Contribution ID: **81** Type: **Poster**

Improving spatial resolution by predicting the initial position of charge sharing effect in photon counting detectors

Wednesday 10 July 2019 15:55 (2 minutes)

X-ray Photon counting detectors are known as next generation x-ray detectors because they have advantages over general energy-integrating detectors. Since X-ray photons are counted, energy information can be obtained. In addition, because of the direct measurement without scintillation, the contrast-to-noise ratio is higher than the general charge integration detector. The photon counting detector measures the electrons generated by the photon incident in the CdTe / CdZnTe. When an incident X-ray photon interacts with an atom of the detector material, a photoelectron or a Compton scattered electron is created as a primary process. The electrons generated by this primary process affect the other pixels due to the phenomenon of spreading in the process of moving to the anode. Also a characteristic x-ray generated by a photoelectric effect forms an electron cloud at another pixel. Due to these two phenomena, distortion occurs in the position information and the energy information. In this work, we use the time-over-threshold (ToT) and projection method to compensate the position information of the pixel sharing charge sharing. We project the charge sharing value of 8 neighboring pixels to the middle pixel, and find the point where the photon has the highest probability of entering the middle pixel. We divided the middle pixel into 3x3 sections and found the location where the x-ray photon was first incident through the projection. Using a timepix chip with CdTe pixels, 50,000 images were acquired for 1.5 seconds at intervals of 30 us with the ToT method. At this time, x-rays were irradiated to various materials at 80 kVp and 5 uA.

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Session Classification: Poster Exhibition 2, Posters ID 81 - 182, chair: Christer Frojdh

Track Classification: general