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LHCb Upgrade: Scintillating Fibre Tracker

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The LHCb detector will be upgraded during 2018/19 in order to collect data from proton-proton collisions at the LHC at higher instantaneous luminosities and to read out the data at 40 MHz using a trigger-less read-out system. All front-end electronics will be replaced and several sub-detectors must be redesigned to cope with the higher occupancy. The current tracking detectors downstream of the LHCb dipole magnet will be replaced by the Scintillating Fibre (SciFi) Tracker.

The SciFi Tracker will be constructed using 2.5 m long scintillating fibres and read out by Silicon Photomultipliers (SiPM) located outside the acceptance. The fibres have a diameter of 0.25 mm, are wound into ribbons with 5 or 6 staggered layers of fibres, and will cover a total active area of around 360 m². State-of-the-art multi-channel SiPM arrays are being developed to read out the fibres. A custom ASIC, the PACIFIC, will be used to digitise the signals from the SiPMs and additional front-end electronics based on FPGAs will be used to reconstruct hit positions.

There are a number of challenges involved in the construction of this detector: the radiation hardness of the fibres and the SiPMs; the mechanical precision required while building large active detector components; and the cooling required to mitigate the effects of radiation damage. The evolution of the design since the Technical Design Report in 2014 and the latest R&D results, including test beam data, will be presented.

Collaboration

LHCb Upgrade Scintillating Fibre Tracker Group

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