ESRF	**Experiment title:** Detection and characterization of microscopic diffuse liver pathologies in 3-dimensions with a macroscopic dark-field imaging technique	**Experiment number**: MD912
Beamline: ID19	**Date of experiment**: from: 2.10.2015 to: 2.10.2015	**Date of report**: 2.08.2016
Shifts: 1	**Local contact(s)**: Alexander Rack	*Received at ESRF:*

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Report:

The Report organized as following: in the first part we briefly overview the aim of the experiment, then the description of actual experimental parameters and examples of obtained results are given; in conclusion the significance of results for our research is discussed.

The aim of experiment:

In this experimental session we used phase contrast microtomography in order to identify a series of sample presenting different stages of the pathology from a total of a 20 samples provided for us by our medical colleagues. We needed these high spatial resolution data to establish a quantitative relation between microscopic picture of overall tissue re-organization and/or disruption and ultra-small angle scattering signal measured with much lower spatial resolution. As stated in the original proposal the development of imaging methods that are sensitive to the presence of microscopic structures, and yet can be performed with a low spatial resolution imaging system are of particular interest.

Experiment:

During the measurements we have acquired data for a sufficient number of diverse samples (see Fig. 1). The following parameters were used in the experiment: Beam energy 26.2 keV, single harmonic mode with 0.5 mm Al filter. Effective pixel size of detector system was ≈ 2.2 μm^2. With such magnification sample dimensions exceeded the field of view thus it was the local tomography. The number of projections taken during 360° rotation was 4000 for all samples. Propagation distance was set to 50 mm to enable phase contrast. Those data was processed with a so-called Paganin phase retrieval method (linear contrast transfer regime).

For a number of samples an additional CT set was acquired at the distance 500 mm for a trial retrieval of the phase with a non-linear approach. Such a comparison was not yet done for absorbing (but homogeneous) samples and therefore is also of interest.

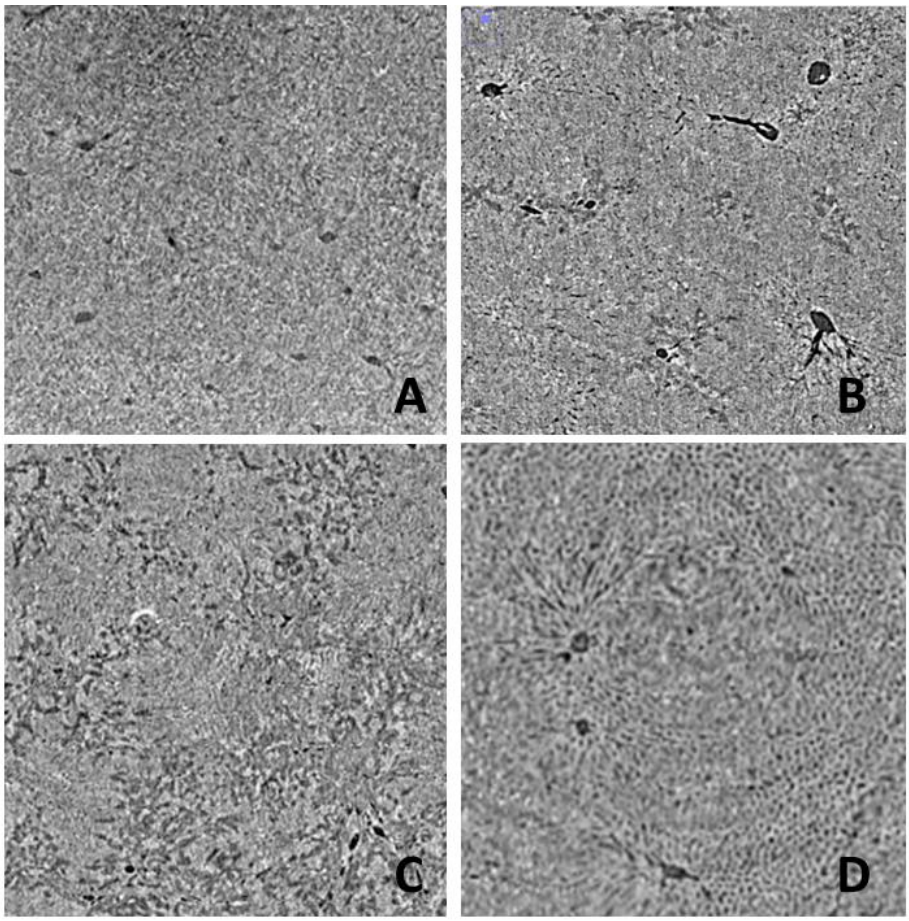

Figure 1. Phase contrast images of four liver specimens at different stage of pathology as classified by an experienced medical doctor: (A) healthy liver; (B) fibrotic liver (beginning stage); (C) fibrotic liver (developed stage); (D) fat liver

Conclusion:

The experimental session was successful. We were able to acquire all the data necessary for the second stage of the study as it was originally planned and thus achieved the primary aim. In the successive beamtime at ID17 those samples were examined with a different imaging modality (see the second part of the report). Moreover it turned out that acquired data is also valuable for a general investigation of the liver pathologies, such as determination of sizes of anatomic and pathologic structures: unlike the conventional histopathology, where information from a very thin slice is available, current data allow examination of a relatively large tissue volumes in 3D. Currently the vascular network is being extracted from data sets indicated at Fig. 1.

Acknowledgement:

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