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Optical Wireless Communication system for particle detectors in High Energy Physics.

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The particle detectors in high energy physics utilize complex networks of high speed optical fibers for communication. Higher bandwidth will be required for future upgrades and any requirements to route new cables may be difficult due to space limitations. Optical wireless communication (OWC) can provide cable-free high speed data links, which could result in reduced material budget and cheaper installation. A joint collaboration of SSSUP and INFN Pisa is targeting the development of such OWC system and here we present the outcome of an initial study. As reference architecture, the inner tracker of Compact Muon Solenoid (CMS) operating in Large Hadron Collider (LHC) is considered. Similar approaches can also be applied to other particle detectors. We studied the performances of an OWC system based on 1550nm source used as transmitter and PIN diodes used as receiver, working at 10cm distance and operating at 2.5Gb/s and 10Gb/s. In particular, we investigated the tolerance to misalignment for different source beam waist as the system must be self-aligning, because no post alignment operation can be performed. It was observed that reasonable tolerance values from +/- 0.25mm to +/-0.8mm can be obtained using beam waist ranging from 0.38mm to 3.5mm respectively. We also performed simulations in order to increase tolerance of the system. With an optimized lens at the receiver it should be possible to obtain tolerances bigger than +/-1mm without having any lens at the transmitter.

Collaboration

This work is joint collaboration of SSSUP and INFN Pisa under INFIERI.

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