Contribution ID: **104** Type: **Oral Presentation**

The Nupix-A1, a MAPS for real-time beam monitoring in heavy-ion physics experiments

Friday 5 August 2022 13:40 (20 minutes)

Due to excellent spatial resolution, fast timing response, and low material budget, the Monolithic Active Pixel Sensor (MAPS) has become one of the most advanced technologies for particle measurement. To perform real-time beam monitoring in heavy-ion physics experiments, a MAPS named Nupix-A1 has been designed. This Nupix-A1 can simultaneously measure the particle hit's position, energy, and arrival time.

The Nupix-A1 consists of 128 x 64 pixels with a pitch of 30μm, thirty-two 12-bit column-parallel ADCs, the DAC array with an I2C interface, and the 5Gbps data transmission link. Each pixel has an energy path and time path. The energy path can measure up to ~145ke- and the Integral Non-linearity (INL) is better than ~1%. The measurement range of the time path can be tuned from 3μs to 275μs. At the typical range of ~7.5μs, the maximum INL is ~1.3%. The noise level is ~8e-. The DAC array can be configured with the I2C interface to tune the bias of the in-pixel circuit. Each column-parallel ADC converts the analog signal from the pixels in two adjacent columns into a digital signal at 3.63MSps with the ENOB of 11.61bits. The digital data is serialized and transmitted with the 5Gbps transmission link, consisting of a 16b/20b encoder, a 20:1 serializer, a Feed Forward Equalization (FFE) driver, and a high-speed receiver to deal with the external clock. This paper will discuss the design and performance of this Nupix-A1.

Minioral

Yes

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Yes

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Session Classification: Front End Electronics and Fast Digitizers

Track Classification: Front End Electronics and Fast Digitizers