CALIBRATION AND OPERATION OF THE 3D SPECTROSCOPIC "MARS" SCANNER

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Introduction:

The Medipix All Resolution System (MARS) is a 3D spectroscopic imaging CT scanner based on the Medipix photon processing x-ray detector. The Medipix hybrid silicon pixel detectors, which were developed at CERN, are capable of high spatial and temporal resolution. Images can be obtained at different energy thresholds offering the potential for spectroscopic x-ray analysis. The present desktop MARS scanner (Figure 1) was constructed through a collaboration of researchers from the University of Canterbury and the Canterbury District Health Board. Mechanical calibration procedures and image quality tests will be presented and the operation and the status of the scanner will be discussed.

Methods:

The MARS scanner combines a broad spectrum micro focus x-ray tube and the energy selective x-ray detector Medipix-2. The detector and the x-ray tube are held in a rigid geometry and are capable of being rotated through 360°. Samples, including pathology specimens and small animals, of up to 90 mm diameter can be positioned in the centre of rotation. A MATLAB interface is used to control the stepper motors positioning the scanner and to read and record imaging data. A modular approach is used in the design of the software and the hardware, both of which are being continually refined. A calibration phantom has been constructed to verify the alignment of the central beam axis, the sensor translation axis, the axis of rotation and the sample movement during scans. Amongst others, measurements of the beam profile of the x-ray tube and tests on the image quality have been performed.

Fig. 1: MARS scanner

Results:

The MARS scanner has undergone a number of design improvements. The current version of the scanner has been in operation since early 2008 imaging phantoms, pathology specimens and mice. Measurements of the physical alignment during the scanning process were performed. Experience has been gained in the operation of the system prompting a number of design improvements.

Conclusions:

The experience in the use of the MARS scanner and the results of the alignment measurements have been used to improve the design, operational processes and image quality.