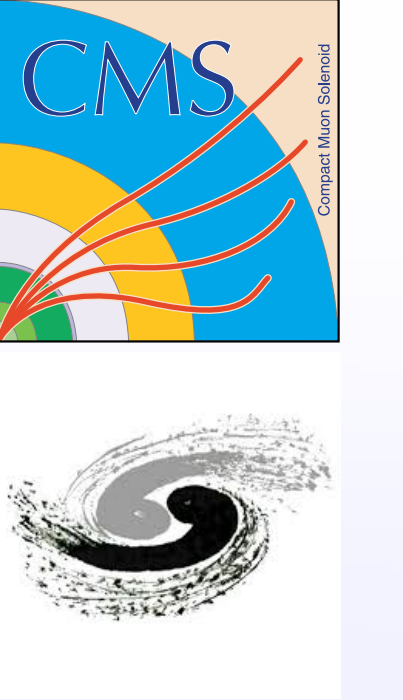


# Constraining nPDFs with Drell-Yan production in pPb collisions with CMS

CMS-PAS-HIN-18-003



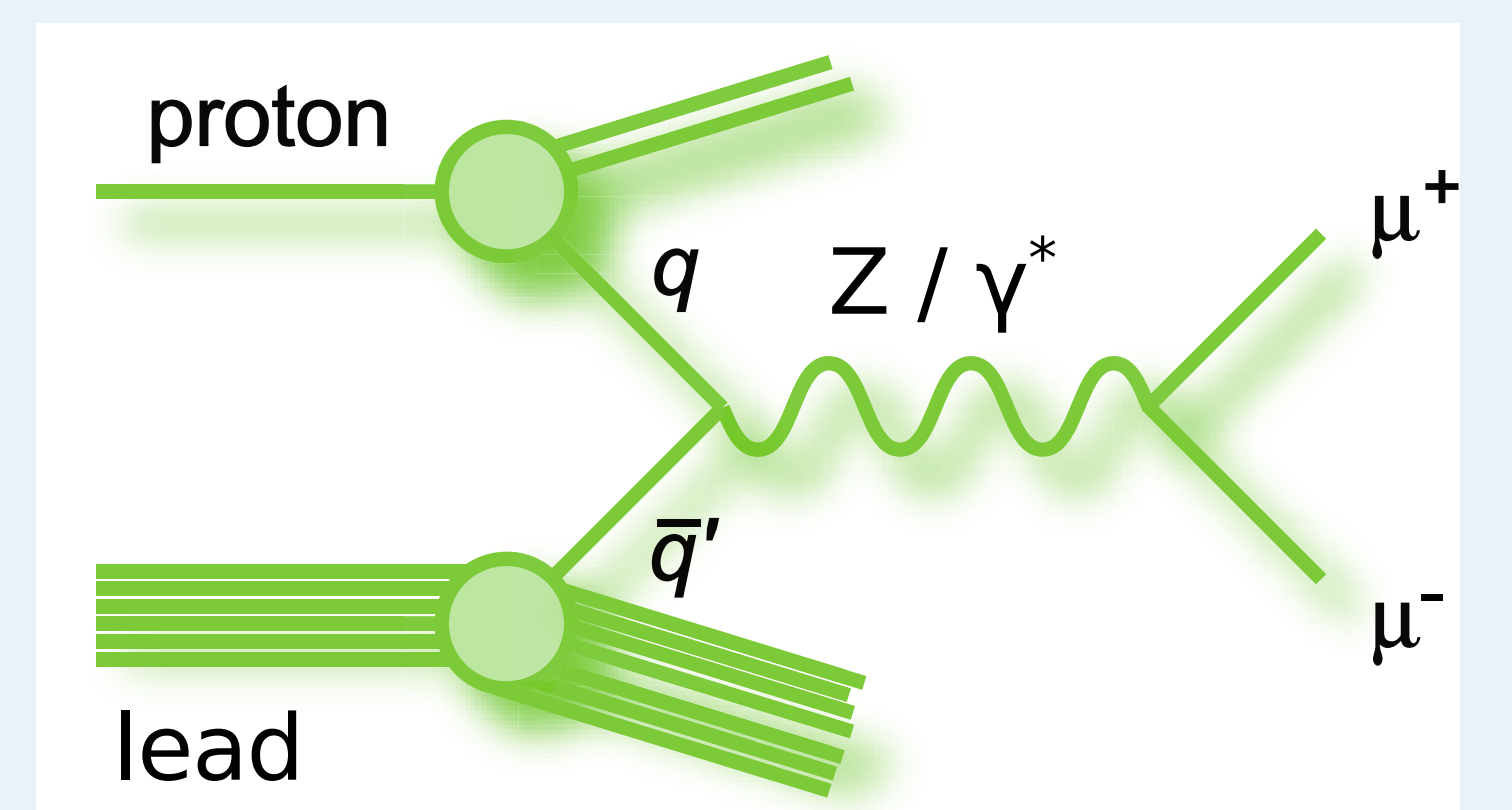
Émilien Chapon, on behalf of the CMS Collaboration

## Introduction

Measurements of differential cross sections for the Drell-Yan process, including Z boson production, in proton-lead (pPb) collisions at a nucleon-nucleon centre-of-mass energy of 8.16 TeV are presented, in the muon channel, for centre-of-mass frame rapidities  $-2.87 < y_{\text{CM}} < 1.93$  [1]. Results are compared to predictions at next-to-leading order (POWHEG [2-4]), including nuclear modifications of parton distribution functions, which they could help better constrain.

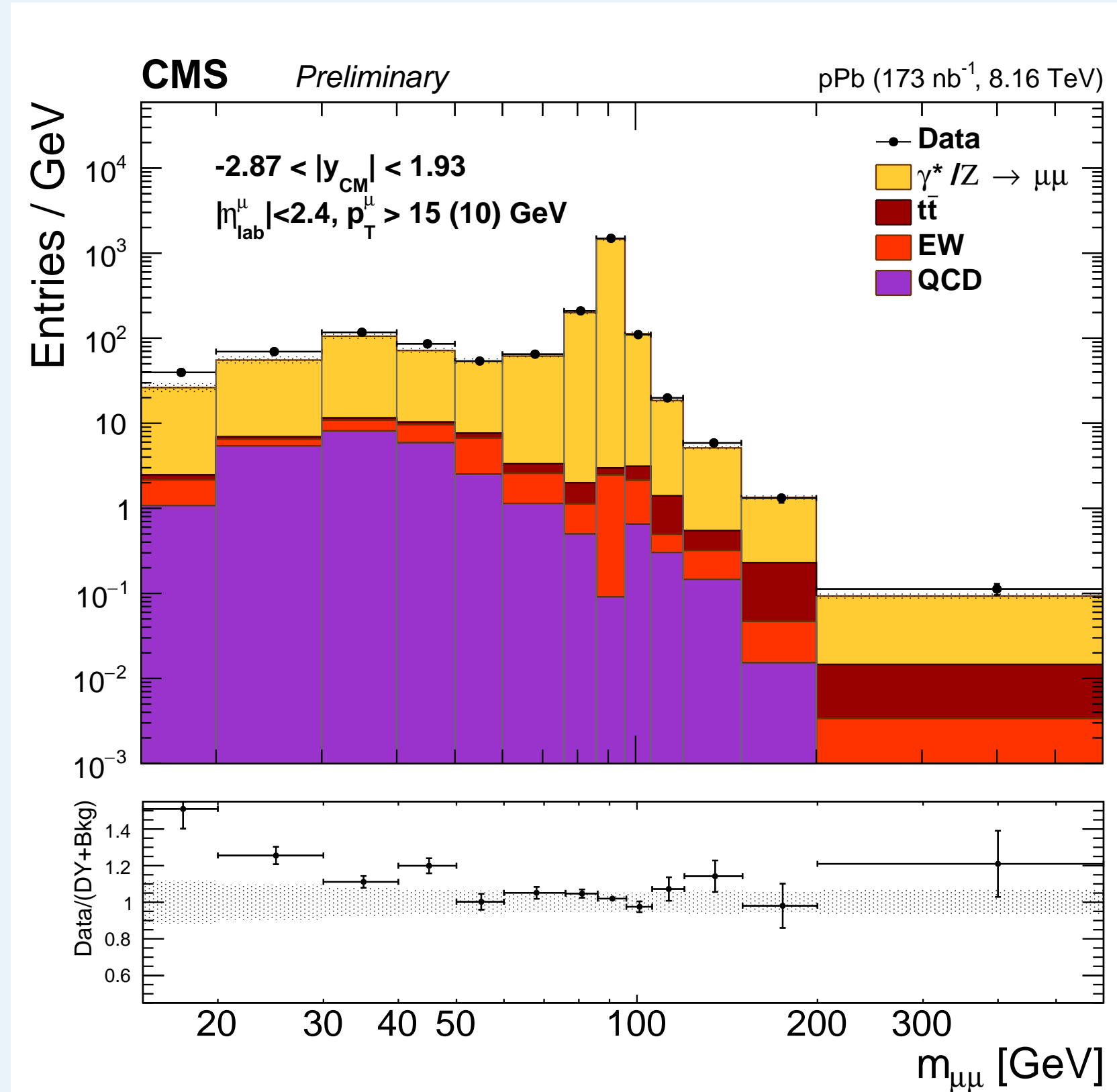
## Variables

- Mass for  $15 < m_{\mu\mu} < 600$  GeV
- For  $15 < m_{\mu\mu} < 60$  and  $60 < m_{\mu\mu} < 120$  GeV:
  - Rapidity  $y_{\text{CM}}$
  - Transverse momentum  $p_{\text{T}}$
  - $\phi^*$  (angular variable  $\sim p_{\text{T}}/m_{\mu\mu}$ )



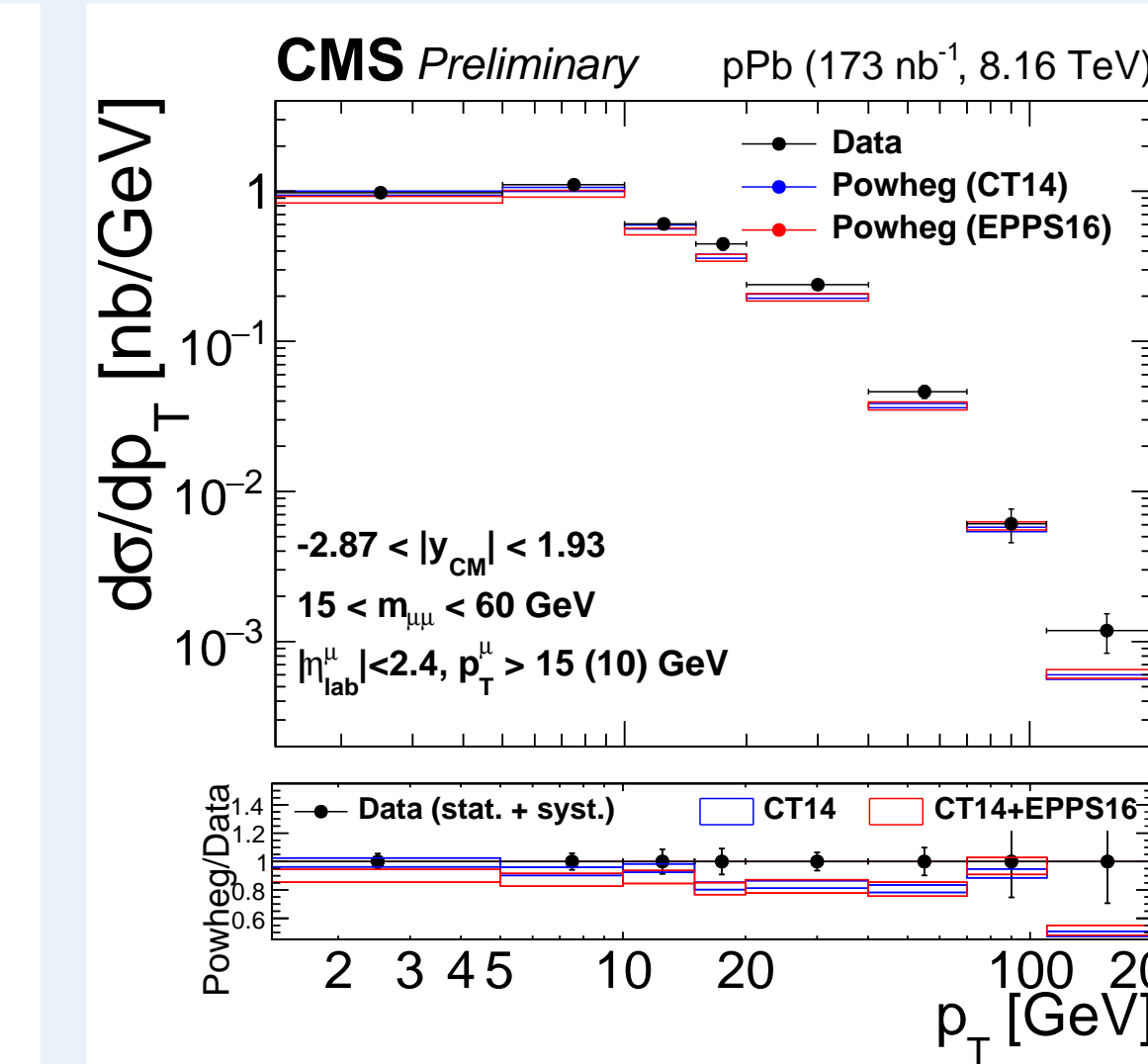
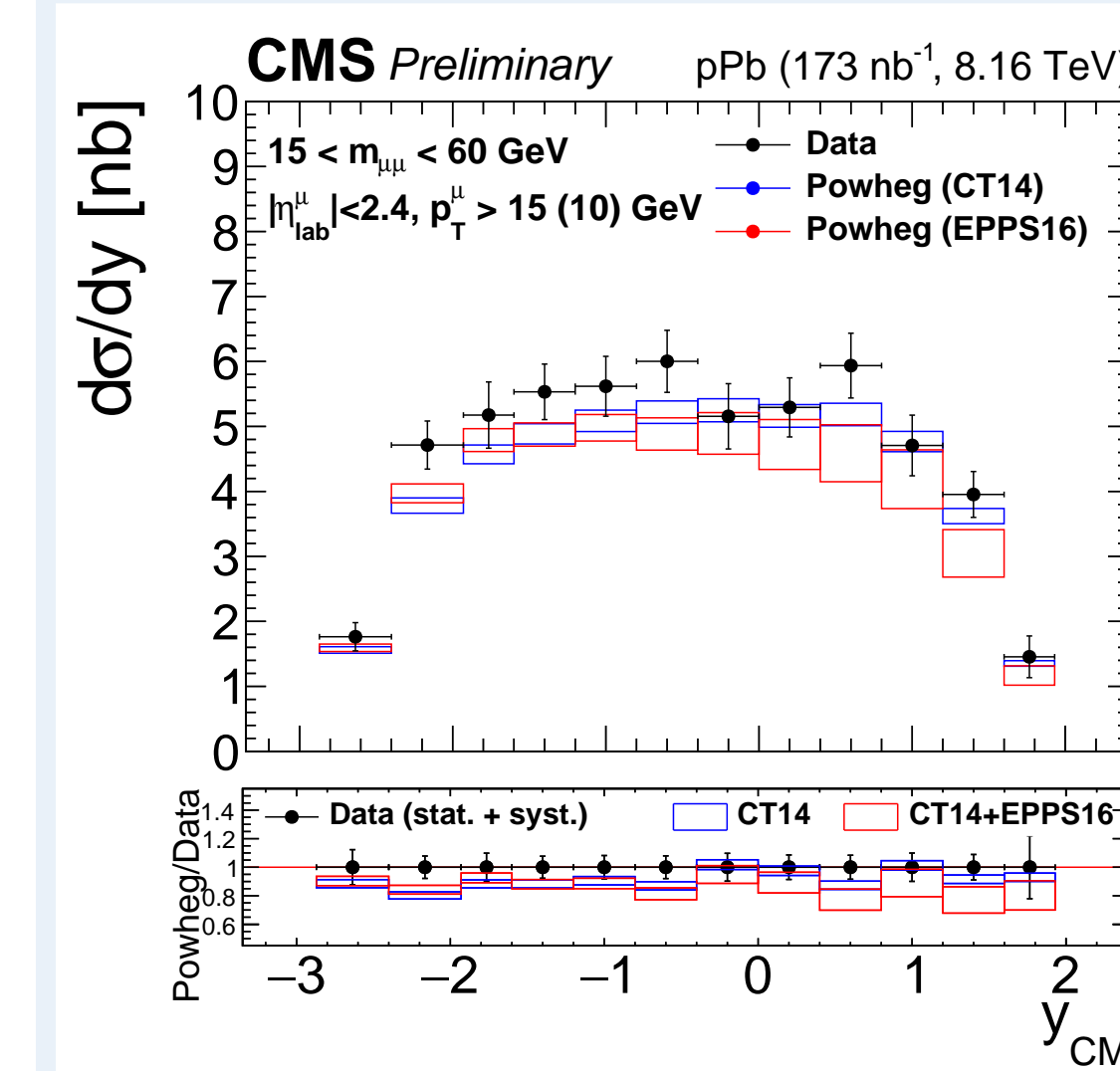
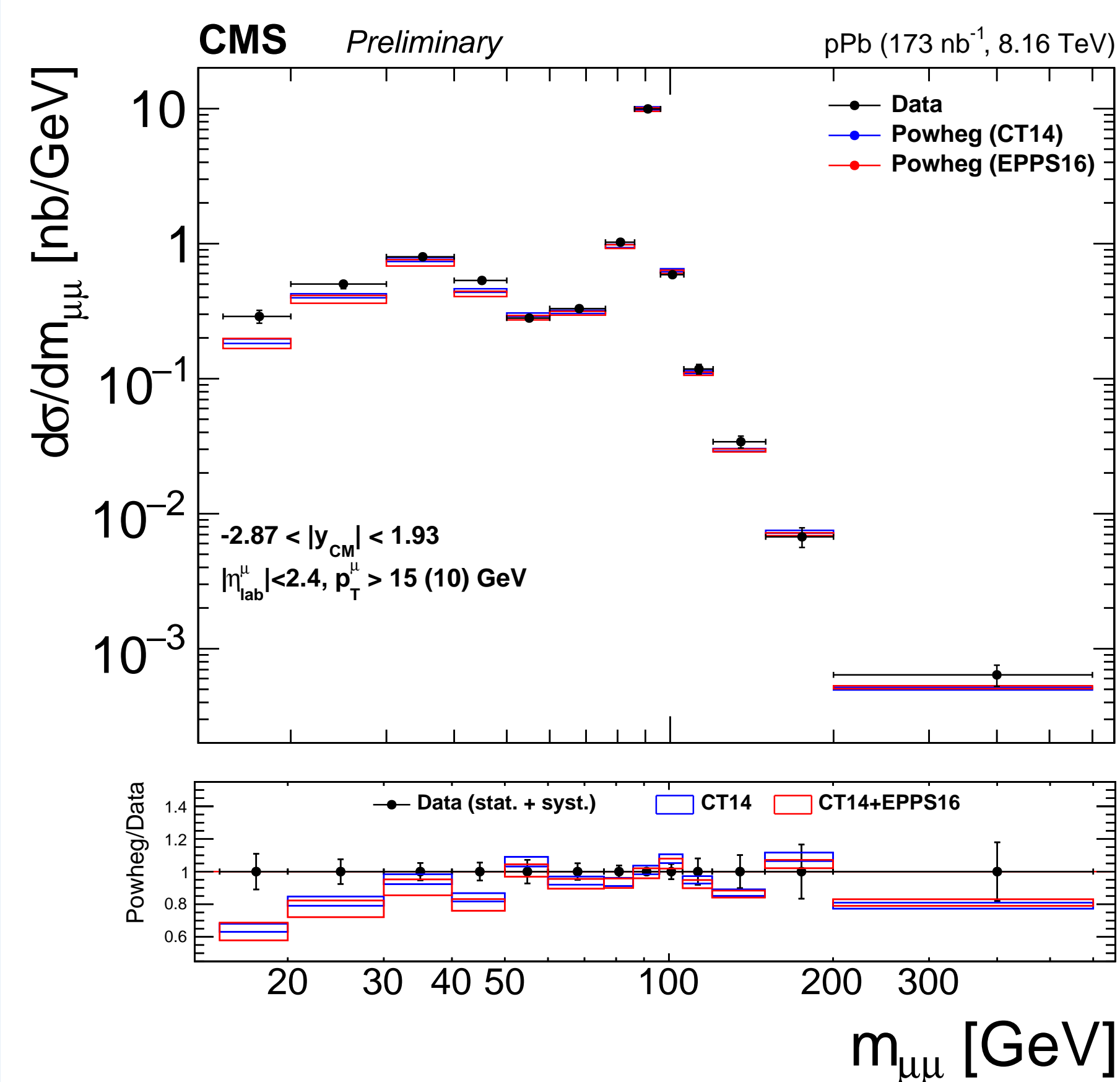
## Analysis procedure

**Backgrounds** are estimated from simulation ( $t\bar{t}$ , EWK) or data (QCD jets) and **subtracted from data**. Results are **corrected for acceptance and efficiency**, and **unfolded** for detector resolution and final state radiation.



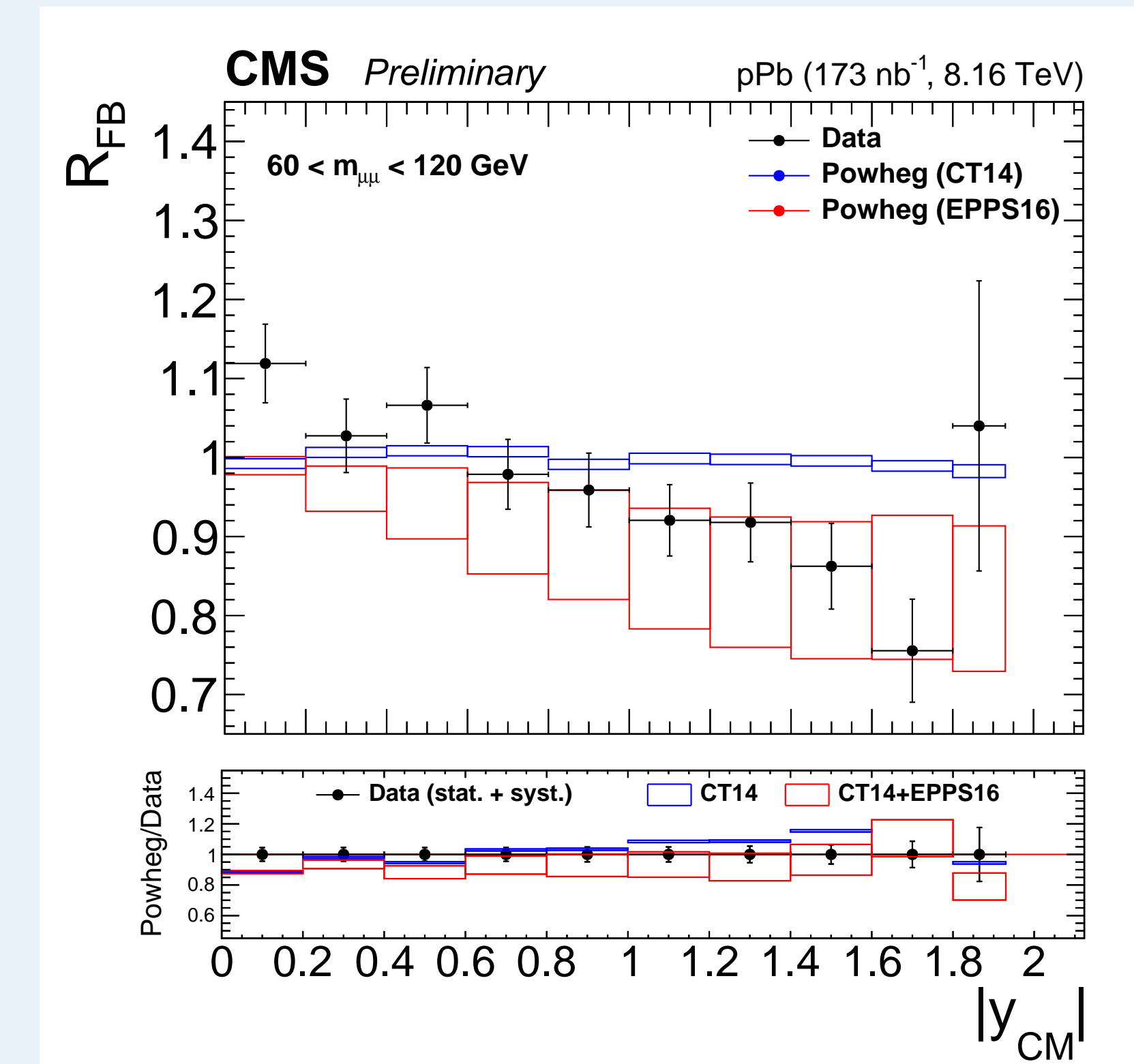
## Fiducial cross sections

Cross sections within single muon kinematic selection  $|\eta_{\text{lab}}^{\mu}| < 2.4$ ,  $p_{\text{T}}^{\mu} > 15(10)$  GeV. Only three examples shown: mass (left), and  $y_{\text{CM}}$  (centre) and  $p_{\text{T}}$  (right) for  $15 < m_{\mu\mu} < 60$  GeV.



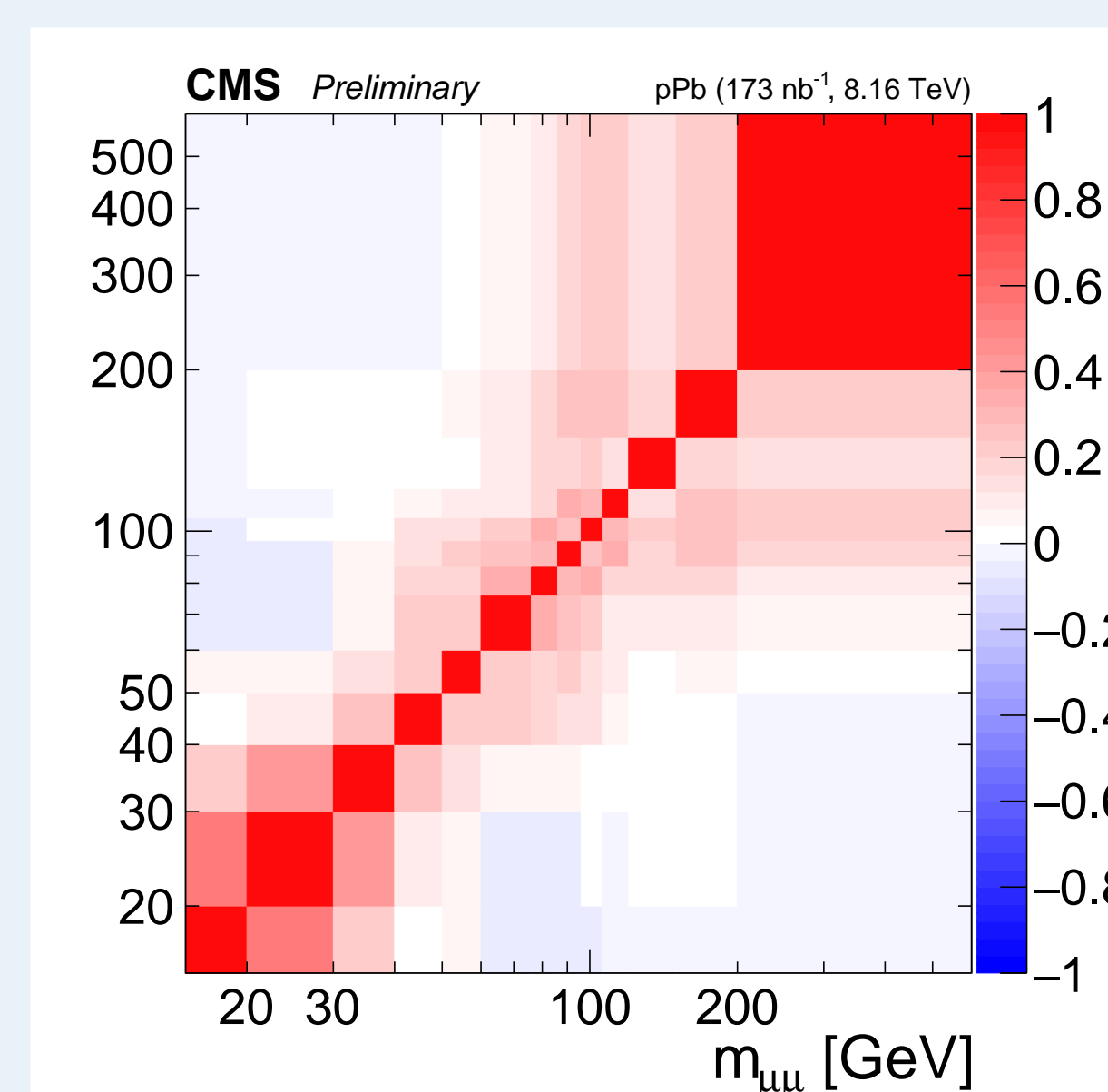
## Forward-backward ratios

$$R_{\text{FB}} = \frac{\sigma(y_{\text{CM}} > 0)}{\sigma(y_{\text{CM}} < 0)}$$

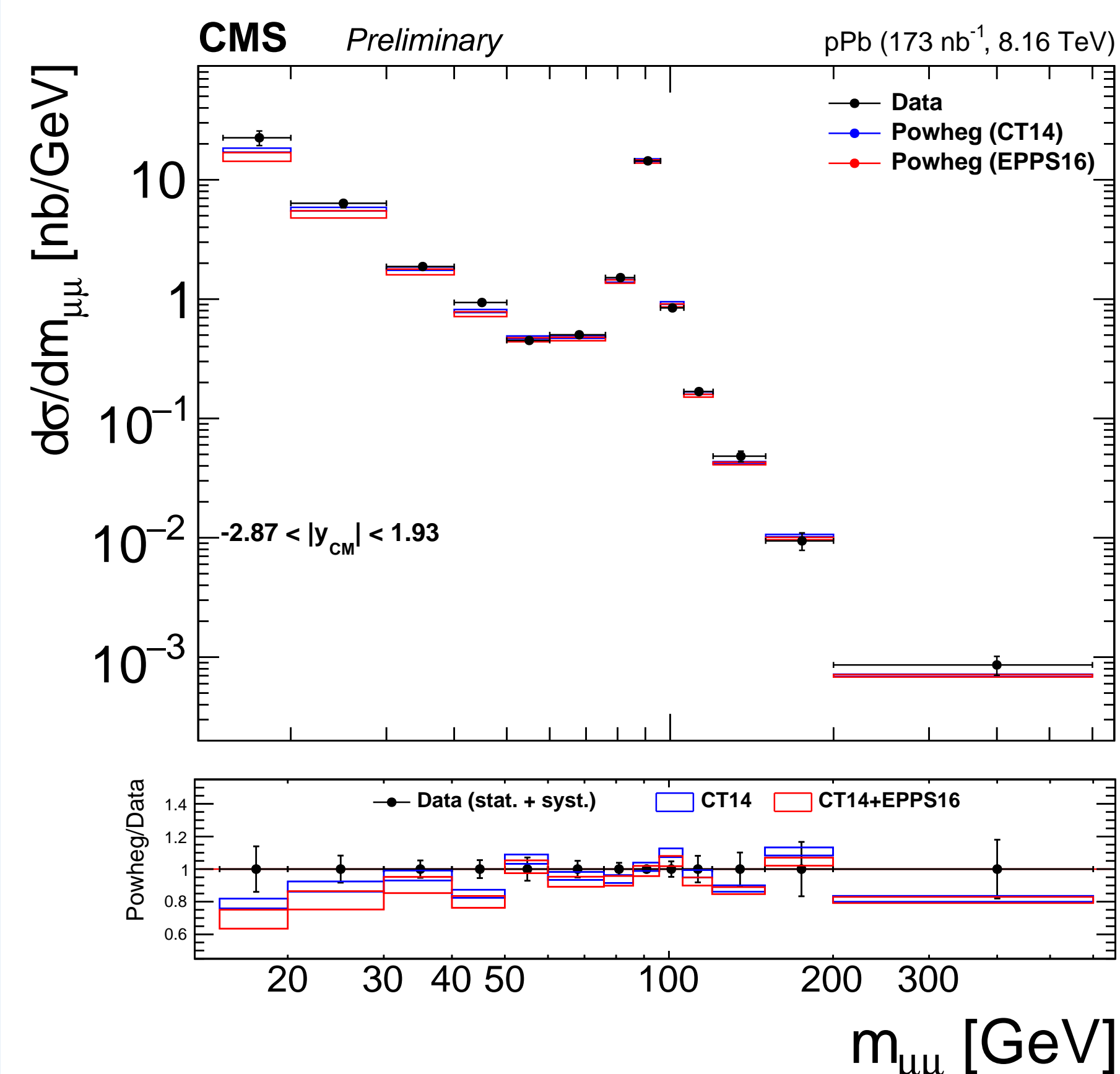


## Systematic uncertainties

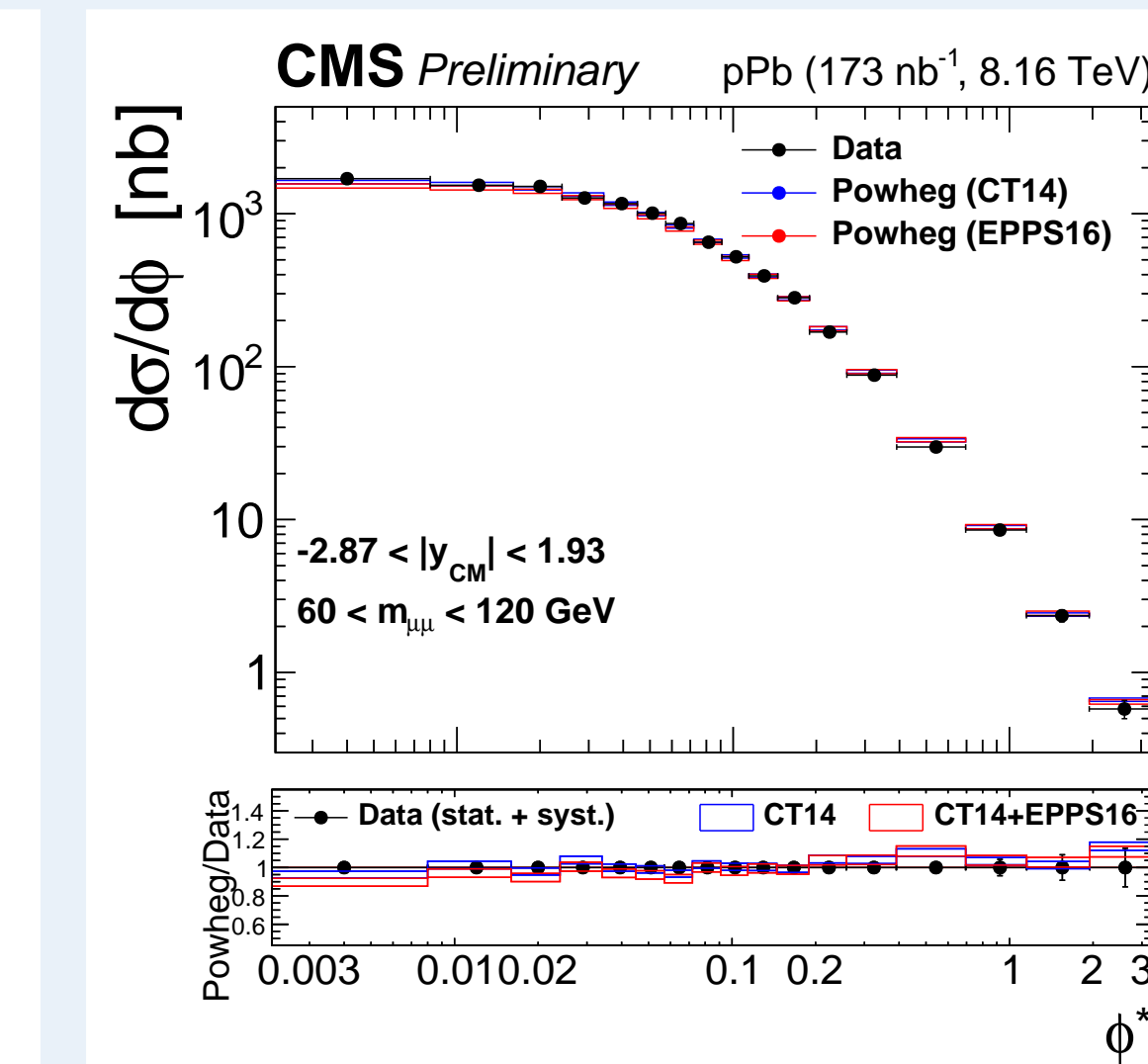
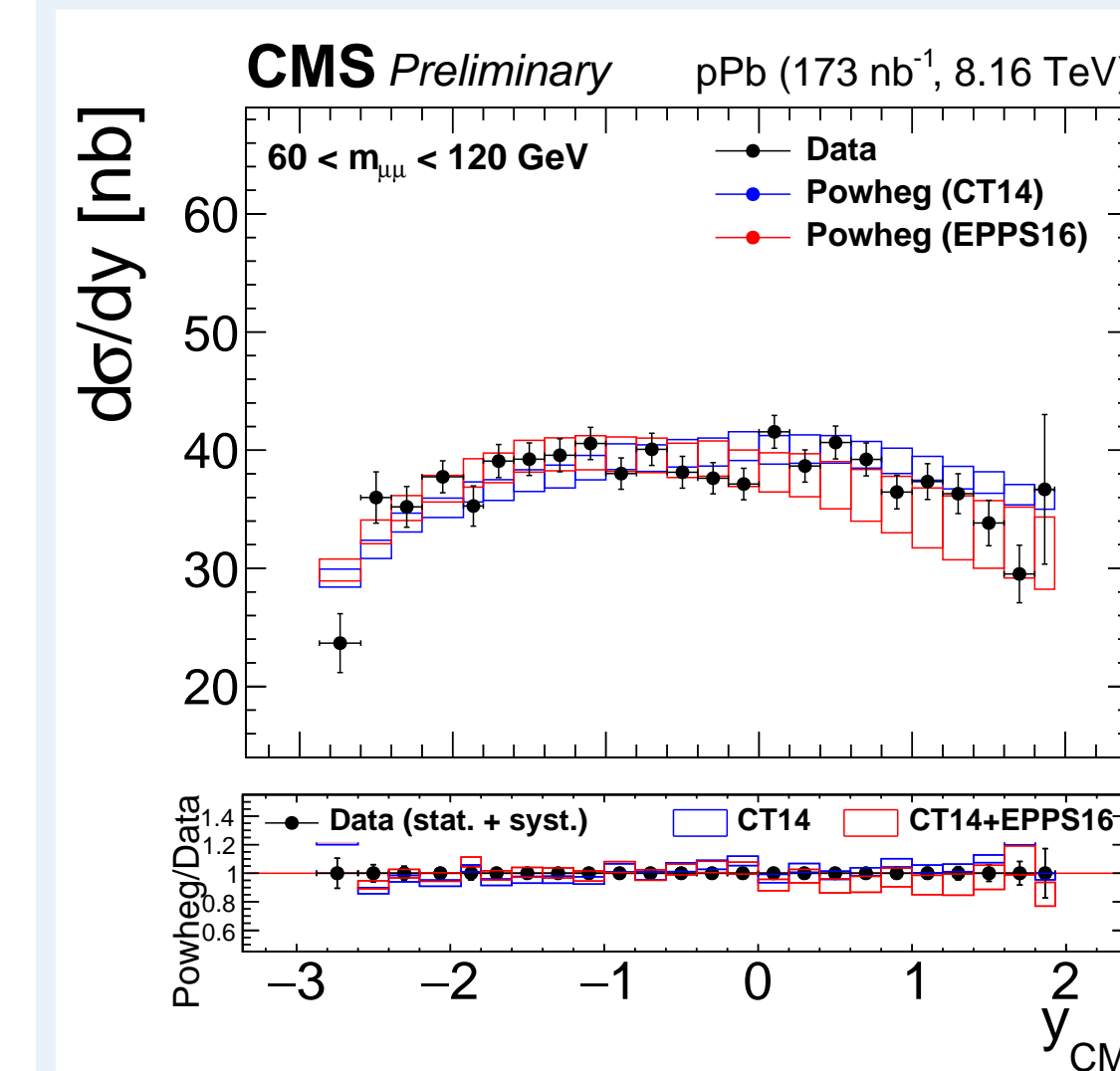
Systematic uncertainties include acceptance and efficiency (theory and detector modelling), momentum resolution, background subtraction, unfolding, luminosity. **Correlation matrices are provided.**



## Cross sections in $-2.87 < y_{\text{CM}} < 1.93$



Cross sections corrected for single muon acceptance. Only three examples shown: mass (left), and  $y_{\text{CM}}$  (centre) and  $\phi^*$  (right) for  $60 < m_{\mu\mu} < 120$  GeV.



## Discussion

Good overall agreement found with POWHEG predictions. Nuclear PDF modifications (EPPS16 [5]) provide a better rapidity description ( $\sigma$  and  $R_{\text{FB}}$ ) than free nucleon PDFs (CT14 [6]). The data tend to be above predictions at low mass.

## References

- [1] CMS Collab., CMS-PAS-HIN-18-003 (2020), <https://cds.cern.ch/record/2718938>.
- [2] Frixione, Nason, Oleari, JHEP 11 (2007) 070.
- [3] Alioli, Nason, Oleari, Re, JHEP 06 (2010) 043.
- [4] Alioli, Nason, Oleari, Re, JHEP 07 (2008) 060.
- [5] Eskola, Paakinen, Paukkunen, Salgado, EPJC 77 (2017) 163.
- [6] S. Dulat *et al.*, PRD 93 (2016) 033006.