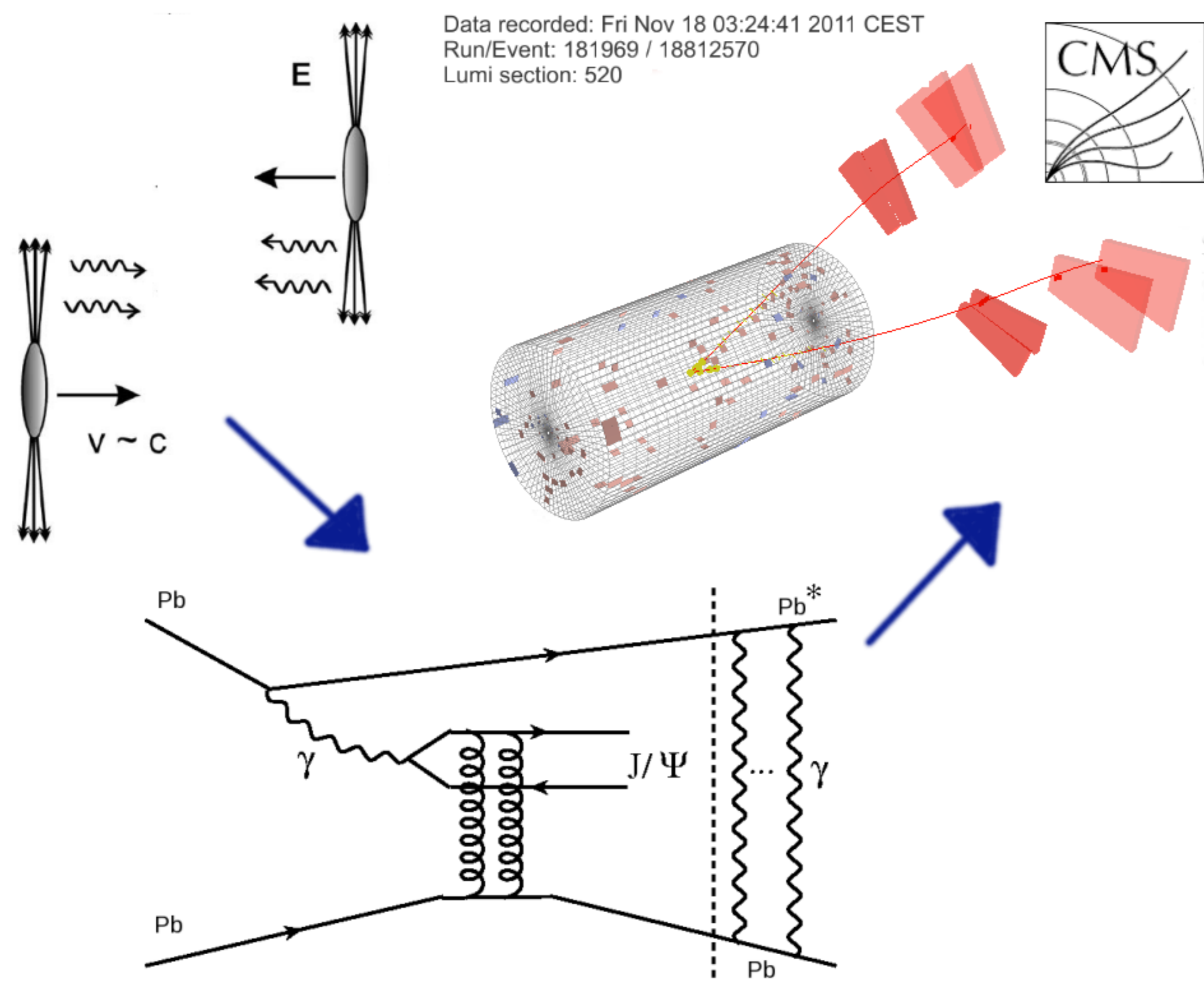


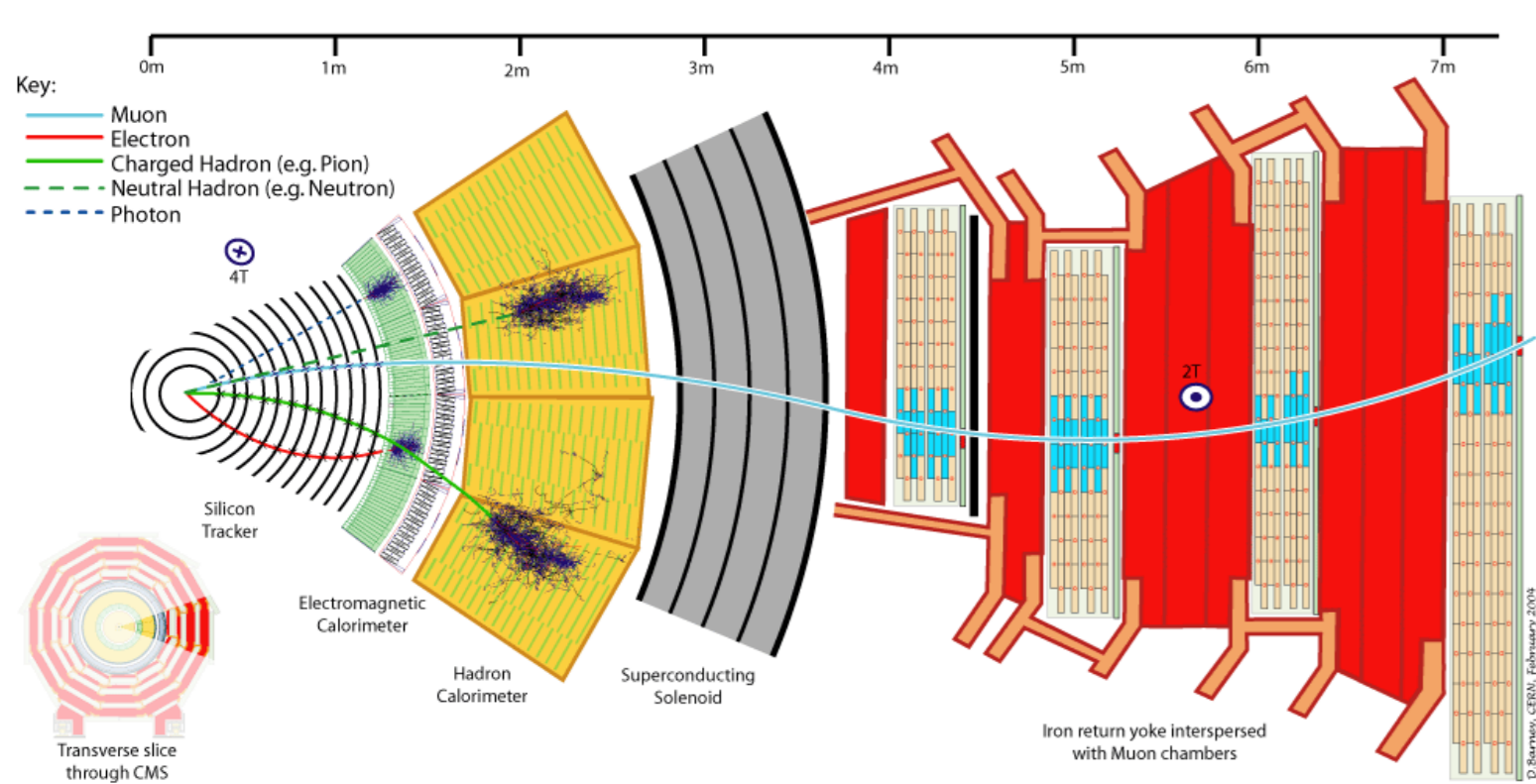
## MOTIVATION

Ultra-peripheral collisions (UPC) occur when ions collide with an impact parameter larger than the sum of the nuclear radii. The interaction is mediated through the exchange of photons. Cross sections for vector meson production in UPC events can be shown to be proportional to the square of the gluon density of the colliding ions [1]. Roughly half of these events are accompanied by the emission of a forward neutron [5].



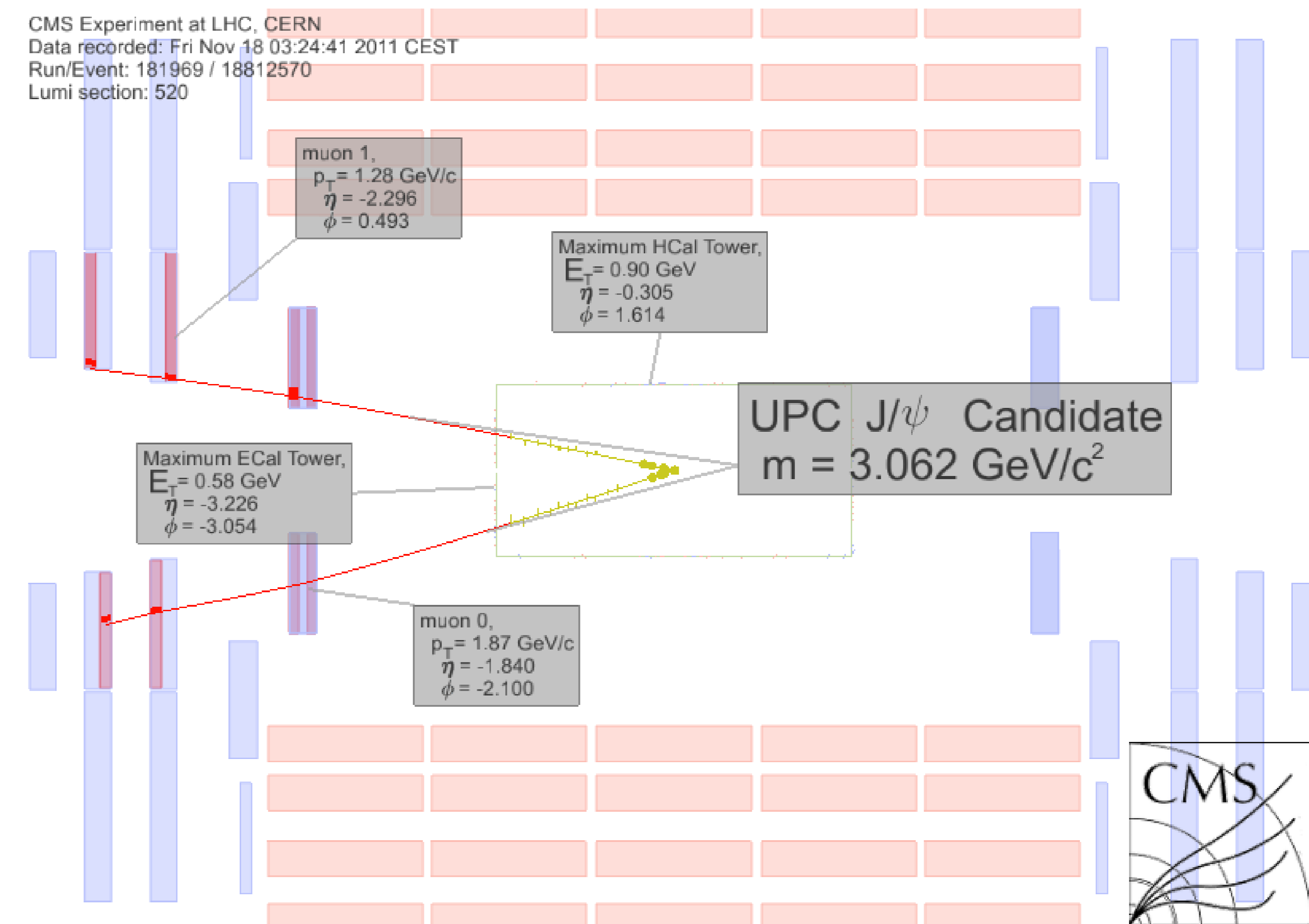
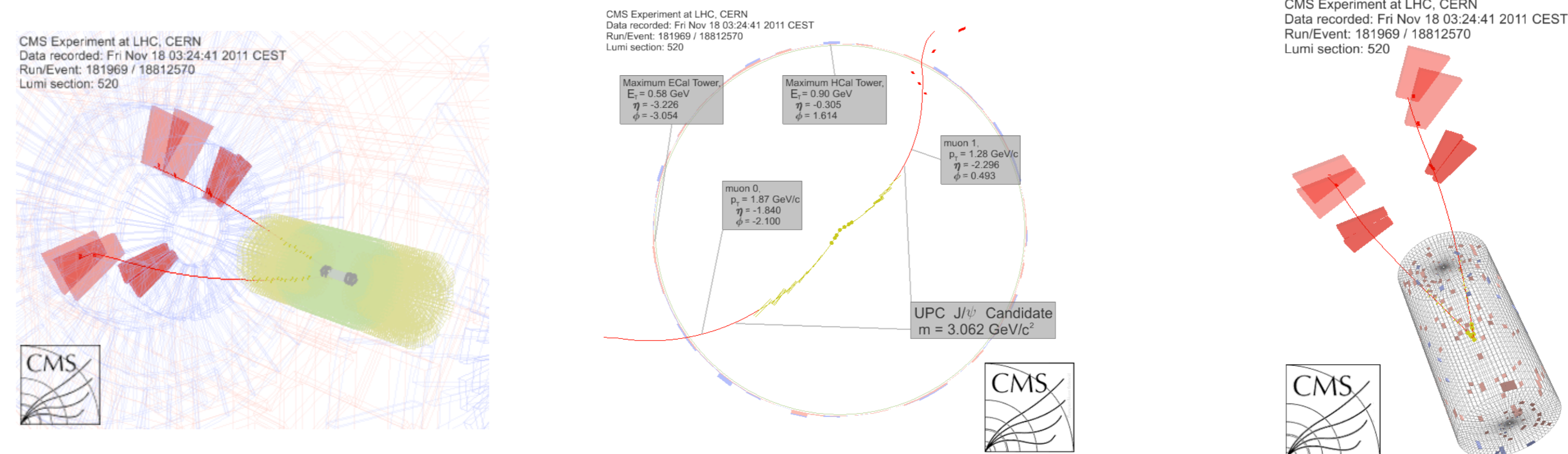
This poster demonstrates the feasibility of measuring UPC  $J/\psi$  yields with CMS.

## EXPERIMENTAL APPARATUS



This analysis uses several detectors to veto nuclear interactions, the Zero Degree Calorimeter to select events with neutrons, the muon detectors to identify muons and the tracker to measure their momentum [2].

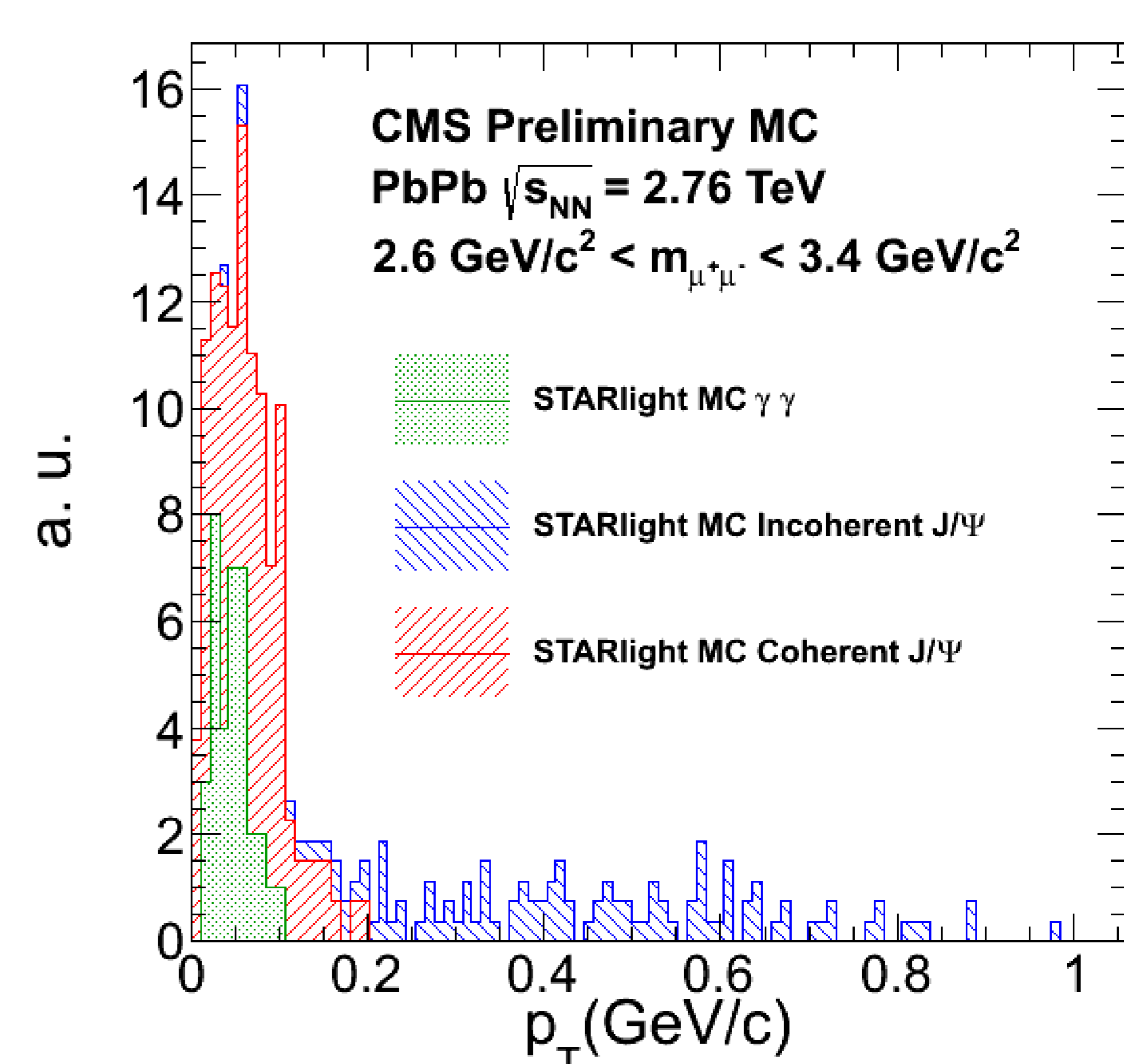
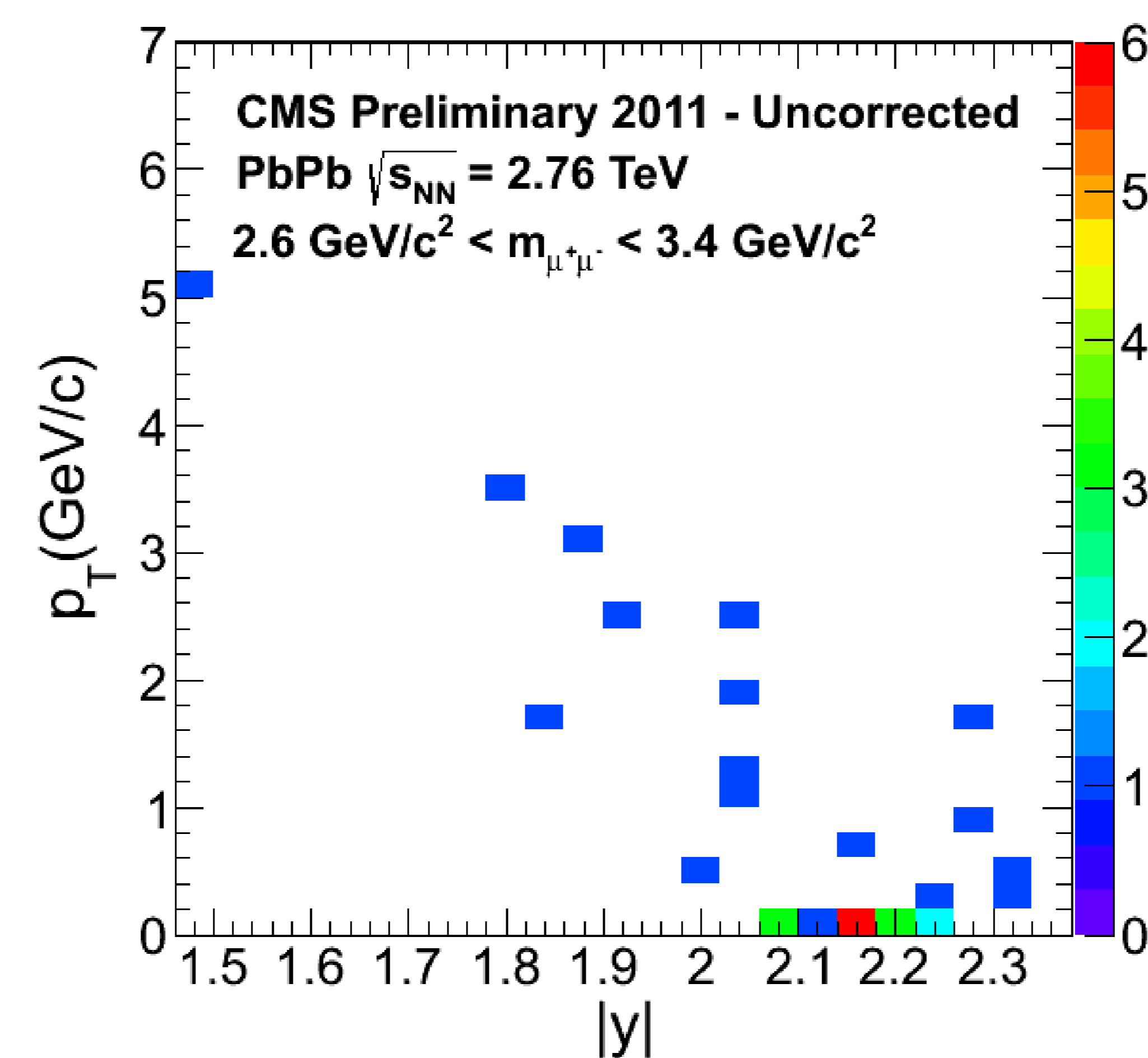
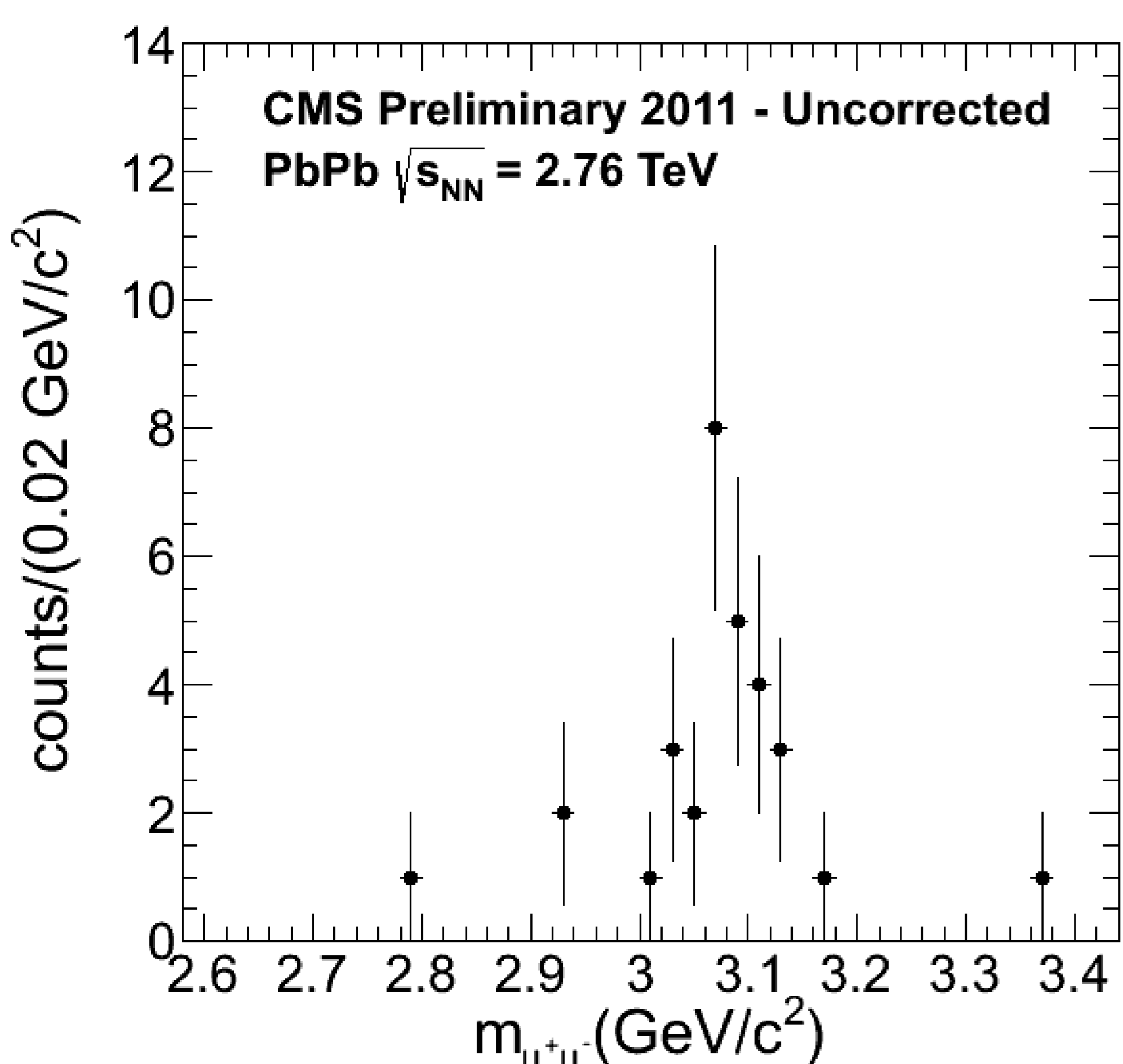
## UPC $J/\psi$ CANDIDATE



## DATA AND ANALYSIS STRATEGY

- ▶ **Dataset:**  $\sqrt{s_{NN}} = 2.76$  TeV PbPb collision data from 2011;
- ▶ **Trigger:** veto on hadronic activity, a hit in at least one ZDC, loose single muon trigger, and at least one track in the pixel tracker;
- ▶ **Event selection:** standard CMS cuts to reject beam-gas background [3], and rejection of events with hits in both HF calorimeters;
- ▶ **Exclusivity cuts:** require only two tracks in the event, and no signal above noise in the calorimeters [4].

## RESULTS



**Figure 1:** Invariant mass spectrum of  $\mu^+\mu^-$  pairs for ultra-peripheral PbPb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV. The statistical uncertainties are shown with vertical bars.

**Figure 2:** Transverse muon momentum versus  $|y|$  of  $\mu^+\mu^-$  pairs with  $2.6 \text{ GeV}/c^2 < m_{\mu^+\mu^-} < 3.4 \text{ GeV}/c^2$  for ultra-peripheral PbPb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV.

**Figure 3:** STARlight transverse momentum distributions after data analysis cuts for  $\mu^+\mu^-$  pairs with  $2.6 \text{ GeV}/c^2 < m_{\mu^+\mu^-} < 3.4 \text{ GeV}/c^2$  for  $\gamma\gamma$  continuum (green), coherent (red) and incoherent (blue)  $J/\psi$  UPC production.

## REFERENCES

- [1] A. J. Baltz et al., Phys.Rept. 458, 1-171 (2008)
- [2] CMS Collaboration, JINST, 3, S08004 (2008)
- [3] CMS Collaboration, Phys.Rev.C84:024906 (2011)

- [4] CMS Collaboration, JHEP 1201, 052 (2012)
- [5] PHENIX Collaboration, Physics Letters B 679, 321 (2009)