Mulit-element Amplifier Readout System for Silicon Drift Detectors

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Silicon diode and Silicon drift detectors (SDDs) have widespread applications in astrophysics, high energy physics, crystallography and medical imaging. Maia, a scanning x-ray fluorescence microprobe was designed with a multi-element photodiode sensor with 384 pixels and two application specific integrated circuits (ASICs) [1,2,3]. The detector was wire-bonded to a front-end ASIC which provided low noise charge pre-amplification and shaping. The output of the shaper was wire-bonded to a precision peak and time detector ASIC with arbitration logic and analog memory.

We present a new Multi-element Amplifier Readout System (MARS) ASIC that has been designed and fabricated in 250 nm CMOS to replace the ASICs currently used in the Maia x-ray microprobe system. The (MARS) ASIC instruments electrons or holes and combines the functions of the two chips currently used for Maia while significantly reducing the physical footprint, the electronic noise, and the power dissipation. The ASIC dissipates 127 mW and combines 32 channels. Each channel is comprised of low noise charge amplification, high order shaping with baseline stabilization, discrimination, pileup rejection, and peak and time detection with analog memory. The readout is sparse with the channel address. Any channel with a processed above threshold event can be read out independent of the other processing channels. The interface is analog differential and digital LVDS. Preliminary measurements for a 96-element silicon detector array will be presented.

References

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