# CMS status
# PbPb run 2011

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(for the CMS collaboration)

Rencontres Ions Lourds, Orsay
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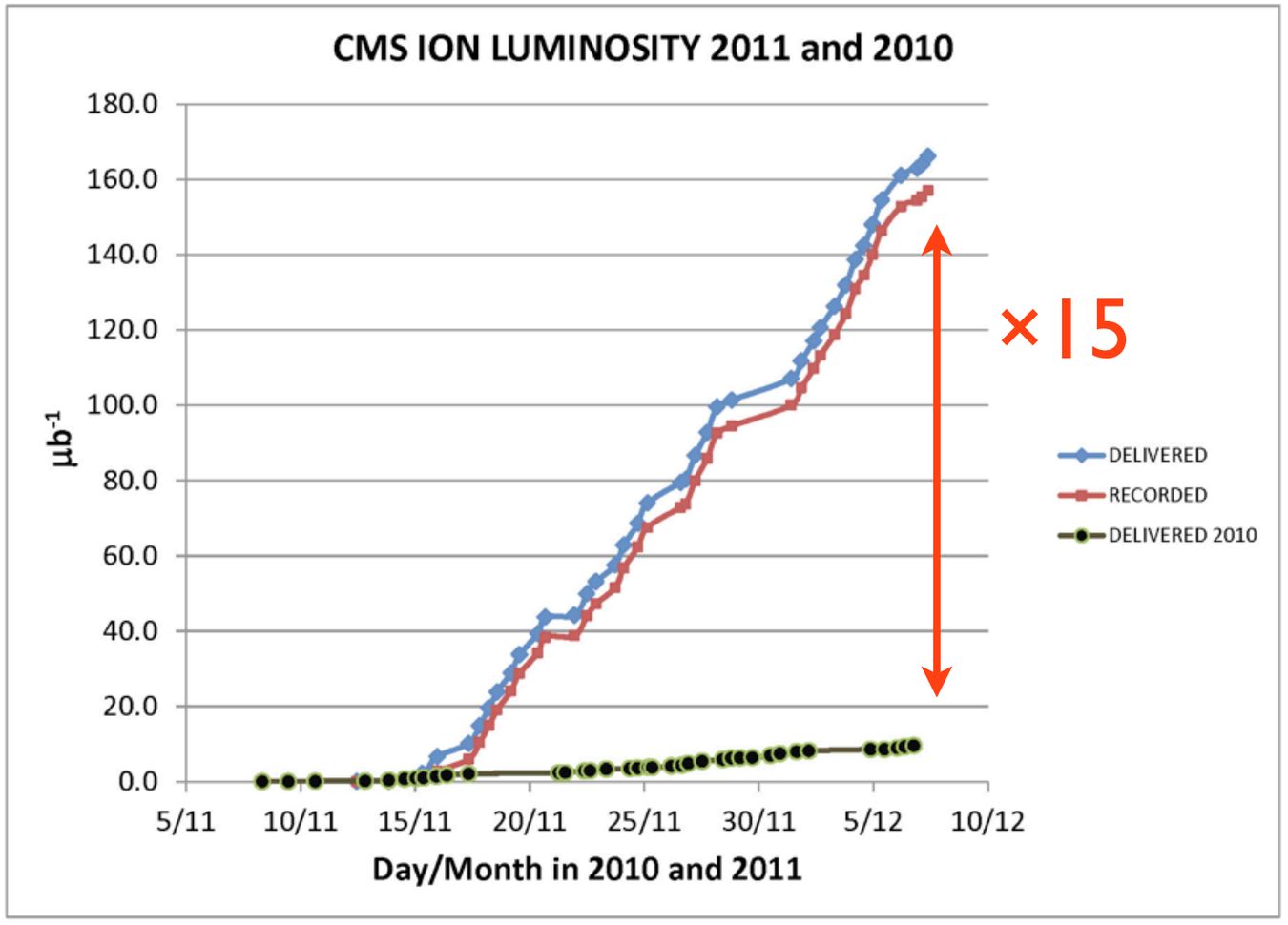
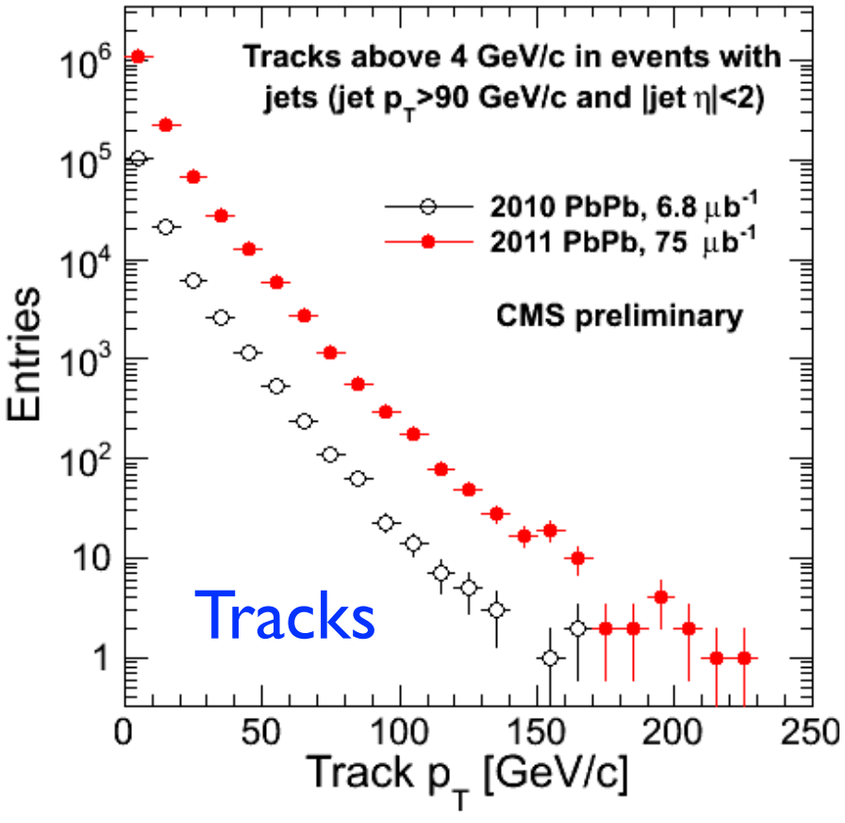
# The PbPb run 2011

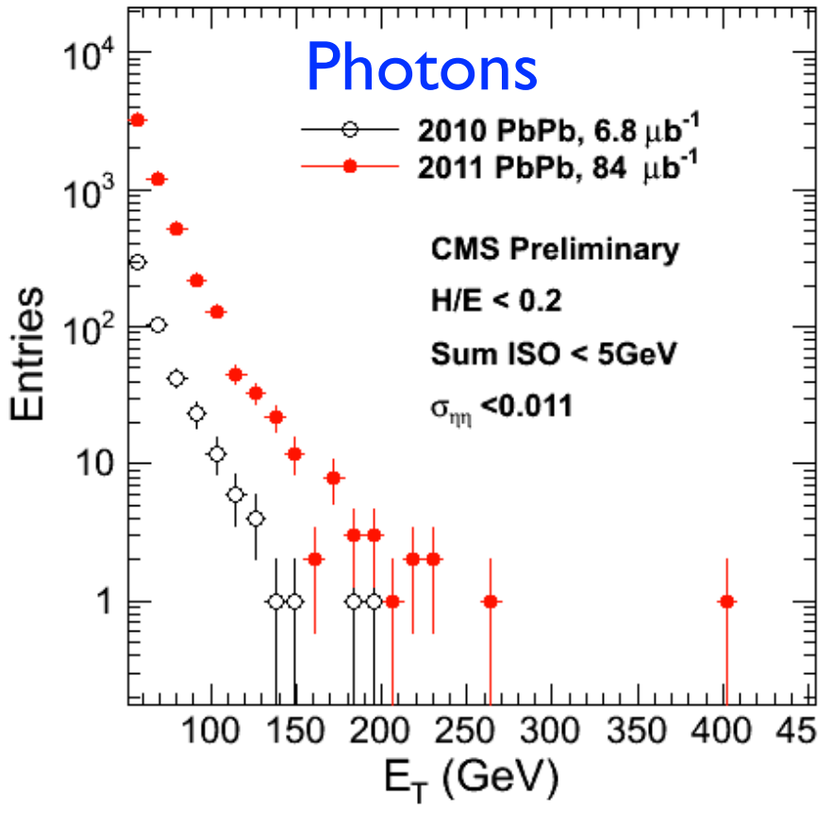


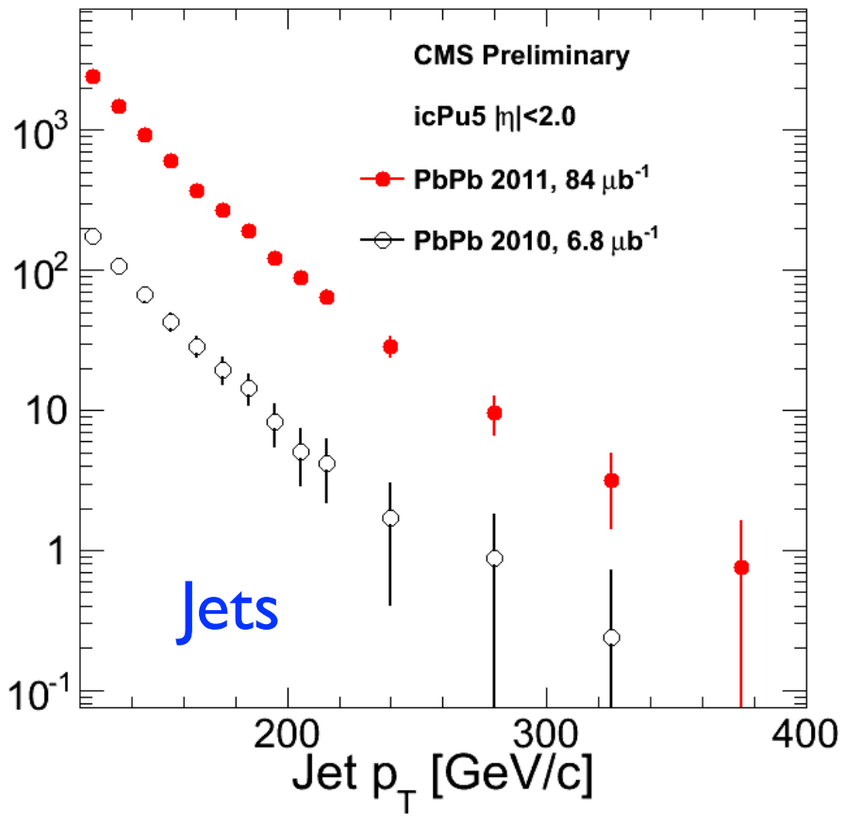

- Very successful data taking period in 2011
- LHC delivered (and CMS recorded) ~15 times the integrated luminosity of 2010
- Kept all physics triggers unprescaled over the full run
  - including a double muon trigger without $p_T$ cut (muon $p_T$ reach limited only by acceptance)
- Running with ~2.5 kHz L1 rate has been very smooth
- Split HLT output into three primary datasets: MinBias, high-$p_T$, and muons

# The PbPb run 2011

- Factor 15 increase in integrated luminosity
  - significantly increased $p_T$ reach of hard probes

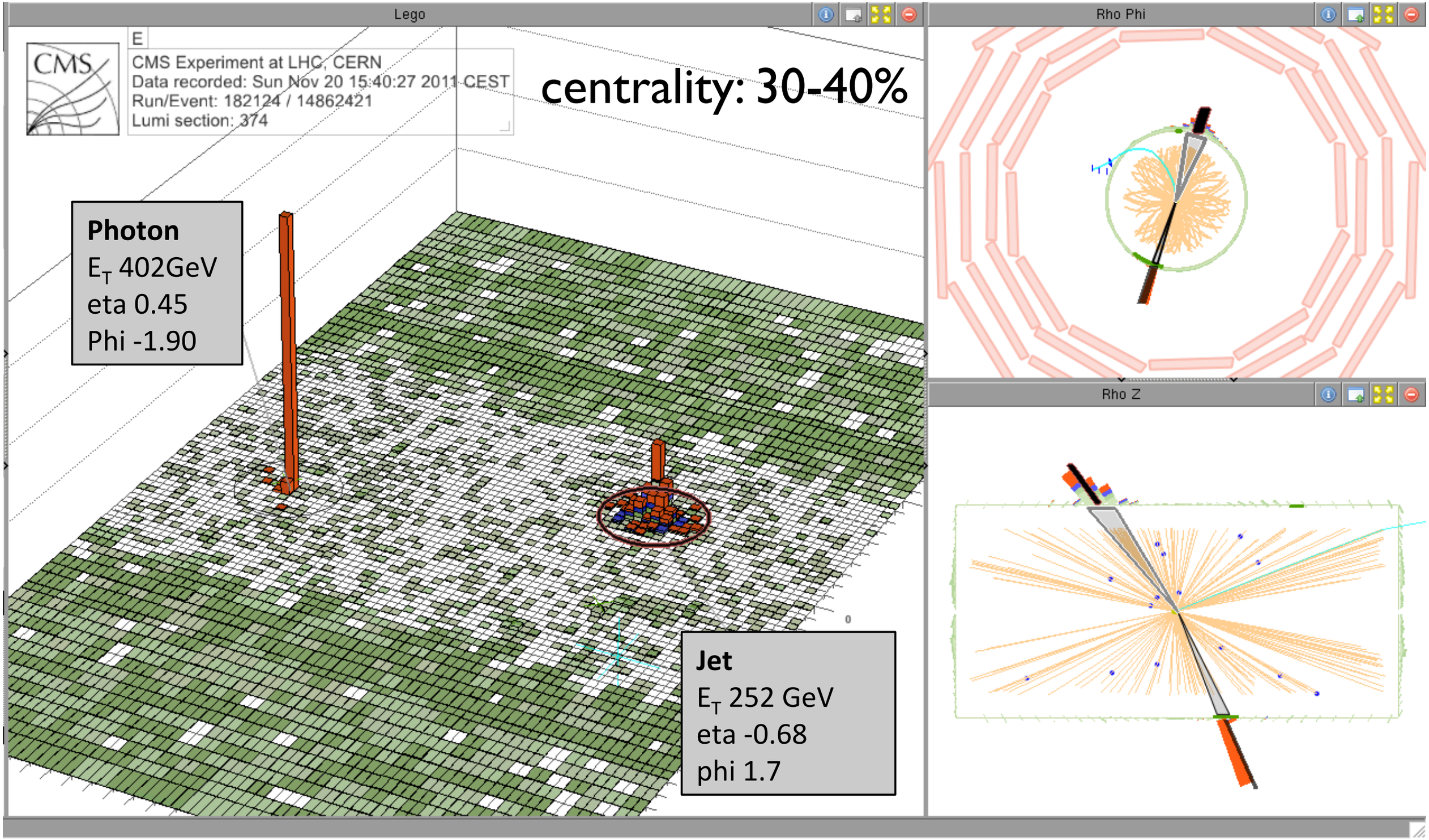


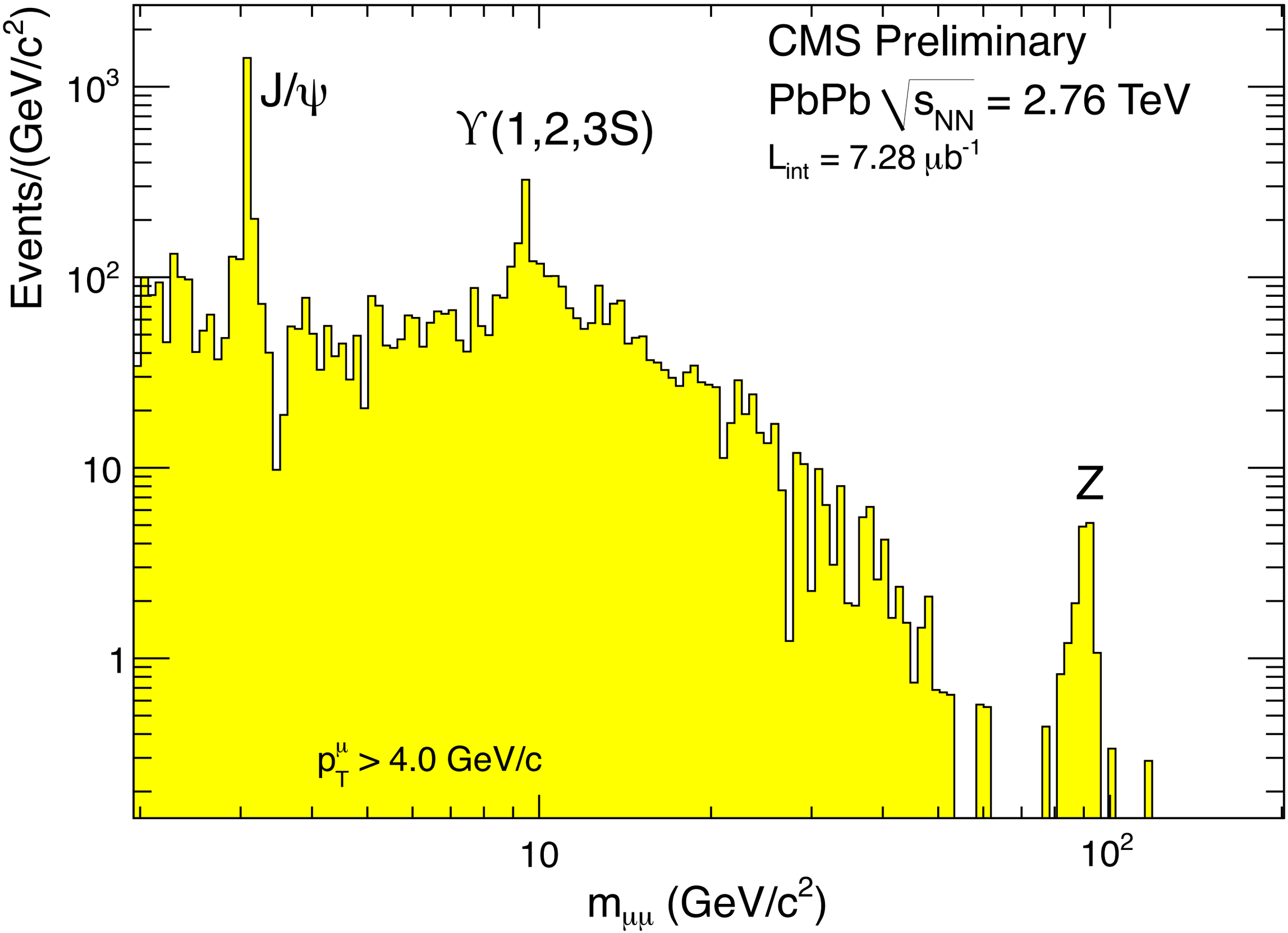



# Photon-Jet events

- Significant sample of high-$p_T$ photons opens the door to $\gamma$-jet measurements



# Dimuons 2010



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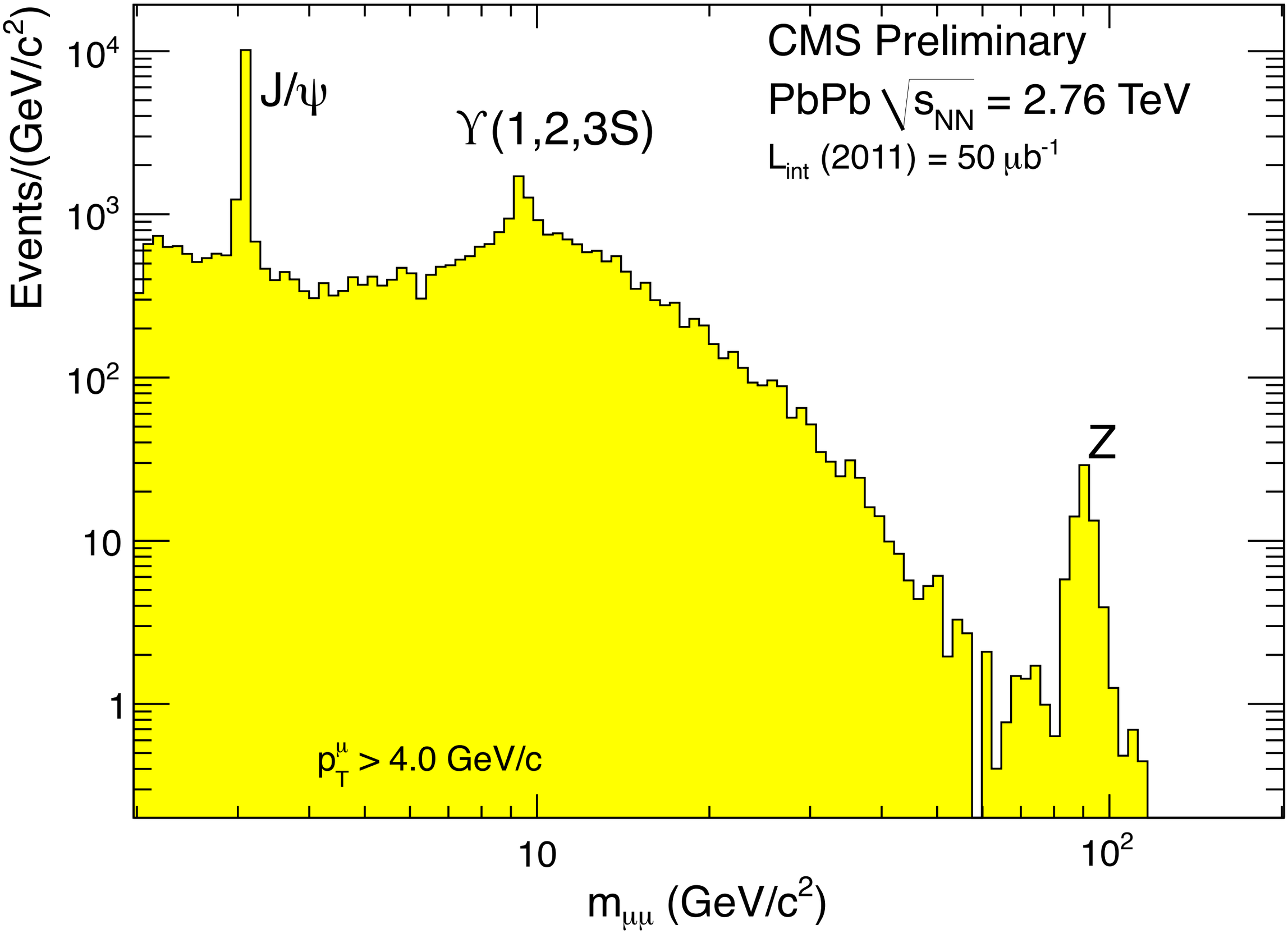
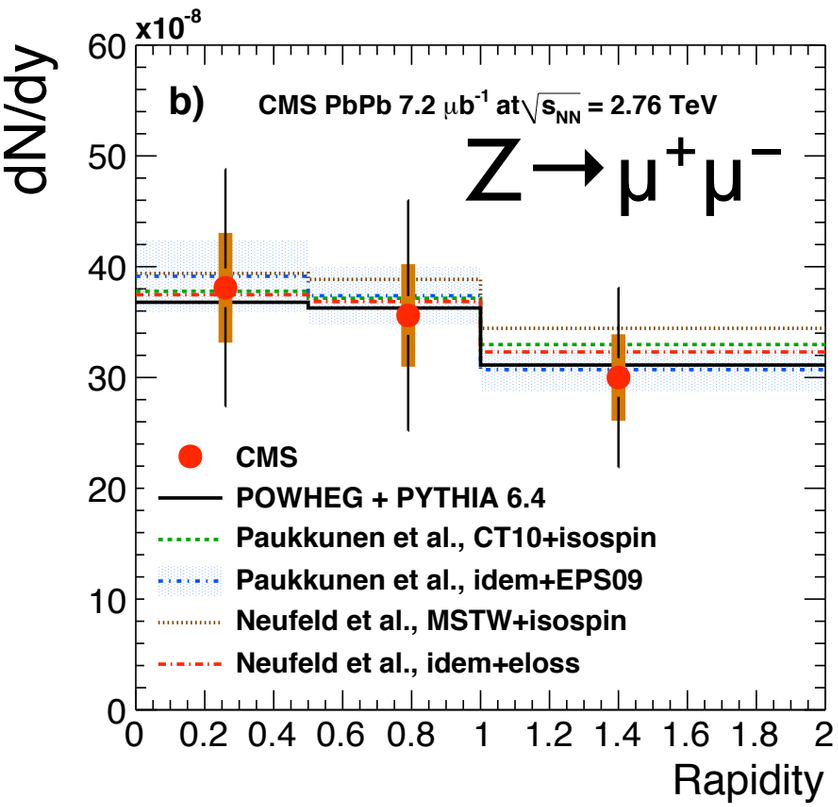
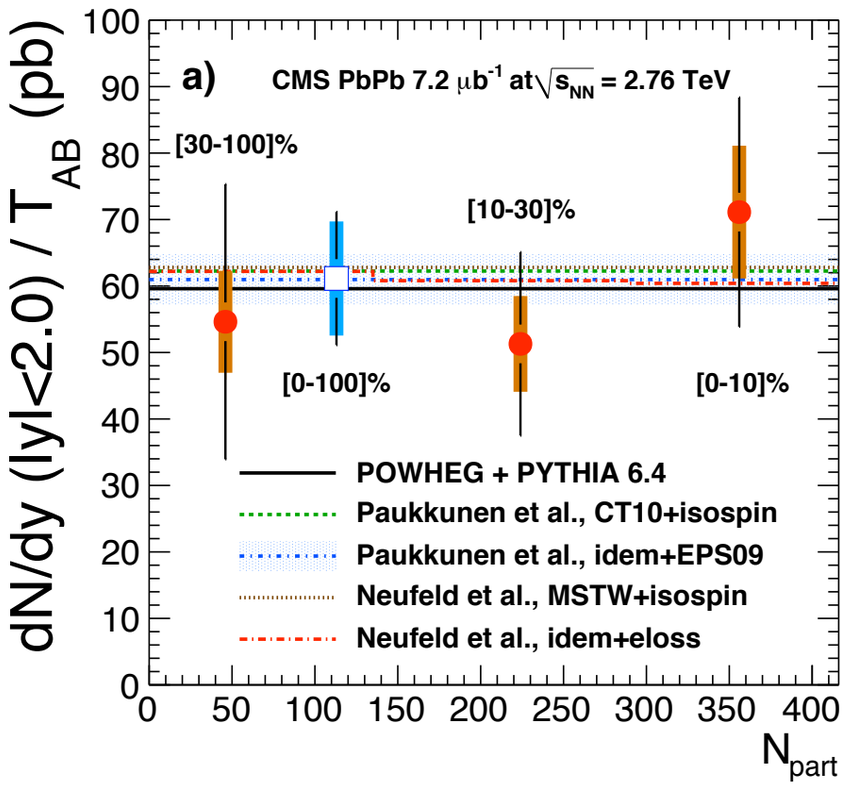


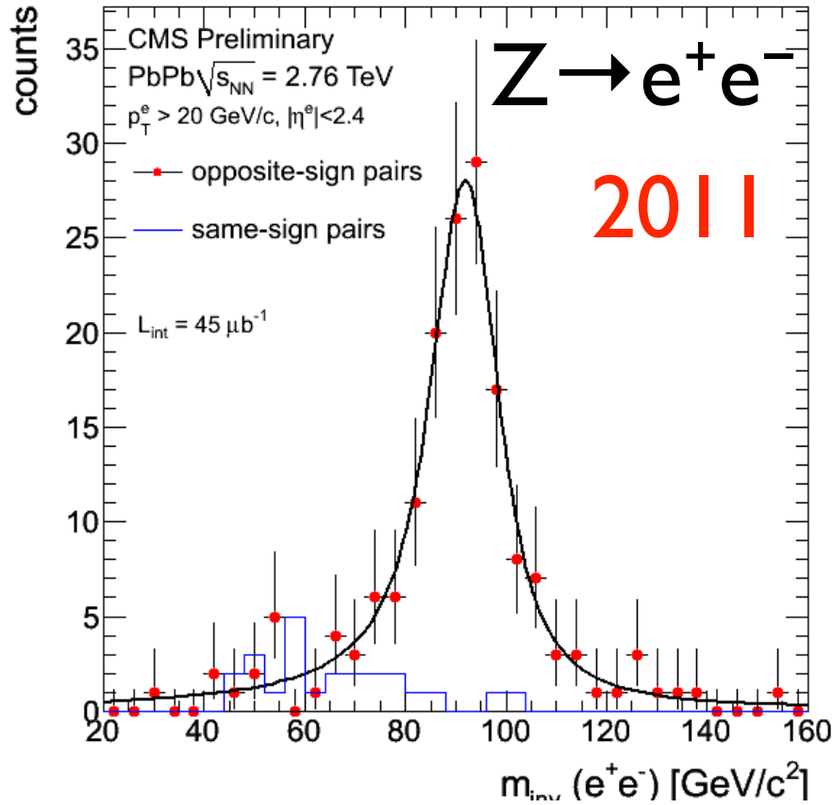
# Z bosons

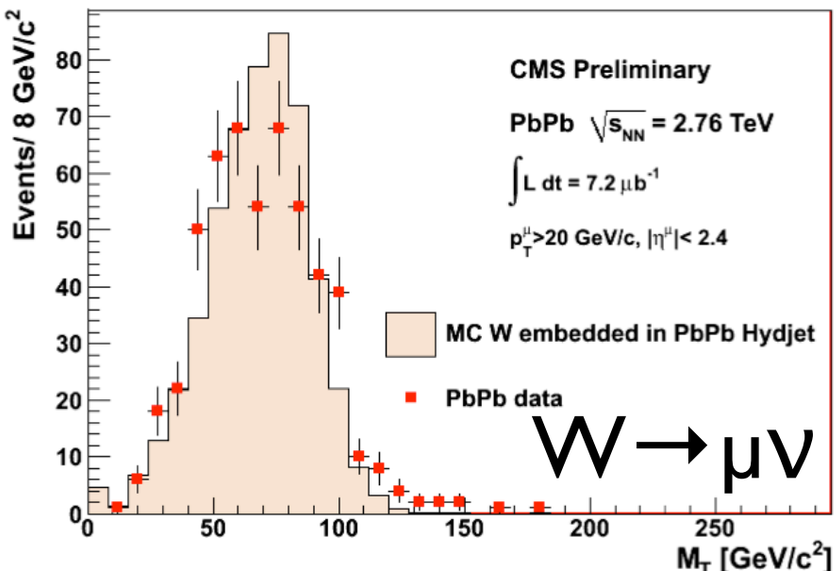
- High statistics sample of W and Z bosons
  - statistical power to discriminate models of initial state effects?

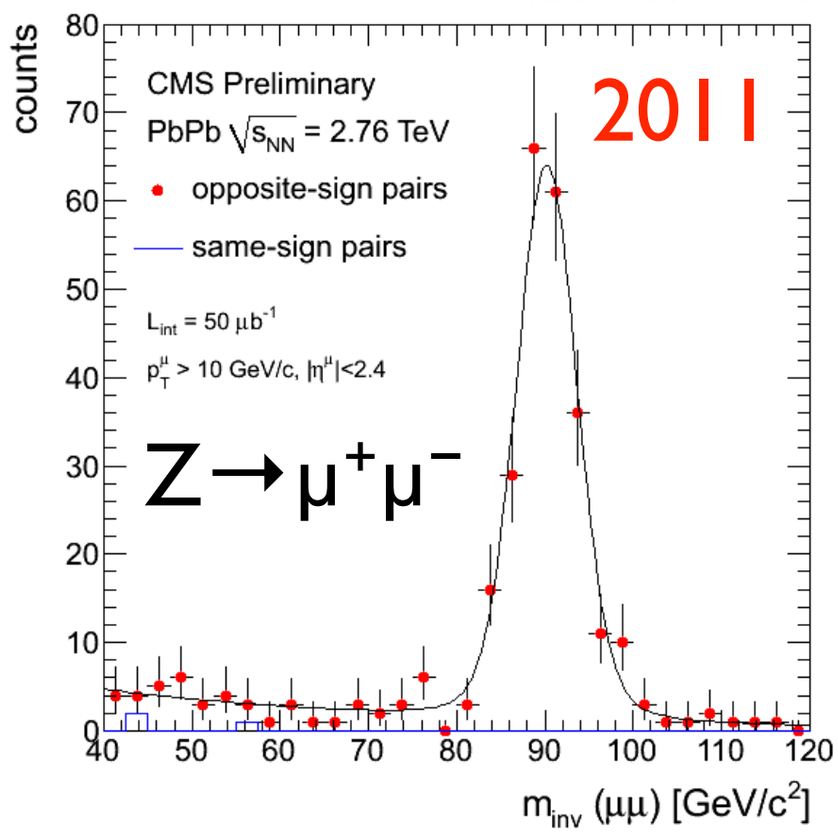
2010



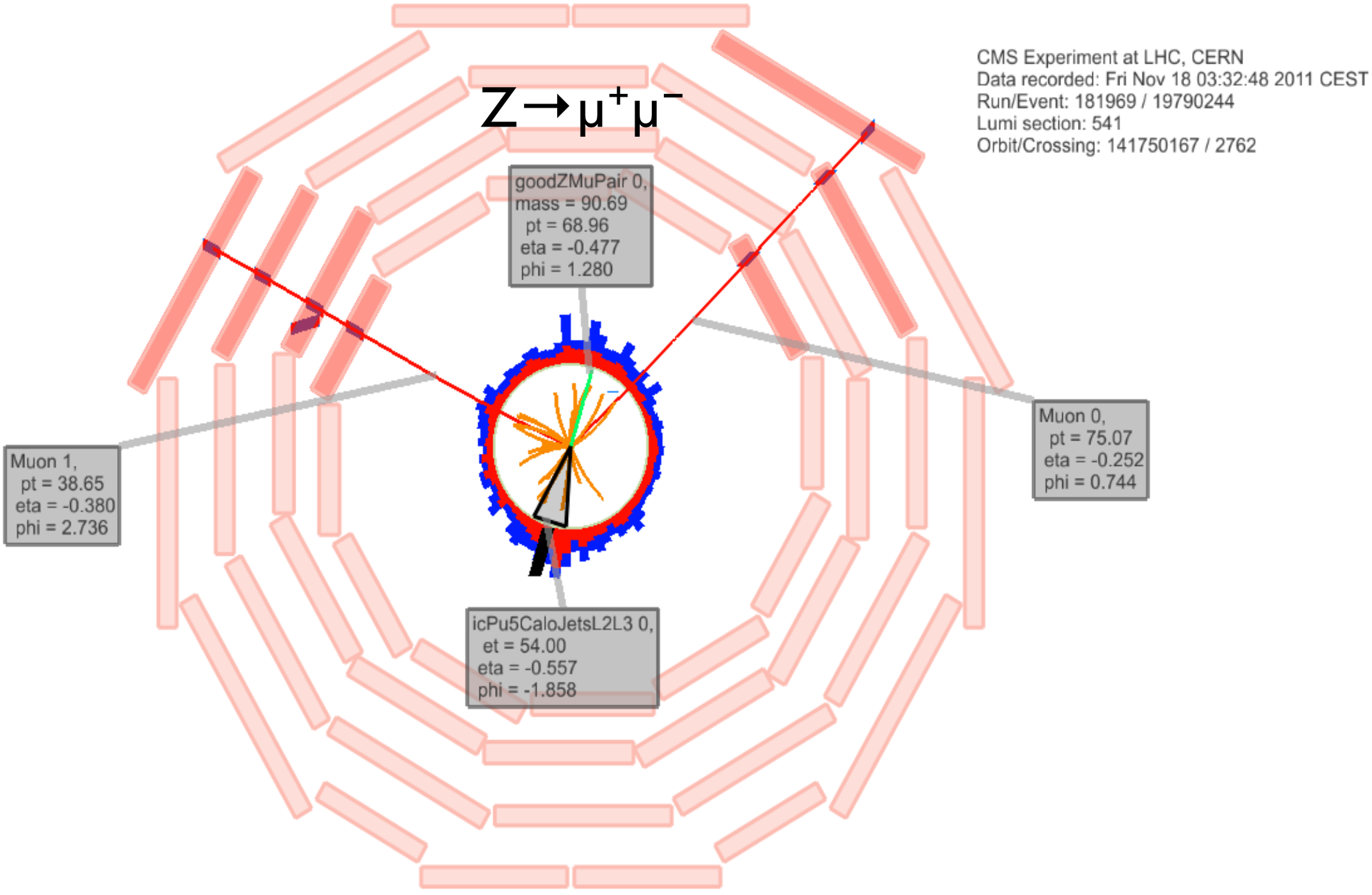



# Z-jet studies?

- Maybe not quite there yet…



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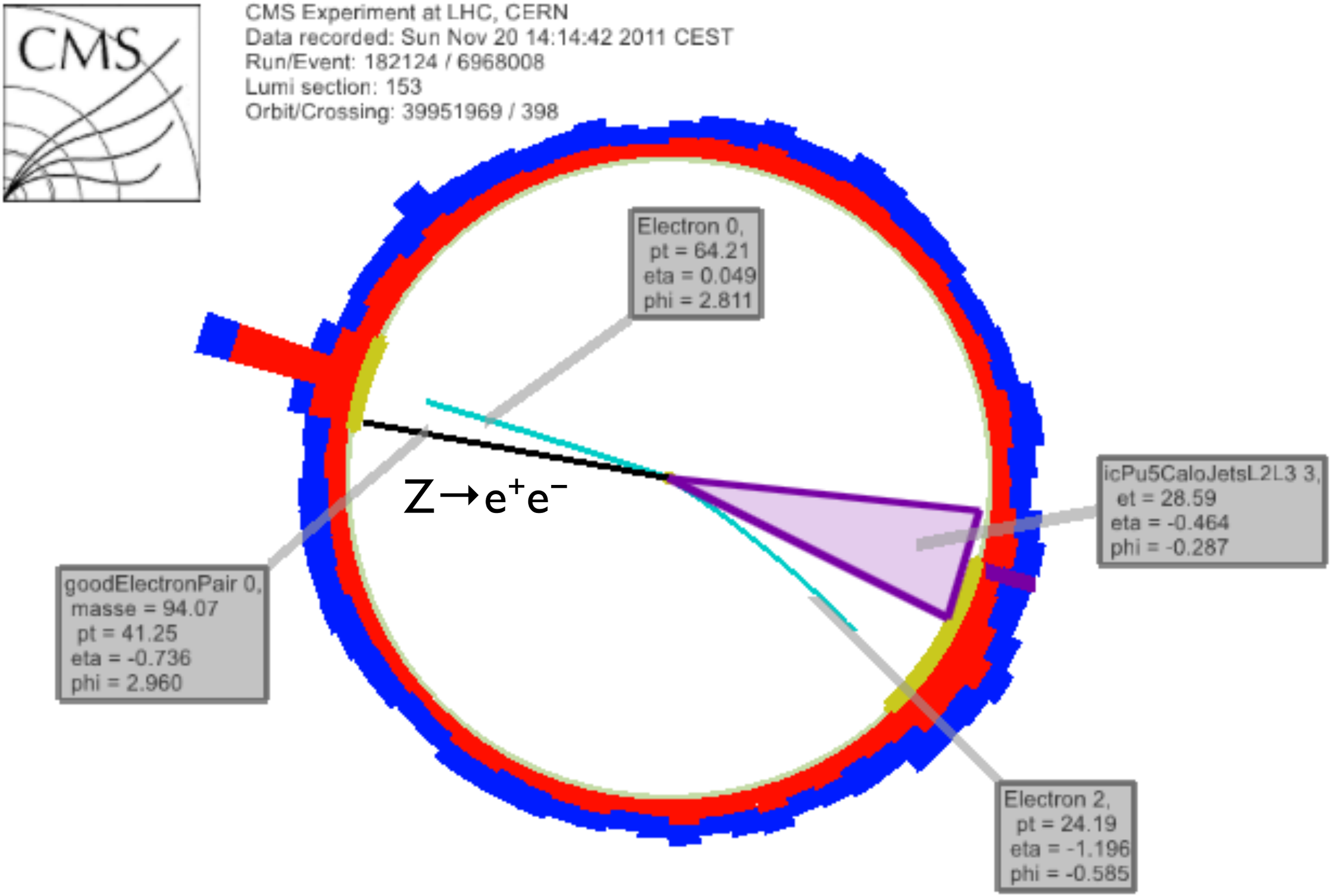
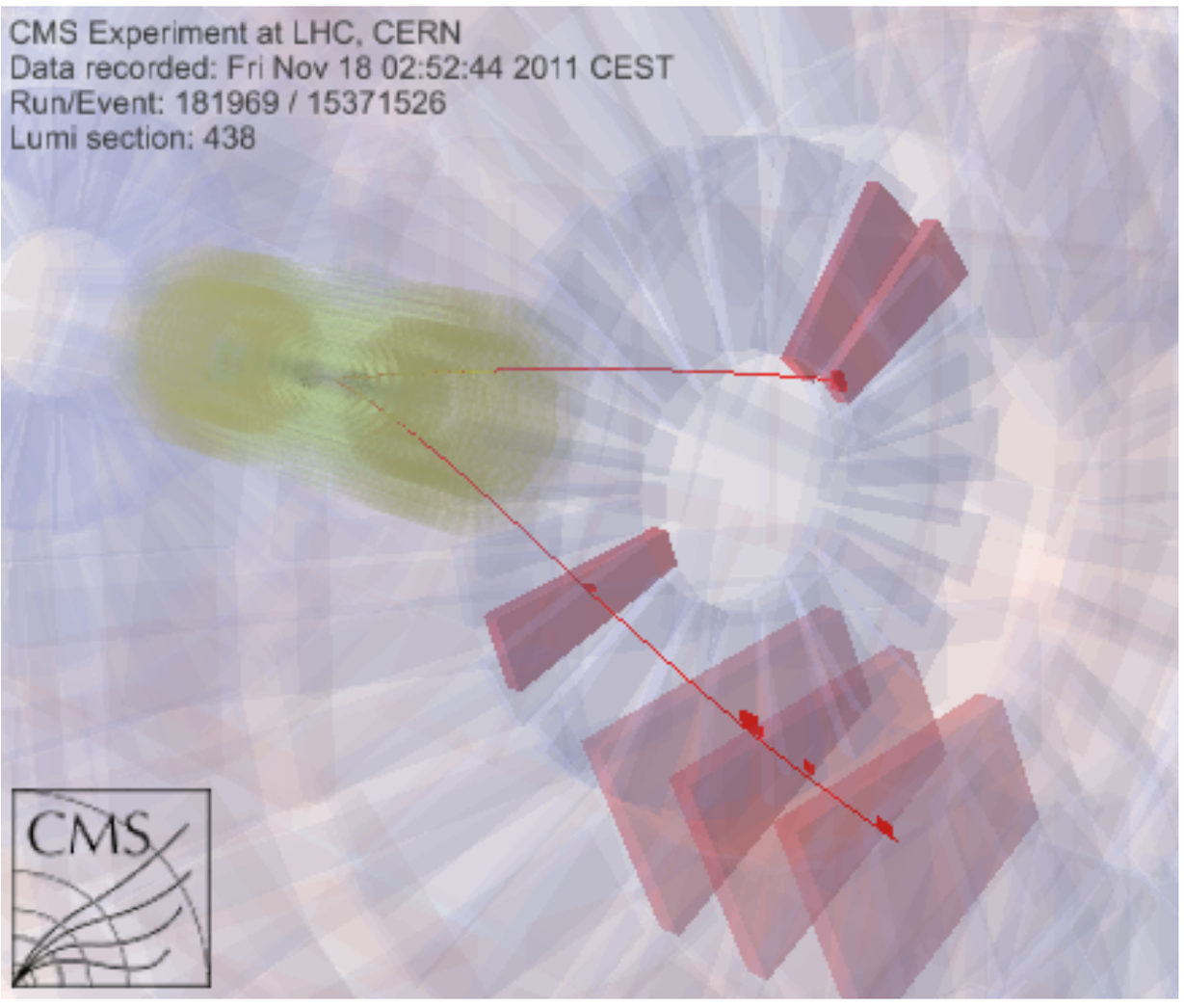
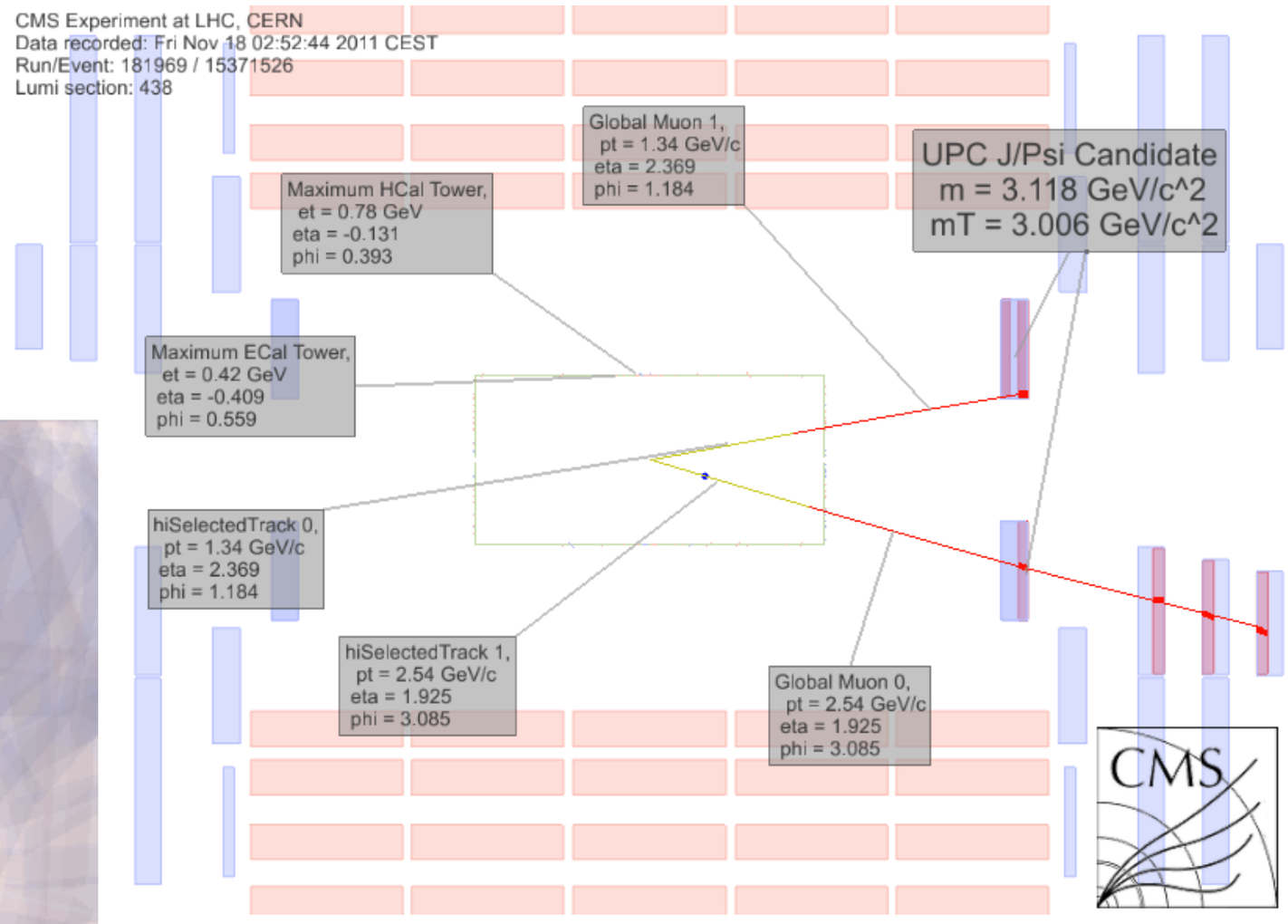


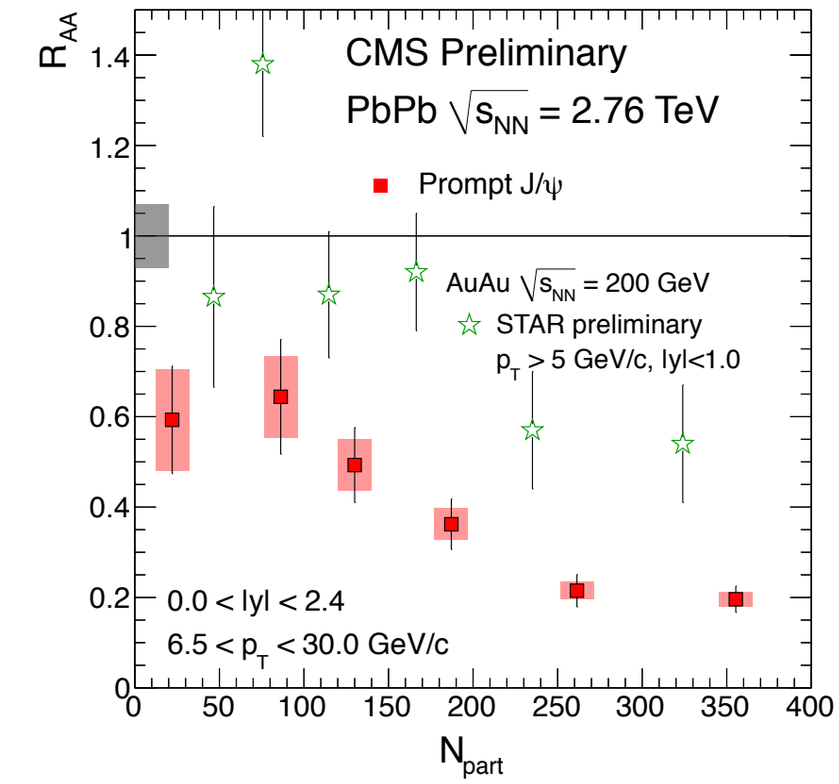
# J/ψ in ultra-peripheral PbPb collisions

- Only two tracks in the event (the two muons), barely any energy in the calorimeters, and classified in the 2.5% most peripheral collision bin for heavy ions



# Expectations for Prompt J/ψ $R_{AA}$










With more statistics may be able to answer the following questions:

- Does $R_{AA}$ go to 1 in peripheral collisions?
  - or will it remain different from one, e.g. due to CNM?
- How far in $p_T$ does the $R_{AA}$ remain 0.3?
- Centrality dependence at mid- and forward rapidity
- Centrality dependence in bins of $p_T$

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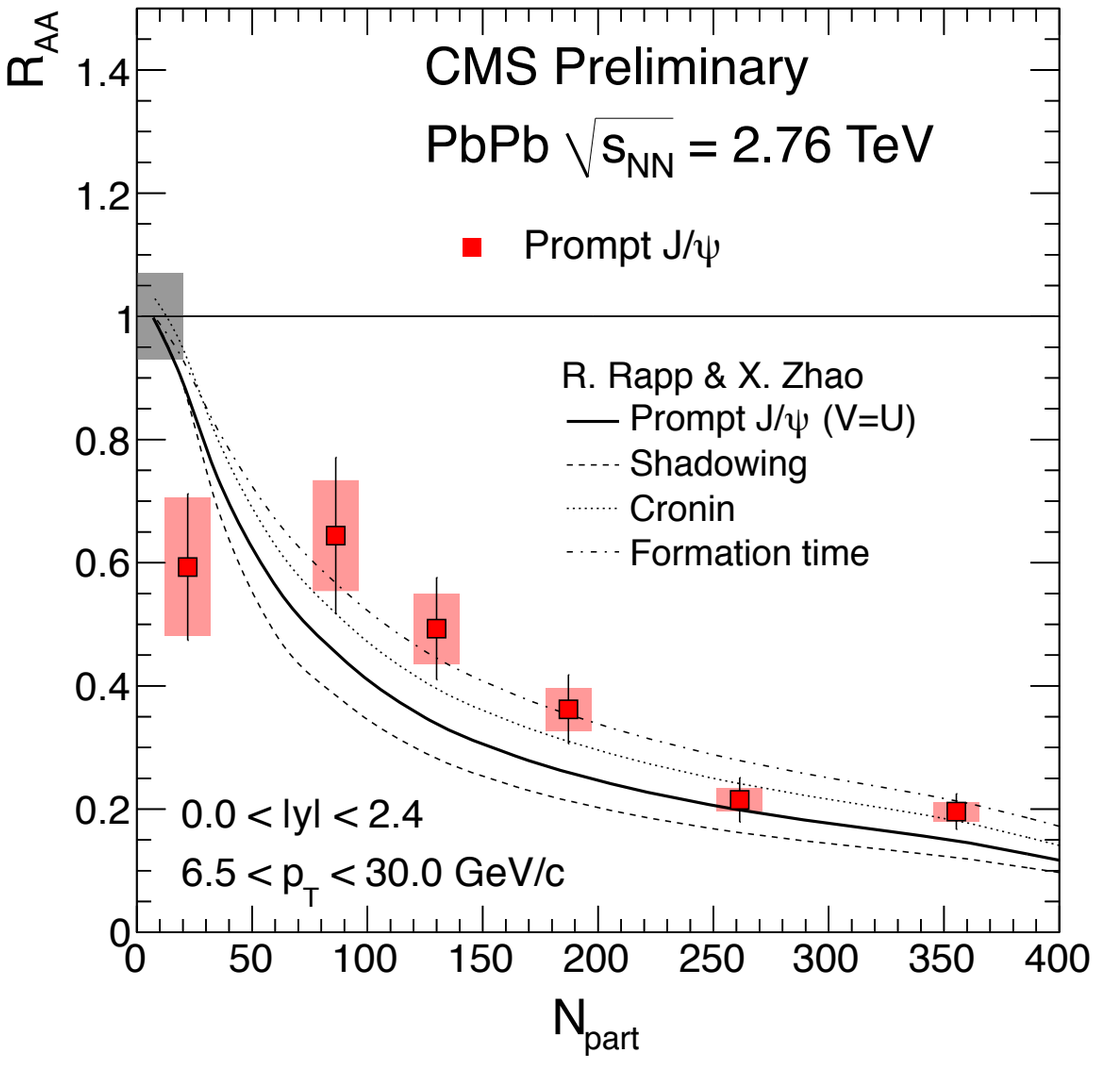
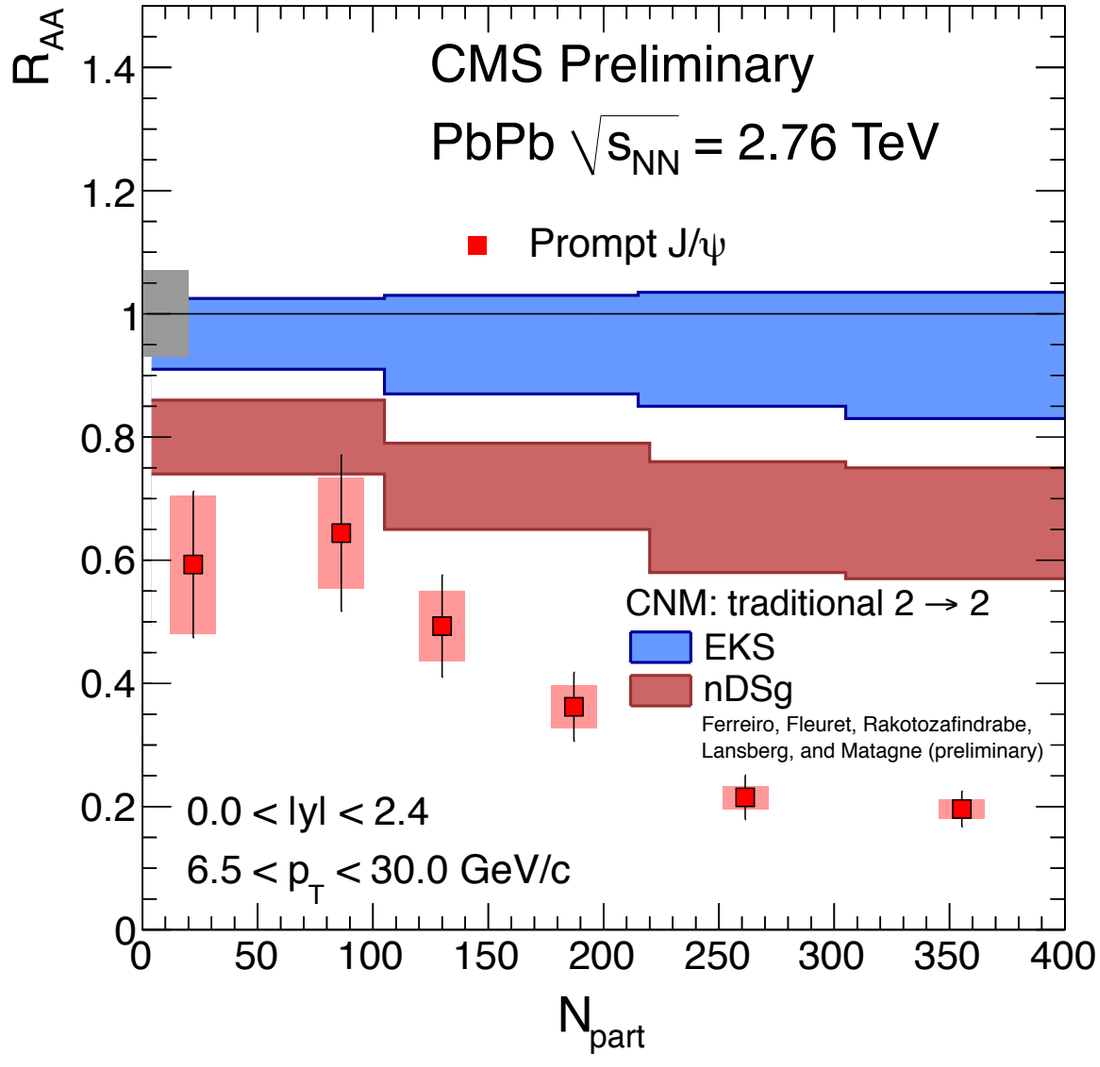
# Prompt J/ψ $R_{AA}$ vs. centrality




Zhao & Rapp, NPA 859 (2011) 114
+ private communication




Ferreiro et al.
(preliminary)

- Work in progress to estimate (anti)shadowing contributions: pPb run would help
- 2011: study centrality dependence in $p_T$ and rapidity bins
  - do models get centrality and $p_T$ dependence right?

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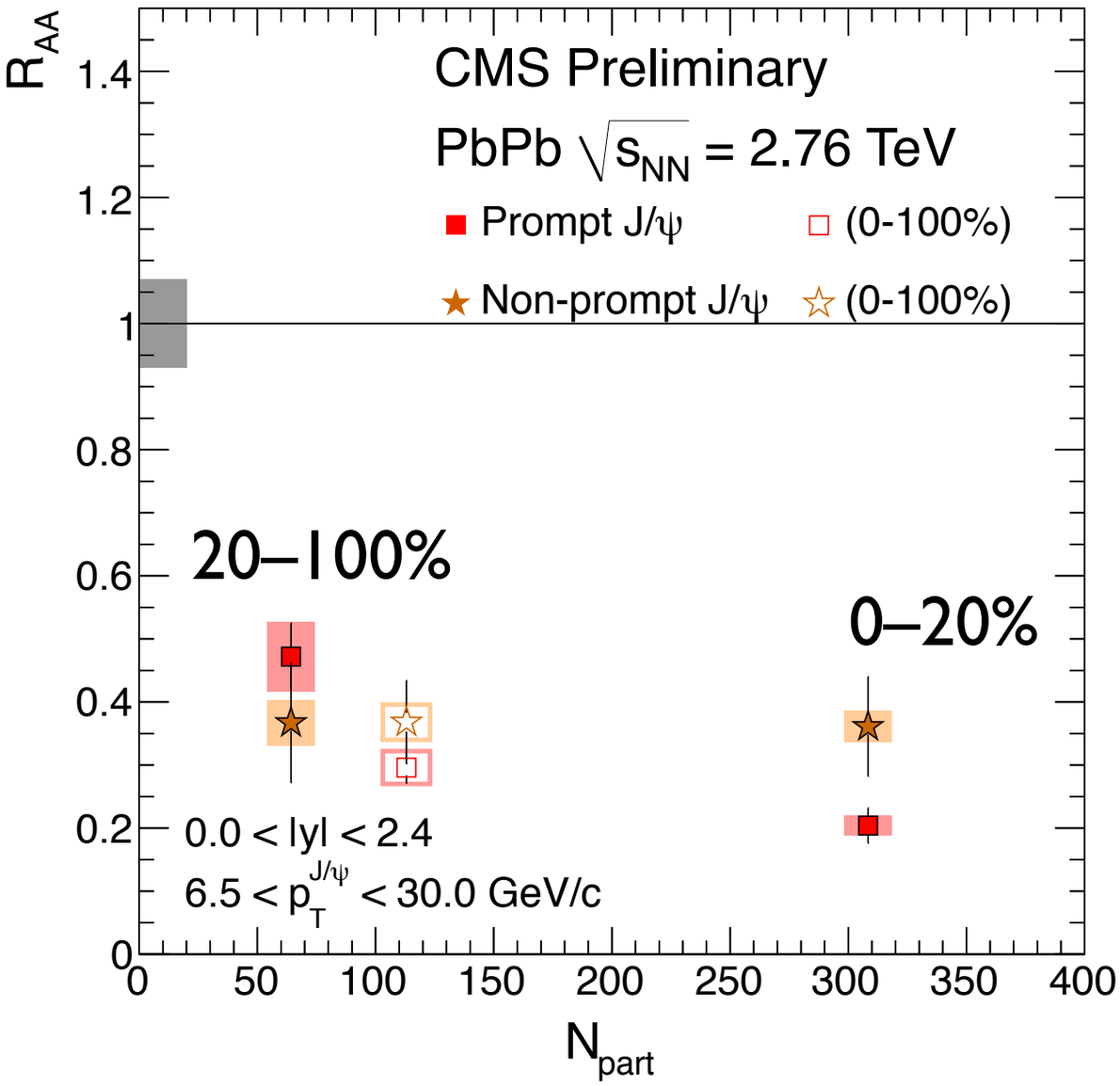
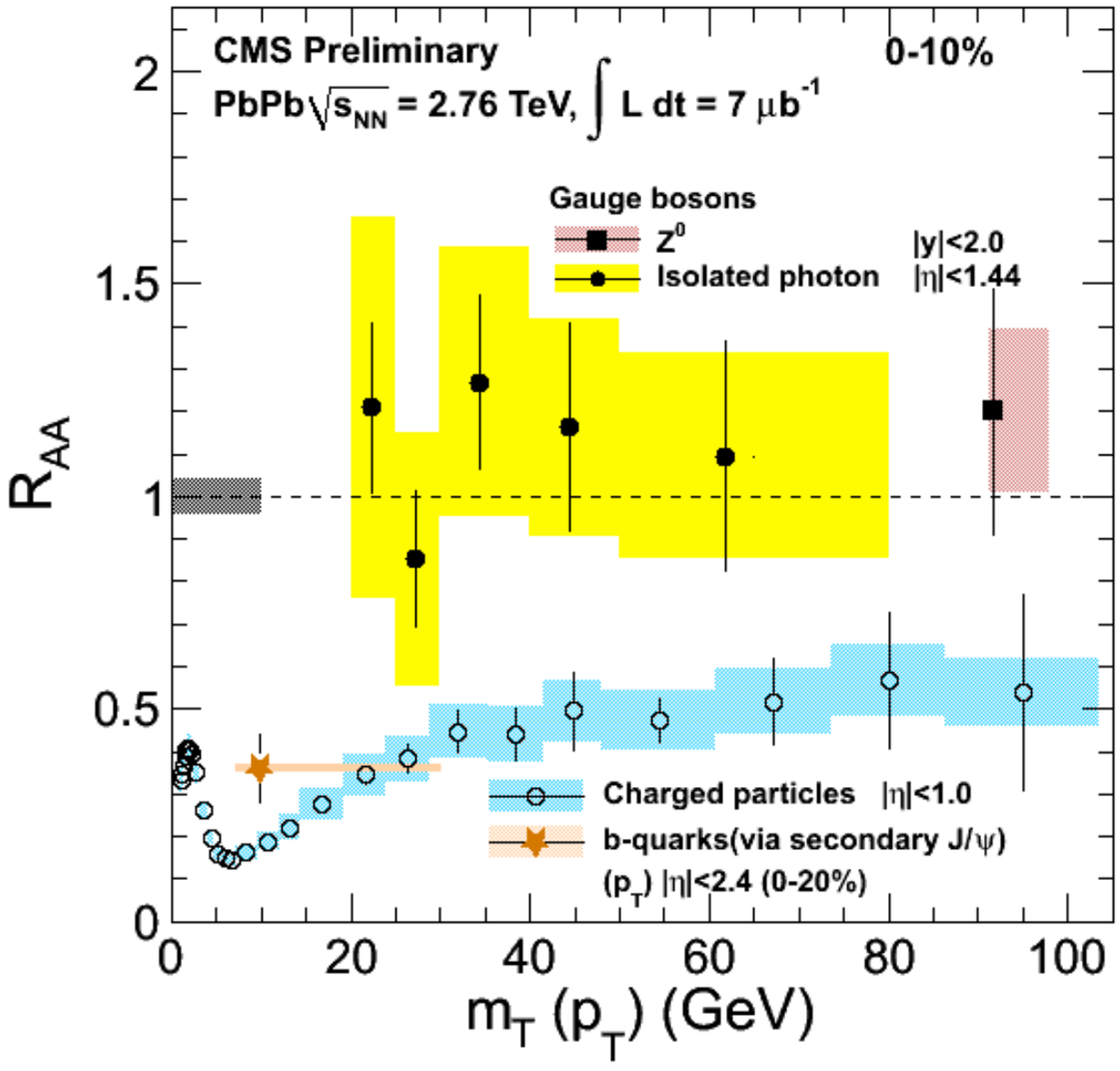
# Expectations for Non-Prompt J/ψ $R_{AA}$




With more statistics may be able to answer the following questions:

- Centrality dependence of $R_{AA}$?
- What are the rapidity and $p_T$ dependences of the $R_{AA}$?
- B/D ratio? ($R_{CB}$: Pol-Bernard Gossiaux, GDR PH-QCD 2011)

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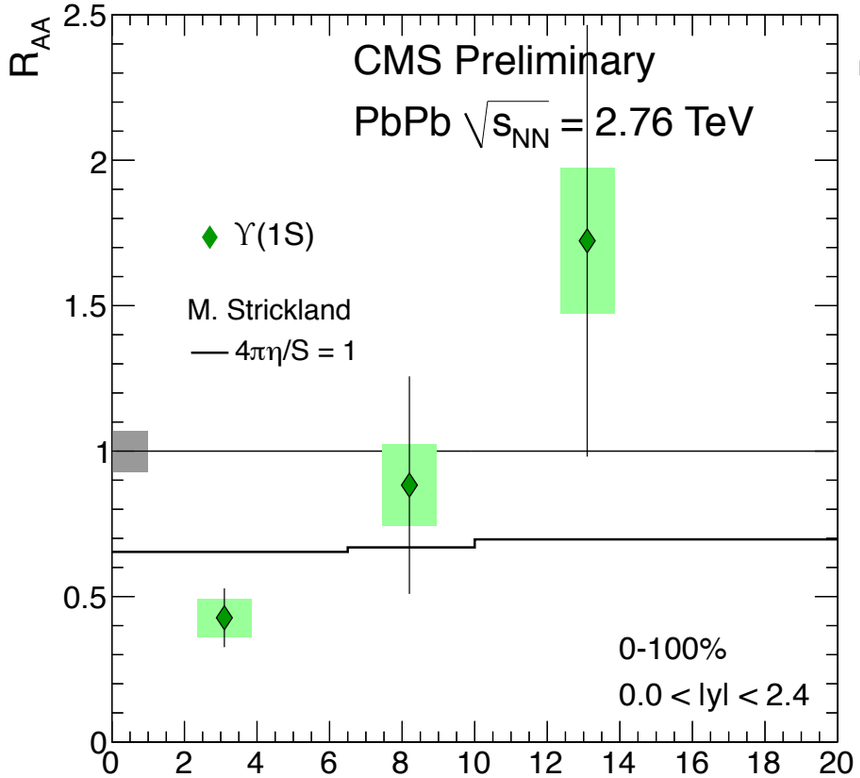
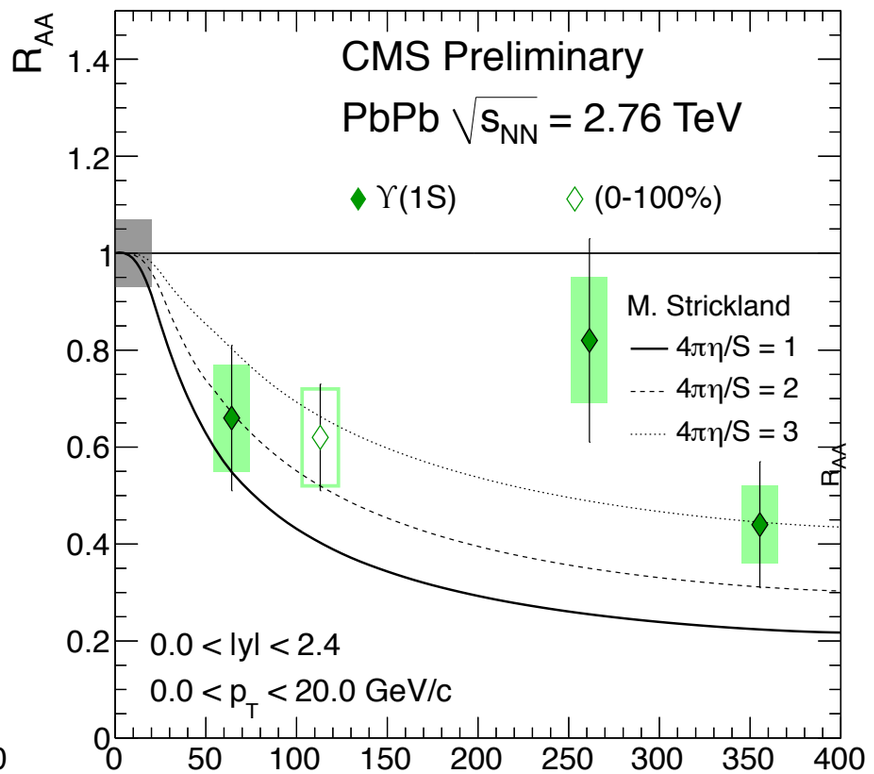
# Expectations for the Υ(1S) $R_{AA}$

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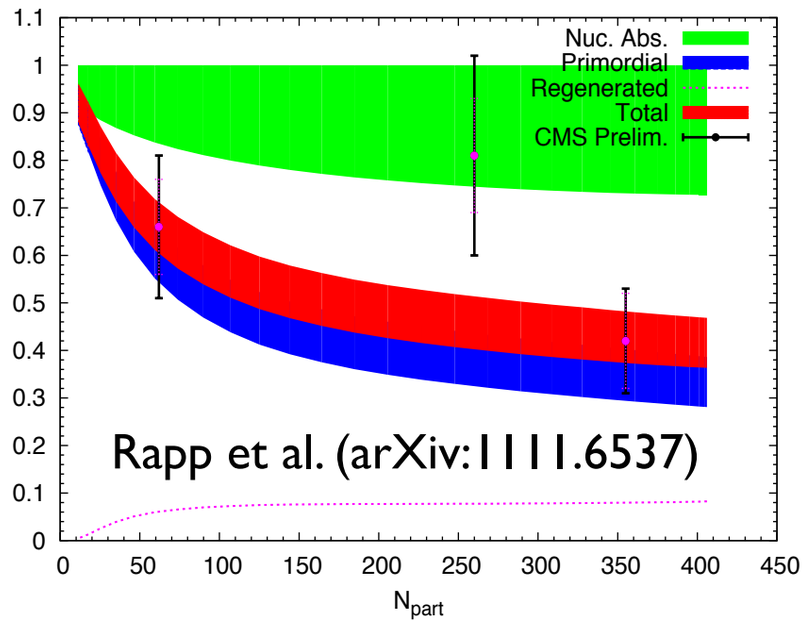
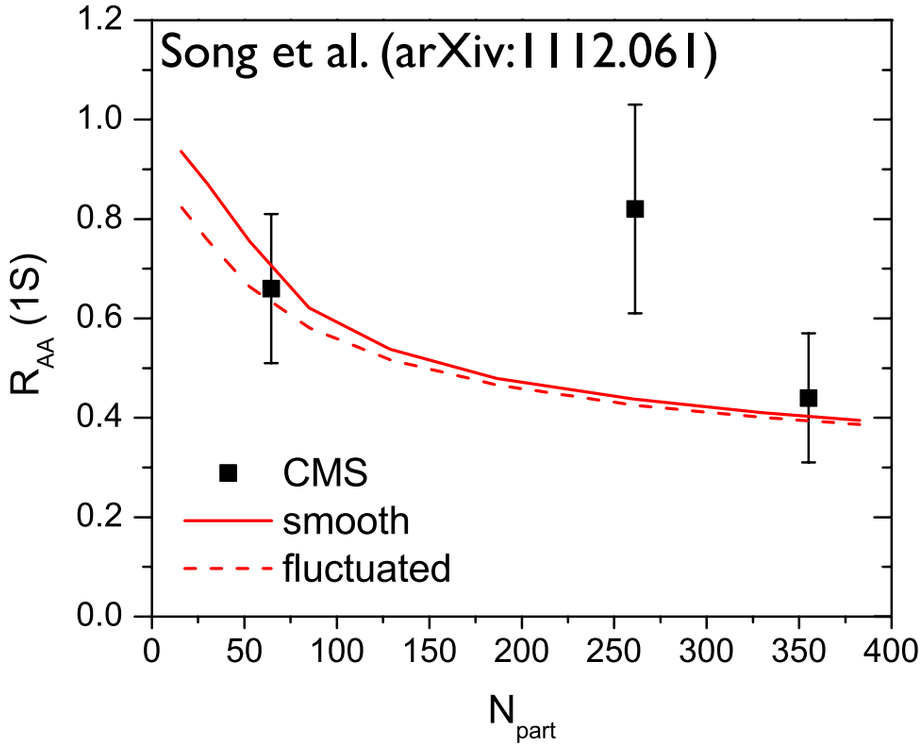
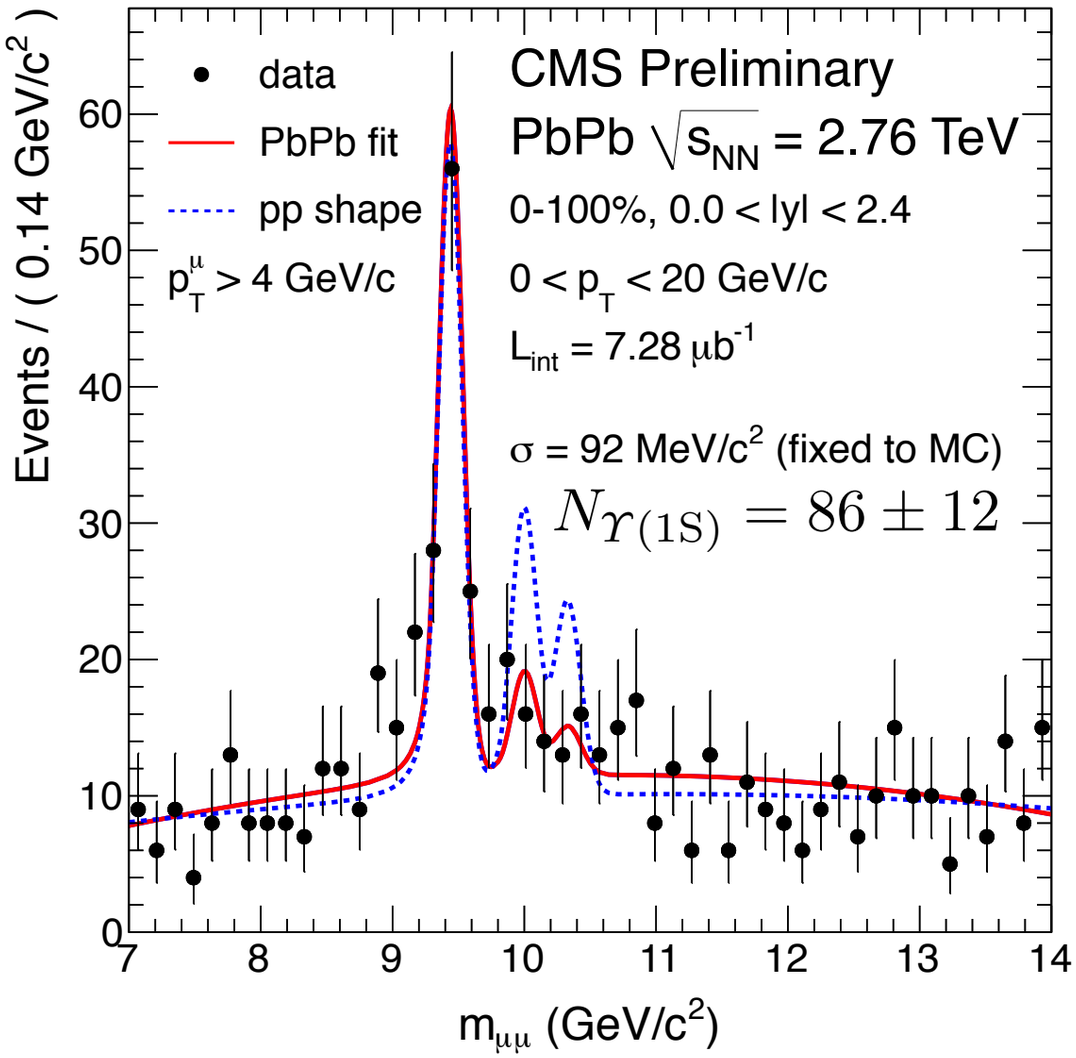
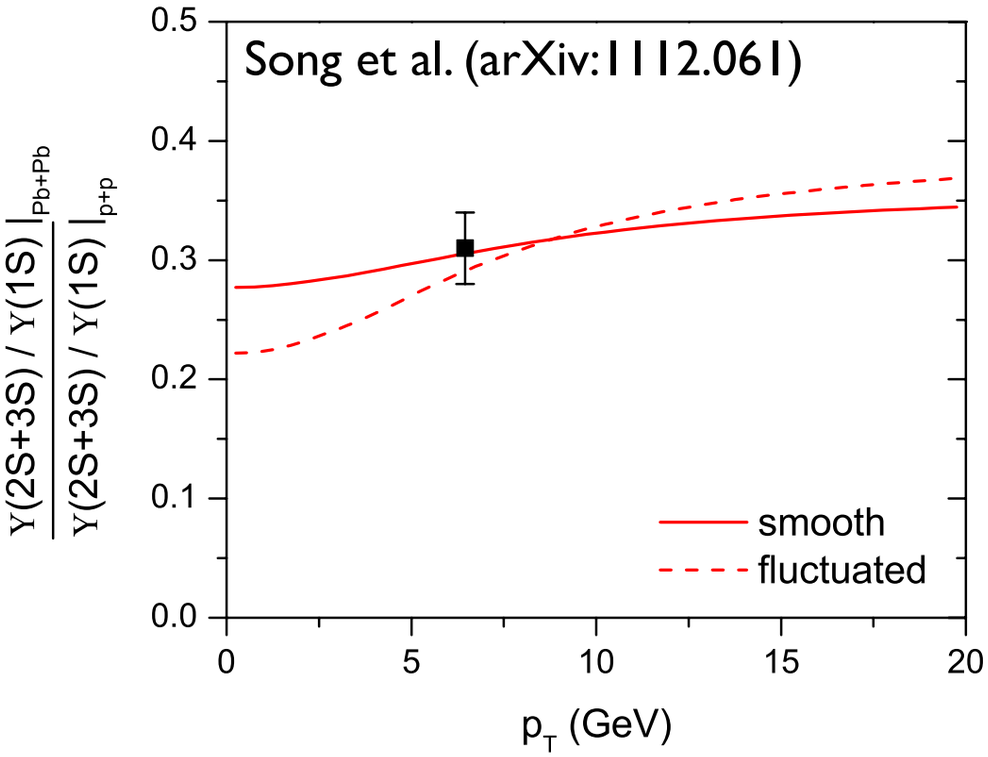



- Υ(1S) suppressed at low $p_T$
  - what about high $p_T$
- More light on rapidity dependence
- A lot of activity on the theory side
  - M. Strickland (PRL 107 (2011) 132301)
  - Rapp et al. (arXiv:1111.6537)
  - Song et al. (arXiv:1112.061)
- May start to rule out models…

# Υ(2S+3S) Suppression




PRL 107 (2011) 052302

$$\frac{\Upsilon(2S+3S)/\Upsilon(1S)|_{PbPb}}{\Upsilon(2S+3S)/\Upsilon(1S)|_{pp}} = 0.31^{+0.19}_{-0.15} \pm 0.03$$

- Confirm suppression of excited states with higher precision
- Measure double ratio as a function of centrality, $p_T$…

# Summary

- Excellent performance of the LHC during the heavy ion run 2011
- Run provided 15 times the statistics of the 2010 heavy ion run
- Charged hadron $R_{AA}$ with high precision to high $p_T$
- More detailed studies of the di-jet imbalance
  - Golden channel: photon-jets
- Will be able to study quarkonia in PbPb collisions in much more detail
  - Double differential measurements of prompt $J/\psi$ $R_{AA}$
  - Precise measurement of excited $\Upsilon$ states double ratio
  - $R_{AA}$ of $\Upsilon$(nS) states
  - Map centrality and $p_T$ dependence of b-quark energy loss with non-prompt $J/\psi$
- Electroweak bosons may start to constrain initial state effects

# Backup

# Dijet AJ distribution