Overview of progress

Yongsun Kim
Korea University Group meeting

16-May-16

Upilron double Ratio

- Pre-approved!
- HIN-16-008

- ***Paper*** for SQM June 27-July

- Signal extration (Jaebeom, UC Davis)
- Y(3S) upper limit (UC Davis)
- Systematics (Yongsun)
- MC reweighting, AN review (Songkyo)
- PAS (Manuel, Chad, Yongsun)

Abstract

We report ratios of Υ meson production in PbPb and pp collisions at $\sqrt{s_{NN}} = 5.02$ TeV using the CMS detector. The analysis is based on data samples with integrated luminosities of 26 pb^{-1} for pp collisions, of 467 μb^{-1} for peripheral 30-80% PbPb collisions, and of 345 μb^{-1} for 0-30% central PbPb collisions taken in the 2015 heavy-ion run at the LHC. We reconstruct the Υ mesons via their decay $\Upsilon \to \mu^+\mu^-$. We study the ratios of yields, comparing the excited states, Υ(2S) and Υ(3S), to the ground state Υ(1S) yields in both pp and PbPb collisions. We report on the double ratios, $(\Upsilon(2S)/\Upsilon(1S))_{\text{PbPb}}/(\Upsilon(2S)/\Upsilon(1S))_{pp}$, which quantify the relative modification of the excited states compared to the nuclear modification of the ground state. The double ratio for the Υ(2S) shows relative suppression at all centralities except for the most peripheral bins. The Υ(2S) double ratio does not vary significantly with transverse momentum or rapidity. In the case of the Υ(3S), we report upper limits on the Υ(3S) double ratio as a function of centrality, as we do not observe a statistically significant signal of Υ(3S) in PbPb at any centrality, indicating a very strong suppression of the Υ(3S) in heavy-ion collisions.

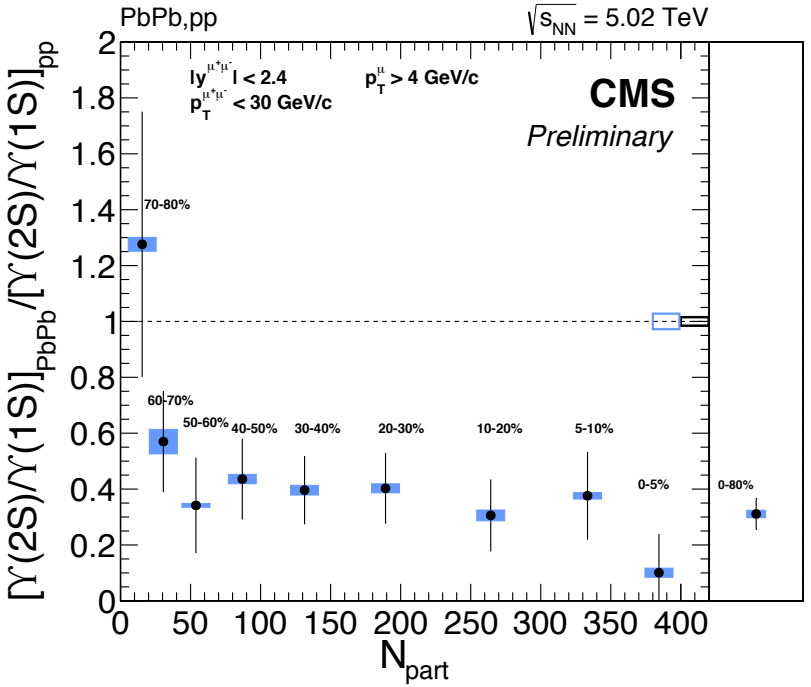
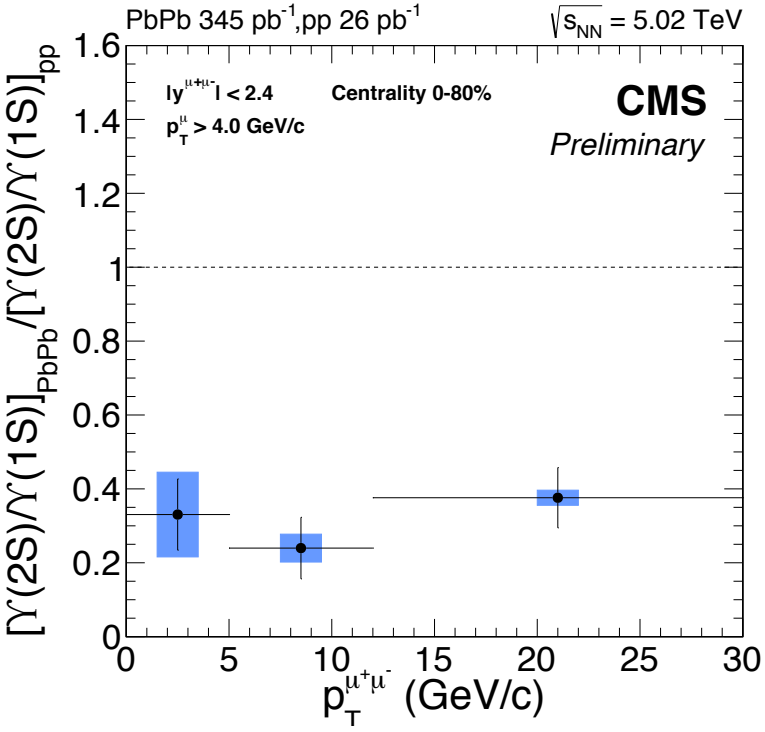


Figure 2


PbPb 345 pb-1,pp 26 pb-1
√sNN = 5.02 TeV
|yμ+μ-| < 2.4
pμT > 4.0 GeV/c
Centrality 0-80%
CMS
Preliminary
[Υ(2S)/Υ(1S)]PbPb/[Υ(2S)/Υ(1S)]pp
pμ+μ-T (GeV/c)

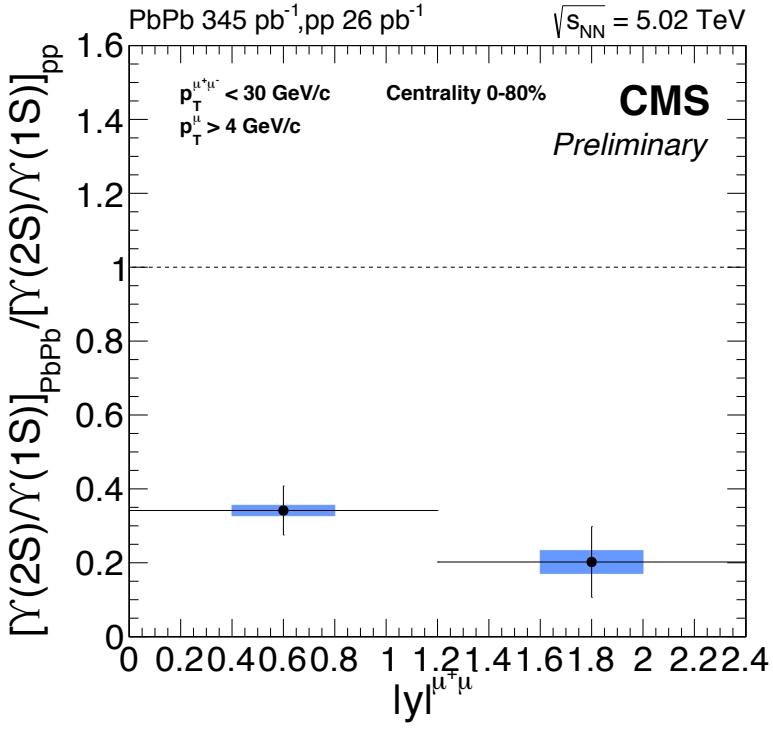

PbPb 345 pb-1,pp 26 pb-1
√sNN = 5.02 TeV
pμ+μ-T < 30 GeV/c
pμT > 4 GeV/c
Centrality 0-80%
CMS
Preliminary
[Υ(2S)/Υ(1S)]PbPb/[Υ(2S)/Υ(1S)]pp
|yμ+μ-|

Figure 3

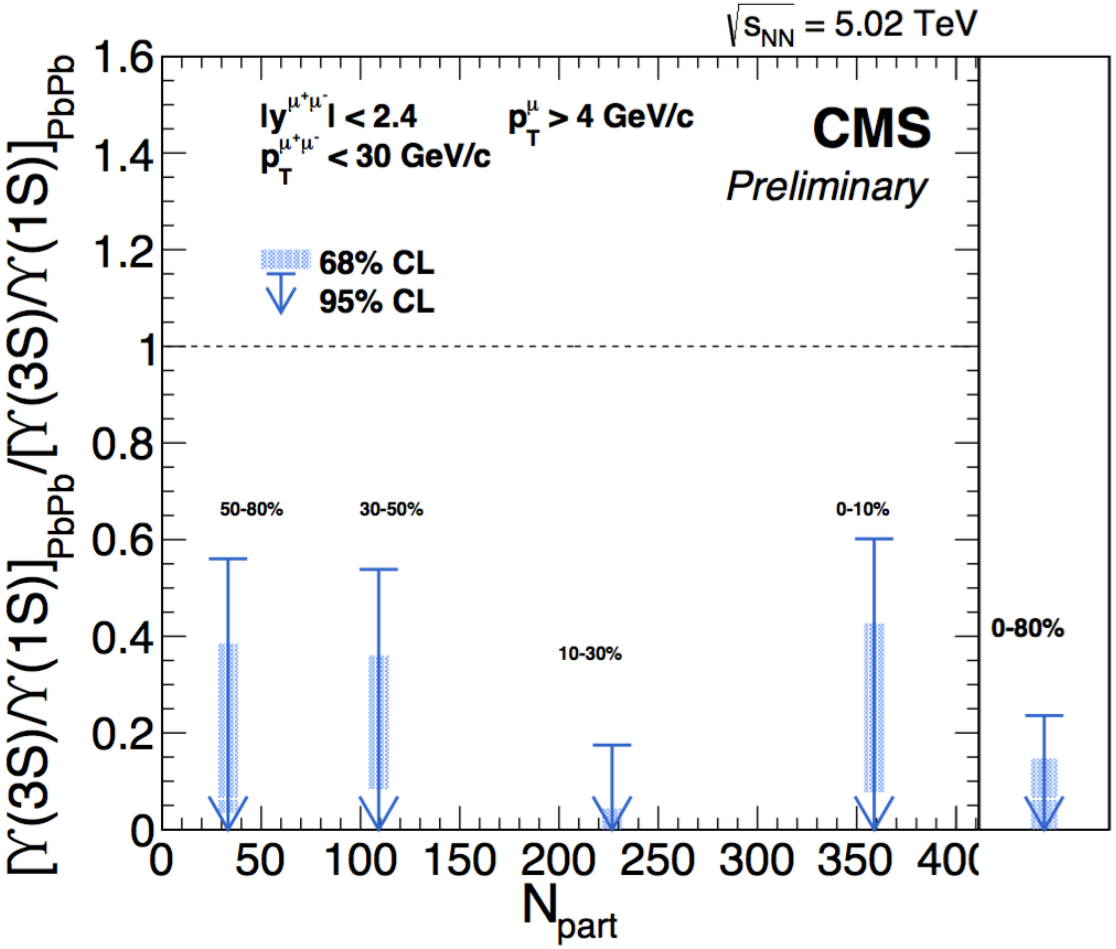
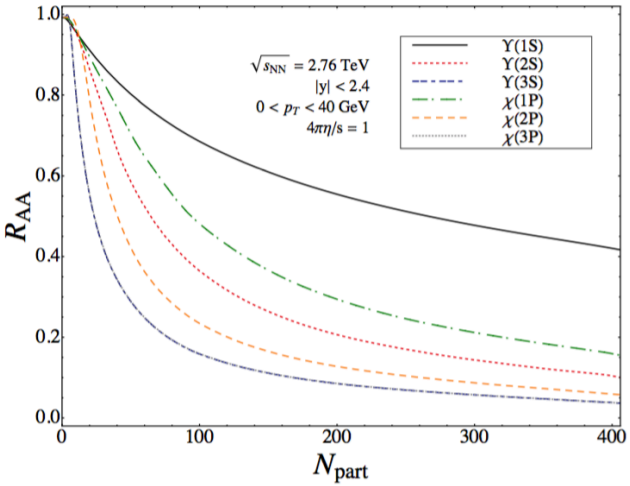
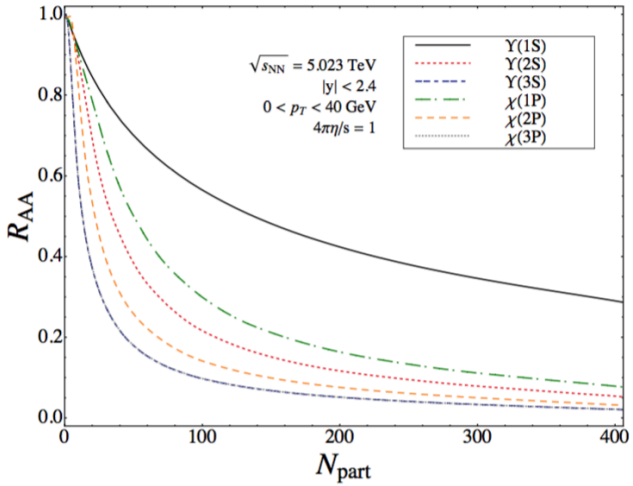
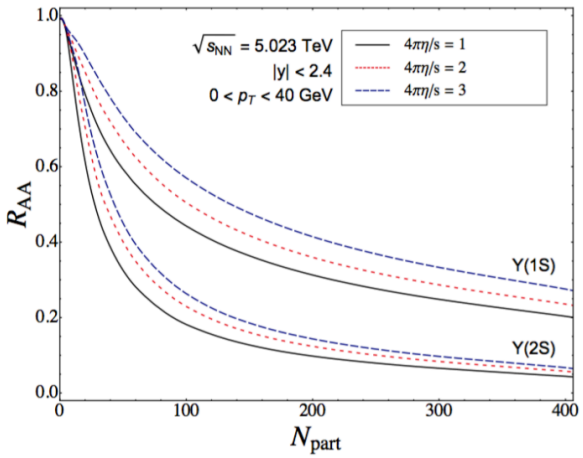


Figure 5: Upper limits of the Double Ratio of Y(3S) as a function of Centrality.

Upsilon decay model







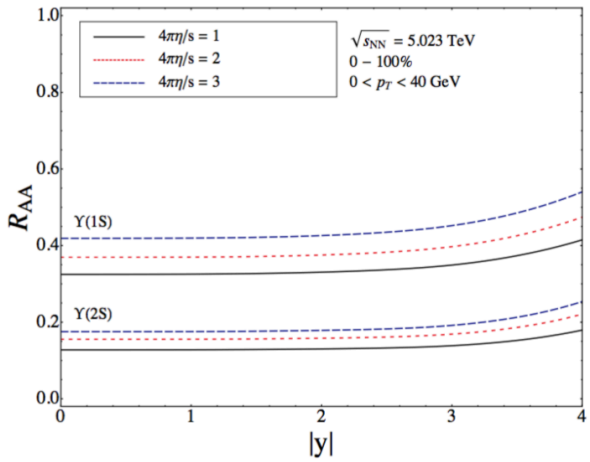


FIG. 5. (Color online) Predictions for inclusive $\Upsilon(1S)$ and $\Upsilon(2S)$ suppression for $\sqrt{s_{NN}} = 5.023$ TeV Pb-Pb collisions.

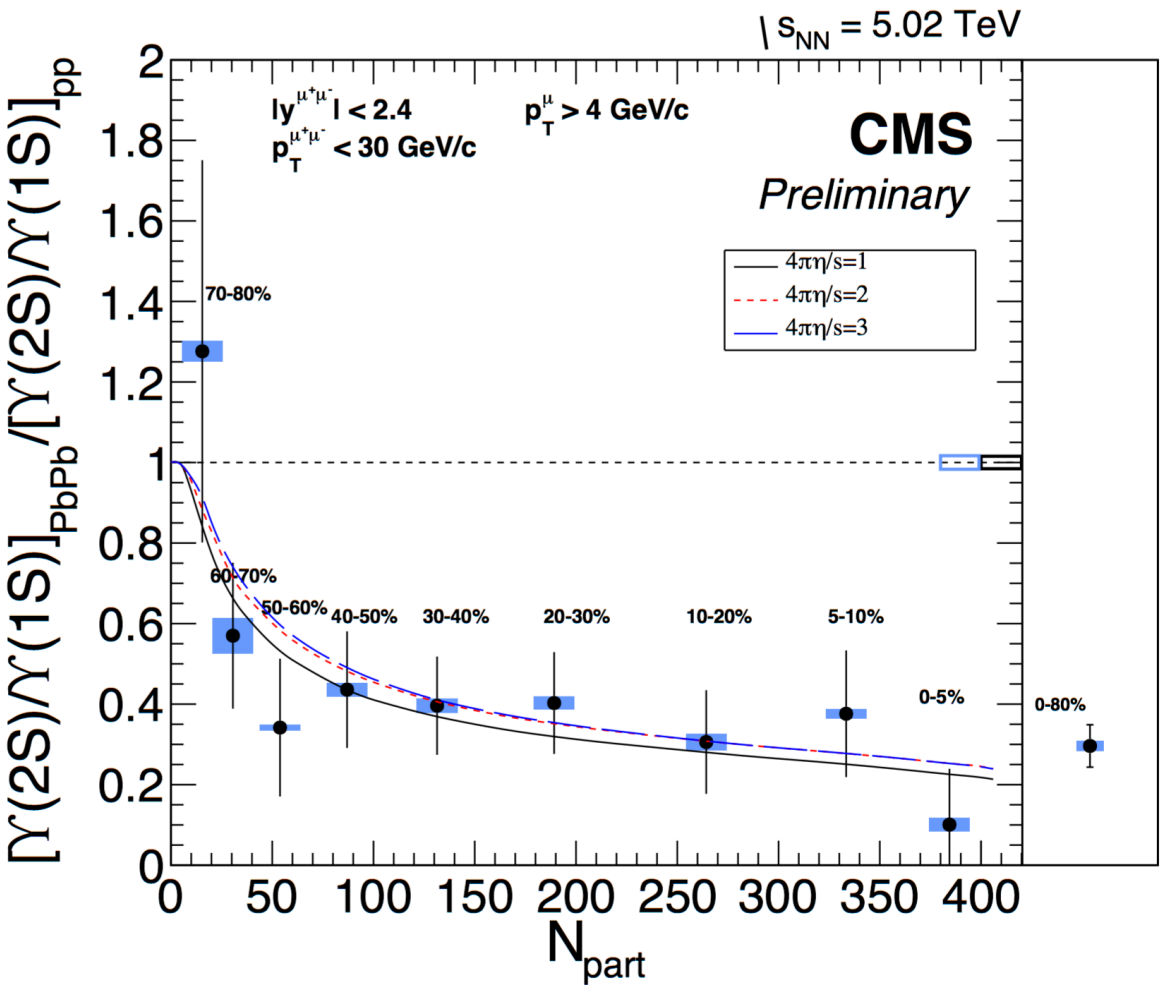
FIG. 7. (Color online) Predictions for inclusive $\Upsilon(1S)$ and $\Upsilon(2S)$ suppression for $\sqrt{s_{NN}} = 5.023$ TeV Pb-Pb collisions.

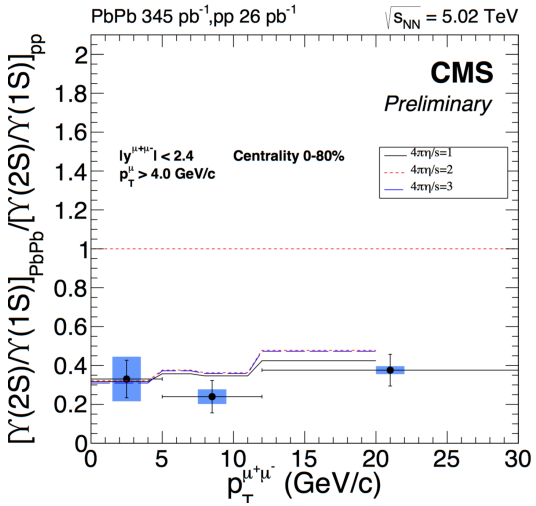
Primodial R_{AA}

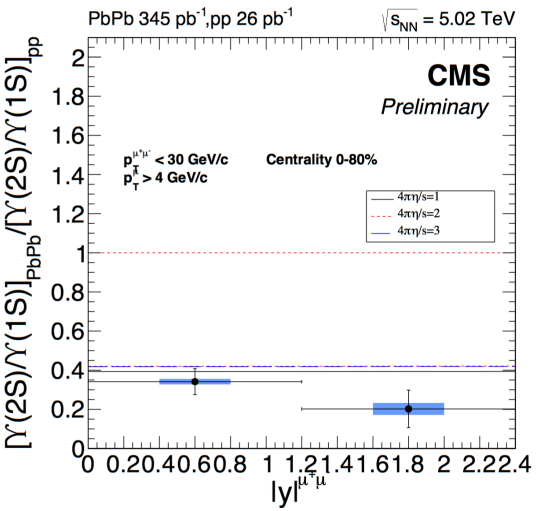
Post feeddown R_{AA}

Arxiv1605.03561
Krouppa, Strickland

Upsilon decay model

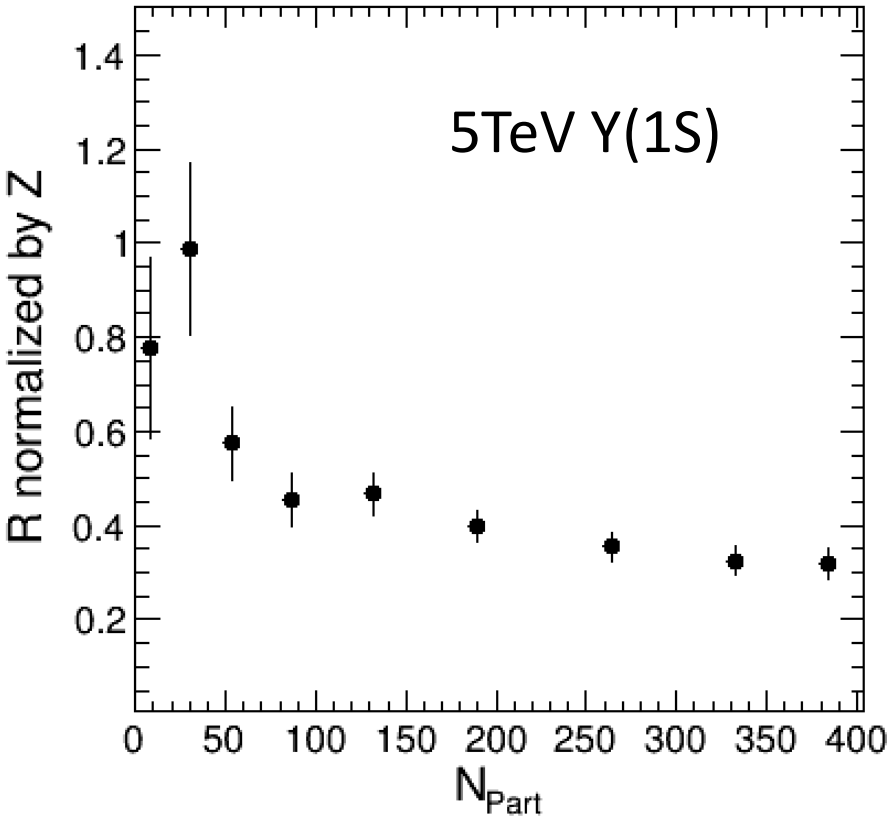


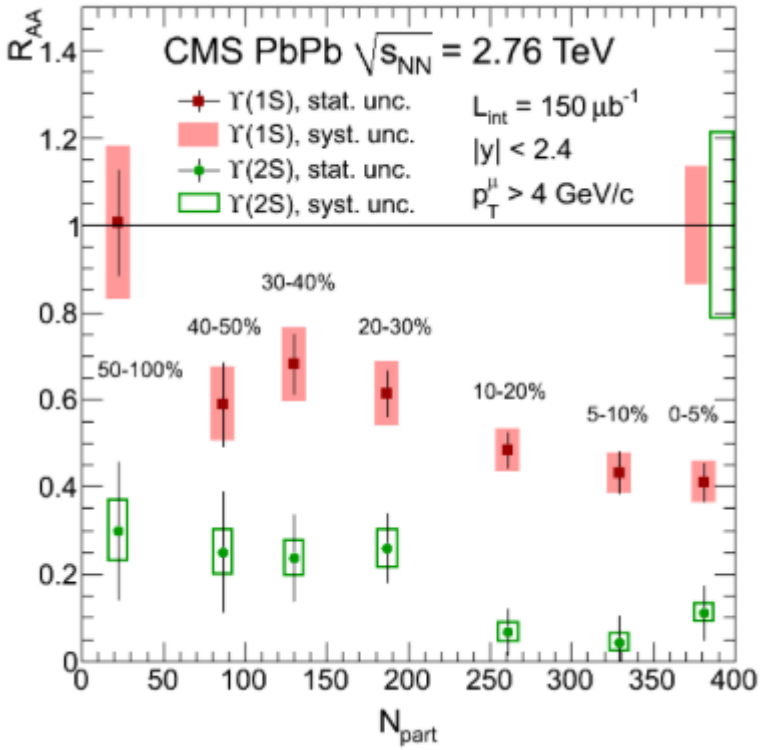




Upsilon R_{AA}

Aiming for HardProbe16 Sept. 22nd, Wuhan
Will request for Cadi entry as soon as DoubleRatio is approved





Upsilon R_{AA}

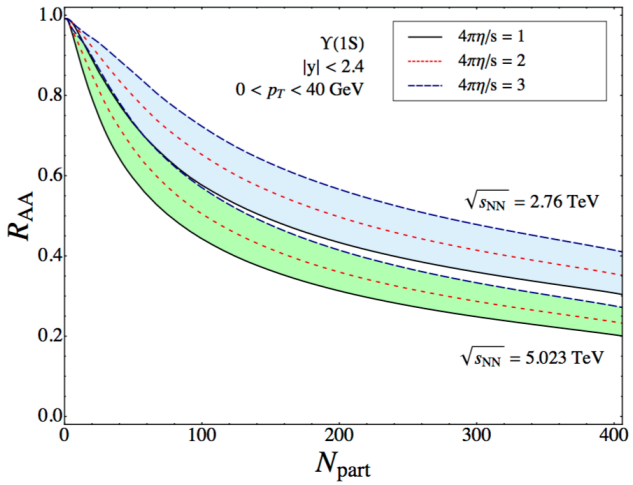
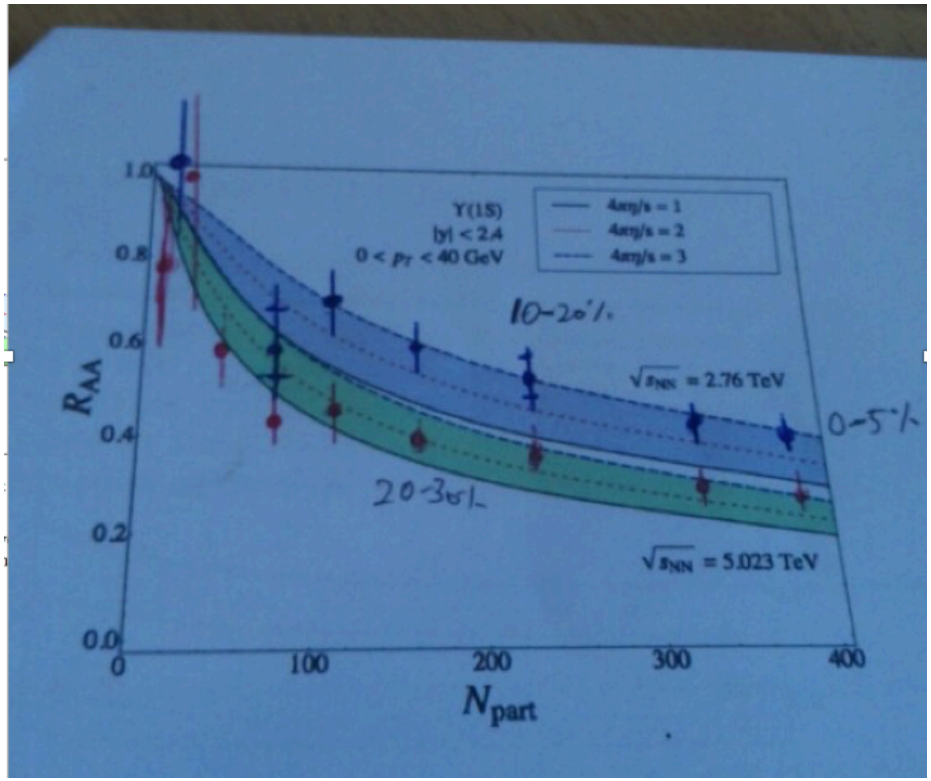


FIG. 2. (Color online) Inclusive $\Upsilon(1S)$ state calculated with feed down contributions from excited states. Here we show a comparison between $\sqrt{s_{NN}} = 2.76$ TeV and $\sqrt{s_{NN}} = 5.023$ TeV collision energies.

Arxiv1605.03561
Krouppa, Strickland



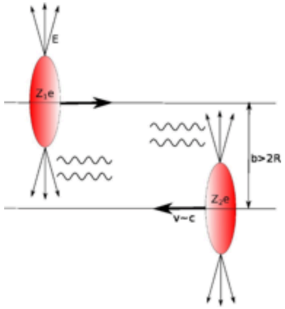
UPC analysis

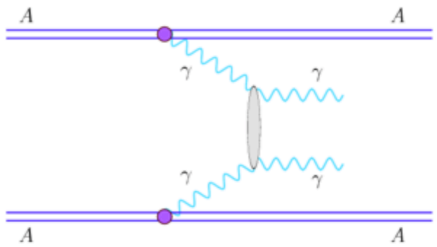
UPC analysis status with CMS

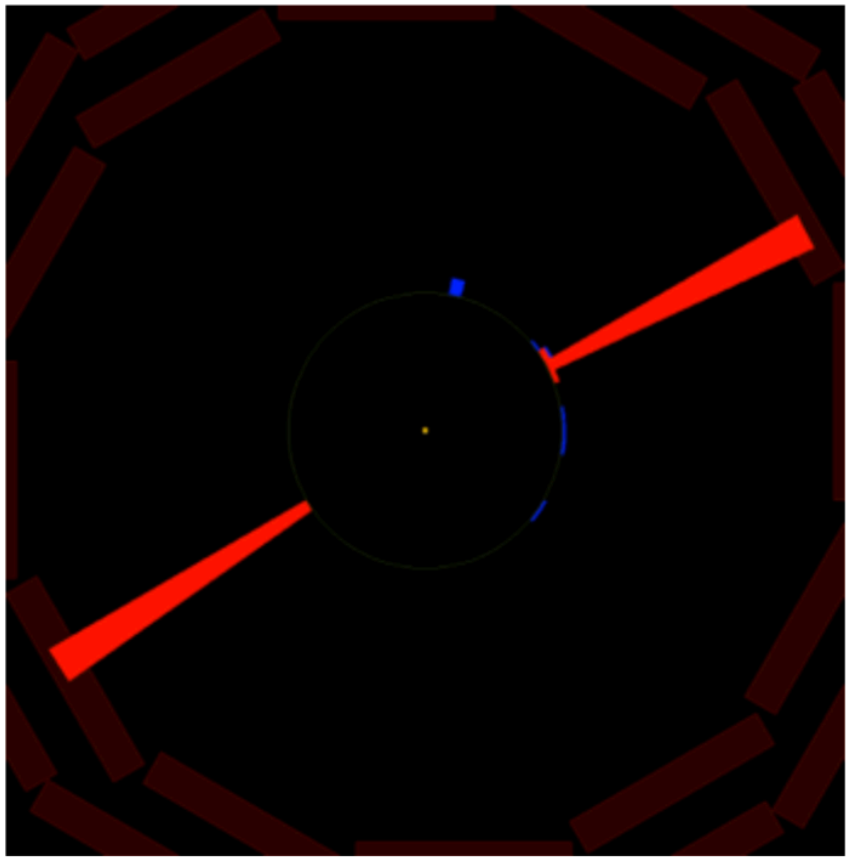
- Two UPC analyses with high-priority ongoing. We request the corresponding CADI entries. The AN will be updated next week
  - **AN-2016/153:** UPC di-photons in Pb-Pb (**Beomgon Kim**, Yongsun Kim, Samuel Boren, DTT) **Main result:** *First observation of UPC di-photons and observation of an excess not consistent with light-by-light scattering. Currently doing event visualization to reject more non-UPC background. Comments from the CMS Exotica group will be beneficial (Axion-like particles?)*
  - **AN-16-083.** Exclusive Rho0 analysis in p-Pb (**Sasha Bylinkin**, DTT). **Main result:** *dSigma/dt for two gamma-proton bins. Possible change of power-law slope at high t as a possible hint of gluon saturation.* **Target conference:** Hard Probes. We are aiming for pre-approval in a couple of weeks
- *We are in tough competition with ATLAS and ALICE on these results!*

Di-photon invariant mass

- The events have exactly 2 photons.
- Ecal noise masking applied.
- $|\eta| < 1.444$
- HFplus < 5 GeV & HFminus < 5 GeV
- $\Delta\phi > 2$
- No jets





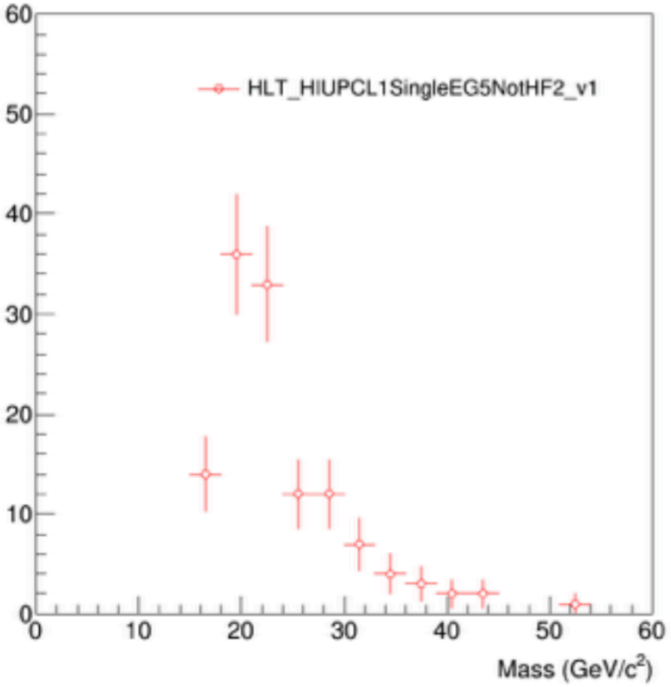


Di-photon invariant mass

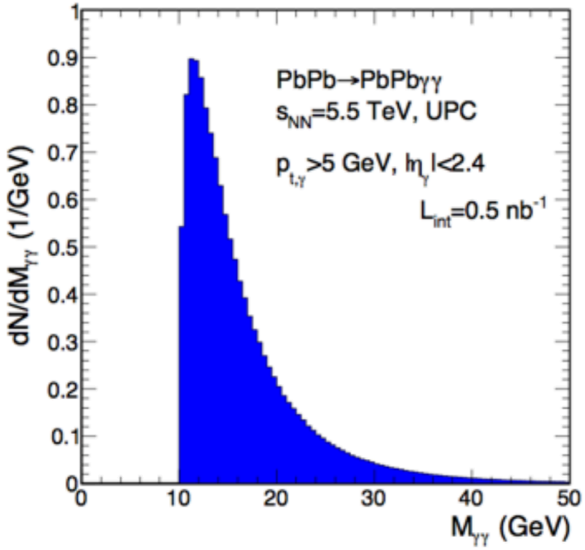
We observe a clear excess of UPC di-photons and it does not appear to be consistent with the light-by-light scattering.

It is well accepted that the light-by-light calculation is very precise

Currently doing event visualization of every event!



Phys. Rev. C 93 (2016) 044907



Let me reserve the delight until the full subtraction of backgrounds!

ISMD talk and posters

- 김용선 Overview of the recent jet results from LHC in heavy ion collisions

- 이기수 poster
  - A. Preliminary result of B meson R_{AA} ➔ Need Cadi approval
  - B. Extraction of B meson in 5TeV ➔ Performance approval

- 이송교 poster
  - R_{pA} of J/psi in 5TeV ➔*Need re-approval of PbPb and approval of pp*

- 고연주 poster
  - A. Gamma-jet correlation in 5TeV ➔ *No clear when it will be approved*
  - B. Purity masurement of photons in PbPb at 5TeV ➔ *more feasible*

- 김범곤 poster
  - Photo—photon scattering in UPC at 5TeV ➔ *Tight schedule, but large support from Daniel*

- 박재범 poster
  - Upsilon Double Ratio

- BACKUP

0-5GeV PbPb bin

53% from Poly4 toy

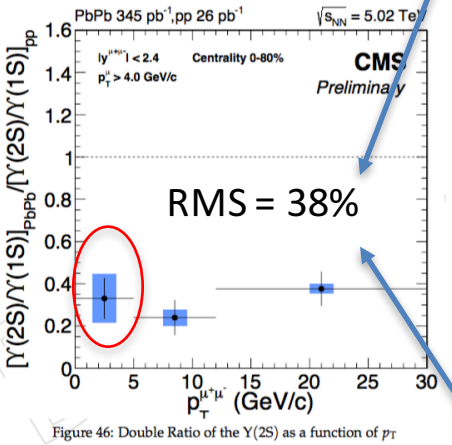
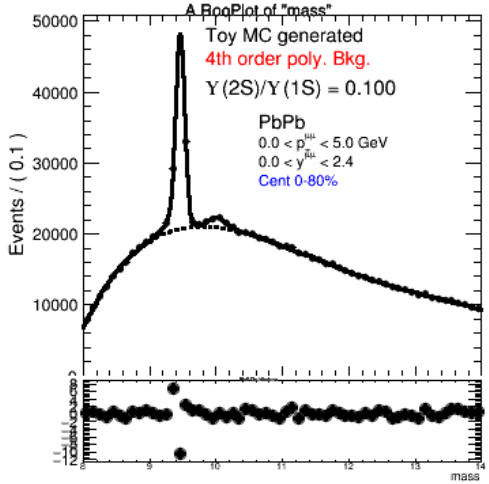
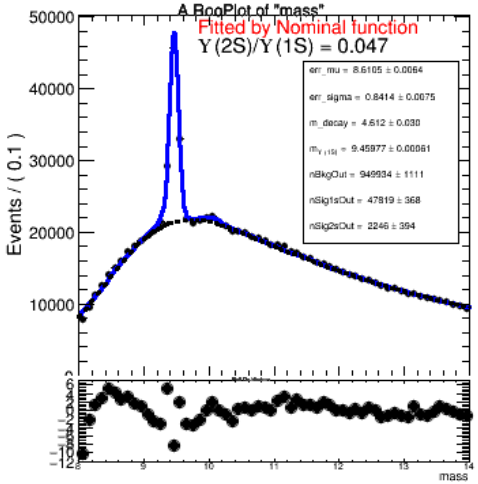
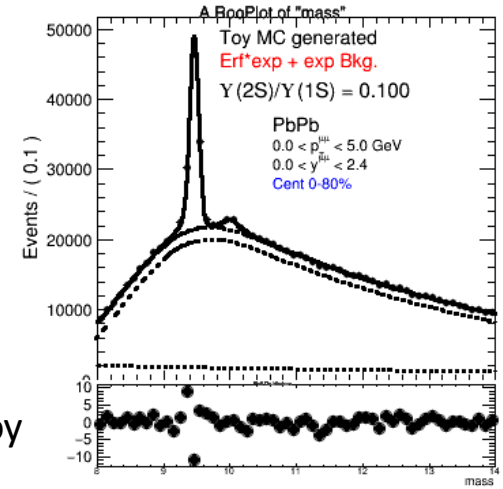


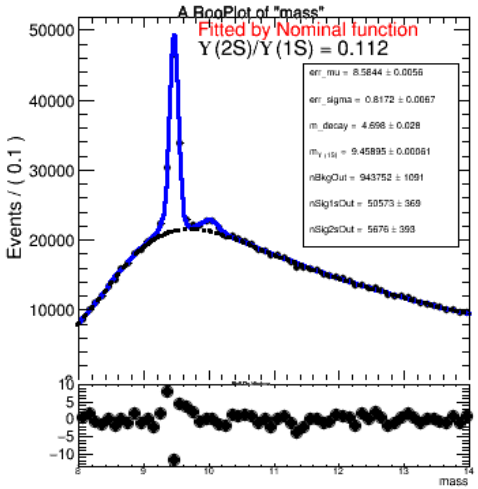
Figure 46: Double Ratio of the Υ(2S) as a function of p_T





12% from Erf + Exp toy





53% seems to be caused by the limitation of the resemblnce of Pol4 and Error*Exp function. This was not resovled by playing with the parameter ranges or initial seeds. I would like to close this issue until pre-approval and/approval and leave this until we get some comments from ARCs