Two types of fixed-exit channel-cut crystal x-ray monochromators are proposed. In both monochromators the groove walls are not parallel. The fixed position of exit beam is achieved by coupling the rotation of crystal with its radial or axial translation.

1. INTRODUCTION

Monolithic channel-cut x-ray monochromators are frequently used in the synchrotron radiation (SR) laboratories, because they keep the direction of the exit beam parallel with that of incident beam and both diffracting parts of monochromator are naturally aligned. The disadvantage of this monochromator consists in the fact that the position of the exit beam changes with the Bragg angle (fig. 1). For this reason it is often necessary to move the sample and the detector with the diffracted SR beam during measurement, which sometimes requires to move the whole equipment to which the sample is attached.

\[ d = 2b \cos \theta, \]

where \( b \) is the distance of the planes taking part in the diffraction in both parts of the crystal and \( \theta \) is Bragg angle.

The obvious way to minimize the changes of \( d \) with \( \theta \) is to make the width of the channel \( b \) as small as possible. In order that the position of the exit beam be independent of \( \theta \), it is necessary that

\[ b_{\theta} \sim \frac{1}{\cos \theta}. \]
This can be easily achieved if the monochromator is fabricated from two independent single crystals separated by a variable distance $b_0$. Fixed-exit monochromator based on this idea was described in [2]. Here the change of distance $b_0$ must not affect the alignment of both crystals, i.e. the diffracting planes of both crystals should remain parallel within the accuracy of arc seconds or even better. This requires extremely good mechanical equipment.

The advantage of monolithic monochromators is the natural alignment of both its diffracting parts. Since the mutual position of these diffracting parts is fixed, the condition (2) can be fulfilled only if $b_0$ in (2) depends on the coordinates of spots where the x-ray beam strikes the crystal.

An example of such monochromator with fixed exit beam position is the Laue-Bragg monolithic monochromator described in [3]. It consists of an L-shaped crystal which can be rotated about its corner. Perhaps the only disadvantage of this monochromator is rather low exit intensity due to the Laue diffraction.

Another solution of this problem consists in the use of a monolithic channel-cut monochromator with the groove walls suitably curved [4]. The fabrication of such kind of monochromator is undoubtedly difficult. Moreover, the monochromator covers only a limited range of Bragg angles and the index of asymmetry is dependent on $\theta$.

In the next section two ways of the realization of the fixed-exit channel-cut monolithic monochromators are proposed which are based on the coupling of the rotation of the crystal with its radial or axial translation.

2. PROPOSAL OF CHANNEL-CUT FIXED-EXIT MONOCHROMATORS

2.1. Monochromator with alignment of $b$ by radial translation (A)

In this type of monochromator the first wall of the channel is cut parallel with the diffracting crystallographic planes and the second wall is deviated from the first

![Diagram](image_url)

**Fig. 2.** The schematic diagram of the fixed-exit channel-cut crystal monochromator with radial movement of the crystal. The proper value of $b_0$ is adjusted by translating the crystal in the direction $\pm X$ for each value of $\theta$. The SR beam always strikes the first surface of the crystal in the axis of rotation.