Novel real-time alignment and calibration of the LHCb detector and its performance

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The LHCb detector is a forward spectrometer at the LHC, designed to perform high precision studies of B and D hadrons. In Run II of the LHC, a new scheme for the software trigger at LHCb allows splitting the triggering of events in two stages, giving room to perform the alignment and calibration in real time. In the novel detector alignment and calibration strategy for Run II, data collected at the start of the fill are processed in a few minutes and used to update the alignment, while the calibration constants are evaluated for each run. This allows identical constants to be used in the online and offline reconstruction, thus improving the correlation between triggered and offline selected events. The required computing time constraints are met thanks to a new dedicated framework using the multi-core farm infrastructure for the trigger. The larger timing budget, available in the trigger, allows to perform the same track reconstruction online and offline. This enables LHCb to achieve the best reconstruction performance already in the trigger, and allows physics analyses to be performed directly on the data produced by the trigger reconstruction. The novel real-time processing strategy at LHCb is discussed from both the technical and operational point of view. The overall performance of the LHCb detector on the data of Run II is presented as well.

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