Diffractive double quarkonium production at the LHC

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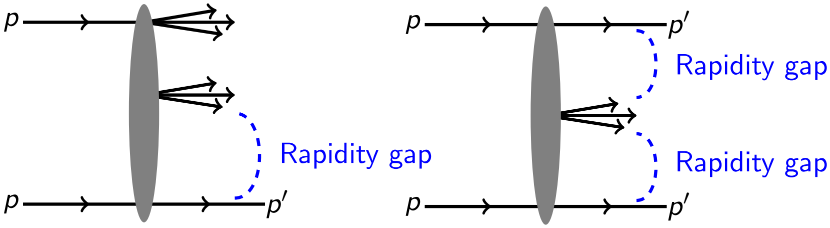
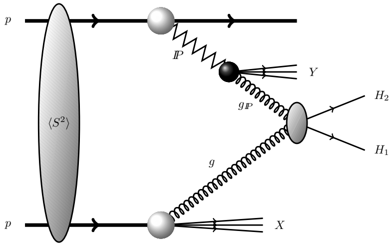
Hadron diffraction

- A reaction with no quantum numbers exchange between the interacting particles is, at high energies, a diffractive reaction.
- A diffractive reaction is characterized by a large, non exponencialy supressed, rapidity gap at the final state.



Singlle Diffraction (SD) x Double Diffraction (DD)



Cross section calculation

- Cross section factorization

$$d\sigma(pp \to p + H_1H_2 + p) = \sum_n g_p^D(x_1, \mu^2) g_p^D(x_2, \mu^2)$$
$$\times d\hat{\sigma}[gg \to Q\bar{Q}_n + Q\bar{Q}_n] \cdot \langle \mathcal{O}_n^{H_1} \rangle \langle \mathcal{O}_n^{H_1} \rangle$$

- Diffractive gluon distribution

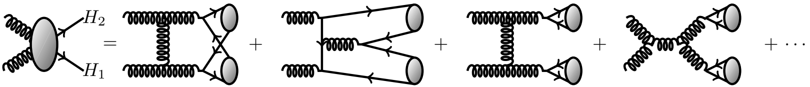
$$g_p^D(x, Q^2) = \int dx_{\mathbf{P}} d\beta \delta(x - x_{\mathbf{P}}) f_{\mathbf{P}}^p(x_{\mathbf{P}}) g_{\mathbf{P}}(\beta, Q^2)$$
$$= \int_x^1 \frac{dx_{\mathbf{P}}}{x_{\mathbf{P}}} f_{\mathbf{P}}^p(x_{\mathbf{P}}) g_{\mathbf{P}}\left(\frac{x}{x_{\mathbf{P}}}, Q^2\right)$$

- Pomeron flux

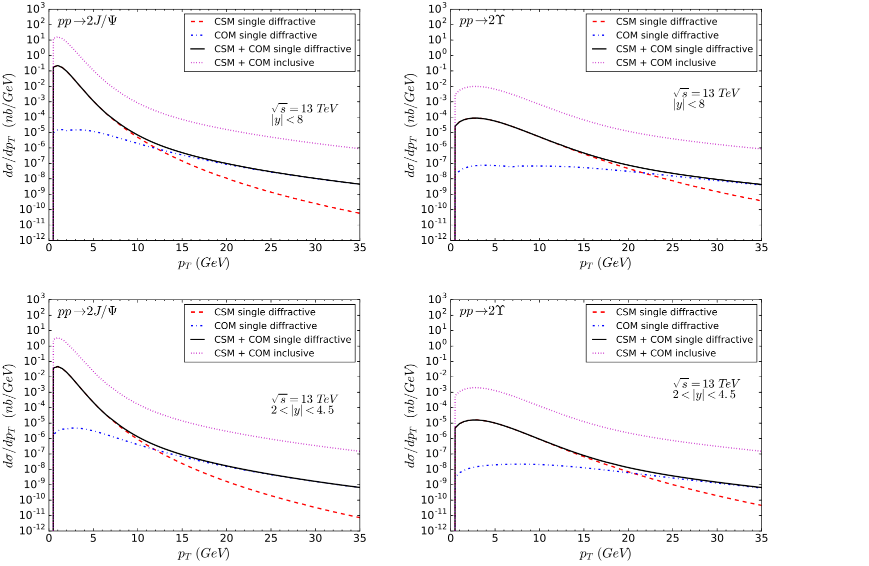
$$f_{\mathbf{P}}^p(x_{\mathbf{P}}) = \int_{t_{min}}^{t_{max}} dt f_{\mathbf{P}/p}(x_{\mathbf{P}}, t) = \int_{t_{min}}^{t_{max}} dt \frac{A_{\mathbf{P}} e^{B_P t}}{x_{\mathbf{P}}^{2\alpha \mathbf{P}(t) - 1}}$$

NRQCD - quarkonium production

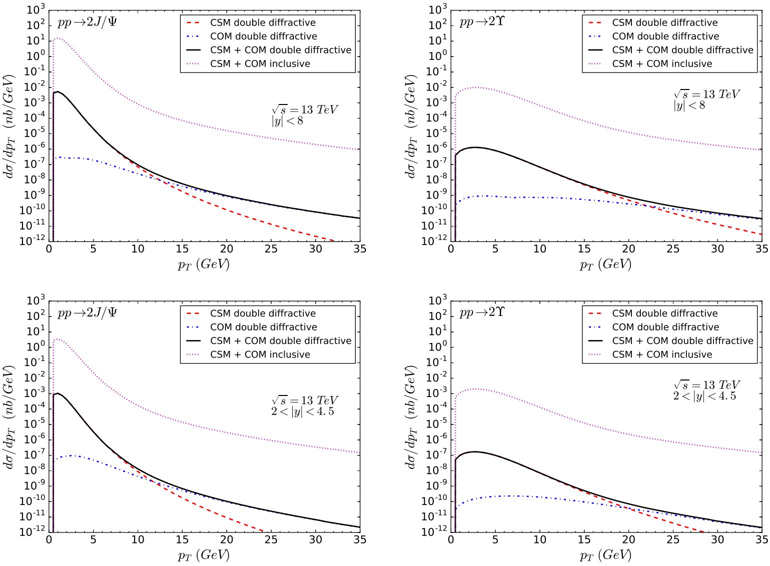
The non relativistic QCD (NRQCD) takes into account the Color Singlet Model (CSM) and the Color Octet Model (COM).



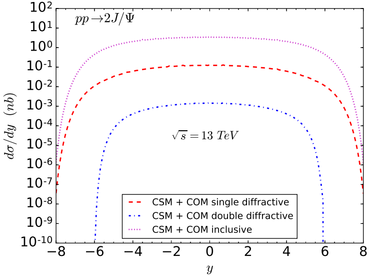
Results for Single Diffration

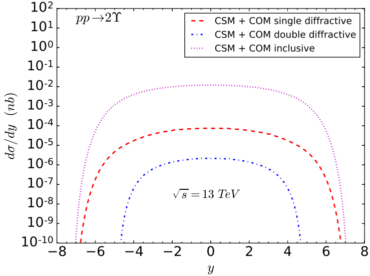


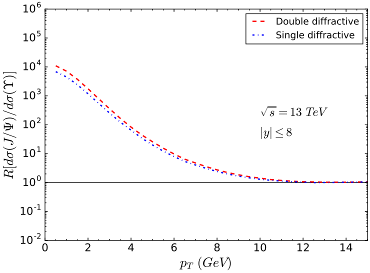
Results for Double Diffraction

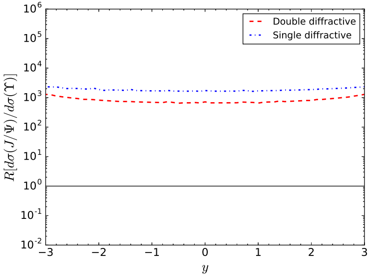


Rapidity distribution and ratios









Sumary

- The cross sections are dominated by CSM, with the COM being important at large p_T, where the magnitude of the cross sections is strongly reduced.
- The contribution of diffractive production in non-negligible at Run II LHC energy, which implies that a future experimental analysis is, in principle, feasible.
- The ratio between cross sections can be useful to probe the treatment of absorptive corrections.
- Future analysis of the diffractive events can be useful to constrain the undelying assumptions present in the description of the double quarkonium production.

Thanks!