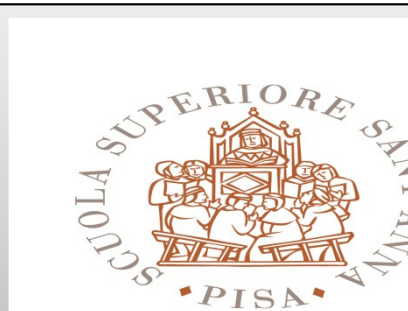


High Speed Data Transmission and Processing

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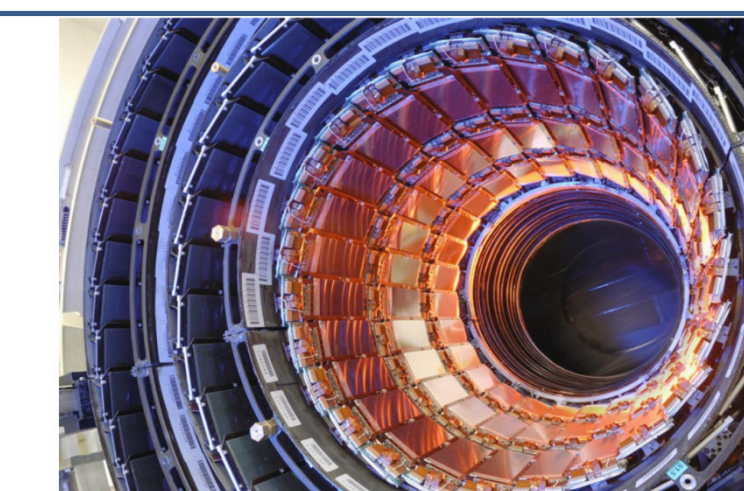
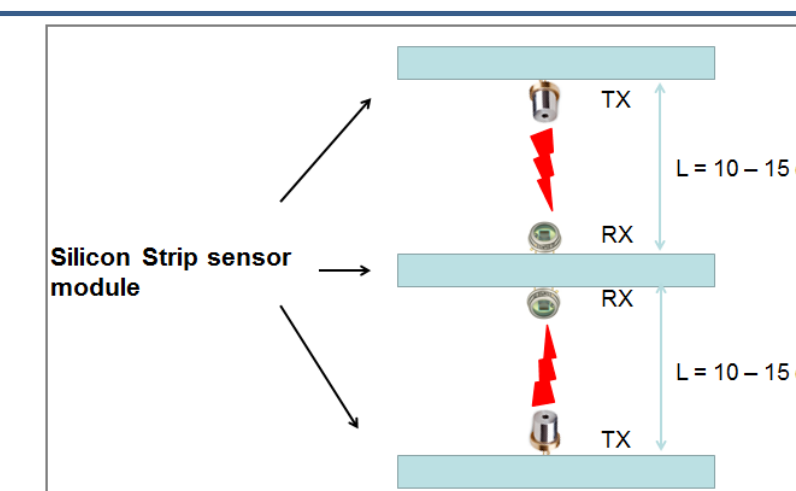


Objective: Design of Optical wireless communication (OWC) System for high bandwidth data transfer in relation to HEP and Astrophysics.

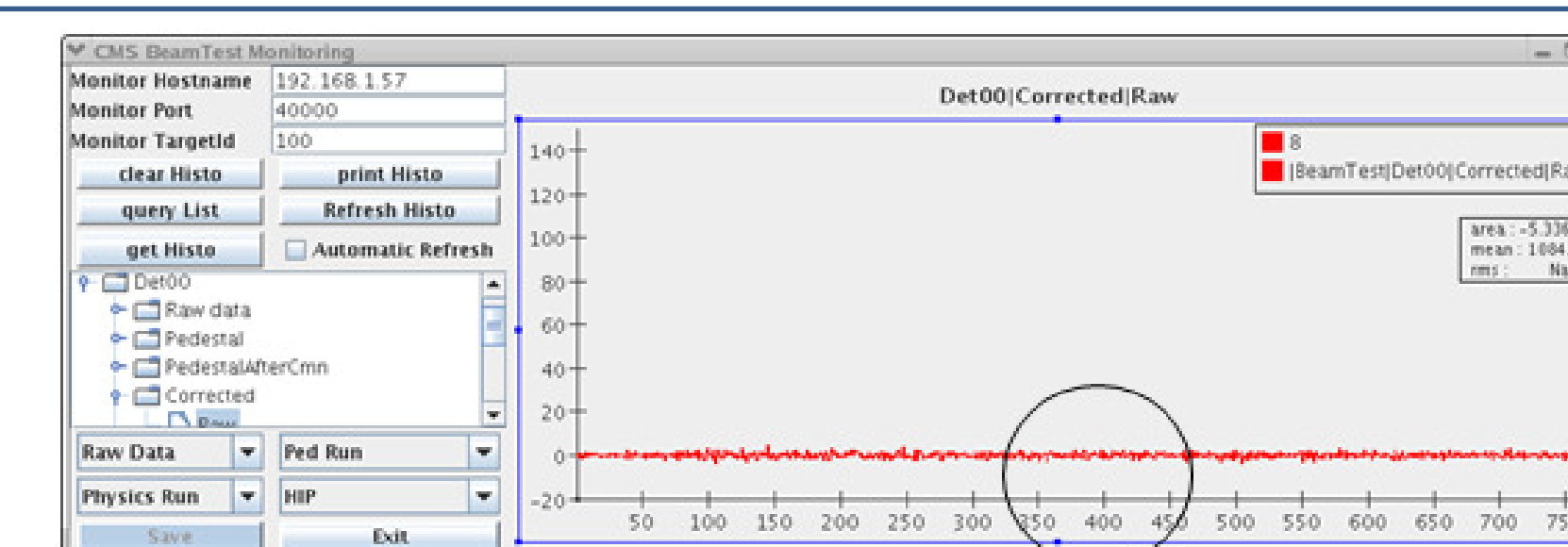
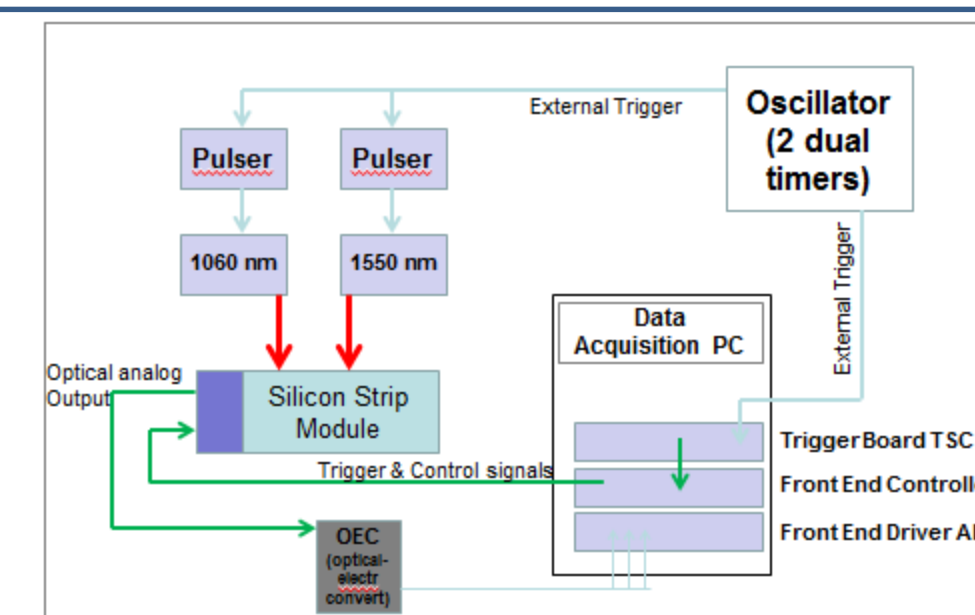
Optical Wireless Transmission System For CMS Tracker

Optical wireless transmission is proposed to connect the silicon strip modules through Giga bit connection.

- No Electromagnetic Interference (EMI) with radio systems.
- No cabling will be required.

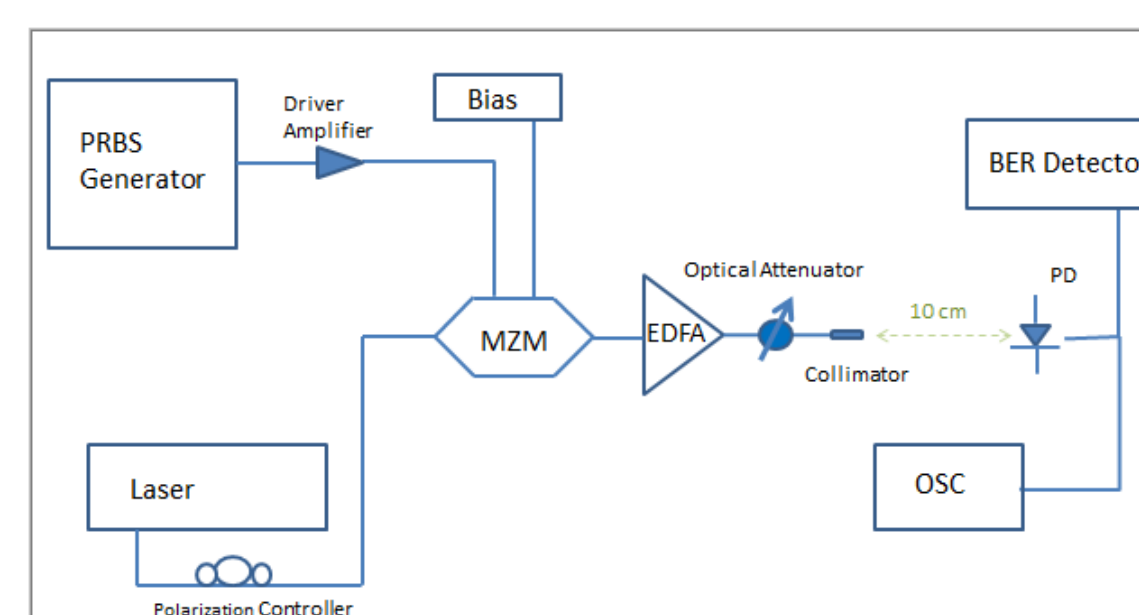


- Experiment is performed along with INFN Pisa in order to verify OWC at 1550nm
- 1550nm does not produce any trace in the acquired signal.
- Laser at 1550nm is applied in both pulse and CW format.



Laser Beam-width Analysis.

- A very narrow beam width laser is required for the OWC as the data rate is in Gbps, with Photodetector (PD) sensitivity area in tens of micro-meter square.
- Experimental activity is performed in order to study the required beam waist of the laser using four different collimators utilizing receiver of 2.5Gbps and 10Gbps equipped with ball lens.
- Approximately same tolerance values are observed for both 2.5Gbps and 10Gbps.



2.5 Gbps					
Collimator	Beam Width(mm)	Beam Width@10cm (mm)	Sensitivity (LOS) (dBm)	Max Displacement (mm)(3dB Point)(Verticle)	Max Displacement (mm)(3dB Point)(Horizontal)
CFS-2	0.38	0.89	-8.9	0.25	0.25
CFS-5	0.87	1.08	-7.7	0.25	0.25
CFS-11	2.1	2.18	-0.9	0.5	0.5
CFS-18	3.5	3.5	2.8	0.8	0.8

10 Gbps					
Collimator	Beam Width(mm)	Beam Width@10cm (mm)	Sensitivity (LOS) (dBm)	Max Displacement (mm)(3dB Point)(Verticle)	Max Displacement (mm)(3dB Point)(Horizontal)
CFS-2	0.38	0.89	-0.9	0.25	0.27
CFS-5	0.87	1.08	-0.4	0.25	0.25
CFS-11	2.1	2.18	7.9	0.5	0.5
CFS-18	3.5	3.5	9.3	0.7	0.7

Challenges.

- Radiation hardness of the optical devices are the main challenge. Lot of research has already been done on Radiation hardness for lasers and PD. Optical devices has also been deployed in CMS.
- Radiation hardened glass is a major area of concern. Due to requirement of very narrow beam width as well as very small PD area glass lens can be used.
- Commercial laser at 1550nm with very fine beam waist and divergence angle is very hard to find.