

Optical wireless communication system for Particle Detectors in High Energy Physics

W. Ali¹, R. Corsini¹, E. Ciaramella¹, R. Dell'Orso², A. Messineo² and F. Palla²

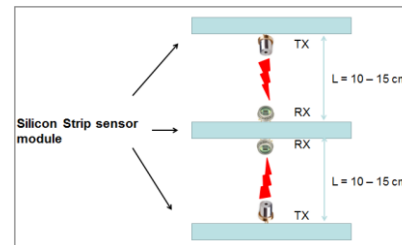
1: Scuola Superiore' Sant'Anna Pisa Italy

2: INFN Pisa Italy



• Abstract:

- Optical Wireless Communication (OWC) system for particles detector can be a viable solution for reducing the complexity of the optical fibre network used to extract the data from the detector. In this work we present the initial study of the tolerance to misalignment for the OWC system under investigation. We observed that using collimators of beam waist from 0.35mm to 3.5mm we can obtain tolerance in range from +/-0.25mm to +/-0.8mm. We also observed using ray trace simulation that both transmitting power and tolerance can be improved by using optimized lens at the receiver having VCSEL as transmitting source



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- OWC system will provide radial connectivity between inner layer to outer layer of detectors in inner tracker of CMS (considered as reference). This will result in reduced latency and faster event selection.
- We studied tolerance to misalignment of OWC system. This is mandatory because only passive alignment will be possible in structure like particle detectors. Therefore, the system must be designed to work within the mechanical tolerance of the structure.
- A Free Space Optics (FSO) setup was realized to study the system tolerance to misalignment. We tested 4 collimators with different beam waist (0.38mm, 0.87mm, 2.1mm, 3.5mm) and photodiodes with flat window and ball lens, for data rate of 2.5 Gb/s and 10 Gb/s.
- We also performed simulations using ray trace software considering VCSEL (transmitter) with no lens and photodiode with ball lens. We observed that using optimized lens at the receiver we can achieve 2.5 Gb/s at distance of 10cm with lower transmitted power and bigger tolerance.

