

INCLUSIVE J/ψ IN UPC

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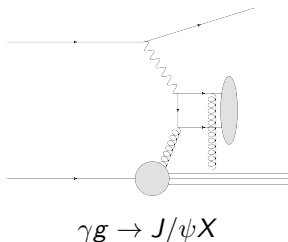
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January 11th 2021



This project is supported by the European Union's Horizon 2020 research and innovation programme under Grant agreement no. 824093

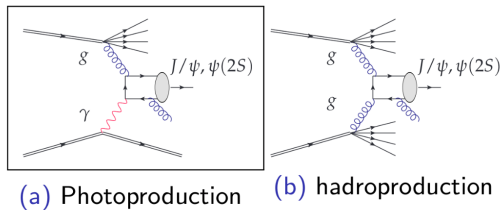
J/ψ Inclusive Photoproduction



- This process is normally studied in lepton-proton colliders.
- Such a process is ideal because;
 - 1 Constraints can be placed on the lepton to ensure $(p - p')^2 = Q^2$ is small.
 - 2 It is a clean environment; no difficulty in distinguishing inclusive and exclusive interactions.
- However, there are no high-energy lepton-proton colliders in function at present;
 - ▶ HERA at DESY (Hamburg, DE) was shut down in 2007.
 - ▶ EIC (BNL, US) ~ 10 years from data collecting.

Inclusive J/ψ production in pp collisions

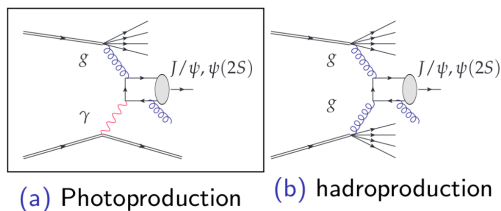
Inclusive reactions



- Inclusive photoproduction [$\gamma + p \rightarrow J/\psi + X$] can be distinguished by requiring;
 - 1 The photon emitting proton stays intact.
 - 2 The gluon emitting proton breaks up.

Inclusive J/ψ production in pp collisions

Inclusive reactions



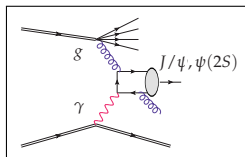
- Inclusive photoproduction [$\gamma + p \rightarrow J/\psi + X$] can be distinguished by requiring;
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Question: can we distinguish these processes in practice? Or do the particles emitted by the inclusive hard reaction pollute the region where the intact proton emerges?

Why inclusive UPC ?

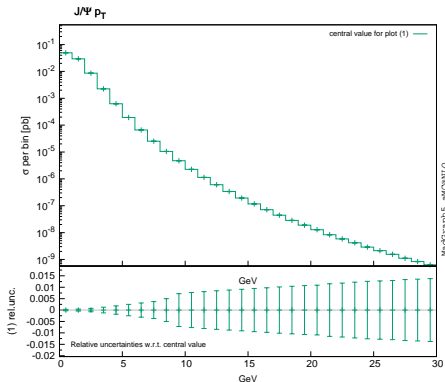
See JPL, Phys.Rept. 889 (2020) 1

It offers new ways to test the mechanisms of inclusive production (octet vs singlet...).

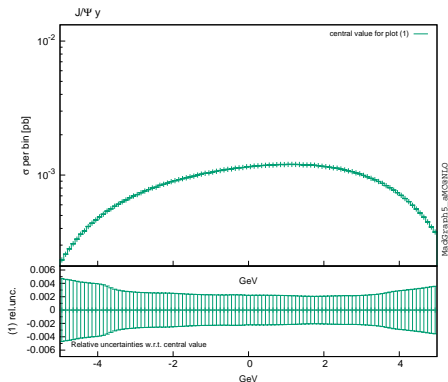


Also allows one to study J/ψ inclusive photoproduction which probes the gluon PDFs

Process without cuts



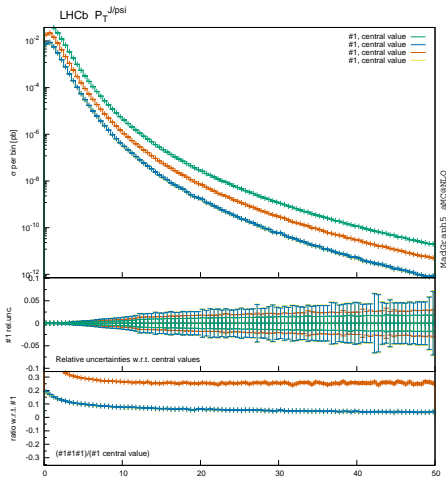
(a) J/ψ p_T



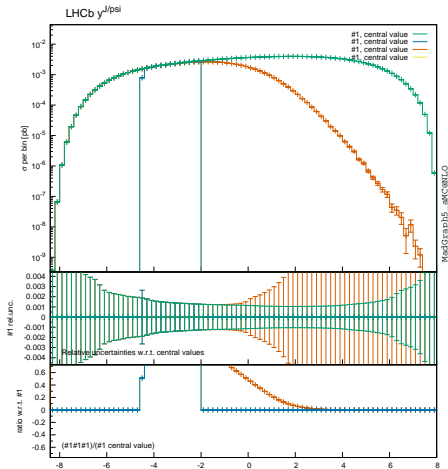
(b) J/ψ γ

$\sqrt{s} = 13$ TeV in pp collision

- 1 p_T of ~ 10 GeV cross section reduced by a factor of 10^5 .
- 2 Asymmetry; J/ψ slightly favour moving in the direction of the γ emitting proton.



(a) J/ψ p_T

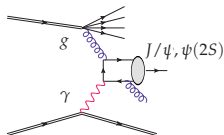


(b) J/ψ y

LHCb detector acceptance ($\sim 16\%$); $y_g < 0$ ($\sim 40\%$); backward gluon in LHCb ($\sim 16\%$).

Outlook

- Aim to learn the mechanism of quarkonium production through studying inclusive J/ψ photoproduction.



- The same study should be extended to the case of pPb .
- It has advantages over pp :
 - ▶ $\sim 95\%$ of photon emission is from the Pb .
 - ▶ Less pileup