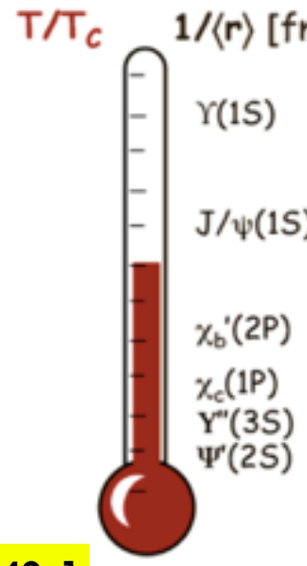
Measurement of bottomonia states in pp, pPb and PbPb collisions from CMS.

JaeBeom Park, Korea University
on behalf of the CMS Collaboration

Motivation

- **Quarkonium : One of the cleanest probe of deconfinement in Heavy Ion Collision**

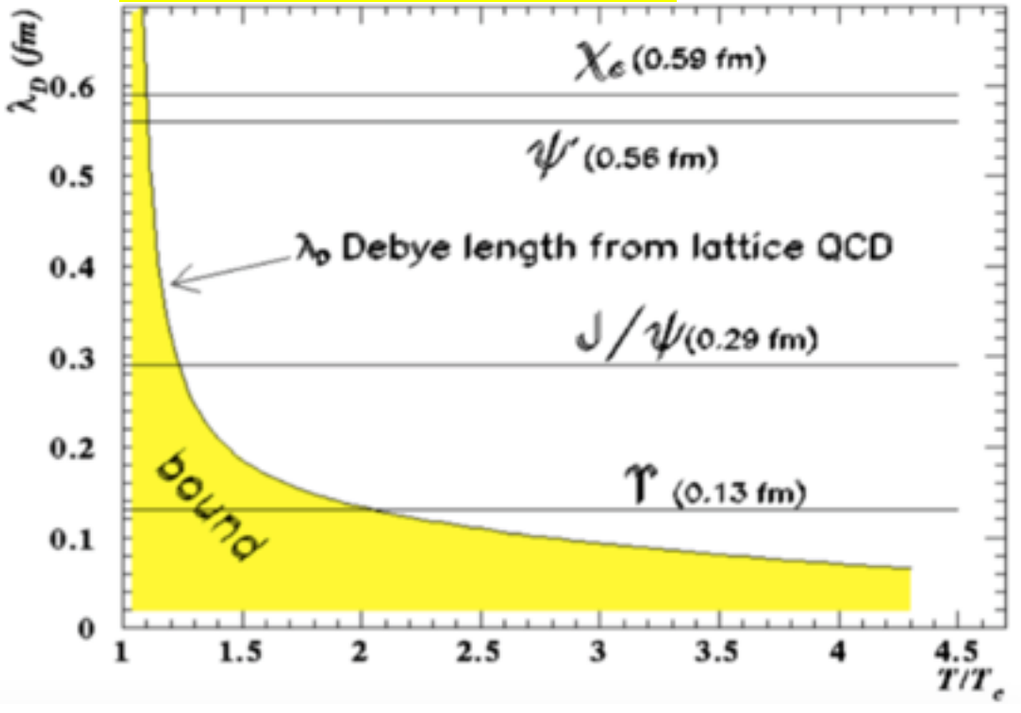
  - Produced by hard scattering early in the collision
  - Expected to be suppressed following the sequential pattern
  - Role as a thermometer



State	J/ψ (1S)	χ_c (1P)	ψ' (2S)
m (GeV/c^2)	3.10	3.53	3.68
r_0 (fm)	0.50	0.72	0.90

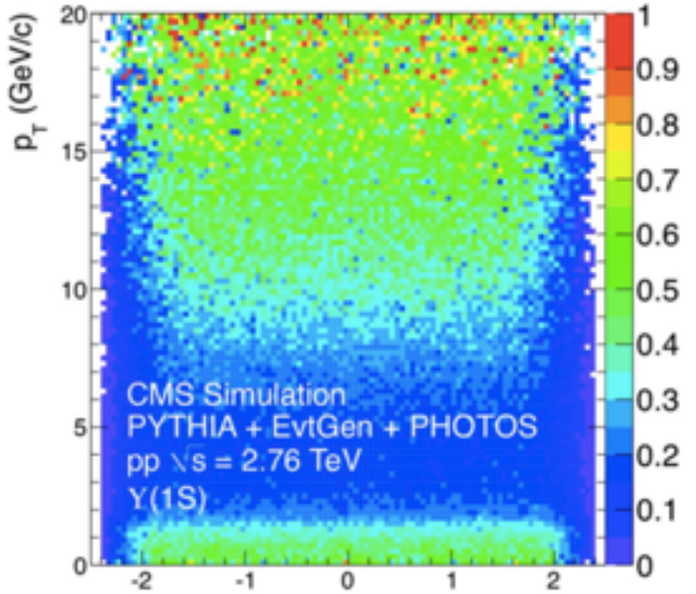
Υ (1S)	χ_b (1P)	Υ' (2S)	χ_b' (2P)	Υ'' (3S)
9.46	9.99	10.02	10.26	10.36
0.28	0.44	0.56	0.68	0.78

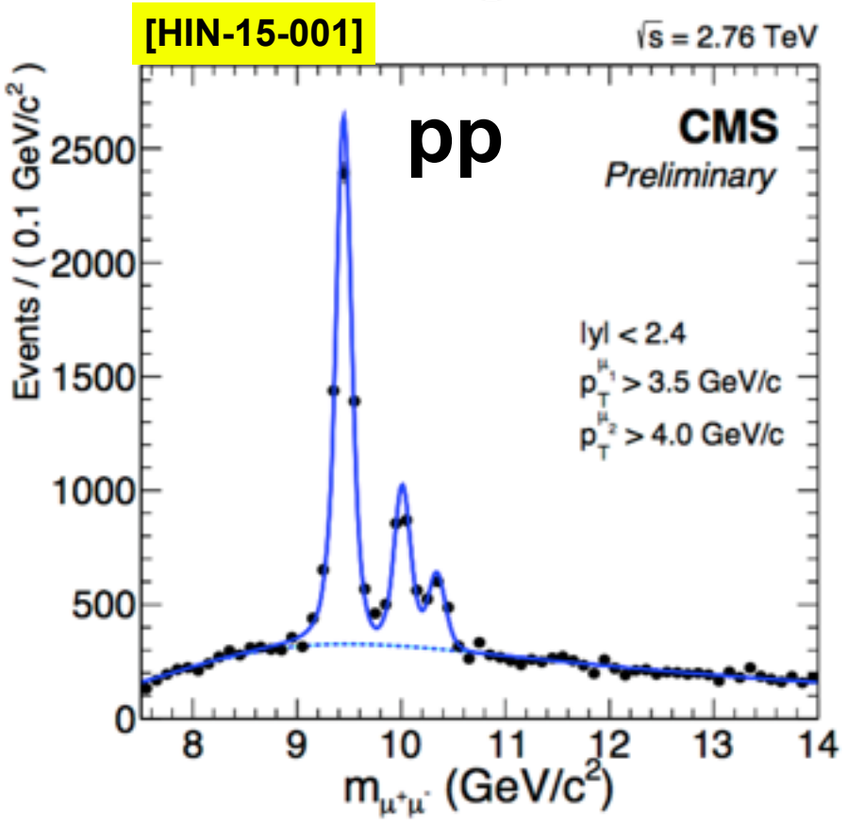
[H. Satz. NPA 783 (2007) 249c]

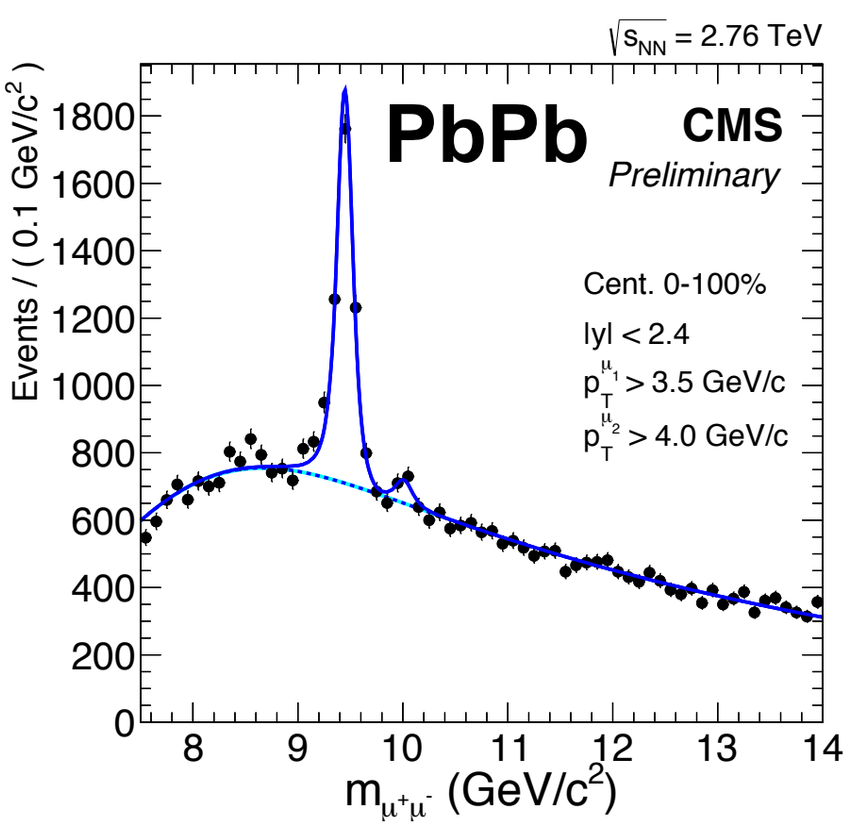


Acceptance and Signal extraction

- **Single Muon Cut : $|\eta|<2.4$, $p_{T_1} > 3.5$ GeV/c & $p_{T_2} > 4$ GeV/c**
- **Upsilons measurement down to $p_T = 0$ GeV/c**
- **No clear Y(3S) peak observed in PbPb collisions for the given statistics**



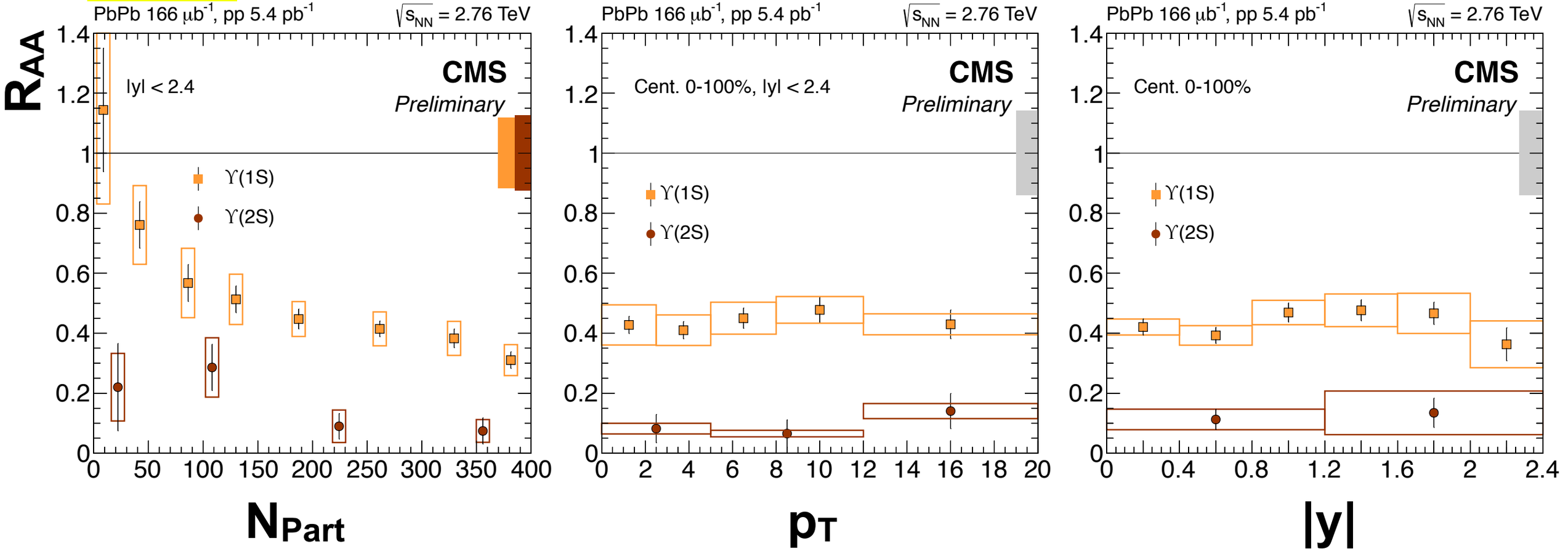




Results

- **Nuclear Modification Factor**
  - $R_{AA}(1S) = 0.454 \pm 0.0141 \pm 0.0288$
  - $R_{AA}(2S) = 0.119 \pm 0.029 \pm 0.008$
  - Sequential and strong suppression in Y states
  - No p_T and rapidity dependence

[HIN-15-001]



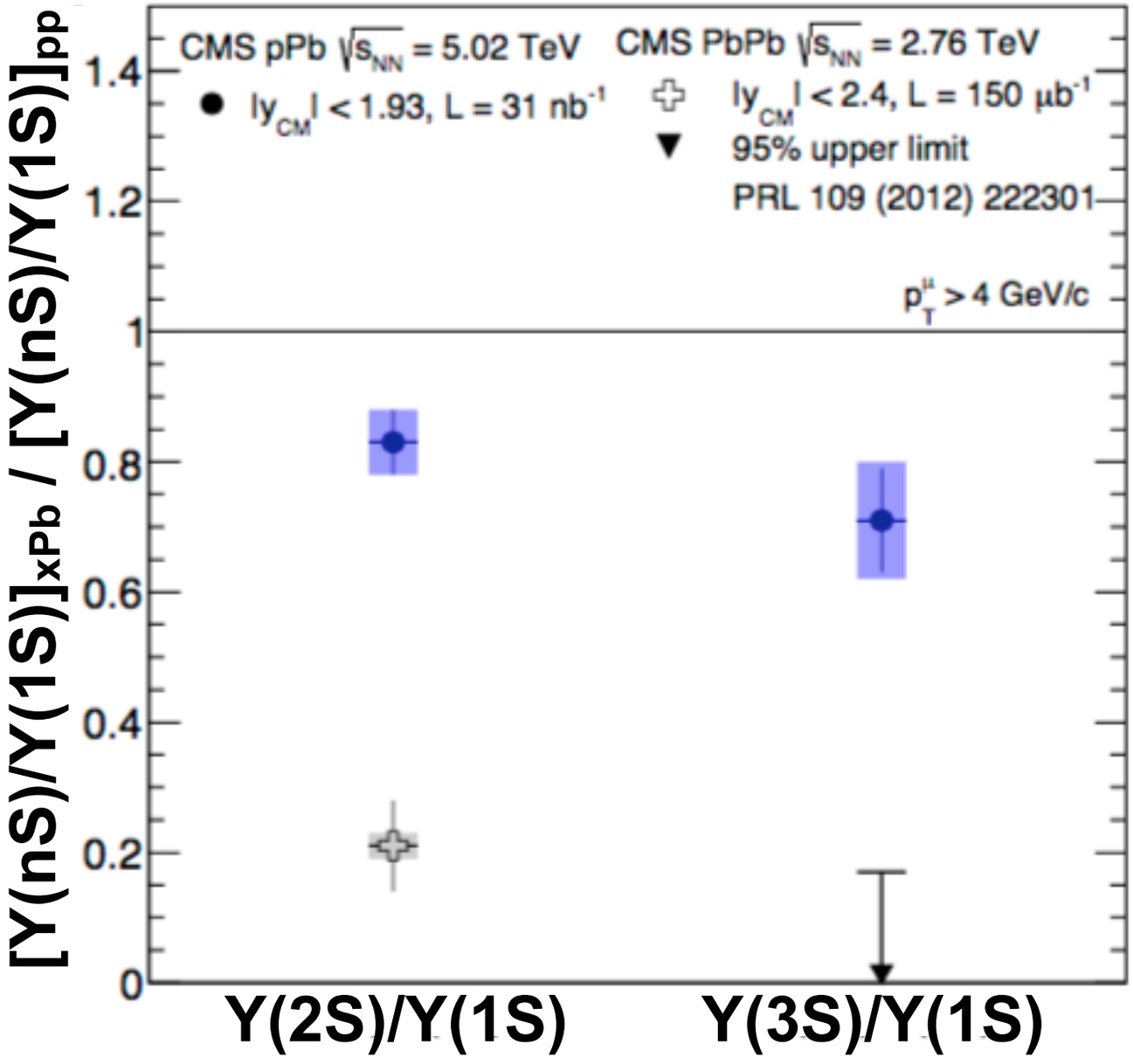
Results

- **Double Ratio**
  - Ratio of the R_{AA} in 2S and 3S

- Suppression in pPb :
  - ✦ Cold nuclear matter effect

- More suppression in PbPb :
  - ✦ Hot nuclear matter effect

[JHEP 04 2014:103]



Summary

- **Bottomonia states measured in pp, pPb and PbPb collisions**
- **Suppression found in pPb and more suppression found in PbPb collisions with observation of sequential melting in Y states**
- **Looking forward to the measurement on the double ratio and nuclear modification factor with more data at higher energy from RUN2**

Run1 (2.76 TeV)	**Run2 (5.02 TeV)**
2013 pp : L_{int} : 5.4 pb^{-1}	2015 pp : L_{int} : 26 pb^{-1}
2011 PbPb : L_{int} : 166 μb^{-1}	2015 PbPb : L_{int} : 346 μb^{-1}