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SiPM readout chip design for Heavy-ion Physics

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Duo to the small size, high gain, high time resolution, low operating voltage, and insensitivity to magnetic fields of the SiPM, the research of SiPM as the sensor of the calorimeter has attracted a lot of attention. This work has designed 8-channel readout chips SICC0 and SICC1, which can simultaneously record the hit time and the energy information of particles. Each channel uses the traditional readout structure, including two readout path, one path uses a counter-type TDC to record the arrival time and the other path uses front-end and ADC to save the energy information, three different gear selections are used for the energy detect to cover a large dynamic input range. The test results show the performance of the SICC0 is as expected. The linearity input range is from 10uA to 3mA, and the time resolution is less than 1LSB (25ns) which can be up to 5ns, the dynamic range is 25ns-6.375us. To improve the time resolution, a new two-step TDC is designed on chip SICC1. The post simulation results shows that the time resolution of the new TDC is 140ps, the dynamic range is 640ns, and the RMS is about 3ps. SICC1 chip is still under testing now.

Primary authors: Mr XIONG, Binqiang (Central China Normal University); YANG, Ping; Prof. HUANG, Guangming (Central China Normal University); Prof. PEI, Hua (Central China Normal University); Ms WANG, Xiao (Central China Normal University); Mr DENG, Yunqi (Central China Normal University); Mr YUE, Zhuang (Central China Normal University)

Presenter: Mr XIONG, Binqiang (Central China Normal University)

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