

The Mammography Project at the SYRMEP Beamline

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A clinical program for mammography with synchrotron radiation (SR) has started in March 2006 at the SYRMEP beamline of Elettra, the SR facility in Trieste, Italy. Up to now about 50 patients have been examined.

SYRMEP is a dedicated bending magnet beamline where preliminary studies have been carried out on phantoms and “in-vitro” breast tissue samples. The promising results obtained have brought to the “in-vivo” phase with the goal of studying unresolved cases selected by radiologists after routine examinations. The research plan foresees to start in planar radiology with film-screen system (FSS) in Phase Contrast (PhC) geometry. The next step is the introduction of digital detectors, both conventional and in-house developed, investigating also new imaging modalities such as low dose tomography and tomosynthesis.

The original beamline layout has been modified and a clinical facility has been realized. Since the laminar beam is fixed, planar images are obtained by scanning the patient through the beam. The patient lays prone on a speed controlled movement support, with her breast leaning out of a circular opening. An appropriate compression device is used for equalizing the thickness of stretched tissues. The detector is mounted on a rail for PhC distance optimization and it scans the beam synchronized with the patient support. A couple of ionization chambers, tailored to meet beam geometry and equipped with custom electronics, act as beam monitors; calibrated with the Italian national standard, they are used for dose control and, together with solid-state detectors, for determining the exposure. The dependence of the FSS response with X-ray energy and scanning speed has been studied and analytical fitting functions identified. In order to fulfill all security requirements, special systems have been designed and implemented, following the redundancy criteria and “fail safe” philosophy.

After a long process to obtain the approval of the concerned authorities, the mammography program is now at about half way to conclusion. Preliminary analysis shows a high diagnostic quality of the images without any increase in the delivered dose.

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