Online, quantitative data analysis for coherent X-ray imaging techniques with the ESRF PyNX toolkit

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The upcoming Extremely Brilliant Source (EBS) upgrade will provide two orders of magnitude more coherent photons, and will give the ability to collect coherent X-ray imaging datasets faster and/or with a higher resolution. Consequently, the increased volume of data requires dedicated tools to fully take advantage of the improved coherent flux.

In this presentation we will discuss the PyNX toolkit[1], which is developed at ESRF to provide fast (GPU-accelerated) and accessible (using simple command-line scripts or notebook) data analysis for a wide range of experimental techniques:

- Coherent Diffraction Imaging (CDI) and Ptychography (far field and near field) for two and three-dimensional imaging
- 3D CDI and Ptychography in the Bragg geometry to also provide strain information in nano-crystals
- Phase contrast imaging

We will present examples of analysis on various types of samples (crystalline or not), and show how the available tools aim to remove the need to master coherent X-ray imaging techniques to exploit them. This will ultimately enable a wider community to take advantage of the increased coherent photon flux, and focus on working on an extended range of applications and samples.

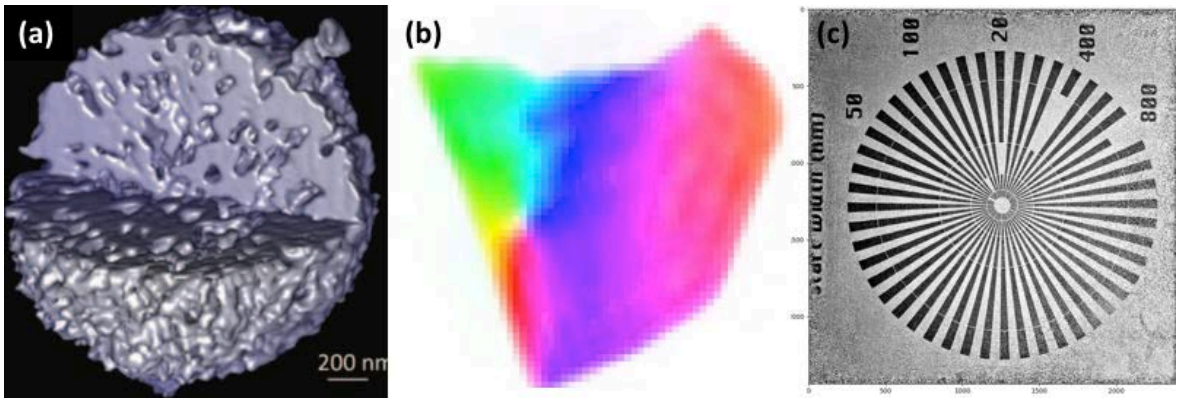

Figure 1: Examples of data which can be analysed using PyNX: (a) Coherent diffraction imaging of a calcium carbonate sample [2] (b) Bragg coherent diffraction imaging of a Pt nano-crystal with a dislocation and[3] (c) near-field ptychography imaging of a Siemens star standard target [4]

References

[1] - http://ftp.esrf.fr/pub/scisoft/PyNX/doc/
[2] - Cherkas *et al.*, Crystal Growth and Design, 14, 4183 (2017).
[3] - dataset courtesy of J. Carnis & M.-I. Richard.
[4] - dataset courtesy of P. Cloetens & J. Cesar da Silva.