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Real-time alignment and temperature dependency of the LHCb Vertex Detector

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The accuracy of the LHCb Vertex Locator (VELO) has ensured excellent detector performance, with a track reconstruction efficiency above 98%, and a vertex resolution along the beam axis of about 70 microns. The real-time alignment and calibration procedure developed by the LHCb experiment for Run 2 (2015-2018) for the full detector, including the VELO, provided extremely stable conditions during the full data taking period. In 2010, a significant shrinkage of the VELO modules was observed at the operating temperature of -30 degrees with respect to survey measurements made at ambient temperature. This has been confirmed by laboratory measurements on a single module. In a recent study, using a dedicated LHCb data sample taken over a range of VELO temperatures, the variation of the detector position as a function of temperature has been evaluated. An overview of the VELO alignment procedure and its performance during Run 2 will be presented, with an emphasis on the study of the temperature dependence.

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