Contribution ID: **217** Type: **Oral presentation**

Multi-bin energy-sensitive Micro-CT using large area photon-counting detectors Timepix

Tuesday 29 June 2021 14:10 (20 minutes)

Jan Dudak1,*, Jan Zemlicka1

1 Institute of Experimental and Applied Physics, Czech Technical University in Prague, Husova 240/5, 110 00 Prague, Czech Republic

*Corresponding author: jan.dudak@cvut.cz

X-ray micro-CT has become a popular widely used tool for purposes of scientific research. Although the current state-of-the-art micro-CT technology is on a high technology level it still has some known limitations. One of relevant issues is an inability to clearly identify and quantify certain materials [1].
The mentioned drawback can be solved by energy-sensitive CT approaches. The dual-energy CT (DECT), which is already frequently used in human medicine, offers identification of two different materials –i. e. to differentiate an intravenous contrast agent from bones or to analyze composition of urinary stones [2].
Resolving of a higher number of constituents within a single object requires also a higher number of energy measurements and, therefore, DECT is not applicable for such measurement. A possible solution for multi-bin –or so-called spectral-CT –is the application of technology of photon-counting detectors (PCD). PCD technology is equipped with an integrated circuitry capable of resolving the energy of incoming photons in each pixel. Therefore, it is possible to collect data in user-defined energy widows [3].
This contribution evaluates the applicability of large-area photon-counting detectors Timepix for multi-bin energy-sensitive micro-CT [4]. It presents a phantom-study focused on simultaneous K-edge-based identification and quantification of multiple contrast agents within a single object. It is based on a set of simulations searching for optimal settings of the energy bins considering their mean energy, width and achievable signal-to-noise ratio. The experimental part of the contribution presents a series of multi-bin energy-sensitive micro-CT scans of a phantom object and results of its material decomposition carried-out using an in-house implemented decomposition algorithm.

[1] M. Willemink et al: “Photon-counting CT: Technical Principles and Clinical Prospects”, Radiology, vol. 289, no. 2, pp. 293-312, 2018.
[2] A. C. Silva et al: “Dual-Energy (Spectral)” CT: Applications in Abdominal-Imaging”, Radiographics, vol 31, pp. 1031-1046, 2011.
[3] C. McCollough et al: “Dual- and Multi-Energy CT: Principles, Technical Approaches, and Clinical Applications”, Radiology, vol. 276, no. 3, pp. 637-653, 2015.
[4] J. Jakubek et al: “Large area pixel detector WIDEPIX with full area sensitivity composed of 100 Timepix assemblies with edgeless sensors”, Journal of Instrumentation, vol. 9, no. 04, pp. C04018, 2014.

The work was done in the frame of Medipix Collaboration and was financially supported from European Regional Development Fund-Project “Engineering applications of microworld physics” (No. CZ.02.1.01/0.0/0.0/16_019/0000766).

Author: Mr DUDAK, Jan (Institute of Experimental and Applied Physics, Czech Technical University in Prague)

Co-author: Dr ZEMLICKA, Jan (Institute of Experimental and Applied Physics, Czech Technical University in Prague)

Presenter: Mr DUDAK, Jan (Institute of Experimental and Applied Physics, Czech Technical University in Prague)

Session Classification: Oral presentations

Track Classification: Applications