

BL 7.1 Powder Diffraction Beamline (MCX)

The Materials Characterisation by X-ray diffraction beamline will allow to perform a wide range of non-single crystal diffraction experiments: grazing angle diffraction and reflectivity, residual stress and texture analysis, phase identification and structural studies, kinetic studies, anomalous scattering and DAFS (from the Phosphor K-edge). Systems that can be investigated vary from organic and inorganic thin films, to thermally and/or mechanically modified surfaces of mechanic components, to polymers, catalysts and highly disordered materials in the form of films, powders, fibres.

In addition to the scientific heritage, a valuable activity will be the support to technology and industrial production, both for specific tasks of non-destructive control and for the development of new products.

In order to fulfill the required flexibility in terms of beam characteristics at the experiment, ranging from spot focus to line focus and to parallel beam, the optics of the line will consist of two mirrors and the monochromator. The first Pt-coated cylindrical mirror collimates the beam on the horizontally focusing Si (111) double crystal monochromator in 1:1 configuration. The second - vertical focusing - platinum coated mirror is flat and bendable, with a radius adjustable from 6 km to flat.

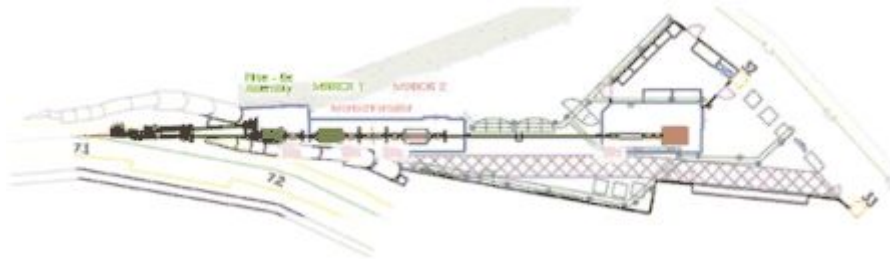


Fig.1 - schematic view of the beamline

Areas of research

- phase identification and structure of polycrystalline samples;
- amorphous, polycrystalline and single crystal layers;
- stressed and textured materials;
- epitaxial layers;

Light source

	2.0 GeV	2.4 GeV
Type	Bending Magnet	
Critical Energy	3.2 KeV	5.5 KeV
Source size	$\sigma_x = 0.139$ mm $\sigma_y = 0.028$ mm $\sigma_y' = 0.009$ mrad	$\sigma_x = 0.197$ mm $\sigma_y = 0.030$ mm $\sigma_y' = 0.013$ mrad
Horizontal beam divergence	2.0 mrad	

X-rays at sample

Energy range	2.1-23 keV
Energy resolution	$\Delta E/E = 2 \cdot 10^{-4}$
Photon flux	10^{11} photons/s
Beam size	From $10 \times 1 \text{ mm}^2$ to $1 \times 1 \text{ mm}^2$

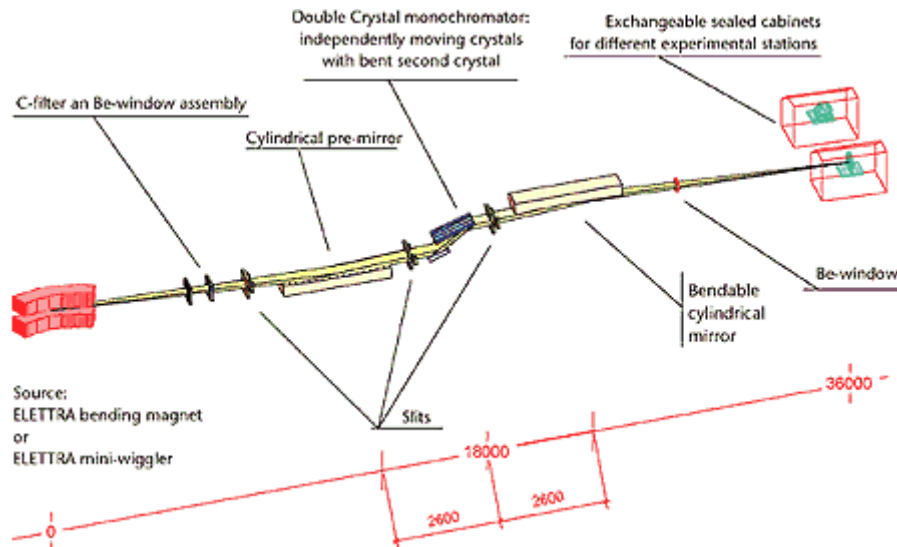


Fig.2 - optical layout of the powder diffraction beamline

Facilities in experimental stations

The diffraction system includes two exchangeable cabinets with goniometers equipped with different optics and non-ambient chambers. The two-cabinets system can be profitably used for off-line testing of experiments and rapid implementation of specific experimental configurations required by the users.

The standard instrument (system #1) is based on a four-circle goniometer with motorized (x-y-z translation) stage for sample holder; a customized version of a commercial instrument will be preferred as a start, also to allow a simple and user-friendly operation by users. Standard optics in the diffracted beam consist of a Si single-crystal analyzer and Scintillation counter. Additional counter systems could also be hosted and operated simultaneously.

System #2 will be based on a more open and versatile configuration than system #1.

A geometry suitable to reflectivity and to symmetrical grazing angle will be implemented, as well as the possibility of easily adapting non-ambient cells for applications to thin films and surfaces. 2D detectors will be used to allow the fast collection of XRD patterns for kinetics studies. Non-ambient cells will include high temperature and controlled environment (gas or liquid controlled circulation) chambers.