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Tracking and Vertexing in 4D

LHCb has recently submitted a physics case to upgrade the detector to be able to run at instantaneous luminosities of $2\times10^{34}cm^{-2}s^{-1}$, an order of magnitude above Upgrade I, and accumulate a sample of more than 300 fb^{-1}. At this intensity, the mean number of interactions per crossing would be 56, producing around 2500 charged particles within the LHCb acceptance. The LHCb physics programme relies on an efficient and precise vertex detector (VELO) to correctly identify the origin point of the b/c decays. To meet this challenge it is necessary to use temporal precision on each hit at the pixel detector region. To achieve this goal a new 4D hybrid pixel detector with enhanced rate and timing capabilities in the ASIC and sensor will be developed. Improvements in the mechanical design will be needed to allow periodic module replacement and lower detector material.

The early stages of R\&D and conceptual design of a 4D VELO will be presented, together with extensive simulation studies showing the prospects of the 4D-tracking approach on physics measurements, compared to typical 3D and timing plane alternatives$p

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