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Upgrade of the BOC for the ATLAS Pixel Insert-able B-Layer

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The first upgrade for the ATLAS pixel detector will be an additional layer, which is called IBL (Insert-able B-Layer). To readout this new layer having new electronics assembled an update of the readout electronics is necessary. The aim is to develop a system which is capable to read out at a higher bandwidth and also compatible with the existing system to be integrated into it. The talk will describe the necessary development to reach a new readout system, concentrating on the requirements of a newly designed Back of Crate card as the optical interface in the counting room.

Summary

The innermost layer of the ATLAS Pixel detector, the B-Layer, will suffer a lot of irradiation damage and therefore will not be operational for the full lifetime of 10 years of ATLAS. To provide a good tracking performance over the full lifetime a replacement or an addition of a pixel tracking layer is to be done. Since the shutdown time for such an operation is rather short, the only possible solution of this is to insert a new additional layer in the phase 1 upgrade pause, around 2013/2014. This additional layer, called IBL (Insert-able B-Layer), will include newly designed on-detector electronics to cover the higher radiation and occupancy. It needs to be read out using an adopted or renewed readout system, which is under development.

Since the distance to the interaction point is reduced the occupancy of the FE chips is higher and the readout bandwidth needs to be adapted to that. A change in the pixel size is reducing this effect so that an increase in readout bandwidth by a factor 2 is sufficient.

The adaption of the readout bandwidth must be done on off-detector side within the Back of Crate card (BOC). Therefore, the Back of Crate card needs a redesign of the data receiving part. It will be the off-detector end of the optical link, which transmits data in both directions. From the BOC card the command and control data is sent to the optoboard (the opto-electrical interface inside the detector volume) and from there electrically to the modules. Vice versa, the modules data is sent electrically to the optoboard and from there optically to the BOC card. While the transmission to the detector will be operated at 40 Mb/s, the readout from the detector will be done at 160 Mb/s bandwidth.

This higher readout speed has several implications, which need to be fulfilled like getting the correct clocks to the different parts of the detector. Also under investigation is a DC balanced signal to transmit the data from the detector. This would enable an automated phase adjustment of the detector data to the readout system clocks.

Under the baseline to be compatible with the remaining parts of the readout system an R&D project is started to study the opportunities of these new BOC card. The constrains and requirements for this card are discussed as well as first results of this investigation.

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