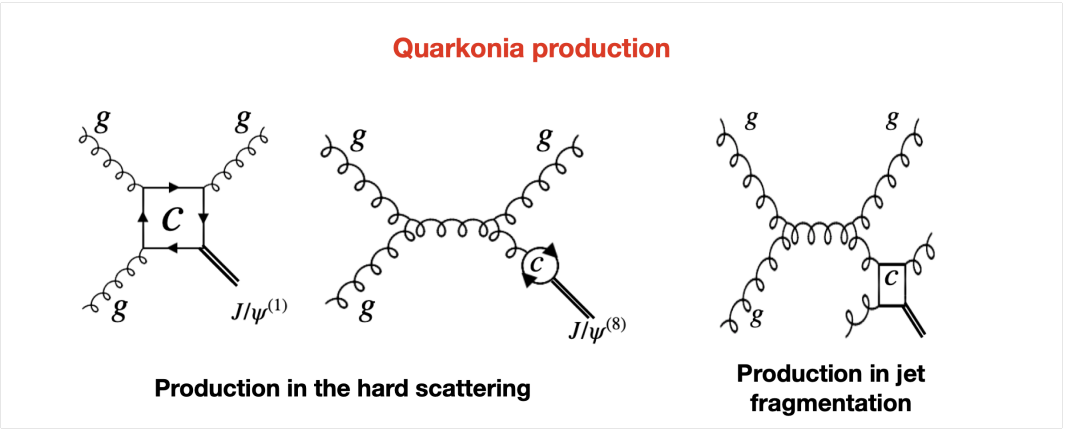
Poster: Fragmentation functions of identified charmed mesons

Sara Sellam on behalf of the LHCb collaboration

QM2022, Kraków, Poland.

April 6, 2022

Motivation



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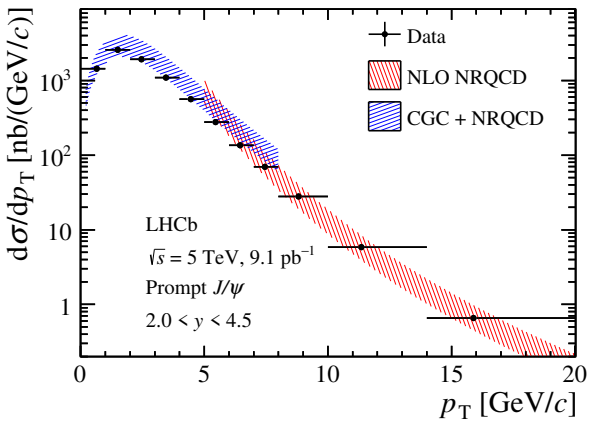
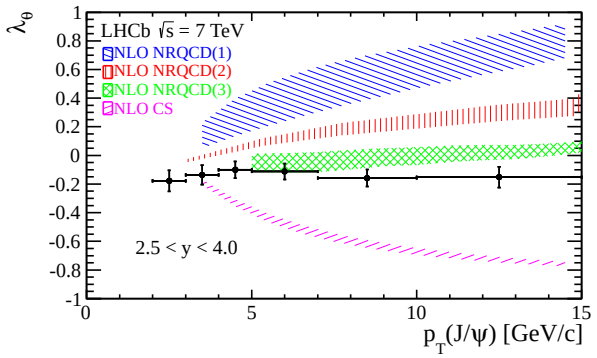


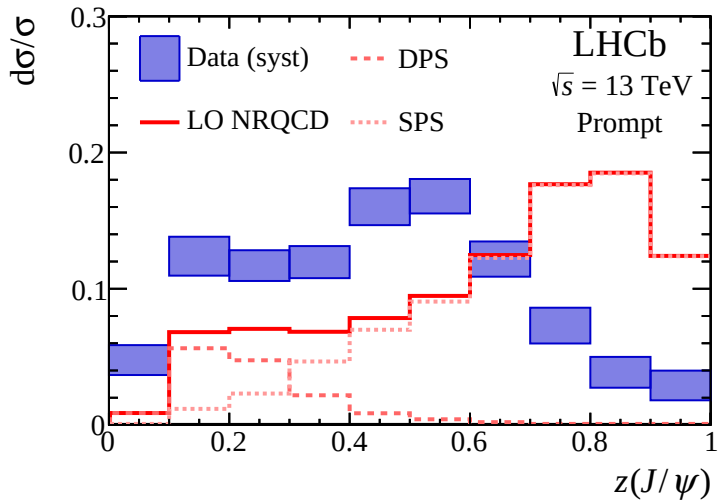
J/ψ Production:

1. Production cross section is well described by NRQCD.
2. Large transverse polarisation is predicted.
3. Direct-production paradigm: isolated or within jets.

Eur.Phys.J.C73,2631(2013)



Motivation



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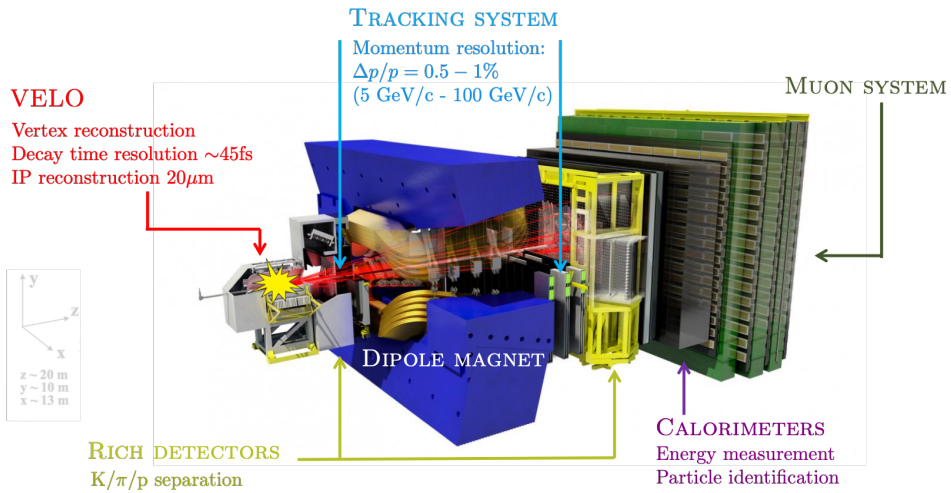
$$z(J/\psi) = \frac{p_T(J/\psi)}{p_T(jet)}$$

Jet fragmentation functions of prompt J/ψ-in-jet disagrees with theoretical prediction.

$\rightarrow$ J/ψ production is not isolated!

LHCb Detector



JINST 3 (2008) S08005

J/ψ in jets

Analysis strategy:

(a) Compute the quarkonia (Q) signal yield for each $[z(Q) = \frac{p_T(Q)}{p_T(jet)}, p_T(jets)]$.

(b) Separate prompt from displaced (from b-hadron decays) using pseudo-lifetime fits: $t_z = (z_Q - z_{PV})\frac{m(Q)}{p_z(Q)}$

(c) Unfold the $z(Q)$ distribution and measure normalised distributions of jet fragmentation function $d\sigma/\sigma$ vs z.

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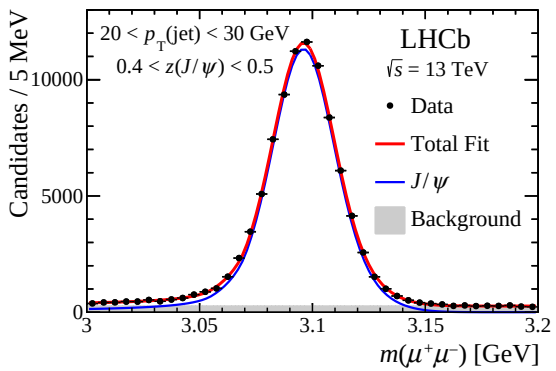
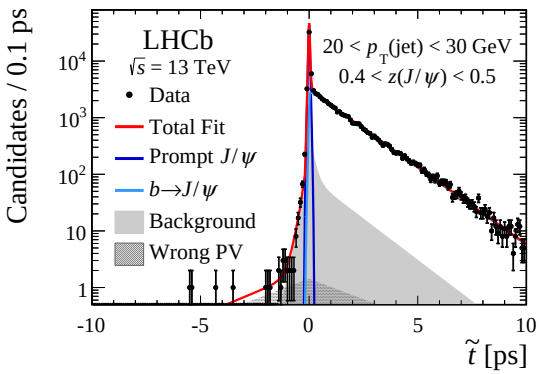
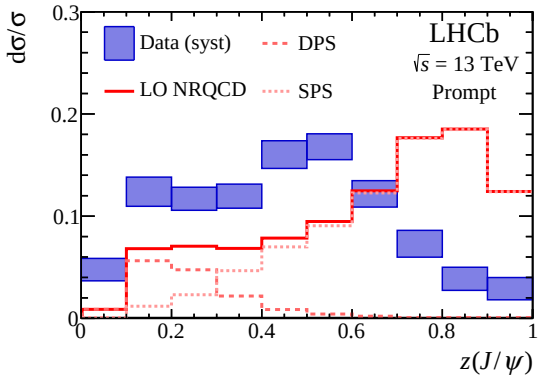


(a)



(b)

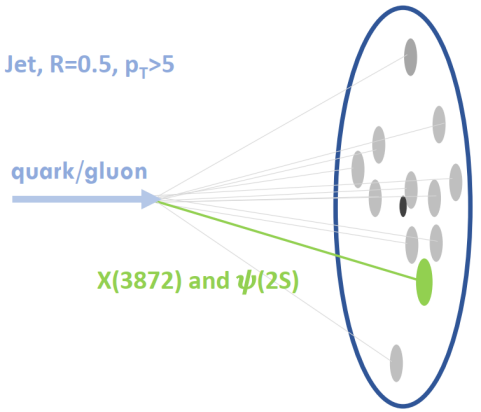


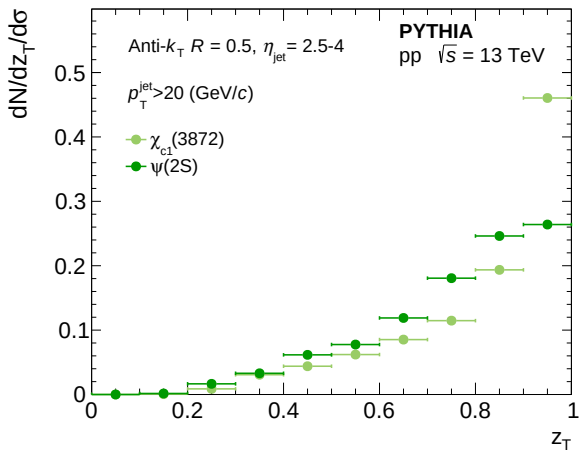
(c)

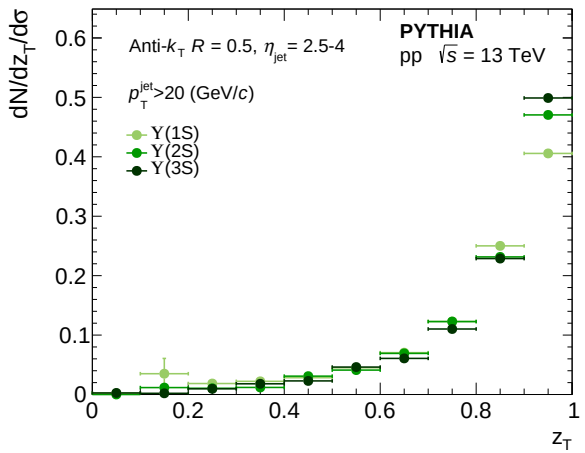
$\chi_{c1}(3872)$, $\psi(2S)$ and Υ in jets

Goal: Expand the J/ψ analysis to more states with higher mass and different quark content to see if these fragmentation functions also differ notably from the PYTHIA and NRQCD expectations.
Uncover how tetra-quark states are produced within jets.

Decay	$\chi_{c1}(3872)$ and $\psi(2S)$ reconstructed from their decay to J/ψ $\pi\pi$ Υ reconstructed in the $\mu\mu$ decay
Data	pp data at 13 TeV
Jets	anti k_T R= 0.5, $p_T > 5$ GeV, η = 2-4.5
Dimuon Trigger	fully reconstructed event written to disk







$\chi_{c1}(3872)$, $\psi(2S)$ and Υ production

Production cross section already measured by LHCb using 13 TeV dataset.

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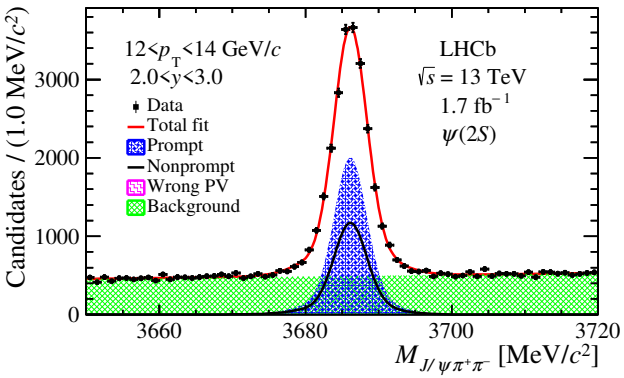

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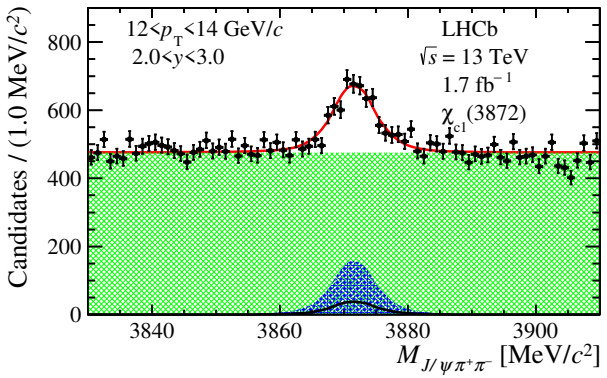

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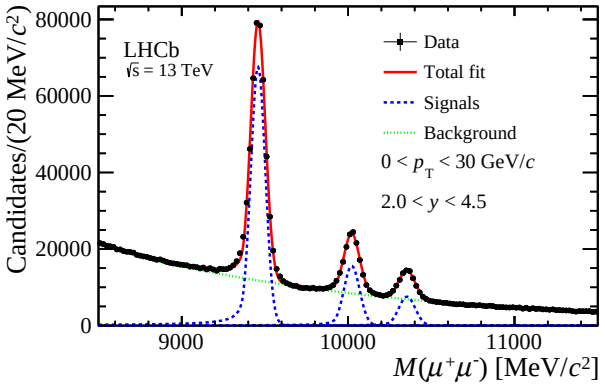

We are able to reconstruct the fragmentation function over a wide z_T range for both the $\chi_{c1}(3872)$ and the $\psi(2S)$ in multiple jet p_T bins ranging from 5-60 GeV.
Our results will be compared with PYTHIA predictions and will be published soon !