Contribution ID: 101

Processing and Analysis of X-ray Diffraction Images to Assess Crystal Quality for X-ray Optics Applications at EuXFEL

The X-Ray Optics (XRO) Group is engaged in characterizing the crystalline quality of silicon and diamond materials to ensure the optimal performance of devices such as monochromators and spectrometers at the European X-ray Free Electron Laser (EuXFEL). A primary technique used for characterization is the combination of X-ray diffraction and topography to identify defects and quantify crystalline quality. The technique, known as Rocking Curve Imaging (RCI), involves the digital collection, processing, and analysis of a series of X-ray diffraction images using X-ray Dynamical Diffraction Theory to evaluate crystal quality. The image processing involves reading, numerically analyzing, and visualizing results from hundreds of images. A fundamental aspect of RCI is the peak shape analysis, which includes evaluating the width, intensity, and position of peaks in the diffraction profile of each pixel across the image series, allowing for the creation of spatial maps for visualization of the crystal quality and determination of its suitability for X-ray optics. To optimize data interpretation, this process can be significantly enhanced with a dedicated computational code capable of handling large data files while integrating basic image processing with profile analysis.

Goal

The goal of this project is to develop a Python code that can process RCI images, analyze the rocking curves, plot the peaks, and represent the results in spatial maps. Additionally, the processing should enable contrast enhancement, cropping, and selection of regions of interest of both raw images and resulting maps to improve visualization and interactivity.

Activities

- Basic learning of X-ray diffraction
- Code development
- Discussions with researchers
- Beamline visit at PETRA
- Potential participation in a beamtime

Group

XFEL_DO_ID_XRO

Project Category

A6. Theory and computing

Special Qualifications

DESY Site

Hamburg

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