– HIN_14_009 status
– Hard Probes 2015

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lab meeting
18th July 2015

HIN-14-009 status

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- **Status : approved** (HP2015)
  - → **PAS is NOT YET public** (should be done ASAP)
  - → **paper timeline ~ October?** (before data-taking)
- **Man power : Songkyo, Yongsun, Kisoo , Lamia**(~Sep.)

- https://twiki.cern.ch/twiki/bin/view/CMSPublic/PhysicsResultsHIN14009

Plan

High priority & short term (this week)

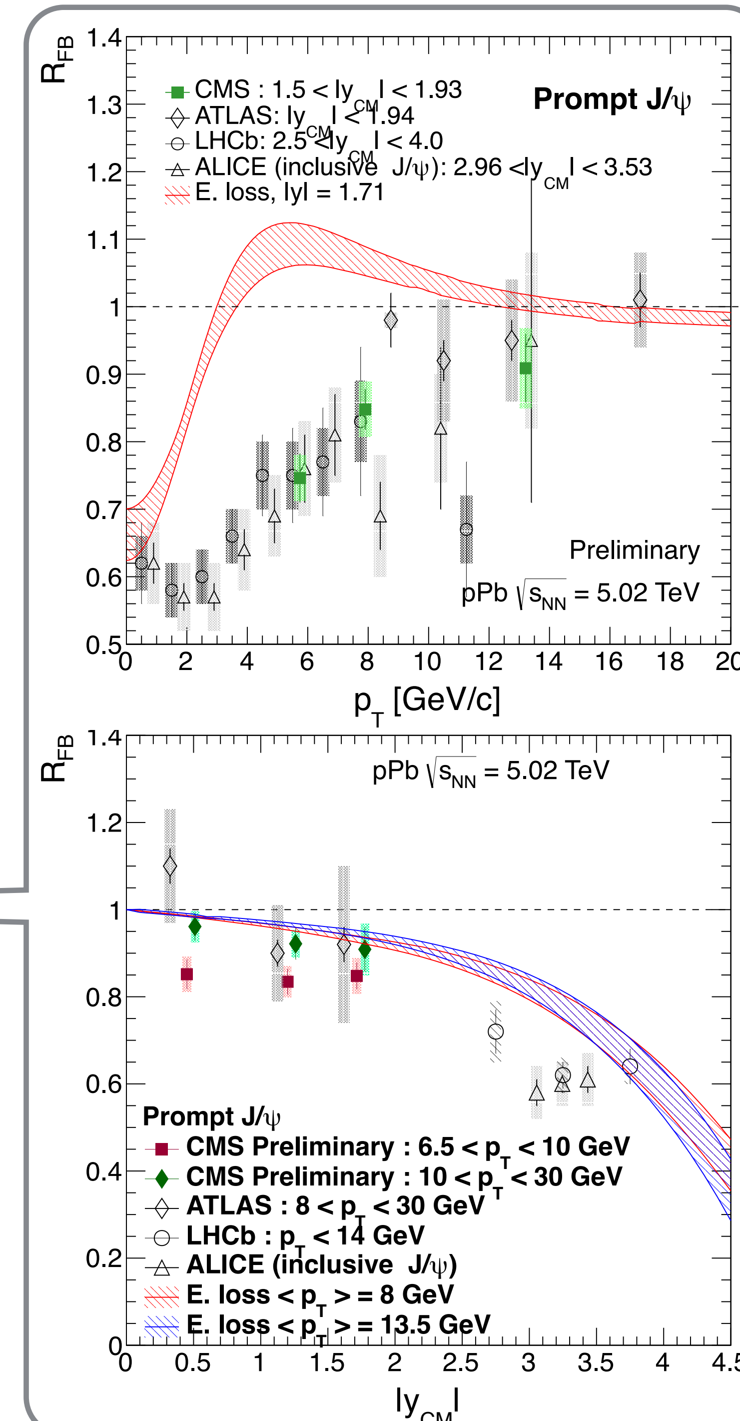
1) Revisit the single muon acceptance cut (Songkyo)
- see the following slides (p4~)

2) New official MC samples (Songkyo)
- exactly the same config. with current ones, but x2 statistics

next to-do (~1 month?)

3) TNP (Yongsun & Kisoo)
- check factorization, uncertainty, etc
- see Camelia's slides

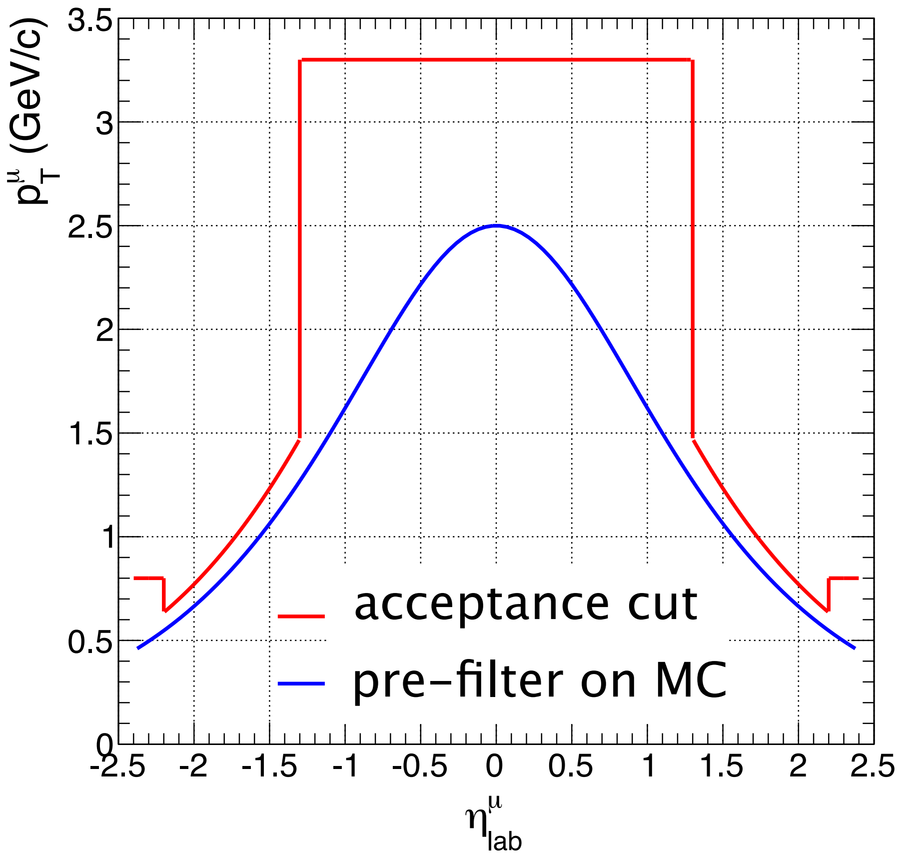
4) Theoretical prediction (Lamia)
- Energy loss figures (Thanks to Francois!)
  plots will be updated & discussion ongoing
- nPDF (e.g. EPS09) should be added



5) More study on systematic uncer. (all)
- fitting procedure (Songkyo)
- TNP (Kisoo & Yongsun)

Old acceptance cut

- **Old single muon acceptance cut**



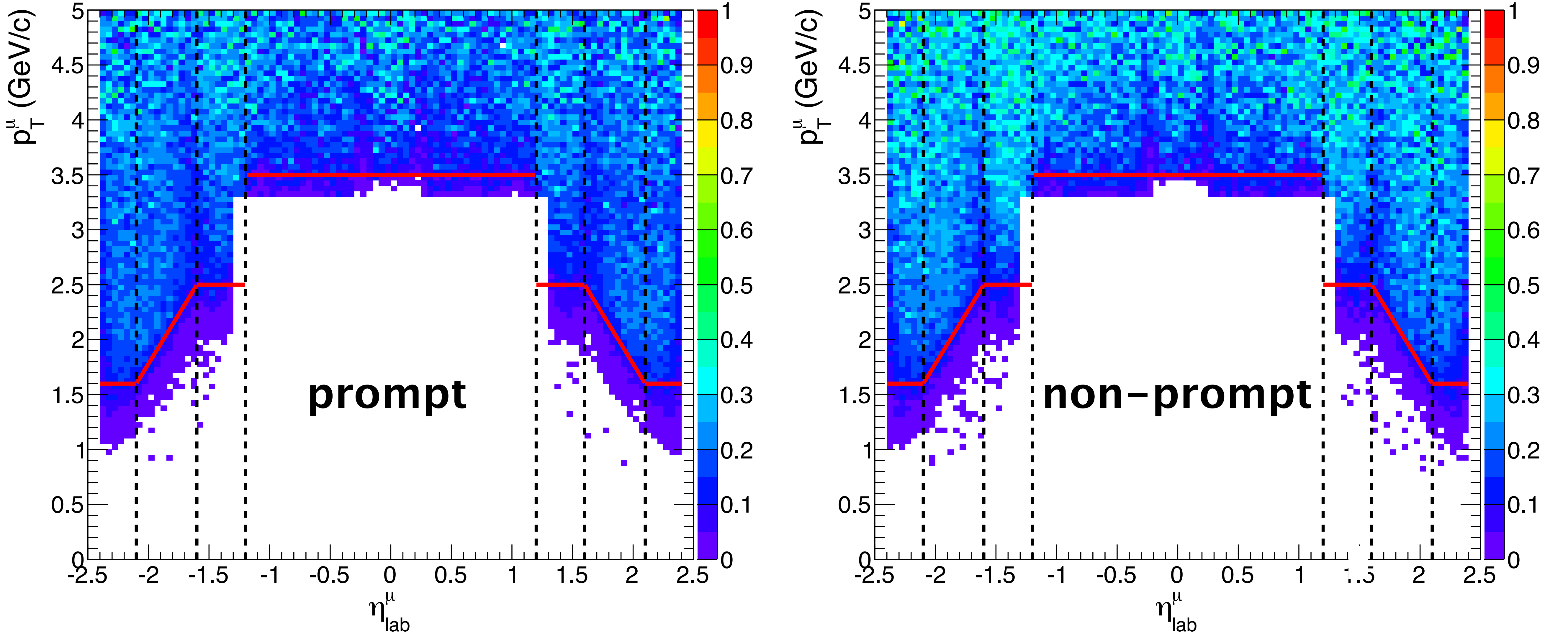
$$|\eta^\mu| < 1.3 \rightarrow p_T^\mu > 3.3\ \text{GeV}/c$$

$$1.3 < |\eta^\mu| < 2.2 \rightarrow p^\mu > 2.9\ \text{GeV}/c$$: p based!

$$2.2 < |\eta^\mu| < 2.4 \rightarrow p_T^\mu > 0.8\ \text{GeV}/c$$

- **New single muon acceptance cut**
  - Ensure the single muon efficiency > 10 %
  - Withdraw “p” cut, and use “p_T” only, for the simplicity and the consistency with TNP (comments from muon POG)
  - Eta ranges considering the detector performance

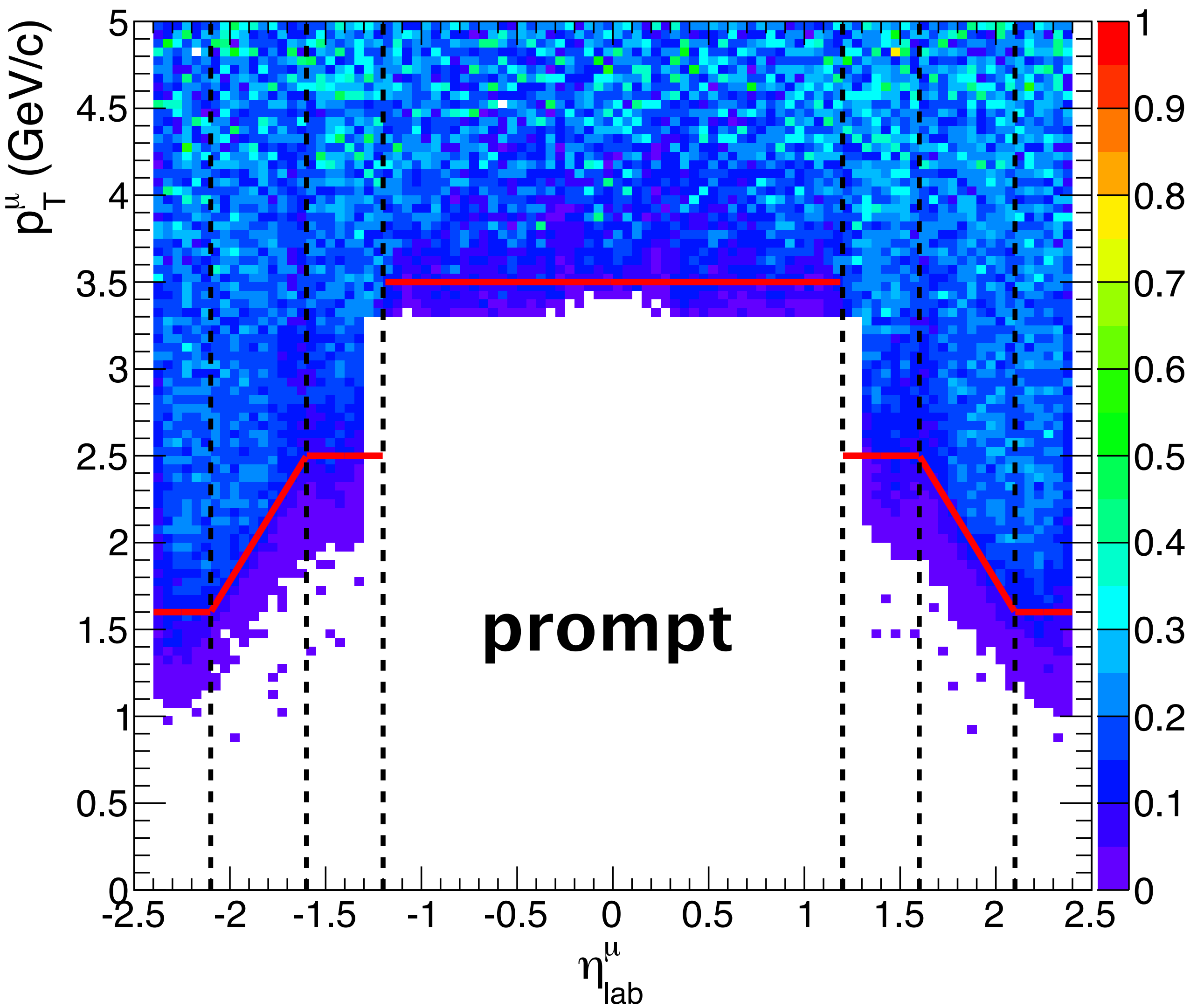
New acceptance cut -1st run

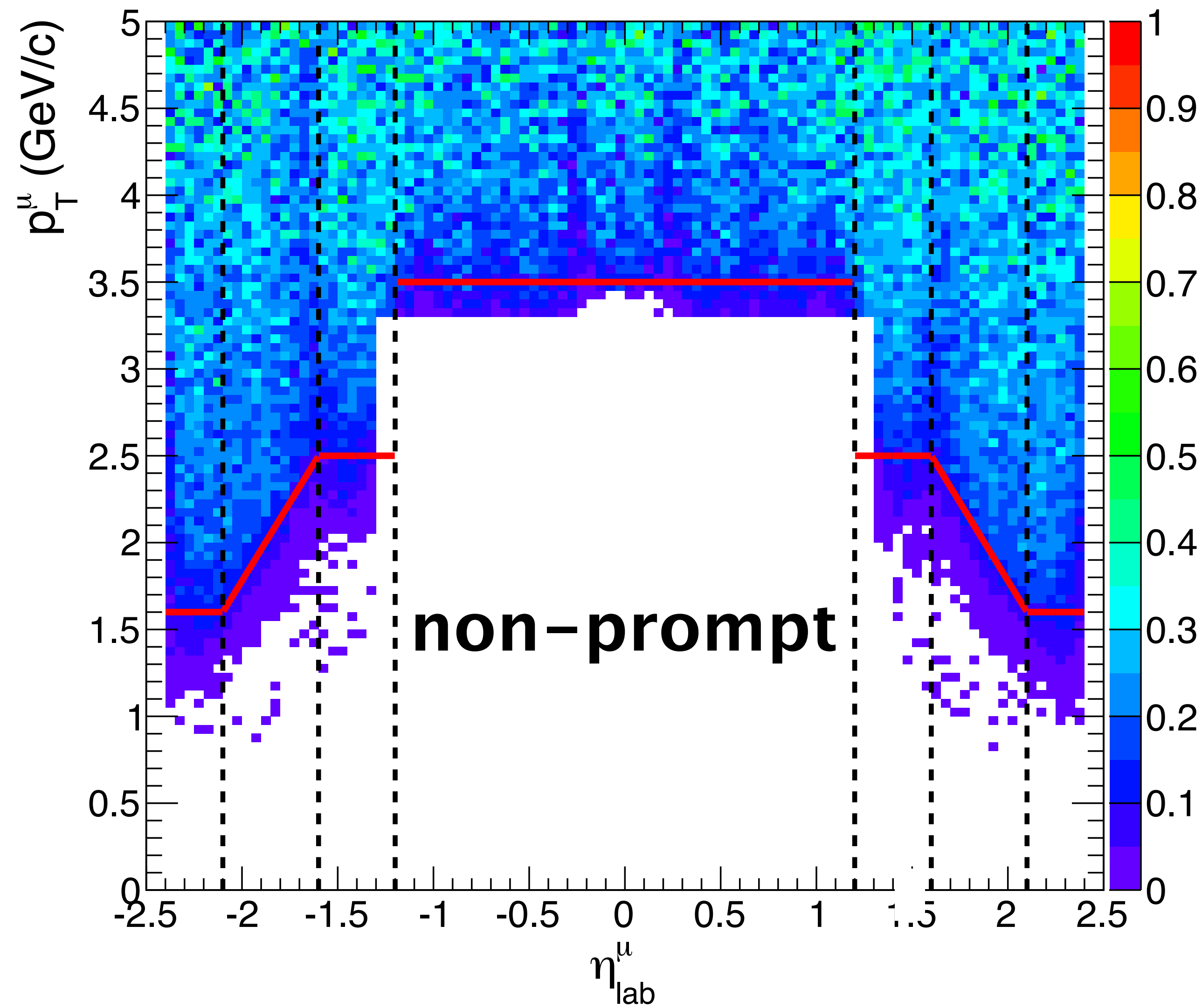


- $|\eta^{\mu}| < 1.2$ → $p_T > 3.5$ GeV/c
- $1.2 < |\eta^{\mu}| < 1.6$ → $p_T > 2.5$ GeV/c
- $1.6 < |\eta^{\mu}| < 2.1$ → $p_T > -1.8 \times abs(\eta^{\mu}) + 5.38$: func. of η^{μ}
- $2.1 < |\eta^{\mu}| < 2.4$ → $p_T > 1.6$ GeV/c

- **$1.2 < |\eta^{\mu}| < 1.3$ && $2.5 < p_T^{\mu} < 3.5$ GeV/c**
  - excluded by the old cut, will be checked with new MC

2nd run





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TNP requests from the muon POG

- **Change the 5 eta bins in which SF have been calculated in order to reflect more the changes in the detector performance:**
→FROM 0-0.6-1.3-1.8-2.2-2.4 TO 0-0.9-1.2-1.6-2.1-2.43

- **Calculate separately (tracking*MuId) and Trigger, that this will be comparable to the numbers delivered by BPH group (Ilse)**

- **Change the systematic sources:**

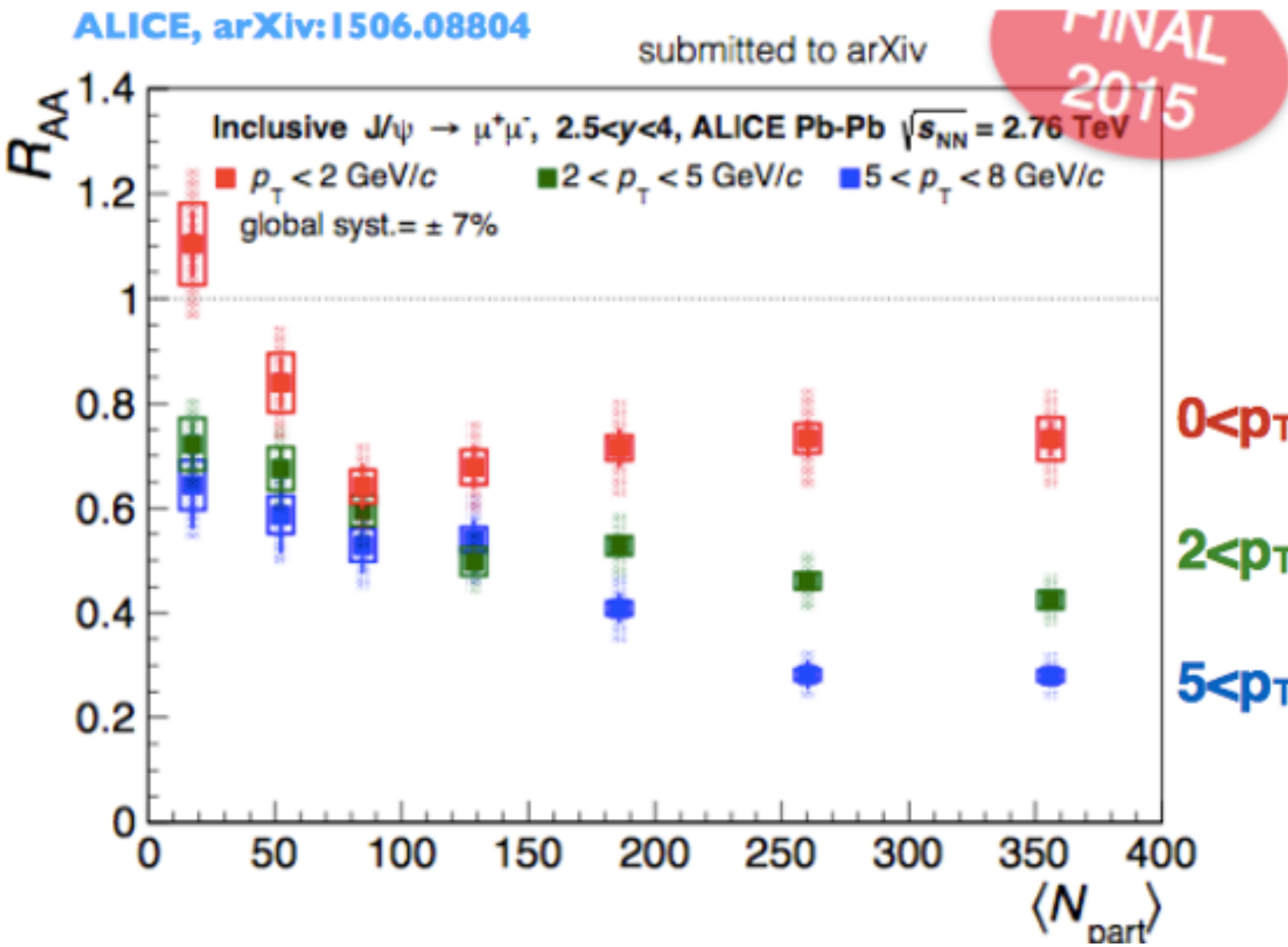
a) if there is only one dominant one (let's say bigger by 1 order of magnitude compared to others), pick only that one

b) the tag cut: will be discussed in Camelia's talk

Hard Probes 2015

ALICE J/psi in PbPb

- Inclusive J/ψ vs N_{part} vs p_T (ALICE, final Run 1 result)
  - ➡ increase of R_{AA} when going from high-p_T to low-p_T
  - ➡ used by people as strong proof of recombination at work



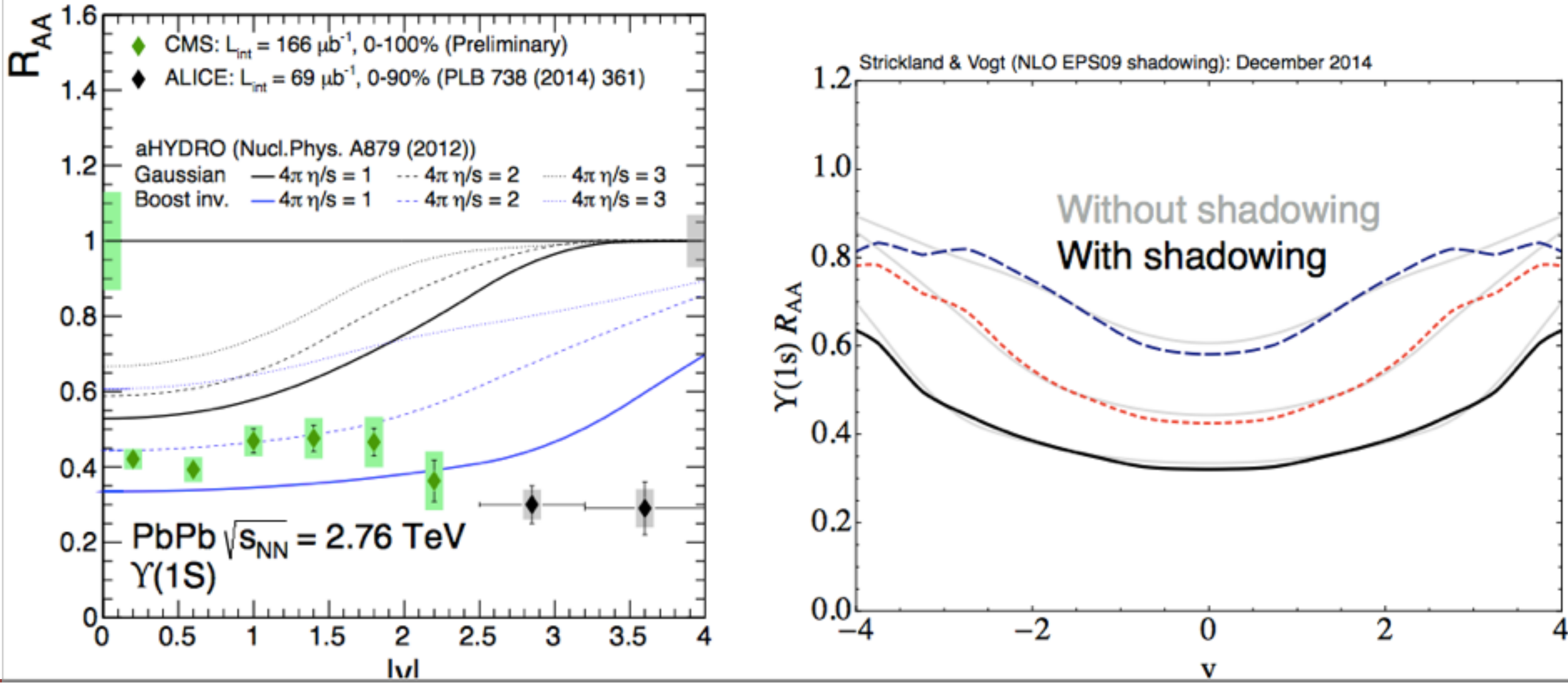
0<p_T<2 GeV/c

2<p_T<5 GeV/c

5<p_T<8 GeV/c

CMS Upsilon in PbPb

- Υ CMS results (first significant pT and y R_{AA} dependence + x-sections)
  - ➡ R_{AA} vs y: not clear what is going on in the forward region:
    - ➡ more shadowing than everybody seems to consider/calculate or
    - ➡ pp (from LHCb engineered) or ALICE PbPb yields fishy
- Made Strickland happy: his 4 years p_T and y Raa was wrong (simple average of Raa vs Npart which made his y and p_T numbers to be higher than it should be)
  - ➡ new paper from him imminent (he will use the new CMS points —> 1st citation!)



CMS Upsilon in PbPb

- 1st HIN-15-001 citation : http://arxiv.org/pdf/1507.03951v1.pdf

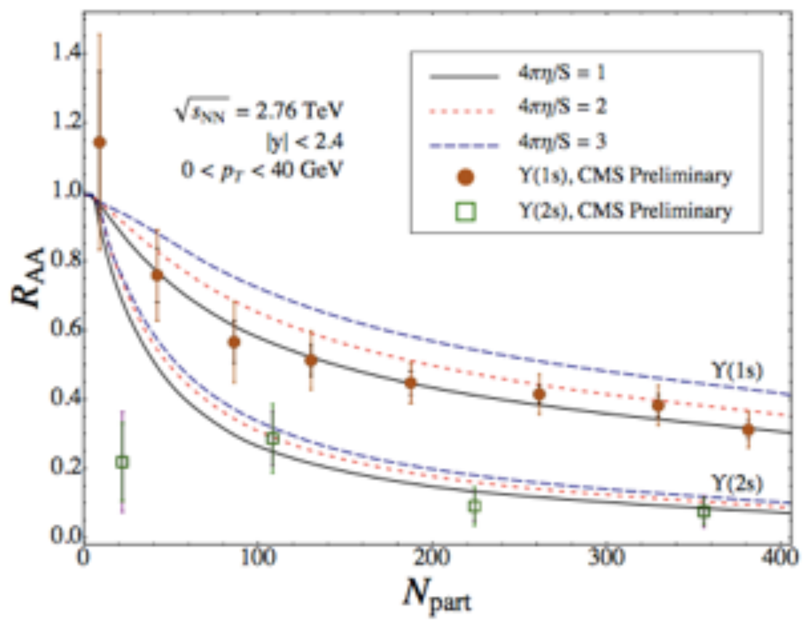


FIG. 2: (Color online) Inclusive R_{AA} for the $\Upsilon(1s)$ and $\Upsilon(2s)$ as a function of N_{part}.

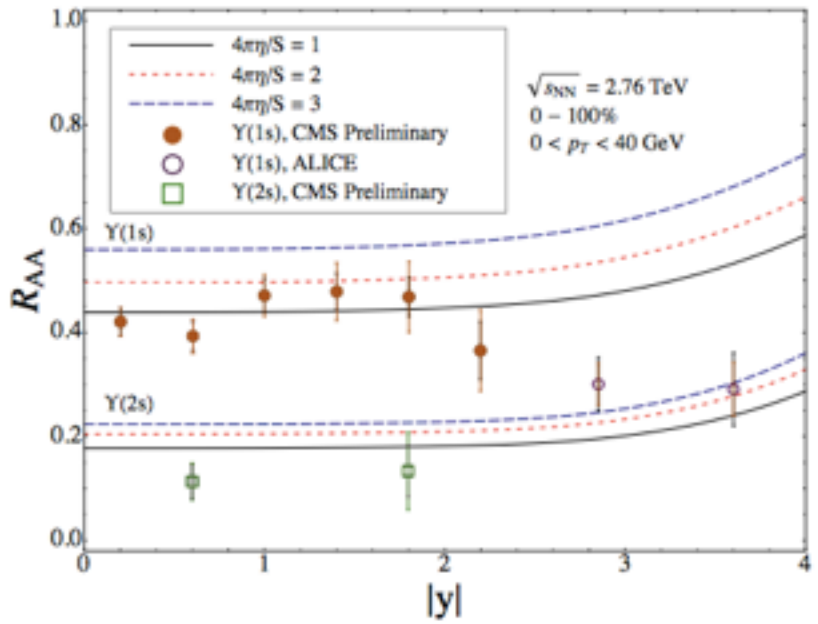


FIG. 3: (Color online) Inclusive R_{AA} for the $\Upsilon(1s)$ and $\Upsilon(2s)$ as a function of y.

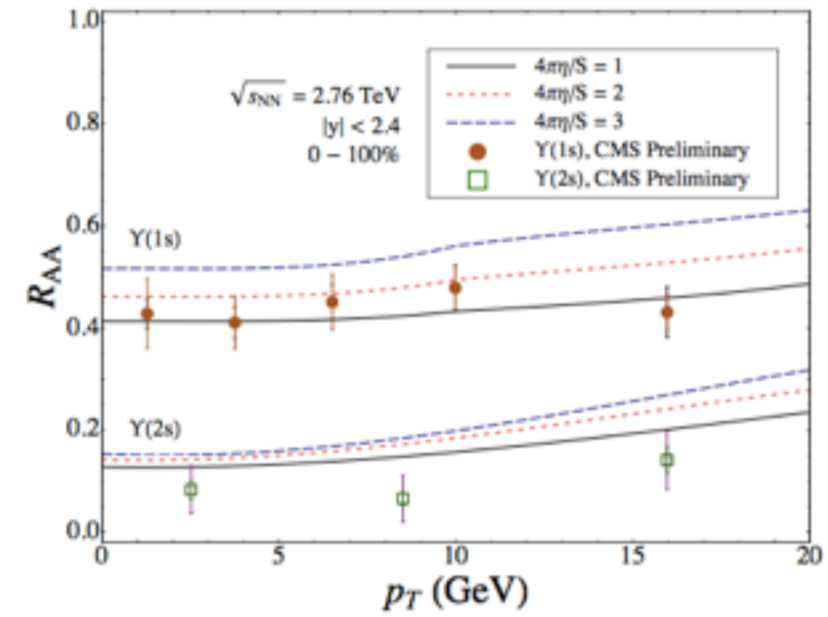


FIG. 4: (Color online) Inclusive R_{AA} for the $\Upsilon(1s)$ and $\Upsilon(2s)$ as a function of p_T.

ALICE J/psi in pPb

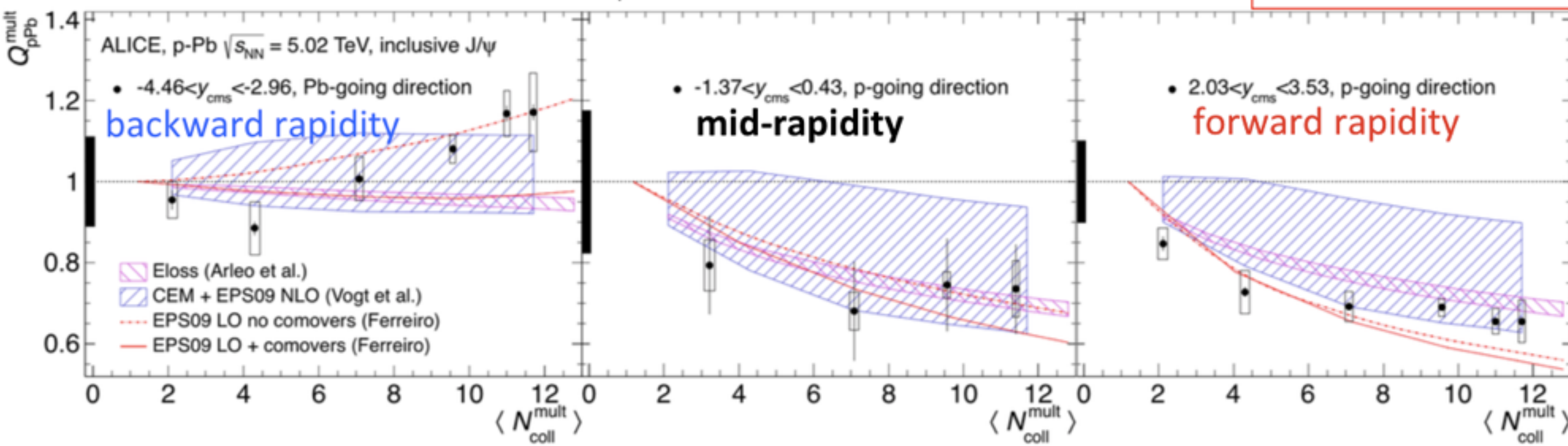
$$Q_{pPb}^{J/\psi,i} = \frac{Y_{pPb}^{i}}{\langle T_{pPb}^{i} \rangle \sigma_{pp}^{J/\psi \to \mu^+\mu^-}}$$

T^{i}_{pPb} is the nuclear thickness function in a given ZN energy event class* i.

$\sigma_{pp}^{J/\psi \to \mu\mu}$ – interpolated pp cross-section at √s = 5.02 TeV.

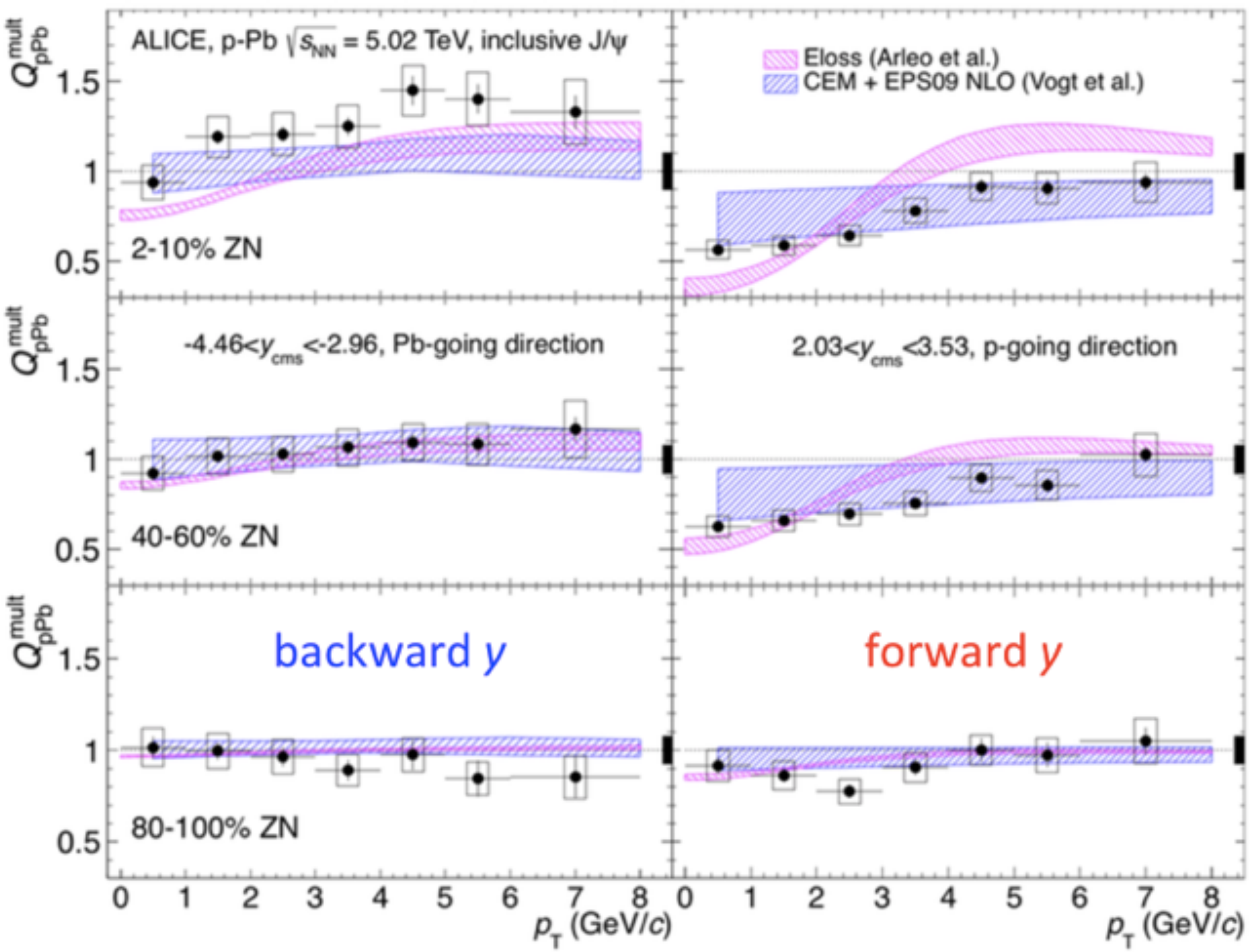
*ZN is the neutron part of the ZDC

arXiv: 1506.08808



- At backward y, $Q_{pPb} \approx 1$ in peripheral collisions, increasing with centrality.
- At **mid-** and forward y, the suppression of the J/ψ production increases with centrality.
- ***Models*** show fair agreement with the data.
- ***Coherent energy loss*** and ***shadowing*** model ***with comovers*** contribution underestimate Q_{pPb} at backward y, for the most central events.

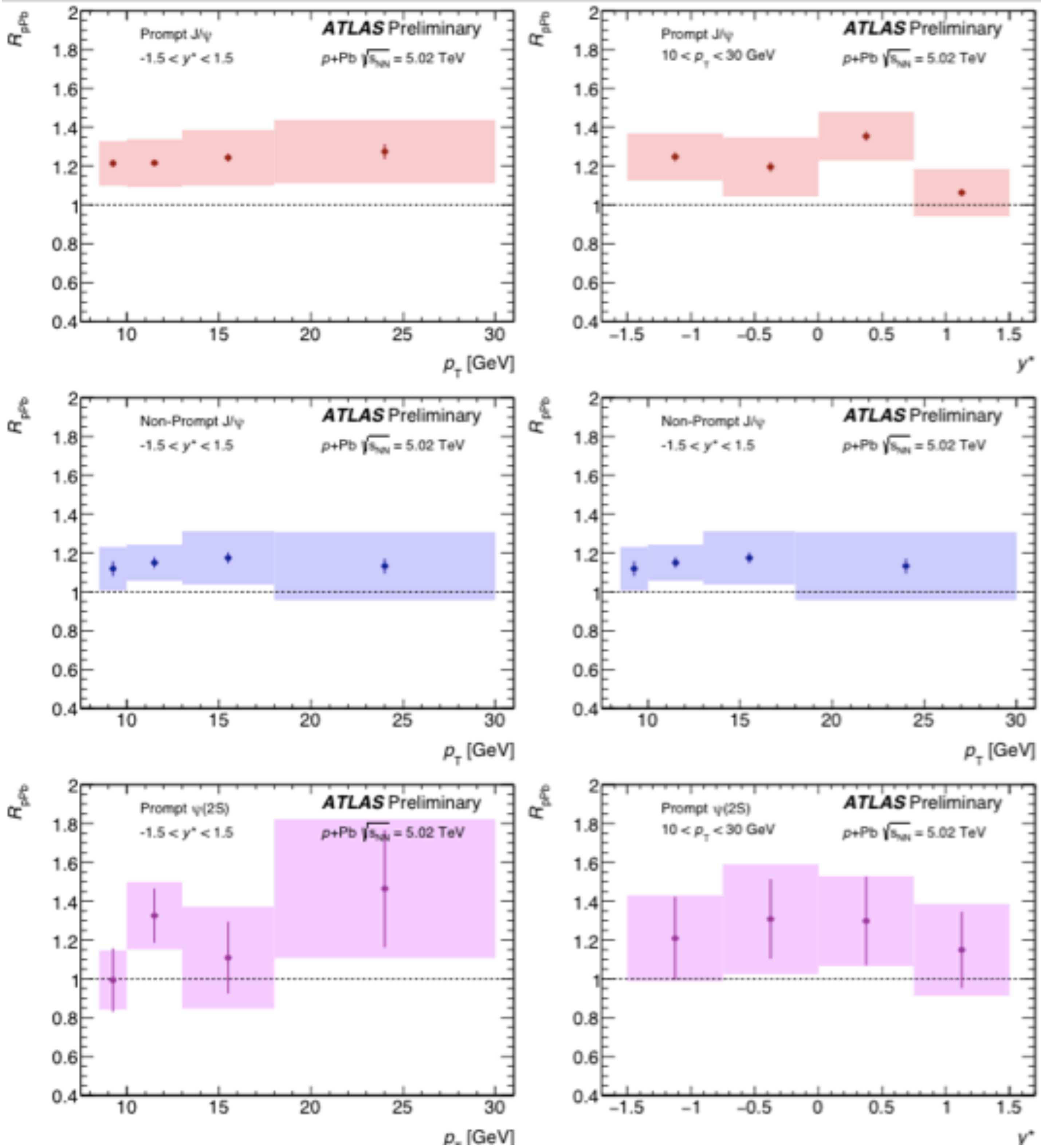
ALICE J/psi in pPb



arXiv: 1506.08808

- Large CNM effects in most central events: Q_{pPb} increases with p_T both at backward and forward y.
- At small event activity Q_{pPb} is consistent with unity for both backward and forward y.

ATLAS J/psi in pPb



R$_{pPb}$ vs. pT, y*

Prompt J/ψ

$$R_{pPb} = \frac{1}{A} \cdot \frac{\frac{d^2\sigma_{p+Pb}}{dy^* dp_T}}{\frac{d^2\sigma_{p+p}}{dy^* dp_T}}$$

J/ψ from b

(Note: these plots are independent of centrality modeling)

Prompt ψ(2S)

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ATLAS J/psi in pPb

R_{pPb}
vs.
~centrality

Prompt J/ψ

$R_{pPb}>1$

J/ψ from b

$R_{pPb}>1$
mid-centrality

Phenix:

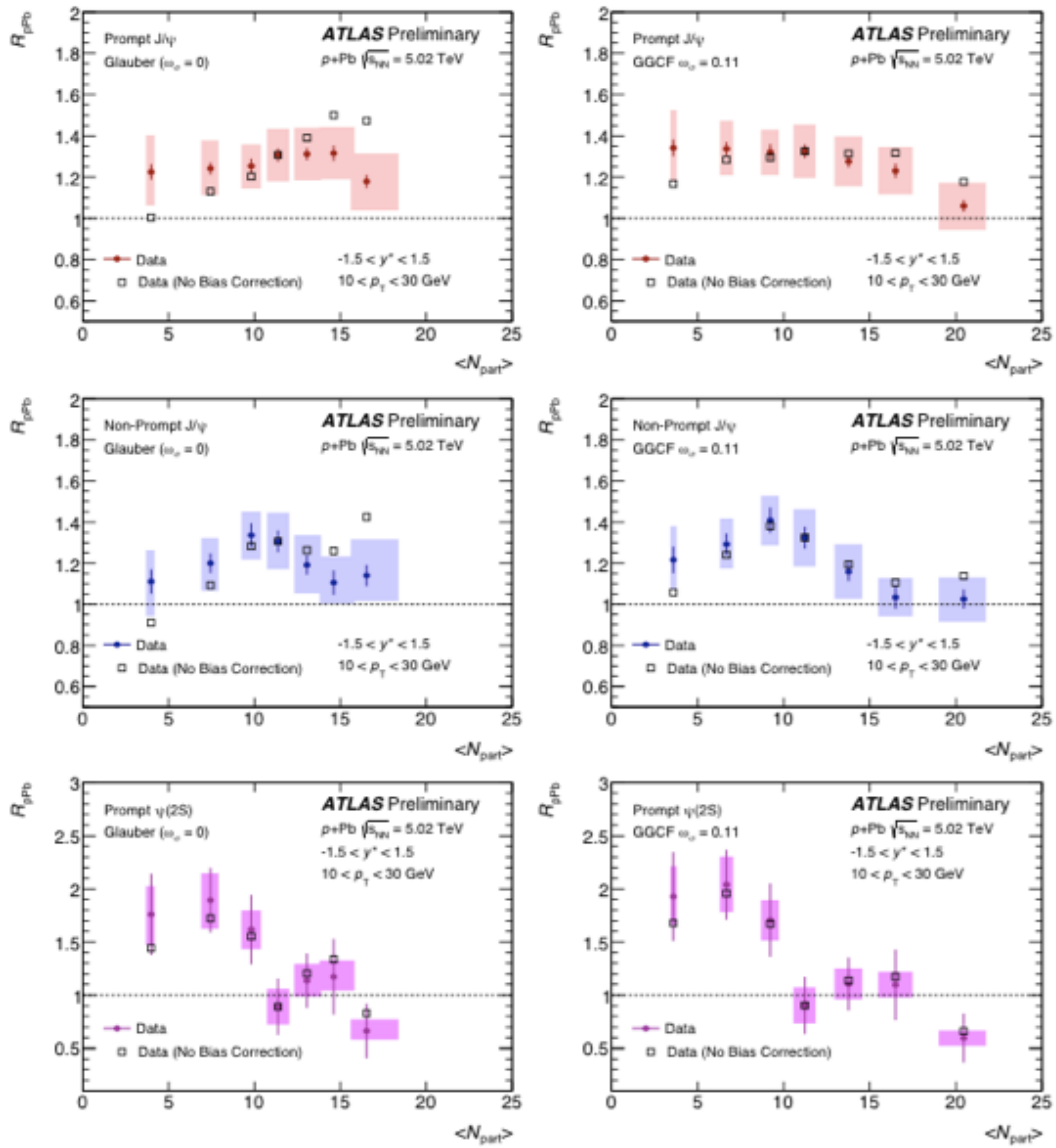
Prompt ψ(2S)

*R_{dAu} =**1** (NColl=3)*

*R_{dAu} =**0.2** (NColl=15)*

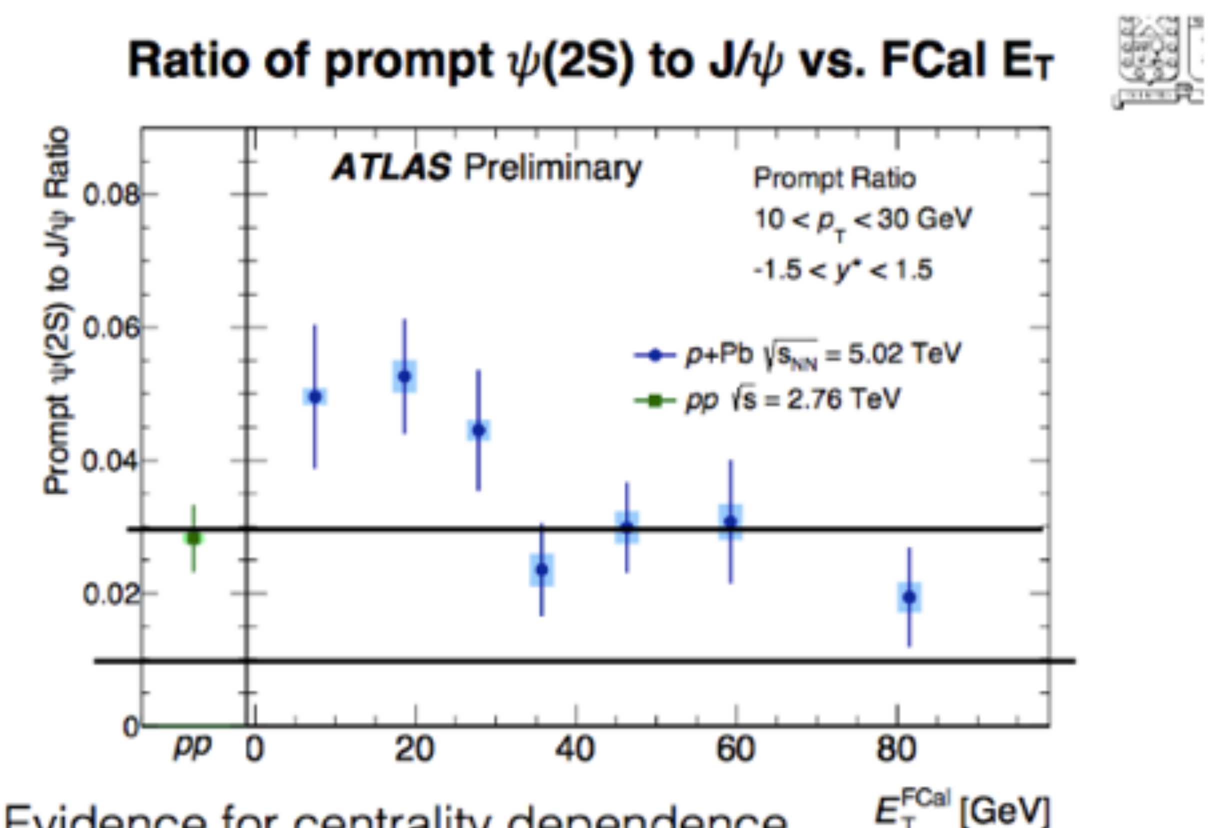
$R_{pPb}>1$
low-centrality

(note vertical scale change)

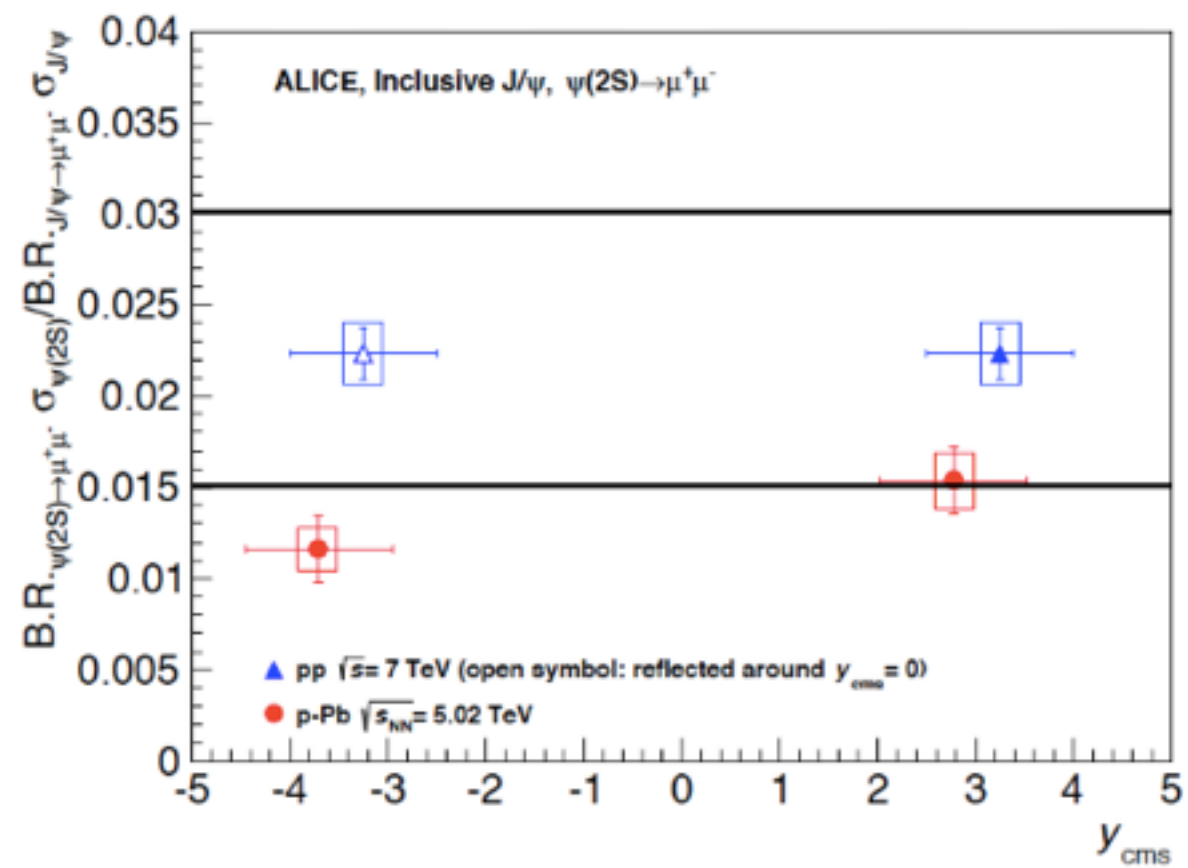


psi(2s) / J/psi

- ATLAS: puzzling Jpsi and Psi(2S) results in pPb
  - ➡ https://indico.triumf.ca/getFile.py/access?contribId=42&sessionId=29&resId=0&materialId=paper&confId=1922
  - ➡ the Psi(2S)/J/psi >> ALICE
    - different pT? Already the pp reference is very different (~0.3 ATLAS vs ~0.2 ALICE)

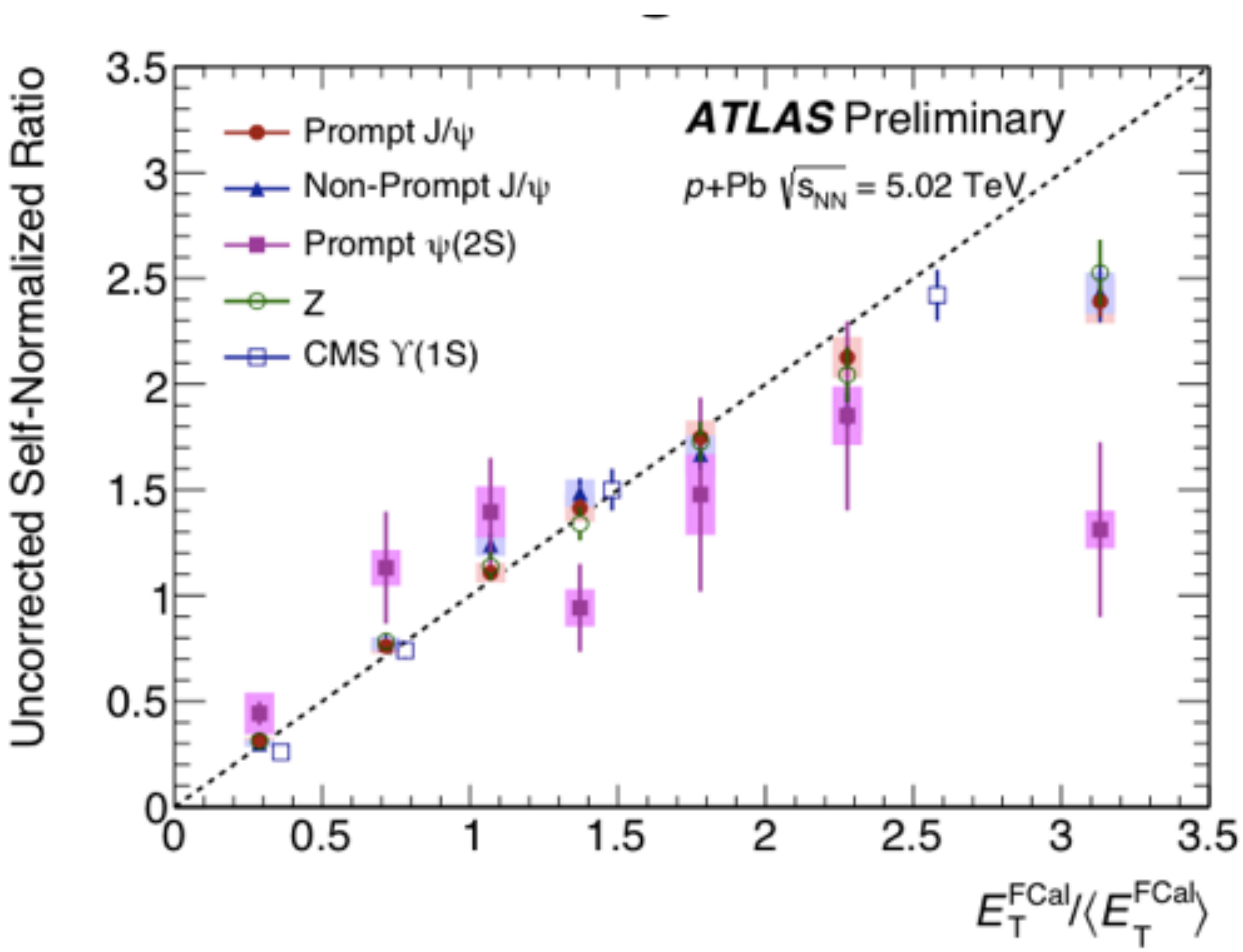


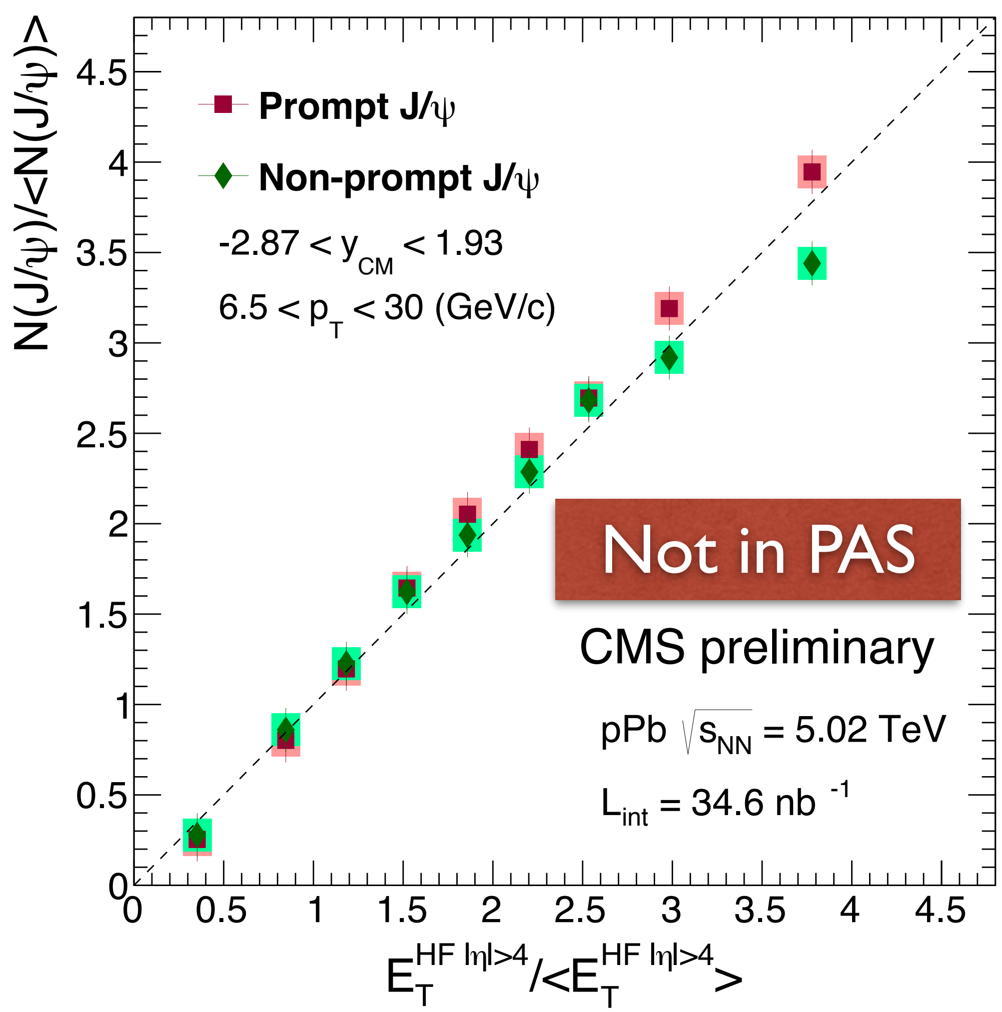
Evidence for centrality dependence
Similar pattern as Z-normalized $\psi(2S)$
Decreasing trend with centrality; magnitude > ALICE's



Self normalized ratio

- **ATLAS in pPb**
  - self-normalized ratios : prompt, non-prompt, Z are all lined up, while psi(2s) seems to go lower (big uncer.) at high multiplicities

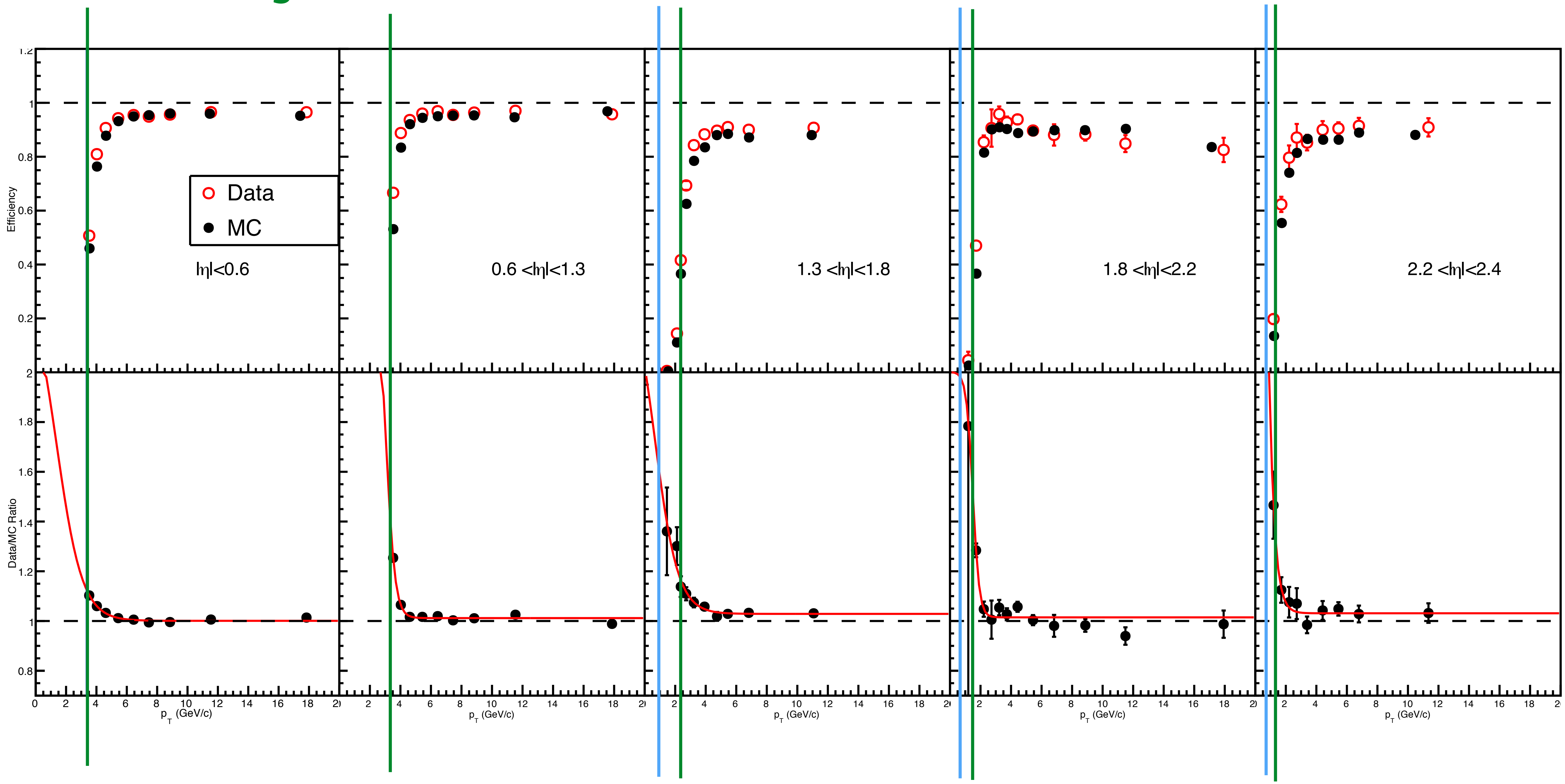




Backup

TNP

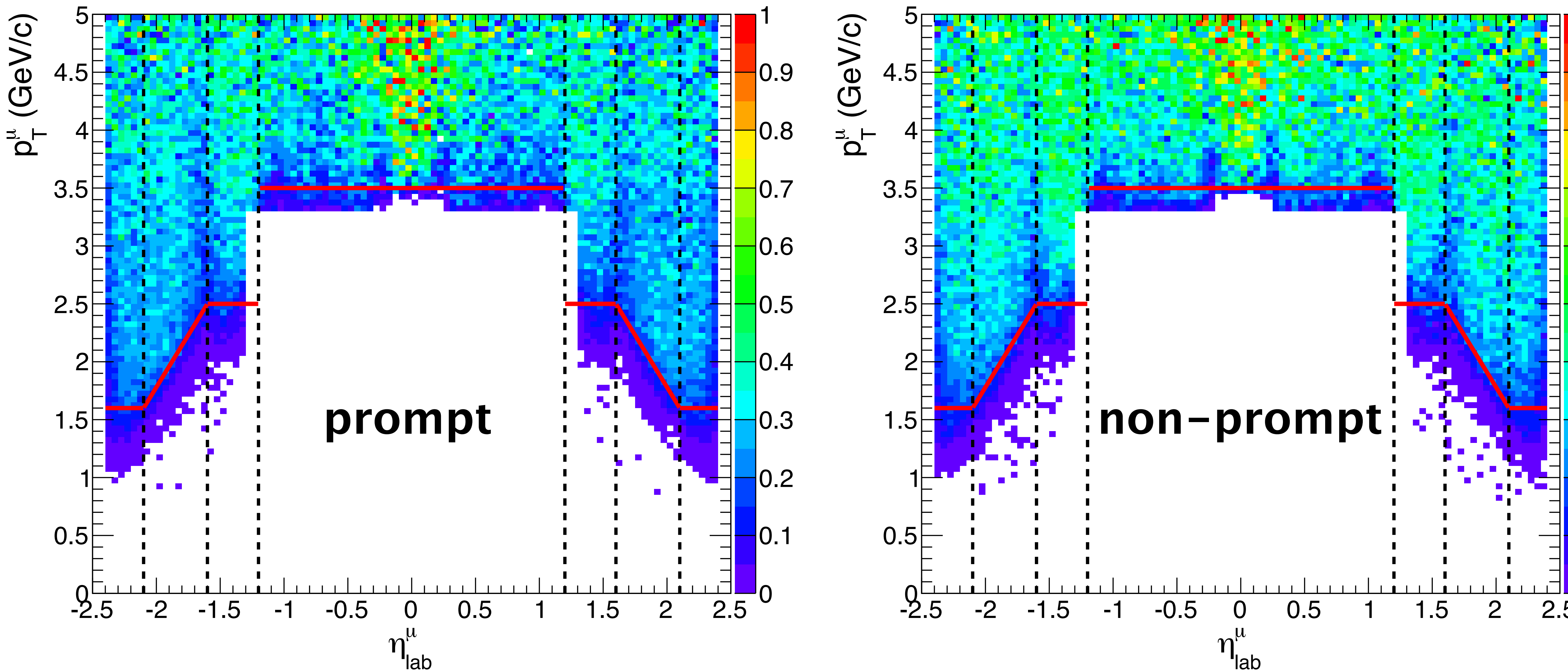
blue : old cut green : new cut



- cross-check if eff. > 10 % with the TNP → yes
- should be checked again after η ranges adjusted →

FROM
— 0-0.6-1.3-1.8-2.2-2.4
TO
—0-0.9-1.2-1.6-2.1-2.4

New acceptance cut



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- **correlation b/w two muons (kineCut_pl && kineCut_mi)**

- **Current MC samples**

$$|\eta^{\mu}| < 1.3 \rightarrow p_T^{\mu} > 3.3 \text{ GeV}/c$$
$$1.3 < |\eta^{\mu}| < 2.2 \rightarrow p^{\mu} > 2.9 \text{ GeV}/c$$
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