Contribution ID: **48** Type: **Oral**

Bandwidth of Micro-Twisted Cables and Spliced SIMM/GRIN Fibers and Radiation Hardness of PIN/VCSEL Arrays

Wednesday 27 September 2006 12:35 (25 minutes)

We study the feasibility of fabricating an optical link for the SLHC ATLAS silicon tracker based on the curret pixel optical link architecture. The electrical signal between the current pixel modules and the optical modules is transmitted via micro-twisted cables. The optical signal between the optical modules and the data acquisition system is transmitted via rad-hard SIMM fibers spliced to rad-tolerant GRIN fibers. The link has several nice features. We will present the result of a study of the bandwidth of the link and an irradiation of PIN/VCSEL arrays with 24 GeV protons at CERN to SLHC dosages.

Summary

The SLHC is designed to increase the luminosity of the LHC by a factor of ten to 10ˆ35 /cmˆ2/s. The optical components of the present pixel detector are mounted on patch panels (PP0) instead of directly on the pixel modules. The radiation level at the optical link location is also expected to increase by a factor of ten. After five years of operation at the SLHC, we expect a silicon component (e.g. ASIC and PIN) of the optical link to be
exposed to a maximum total fluence of 2.5 x 10ˆ15 1-MeV neq/cmˆ2. The corresponding fluence for a GaAs component (e.g. VCSEL) is 1.4 x 10ˆ16 1-MeV neq/cmˆ2.
In the present pixel detector, the electrical signal between the pixel modules and the optical modules (opto-boards) is transmitted via ˜ 1 m of micro twisted cables. The opto-boards contain optical packages with PIN and VCSEL arrays to receive and transmit optical signal. Each array in an package couples to a rather robust fiber ribbon with a removable MT connector. Each ribbon consists of 8 m of rad-hard SIMM fibers spliced to 70 m of rad-tolerant GRIN fibers.
The design of the present pixel optical links has several nice features:
• Much reduced radiation level: Since the optical components are mounted on PP0 instead of directly on the pixel modules, the radiation exposure is much reduced.
• Separation of pixel modules and opto-boards production: The separation of the opto-boards from the pixel modules decouples the production of both components and greatly simplifies their design and fabrication.
• Removable and robust fiber ribbon: An optical package on a pixel opto-board couples to a removable and robust 8-channel fiber ribbon terminated with an MT connector.
For the SLHC, we would like to take advantage of the several years of R&D that produced this design.
We currently transmit optical signals at 80 Mb/s and expect to transmit signals at ˜ 1 Gb/s at the SLHC. We have studied the feasibility of an upgrade for the silicon tracker based on the present architecture. If the present architecture can transmit signals at the higher speed, the constrain of requiring no extra service space is automatically satisfied. We will present our measurement of the bandwidth of the micro-twisted cables and the spliced SIMM to GRIN fiber ribbon. In addition, we will present the results on irradiation with 24 GeV protons at CERN to SLHC dosages for candidate PIN and VCSEL arrays from various vendors, including measurements of the single event upset (SEU) rates.

Author: GAN, Kock Kiam (The Ohio State University)

Presenter: GAN, Kock Kiam (The Ohio State University)

Session Classification: Parallel Session A4-Optical links