The LHCb Upgrade Scintillating Fibre Tracker

Blake D. Leverington

March 24, 2015

The Scintillating Fibre (SciFi) Tracker is designed to replace the current downstream tracking detectors in the LHCb Upgrade during 2018 [1]. The planned increase in interactions per bunch crossing and 40 MHz trigger rate in order to collect up to $50\,\mathrm{fb}^{-1}$ of data over 10 years will result in an increased occupancy in the tracking detectors and will exceed the operational occupancy for the Outer Tracker. Here we present the SciFi Tracker as the replacement for the Outer and Inner Trackers.

The SciFi Tracker is based on 2.5 m long multi-layered ribbons from 10,000 km of 0.250 mm diameter scintillating fibre as the active medium and signal transport over 12 planes covering $350\,\mathrm{m}^2$. Cooled silicon photomultiplier (SiPM) arrays with 128 channels and 0.25 mm channel width are used as readout. The front-end electronics are designed to digitize the signals from the SiPMS with a custom ASIC chip, the PACIFIC, for the approximately 560,000 channels and reconstruct the track hit position within an on-board FPGA. Several challenges facing this detector will be presented regarding the precision construction of the large active detector components, the radiation hardness of the scintillating fibres and the SiPMs, the high density readout electronics, and the necessary cooling systems.