



Experiment title: FEASIBILITY STUDY OF A NOVEL TRANSMISSION X-RAY MICROSCOPE BASED ON A SPHERICAL CRYSTAL

Experiment number:
MI-565

Beamline: BM5	Date of experiment: from: 28/04/2002 to: 02/05/2002	Date of report: 31/07/2002
Shifts: 18	Local contact(s): T Bigault	<i>Received at ESRF:</i>

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Report:

The experiment performed at BM 5 was successful, and the results can be classified in three items;

- **Characterization of mica and quartz bent crystals by rocking curves. Many crystals have been analysed. In particular, we recorded a good collection of data from different quartz crystals at different reflections. A paper to be submitted to J. Appl. Cryst. is in preparation. A sample figure is included (Fig. 1).**
- **Testing of the new design of projection microscope using a bent crystal. The effect we looked for has been seen. Results have been presented at the XRM2002 (Grenoble, 29/7 2/8 2002). The abstract is included.**
- **Focalization of synchrotron beam using spherical crystals. We managed to focus the BM beam of 8.2 keV into a 40X40 μm^2 using a mica (0,0,26) crystal. This gave us the idea to start projection images using the focus obtained in this way. The mica crystal was not very efficient, and new crystals and configurations are under study. A new proposal will be submitted.**

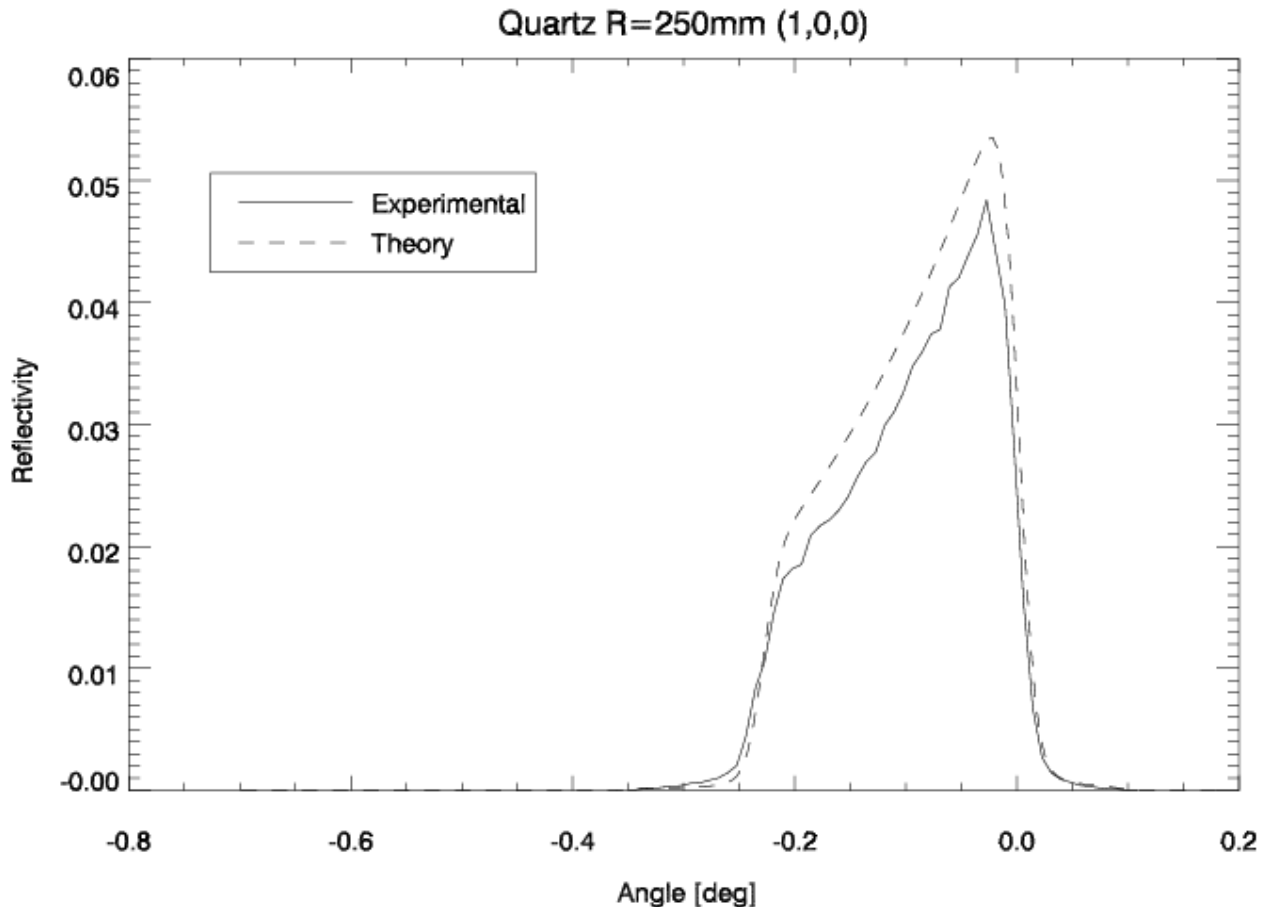


Fig 1: Theoretical and experimental diffraction profiles for bent (R=250 mm) AlphaQuartz (0,0,1) of 60 μm thickness at photon energy of 20 keV.

Optical configurations for x-ray imaging by projection
(Abstract, presented at the XRM2002 conference, 1/8/2002)

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Abstract. The recording of the image projected by an absorbing object placed in an x-ray beam is the simplest, and perhaps most used x-ray imaging technique. Although in some cases no optics is used (contact imaging, medical radiography, projection microscopy), it is often desirable to use some optics to improve the characteristics of the beam and therefore enhance the image. A key factor to consider in the design of the optics is the geometrical characteristics of the x-ray source. For point-like isotropic sources (like x-rays from laser-generated plasmas and microfocus x-ray tubes) a versatile and flexible design using a spherically curved crystal is outlined. For collimated beams (synchrotron radiation), it is necessary to consider an optical device that transforms the collimated x-ray beam into a small divergent spot. Several optical configurations aiming to create images of sub-millimetre objects with magnification from 1 to 100 have been experimentally tested at the ESRF BM5 beamline. A Kirkpatrick-Baez (KB) system is used for focusing the beam into a 30 microns spot and then direct projection images are recorded. Some results using a spherical crystal downstream from the KB system are presented. The possibility to focus the synchrotron beam into a 40 microns spot using a spherical crystal in quasi-normal incidence is demonstrated and its use for projection microscopy is discussed.