Experimental Report

(preliminary)

Experiment title: Effect of: synchrotron radiation on image quality and dose in mammography

Experiment number: LS-884

Beamline: ID17

Date of Experiment: from 5. June 1998 to 9. June 1998

Shifts: 12

Local Contact: Per Spanne

Name and affiliation of applicants:

Francis R. Verdun, Institut de Radiophysique Appliquée, Lausanne

J.-F. Valley, IRA, Lausanne

* **R. Moeckli, IRA, Lausanne**

C. Hessler, CHUV, CH-1011 Lausanne

J.-F. Le Bas, Unité d'IRM, CHU, Grenoble

P. Spanne, ESRF

A.-M. Charvet, ESRF

H. Elleaume, ESRF

Report:

The aim of the experiment was to study the effect of monochromatic x-rav beam on image quality and dose in a context of patient dose optimisation in the field of mammography. The detector used was a standard screen-film system dedicated for mammography. The phantom and the detector were scanned vertically during the image acquisitions.

The expected results have not been achieved for the following reasons:

1) The detector we used was a screen-film system, which is a standard detector for imaging in mammography. Such image acquisition does not allow a post-processing of the data. For this reason, the beam must be as homogeneous as possible.

Two problems linked to the use of a screen-film system occurred: first, there was phase contrast in the beam. This phase contrast was due to the carbon filters placed at the beginning of the beam line. Vertical lines with a typical width of a few millimetres were visible on the images. Clearly, these images were not acceptable either for diagnostic purpose or objective measurements.

The second problem was the fact that the beam was not flat: the flux of photons on the border of the beam was less than 50 % compared to the flux in the middle of the beam. Such a difference produces a great variation of optical density which ruined the image quality.

2) Due to the low energy used in the experiments (between 20 to 25 keV), the harmonics had to be eliminated. The crystals of the monochromator of the medical beam line are bended thus it is not possible to disalign the second crystal to eliminate the harmonics. We tried to add a Si 521 crystal (Bragg - Laue configuration) after the monochromator in order to select the desired energy. Unfortunately, the **absorption** into the crystal made the output flux too low to obtain the correct optical density on the screen-film system.

3) We asked for an energy of 17 keV in order to evaluate the relationship between absorbed dose and image quality at low energy. The lowest achievable energy on the medical beam line was 20 keV because the crystals of the monochromator are bended. In such a context, the optimisation possibility is very limited.

In summary, the experiment failed because the medical beam line was not optimal for our measurements. Nevertheless, we are still convinced that the subject is very promising and might be feasible on another beam lime, such as BM 5.