

SPECTROSCOPIC CONTRAST-AGENT IMAGING WITH THE MEDIPIX CT-SCANNER “MARS”

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Introduction:

The prototype MARS (Medipix All Resolution System) x-ray CT scanner provides spatial and energy resolution at the same time. It is currently operated at Christchurch Hospital to evaluate the clinical potential of spectroscopic images. The first datasets with a focus on contrast-agent imaging have been processed.

Methods:

The scanner combines a broad spectrum micro-focus x-ray tube and the energy selective x-ray detector Medipix-2. It is used to acquire tomographic datasets of specimens with a choice of spectral energy bins at a voxel size of 43 microns.

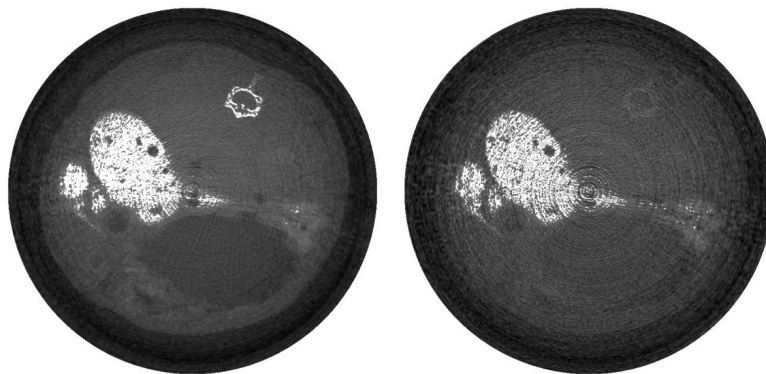
The attenuation coefficient for each material in the sample is energy-dependant. Of particular interest are contrast agents which feature a k-edge at high energies leading to a high absorption. Sections from different energy channels enable us to distinguish between two materials that would look similar in a conventional, non-energy selective CT.

The data has been post-processed to correct for tube fluctuations and a Fourier filtering technique has been applied to avoid ring artefacts. The CT reconstruction was done using a Feldcamp-type cone beam back-projection.

Results:

The scanner has been operational for several months, imaging mice and phantoms with different types of contrast agents.

Fig. 1 shows the result from scans on a mouse with contrast agent (iodine) in the gastro-intestinal tract. The ‘high-energy’ slice (right) indicates a clear difference in grayscale between bone and contrast agent in the belly, which cannot be identified in the ‘broad spectrum’ slice on the left.



*Fig. 1: Reconstructed slices of a Mouse with Iodine in stomach and bowel:
left with a lower threshold at 12 keV, right at 33 keV*

Further scans of mice and pathological samples are currently being prepared and will be used to further investigate the new information contained in spectroscopic datasets. New methods for identifying different materials from the CT-reconstructed data in the different energy bins are currently being developed.

Conclusions:

Initial measurements have proven the ability of the spectroscopic CT scanner to improve multi-contrast-agent imaging.