THE SYRMEP COLLABORATION AT ELETTRA: THE BEAMLINE THE DETECTOR AND SOME PRELIMINARY EXPERIMENTAL STUDIES

SYRMEP collaboration: Università degli Studi di Trieste, Istituto Nazionale di Fisica Nucleare - Sezione di Trieste, Sincrotrone Trieste
Presented by: Giuliana Tromba

In diagnostic radiology, the use of monochromatic X-Rays allows, in principle, an improvement in the clinical quality of images.

The SYRMEP (SYnchrotron Radiation for MEdical Physics) beamline at Elettra has been designed for medical research in diagnostic radiology. The first application will be mammography, a technique where dose reduction and high sensitivity are greatly demanded.

The beamline, from one of the bending magnets, will provide at a distance of about 20 m from the source, a monochromatic, laminar-section X-ray beam with a maximum area of 150x4 mm^2 in the energy range between 10 keV and 35 keV.
The beam will illuminate *in vitro* samples and will be detected by a Silicon detector forming a matrix of pixels. Digital images of phantoms with a size typical in the clinical practice (i.e. in mammography - 150x150 mm^2) will be produced by a scanning movement of the sample itself.
The optics is constituted of a Be window which cuts the low energy component of the beam, the entrance slits systems, the monochromator and the exit slits. A tungsten beam stopper is installed after the monochromator, to allow the access to the experimental area while the beam is on without prejudice to the thermal stability of the crystal. The monochromator is based on a monolithic channel-cut Si(1,1,1) crystal. Its intrinsic energy resolution is 10^{-4} which is degraded to about 10^{-3} by the natural divergence of the beam.

The SYRMEP detector is based on an array of silicon micro strips used in an Innovative geometrical configuration in which radiation impinges on the side rather than on the surface of the chip and is therefore totally absorbed within the active volume of the detector. Some prototype detectors with about 100 channels and pixels of 500x500 μm^2, 400x200 μm^2 and 300x200 μm^2 have been tested using a radioactive monochromatic X-ray source and a conventional X-ray

generator. The images of simple phantoms show the high sensitivity of the detector.
The final configuration of the detector will consist of 4 stacks silicon chips each with 250 pixels with an area of 200x300 μm^2.

Preliminary experimental measurements with synchrotron radiation have been performed at the National Synchrotron Light Source of Brookhaven in collaboration with the local group of medical physics (W. Thomlinson et al.).
Images of a standard phantom, used for quality control of mammography equipment, has been taken at different X-Ray energies with conventional films and Imaging Plates. Radiation doses have been measured with a ionisation chamber and thermoluminescence dosimeters. The Signal-to-Noise Ratio of the images normalised over the mean glandular dose are plotted versus X-ray energy .
Images of the same phantoms have been acquired at a conventional generator. As expected, for the same dose delivered to the phantom, an improvement has been found in the images with synchrotron radiation with respect to the conventional radiographies.