Purpose: In the last decade, grating-based x-ray phase-contrast imaging was developed as a novel and very promising imaging modality. It is demonstrated to not only significantly increase the soft tissue contrast compared to conventional absorption- based imaging, but also to provide quantitative information about the tissue. In this work we report on the results of our study to determine quantitative CT numbers in phase contrast (corresponding to Hounsfield Units (HU) in absorption CT) for various healthy and cancerous human soft tissue, and to correlate these numbers to the HUs in absorption contrast.
Methods: The study concentrates on two types of human soft tissue, breast and liver tissue, as the imaging of theses tissue types is already a great demand on the conventional absorption CT. The specimens are fixated in formalin and analyzed tomographically with grating-based imaging at a synchrotron radiation source. This benchmarking study used monochromatic synchrotron radiation to ensure a high accuracy of the measured values.
Results: Our study shows that the grating-based imaging modality significantly enhances the soft-tissue contrast and allows clearly distinguishing between healthy and cancerous tissue. From the gray values the CT numbers can be calculated directly by averaging over different regions and geometrical corrections, as the values are measured relative to those of water.
Conclusions: With this work we demonstrate the potential of grating-based phase-contrast imaging to determine quantitative, tissue specific values for human soft tissue. We strongly believe that these results will enhance the quality of the tumor detection in both, human breast and liver, as the tissue-specific values can directly be used for numerical simulations and optimization of the setup, as well as for phase-contrast imaging dedicated phantoms design.