$\overline{\mathrm{ESRF}}$	Cancer Tissue	number: MD 33
Beamline: ID02	Date of experiment:           from: 7.11.2003         to: 10.11.2003	Date of report: August 24, 2004
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## Report:

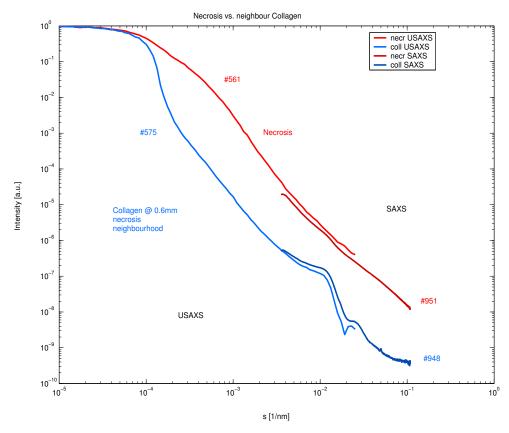
The experiment was continuation of three previous experiments LS-1695, LS-2096 and MD-1. It was combined with prior sample examination at ID17 (See exp. report MD39). The methods for SAXS pattern acquisition were similar as in the previous experiments. Thin breast tissue samples were scanned through the beam in small steps, positioned by stepper motors. The samples were formalin fixed. This makes the samples denser, but the essential structure remains unchanged. The SAXS patterns were recorded with a 2D FReLoN CCD detector at the pinhole camera set-up of the beamline. The positions of the measurement points were selected from previous histopathological examinations of the samples and radiographic images acquired at ID17 during the previous days. Moreover, Bonse-Hart camera was used to record USAXS patterns of the same samples. These measurements were performed at the same spots where the SAXS measurements were taken. Stepper motor positions were referred to the frame of the sample holder, so measurements in both set-ups were repeatable.

The studied regions of the samples included different types of tissues, whose supramolecular structure can be dermined from the scattering patterns. These tissue types included fatty tissue and collagen-rich connective tissue, either healthy or invaded by cancer cells. The SAXS patterns from the collagen are of particular interest. Previous experiments have shown that, upon cancer invasion, the collagen fibrils present clear structural differences: their diameter is smaller and the axial period appears to be approximately 0.5% shorter than in healthy tissue. This result is consistent with the

longer, but it also shrinks approx. 0.5% in invaded tissue.

Several indicators of the structural changes of the collagen were extracted from the SAXS patterns and used to build maps. Maps were build plotting colour dots at every spatial measurement spot. The colours indicated scattering quantities from the patterns. The quatities plotted were the axial period and the scattered intensity between collagen peaks. The maps were compared with the histological slices of the samples. The histo- pathological information was found to be in very good agreement with the scattering maps. Invaded areas of the samples could be easily identified from the SAXS maps, and were spatially and pathologically consistent with the histology.

USAXS patterns were acquired using the Bonse-Hart set-up, on the same beamline. The same spots were studied. Particular attention was paid to avoid the radiation damage of the samples, which were exposed during several minutes to the beam for each measurement. Moreover, specific studies of radiation damage on tissues were performed. Of special interest were the necrotic areas of some samples, which showed high scattered intensity. Histological examination of the samples showed that some of the necrotic areas contained microcalcifications, which may be the sources of the high scattered intensity.



**Figure 1:** SAXS and USAXS patterns of two spots from the same sample. The lower curve represents healthy collagen. The upper curve corresponds to a necrotic region 0.6 mm apart from the first spot.