

ALICE Measurements of Coherent ρ^0 Photoproduction in Pb-Pb Ultra-peripheral Collisions



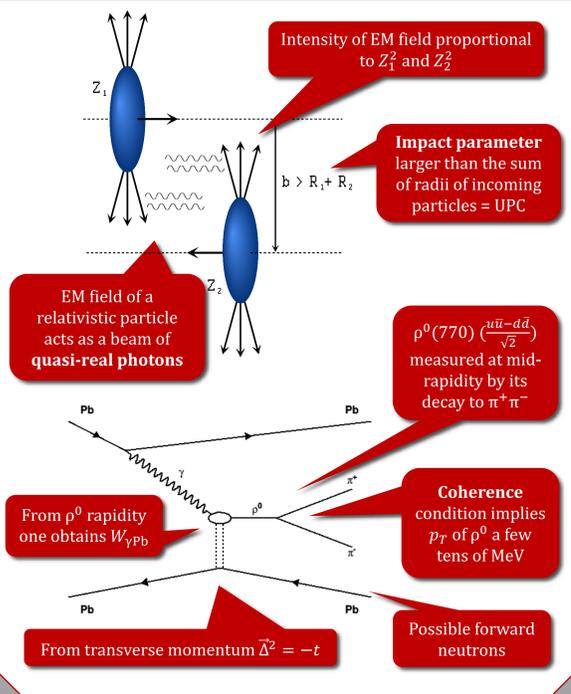
David Horák for the ALICE Collaboration
Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague

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Abstract

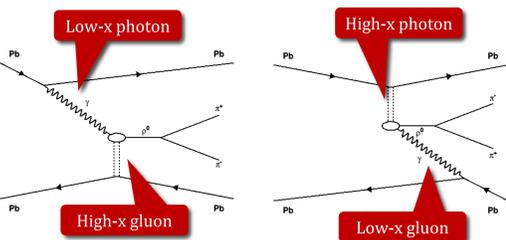
The powerful photon fluxes of relativistic nuclei provide the possibility to study photonuclear and two-photon interactions in ultra-peripheral collisions (UPC), where the nuclei do not overlap and no strong nuclear interactions occur. Within the Vector Meson Dominance Model (VDM), the ρ^0 contribution dominates the QCD part of the photon structure function. The $\gamma + A \rightarrow \rho^0 + A$ process in heavy-ion UPC is an excellent tool to test the black disk regime, where the target nucleus appears like a black disk and the total $\rho^0 + A$ cross section reaches its limit. RHIC and first LHC results have deviated from some Glauber+VDM calculations, which thus call for new data. ALICE reports [1] the first measurements of coherent rho photoproduction accompanied by electromagnetic dissociation (EMD) with data taken at $\sqrt{s_{NN}} = 5.02$ TeV. The rapidity-dependent cross section of coherent ρ^0 photoproduction is measured and it is compared to theoretical models. In addition a wide resonance-like structure around $1.7 \text{ GeV}/c^2$ is observed.

What are UPC?



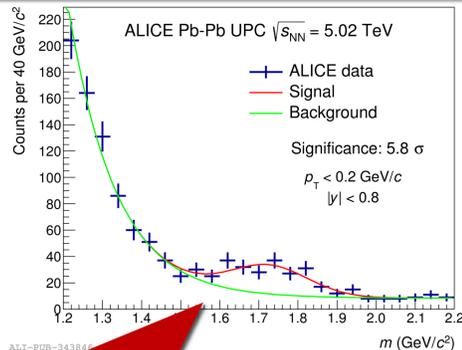
Motivation

UPC cross section
 $\frac{d\sigma_{PbPb}(y)}{dy} = N_{\gamma Pb}(y, \{b\}) \cdot \sigma_{\gamma Pb}(y) + N_{\gamma Pb}(-y, \{b\}) \cdot \sigma_{\gamma Pb}(-y)$
Mid-rapidity – both contributions are equal
Other rapidities – two different contributions

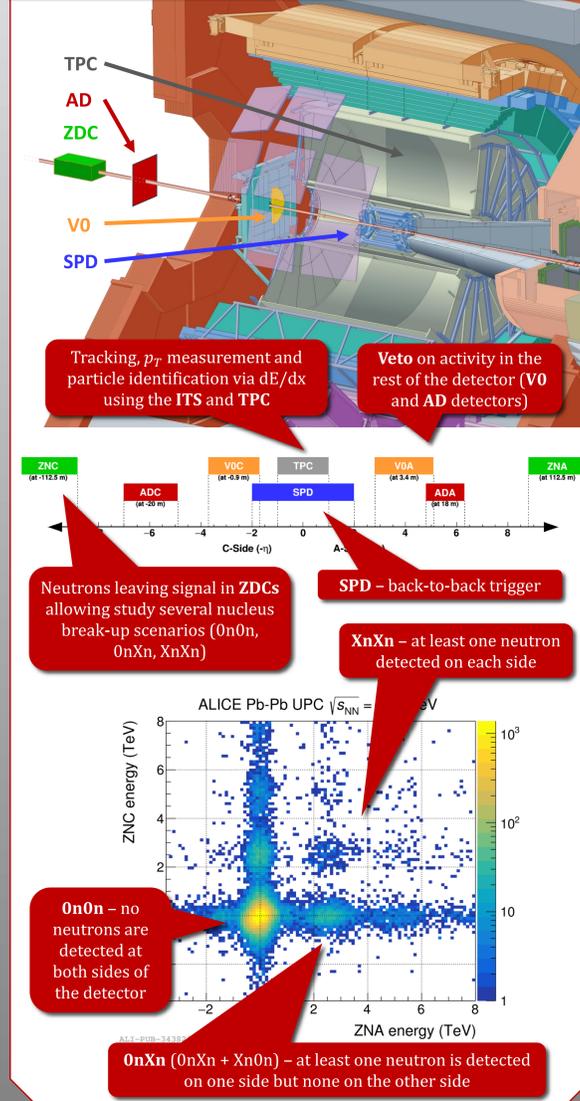


Both contributions can be distinguished using different processes, e.g. various break-up scenarios [2]:
 $\sigma_{0n0n} = N_{0n0n}(+y)\sigma_{\gamma Pb}(+y) + N_{0n0n}(-y)\sigma_{\gamma Pb}(-y)$
 $\sigma_{0nXn} = N_{0nXn}(+y)\sigma_{\gamma Pb}(+y) + N_{0nXn}(-y)\sigma_{\gamma Pb}(-y)$

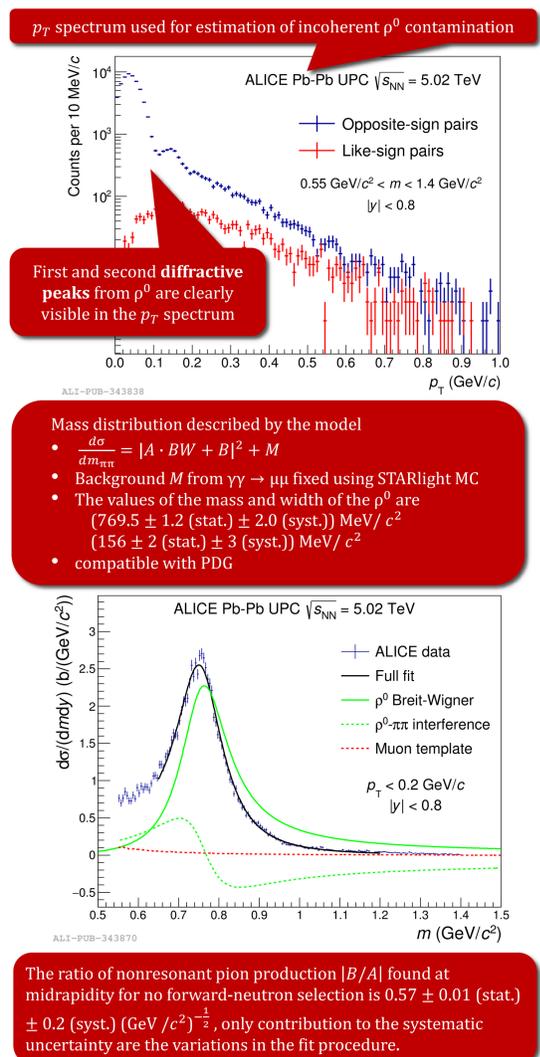
High-mass state



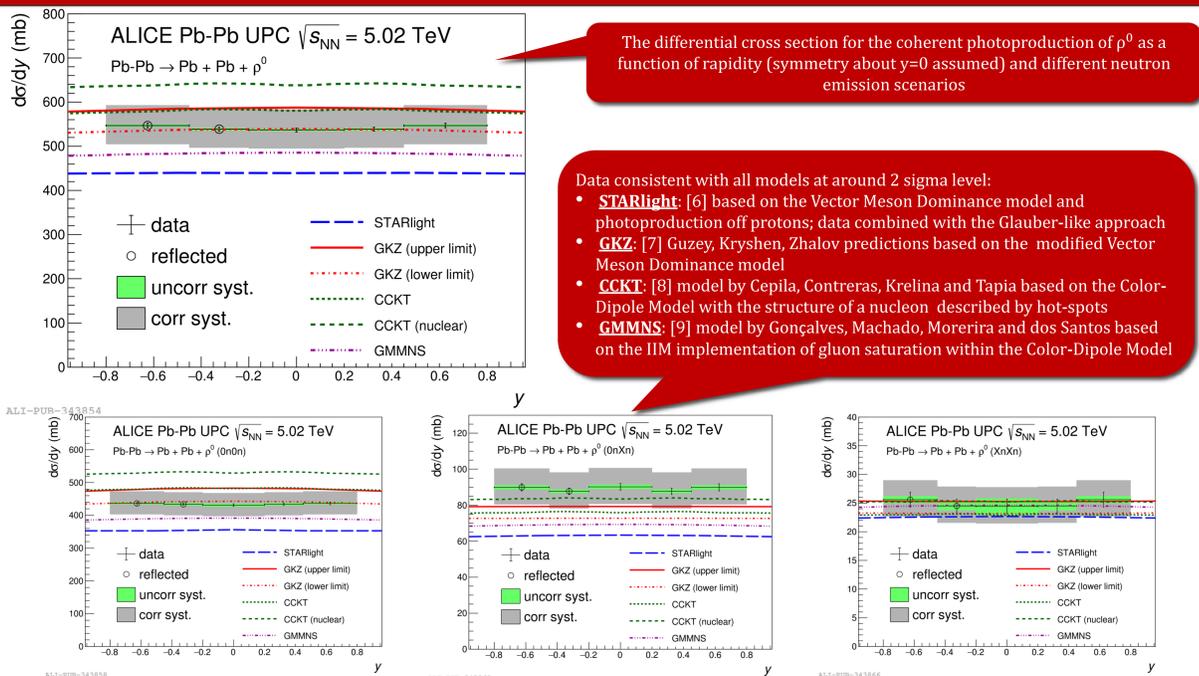
Detector



Signal Extraction



Results



References

- [1] ALICE Collaboration, Coherent photoproduction of ρ^0 vector meson in ultra-peripheral Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. arXiv:2002.10897 [nucl-ex].
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Conclusions

ALICE reports [1] the cross section of ρ^0 photoproduction at mid-rapidity at $\sqrt{s_{NN}} = 5.02$ TeV. The measured cross section is compatible with all models within around 2 standard deviations, except for the single neutron emission class (0nXn), where models underestimate data slightly. This suggests that the measurement of coherent vector meson production accompanied by EMD could also be used to separate the low and high energy contributions to the cross section at forward rapidities as suggested in [2].