ESRF	**Experiment title:** Exploring the peri-infarct zone on cardiovascular magnetic resonance using synchrotron light	**Experiment number**: MD-956
Beamline:	**Date of experiment**: from: 18.02.17 to: 20.02.17	**Date of report**:
Shifts:	**Local contact(s)**: OLBINADO Margie, RACK Alexander Oliver	*Received at ESRF:*

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Report:

Please be advised that this is a perliminary report, as we were not able to fully analyze the data in the short timeframe between completion of the experiment and re-application for new beamtime (9 days).

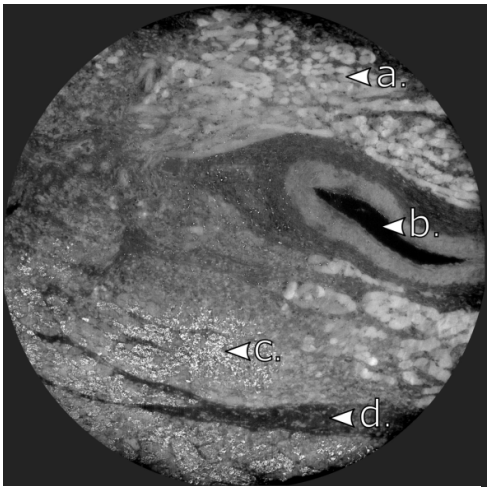

Figure 1. High-resolution image of myocardial infarction (porcine heart); FOV approx 1,3mm. Anatomical structures such as intact cardiomyocytes (a.; white), a vessel (b.) and connective tissue strands (d.) are clearly recognizable. The infarcted area (c.) is characterized by loss of cellular architecture and white deposits, potentially representing gadolinium or calcium.

In brief, the aim of the experiment was to visualize both the tissue anatomy and gadolinium distribution in cardiac biospies from pigs who underwent myocardial infarction. Samples were taken from the infarct, the peri-infarct and the remote (healthy) zone and conserved by three different methods (formalin/paraffin, glutaraldehyde/osmium/resin and cryopreservation).

Day 1: Samples were imaged on the pink beam at approx 19.2keV with the aim of obtaining anatomical information. Among different sample presevation techniques, osmium/gltuaraldehyde showed the most promising results (see Figure 1). We were able to obtain an anatomical picture with cellular resolution allowing us to clearly distinguish between structures, such as vessels, individual cardiomyocytes, and infarcted areas with concomittant loss of cellular organization.

Interestingly, the infarcted area showed a high concentration of "white speckles" (c. in Figure 1). We speculate that these speckles represent gadolinium, which can be expected at higher concentrations in the infarcted area. Alternatively these speckels represent calcium deposits. Future studies will be necessary to discern these two hypotheses.

Resume: We have coomplished our goal of obtaining anatomical information from myocardial infarction and deem this part of the experiment to be a success.

Future Directions: We aim at generating a 3D reconstruction of this sample with depiction of individual healthy myocyte strands, vessels and the infarcted area. Given the high intensity of the "white speckles", allowing for relatively easy distinction compared to other structures, we aim at conducting a relative quantification of these speckles by comparing their volumetric concentration between healthy areas and the infacted area. If these speckles represent gadolinium, they should be distributed similarly as extracellular volume, i.e. 100% in the infarcted area, compared to ~20% in th healthy myocardium.

Day 2: The main goal of day two was to conduct k-edge imaging for gadolnium in an effort to confirm the identity of the "white speckles" as gadolinium particles. Alas, we were – subject to final analysis of one sample – not able to successfully conduct susbstratctive k-edge imaging to visualize the gadolinium in our tissue samples. We tried different imaging parameters (exposure times) however, ran out of time to conduct more in-depth trouble shooting. We did, however, successfully image a gadolinum phantom (280mg/ml gadolinium), proving general feasibility of k-edge imaging of our gadolinium source on the ID19 beamline (Figure 2).

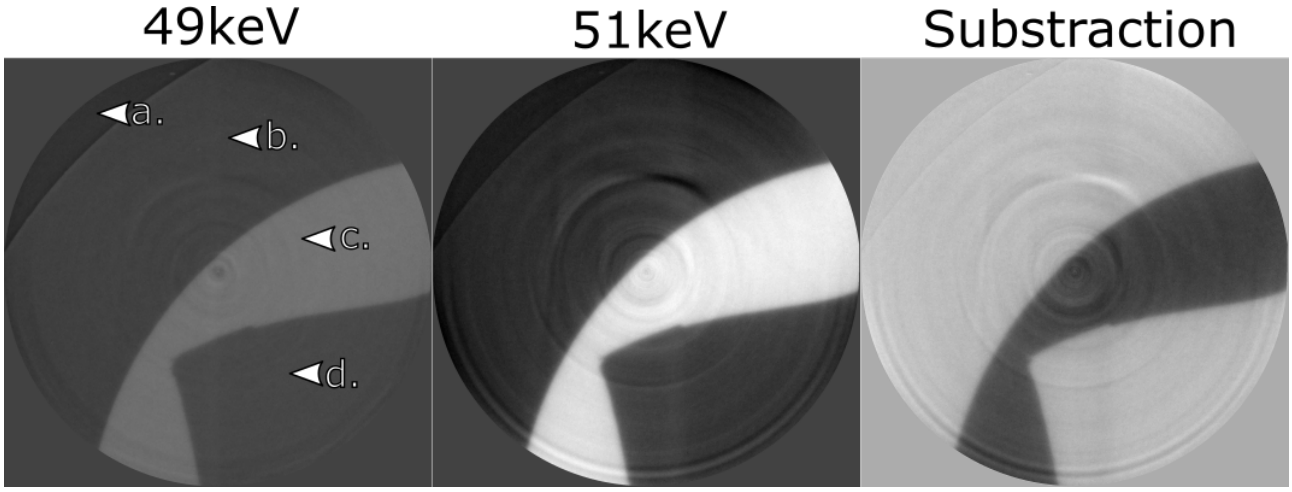

Figure 2. Image showing K-edge substraction for gadolinium in a gadolinium phantom. a. air, b.container wall, c.gadolinium solution, d. piece of epoxy resin

Resume: Despite not being able to image gadolinium in our tissue sample, we proved general feasibility with a gadolinium phantom. We therefore consider this part of the experiment a partial success.

Future Directions: As part of our next beam-time application we will run simulations to determine the optimal gadolinium concentration and imaging parameters prior to imaging at the sychrotron facility.

We would also like to use this opportunity to thank both of our local contacts Oblinado Margie and Rack Alexander. Without their dedication and assistance it would not have been possible to obtain these results.