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LHCb VELO: Radiation Damage Effects and Operations in LHC Run 2

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The LHCb detector is a single-arm forward spectrometer covering the pseudorapidity range $2 < \eta < 5$, designed for the study of particles containing b or c quarks. The detector includes a high-precision tracking system consisting of a silicon-strip vertex detector (VELO) surrounding the pp interaction region, a large-area silicon-strip detector located upstream of a dipole magnet and three stations of silicon-strip detectors and straw drift tubes placed downstream of the magnet. Calorimeters, RICH and Muon detectors for particle identification complement the detector.

The VELO comprises 42 modules made of two n^+-on-n 300 μm thick half-disc silicon sensors with R-measuring and Phi-measuring micro-strips, featuring a double metal layer for signal routing. One upstream module is manufactured with n^+-on-p technology, allowing a direct comparison of the two technologies. The VELO is installed as two movable halves containing 21 modules each to ensure its safety during beam injection.

The extreme proximity (~8 mm) of the VELO sensors to the LHC beam renders the VELO an ideal laboratory to study the effects of radiation damage on silicon detectors. Therefore, and to ensure efficient operation until the end of LHC Run 2, the radiation damage is studied closely with several methods complementing one another: IV scans, IT scans and CCE scans. The latest results as well as operational challenges for the VELO in LHC Run 2 will be presented.

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