Contribution ID: **107** Type: **Poster + flash-talk**

# The role of the underlying event in the charm-baryon enhancement observed in pp collisions at LHC energies

*Monday 1 August 2022 18:20 (10 minutes)*

The factorization hypothesis states that the production cross-section of heavy-flavor hadrons can be calculated as the convolution of three independent terms: the parton distribution function of the colliding hadrons, the production cross sections of the heavy-quarks in the hard partonic process, and finally the fragmentation functions of the heavy-flavor quarks into the given heavy-flavor hadron species. The fragmentation function has been traditionally treated as universal, i.e. independent of the collision systems.

Recent charmed-baryon measurements by ALICE and CMS show a low-momentum enhancement over model predictions based on $e^+e^-$ collisions, which challenges this traditional assumption [1,2]. One of the latest measurements also shows that this enhancement depends on the final-state multiplicity of the collision event [3]. Several scenarios have been proposed to explain the emerging pattern, including string formation beyond leading order, the so-called enhanced color re-connection [4], which provides a qualitatively correct description of these findings for pp collisions.

In our contribution, we investigated the charm-baryon enhancement with PYTHIA 8 Monte-Carlo generator and enhanced color-reconnection models. We proposed a method based on several event-activity classifiers to identify the source of the charm-baryon enhancement. We conclude that, within the scenario under investigation, the excess $\Lambda_c$ production is connected to the underlying event and not to the jet production [5]. We also present studies with several charmed-baryon species that address the role of the quark content and isospin state and allow for the comparison of charm and strange-baryon enhancement mechanisms.
These new observables will provide a unique opportunity in the upcoming measurements from the high-luminosity LHC Run3 phase to understand charm fragmentation mechanisms, and will serve as valuable means for further model development.

[1] CMS Coll., Phys. Lett. B 803 (2020) 135328, arXiv:1906.03322.
[2] ALICE Coll., Physicial Review Letters 127, 202301 (2021), arXiv:2011.06078.
[3] ALICE Coll., Phys.Lett.B 829 (2022) 137065, arXiv:2111.11948.
[4] C., J.R., S., P.Z., JHEP 2015, 3 (2015), arXiv:1505.01681.
[5] Z. V., R. V., Submitted to J.Phys.G. (accepted), arXiv:2111.00060.

## On behalf of collaboration?

## Attending in-person?

Yes

## Subfield

Nuclear experiment

## Preferred track

Hadronic Issues in Heavy-Flavour Physics

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**Session Classification:** Poster Session