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A concept of long buffer readout system for large-area gamma-ray facilities

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One of the constrains for the instruments with large number of readout channels is the cost of a complex data acquisition (DAQ) system. We suggest here the novel approach - the Long Buffer ReadOut System (LiBROS).

The LiBROS comprises the trigger, based on Field-Programmable-Gate-Array (FPGA) and the readout system based on Flash Analog-To-Digital Converters (FADCs). The readout channel analog signal is split in two branches: the trigger branch and the data branch. The trigger branch is fed to discriminators which produce time-over-threshold (TOT) logic signals. We suggest to digitize these signals with only 1-bit resolution but high rate of 1 GHz, directly inside the FPGA, exploiting the Serializer/Deserializer (SerDes) feature. In this manner, the start and the stop time of the TOT signal is tagged that estimates the arrival time of the initial signal with precision better then 1˜ns. Having the time reconstructed by the trigger system the data branch can have a limited bandwidth and, therefore, reduced FADC sampling rate. This suppressed FADC datastream is piped directly to the FPGA memory in serial mode, using only one datastream per FPGA input pin. This allows one FPGA chip to serve large number of readout channels that simplifies the design and reduces costs by the factor of at least 4, compared to the current DAQ approaches used in Imaging Atmospheric Cherenkov Telescopes.

Moreover, due to the large FPGA memory and suppressed data volumes, the suggested DAQ approach will possess the extremely long data buffer of$>$50 μs. This allows to design the simple central trigger system for arrays covering more than a several km^2. The high integrity, low cost and simplicity of the concept offers it for any air-Cherenkov facility with a large number of readout channels

Collaboration

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