

8th "Trento" Workshop on Advanced Silicon Radiation Detectors (3D and p-type)

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Performance and radiation hardness of the LHCb Velo

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LHCb is a dedicated experiment to study New Physics in the decays of heavy hadrons at the Large Hadron Collider (LHC). Heavy hadrons are identified through their flight distance in the VELO, the retractable silicon-strip vertex detector surrounding the LHCb interaction point at only 7 mm from the beam during normal LHC operation.

Both VELO halves comprise 21 silicon micro-strip modules each. A module is made of two n-on-n 300 μm thick half-disc sensors with R- and ϕ -measuring geometry, mounted on a carbon fibre support paddle. The minimum pitch is approximately 40 μm . The detector is also equipped with the only n-on-p module operating at the LHC.

The performance of the VELO in its three years of successful operation during the LHC physics runs will be presented. Highlights will include alignment, cluster finding efficiency, single hit resolution, and impact parameter and vertex resolutions.

The VELO module sensors receive a large and non-uniform radiation dose having inner and outer radii of only 7 and 42 mm, respectively. In this extreme and highly non-uniform radiation environment type-inversion of the inner part of the n-on-n sensors has already been measured.

Radiation damage is monitored and studied in three ways: (1) dependence of sensor currents on voltage and temperature; (2) noise versus voltage behaviour; and (3) cluster finding efficiency. Results will be presented in all three areas with updates based on recent results from the 2012 LHC running.

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