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## LHCb SciFi Tracker and future upgrades

The LHCb (Large Hadron Collider Beauty) experiment will undergo its high-luminosity detector upgrade (known as Upgrade II) in the long shutdown 4 of the LHC (2033-2034) to operate at a maximal instantaneous luminosity of  $1.5 \times 10^{34}$  cm<sup>-2</sup>s<sup>-1</sup> in Runs 5 and 6, ten times higher than in previous data taking periods. This increase in instantaneous luminosity poses a challenge to the tracking system to achieve proper track reconstruction with a tenfold higher occupancy. In this abstract we focus on foreseen solutions for the tracking stations after the magnet, currently performed by the Scintillating Fibre (SciFi) Tracker. The SciFi Tracker is composed of mats of staggered scintillating fibres with a silicon photomultiplier (SiPM) readout system to detect charged particles. In Upgrade II, the inner region of the SciFi will be instrumented with an HV-CMOS pixel detector to cope with the high occupancy in this region. For the outer SciFi region, adding timing information to the track reconstruction is currently being evaluated in a dedicated simulation study to understand its role in reducing the occupancy, minimising ghost tracks (reconstructed tracks not produced by real charged particles) and decreasing the track computation time.

Additionally to the higher instantaneous luminosity, the integrated luminosity will also increase in the future data taking periods, with an aim to collect a total of 240 fb<sup>-1</sup>. This will lead to a drastic increase in the radiation environment and thus in the SiPM's dark count rate (DCR), making cryogenic cooling and novel detector technologies necessary to maintain single photon detection capabilities. This also requires an update of the front-end electronics to operate at such a large temperature range and to maximise charge collection.

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