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ψ(2S) Measurement in p+Pb collisions

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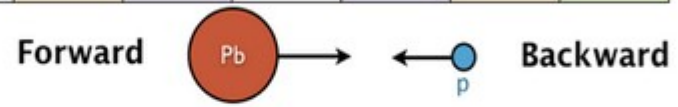
Flash Back: Pb+p Run in CMS

1. Run 210498–211256 (18/nb)

Ref. system	Pb+p	symmetric bins in CM					
LAB		-2.4	-1.47	-0.47	0.53	1.47	2.4
COLLISION (CM)		1.93	1	0	-1	-1.93	-2.87

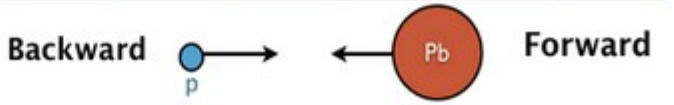
$\eta_{cm} = -(\eta_{lab} + 0.465)$



2. Run 211313–211631 (12/nb)

Ref. system	p+Pb		symmetric bins in CM				
LAB		-2.4	-1.47	-0.53	0.47	1.47	2.4
COLLISION (CM)		-2.87	-1.93	-1	0	1	1.93

$\eta_{cm} = \eta_{lab} - 0.465$



Physics Aim

- To obtain Psi(2S) to J/Psi ratio as a function of rapidity and pT to study the effect of Cold Nuclear Matter Effects on the two Charmonia states.

- We can also obtain Psi(2S) R_{pPb}

Data Used (Based on CMS AN-13-346 (J/psi in p+Pb))

- Mis-aligned 1st 7 runs (210498-): store/caf/user/lamia/merged_pPbData_1st_ntuple_ReprocessedReco-v1_GR_P_V43F_pileupRej_mulD_tot.root
- 1st run Pbp (run 210-) : store/caf/user/lamia/merged_pPbData_1st_ntuple_PromptReco-v1_GR_P_V43D_pileupRej_mulD_tot.root
- 2nd run pPb (run21131-) : /store/caf/user/lamia/merged_pPbData_2nd_ntuple_PromptReco-v1_GR_P_V43D_pileupRej_mulD_tot.root

Bins

$$\eta_{CM} = -(\eta_{lab}^{1st} + 0.465)$$

$$\eta_{CM} = \eta_{lab}^{2nd} - 0.465$$

Y_{CM} = [-1.93,-0.9,0,0.9,1.93]

Y_{Lab}^{I} = [1.47,0.43,-0.47,-1.37,-2.4]

Y_{Lab}^{II} = [-1.47,-0.43,0.47,1.37,2.4]

p_T = [5.0,6.5,10,30]

Fitting Method (Based on CMS AN-12-118 (ψ(2S) in Pb+Pb))

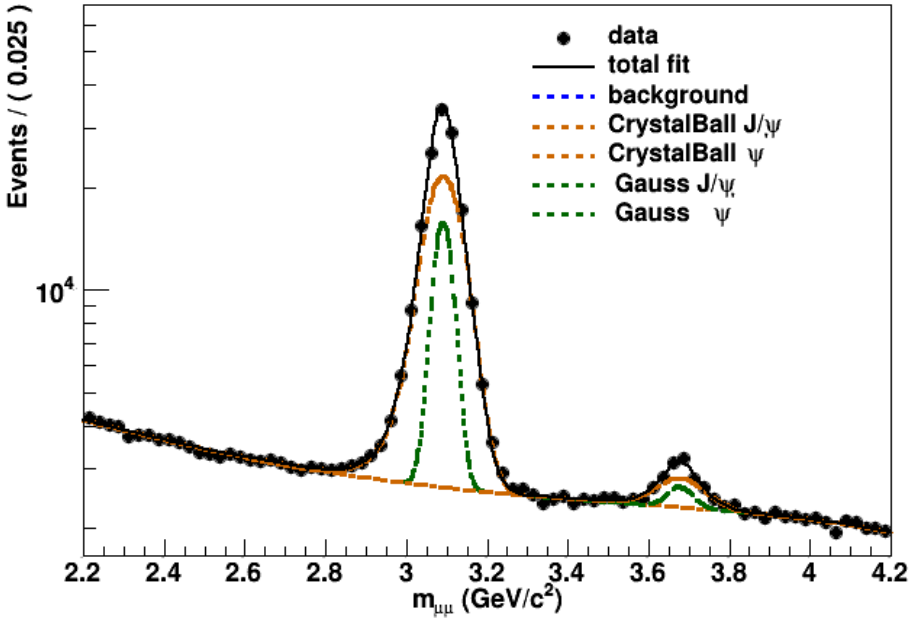
- Unbinned maximum likely hood fitting using rooFit
- Signal Shape :CB + Gaussian for both ψ(1S) and ψ(2S)

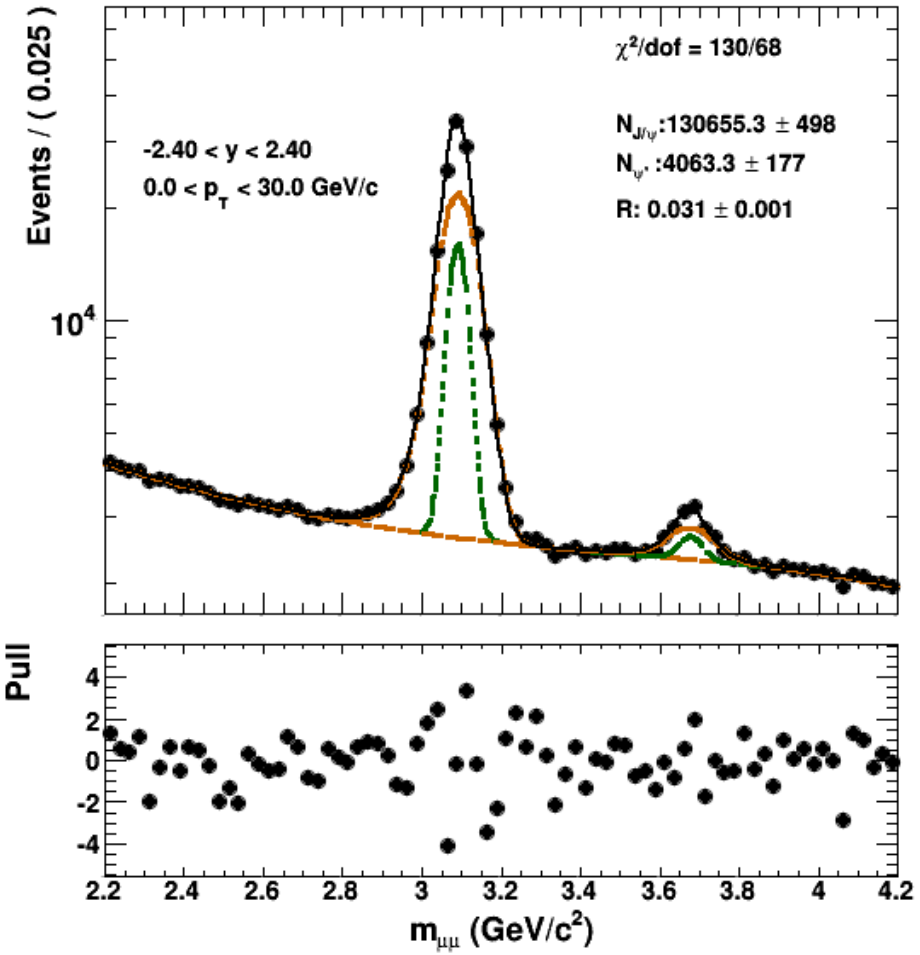
- Background : Chebeychev Polynomial

Single Muon acceptance Cut

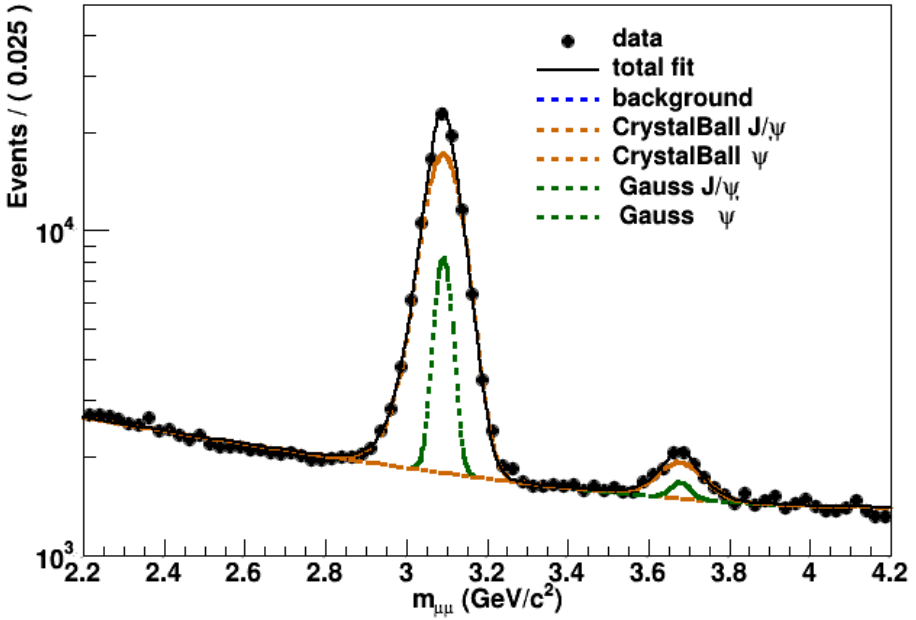
$$
\begin{aligned}
|\eta^{\mu}| < 1.3 &\rightarrow p_{\mathrm{T}}^{\mu} > 3.3 \text{ GeV}/c \\
1.3 < |\eta^{\mu}| < 2.2 &\rightarrow p^{\mu} > 2.9 \text{ GeV}/c \\
2.2 < |\eta^{\mu}| < 2.4 &\rightarrow p_{\mathrm{T}}^{\mu} > 0.8 \text{ GeV}/c
\end{aligned}
$$

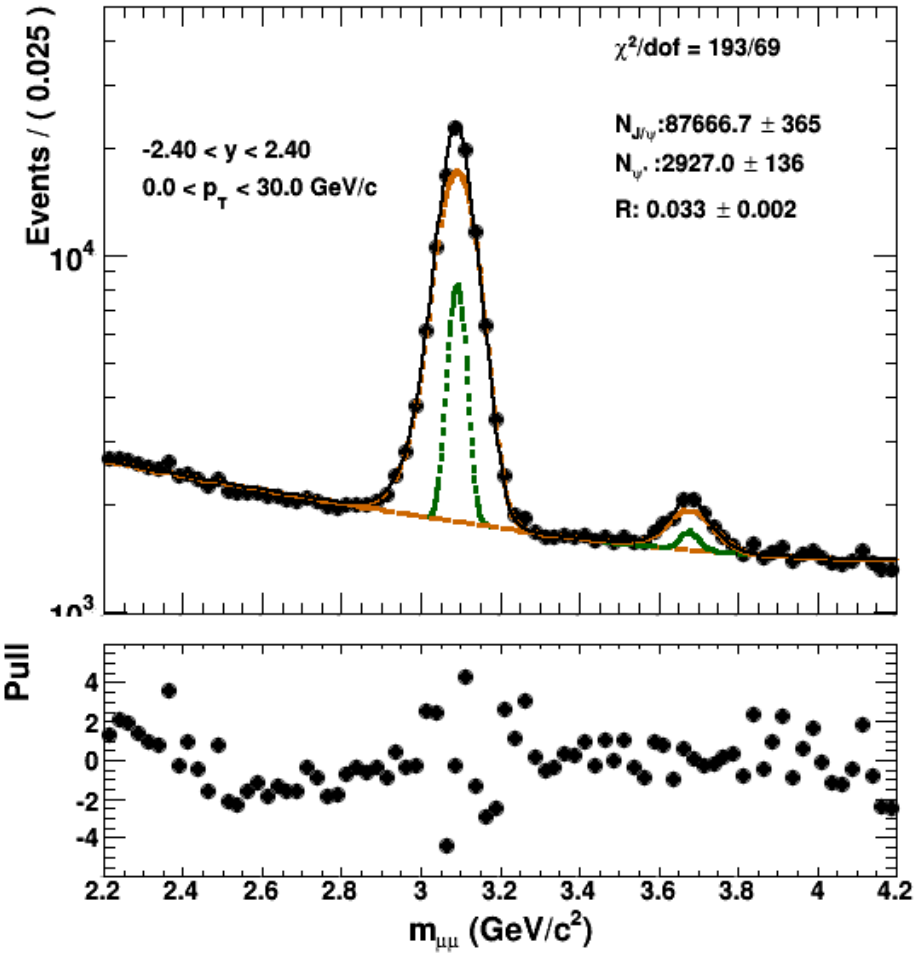
Invariant Mass Plots (Pb+p) Total



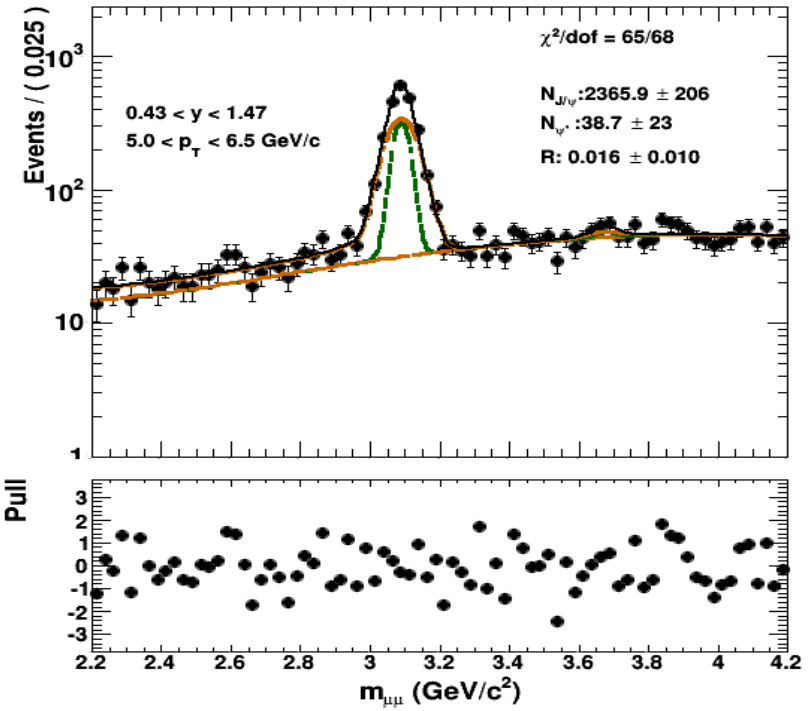


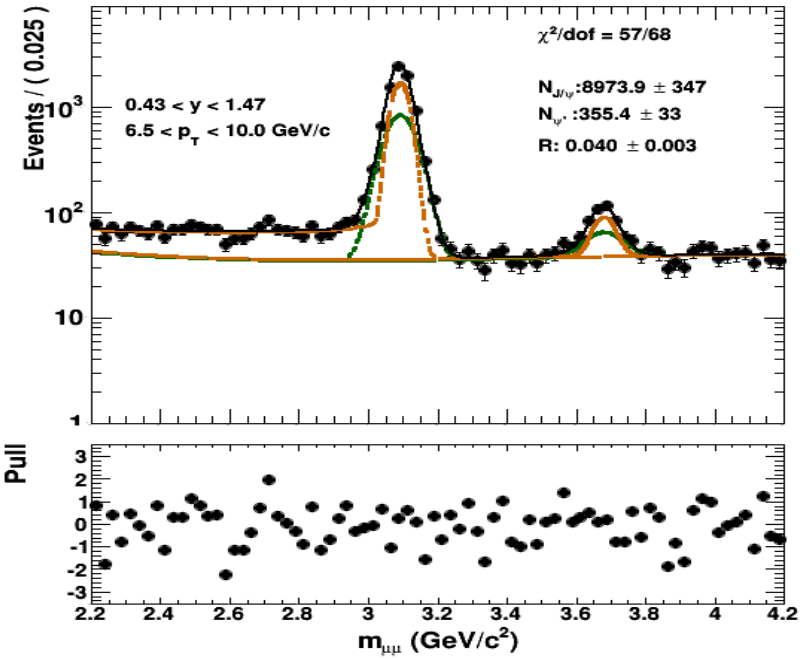
Invariant Mass Plots (p+Pb) Total

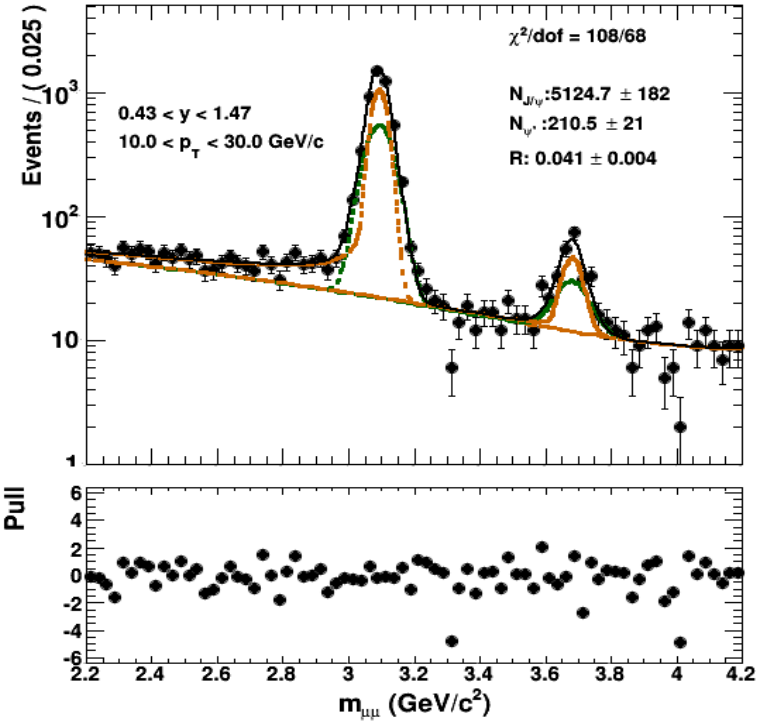




Invariant Mass Plots (Pb+p)







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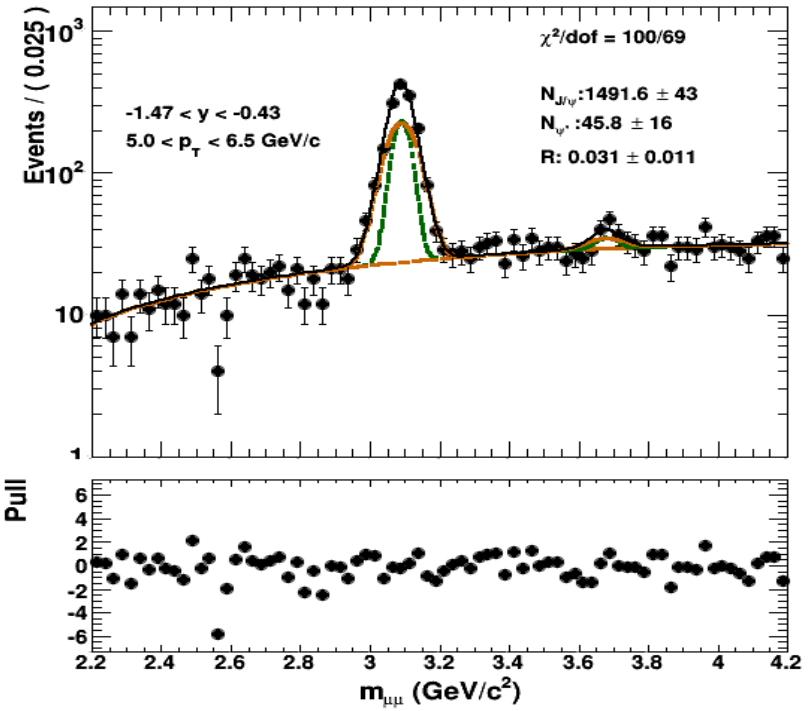
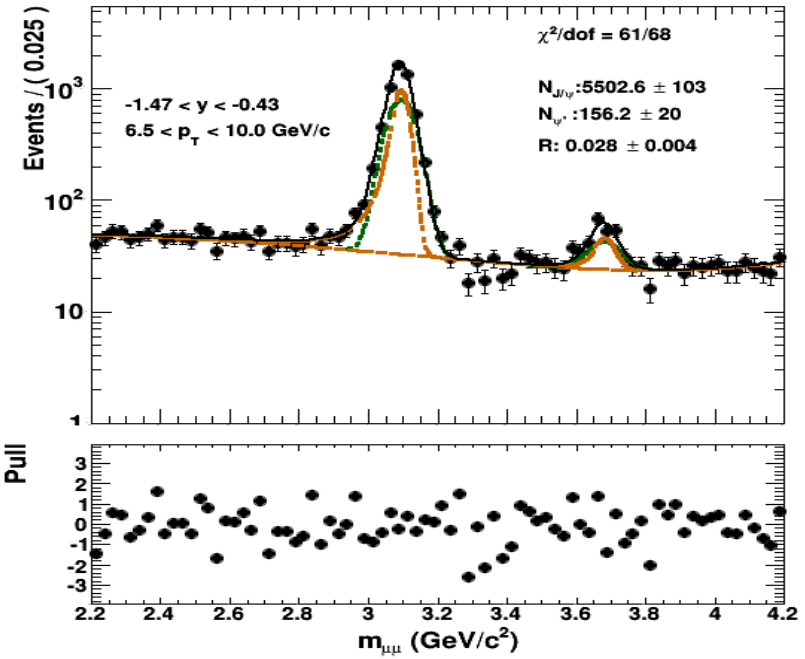
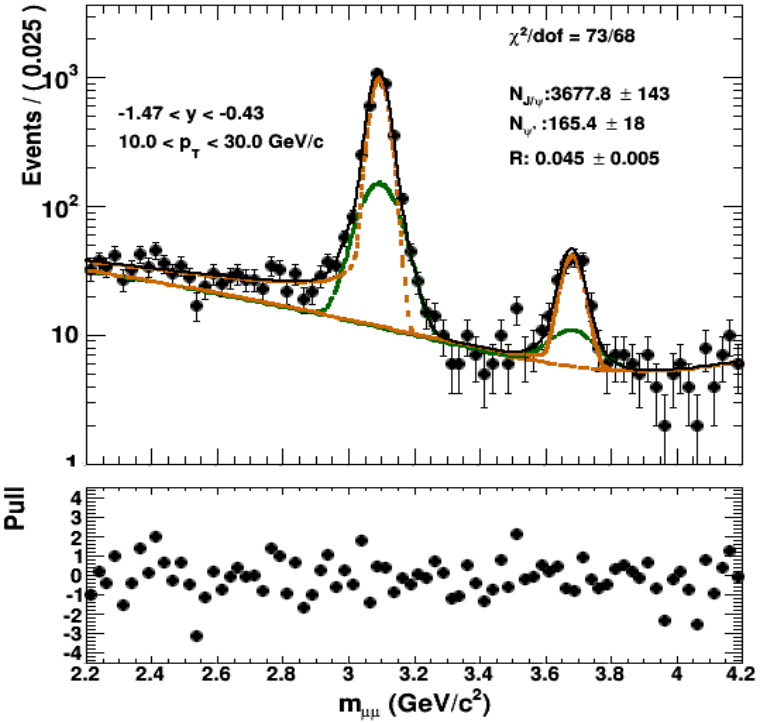
Invariant Mass Plots (p+Pb)







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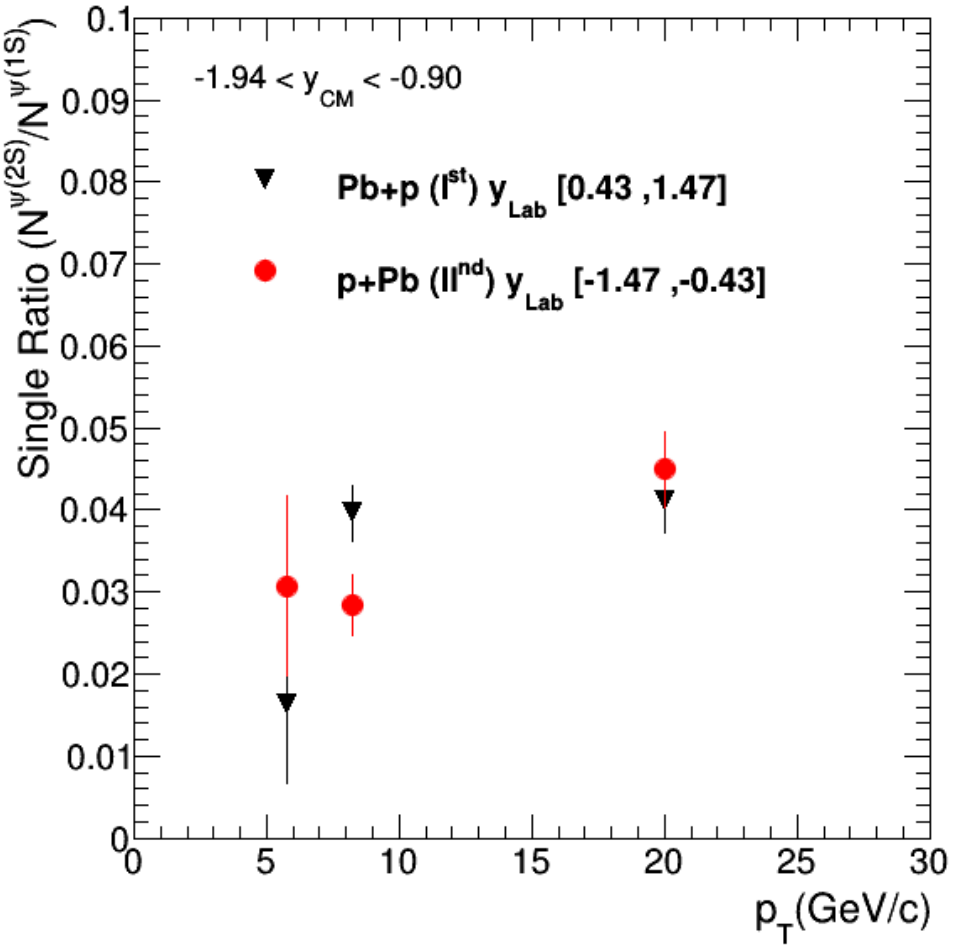
Single Ratios



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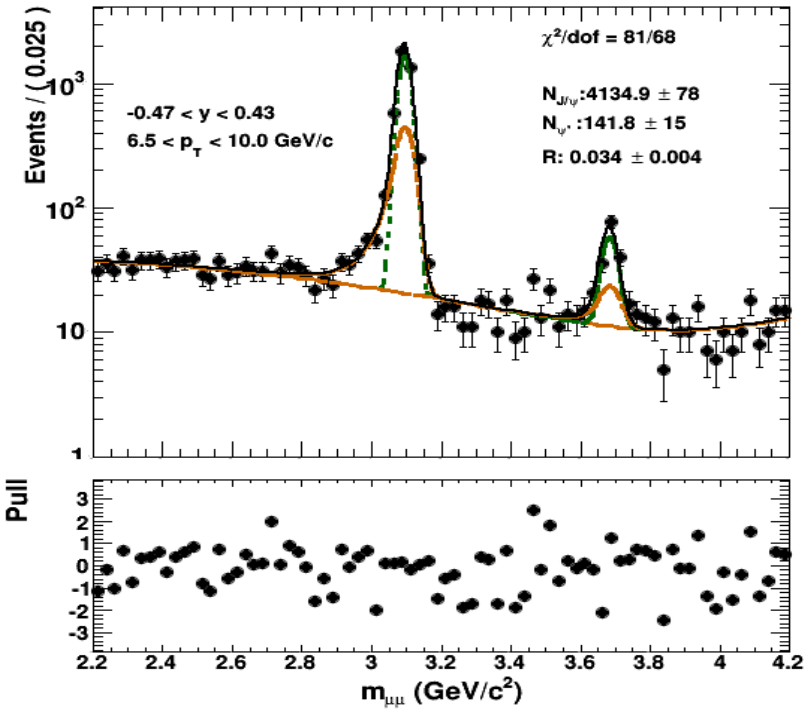
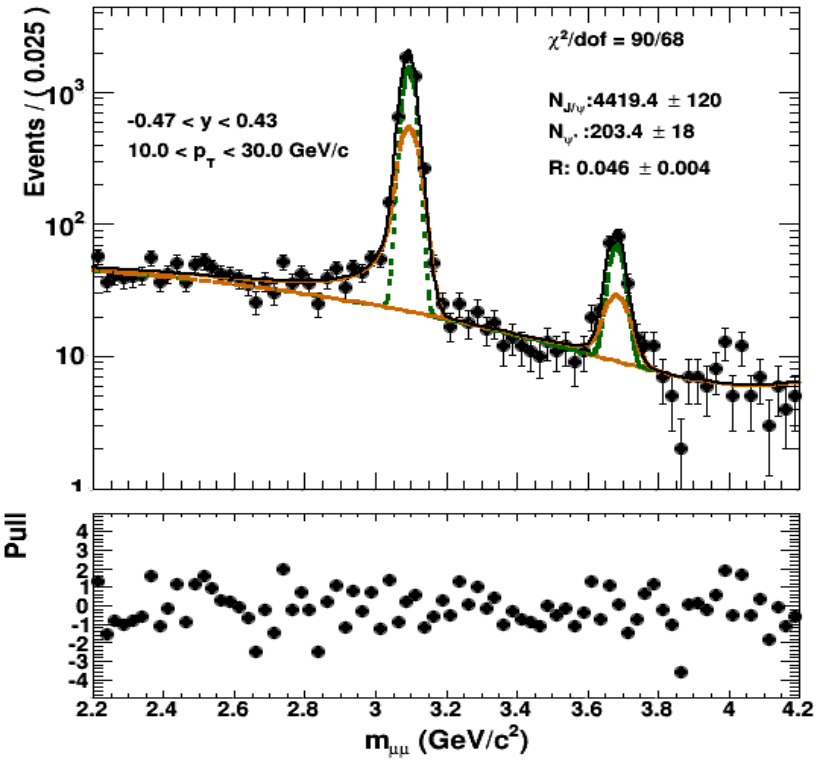
Invariant Mass Plots (Pb+p)





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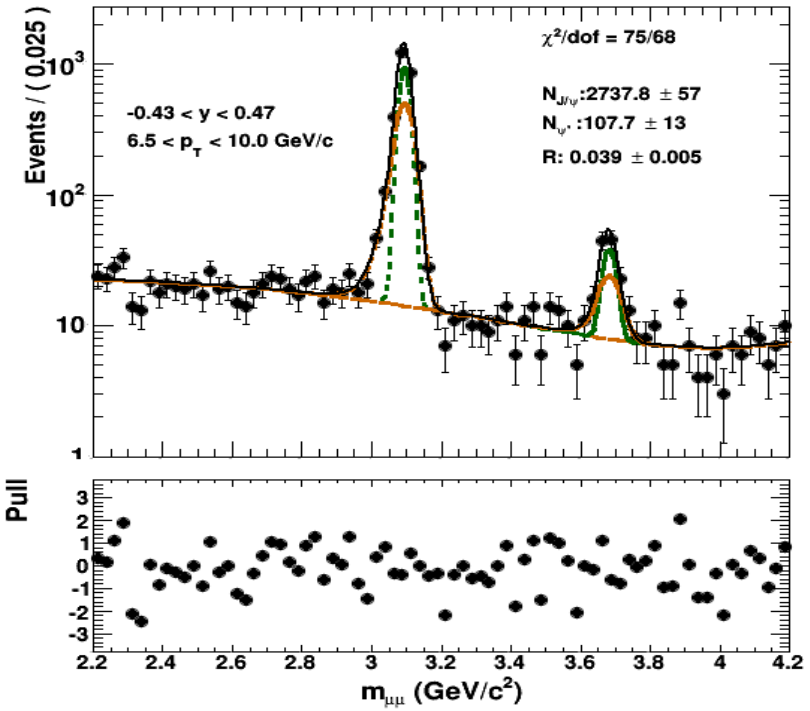

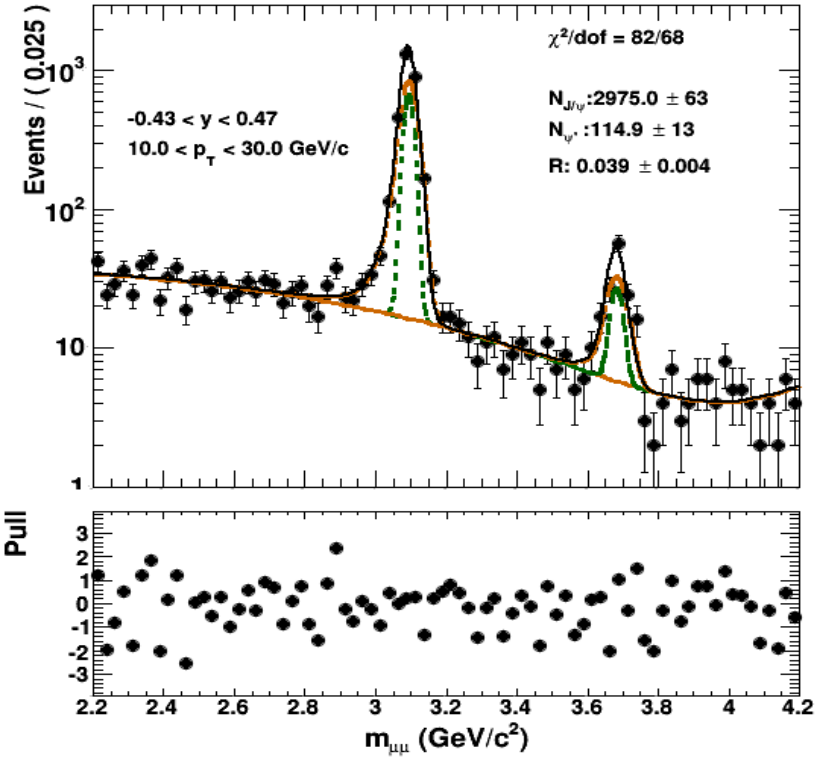

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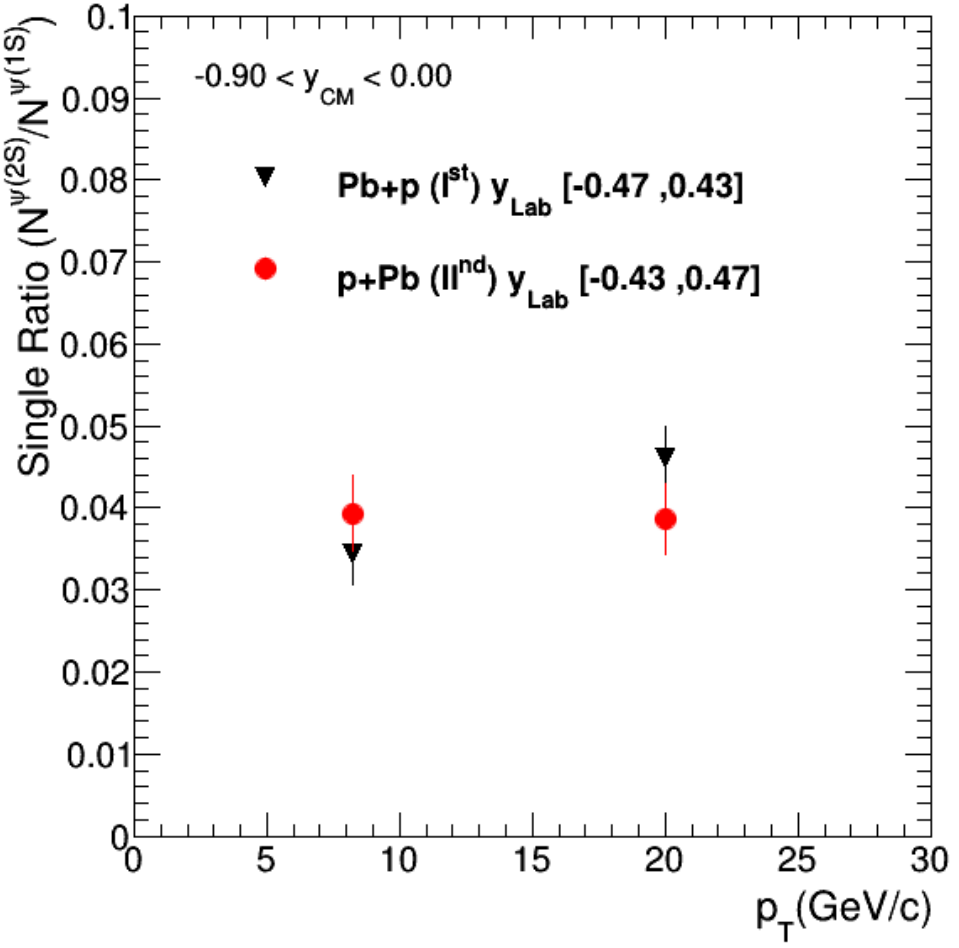

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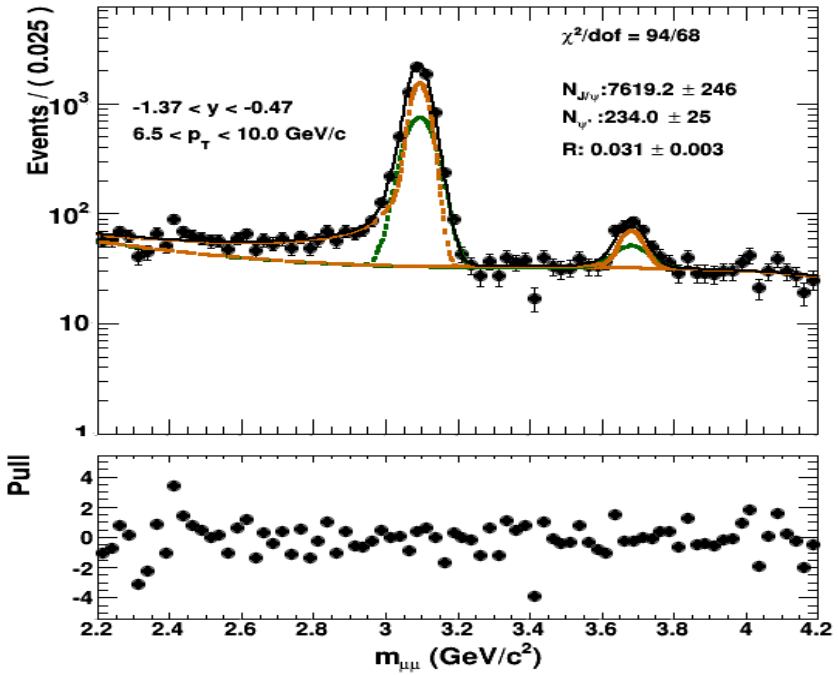
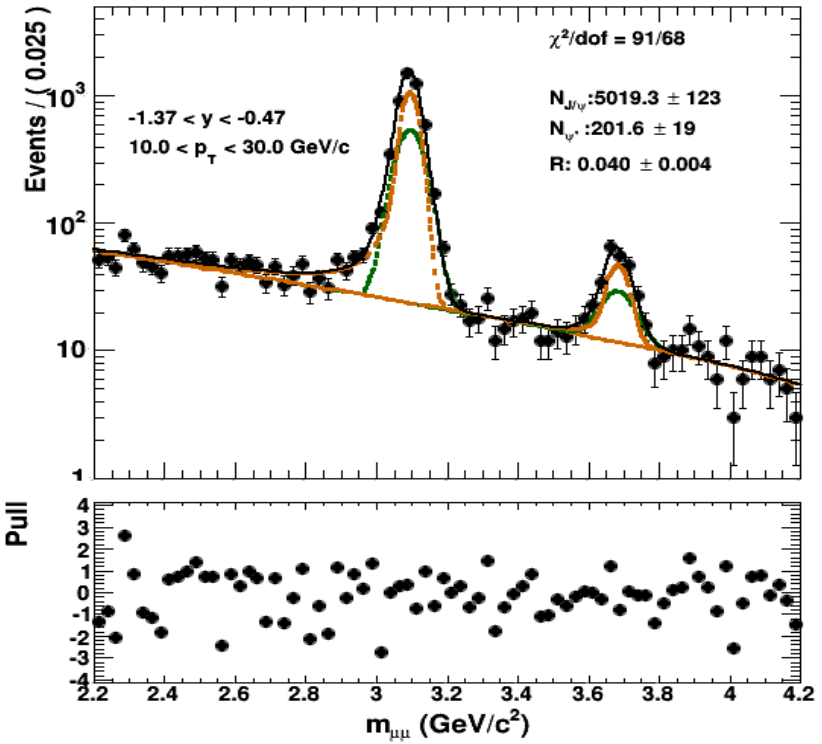
Invariant Mass Plots (Pb+p)





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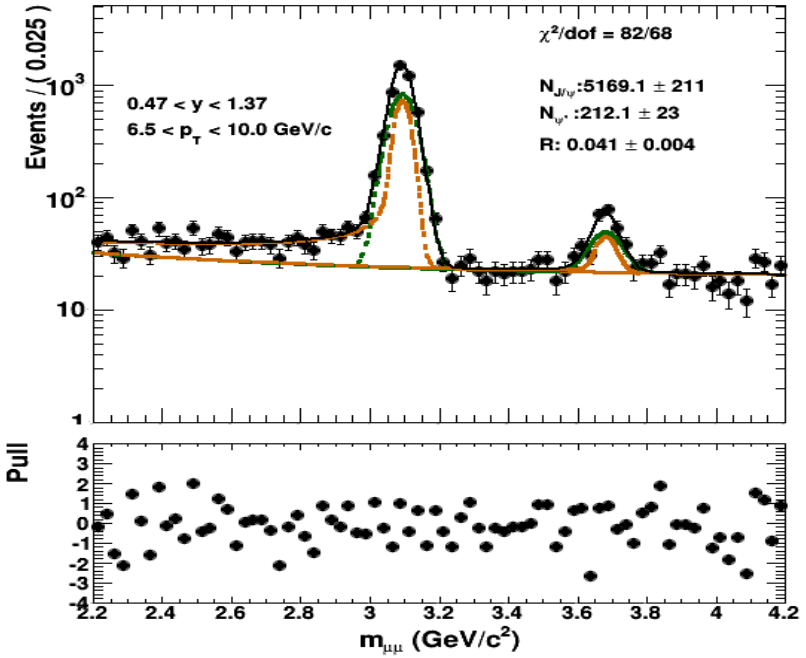

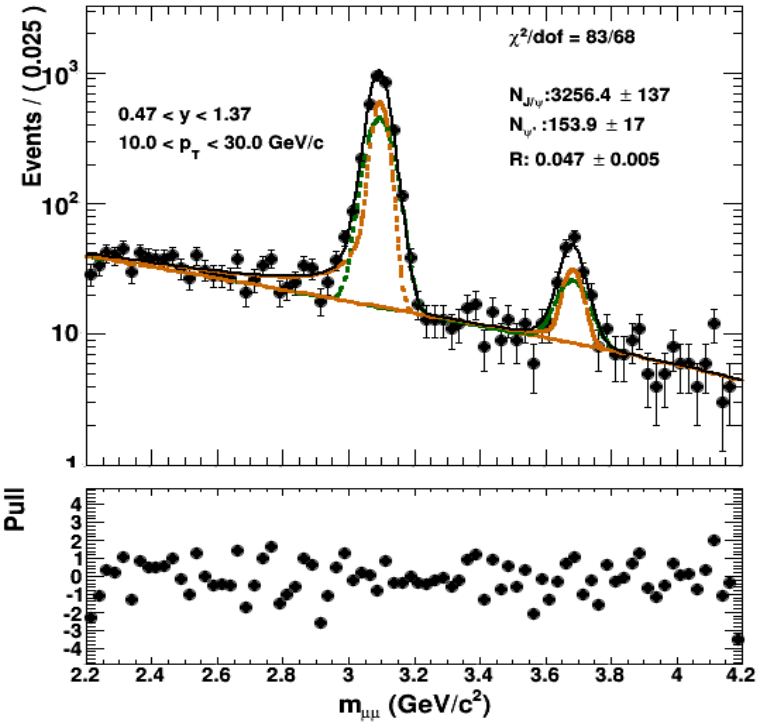

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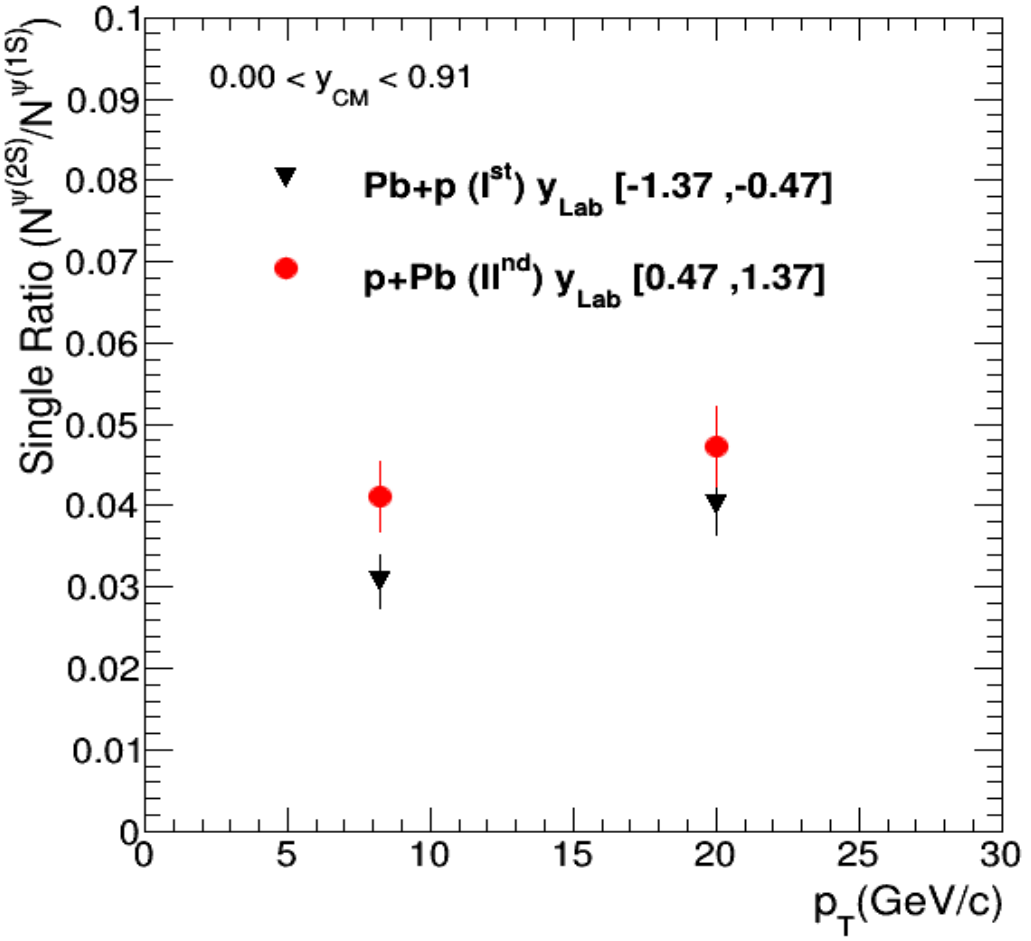

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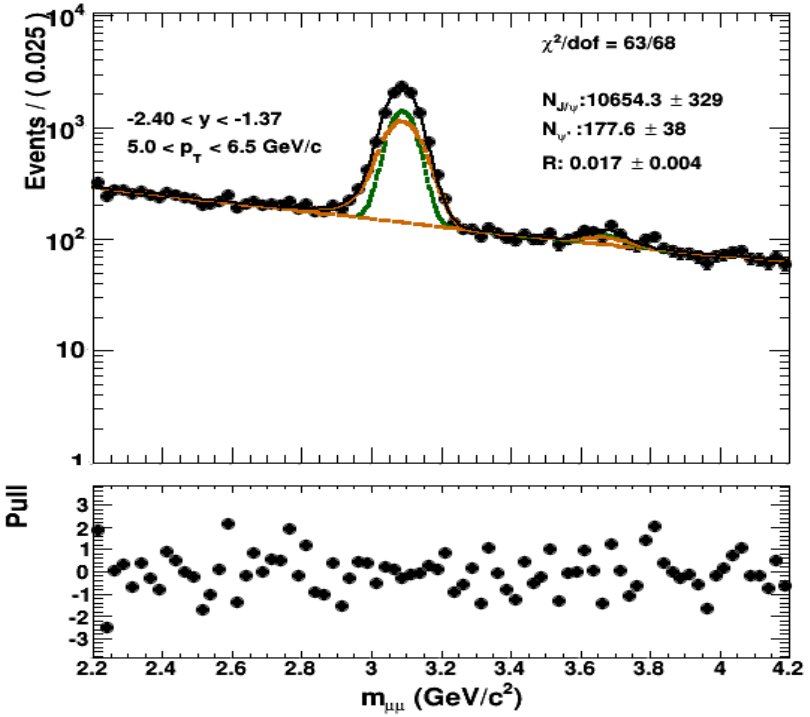
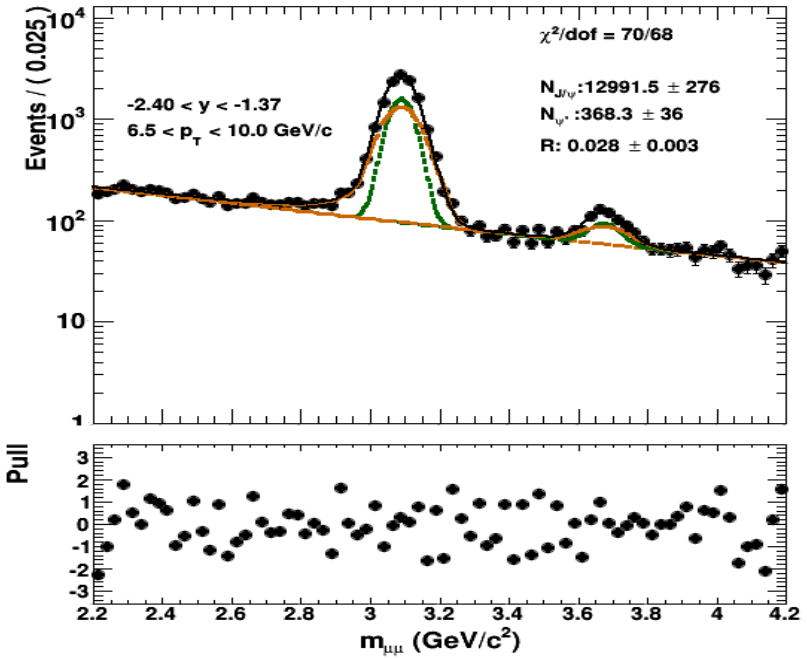
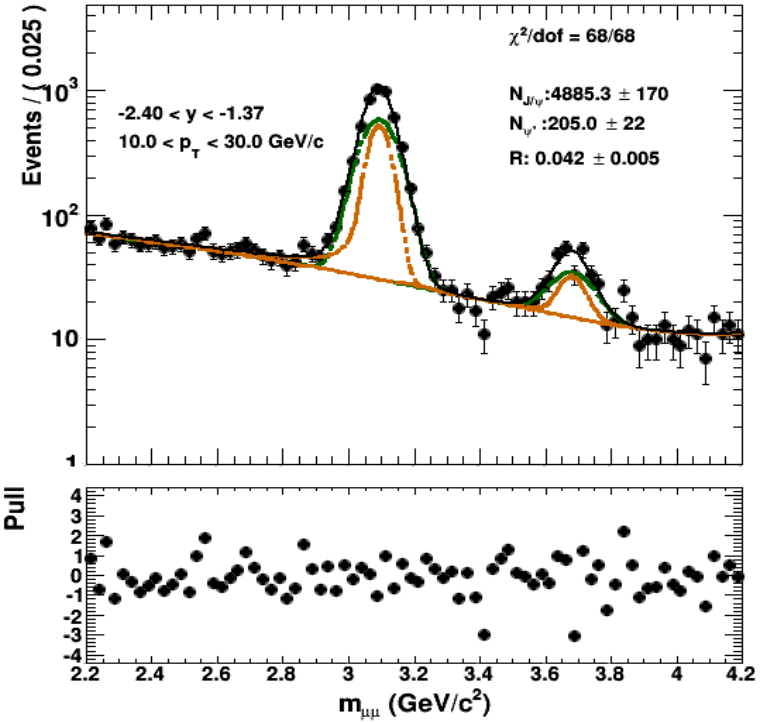
Invariant Mass Plots (Pb+p)







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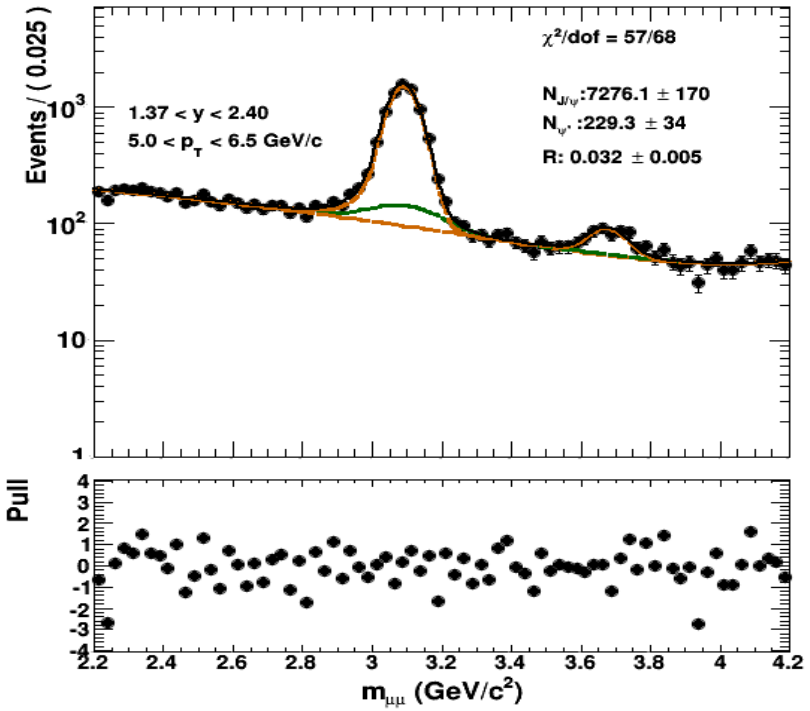
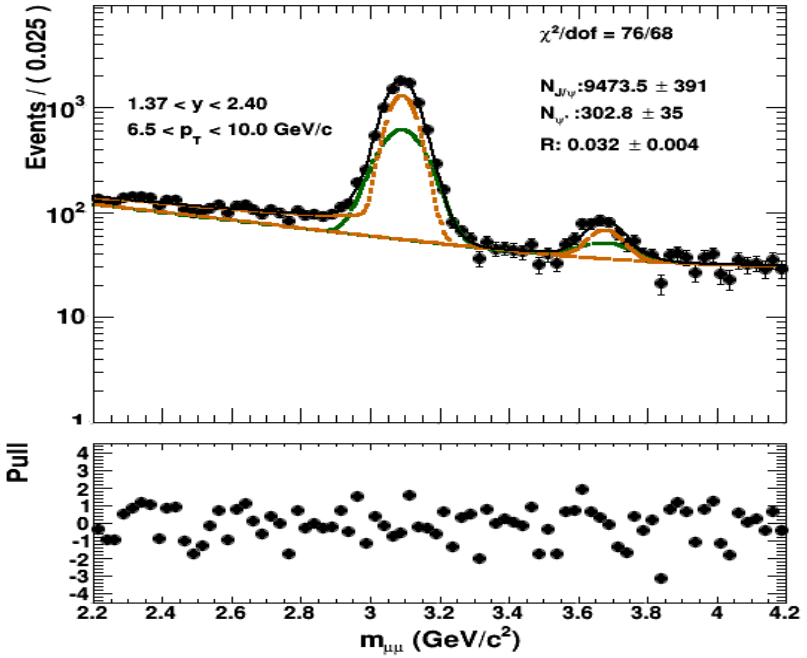
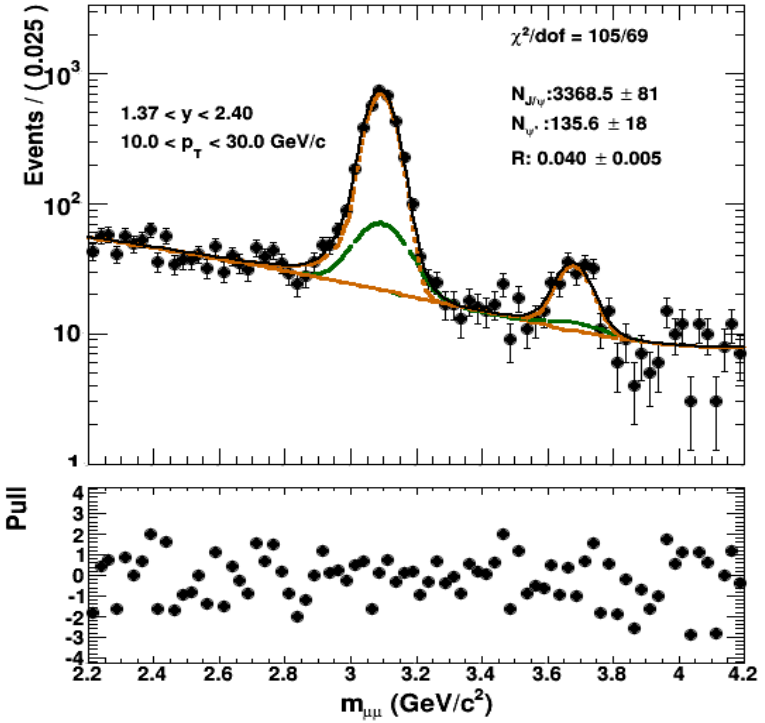
Invariant Mass Plots (p+Pb)







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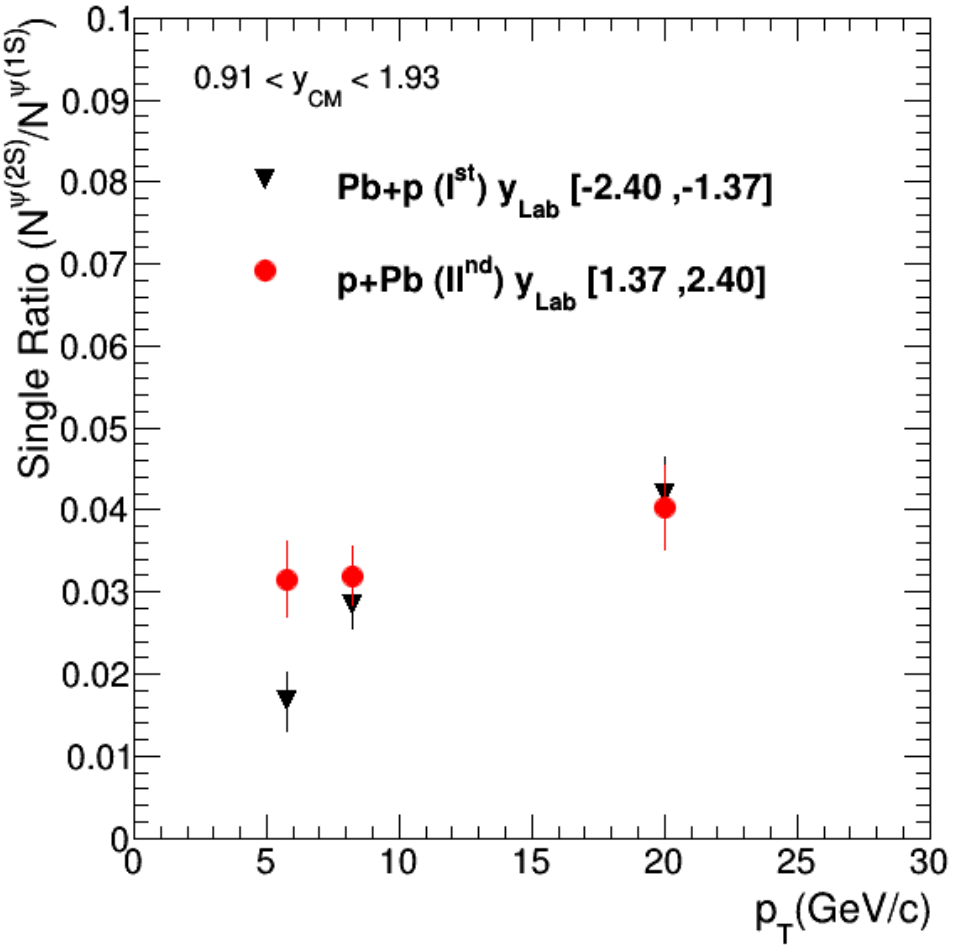
Single Ratios



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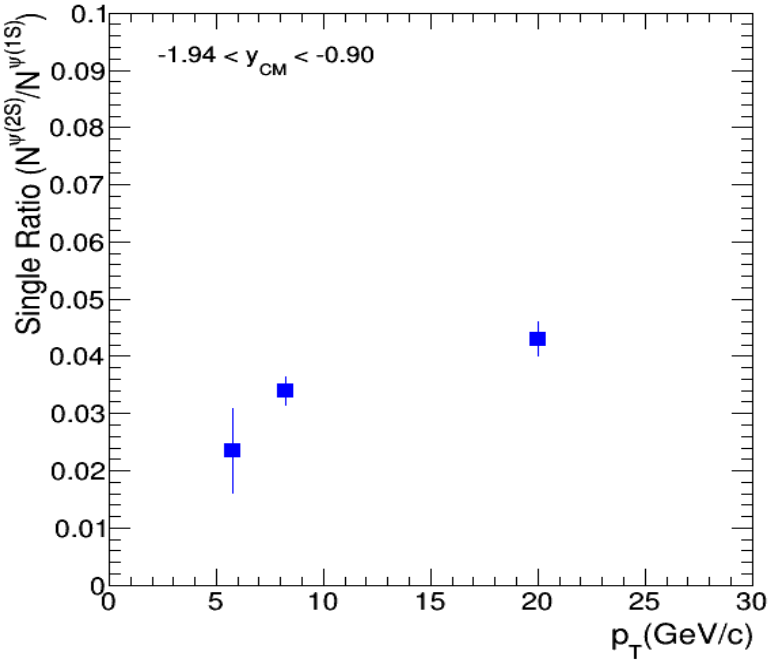
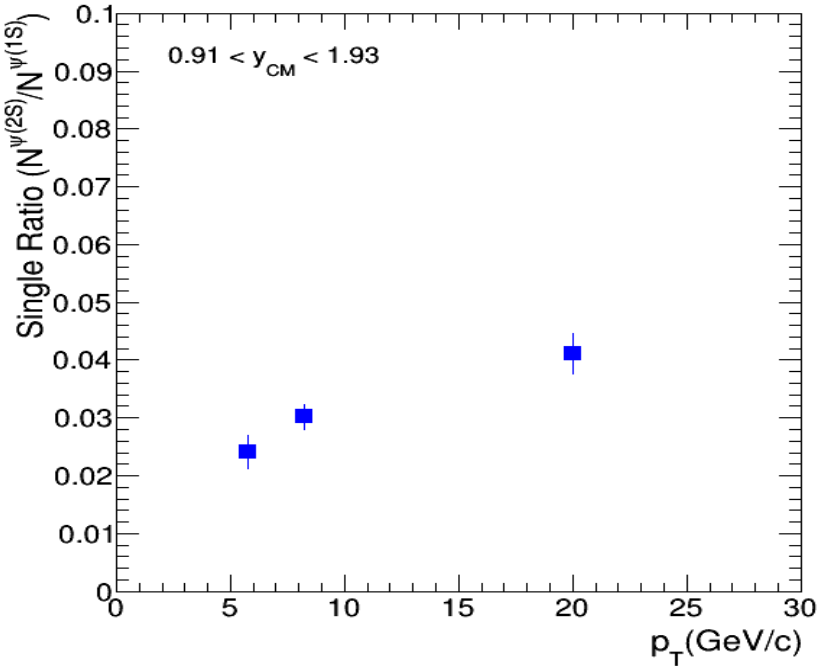
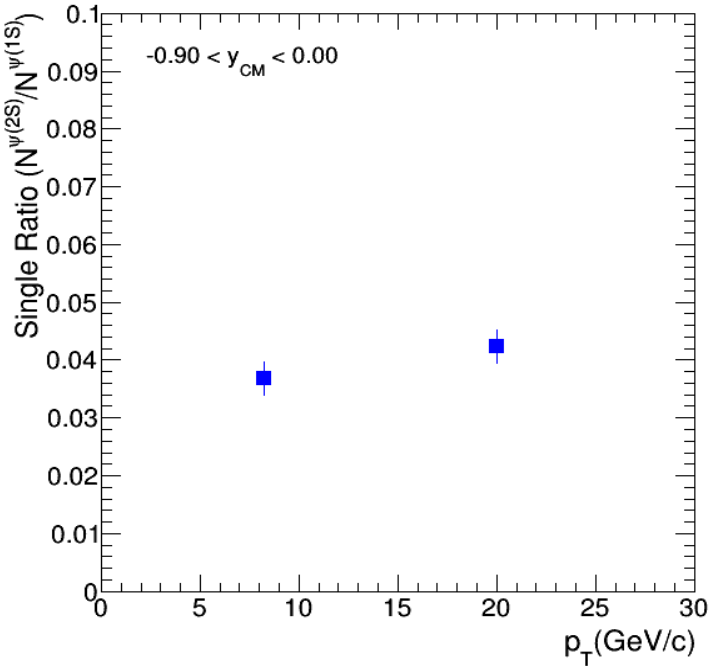
Results

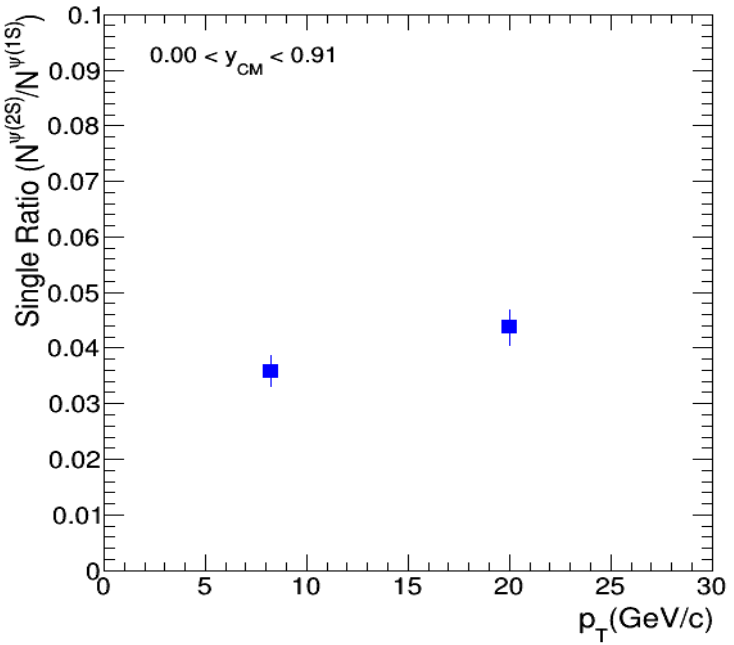
Single Ratios

Y_{CM} = [-1.93,-0.9,0,0.9,1.93] p_T :[5.0,6.5,10,30]

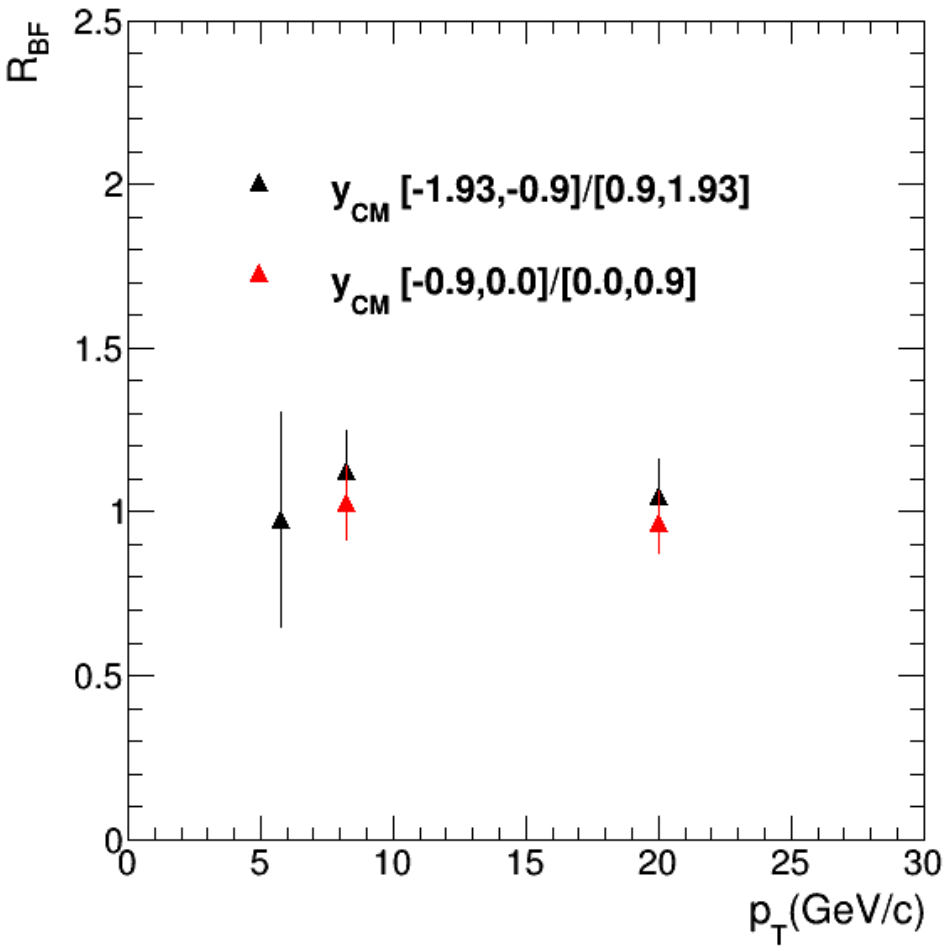


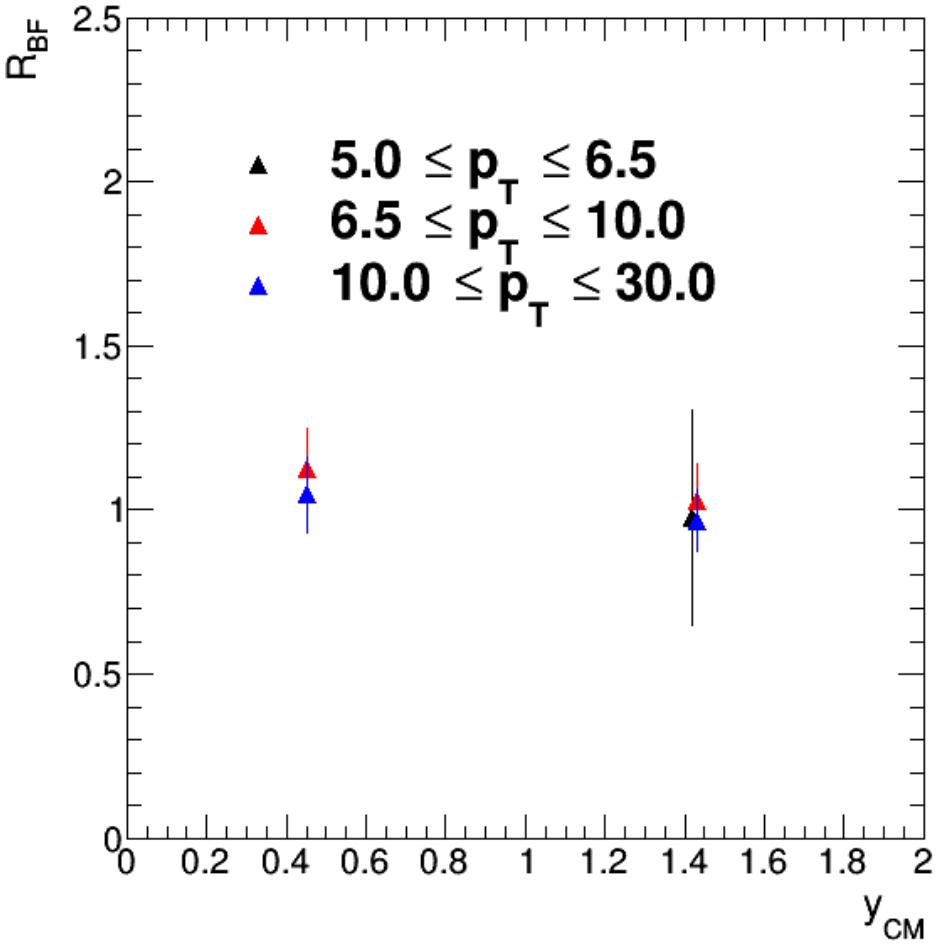




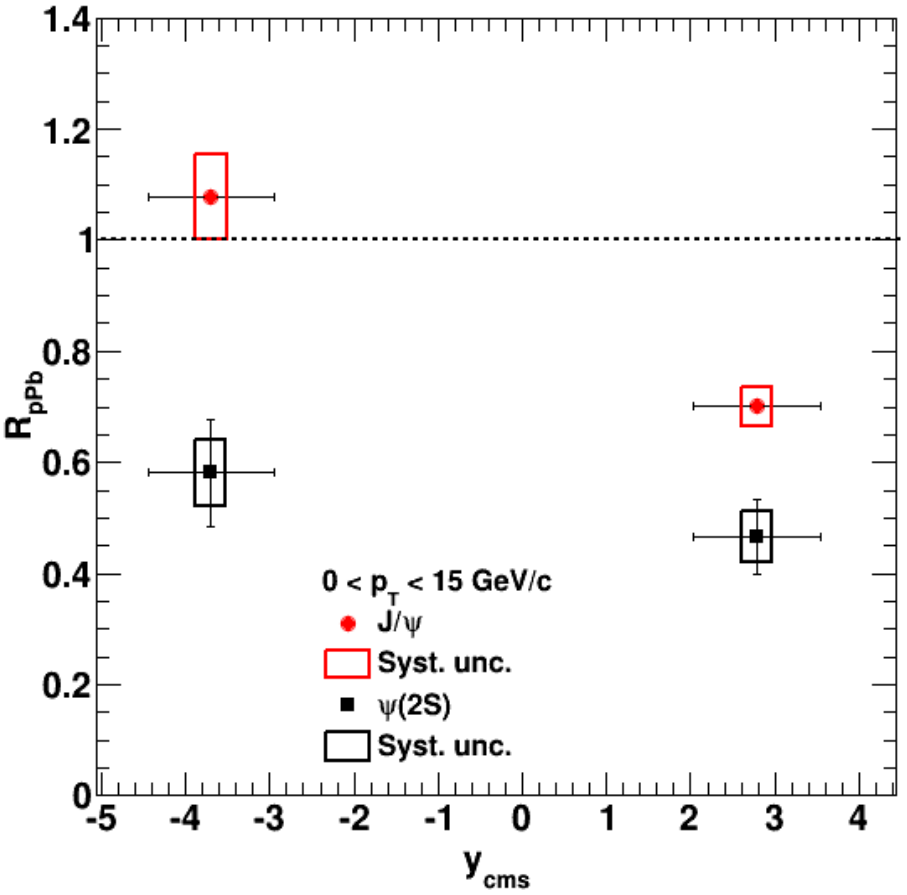


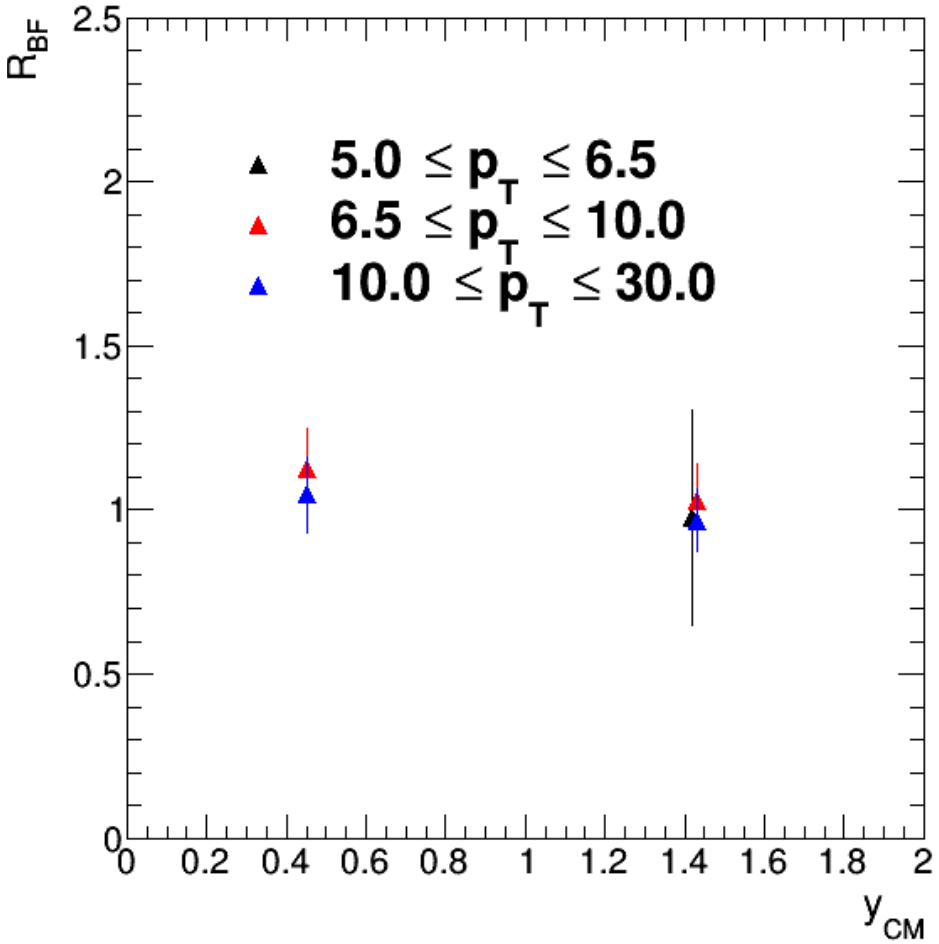
R_{BF} (Uncorrected) Y_{CM} = [-1.93,-0.9,0,0.9,1.93] p_T :[5.0,6.5,10,30]





Compare with ALICE





ALICE: 0.55 and 0.64

R_{BF} : 0.66

Summary and Outlook

- Ratio of Psi(2S) to J/Psi is obtained for Pbp and pPb datasets.
- Single ratios [Psi(2S) / J/Psi] increase with pT for every rapidity bin.
- R_{BF} as a function of rapidity and pT