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## Characterization of the TimePix3 readout chip and radiation-hard sensors for the VELO upgrade

The LHCb experiment located at CERN, Switzerland, studied the difference between matter and antimatter, successfully acquiring data since 2009. The experiment will undergo an upgrade on its detectors to allow operation with higher luminosity, increasing the data acquired by about 10 times. Prototypes for the new detectors were studied for the vertex detector (VELO) detector upgrade. Different types of sensors were tested and characterized to determine whether they satisfy the requirements of the upgrade. The, relatively new, TimePix3 readout chip, which is a prototype for future VELO read-out chip, called VELOPix, was used for the tests of the sensors. The analysis of the most important characteristics of TimePix3, relative to VELOPix, and the tests of the sensors are presented. Also, a comparison between different methods of calibration is performed for the proposed TimePix3. The results obtained shows that some of the prototypes meet successfully the critical requirements (radiation resistance and tolerance to high voltage) of the upgrade.

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