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Combining SR Computed Tomography and Fluorescence X-Ray Computed Tomography

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An x-ray image highlighting technique which might prove more sensitive than simple attenuation alteration, is imaging the x-ray fluorescence from specific markers. This technique is exploited to great effect on x-ray fluorescence microscopy beam lines like our XFM facility. On IMBL we would like to develop a lower resolution, but wider field of view method of reconstructing 3-D fluorescence imaging compatible with SRCT.

A beam modulation technique has been proposed previously to allow fluorescence CT (FXCT) and SRCT data to be collected simultaneously [1]. This work resulted in some proof of concept modelling and a simple experiment test system.

Since seminal papers on the subject were published in 2008, there has been significant activity around Compressive Sensing (CS). Ideas in CS have been proven for imaging at optical and infra-red wavelengths. CS has also caused a lot of excitement in the medical imaging community. However, to date not much has been published on using CS techniques in SR x-ray imaging. We believe CS imaging techniques suit IMBL and may overcome the issues in combining SRCT and FXCT.

We present some recent data, and model outputs which demonstrate the reconstruction of low resolution iodine fluorescence maps of realistic phantoms from data collected with a single point detector during a CT scan on IMBL.

[1] - C. Hall, 'Combined x-ray fluorescence and absorption computed tomography using a synchrotron beam', 2013, Journal of Instrumentation. doi:10.1088/1748-0221/8/06/C06007

Keywords

X-ray fluorescence CT, x-ray compressive sensing imaging

Primary author: Dr HALL, Chris (Australian Synchrotron)

Co-authors: Mr WINNETT, Alex (Swinburne University of Technology); Prof. WANG, Feng (Swinburne University of Technology); ACRES, Robert (Australian Synchrotron)

Presenter: Dr HALL, Chris (Australian Synchrotron)

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