Regularized phase retrieval for magnified X-ray nano-tomography

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X-ray phase contrast imaging is a well-known imaging modality, that offers a better sensitivity (three orders of magnitude higher) than conventional radiology, for hard X-rays and soft tissues. The simple set-up of in-line phase contrast imaging allows to get a 3D map of the refractive index of an object, by first extracting the phase information of the acquired projections (so-called "phase retrieval"), and then performing tomographic reconstruction with these phase projections[1].

The phase retrieval process is nevertheless sensitive to low-frequency noise. To alleviate this problem, an initial guess of the retrieved phase has been introduced as a prior, under different assumptions on the object [2], [3], [4], [5].

Three main goals are considered in this project. Firstly, to adapt regularized approaches in the nano-imaging set-up recently implemented at the ESRF. Secondly, to combine phase retrieval with tomographic reconstruction, in order to reduce the assumptions on the object[6], with applications in bone imaging. Finally, to develop a Monte-Carlo simulation for phase-contrast using the VIP platform.

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