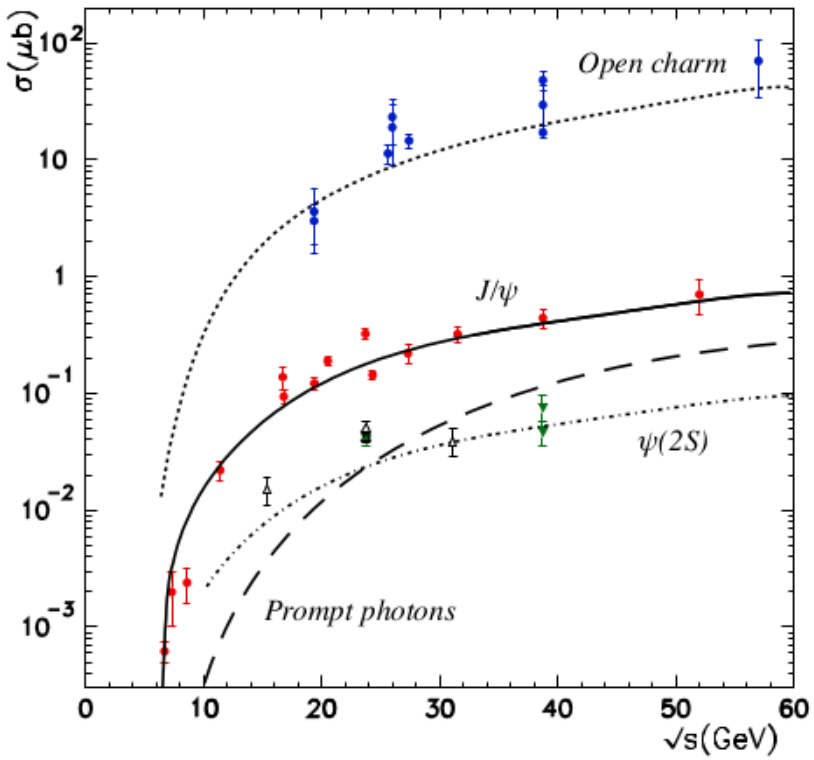
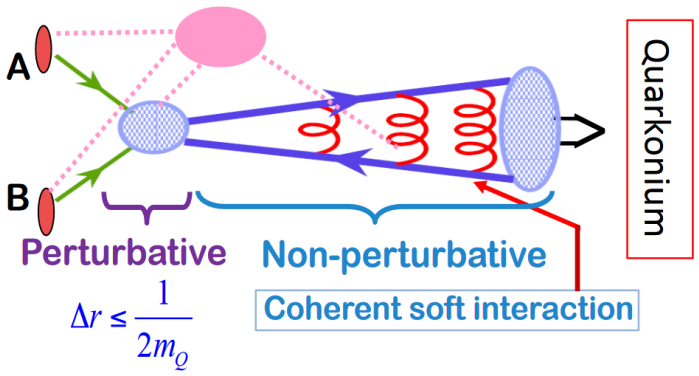
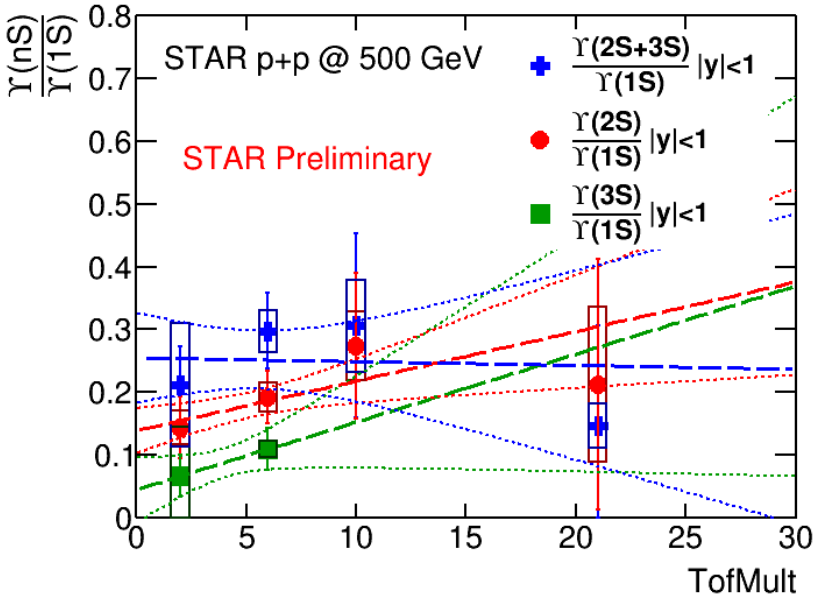
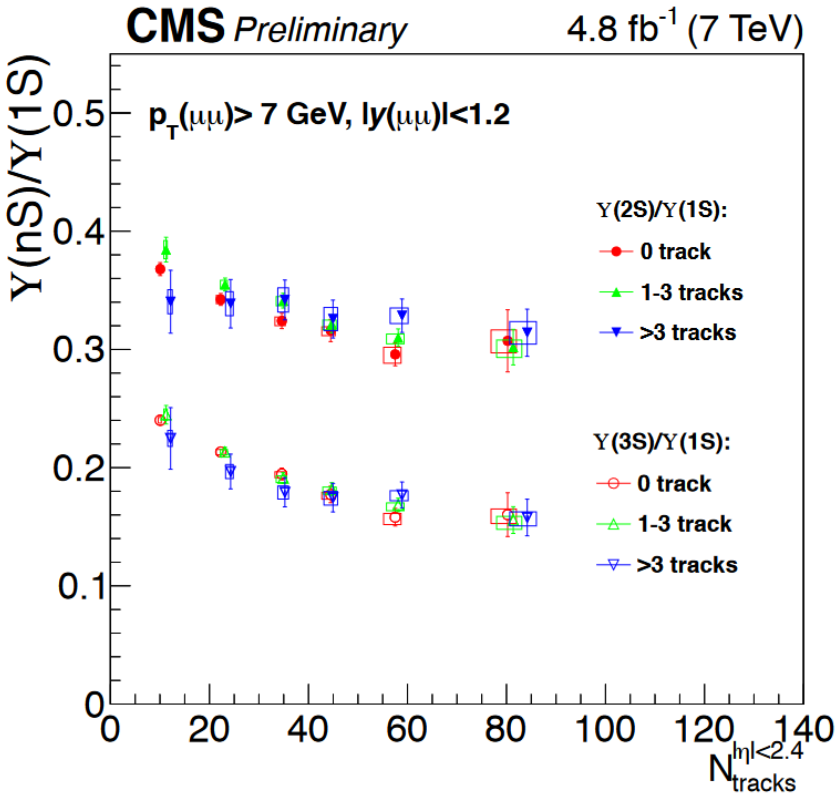
Subthreshold charmonium/charm production





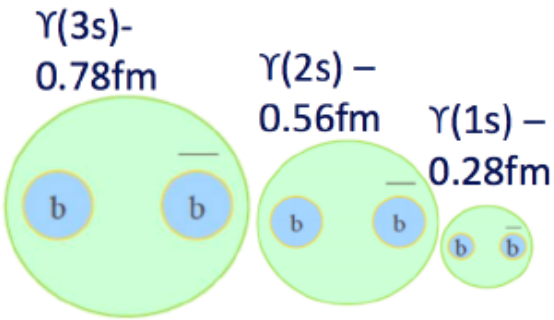
- Subthreshold production can be studied at NICA
  - What are the prospects?
  - Other experiments: FAIR, SPS(NA61 SHINE)
- What is the production mechanism? Factorization picture may brake down.
  - Most likely non-perturbative/non-linear interactions responsible for $c\bar{c}$ production.
  - What studies may provide insight into this process?

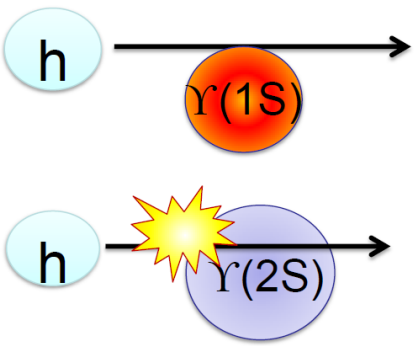




- Can we study comover interactions of quarkonium-h in p+p?
  - Ratios of quarkonium $nS/1S$ states
  - Multiplicities should be high enough at LHC as high-N_{ch} p+p collisions approach A+A

Comover interactions

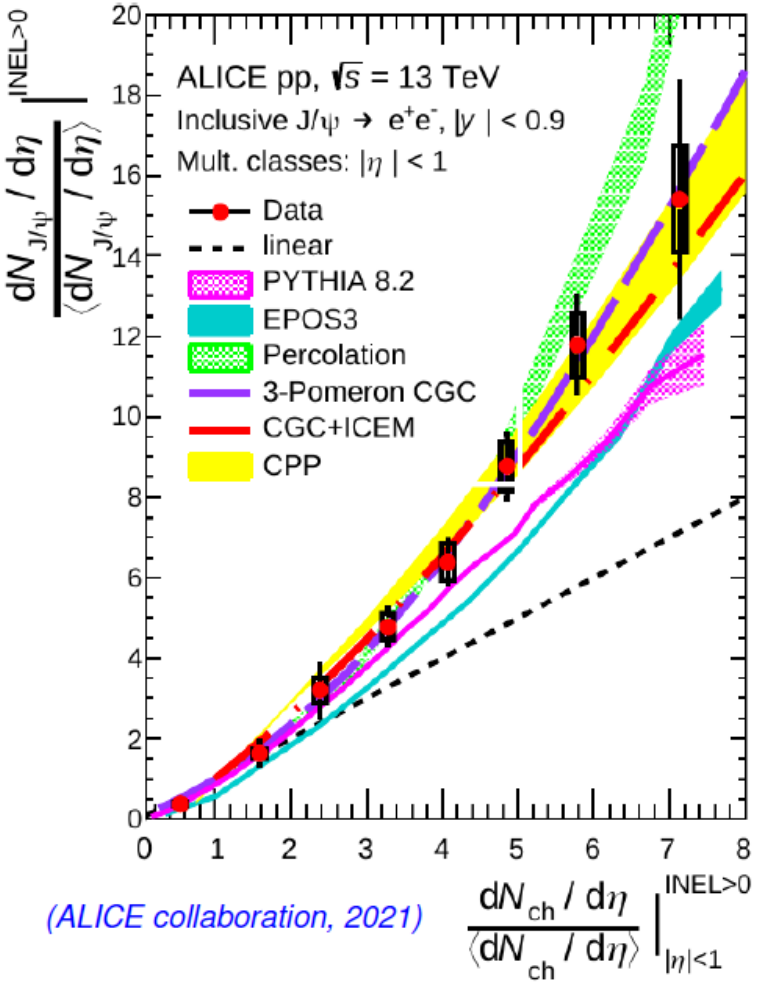




- Excited states have larger radii than 1S
  - Larger quarkonium-h cross section
- $J/\psi - h$ femtoscopic correlations: *[Eur. Phys. J. C 81, 305 (2021)]*

Multiplicity dependence - saturation or hydro?

- Seems that similar effect (reduced N_{ch}) can be either due to hydro evolution or parton saturation
- "Nevertheless, hydro evolution of the core reduces the charged particles multiplicity, because part of the energy goes into flow instead of particle production." - [J. Jahan, Quarkonia as Tools 2022]
- Heavy flavors $\propto N_{MPI}$ - unaffected by hydro evolution, due to flavor conservation.
- $N_{ch} \neq A \cdot N_{MPI}, N_{pom}$ - hydro evolution or parton saturation breaks the proportionality
- $N_{ch} \propto$ energy density
- How can we test which mechanism is responsible for the observed normalized multiplicity dependence of heavy flavor production?
- Can it be combination of both?



(ALICE collaboration, 2021)