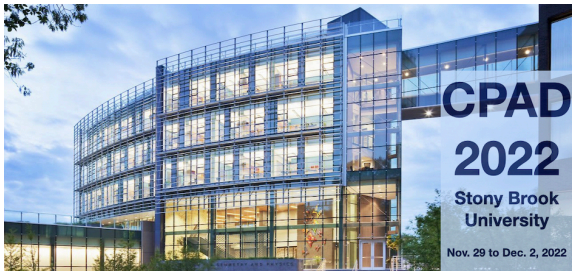

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LArPix and LightPix: highly-scalable, cryogenic readout electronics

Thursday, 1 December 2022 11:55 (20 minutes)

3D ionization information facilitates unambiguous mm-scale fine-tracking in high occupancy liquid argon time-projection chamber (LArTPC) environments. LArPix-v2 incorporates low-power 64-channel custom ASICs with a mixed-signal large-format printed circuit board for an unambiguous 3D charge-readout anode. With robust I/O and control architecture, a 10-by-10 array of ASICs instrument a 6,400-pixel PCB-based anode. The system is compatible with standard large-scale commercial electronics production techniques, enabling low-cost quick-turn production. Here I present a system design overview alongside LArPix-v2 ASIC and pixel anode tile benchmark performance evaluation. This system will be deployed in upcoming ProtoDUNE-ND LArTPC physics operation.

The development of scalable cryogenic-compatible electronics capable of reading out very large numbers of silicon photomultipliers (SiPMs) would enhance current and future neutrino and dark matter experiments. The prototype LightPix system is an attempt to meet this need, and is based on slight adaptation of the LArPix system that has been proven in liquid argon time-projection chambers at the 100,000-channel scale. The first-generation LightPix ASIC reuses most of the LArPix design, adding a low-power TDC with sub-nanosecond resolution. Additionally, LightPix-v1 features multi-channel coincidence triggering modes to suppress excess data from SiPM dark noise. Here we present an initial performance evaluation of the LightPix-v1 ASIC.

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