Investigation of Opto-electronic Data Transmission Methods for Experiments at the CERN Large Hadron Collider

by

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Synopsis

This thesis covers work carried out by the author on the investigation of data link technologies applicable for use in Large Hadron Collider detectors. The work has been pursued in particular for use in the readout of the ATLAS Semiconductor Central Tracker. Three technologies have been evaluated: optical analogue readout using passive modulators, optical binary readout using a custom LED and photodiode package, and electrical binary readout over shielded twisted pair cables.

In each case the performance of the links has been evaluated for use in ATLAS SCT environment. Particular requirements are placed on the links in terms of:

- data transmission quality
- reliability
- radiation tolerance
- material
- cost

Each link has advantages and disadvantages. The binary based links were chosen over the analogue link in March 1996. The choice was based on the combination of a large cost saving and more advanced technical solutions for the binary based readout. A choice for the baseline readout for the SCT was made in May 1997. The optical link was chosen over the electrical link because of its low material contribution to the Inner Detector and because of worries about electromagnetic noise radiation and pick-up in the electrical option.

The optical binary link, however, is still not a fully proven solution for the SCT readout and is an ongoing development project.