Ψ(2S): MEASURING THE EXCITED COUSIN OF J/Ψ

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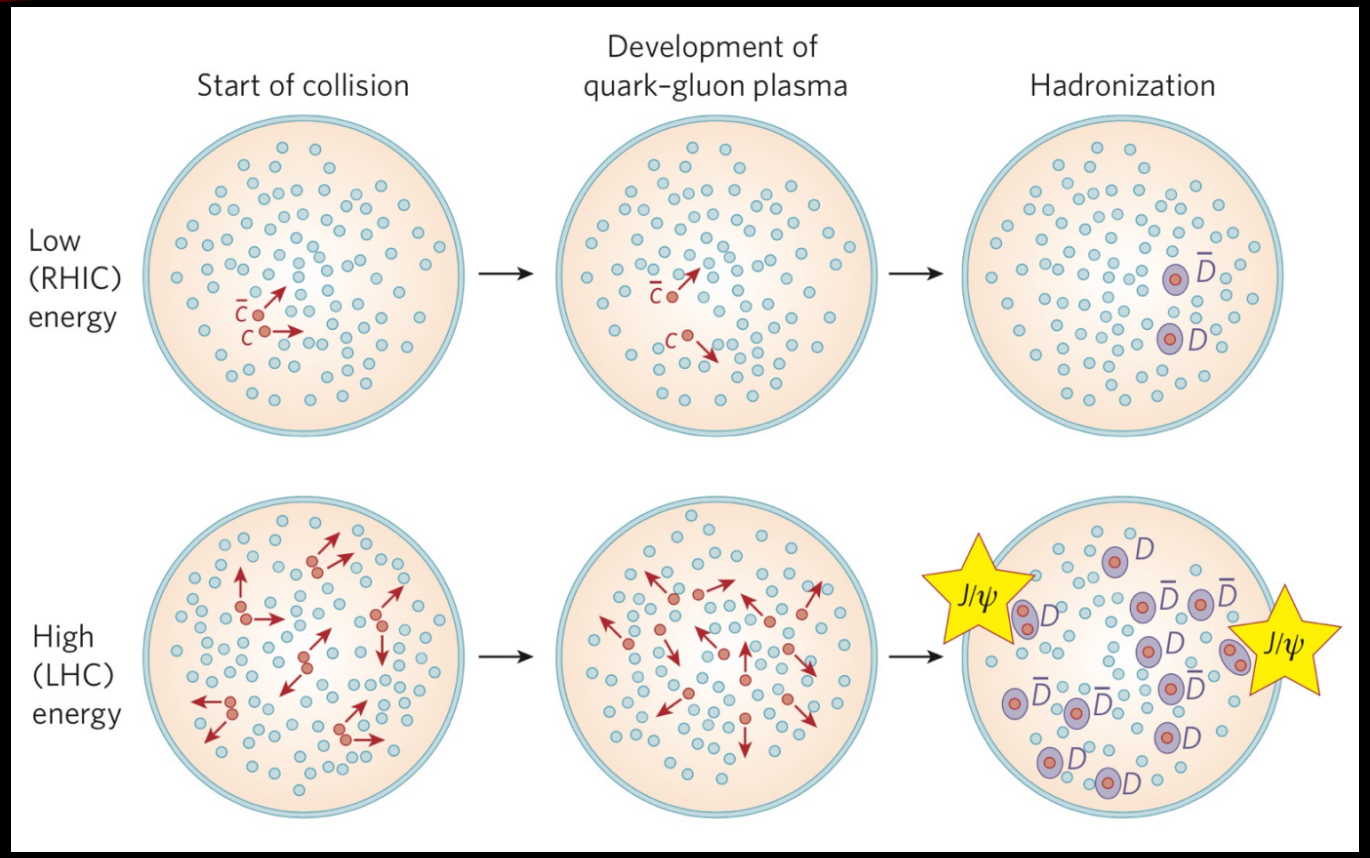
Outline

- Motivation
- ALICE Experiment
- Results (including work in progress)

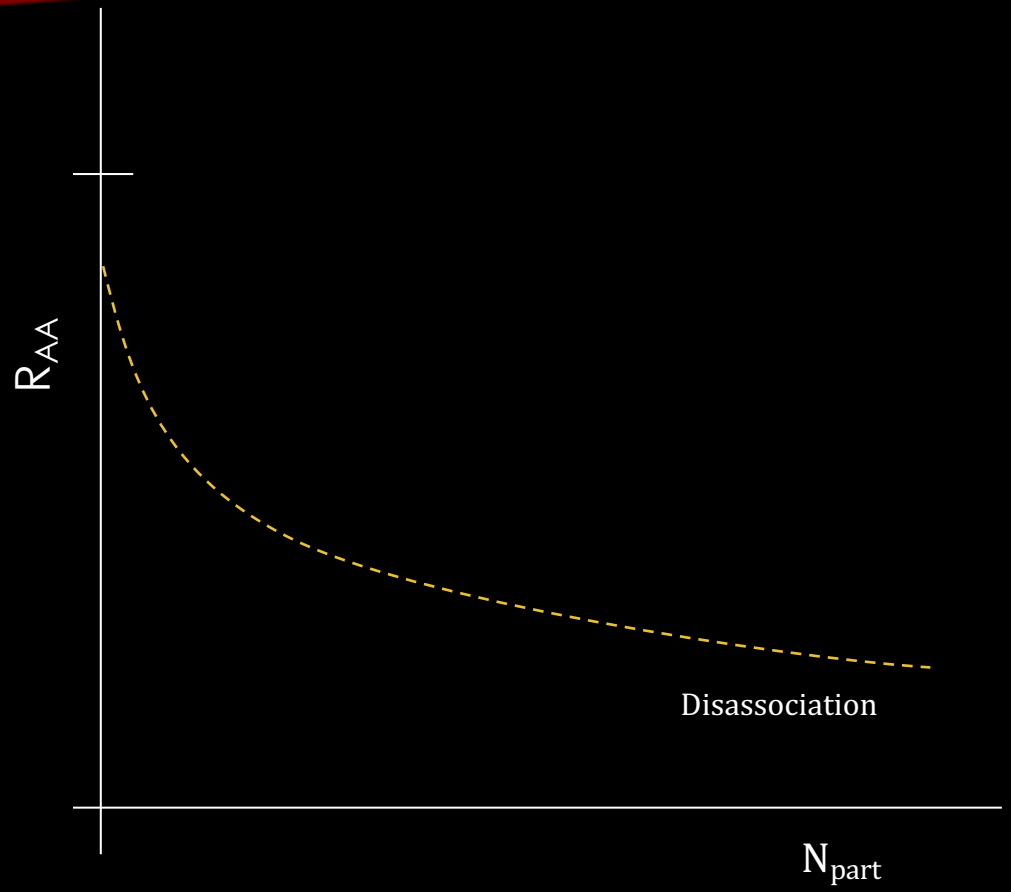
Quarkonia as a probe of QGP



- Direct charmonia production is suppressed due to colour screening
- LHC: charm quark (*c* and *c*bar) production cross section larger compared to RHIC energies
- Additional production mechanism: (re)generation of quarkonium. Quarkonium can be used to study deconfinement in the QGP

Quarkonia as a probe of QGP

$$R_{AA} = \frac{Y_{PbPb}}{N_{coll} \times Y_{pp}}$$



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- Disassociation: Ψ(2S) melt inside the medium (color screening)

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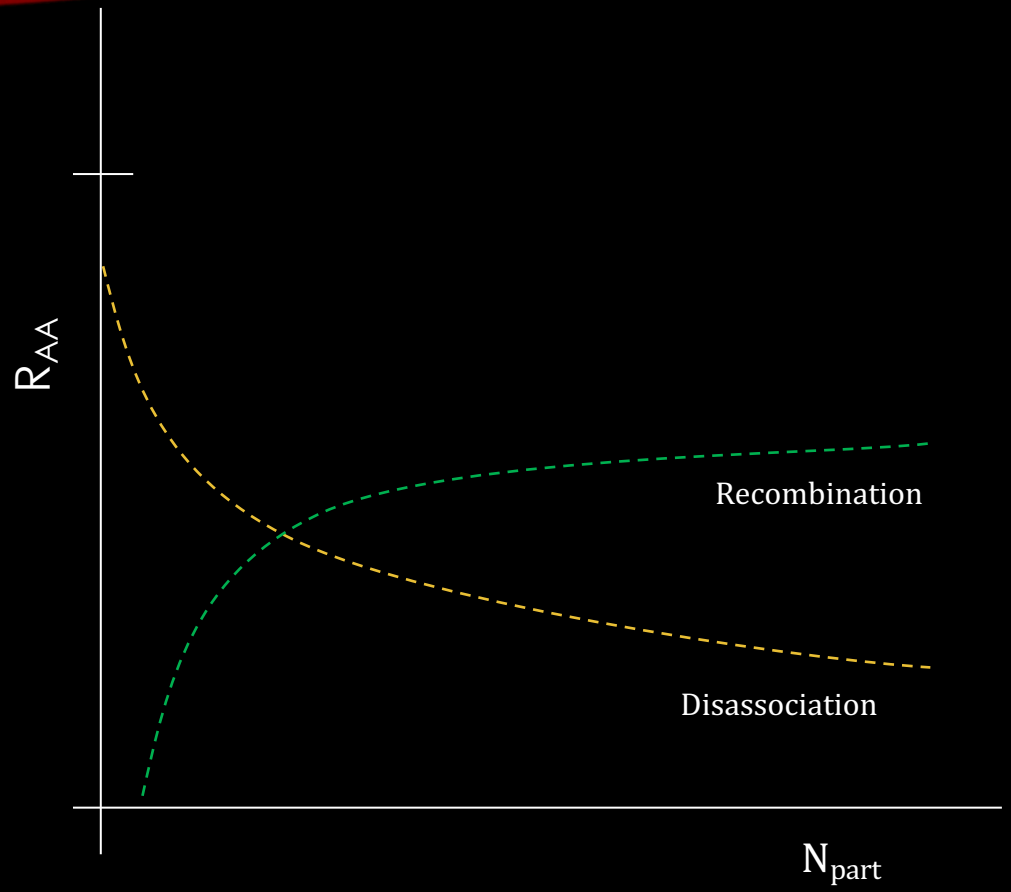

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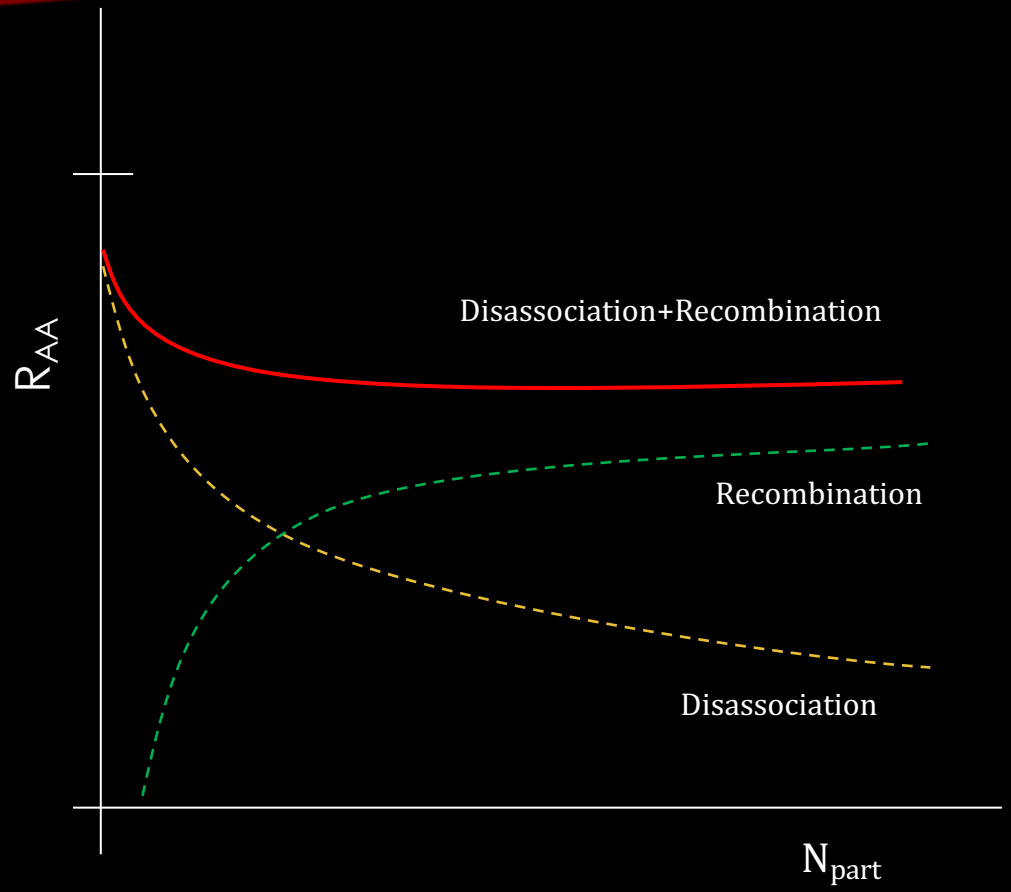

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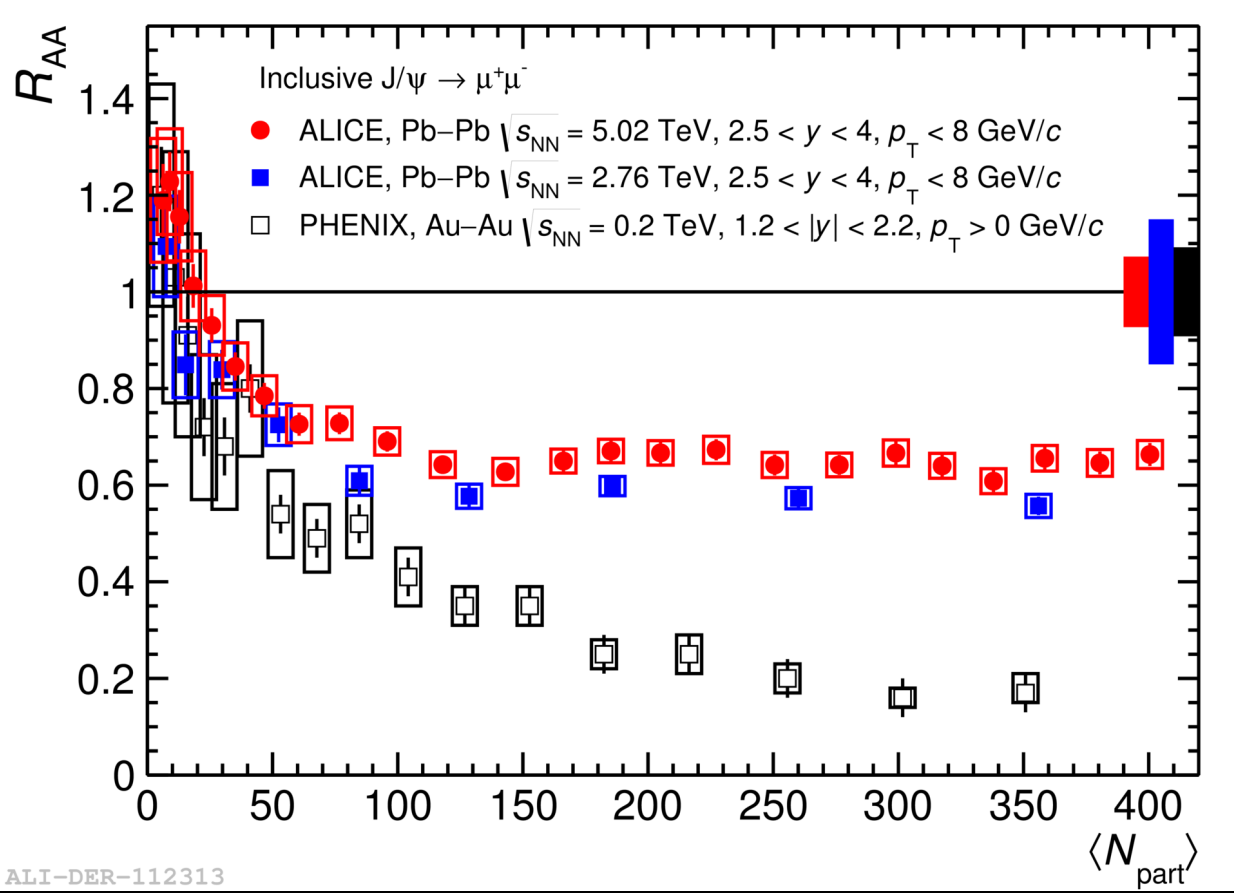
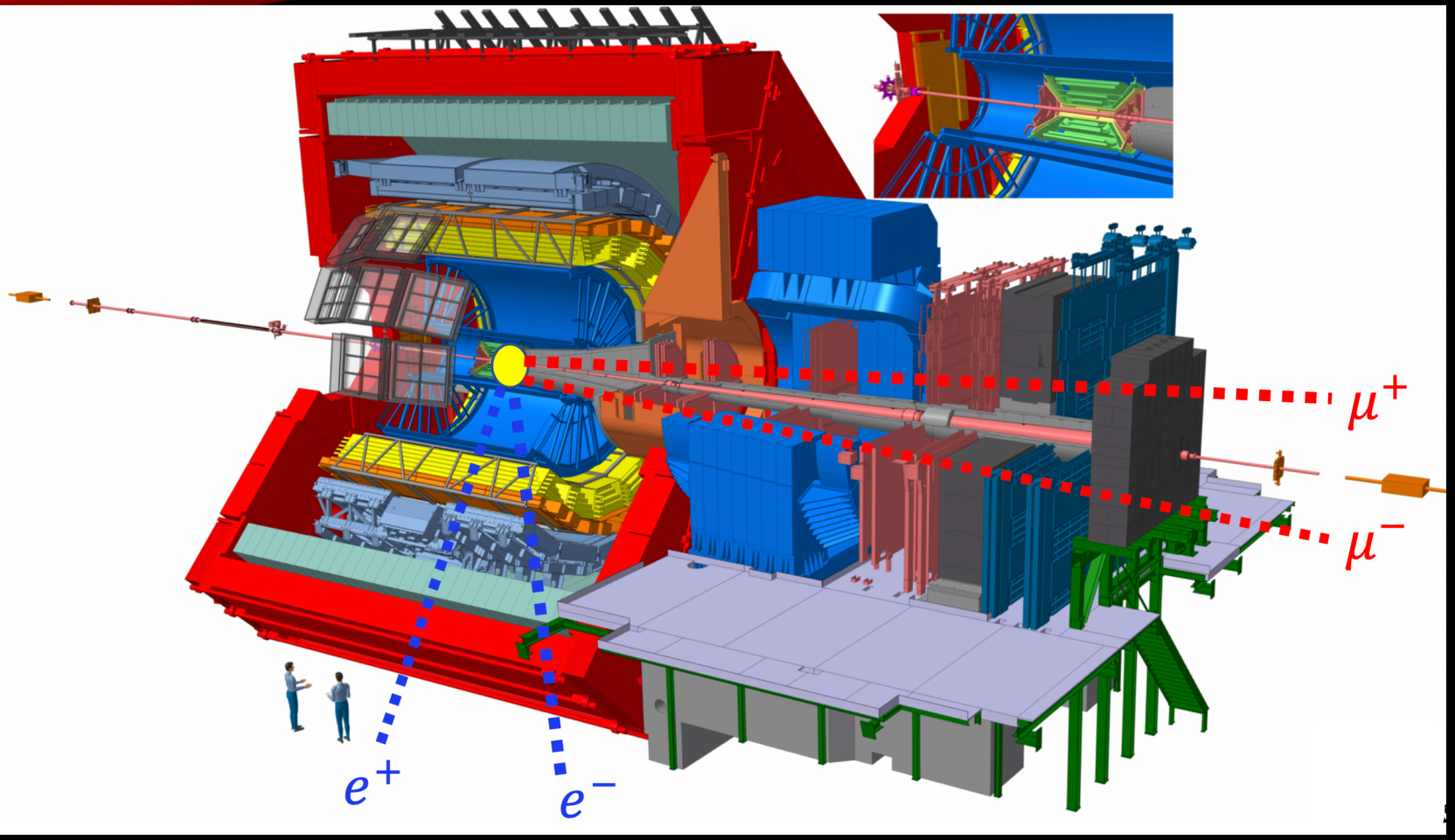


- Smaller suppression for central events in ALICE despite a collision energy more than 10 times higher -> First clear sign of regeneration
- Smaller binding energy of Ψ(2S) makes it difficult for theoretical calculations
- Stronger suppresion for Ψ(2S) is expected due to smaller binding energy and Debye Screening

ALICE Experiment



Inner Tracking System
- Tracking, vertex reconstruction

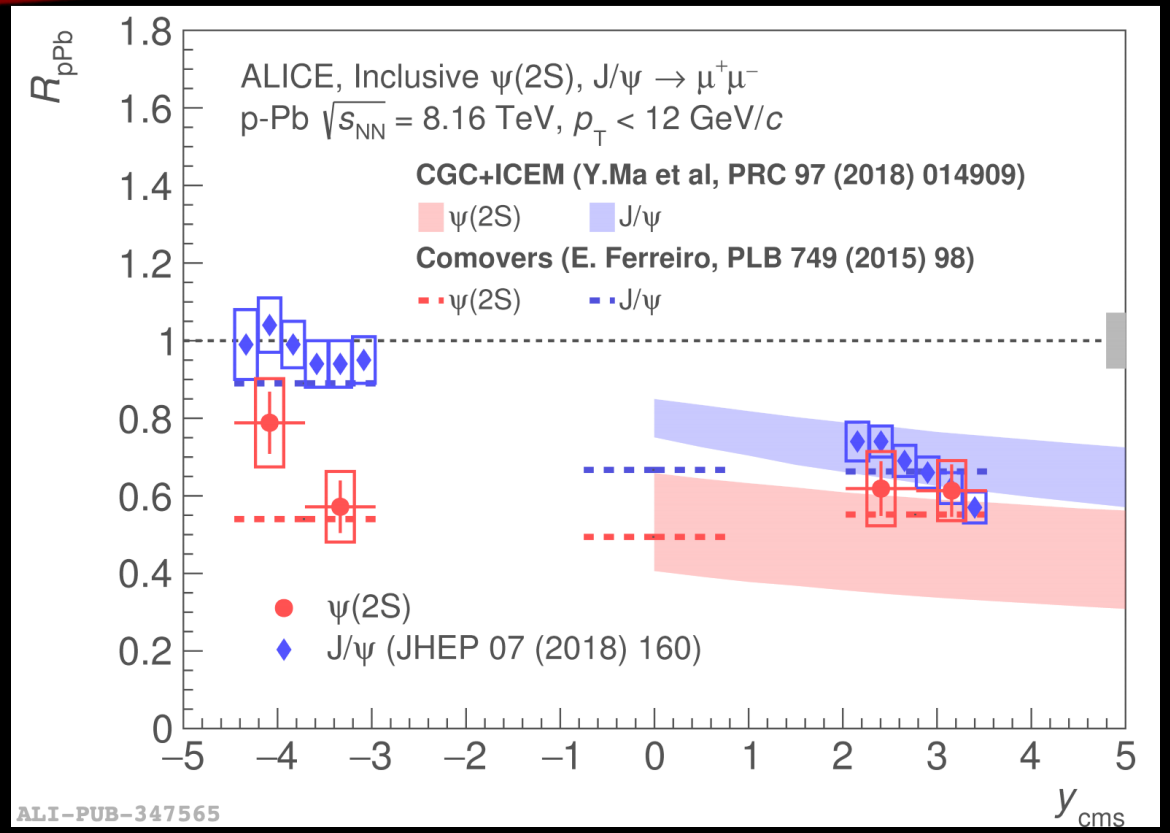
V0 Detector
- Centrality determination triggering, and event characterisation

Muon Spectrometer
- Trigger and tracking for muons

Zero Degree Calorimeter
- Triggering information and event characterization

- Can measure down to $p_T = 0$

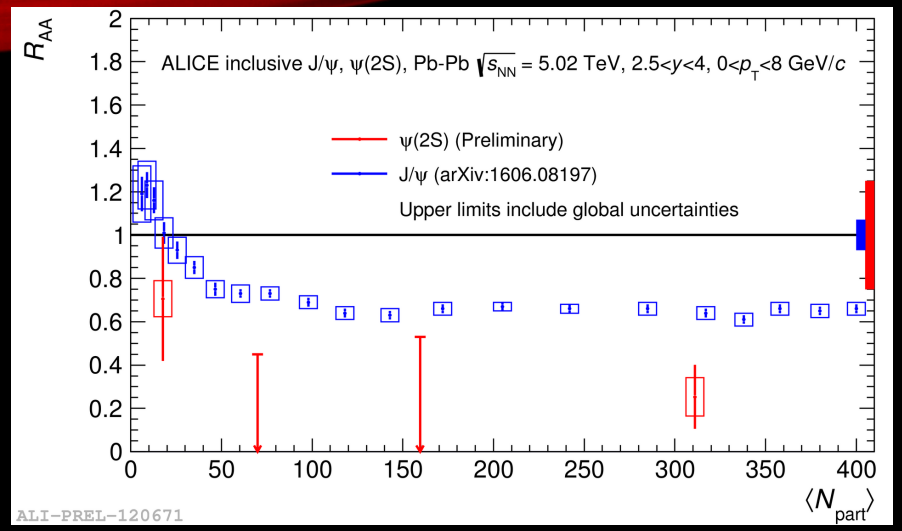
Results so far

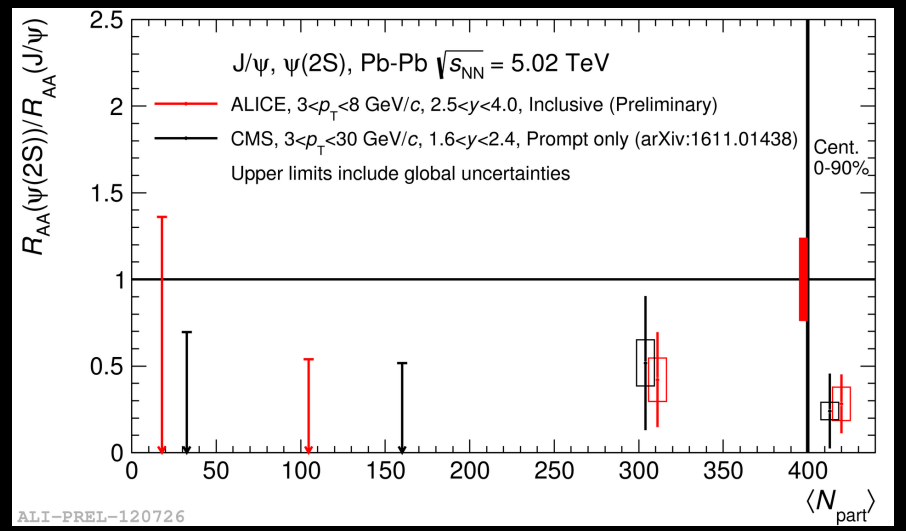


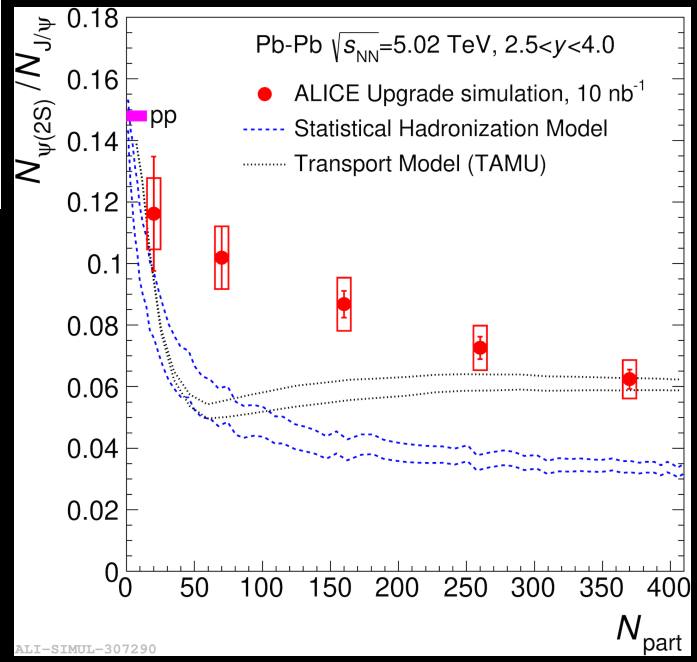
JHEP07 (2020) 237, ALICE Collaboration

- Stronger suppression indeed seen for Ψ(2S) at backward rapidity:
  - This is reproduced by theoretical models that complement initial state with final state break up effects

Results so far







- ψ(2S) showed a stronger suppression, in semi-central and central collisions, than the J/ψ, higher statistics can provide a better picture now

- Advantages of studying ψ(2S):
  - Cancellation of theoretical uncertainties related to charm production cross -> strong constraints on the models!
  - Cancellation of a large fraction of experimental uncertainties

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Current Status

- My analysis: Measurement of $\Psi(2S)$ at forward rapidities in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with full statistics from 2015-2018

- Dimuon invariant mass analysis to estimate the production of $\Psi(2S)$ as a function of charge particle multiplicity and p_T

Current Status

- Re-affirmation of the results from 2015
- Stronger suppression observed for $\Psi(2S)$ in central and semi-central collisions with improved statistics

Current Status

- $\Psi(2S)$ shows stronger suppression from low to high p_T till 3-4 GeV/c, after which there is a decrease in the R_{AA} with increasing p_T

- One of the more important results from ALICE Run2 -> expected inclusion in the Run2 review paper

Thank You