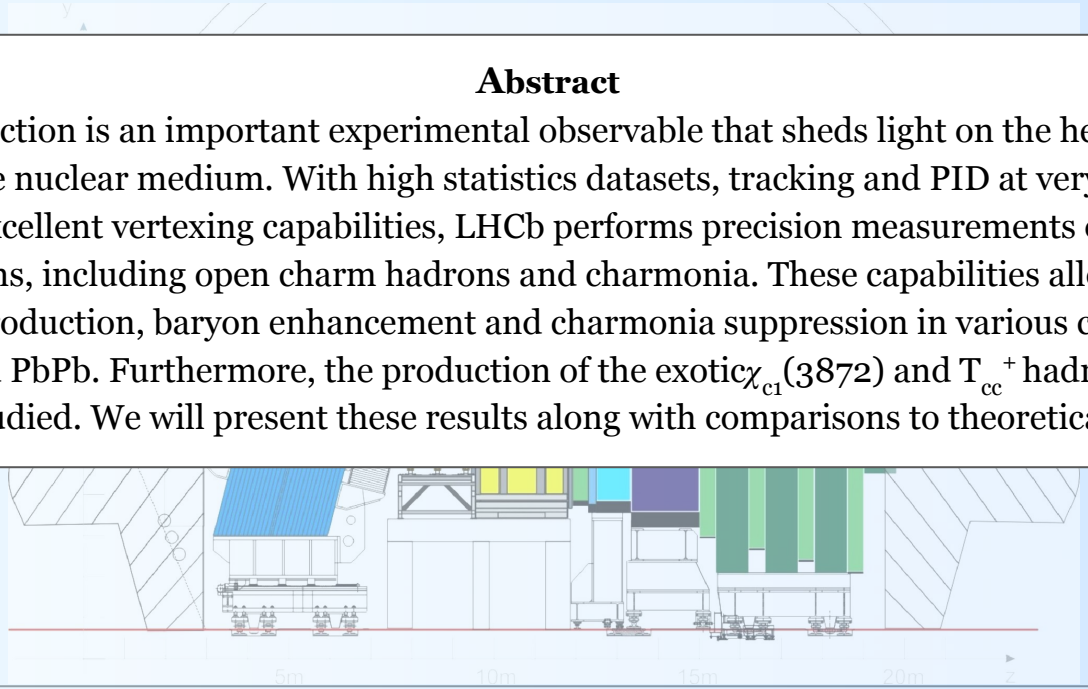
Heavy Flavor and Exotic Production at LHCb

Krista Smith, for the LHCb Collaboration

Abstract

Heavy quark production is an important experimental observable that sheds light on the heavy quark interaction with the nuclear medium. With high statistics datasets, tracking and PID at very low transverse momentum, and excellent vertexing capabilities, LHCb performs precision measurements of a rich set of heavy flavor hadrons, including open charm hadrons and charmonia. These capabilities allow for precise studies of charm production, baryon enhancement and charmonia suppression in various colliding systems from *pp* to *p*Pb and PbPb. Furthermore, the production of the exotic $\chi_{c1}(3872)$ and T_{cc}^{+} hadrons in *pp* and *p*Pb collisions is also studied. We will present these results along with comparisons to theoretical calculations.

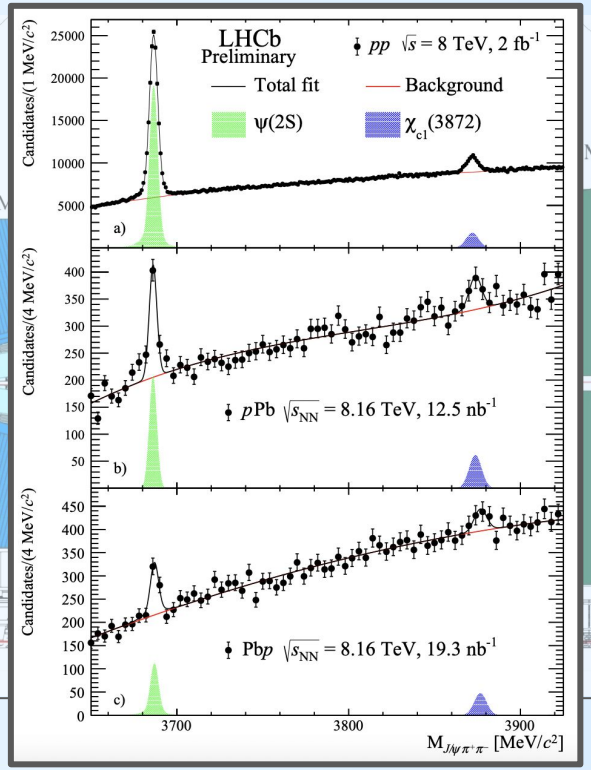


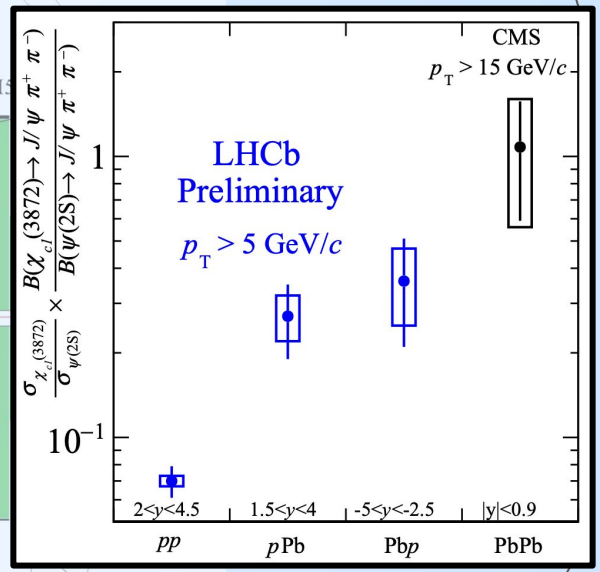
Prompt Production of $\chi_{c1}(3872)$ and $\psi(2S)$ in pp, pPb, and Pbp Collisions

Krista Smith, for the LHCb Collaboration

Left: The $J/\psi\pi^+\pi^-$ invariant mass spectra is shown for pp, pPb, and Pbp collisions. In collisions with heavy targets, exotic hadrons can interact with the nuclear remnant and are exposed to QGP effects.

Right: The cross sectional ratio of $\chi_{c1}(3872)$ to $\psi(2S)$ for LHCb (blue) and CMS data (black). Some nuclear effects modifying charm production cancel in the ratio, leaving final-state effects to dominate.





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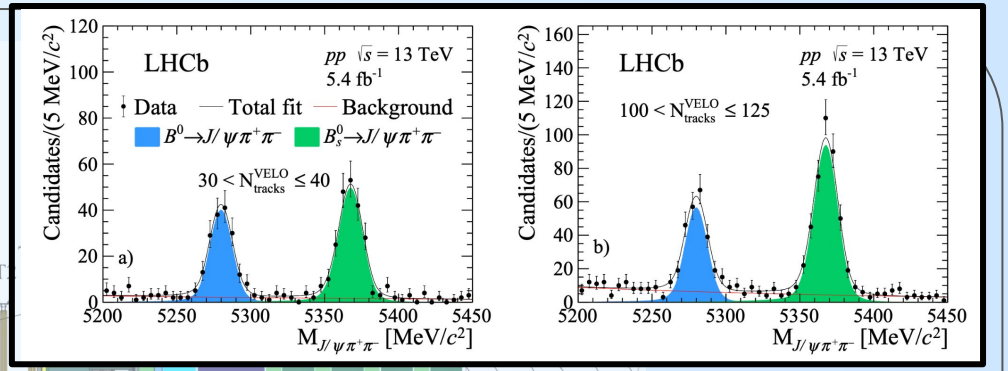
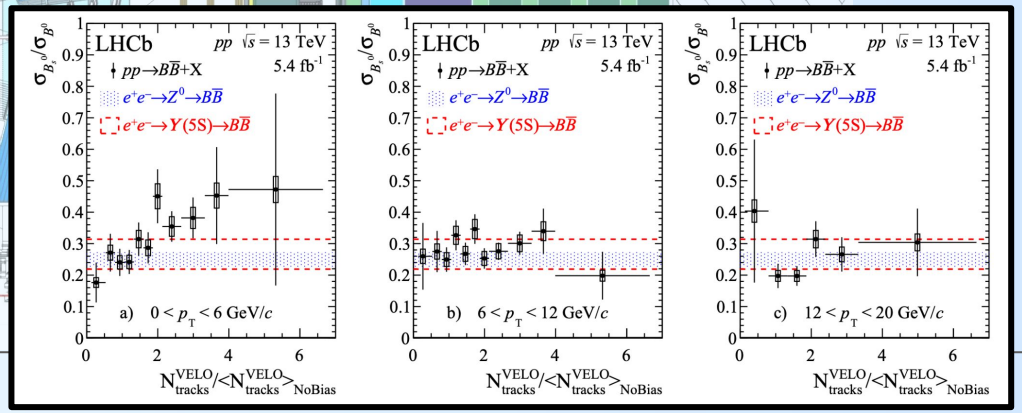
Evidence for Modification of *b* quark Hadronization in *pp* Collisions

Krista Smith, for the LHCb Collaboration

Top: The $J/\psi\pi^+\pi^-$ invariant mass spectra is shown for *pp* collisions at two different multiplicity intervals. An increase of the B^0_s yield relative to the B^0 yield in the high-multiplicity interval is apparent.

Bottom: $\sigma B^0_s / \sigma B^0$ is shown as a function of multiplicity for different B meson p_T ranges. The ratio increases with multiplicity only in the lowest p_T interval. Fitting the data for 0-6 GeV/c with a straight line, the slope difference with zero is 3.4σ





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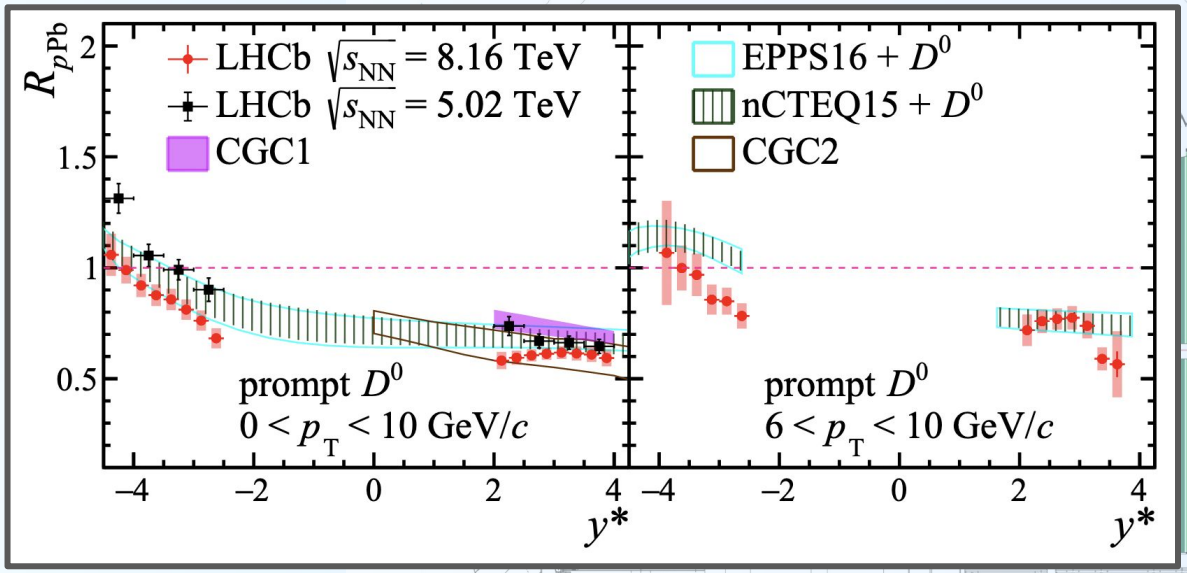
Measurement of Prompt D⁰ Nuclear Modification in *p*Pb Collisions

Krista Smith, *for the LHCb Collaboration*



Prompt D⁰ R_{pPb} is shown in two p_T intervals as a function of y^*. Stronger suppression is observed at forward than backward rapidity, where the data is better described by the CGC2 over CGC1.

At backward rapidity, the smaller R_{pPb} values of the data compared to EPPS16 and nCTEQ15 predictions may indicate the presence of additional final-state effects, such as energy loss.

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Summary

In summary, the first measurement of the $\chi_{c1}(3872)$ in pPb collisions has been presented by the LHCb Collaboration. Taking the cross sectional ratio of $\chi_{c1}(3872)$ to $\psi(2S)$ cancels some nuclear effects modifying charm production, leaving final state effects to dominate. An increasing trend is seen from small to larger systems, suggesting the exotic $\chi_{c1}(3872)$ interacts differently with the nuclear medium than the $\psi(2S)$.

The ratio of B^0_s mesons to B^0 mesons in pp collisions at $\sqrt{s}$ = 13 TeV was measured as a function of multiplicity in three different p_T intervals. The measurements in the lowest p_T interval indicate that B^0_s meson production is enhanced with respect to B^0 mesons in collisions with high charged-particle multiplicity, which is consistent with expectations of strangeness enhancement.

The prompt D^0 R_{pPb} measurements at backward rapidity at the higher p_T range show stronger suppression than that predicted by nPDF calculations, supporting the presence of additional final state effects such as energy loss. At forward rapidity, the data is described by CGC2 calculations, favoring cold nuclear matter effects as the dominant contribution to prompt D^0 nuclear modification.