

Detection of X-ray spectra and images

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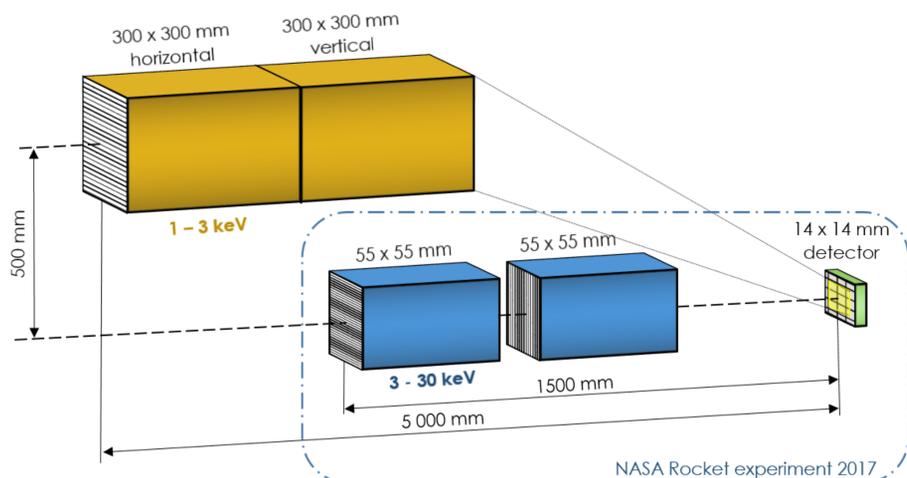
Introduction

X-ray monitoring for astrophysical applications mainly consists of two parts - optics and detector. The poster shows an approach based on a combination of Lobster Eye (LE) optics with Timepix detector. This arrangement with two 2D LE optics designed for the energy range 1–3 keV and 3–30 keV allows to detect multiple X-ray sources and to measure their spectra.

Construction

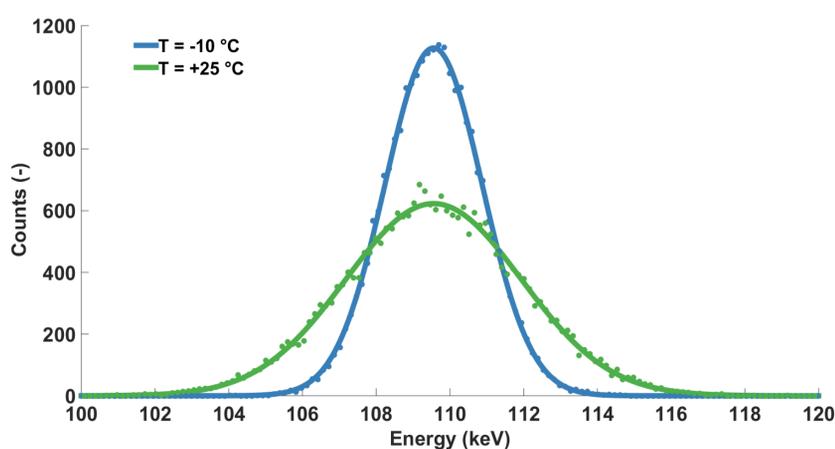
Timepix, a pixel detector, enables to take an X-ray picture and evaluates the energy spectrum at the same time. The side 1D LE focus together with the right code mask and postprocessing can be determined the number and direction of X-ray sources.

The Timepix is a hybrid pixel detector with 256 x 256 pixels with a pitch of 55 μm , therefore the detection area has a little more than 14 square millimetres. Without any upgrades, it has approx. 3 keV threshold. One of the upgrades can be a usage of a back-side-pulse and thermal stabilisation, for example.



Thermal stabilisation

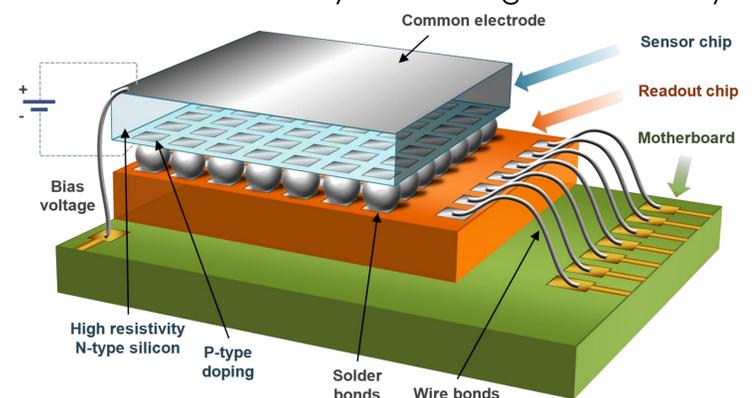
One of the possibilities for an improvement of the Full Width at Half Maximum is thermal stabilisation or cooling. Originally is the TIMEPIX detector uncooled and temperature unstabilised as well. This method of measurement can cause inaccuracies because the noise characteristics of the detector vary with its temperature. Cooling the detector or at least its thermal stabilising should improve these parameters.



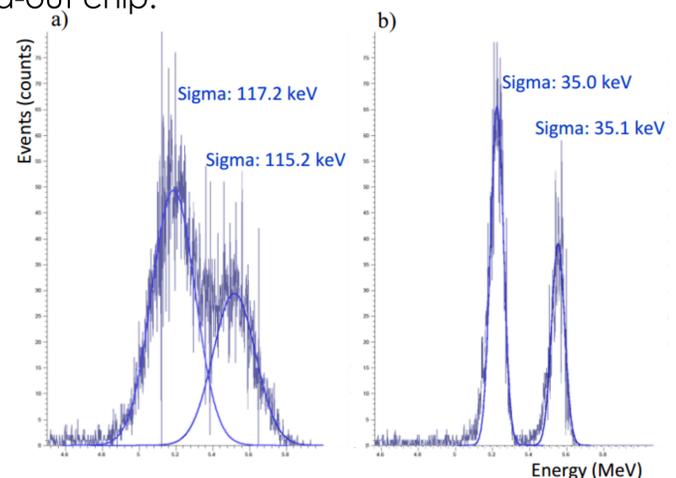
Common electrode of pixelated detector

The undesirable background radiation and noise usually overlay signal of interest. This effect can be minimised by triggering. Used Medipix/Timepix is not equipped with this function and therefore an additional external trigger is often used.

Using of common electrode brings the possibility to use the same detector. Back-side-pulse, an analogue pulse from the common electrode, is amplified by charge sensitive amplifier and detected. Only bias voltage is necessary.



Back-side-pulse can be used as fast self-trigger and as a spectroscopic signal from the whole detector (one pixel). This feature brings the possibilities of self-triggering with minimum energy and evaluates basic spectra without noise from read-out chip.



Spectra of a combination Am (5.49 MeV) and Pu (5.16 MeV) from the common electrode in two modes: a) Timepix read-out connected, b) Timepix without power.

References

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PLATKEVIC, Michal. *Signal Processing and Data Read-Out from Position Sensitive Pixel Detectors*. Prague, 2014. Ph.D. Thesis. Institute of Experimental and Applied Physics, Czech Technical University in Prague.



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