

# ANKAphase: phase retrieval software for X-ray phase contrast images taken at a single distance

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Propagation-based, or "inline", X-ray phase contrast, is a widely-used option on tomography stations at synchrotron light sources. One of its attractive properties is that it combines the high spatial resolution of synchrotron-radiation imaging with the enhanced density resolution of phase-sensitive X-ray imaging methods. Another is the simple setup: by leaving an appropriate drift space between the sample and the imaging detector, Fresnel diffraction on interfaces within the probed specimen creates interference fringes that enhance these sharply-localized edges. However, while this information can often be directly used for visual inspection, any further quantitative analysis that requires segmentation of the volume data is not easily possible using the plain phase-contrast data. But if the transmission radiographs are sent through a phase-retrieval process, the tomograms will exhibit "area contrast" rather than edge-enhancing contrast. The data can then be much easier segmented.

There are excellent phase retrieval routines available, for example the holotomography approach developed at ESRF [1]. Unfortunately, many of these approaches require data recorded at different distances between sample and detector. This precludes their application in many cases where acquisition time is a critical issue, for example in solidification studies or when sample throughput needs to be optimized. Phase-retrieval algorithms based on a single distance have been developed in the past, but not all of them can deal with samples that show non-negligible absorption. One approach that can solve this problem for a large class of samples is an algorithm introduced by D. Paganin et al. [2].

In our poster we will present a computer program named ANKAphase that implements this algorithm [3]. The program is designed to process stacks of images, on which it can additionally perform flatfield normalization and subtraction of dark images. It is thus adapted for the pre-processing of tomography data sets (although it does not perform tomography reconstruction itself). An intuitive graphical user interface makes it accessible to non-experts. It is written in Java and runs on most of the common computer platforms and operating system. It can be used as a standalone application or as a plugin to the widely-used open-source image viewing/processing program ImageJ [4].

[1] P. Cloetens et al. 1999: Appl. Phys. Lett. 75, 2912.

[2] D. Paganin et al. 2002: J. Microsc. 206, 33.

[3] T. Weitkamp et al. 2011: J. Synchrot. Rad. 18, 617-629.

[4] <http://rsb.info.nih.gov/ij/>, the ImageJ web site.