UPC plans in Run 3 (and 4)

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ALICE UPC in Run 3 and Run 4

- The higher LHC luminosity and experimental upgrades => improved samples of UPC events
- ALICE continuous readout
  - No trigger-based constraints
  - High-efficiency collection of large samples
- The increases in sample sizes larger than by scaling the luminosity
  - Pb-Pb integrated luminosity goal Run 3+4: 13 nb^{-1}

PbPb				
Meson	σ	All Total	Central 1 Total	Forward 1 Total 1
$\rho \to \pi^+\pi^-$	5.2b	68 B	5.5 B	4.9 B
$\rho' \to \pi^+\pi^-\pi^+\pi^-$	730 mb	9.5 B	210 M	190 M
$\phi \to K^+K^-$	0.22b	2.9 B	82 M	15 M
$J/\psi \to \mu^+\mu^-$	1.0 mb	14 M	1.1 M	600 K
$\psi(2S) \to \mu^+\mu^-$	30μb	400 K	35 K	19 K
$\Upsilon(1S) \to \mu^+\mu^-$	2.0 μb	26 K	2.8 K	880

ALICE UPC in Run 3 and Run 4

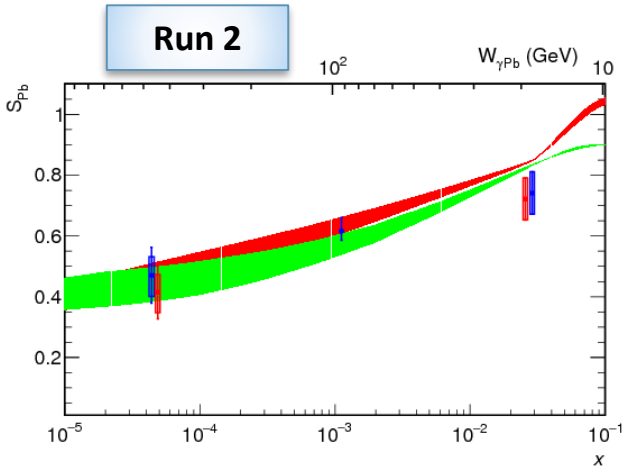
- Coherent production of two pions with masses above 1 GeV/c^2
  - Interplay of soft and hard dynamics as a function of mass and p_T
- Heavier 2π, 4π and other resonances on ion targets
  - Search for the photoproduction of exotic mesons
  - From data on proton targets and ion targets, it is possible to separate the photon-meson coupling constant and the meson-nucleon interaction cross sections.

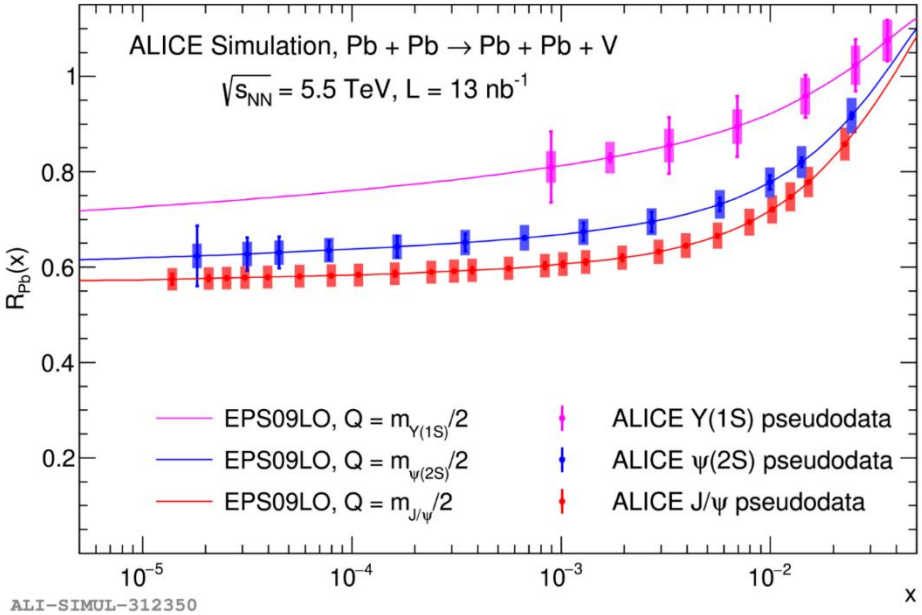
ALICE UPC in Run 3 and Run 4

- Double vector mesons photoproduction available
  - By a single ion-ion pair by exchange of two independent photons
  - Many quantum correlations, including the possibility of observing stimulated decays of vector mesons
  - Two photons share the same linear polarisation => photoproduction with polarised photons
- Beyond precise cross section measurements for J/ψ, ψ' and Υ(1S)
  - Allow tomographic measurements
  - Can be used to infer information on the nuclear wave function

ALICE UPC in Run 3 and Run 4

- Extend substantially the x range for coherent J/ψ photoproduction on nuclei
  - Using impact parameter distribution in peripheral and ultra-peripheral collisions
  - Via forward neutron production
- High statistics coherent Υ(1S) production in γp and γA
  - Probe gluon shadowing at a factor of 10 higher Q^2 than in J/ψ production





Tomographic measurement

- In coherent photoproduction, production amplitudes from each individual scattering site add with a phase factor $\exp i(\vec{x} \cdot \vec{k})$
- Fourier transform of the $\mathrm{d}\sigma_{\mathrm{coherent}}/\mathrm{d}t$ => location of the scattering in nucleus
  - Spatial dependence of nuclear shadowing = transverse profile

$$F(b) \propto \frac{1}{2\pi} \int_0^\infty p_{\mathrm{T}} dp_{\mathrm{T}} J_0(bp_T) \sqrt{\frac{\mathrm{d}\sigma_{\mathrm{coherent}}}{\mathrm{d}t}}$$

- Calculation is data-hungry, number of theoretical uncertainties
- STAR applied it to ρ photoproduction in UPCs