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## Measurement of the differential distributions of $B_s^0 \rightarrow D_s^* \mu \nu$ decay with the LHCb detector

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This analysis aims to a comprehensive study of the decay kinematics of the semileptonic decay  $B_s^0 \rightarrow D_s^* \mu \nu$ , with  $D_s^* \rightarrow D_s \gamma$  and  $D_s \rightarrow K^- K^+ \pi$ , using data collected by LHCb in Run 2. The study of semileptonic decays of  $B_s^0$  meson plays a crucial role in the validation of the Standard Model, since these help to constrain the parameters of the CKM matrix, to test Lepton Flavour Universality, to understand CP violation and to investigate New Physics effects. With this work a first measurement of the form factors describing the  $B_s^0$  meson semileptonic decay is provided, performing a four-dimensional binned fit in the space given by the variables describing the decay kinematics, namely  $q^2$ ,  $\cos \theta_l$ ,  $\cos \theta_d$  and  $\chi$ . Taking into account the detector acceptance, as well as the reconstruction efficiencies and the resolution effects, the full differential distribution is evaluated; then, a fit to this distribution is performed using different parameterizations for the  $B_s^0 \rightarrow D_s^*$  transition form factors and including a term for New Physics contribution. Furthermore, the unfolded distributions are also computed and compared with the theoretical predictions and the Belle-II experiment results. Finally, using the unfolded shapes, a model-independent approach is tested and its compatibility with the model-dependent results is studied.

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