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Extreme imaging on Imaging and Medical Beamline

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The Imaging and Medical Beamline (IMBL) of the Australian Synchrotron is recognised as one of the most advanced facility for the Computed Tomography (CT) experiment. It was designed for the macro-imaging, just touching the microscopy ranges in the highest magnification configuration. This design assumes that the beamline must be capable of imaging large objects up to 50cm wide. The monochromatic beam available on the IMBL can penetrate through the large object only if it consists of softer materials usually met in the biological tissues, while the samples of higher densities are not transparent enough to form the contrast of sufficient quality. In order to overcome this limitation we have been testing the pink-beam imaging modality. In this mode we are not using the monochromator which extracts a very narrow band from the wide spectrum produced by the superconducting multipole wiggler of the IMBL, but instead applied extensive filtration which suppresses the low-energy component of the beam allowing only the highest energy fraction to pass through. This approach is optimally implemented when the high magnetic field (4T) is applied to the wiggler magnet, what shifts the spectrum toward the high-energy end.

In the last year we have tested this technique in two major beamline configurations: the near-source imaging in the enclosure 2B and the far-end in the enclosure 3B. The first of these configurations is optimal for the highest energy beam due to the high flux which is achieved for the price of the relatively small beam - up to 70(w) x 7(h) mm. Combination of this beamline configuration with the most sensitive of our detector (Hamamatsu flat panel, 200μm pixel size) defines the most extreme imaging conditions available on the IMBL. The pink beam produced under these conditions has the peak energy above 360keV and allows to perform a successful CT scan of a 4cm led sample in less than one hour. In the far-end configuration of the IMBL the beam reaches 45(w) x 4(h) cm in size, what reduces the flux and dictates softer filtration with the peak energy of the pink beam being slightly above 300keV. The beam was tested with various objects which included a soil sample more than 35cm in width, metal tools of various sizes and large fossils. This presentation describes the method in details and presents some of the results obtained.

Keywords or phrases (comma separated)

computed tomography, x-ray imaging, pink beam

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No

What is your gender?

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