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SciFi optimization during commissioning

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The Scintillating Fibre (SciFi) is a new tracker detector after magnet at LHCb, which was installed in last year and has been being under commissioning using LHC 2022 and 2023 early collision data. This detector was built from scintillating fibres with a diameter of 250 μm . Scintillation light from fibres is recorded with arrays of state-of-the-art multi-channel silicon photomultipliers (SiPMs). A custom ASIC is used to digitize the SiPM signals. Subsequent digital electronics performs clustering and data-compression before the data is sent via optical links to the DAQ system. The front-end electronics (FEE) internal clock per data link is adjusted in order to achieve low transmission error rates of the data transmission before commissioning with beam. Then SciFi FEE time phase is calibrated with respect to beam interactions to capture detector signals with the correct phase and in the correct bunch cycle. The master clock and control phase are scanned with granularity around 0.78ns to obtain the beam scan samples, and the baseline time (t_0) per data link is defined using these samples. A time offset is applied to t_0 for best efficiency, which is determined using specific SciFi simulation, given that particle arrival times for each data link from proton-proton collisions are different. Moreover, the t_0 has been monitored over a long time scale, which shows a good time stability of SciFi electronics. The detector position is measured and monitored by a camera system, which offers the first detector position information. The most precise alignment information is obtained with a software algorithm that uses charged particle trajectories. Positions of each half-layer, module and mat are parametrized by three translations and three rotations and these alignment parameters play an important role in the track reconstruction. In addition, the detector position resolution in track reconstruction is improved significantly after alignment. This talk will give an overview of the SciFi, and then present the experience during commissioning and preliminary performance.

Collaboration / Activity

LHCb

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