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The IBL Readout System

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With higher instantaneous luminosity, the present Pixel detector system will run into readout inefficiencies. To compensate for those and yet provide good impact parameter resolution with an upgraded LHC, a Layer designed for reading out higher occupancies is to be inserted into Pixel during the Phase1 Upgrade of ATLAS. This additional layer, called IBL (Insertable B-Layer), will include newly designed on-detector electronics to cover the higher radiation and occupancy. It needs to be read out using a 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 a balanced signal transmission will be set up for that data link to reduce calibration effort and stabilize the system. It will enable an automated phase adjustment of the detector data to the readout system clocks. Using VME as the form factor helps staying as compatible as reasonably possible to the former Pixel system and eventually allows for upgrading the Pixel Layer 2 readout system to run at 80 MBit/s with few exchange effort.

Summary

The first upgrade for the ATLAS pixel detector will be an additional layer, which is called IBL (Insertable 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.

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