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A Longitudinal Density Monitor for the LHC

The Longitudinal Density Monitor (LDM) is primarily intended for the measurement of the particle population in nominally empty RF buckets. These so-called satellite or ghost bunches can cause problems for machine protection as well as influencing the luminosity calibration of the LHC. The high dynamic range of the system allows measurement of ghost bunches with as little as 0.01% of the main bunch population at the same time as characterization of the main bunches.

The LDM is a single-photon counting system using synchrotron light. The photon detector is a silicon Avalanche Photo-Diode operated in Geiger mode, which allows the longitudinal distribution of the LHC beams to be measured with a resolution of 90ps.

Results from the LDM are presented, including a method for constructing a 3-dimensional beam density map by scanning the LDM sensor in the transverse plane. In addition, we present a scheme to improve the effective dynamic range of the system by using an optical switching technique.

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