Contribution ID : **27** Type : **Poster**

Comparison between Hamamatsu C10900D and Xineos 3030HR detectors at IMBL for phase-contrast computed tomography of full mastectomy samples

Monday, 2 December 2019 18:33 (1)

We are developing phase-contrast computed tomography (PCT) using synchrotron sources that will be applied for medical breast imaging in the near future. This study is conducted in hutch 3B of the Imaging and Medical beamline (IMBL) of the Australian synchrotron. Currently, we are using two large-area flat-panel imaging detectors. The first detector is Hamamatsu CMOS Flat Panel Sensor C10900D, with CsI scintillator deposited directly on 2D photodiode array, with 1216 × 1232 pixels of 100 μm size in "fine mode" and maximum detected signal counts of 4000 (12 bit). The detector was used with minimum exposure time of 59 ms and frame rate of 17 fps. The second detector is Xineos CMOS flat panel detector, with medical-grade columnar CsI scintillator, with 2994x2997 pixels of 99μm pixel size and maximum counts of 16000 (14bit). The detector was used in Mag1 (70%) mode to achieve exposure time 25 ms and frame rate of 40 fps. Both detectors have high quantum efficiency and very low noise level, which is important for this type of application. Certain important parameters such as the X-ray energy, effect of the propagation distance, mean glandular dose were explored in this study using both detectors. Fresh full mastectomy samples with different types and grades of breast cancer lesions, as well as cancer-free samples, were used to approximate the real conditions of human breast imaging. The phase retrieval step that is added to the CT reconstruction process allows us to work with noisier images, offering a lower radiation dose delivered to the patients. The unique properties of synchrotron X-ray sources such as high coherence, energy tunability and high brightness are very important for producing low-dose PCT scans within short scanning times. These source characteristics needs to be complemented with a highly efficient detector having high frame rate, high resolution, large area and low noise level in order to maximize the outcomes for breast cancer imaging.

Speakers Gender

Female

Travel Funding

No

Level of Expertise

Experienced Researcher

Do yo wish to take part in the poster slam

No

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Session Classification : Welcome Function