



Contribution ID: 141

Type: **not specified**

Capillary Collimated XRF-imaging with Timepix 3

Tuesday 9 July 2019 13:55 (15 minutes)

X-ray fluorescence (XRF) imaging have been published addressing the non-destructive investigation of the elemental distribution in heterogeneous media in many microscopy imaging applications, especially when the separation of different elements are crucial. Usually, single pad detectors of high spectroscopic quality are used for the precise elemental analysis. By scanning the sample surface with a focused X-ray beam, information about the spatial distribution of a given element in the sample can be obtained [1]. However, this scanning process is tedious and time-consuming. One single shot setups based on a pinhole camera configuration has been proven successful for some applications, as shown in Fig. 1 (Left) [2]. In this work, a single shot setup based on a capillary collimator instead of a pinhole collimator is evaluated.

In this paper, we determine the suitability of the Timepix 3, a hybrid pixel readout chip, for one single shot XRF imaging. In order to acquire an XRF image of the sample in one single shot, a detector capillary collimator is required in front of the detector. The setup consists of an X-ray tube with silver cathode, a capillary collimator made of 1 mm thick lead glass with 10 μm pinholes and a USB 3.0 readout system for Timepix3 detectors [3], as shown in Fig.1 (Right). If imaging lead (Pb), X-ray fluorescence signals from the Pb (L-line 10.55 keV and 12.61 keV) in the coating of the sample will pass through the monolithic capillary channels and a material resolving image is achieved. With a precise per pixel calibration, this technique allows to obtain the spatial distribution of a specific element. One shot XRF imaging could be achieved using a high pitch energy resolving imaging system with a capillary collimator.

Fig.1 Pinhole camera setup (Left) and capillary collimated setup (Right) for X-ray fluorescence imaging.

REFERENCES

- [1] Norlin, B., Reza, S., Fröjd, C. & Nordin, T. (2018). Precision scan-imaging for paperboard quality inspection utilizing X-ray fluorescence. *Journal of Instrumentation*, vol. 13: 1
- [2] Žemlička, J., Jakůbek, J., Kroupa, M., & Tichý, V. (2009). Energy- and position-sensitive pixel detector Timepix for X-ray fluorescence imaging. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 607(1), 202-204.
- [3] Dreier, T., Krapohl, D., Maneuski, D., Lawal, N., Schöwerling, J. O., O'Shea, V., & Fröjd, C. (2018). A USB 3.0 readout system for Timepix3 detectors with on-board processing capabilities. *Journal of Instrumentation*, 13(11), C11017.

Author: AN, Siwen (Mid Sweden University)

Co-authors: KRAPOHL, David (Mid Sweden University); NORLIN, Börje; THUNGSTROM, Goran

Presenter: AN, Siwen (Mid Sweden University)

Session Classification: Timepix, Micromegas, chair: Bernd Schmitt

Track Classification: general