

Measurements of quarkonia production in jets at LHCb

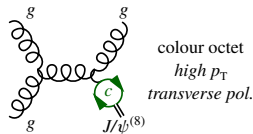
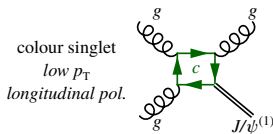
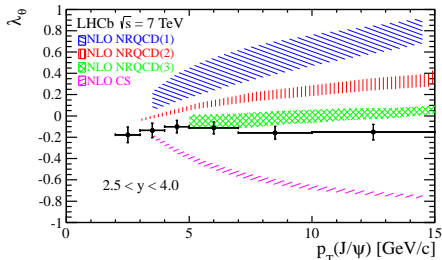
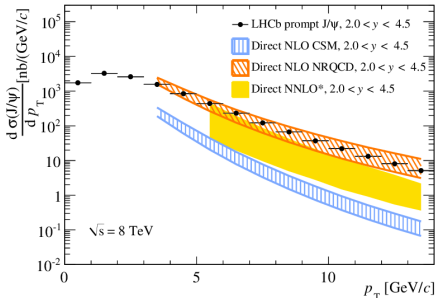


Naomi Cooke on behalf of the LHCb collaboration

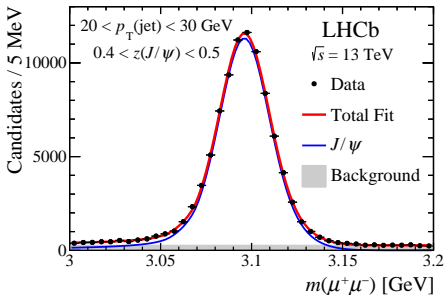
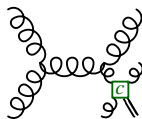
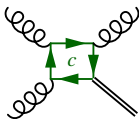
University of Birmingham
Strangeness in Quark Matter 2022

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- **Hard production** Non-Relativistic QCD (NRQCD) predicts:
 - Differential production cross section consistent with measurement.
 - J/ψ produced largely isolated.
 - Large transverse polarisation, minimal observed.

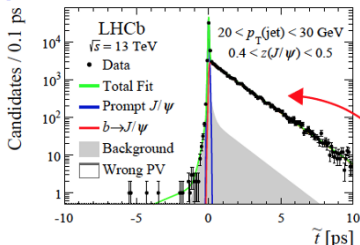
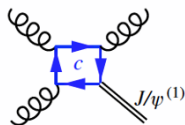
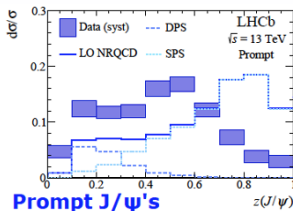


- Shower production analytic resummation NRQCD predicts:
 - Lack of polarisation
 - J/ψ rarely produced in isolation
- Two pictures of quarkonia production distinguished by studying radiation associated with them \rightarrow JETS
- Instead of measuring cross section wrt $p_T(J/\psi)$, take into account surrounding radiation with $z \equiv p_T(J/\psi)/p_T(\text{jet})$.

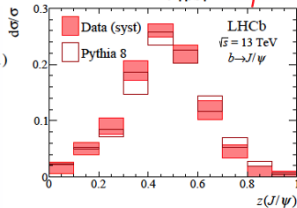
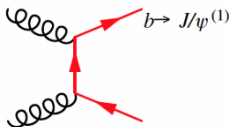


Procedure:

- Build Quarkonia (Q) $\rightarrow \mu^+\mu^-$ candidates in jets
- Determine Q signal yield with mass fits

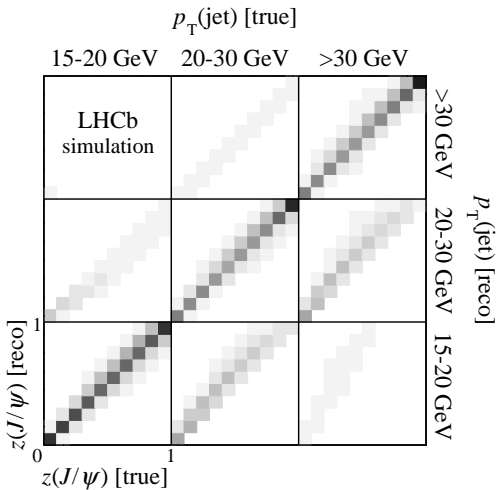


Displaced J/ψ 's



- Separate prompt (direct) from displaced (eg. b decays) yields with pseudo-lifetime fits, $t \equiv x_z - x_z(\text{PV})m_Q/p_z$
- Measure $d\sigma/\sigma$ versus $z \equiv p_T(Q)/p_T(\text{jet})$, to probe DPS.
- Obtain different z distributions for different Q with unfolding and efficiency corrections: J/ψ , $\psi(2S)$, $\Upsilon(1S)$, $\Upsilon(2S)$, $\Upsilon(3S)$ and $X(3872)$.

Unfolding $p_T(\text{jet})$ from reconstruction to truth level is done to correct for jet energy resolution effects, using RooUnfold.



- Presented here results for $z(J/\psi)$.
- Analyses for $\psi(2S)$, $\Upsilon(1S)$, $\Upsilon(2S)$, $\Upsilon(3S)$ and $X(3872)$ are in progress.
- Predictions for the $z(Q)$ distributions are shown below, where Υ 's are predicted to be more isolated than $\psi(2S)$ and $X(3872)$.

