Karlsruhe Institute of Technology

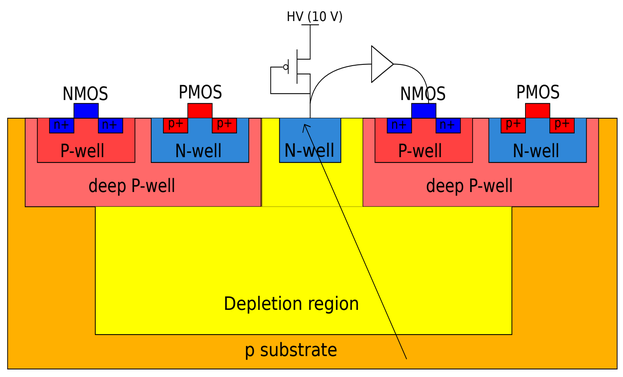
HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

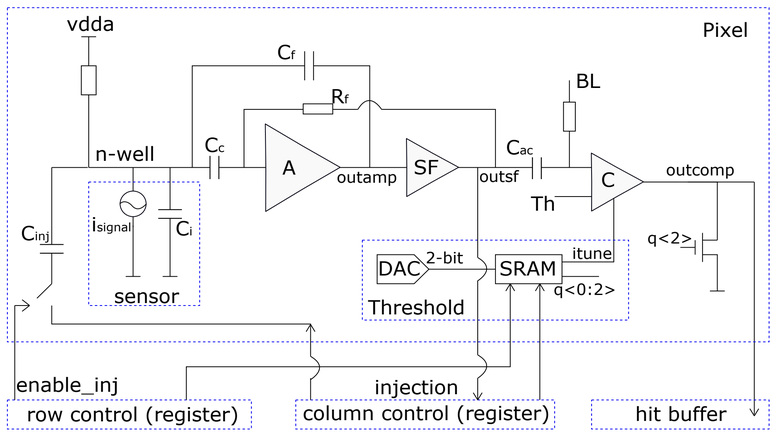
Monolithic pixel sensor with 25µm * 35µm pixel size and high time resolution implemented in 180nm technology

Hui Zhang, Ivan Peric (Karlsruhe Insitute for Technology, Germany)

HVMAPS25 ASIC Desig and Implementation

- Technology: 180nm HVCMOS technology of on 2000 ohmcm substrate
- Application: as a Vertex Detector for some future experiments such as CLIC and CEPC
- Pixel Size: 25µm * 35µm
- Charge Collection Electrode: 2µm * 4µm
- The analog and digital parts are placed inside the pixel
- The deep P-well is used to isolate the pixel electronics from the sensor substrate
- The signal charge collection electrode is embeded in the high resistivity p-type substrate
- The n-wells are AC-coupled to the amplifiers and it could be biased with 10V with respect to the p substrate



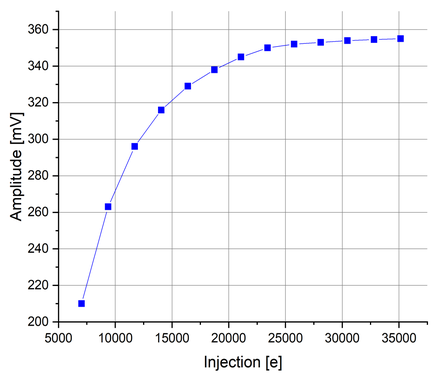


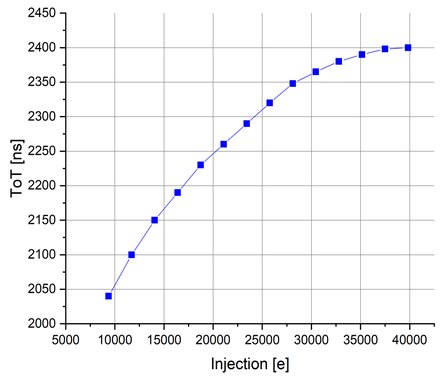
Measurement results

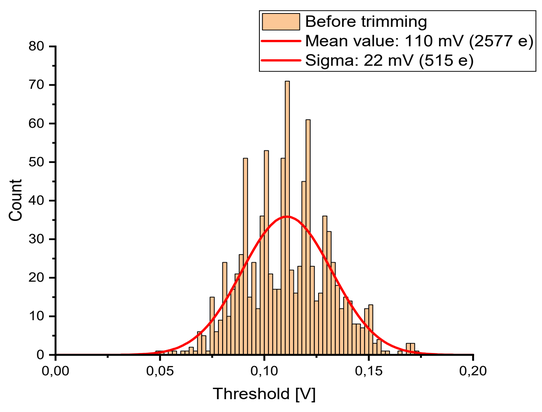
This part describes some measurement results of the HVMAPS25 chip. They include: measurements of the amplitude and pulse width, threshold scans and trimming and Fe55 radioactive source measurements.

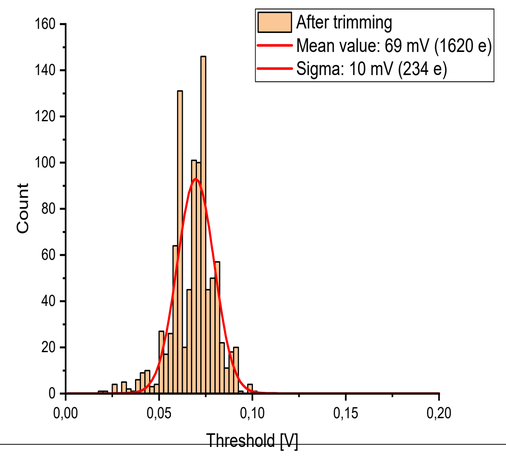
Threshold Scan Measurement

The threshold dispersion is caused mainly by the gain mismatch of the CSA and the mismatch between the threshold of the input transistors of the discriminator. The threshold dispersion can be alleviated using the threshold tune DACs. Two bit DACs can be used to adjust the threshold of each comparator. The local threshold is the sum of the externally set threshold and the DAC value.



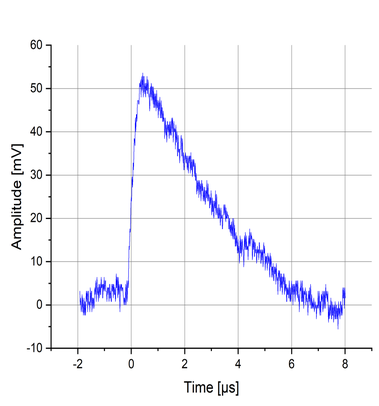


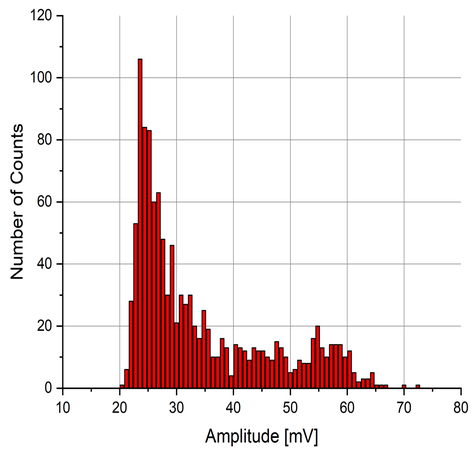




Measurement wit injection circuit

The amplitude and pulse width change versus different injection values.





Measurement with Fe55 radioactive source

The whole system is also tested with Fe55 source, around 6000e. The maximum value of the amplifier output has been histogrammed. The average signal is 55 mV. The same value could be achieved of 0.07 V injection.

Conclusion

- Hit arrival time measurement with 10 bit resolution
- Amplitude measurement (ToT) with 6 bit resolution
- Time resolution < 10ns
- Current consumption < 1µm per pixel amplifier