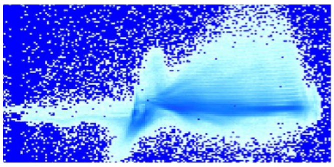

COHERENCE 2024
11th International Conference
on Phase Retrieval
and Coherent Scattering

Contribution ID: **111** Type: **Oral**

Deep Learning and innovative experimental setup accelerate Ptychographic X-ray Computed Tomography for characterizing heterogeneous materials

Wednesday, 19 June 2024 16:35 (15 minutes)

Ptychographic X-ray computed tomography (PXCT) is a high-resolution imaging technique that is widely used for characterizing various materials. It has two variants, namely far-field and near-field, which, when combined with spectroscopic techniques, provide new possibilities for material characterization. PXCT can be used to analyze mass density, localize chemical elements, inspect microstructure, and even map the magnetic field of a sample. Although the acquisition of data has become faster and the size of possible scanned volumes has increased, the dream of time-resolved analysis or hyperspectral nanoimaging still requires further acceleration of data acquisition. This challenge can be addressed in two ways: either by improving the instrumentation and the geometry of the experimental setup or by modifying the data processing strategy to work with less data while still maintaining high-resolution and quantitative contrast.
Some beamlines, such as cSAXS, PSI, CH, and SWING at SOLEIL Synchrotron in France, have already adopted the first method. They offer experimental setups allowing very fast acquisition and with large beam sizes at the sample due to the long sample-to-detector distance. In this regard, we will introduce here the new French beamline, FAME-PIX, which has been in construction at the ESRF. This beamline will be dedicated to PXCT and spectro-ptycho, and it will employ an innovative scanning technology that enables quick sample scanning. We will showcase the applications of this technology by sharing the results we obtained at the SWING beamlines at SOLEIL.
Modifying the data analysis process is the second way to speed up the PXCT acquisition. We will be discussing an approach that uses Deep Learning networks based on MSDNET and TomoGAN to reduce the amount of data required by a factor of 4 or more without compromising the quality of the images. We ensure the accuracy of our results by implementing a robust refinement process that corrects any artifacts that may have been introduced by the Deep Learning networks. This approach can be applied to various tomographic techniques, and to facilitate the sharing of our neural networks with the community, we have created an AI tomographic hub called AIAX at the University of Grenoble Alpes in collaboration with other laboratories at Grenoble. The primary objective of AIAX is to assist the community in processing their data using our neural networks.

Primary authors: Dr DA SILVA, Julio (CNRS Institut NÉEL); Dr KULOW, Anico (CNRS Institut NÉEL); BOUDJEHEM, Redhouane (CNRS Institut NÉEL); Dr PEREZ, Javier (SOLEIL Synchrotron); Dr HAZEMANN, Jean-Louis (CNRS Institut NÉEL)

Presenter: Dr DA SILVA, Julio (CNRS Institut NÉEL)

Session Classification: Numerical methods