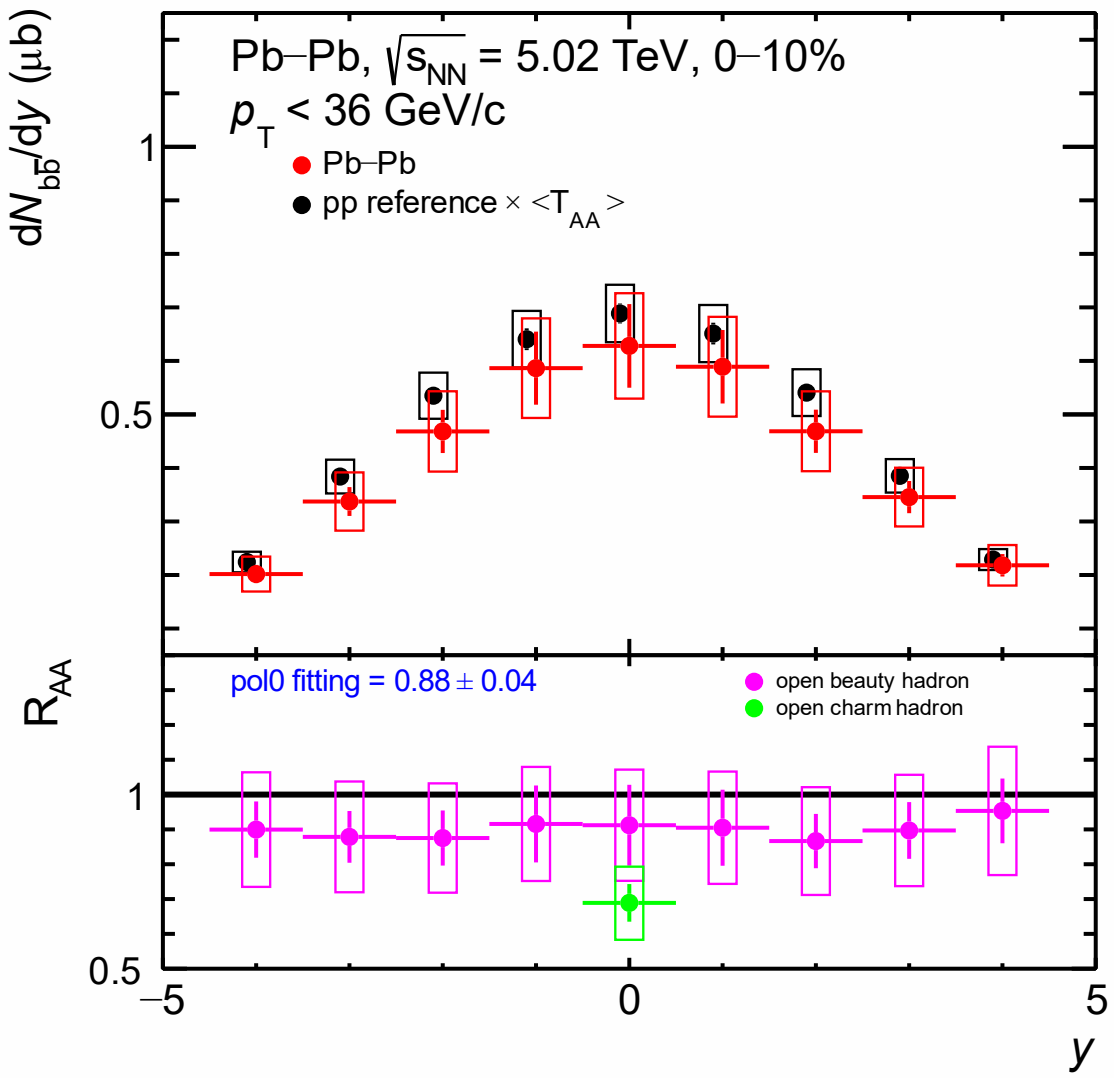

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
30–50%, |y| < 10
Weighted average data
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dp_T$ (GeV/c)$^{-1}$
R_{AA}
p_T (GeV/c)

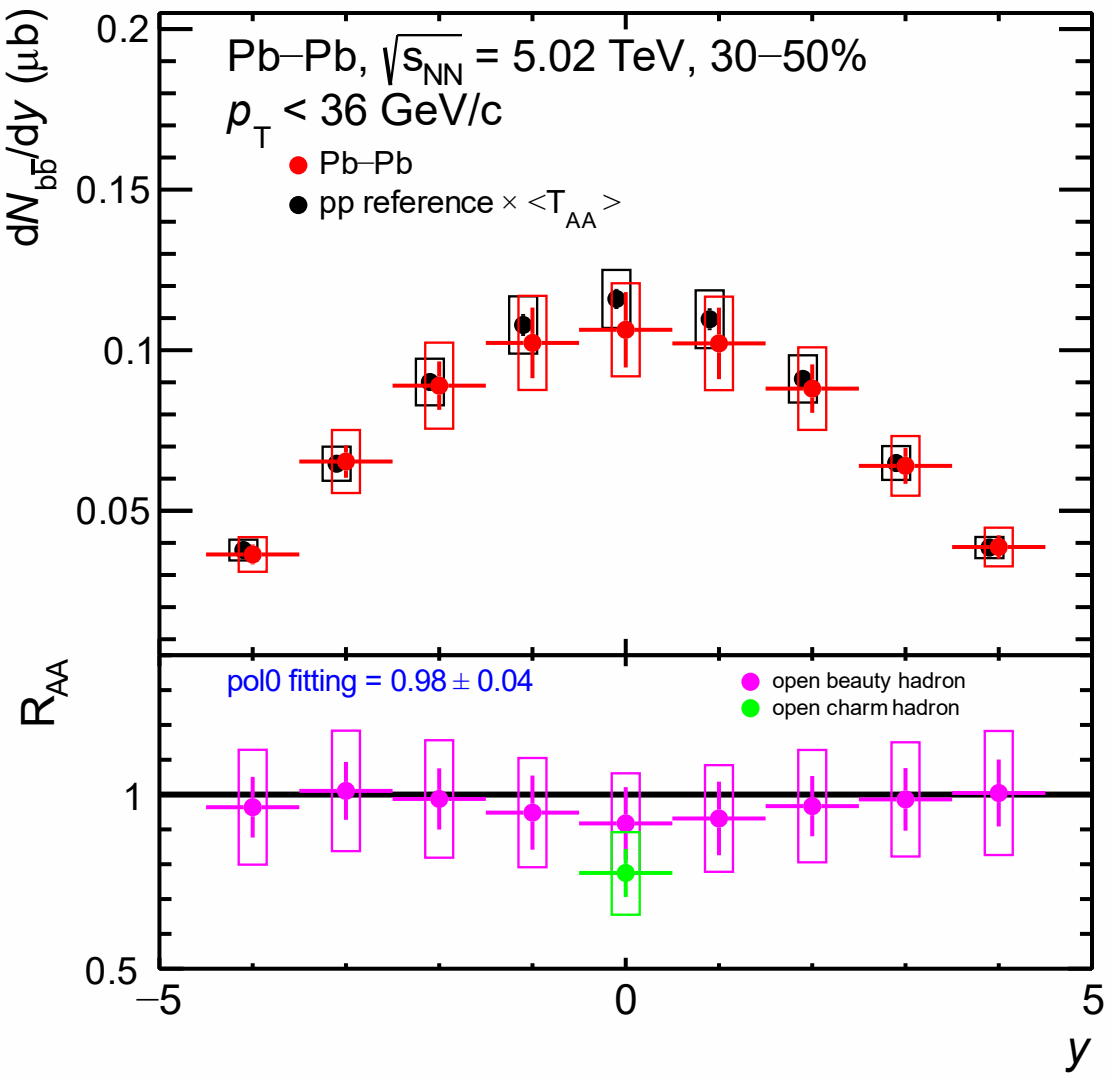

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
0–10%, |y| < 0.5
B → D^0 + X
B → J/ψ + X
$dN_{b\bar{b}}/dp_T dy$ (GeV/c)$^{-1}$
Ratio
p_T (GeV/c)

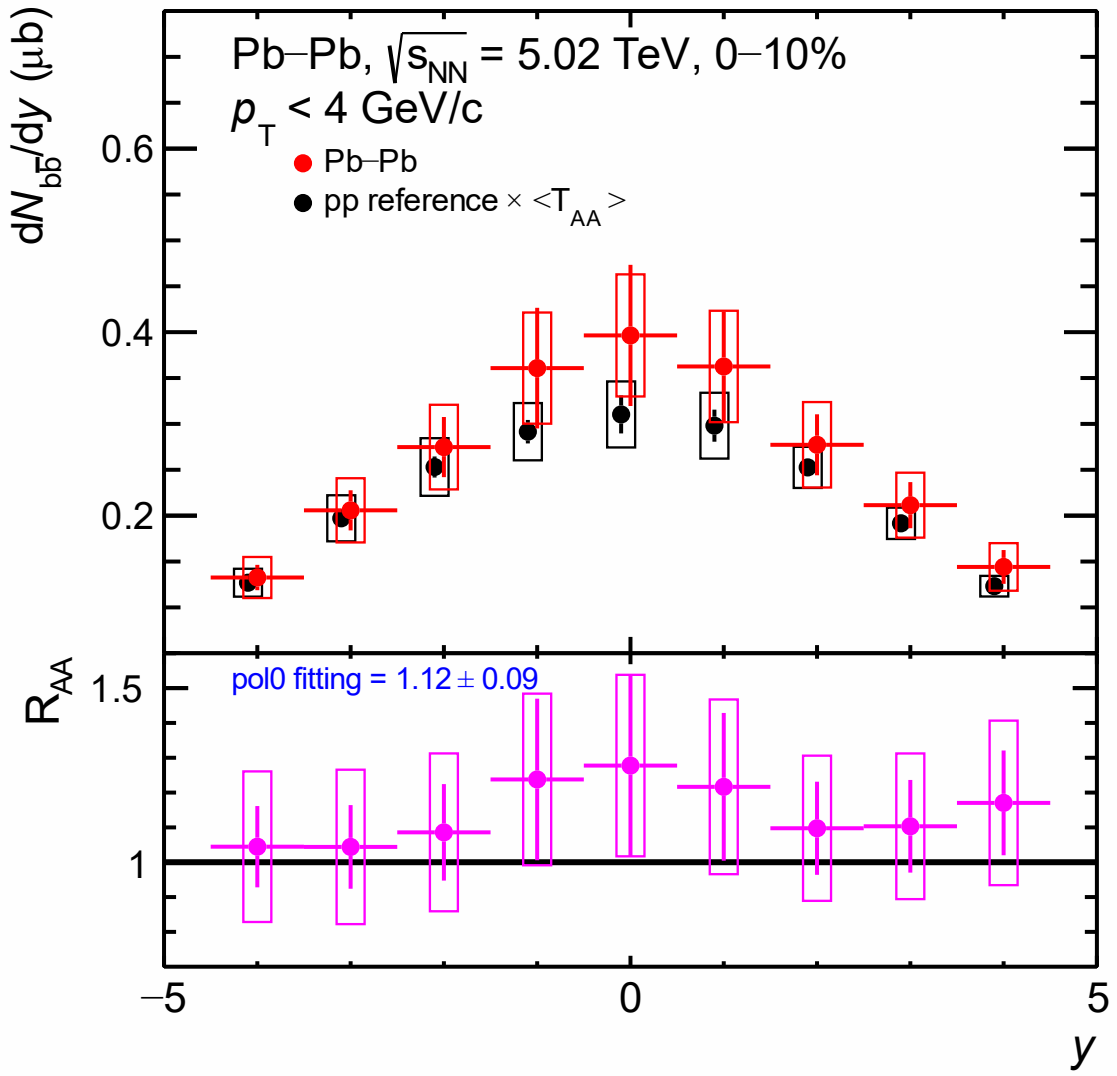

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
30–50%, |y| < 0.5
B → D^0 + X
B → J/ψ + X
$dN_{b\bar{b}}/dp_T dy$ (GeV/c)$^{-1}$
Ratio
p_T (GeV/c)

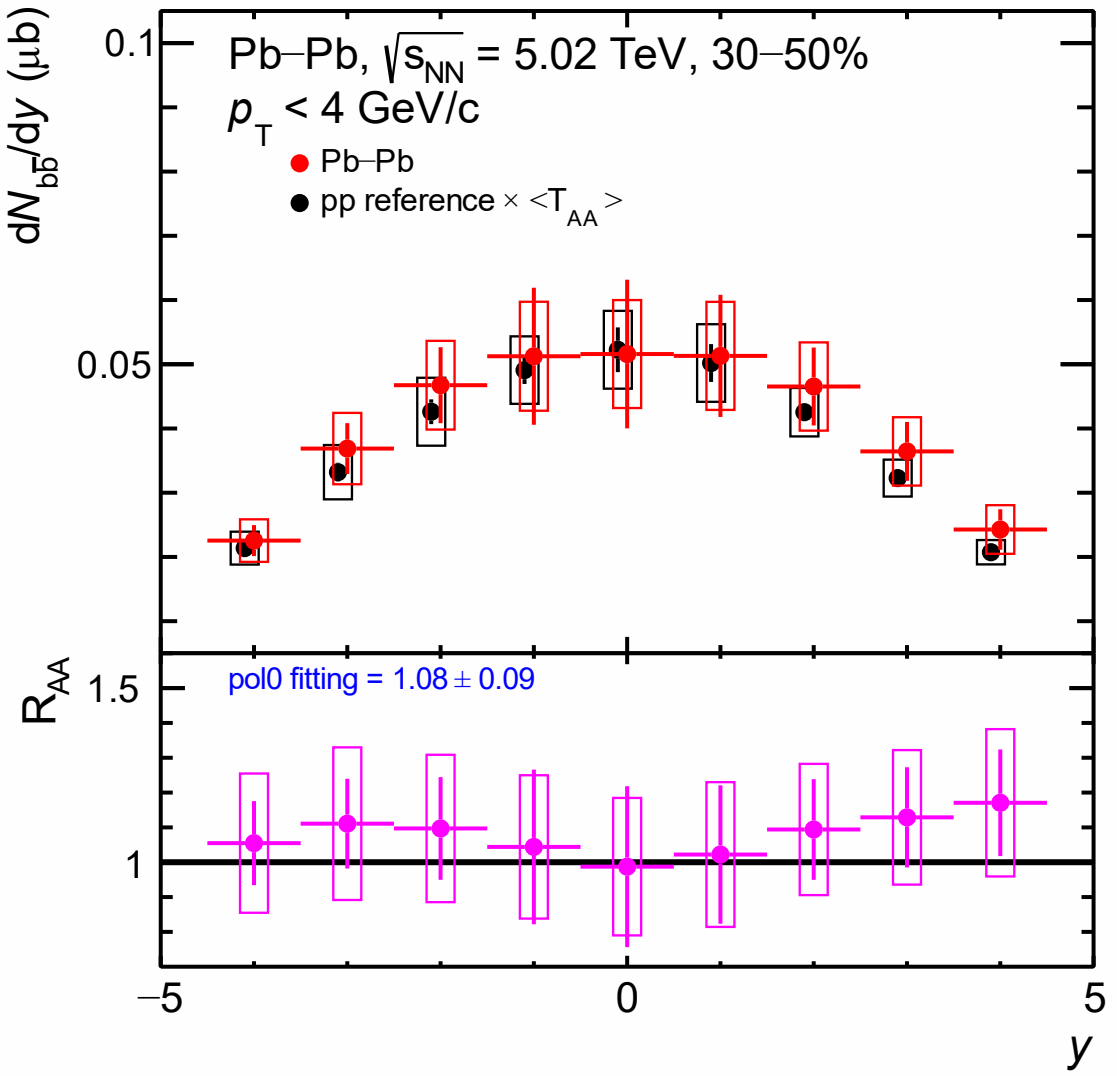

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
0–10%, |y| < 0.5
Weighted average data
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dp_T dy$ (GeV/c)$^{-1}$
R_{AA}
open beauty hadron
open charm hadron
charged particle (0-5%)
Langevin
LBT–PNP
p_T (GeV/c)

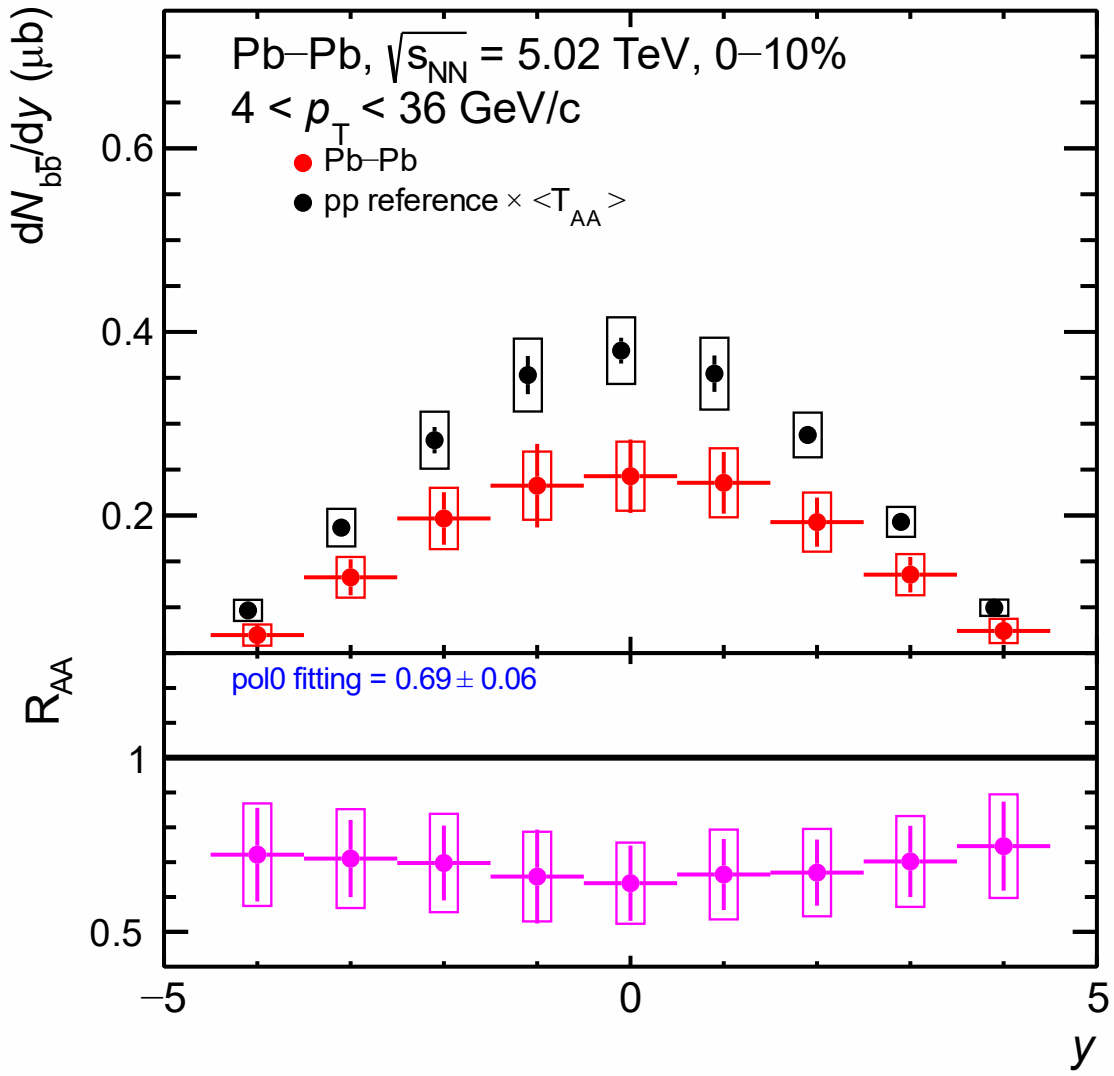

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
30–50%, |y| < 0.5
Weighted average data
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dp_T dy$ (GeV/c)$^{-1}$
R_{AA}
open beauty hadron
open charm hadron
Langevin
LBT–PNP
p_T (GeV/c)

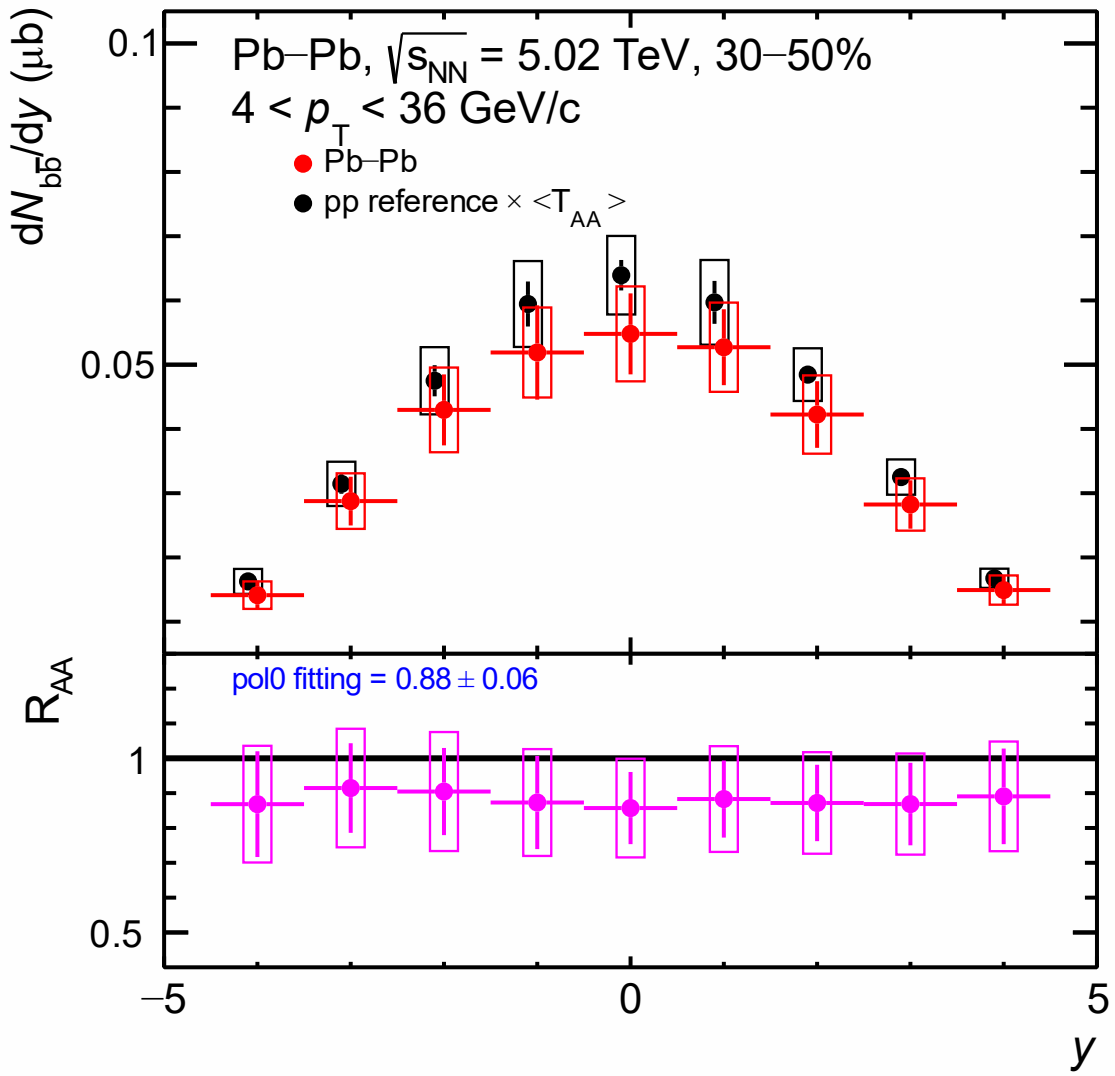

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV, 0–10%
p_T < 36 GeV/c
Pb–Pb
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dy$ (μb)
pol0 fitting = 0.88 ± 0.04
open beauty hadron
open charm hadron
R_{AA}
y

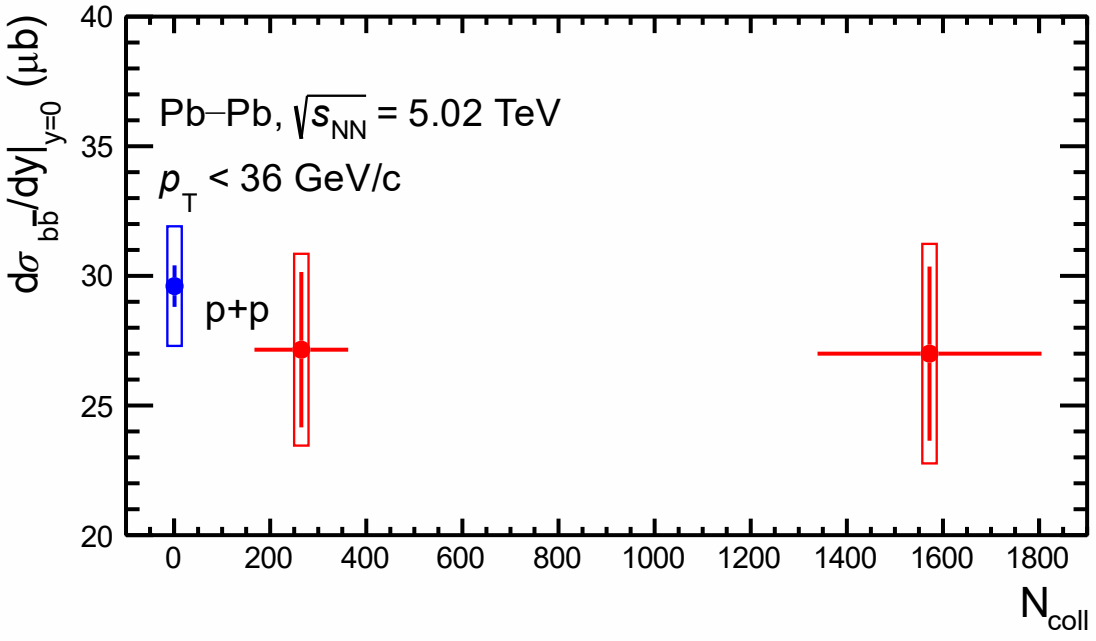

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV, 30–50%
p_T < 36 GeV/c
Pb–Pb
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dy$ (μb)
pol0 fitting = 0.98 ± 0.04
open beauty hadron
open charm hadron
R_{AA}
y

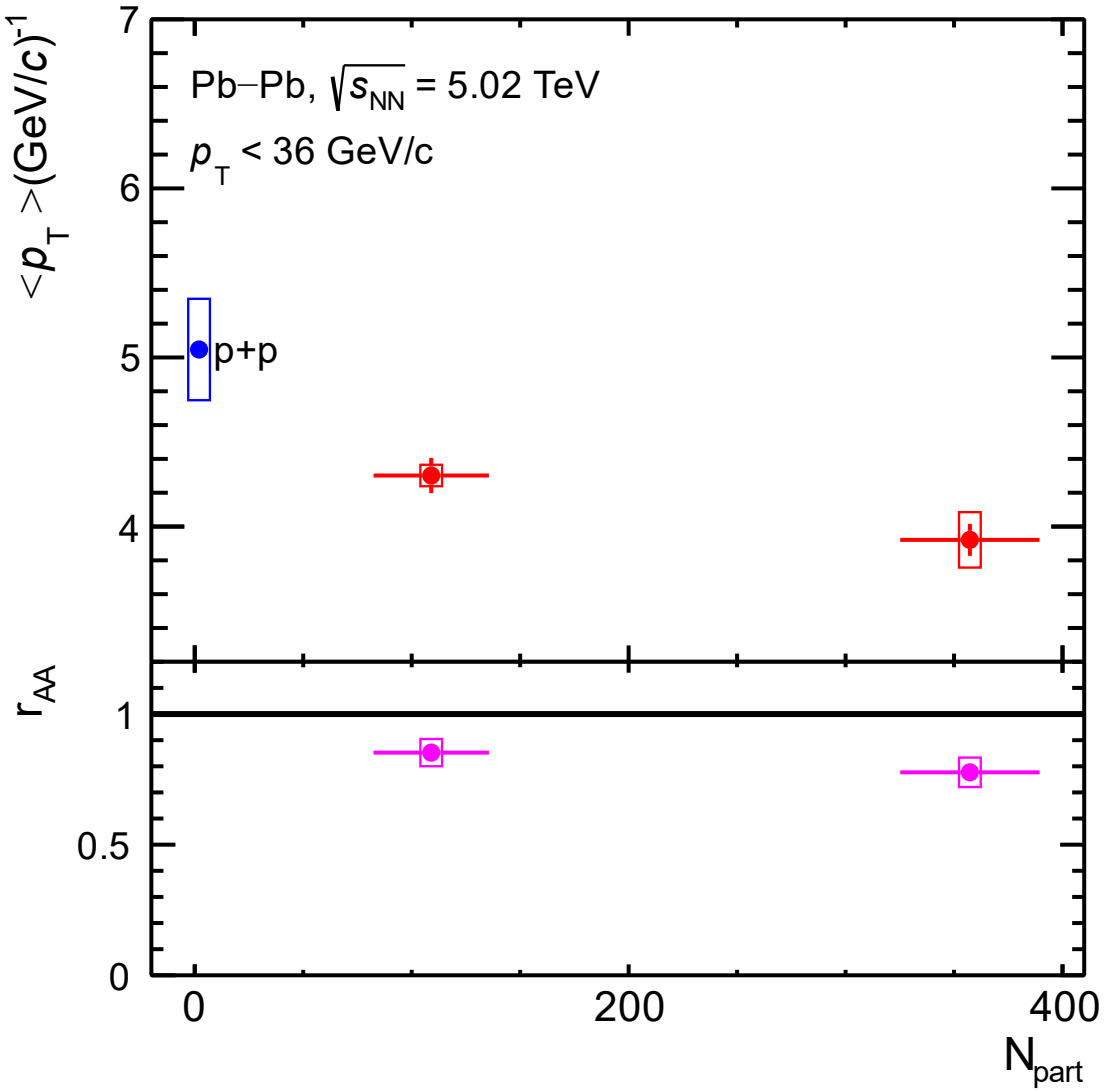

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV, 0–10%
p_T < 4 GeV/c
Pb–Pb
pp reference × <T_{AA}>
$d\sigma_{b\bar{b}}/dy$ (μb)
R_{AA}
pol0 fitting = 1.12 ± 0.09
y

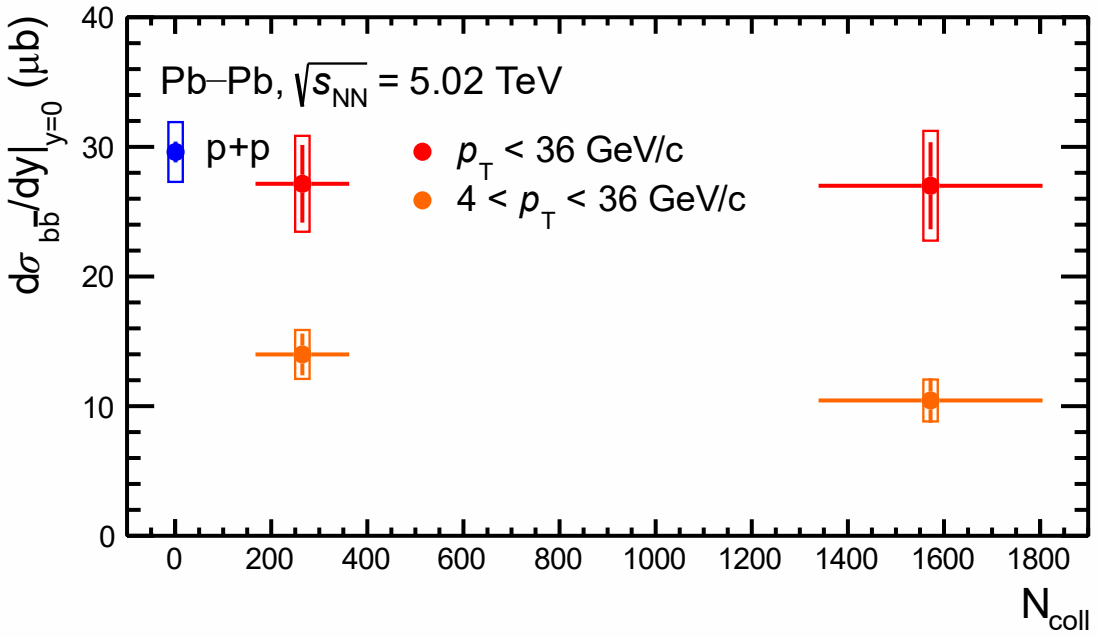

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV, 30–50%
p_T < 4 GeV/c
Pb–Pb
pp reference × <T_{AA}>
$d\sigma_{b\bar{b}}/dy$ (μb)
R_{AA}
pol0 fitting = 1.08 ± 0.09
y

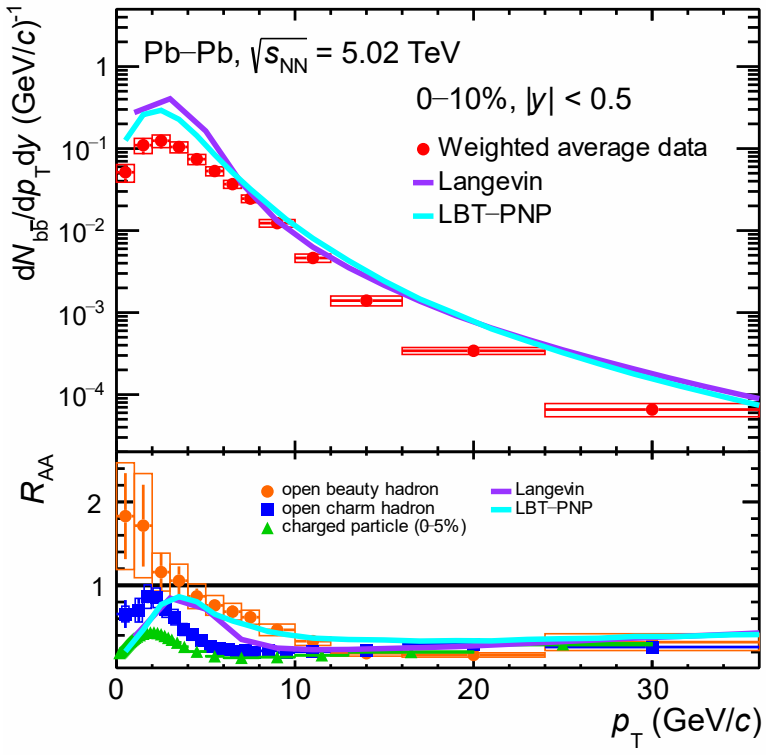

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV, 0–10%
4 < p_T < 36 GeV/c
Pb–Pb
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dy$ (μb)
R_{AA}
pol0 fitting = 0.69 ± 0.06
0.6
0.4
0.2
1
0.5
−5
0
5
y

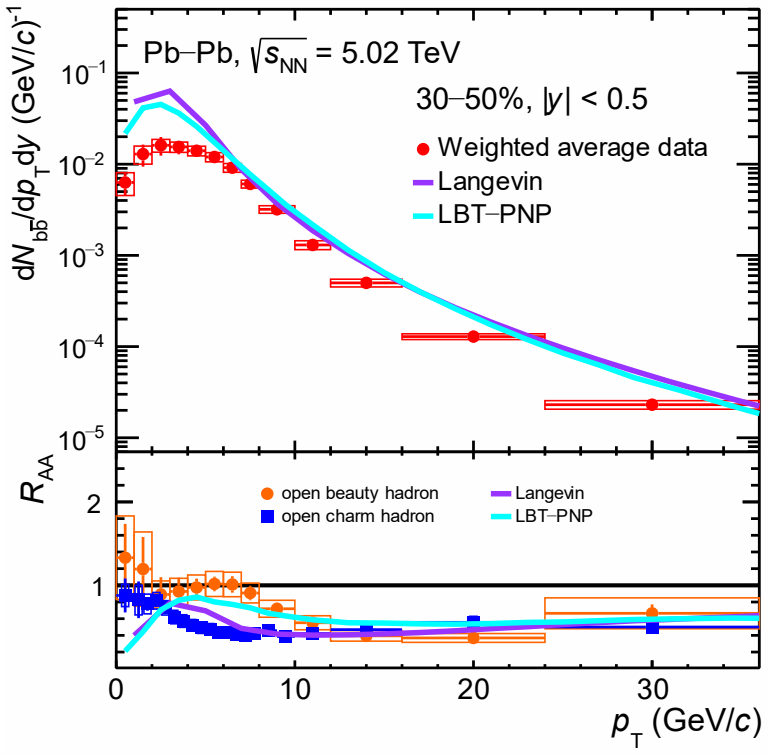

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV, 30–50%
4 < p_T < 36 GeV/c
Pb–Pb
pp reference × <T_{AA}>
$dN_{b\bar{b}}/dy$ (μb)
R_{AA}
pol0 fitting = 0.88 ± 0.06
0.1
0.05
1
0.5
−5
0
5
y

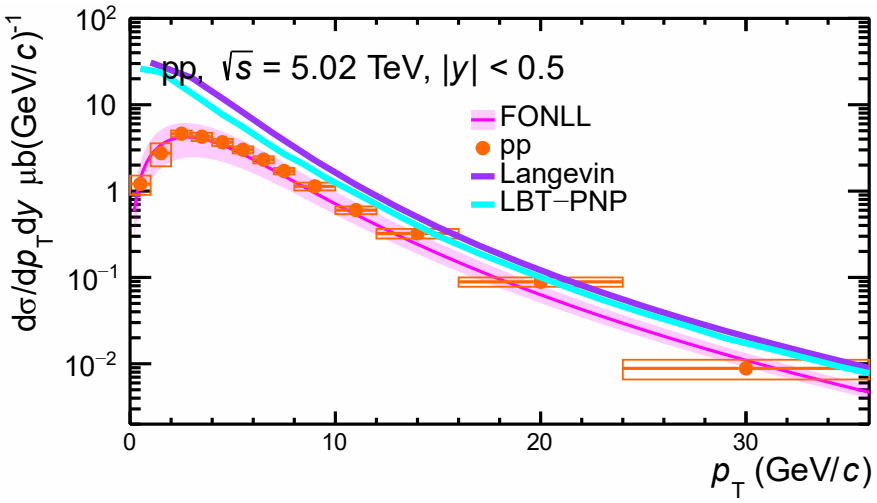

Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
p_T < 36 GeV/c
p+p
$d\sigma_{b\bar{b}}/dy|_{y=0}$ (μb)
N_{coll}


Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
p_T < 36 GeV/c
p+p
$<p_T>$ (GeV/c)$^{-1}$
r_{AA}
N_{part}


Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
p+p
p_T < 36 GeV/c
4 < p_T < 36 GeV/c
$d\sigma_{b\bar{b}}/dy|_{y=0}$ (μb)
N_{coll}
0
10
20
30
40
0
200
400
600
800
1000
1200
1400
1600
1800


Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
0–10%, |y| < 0.5
Weighted average data
Langevin
LBT–PNP
$dN_{b\bar{b}}/dp_T dy$ (GeV/c)$^{-1}$
R_{AA}
open beauty hadron
open charm hadron
charged particle (0-5%)
Langevin
LBT–PNP
p_T (GeV/c)


Pb–Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
30–50%, |y| < 0.5
Weighted average data
Langevin
LBT–PNP
$dN_{b\bar{b}}/dp_T dy$ (GeV/c)$^{-1}$
R_{AA}
open beauty hadron
open charm hadron
Langevin
LBT–PNP
p_T (GeV/c)


pp, $\sqrt{s}$ = 5.02 TeV, |y| < 0.5
FONLL
pp
Langevin
LBT–PNP
$d\sigma/dp_T dy$ μb(GeV/c)$^{-1}$
p_T (GeV/c)