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Phase Contrast Imaging at Classical and Compact Synchrotron Light Sources for Medical Applications

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Phase contrast imaging shows promising improvements over absorption contrast imaging, especially when it comes to the discrimination of soft tissues. Grating interferometer based phase contrast imaging (GIBP) in particular allows the recording of the classical absorption signal as well as the complementary phase and dark field signals, making it a powerful diagnostic tool in medical applications.

While being compatible with classical X-ray sources, GIBP suffers from the large energy spectrum of emitted photons. The photon energy dispersion indeed leads to a washing out of the Talbot carpet which serves as a basis for the phase signal recording (Figure 1 & 2) and finally to a decrease of the signal to noise ratio.

One way of solving this problem while remaining compatible with bedside applications is the use of miniature synchrotron light sources such as the compact light source (CLS - Lyncean Tech) which provide a high brilliance monochromatic source of photons with energies up to 35 keV. Another approach is the use of X-ray imaging detectors with energy discrimination capabilities such as the Medipix 3 readout chip combined to a high Z material sensor.

In the frame of the future MAP2 project which encompasses the installation and use of a Compact Light Source "BRIX"in the Munich area to perform advanced preclinical studies, and in order to explore the domain of spectral phase contrast imaging, a dedicated detector development program is planned. The planned detector is based on the Medipix 3 readout chip bump bonded to a high Z material sensors and will a) offer the speed and noise performance needed to perform the various BRIX based experiments, and b) allow to explore the domain of spectral phase contrast imaging thanks to the capabilities of Medipix 3 chip spectroscopic mode.

This proposed poster offers to detail the use of the detector in the phase contrast based MAP2 proposed applications.

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