

Searching for Gluon Saturation in UPC p-Pb Collisions

- The beam-energies of heavy-ion collisions at the LHC make it the most energetic photon source available [2]
- Exclusive vector meson photoproduction off the proton is sensitive to gluon saturation [1]

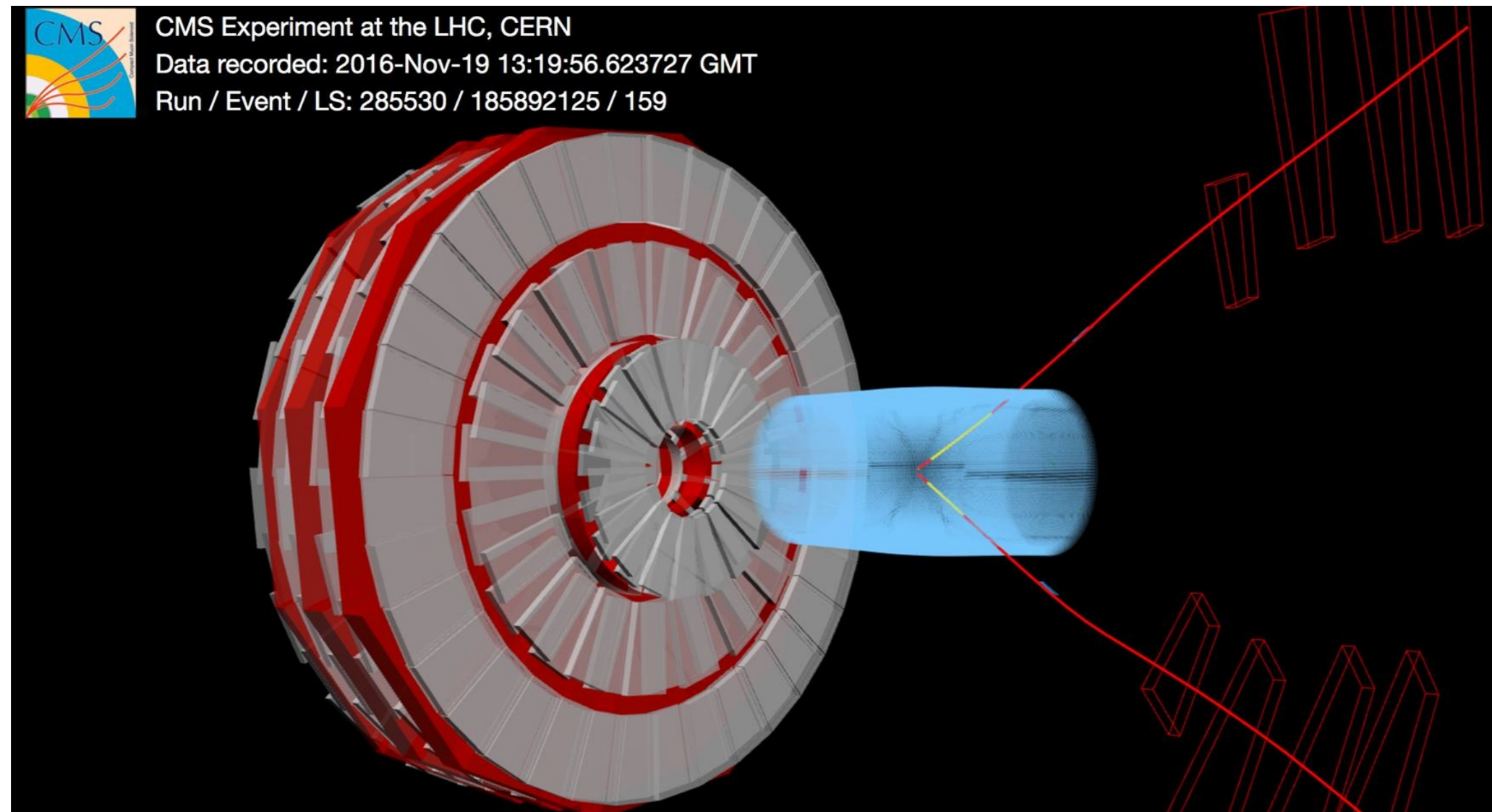


Figure 1: Ultraperipheral p+Pb collision with $\Upsilon(1s)$ Photoproduction Candidate [4]

Triggering Strategy in CMS

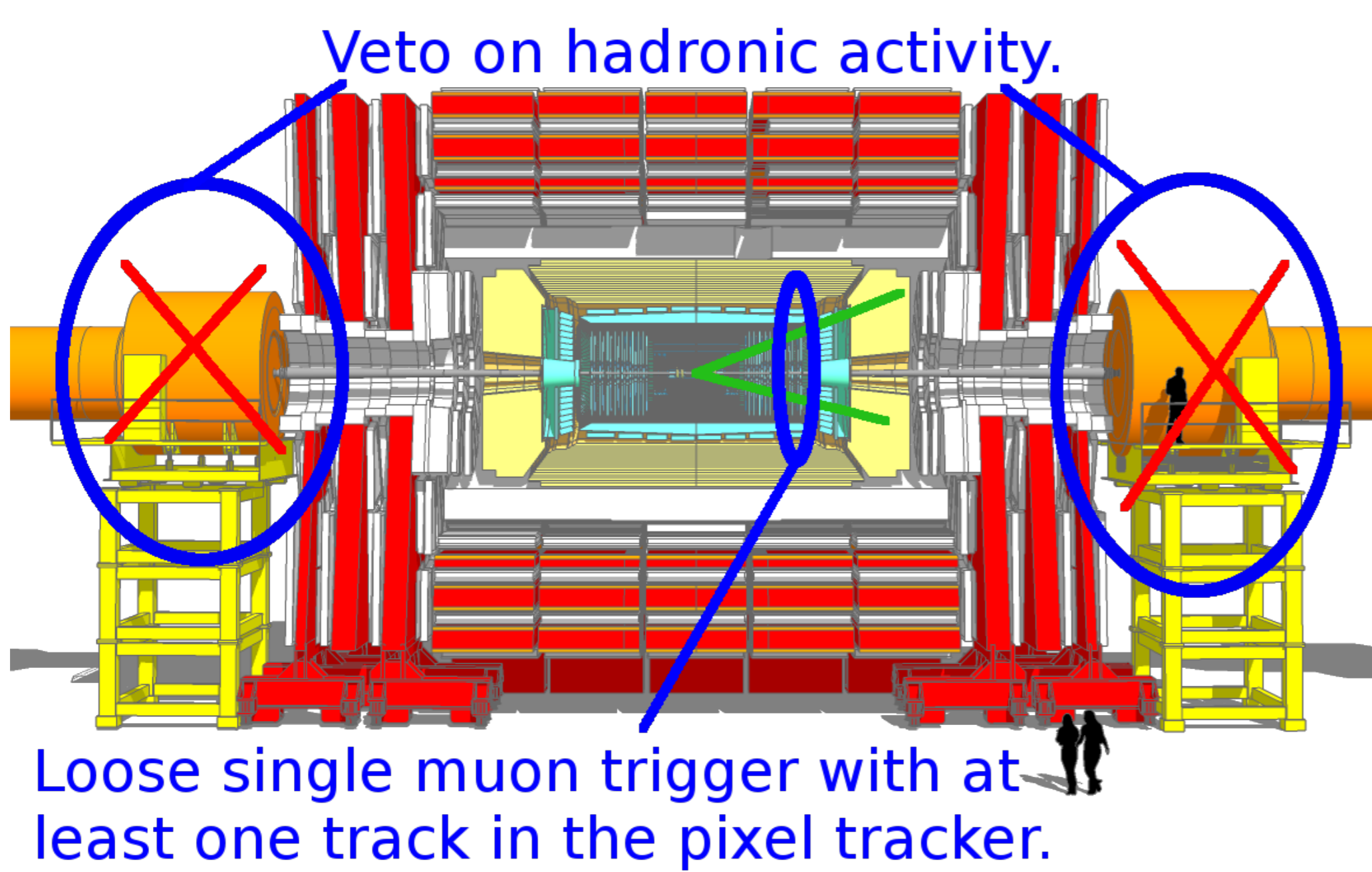


Figure 2: Cross-sectional view of CMS with triggering conditions for ultraperipheral collisions

Challenge: Estimate Proton Dissociation Background

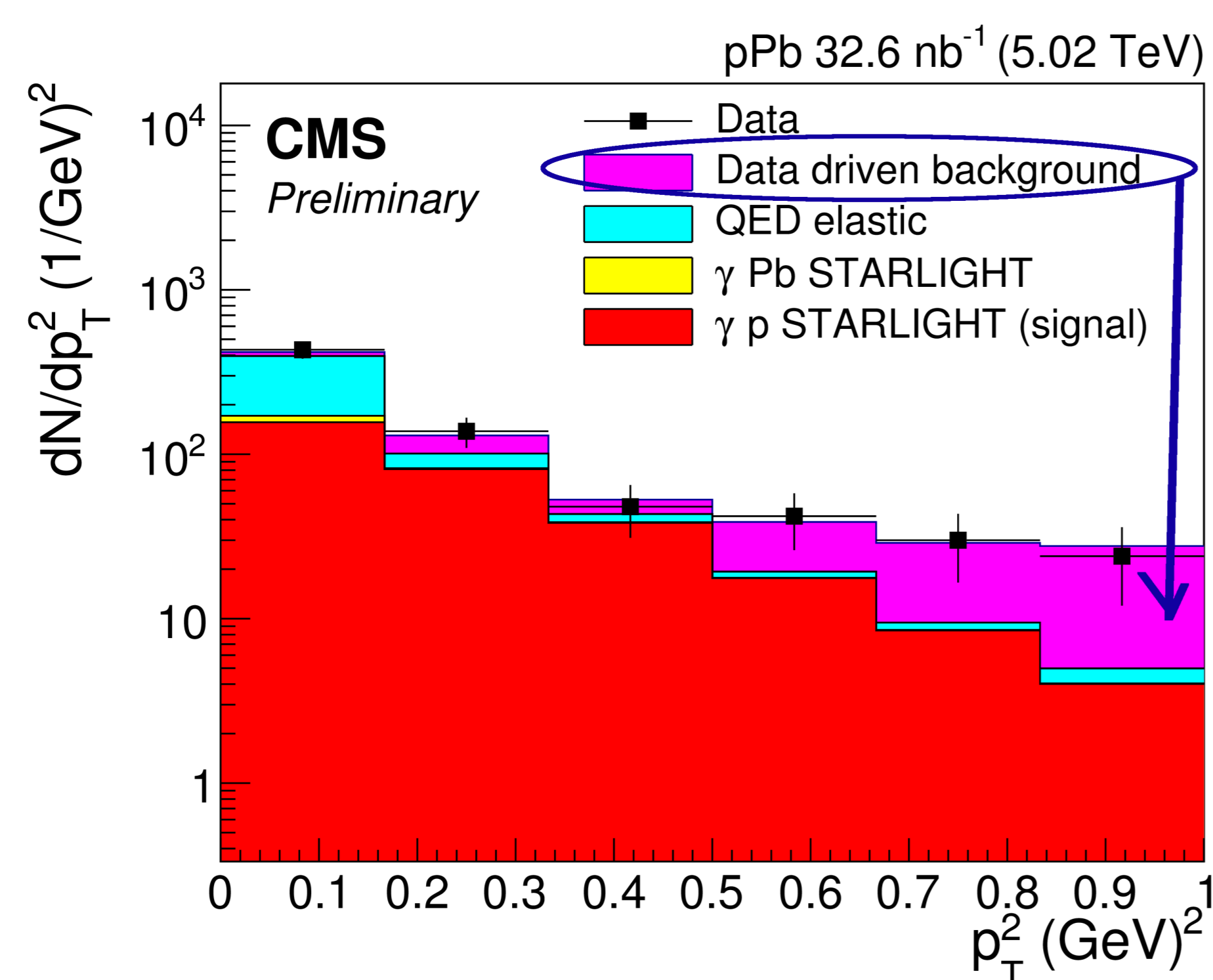


Figure 3: Exclusive Υ p_T^2 distribution [3]

Proton dissociation is also sensitive to gluon saturation at high energies

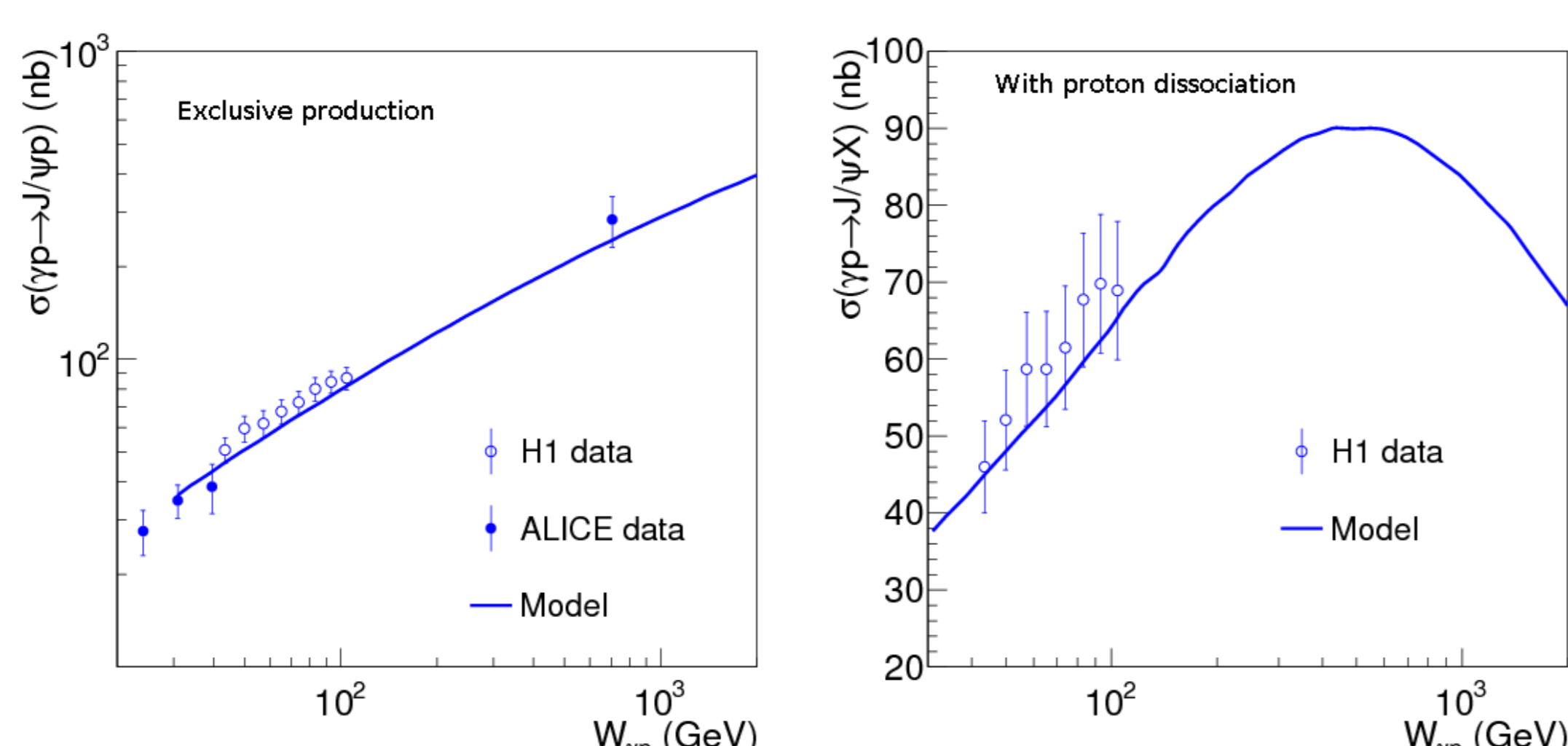


Figure 4: Predictions J/Ψ cross-section as a function of $W_{\gamma p}$: exclusive photoproduction (left); with proton dissociation photoproduction (right) [2]

Exclusive Photoproduced $\Upsilon(1s)$ Cross-section in p-Pb at CMS

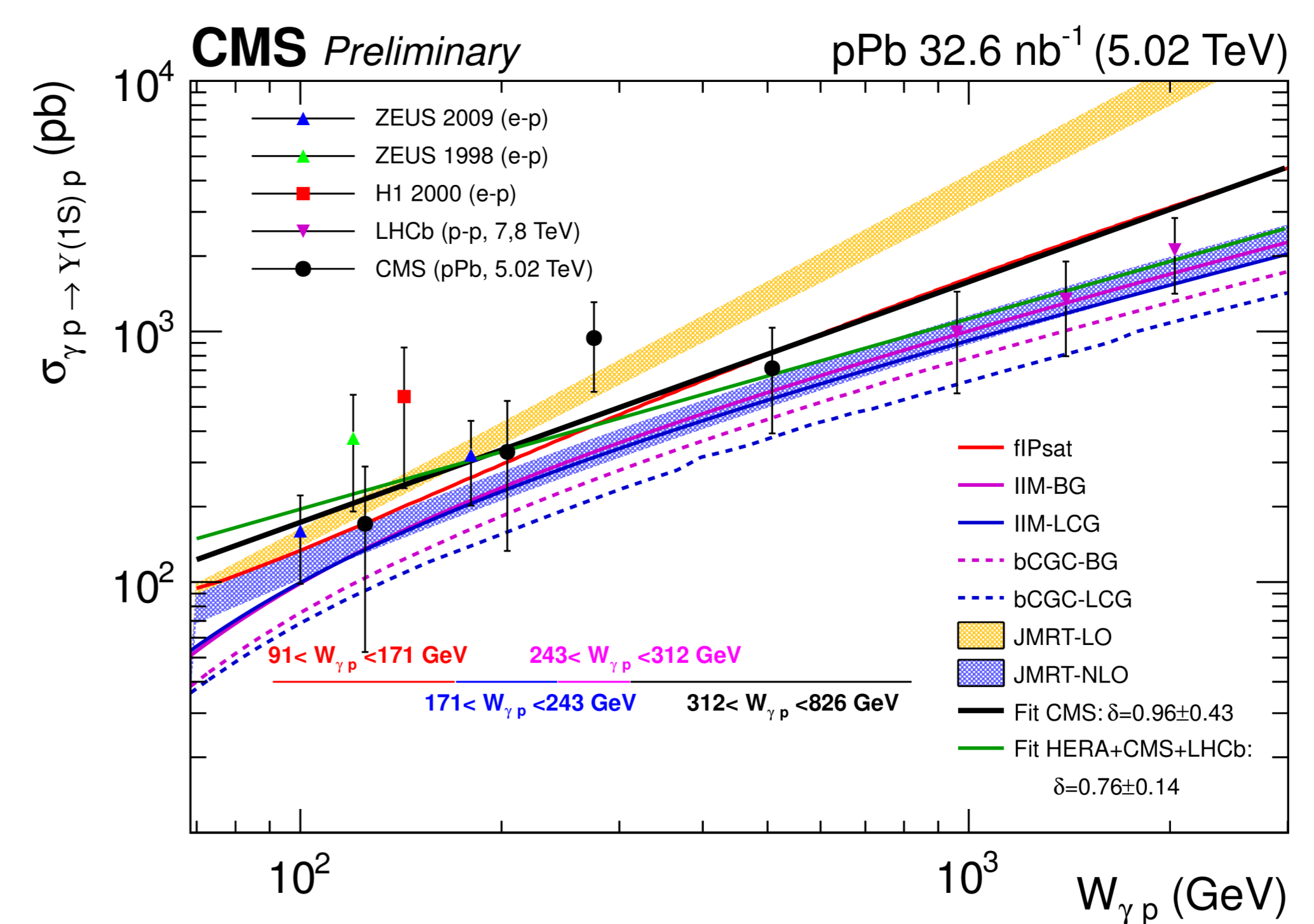


Figure 5: Υ cross-section as a function of $W_{\gamma p}$ [3]

UPC Υ $|t|$ -Distribution at CMS

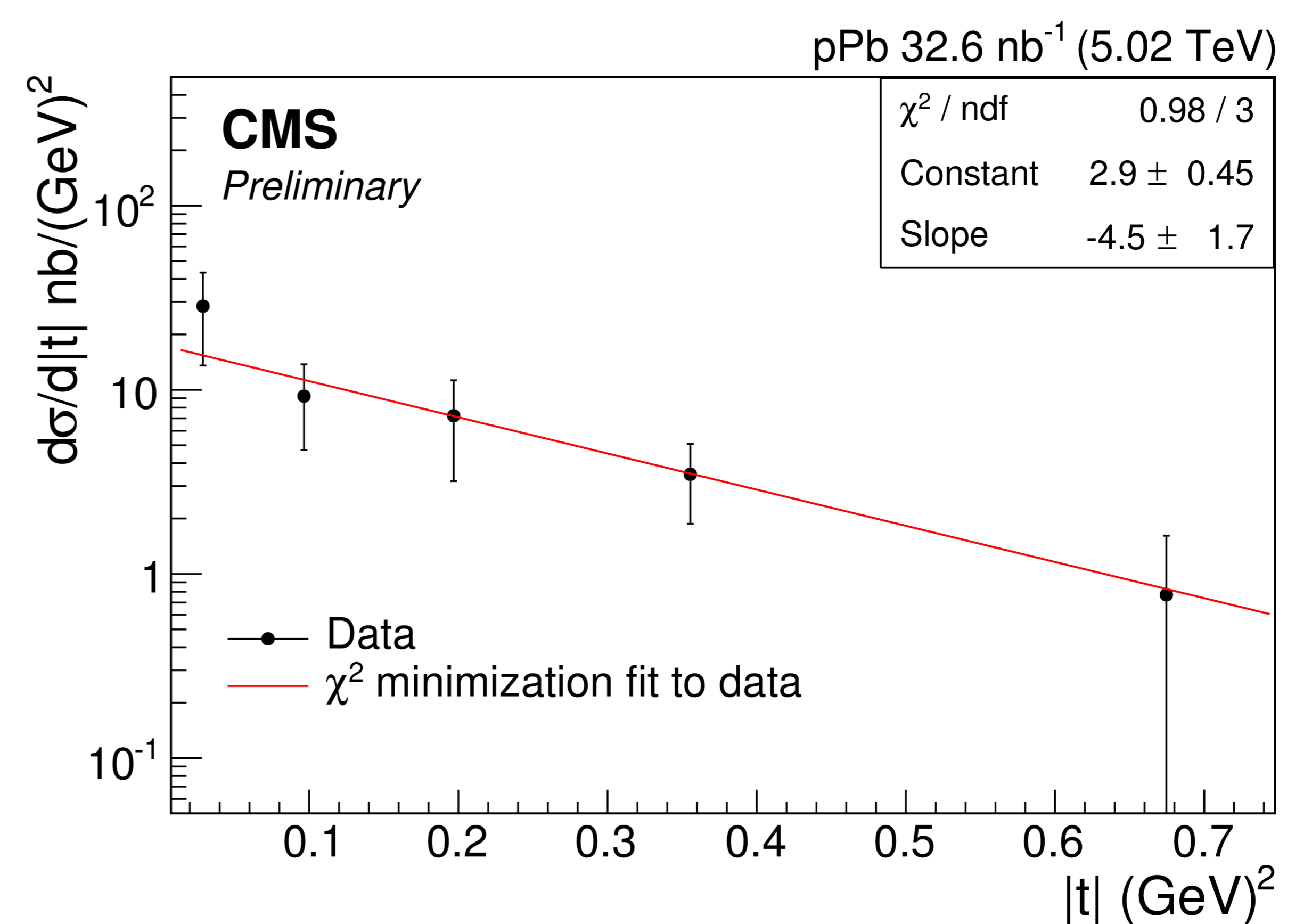


Figure 6: Exclusive Υ differential cross-section in $|t|$ [3]

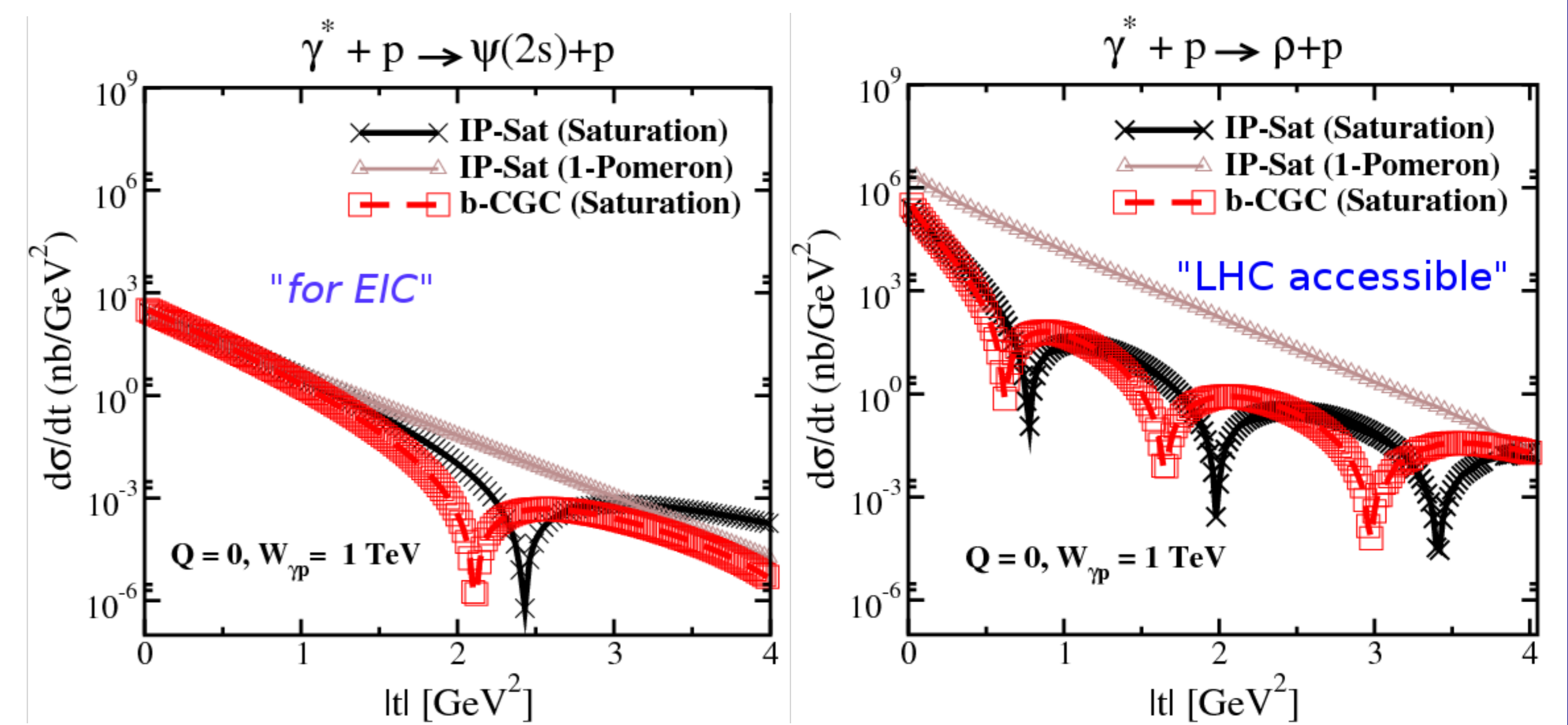


Figure 7: Exclusive $\Psi(2s)$ (left); Exclusive ρ (right) [1]

- To access the high- t dependence of exclusive J/Ψ , $\Psi(2s)$, and Υ , the Electron Ion Collider (EIC) is needed. However, the exclusive $\rho(770)$ high- t dependence is accessible at LHC, and work is in progress in CMS.[5]

References

- [1] Nestor Armesto and Amir H. Rezaeian. Exclusive vector meson production at high energies and gluon saturation. *Phys. Rev.*, D90(5):054003, 2014.
- [2] J. Cepila, J. G. Contreras, and J. D. Tapia Takaki. Energy dependence of dissociative J/ψ photoproduction as a signature of gluon saturation at the LHC. *Phys. Lett.*, B766:186–191, 2017.
- [3] CMS Collaboration. Measurement of exclusive Υ photoproduction in pPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. (CMS-PAS-FSQ-13-009), 2016.
- [4] Thomas Mc Cauley. Events recorded by the CMS detector during the proton-lead collision run of 2016. (CMS-PHO-EVENTS-2016-009), Nov 2016.
- [5] Tobias Toll and Thomas Ullrich. Exclusive diffractive processes in electron-ion collisions. *Phys. Rev.*, C87(2):024913, 2013.