

FAME-UHD & FAME-PIX : A French Hub Dedicated To X-Ray Absorption Spectroscopies At The ESRF

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ABSTRACT

The French hub FAME (French Absorption spectroscopy beamline in Material and Environmental science) at the ESRF (European Synchrotron Radiation Facility) consists of two instruments : FAME-PIX (Ptychography Imaging with X-rays) and FAME-UHD (Ultra-High Dilution). Those instruments are dedicated to x-ray absorption spectroscopy studies. They cover a wide range of fields : condensed matter physics, material science, biophysics, chemistry, and mainly Earth sciences. For the latter, FAME instruments are particularly well suited since the majority of the geosciences probed elements are highly diluted. Measurements can be carried out at low temperature (e.g. to limit radiation damages), at high temperature, at high pressure or under controlled atmosphere for *in situ* or *operando* studies [1].

Thanks to two governmental fundings obtained jointly with the other ESRF French CRG beamlines [2], the original FAME beamline has been entirely rebuilt to become FAME-PIX and the FAME-UHD detection equipment has been upgraded. In details :

- (a) On FAME-PIX, new state-of-the-art mirrors have been installed to take the best benefit of the quality of the new ESRF source.
- (b) A new solid-state 16-element germanium detector as well as a new digital electronics have been bought for FAME-PIX. The photons emitted by the sample can now be detected with a better resolution and a higher counting rate compared to what was achieved with the equipment.
- (c) A new imaging end-station is being built on FAME-PIX, aiming at taking advantage of the increased coherence of the EBS source to carry out x-ray ptychographic measurements. Once achieved, samples will be imaged with a spatial resolution of about 50nm.
- (d) New crystal analysers have been acquired to increase the detection capacities of FAME-UHD : detection angles can be better optimised for each probed element, thus optimising the collected signal (energy resolution about 1eV).
- (e) On both beamlines, departing from previous step-by-step monochromator movements, continuous measurements have been implemented in order to allow faster analysis.

The construction of FAME-PIX imposed the closure of the previous FAME beamline for 30 months. Now, both FAME-PIX and FAME-UHD beamlines are in operation, except the ptychography end-station, still under construction.

REFERENCES

- [1] Nassereddine et al., « Novel high-pressure/high-temperature reactor cell for in situ and operando x-ray absorption spectroscopy studies of heterogeneous catalysts at synchrotron facilities », *Rev. Sci. Instrum.* 2024
- [2] Fundings obtained through the *Agence Nationale de la Recherche* in the frame of the MAGNIFIX *Investissements d'avenir* programme « ANR-21-ESRE-0011 », and in the frame of the DIADEM *Programmes et Equipements Prioritaires de Recherche (PEPR)*.