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Flat-field correction for dynamic processes

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Using hard coherent x-rays, as produced in PETRA III at DESY, objects of μm length-scale can be imaged with full-field phase-contrast imaging. A recorded single-pulse hologram of the object under investigation in a lens-less imaging setup is disturbed by illumination artifacts. The origin of these artifacts lies in aberrations in the optics, such as figure errors and surface roughness. For further analysis, the illumination artifacts have to be removed, which is achieved by a flat-field correction. Therefore, the x-ray image of the object of interest is divided by an empty-beam image. This approach assumes temporal stability of both illumination and object. For an experiment conducted at beamline P02 at PETRA III, in addition to vibrations in the beamline's optical components, the object itself incorporates dynamic movements. The common case of flat-field correction can be improved by recording an empty-beam image series. With principal component analysis (PCA) of the image series and a careful selection of the principal components, a synthetic flat-field can be reconstructed for each object image.

Category

Other

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