11th International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors(HSTD11)

In conjunction with 2nd Work shop on SOI pixel Detectors (SOIPIX2017) at OIST, Okinawa, Japan

A Simulation System for Signal Readout of CMOS Pixel **Sensors in High Energy Physics experiments**

Xiaomin WEI, Bo Li, Yingjie HE, Wei NIU, Ran ZHENG, Jia WANG, Tingcun WEI, Yongcai HU

School of Computer Science and Engineering, Northwestern Polytechnical University, 710072 Xi'an, P.R. China

weixm@nwpu.edu.cn

Signal Readout of CMOS Pixel Sensors

In order to achieve extreme high readout speed and low power consumption, many researches are focused on data sparsification and data compression during the signal readout.

Mimosa: Rolling shutter readout [1]



ALPIDE: Priority Address Encoder and Reset

Decoder data-driven readout [2]



Orthopix: Four direction projection readout [3]





Classical Readout:

- •Data compressed after readout
- Readout performances depends on the size of pixel array.

- Signal compressed during readout
- Signal readout related with the hit number and distribution



A simulation system with proper input particle images will be helpful for high speed and low power readout system design.

Simulation System



matrix of 1024 ×1024 with cluster size of 4.

Orthopix readout simulation: efficiency versus hit per frame with different pixels and cluster sizes

Reference

[1] A. Himmi, G.Doziere, O. Torheim, C.Hu-Guo, M.Winter, "Zero Suppression Micro-Circuit for Binary Readout CMOS Monolithic Sensors," presented at the TWEEP, Paris, 2009. [2] P. Yang, G. Aglieri, C. Cavicchioli, et al, "Low-power priority Address-Encoder and Reset-Decoder data-driven readout for Monolithic Active Pixel Sensors for tracker system," Nucl. Instrum. Methods Phys. Res., Sect. A, vol. 785, pp. 61-69, 2015.

[3] P. Giubilato, C. Cavicchioli, P. Chalmet et. al, "Low power, high resolution MAPS for particle t racking and imaging," Journal of Instrumentation, vol. 10, pp. 1-10, 2015.