

SciFi – Upgrading LHCb with a Scintillating Fibre Tracker

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LHCb will undergo a major upgrade during the LHC long shutdown in 2019/2020 to cope with increased instantaneous luminosities and to implement a trigger-less 40 MHz readout. The current inner and outer tracking detectors will be replaced by a single homogeneous detector based on plastic scintillating fibres (SciFi).

The SciFi tracker covers an area of 340 m² by using more than 10,000 km of scintillating fibre with 250 µm diameter, enabling a spatial resolution of better than 100 µm for charged particles. Six-layer fibre mats of 2.4 m length are assembled to form individual detector modules (0.5 × 4.8 m²) consisting of 8 mats each. Linear arrays of Silicon Photomultipliers cooled to -40°C are placed at the fibre ends. The readout of 524k channels occurs through custom-designed front-end electronics.

The LHCb requirements and environment impose stringent demands on the performance of the fibres. A R&D program aiming at the development of very fast and efficient scintillating fibres, based on a novel type of luminophores (NOL), has been launched in parallel to the SciFi production. The performance of the prototype NOL fibres is competitive, in particular the decay time constant is close to 1 ns, i.e. about 50% shorter than the best standard fibre.

The talk will give a brief overview of the SciFi detector design, production and performance of various components and status of the detector assembly. Furthermore, we will report on the latest results of the NOL fibre development.