Development of the signal readout and processing ASIC for GEM detectors

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Design approach and structure of an Application-Specific Integrated Circuit (ASIC) for multichannel Gas Electron Multiplier (GEM) detectors are presented. This ASIC is designed for use in tracking and calorimetric systems of large physical experiments such as CBM (FAIR, Darmstadt) and MPD (NICA, Dubna). The amount of data to be processed by ASIC is related to the channel event rate, ADC resolution, and sampling rate. For the CBM experiment the average event rate is 1 MHz, with 10-bit ADC resolution and 200 ns peaking time. That results in about 100 Mbit/s of generated raw data for each channel. Modern ASICs usually contain at least 32 readout channels, therefore the output data rate for each of them is not less than 3.2 Gbit/s. The ASIC contains a digital data processing block, which particularly calculates a signal peak amplitude, event timestamp and also determines signal shape and pile-ups. The block allows transmitting values of interest only, significantly reducing the output data flow, and using a less complex interface circuit at lower power consumption.

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