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Luminosity measurements at LHCb

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Content

Luminosity measurements at LHCb are of pivotal importance. They have been used in about 50 LHCb publications of production cross section results. The interaction rate at LHCb is continuously monitored by several luminosity counters (like the number of reconstructed tracks) measuring the fraction of “empty” events, i.e. events which fall below a chosen threshold of a given luminosity counter. Using the law of Poisson statistics, an average interaction rate per bunch crossing is derived from the “empty” events fraction. The absolute calibration of the luminosity counters is performed a few times per year (typically for each new beam energy and beam types), mostly in dedicated LHC fills. Two techniques are employed for the direct luminosity measurement. The first one is the classic van der Meer scan method which is used by all four LHC experiments. The second one is unique to LHCb. Here, the beam profiles and their overlap integral are determined from the beam “images” recorded with beam-gas interactions. Both techniques give similar accuracy but have different systematics. Their combination has allowed us to obtain in LHC Run I the most precise luminosity measurement ever achieved at a bunched hadron collider. In this talk, we give an overview of the LHCb experience with the luminosity calibration, present several recent calibration results and outline the developments which are being pursued to obtain a better understanding of the calibrations.

Summary

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