A new tool for CDI data analysis and simulation

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Coherent Diffraction Imaging (CDI) is a promising technique for the development of an X-ray microscope. Currently, Brazil is on the verge of opening a new synchrotron radiation facility, the Sirius project, meaning that there will be a huge leap in X-ray imaging experimentation. However, together with such instrumentation, it is important to develop algorithms for phase retrieval reconstruction and make them available to the Brazilian imaging community. To this end, we have built an open-source tool based on the Orange Data Mining project that is capable of both simulating and reconstructing data for a plane wave CDI experiment.

This development allows the user to choose any given image and simulate the Fraunhofer diffraction pattern in the far-field regime. On top of that, the workflow also accounts for Poisson noise in the diffraction pattern and missing data regions in the detector. Concerning data analysis, the phase retrieval is implemented using various well-established algorithms, such as the widely used Fienup’s hybrid input-output (HIO); Thibault’s difference map; and Luke’s Relaxed Averaged Alternating Reflection (RAAR).

The Orange Data Mining tool permits the usage of Python codes, with widgets such as *numpy to Orange* and *Orange to numpy* allowing the user’s own codes to be implemented in Python. Both simulated data and real data reconstruction were built based on this strategy. The dynamic interface of Orange allows even non-programmers to use and understand the steps of phase retrieval, as well as visualizing each step with ease. Users are able to compare all the different algorithms that are available, together with full control over internal parameters, like the number of iterations or the projector weighting inherent to this family of iterative codes.