Nuclear modification of bottomonium states at 2.76 and 5.02 TeV from CMS

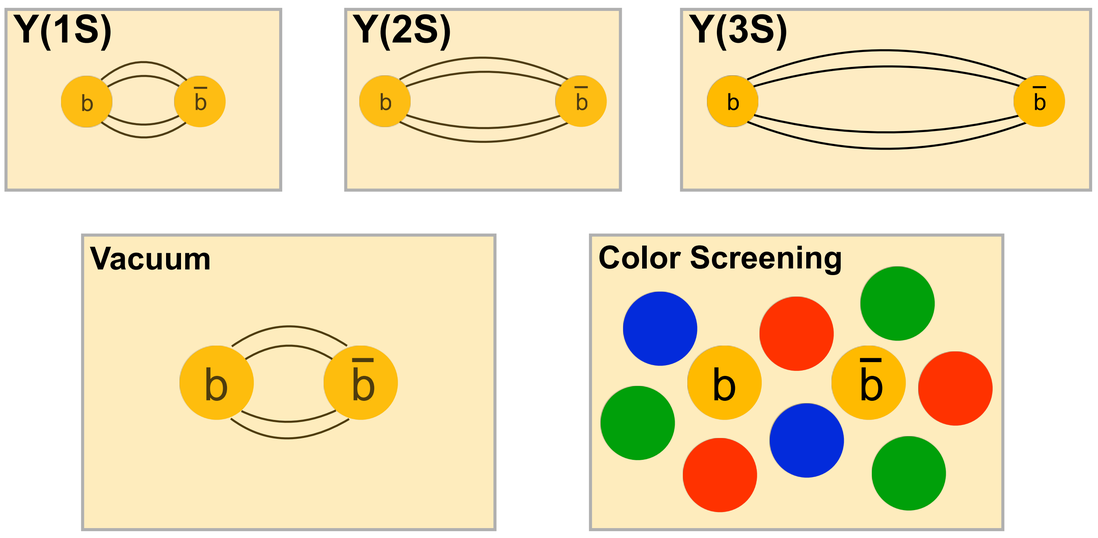
JaeBeom Park, Korea University
on behalf of the CMS Collaboration

Motivation

Bottomonia

- Important and clean probe for investigation of quarkonia melting in Heavy Ion Collisions
- Produced at early stage of collisions by hard scattering : experience the whole evolution of the medium
- Sequential Melting [1]
  - Debye Screening
  - Role as a thermometer

State	Y(1S)	Y(2S)	Y(3S)
m (GeV/c^2)	9.46	10.02	10.36
r_0 (fm)	0.28	0.56	0.78



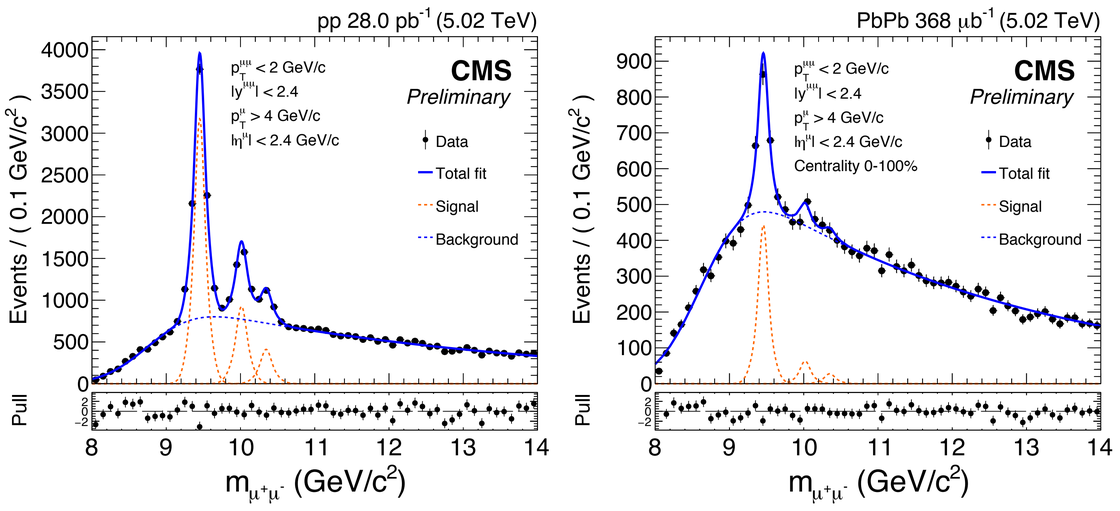
Signal Extraction

Bottomonium acceptance

- Single muon cut : $|\eta| < 2.4$, $p_T > 4$ GeV/c
- Y(1S) pdg mass near 9.46 GeV/c^2 : single muon cut $p_T > 4$ GeV/c still allows Upsilon measurement down to $p_T = 0$ GeV/c

Invariant mass

- Excellent momentum resolution
  - Clear separation of three states
- No clear Y(3S) peak observed in PbPb collisions for the given statistics

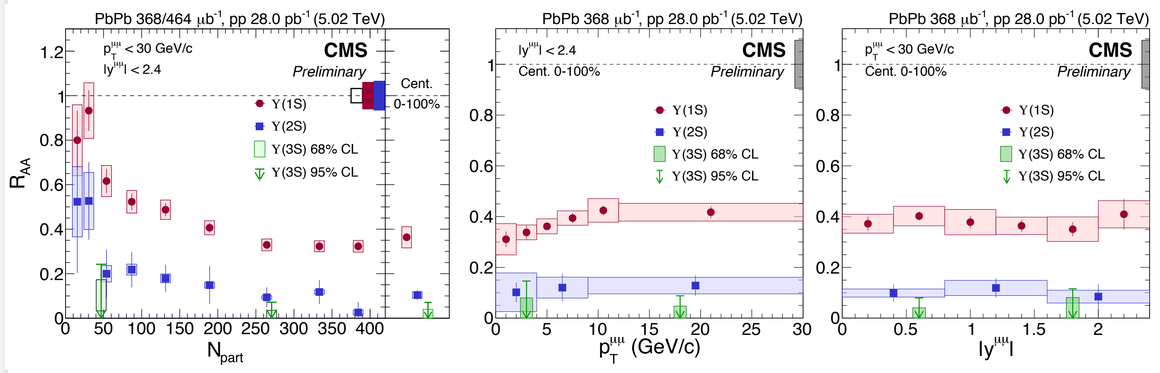


RAA

Nuclear Modification Factor

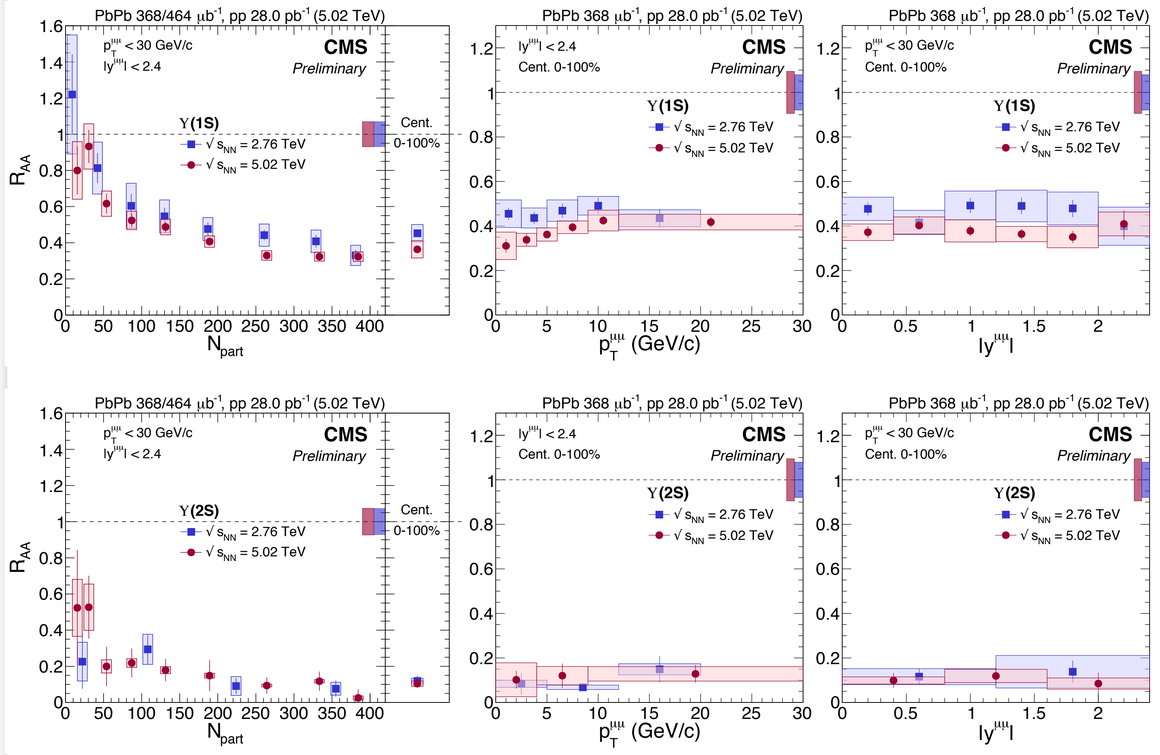
$$R_{AA} = \frac{L_{pp}}{T_{AA} N_{MB}} \frac{N_{PbPb}}{N_{pp}} \frac{\varepsilon_{pp}}{\varepsilon_{PbPb}}$$

- R_{AA} measured as a function of centrality, p_T and rapidity
- Large suppression for the excited state
  - Upper limit set for Y(3S)
    - Employ Feldman-Cousins (FC) method for 68% and 95% C.L.
  - Sequential melting observed because of Debye screening in order of binding energy
- Y(3S) strongly suppressed in all kinematic ranges
- No rapidity dependence, turn-on hint for p_T dependent R_{AA} for Y(1S)



RAA : 2.76TeV vs 5.02TeV

	$\sqrt{s_{NN}}$ = 2.76 TeV	$\sqrt{s_{NN}}$ = 5.02 TeV
pp	L_{int} = 5.4 pb^{-1}	L_{int} = 28 pb^{-1}
PbPb	L_{int} = 166 ub^{-1}	L_{int} = 368 ub^{-1}



- Centrality-integrated R_{AA} values for Y(3S) :
  - R_{AA}(Y(3S)) < 0.145 (95% C.L. at **2.76 TeV**)
  - R_{AA}(Y(3S)) < 0.071 (95% C.L. at **5.02 TeV**)
- Sequential melting of Y(1S), Y(2S) and Y(3S) in both collision systems

Reference

[1] H. Satz. NPA 783 (2007) 249c [2] HIN-16-023