**LaueMAX: a high-flux Laue diffraction X-ray microscope for materials science and nanoscience**

The Laue microdiffraction end-station on the French CRG-IF BM32 beamline at ESRF was upgraded in early 2024 thanks to the Equipex+ MAGNIFIX project. Compared to the previous setup, the intensity of the beam incident on the sample has been multiplied by at least a factor of 10, with a size of the X-ray beam of 300x300 nm².

Laue microdiffraction is a well-established technique for microstructural characterisation in polycrystalline materials on a scale of a few hundred nanometres, with high angular resolution for determining orientation, strain levels and lattice parameters within a resolution of 0.01%. Non-destructive, it is suitable for all types of crystallized materials (oxides, metals, semiconductors), whether isolated or assembled. In addition to standard measurements, the precise energy of peaks can be determined to assess the local stress tensor, and the depth resolution obtained by displacing a mask between the sample and the detector (DAXM - Differential Aperture X-ray Microscopy). Finally, *operando* or *in situ* studies can be carried out (temperature, mechanical load, light emission, etc.).

In conjunction with these instrumental advances, the analysis of massive data (from mapping, screening...) is being accelerated (as part of the PEPR DIADEM/‘ESRF’ project) thanks to the design of processing chains using intensive computing on several tens of thousands of Laue diagram images that may contain several thousand diffraction spots. Automatic and rapid indexing using artificial intelligence enables the analysis of complex Laue diagrams from a dozen probed crystals or crystallographic lattices with low symmetry.

Thanks to these developments, on the one hand, rapid knowledge of the structural data during the collection time will make it possible to better guide the collection and, on the other hand, the reliability and representativeness of the results will be increased.

We will illustrate this work with examples taken from recent measurements.