Contribution ID: **21** Type: **Oral**

Experiences with the ATLAS Pixel Detector Optolink and researches for future links

Tuesday 16 September 2008 15:25 (25 minutes)

The ATLAS Pixel optical link connects the readout electronic in the counting room and the active detector elements.
After installation the link has been comissioned and tuned. Tests for optical and electrical functionality of components sorted out failures on the off-detector side and had the system more than 99% functional after installation.
For optical links in future detectors in higher radiation environments thermal effects in laser-diodes become essential and have to be understood.
A research program to study thermal properties and its consequences will be discussed and is performed in the context of the Joined ATLAS/CMS activities.

Summary

The ATLAS Pixel detector package is connected with it's off-detector readout and control system via an optical link.

This optolink consists of an optoboard on-detector, containing receiving and transmitting optical and electrical components. 80m of both, radiation hard and radiation tolerant, fibre connect this optoboard with an optical interface off-detector, the Back-of-Crate card.

All optical components ran through production testing before installation into the pixel package respectively the off-detector readout crates. Before final installation, the Pixel package was fully tested and qualified. The same qualification was done after installation and showed new failures which are mostly located outside the package itself in the off-detector readout hardware.

These faulty off-detector optical components needed replacement even though previous tests passed and their failure is still under investigation. Failure modes of the optical link as well as methods to find those faulty links are to be shown.

All functional detector components are signed off with a functional optical link and were tested for data transmission. During calibration of the detector, various features of the optical link (delays, duty cycle correction) are to be tested, which are meant to increase physical performance. These are not critical for general functionality of the Pixel detector and thus were not part of the link qualification.
Methods to set up parameters of the optical link to retrieve ideal functionality are to be shown during this presentation, as is for problems during tuning and how to resolve these with a change of concepts for the future.
To step into the development of future optical links a research program to study laser diodes which serve a higher bandwidth and withstand a higher radiation environment. A measurement to determine material properties like the thermal resistance is set up.
Thermal effects become nearly as important as irradiation damages inside the material when looking at the radiation tolerance of semiconductor laser diodes.
Heat effects inside the laser diodes affect the laser output power in the same order as the irradiation itself. The better the heat can leave the diode the longer the laser can work and the more radiation can be tolerated. The thermal resistance has to be measured for the pure laser diode and also for the laser package to be able adopt mounting and the heat sink optimal.
To characterize the laser diodes foreseen for new detectors a setup to measure the output wavelength of the lasers in dependence of the junction temperature is used. With this the thermal resistance of the laser diode can be determined.
The setup has been realized for CMS tracker studies and will now be used for testing new lasers for SLHC. The CMS setup at CERN serves as basis and reference setup, while a new setup is built in Wuppertal optimizing some components. The laser characterization is done in context of the Joined ATLAS / CMS Optogroups work.

Primary authors: Prof. ZEITNITZ, Christian (University of Wuppertal); Dr LENZEN, Georg (University of Wuppertal); Mr DOPKE, Jens (University of Wuppertal); Prof. MAETTIG, Peter (University of Wuppertal); Mr SANDVOSS, Stephan (University of Wuppertal); Dr FLICK, Tobias (University of Wuppertal)

Co-authors: Dr GEMME, Claudia (INFN Genova); Dr ARGUIN, Jean-Francois (Lawrence Berkley Laboratories); Mr MOSS, Joshua James (Ohio State University); Dr MASETTI, Lucia (University of Bonn); Dr STRANDBERG, Sara Kristina (Lawrence Berkley Laboratories)

Presenter: Mr DOPKE, Jens (University of Wuppertal)

Session Classification: Parallel session B2 - Optoelectronics