A High-Granularity Timing Detector for the ATLAS Phase-II upgrade

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Abstract

The impact of the expected increase of the particle flux (pile-up) at the HL-LHC [1] with luminosities of $L \approx 7.5 \times 10^{34} cm^{-2} s^{-1}$ on the ATLAS detector [2] reconstruction and trigger performance will be significant. It will mainly affect the forward and end-cap regions where the liquid Argon calorimeter has coarser granularity and the inner tracker has poorer momentum resolution. In order to mitigate the pile-up contamination coming from this high luminosity, a High Granularity Timing Detector (HGTD)[3] is proposed in front of the LAr end-cap calorimeters, covering the pseudo-rapidity range from 2.4 to 4.0. High-precision timing information for MIPs will be provided by two Silicon sensors double sided layers, with a resolution better than 30 ps per track, which will allow to assign each particle to the correct vertex. Readout cells of 1.3 mm $\times$ 1.3 mm will lead to a highly granular detector with 3 million channels. To provide enough gain to reach the large signal over noise ratio needed, low Gain Avalanche Detectors (LGAD) [4] technology has been chosen. The overall specifications and requirements of the HGTD as well as the technical proposal will be presented. LGAD R&D campaigns are carried out to study the sensors, the related ASICs and the radiation hardness. Laboratory and test beam results will be discussed.

References

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