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Calibrating MARS Cameras using X-ray Fluorescence

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ABSTRACT

We develop a XRF (x-ray fluorescence) method to characterise the energy response of a multi-element camera in a MARS spectral scanner. Due to the low emission and detection efficiency of the XRF signal it is challenging to measure a well-defined XRF peak. Nearly monochromatic XRF sources are created in the MARS small bore spectral scanner by placing metallic foils between the x-ray source and the camera. The metallic foils are permanently mounted on the filter bar (in addition to a range of filters) inside the MARS scanner, thereby providing an automatable method for generating the XRF photons.

The experimental parameters that affect the strength of the XRF signal are discussed, followed by experimental results of a geometrical setup that measures oblique (off-axis) fluorescence by minimising contamination from the primary beam. The mathematical model developed in [1] is used to obtain the optimum scanner parameters for this oblique fluorescence setup. We present results where each element in the camera is Medipix3RX bump bonded to a 2mm thick CZT or CdTe sensor.

The XRF photons can be used to characterize the energy response of each of the pixels in the camera. This work improves the quality of the 2D spectroscopic data set obtained with the MARS small bore scanners, hence makes the material analysis more accurate, and in turn makes our MARS images more medically useful.

REFERENCES

[1] L. Vanden Broeke, A. Atharifard, and others, *Oblique fluorescence in a MARS scanner with a CdTe-Medipix3RX*, Journal of Instrumentation, vol. 11, December 2016.

Author: Ms VANDEN BROEKE, Lieza (University of Canterbury, New Zealand)

Presenter: Ms VANDEN BROEKE, Lieza (University of Canterbury, New Zealand)

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