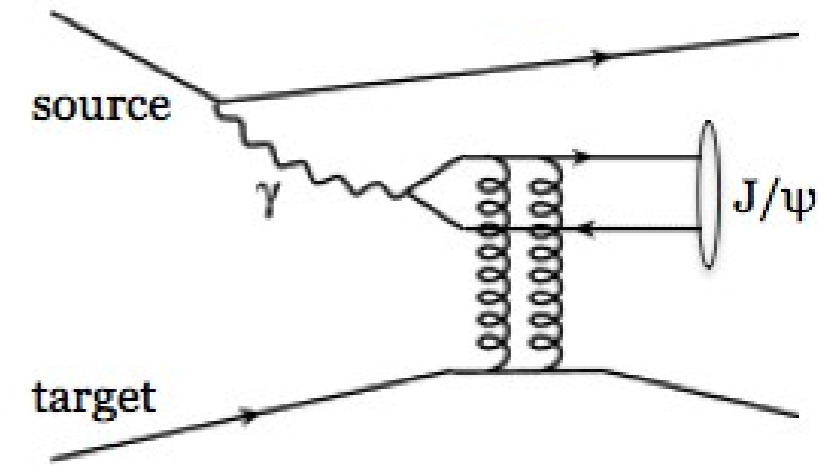


The nature of the initial state



A common denominator in heavy-ion physics analyses is the need to distinguish between final state effects expected from the QGP from those inherent to the nuclei themselves. Thus, ***the nature of the initial state is one of the most important questions in relativistic heavy-ion physics.*** This would naturally provide insights into the crucial role played by gluons in the nuclei.

UPCs are cleaner probes of nPDFs

My group seeks to tackle these questions by using a novel approach that consists in studying ***ultra-peripheral heavy-ion collisions (UPC) to probe the nucleus.*** This will be carried out by studying quarkonia and jet production with CMS at LHC

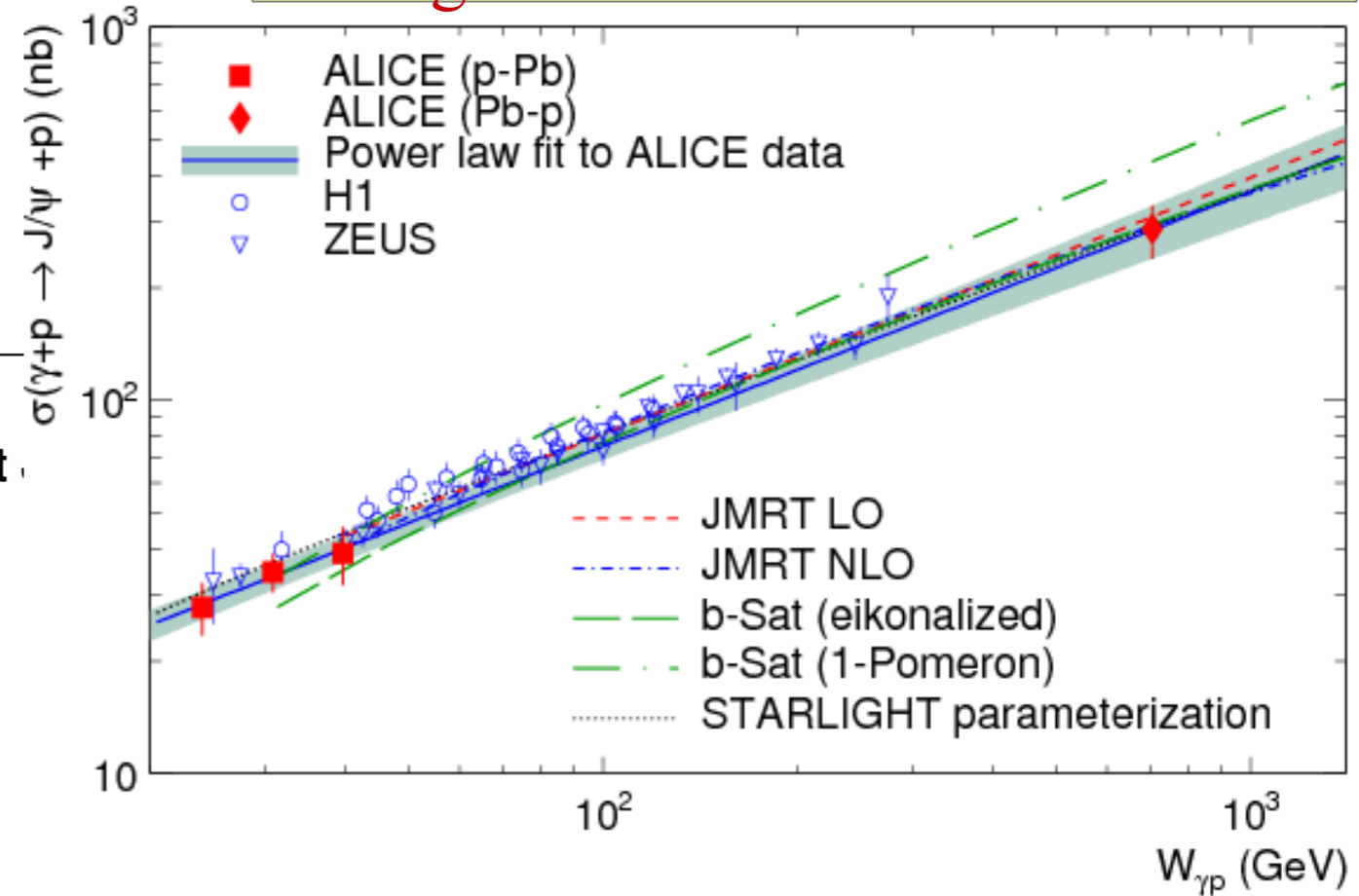
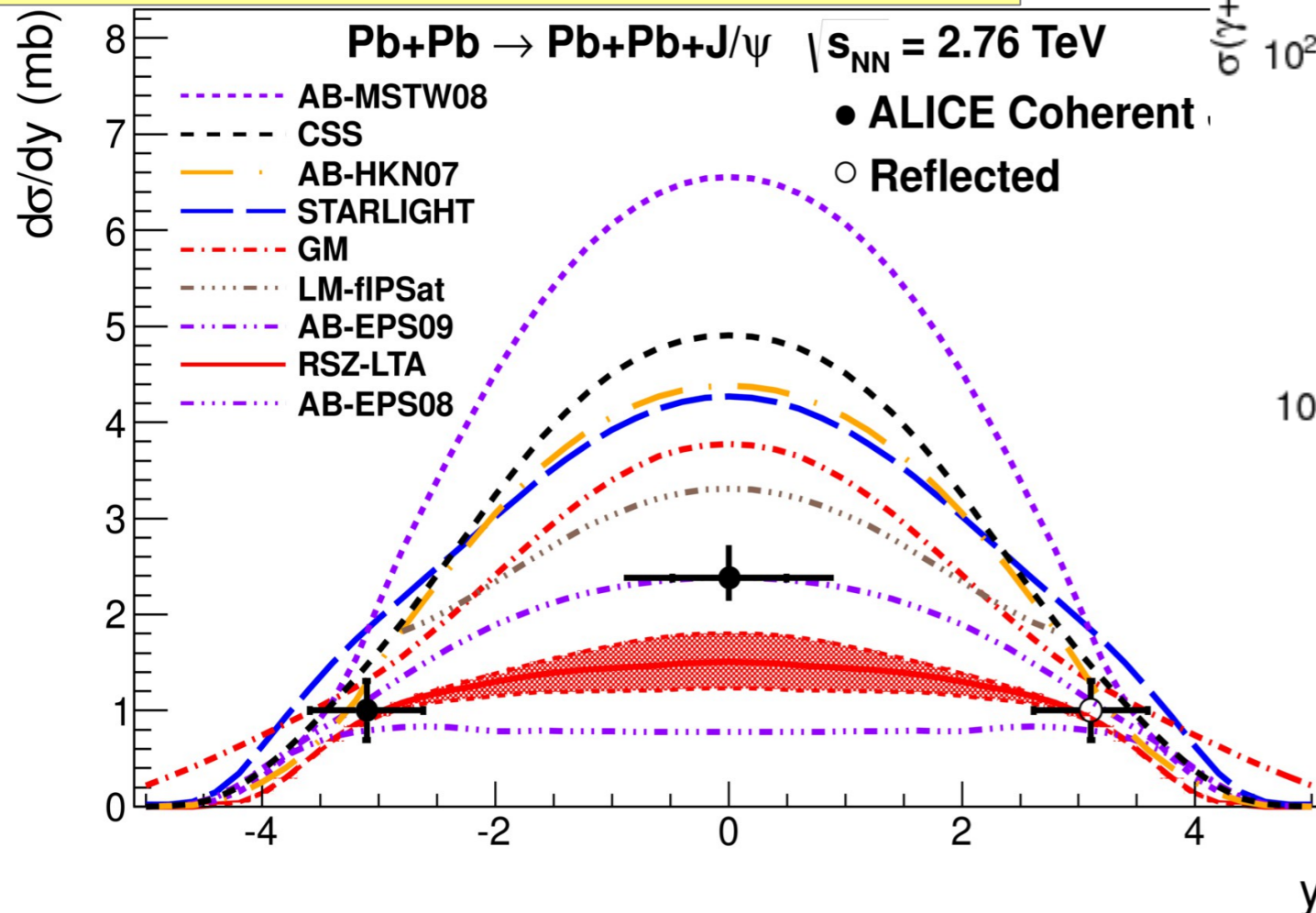
Recent results by my group

From pQCD at L0 (Ryskin 1993)

$$\frac{d\sigma}{dt} \Big|_{t=0} = \frac{\alpha_s^2 \Gamma_{ee}}{3\alpha M_V^5} 16\pi^3 \left[xg\left(x, \frac{M_V^2}{4}\right) \right]^2$$

Direct evidence of nuclear gluon shadowing

No change on the proton gluon density between HERA and LHC energies



Three recent publications:

Phys. Lett. B718 (2013) 1273-1283
 Eur. Phys. J. C73 (2013) 2617
<http://arxiv.org/abs/arXiv:1406.7819>

Future plans at CMS

- **Initial state shadowing can be effectively separated in UPCs**
- Hadronic background is highly suppressed
- Excellent triggers and detector capabilities

Future analyses in UPC Pb-Pb:

- **Upsilon production in UPC Pb-Pb**
- **Dijets and heavy-flavor jets in UPC Pb-Pb**
- In addition, **UPC p-Pb** allow us to study **γp collisions** \rightarrow gluon saturation

UPC studies at LHC: insights that will be important as the US electron-ion collider facility is developed.

CMS Experiment at LHC, CERN
Data recorded: Fri Nov 18 03:24:41 2011 CEST
Run/Event: 181969 / 18812570
Lumi section: 520

