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Data acquisition systems for future calorimetry at the International Linear Collider

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A data acquisition system is described which will be used for the next generation of prototype calorimeters for the ILC. The design is sufficiently generic such that it should have applications elsewhere, be they other ILC detectors or elsewhere within physics. An under-pinning thread is the use of commercial components. Therefore the system should be easily upgradeable, both in terms of ease
of acquiring new components and competitive prices. Results and tests already done will then be shown indicating the potential of the approach. The status of the system to read out prototypes in 2009 will be discussed.

Summary

Within the CALICE collaboration, which is designing a calorimeter for the International Linear collider (ILC), a collection of UK groups (CALICE-UK) are part of the effort to prototype a highly-granular calorimeter composed of silicon and tungsten. The CALICE-UK groups have designed an R&D
programme for the design of the data acquisition (DAQ) system for a future calorimeter. In the work, DAQ equipment will be developed which attacks likely bottlenecks in the future system and is also sufficiently generic to provide the readout for new prototype calorimeters, such as the prototype
to be built in the EUDET project. The principle of a generic design using commercial components should be applicable to many detector sub-systems. Therefore, the R\&D to be performed here may have consequences or applications for DAQ systems in high energy physics in general.

Although of a generic nature, the final ILC calorimeter acts as a test-case for the DAQ system under development. Data will be transported off the detector via a "Layer-1" switch which can re-route data should the off-detector data receiver not be available due to a fault or busy signal. These switches are cutting edge technology being used in the telecommunications industry and could improve the efficiency of data taking in high energy physics experiments. Further details of the overall system will be discussed, both for data coming off and being sent off the detector.

The PCs which act as the off-detector receiver contain PCI cards, which are again all based on commercial, off-the-shelf technology. The PCI card acquired has been developed and built by the company PLD applications. This contains optical and electrical links with a large FPGA and PCI-Express bus. The PCI card will act as a data receiver and also source for the clock, control and
configuration data. This card will allow high data rates to be received off the detector which can then be used by detectors which require this or aggregate large amounts of data and thereby require less hardware. Results on the performance of the PCI card, optical switch and data transfer rates and efficiency will be discussed.

The actual system, based on the generic design, being built within the EUDET framework for the CALICE technological prototypes will be detailed and specifics of hardware and software given. Its status and readiness to read out prototypes in 2009 will be discussed.

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