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Equalization of Medipix2 imaging detector energy thresholds using measurement of polychromatic X-ray beam attenuation

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The single photon counting pixel detector Medipix2 is a powerful tool for energy resolved X-ray imaging. It allows discriminating energy of incoming X-rays by setting an energy threshold common to all pixels. As parameters of individual pixels vary, each pixel further contains a 3-bit digital-to-analogue converter (DAC) adjustment. Values of these DACs are traditionally determined by finding the noise floor in each pixel.

Our approach is based on a polychromatic X-ray beam attenuation measurement.

An attenuation curve is measured using varying thickness of aluminium foil. The attenuation curve is fitted in each pixel with a function calculating the detected signal. Free parameters of the fit are the beam intensity and the energy threshold. The measurement is done twice, with the threshold adjustment set to minimum resp. maximum value in all pixels. The result is a calibration of the adjustment DACs, allowing finding the value of the adjustment DAC in each pixel such that the dispersion of energy thresholds between pixels is minimized.

It is a fast and simple to use method that does not require modification of the imaging setup. It will be shown that it reduces the dispersion of threshold values by up to 40% compared to the noise-floor based technique of equalization.

Primary author: Dr UHER, Josef (CSIRO PSE)

Co-author: Dr JAKUBEK, Jan (IEAP-CTU)

Presenter: Dr UHER, Josef (CSIRO PSE)

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