

Phase contrast X-ray imaging in biomedicine: the ESRF experience

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It has been widely shown in the literature that phase contrast techniques are the most suitable imaging modalities to reveal tissue structures without the aid of a contrast agent. Strong development in this field is carried out at several synchrotron radiation facilities, covering a wide range of applications, from basic studies up to clinical trials.

At the ESRF, the free propagation (FP) and the analyzer-based imaging (AI) techniques are applied in in-vitro and in in-vivo preclinical bio-medical studies using single projection and 3D micro-tomography modalities.

FP and AI have found successful application in various medical-related fields. In-vitro human samples are examined in the frame of mammography and breast cancer characterization programs, and of osteoporosis and bone ingrowth studies; in-vivo techniques are applied to in-vivo animal models to follow up the development of diseases like osteoarthritis.

X-ray beams suitable for clinical application of phase contrast techniques (collimated, highly intense and quasi monochromatic) are presently available at synchrotron radiation facilities only. It is expected that the exciting preclinical and clinical results at these facilities stimulate the engineering of new intense table top sources to be introduced in the clinical diagnosis routine.