Karlsruhe Institute of Technology

HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

Measurement results on Capacitively Coupled Particle Detector with 25µm * 50µm pixel size and 50µm Pad Pitch

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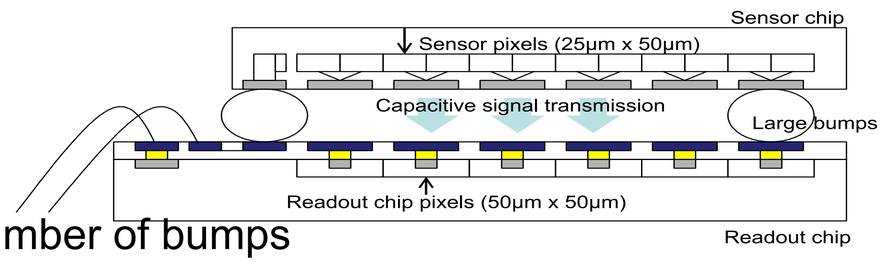
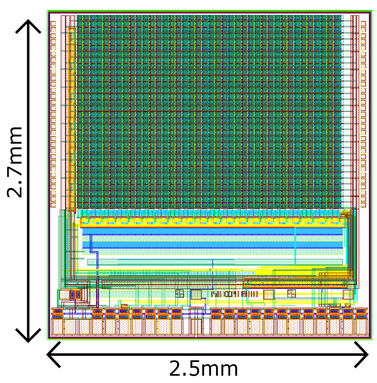
CCPD concept

- A type of hybrid detector
- Sensor chip Application: inner layer of ATLAS pixel detector
- The sensor chip and readout chip are connected by several small number of bumps
- The signals from sensor chip have large amplitude and they are transmitted over the gap via capacitive coupling



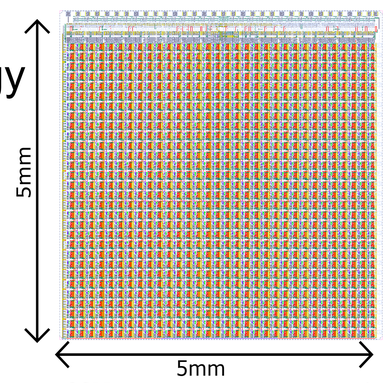
CCPD sensor chip

- AMS 180nm HVCMOS Technology
- Pixel size: 25µm * 50µm
- Pixel numbers: 64 * 60
- Chip size: 2.5mm * 2.7mm
- Pad size: 50µm * 50µm



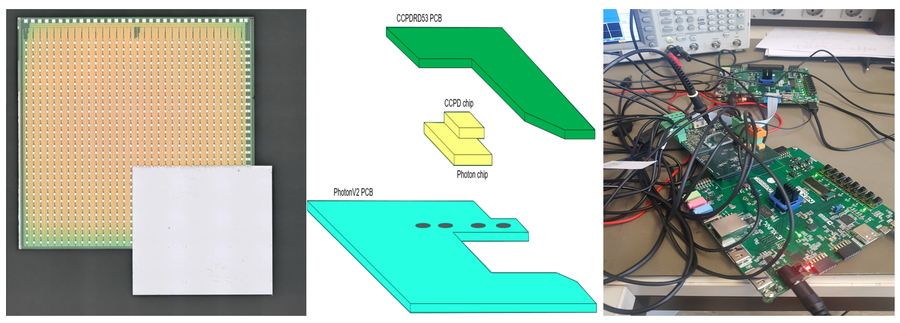
PHOTON readout chip

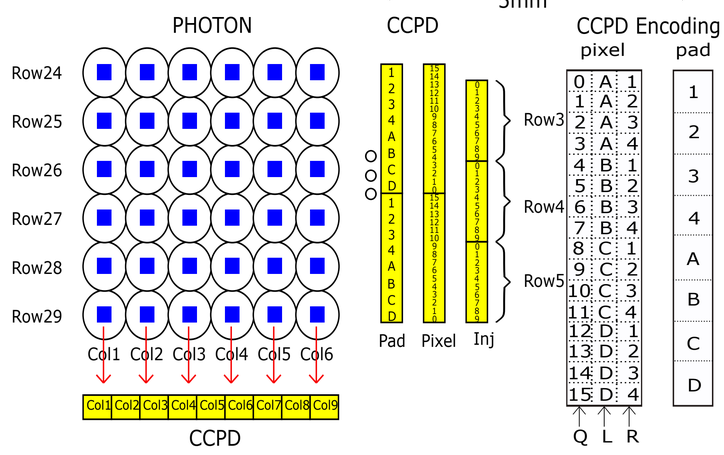
- UMC 180nm HVCMOS Technology
- Readout size: 120µm * 120µm
- Readout numbers: 32 * 30
- Chip size: 5mm * 5mm
- Pad size: 150µm * 150µm



Connection and Encoding of Sensor Chip and Readout Chip

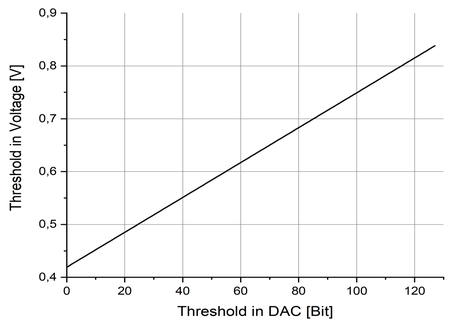
The two chips are flipped together and then connected to respective FPGA board. In sensor chip, each pixels has two outputs and 16 pixels are connected to 8 pads.

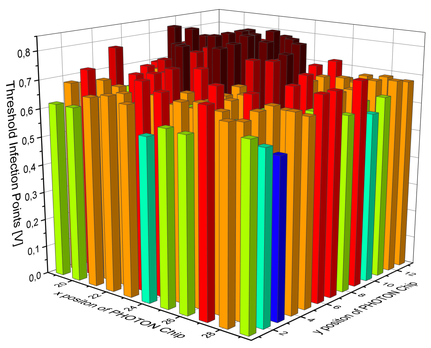


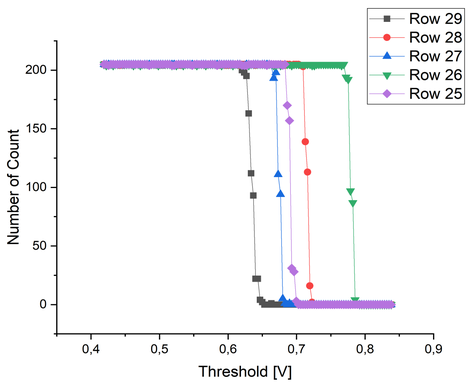


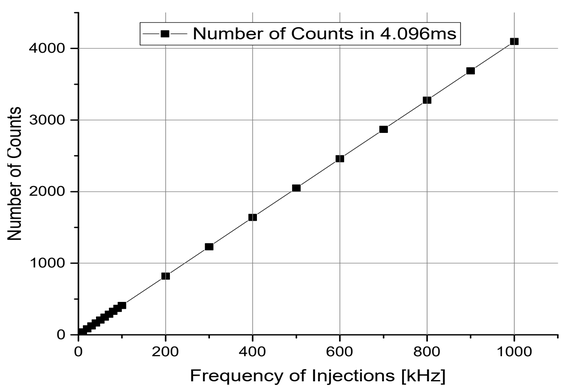
Threshold Scan Measurement

Due to production imperfections, the signal strength can vary. The threshold of each pixel is measured by efficiency S-curves. The spread of thresholdas is about 0.25mV.



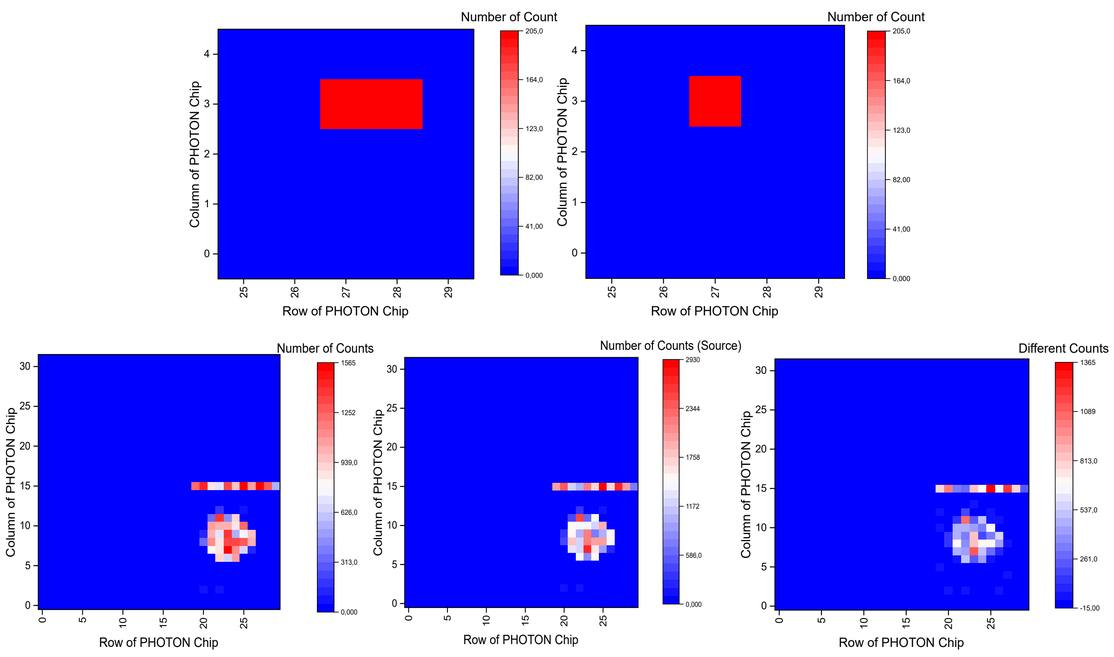






Pixel Position Measurement

The pad of the sensor chip is 3 times smaller. Some pixels could be detected by two readout cells.



Source Measurement

The whole system is also tested with Fe55 source, around 6000e. The number of counts is much more than the result only with injection board after 12 hours.

Counting Function Measurement

A charge signal about 6000e has been injected into sensor chip of different frequency from 10kHz to 1MHz and to readout the count of PHOTON chip. The counting time is about 4ms for each measurement.

Conclusion

- We have developed a new CCPD sensor chip with very small pixel size.
- Readout with PHOTON chip has been measurement with injection board and Fe55 source.