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CBM First-level Event Selector Input Interface Development

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CBM is a heavy-ion experiment at the future FAIR facility in Darmstadt, Germany. Featuring self-triggered front-end electronics and free-streaming read-out event selection will exclusively be done by the First Level Event Selector (FLES). Designed as an HPC cluster, its task is an online analysis and selection of the physics data at a total input data rate exceeding 1 TByte/s. To allow efficient event selection, the FLES performs timeslice building, which combines the data from all given input links to self-contained, overlapping processing intervals and distributes them to compute nodes. Partitioning the input data streams into specialized containers allows this task to be performed very efficiently.

The FLES Input Interface defines the linkage between the FEE and the FLES data transport framework. A custom FPGA PCIe board, the FLES Interface Board (FLIB), is used to receive data via optical links and transfer them via DMA to the host's memory. The current prototype of the FLIB features a Kintex-7 FPGA and provides up to eight 10 GBit/s optical links. A custom FPGA design has been developed for this board. DMA transfers and data structures are optimized for subsequent timeslice building. Index tables generated by the FPGA enable fast random access to the written data containers. In addition the DMA target buffers can directly serve as InfiniBand RDMA source buffers without copying the data. The usage of POSIX shared memory for these buffers allows data access from multiple processes. An accompanying HDL module has been developed to integrate the FLES link into the front-end FPGA designs. It implements the front-end logic interface as well as the link protocol.

Prototypes of all Input Interface components have been implemented and integrated into the FLES test framework. This allows the implementation and evaluation of the foreseen CBM read-out chain. The full chain from FEE up to timeslices has been tested successfully. Setups with 16 and more free-streaming input links will be used for upcoming beam tests. An overview of the FLES Input Interface as well as latest results from performance and stability measurements will be presented.

Tertiary Keyword (Optional)

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