ESRF	**Experiment title:** **Coherent scattering from** static and dynamic steps on a Ge(l 11) surface	**Experiment number:** **SI-162**
Beamline: **ID3**	**Date of experiment:** from: 13/6/96 to: 21/6/96	**Date of report:** **20/8/96**
Shifts: **18**	**Local contact(s):** **S.** Ferrer	*Received at ESRF:*

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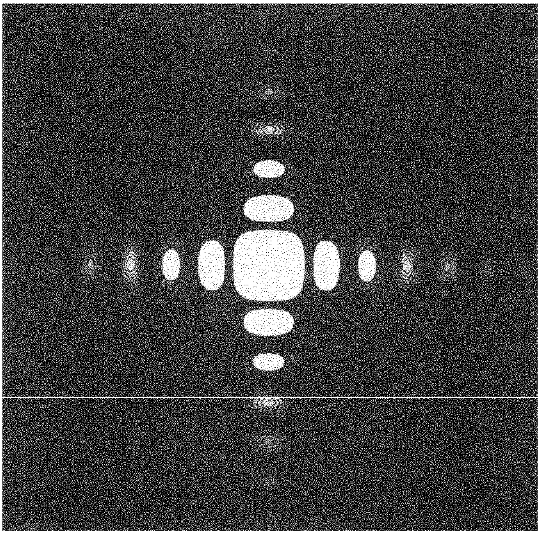
Report:

The aim of the experiment was two-fold: (1) try a new and convenient way to make an X-ray pinhole, and (2) use this pinhole to observe the coherent scattering from the steps on a Ge(111) surface.

Most pinholes used to generate a coherent beam are laser-drilled holes in metal foils. Even though many successful experiments have been performed with these, such pinholes have a number of drawbacks: (1) often a number of these foils have to be put in series in order to have sufficient attenuation, (2) a pinhole has a fixed size and (3) it's very difficult to obtain pinholes of a size of 1 µm or less. In order to overcome these difficulties, we have used polished slits on a very accurate translation stage (Micro Controle PS 1O-X). The slits were made of 1 mm thick tungsten and the blades had an angle of only 0.5° so that the range over which the X-radiation is only partly attenuated was a few tenths of a µm. A crossed set of these slits was used, so that the beam could be slitted down independently in the horizontal and vertical directions. The slits were located in the optics hutch at a distance of 35 m from the source.



The figure shows the type of Fraunhofer pattern that is observed when both slits are closed to 1 μm: a 'Fraunhofer cross' is formed. (The figure is computer-generated, because the real data have not yet been processed). The new CCD camera on ID3 was used for these experiments and was positioned 10 m from the slits in order to clearly resolve the Fraunhofer fringes. Such an area detector is indispensable for this type of work. Opening the horizontal slit leads to the disappearance of the horizontal fringes, and to an increase in intensity in the vertical ones. The smallest pinhole we have been able to make had dimensions of 0.7 x 0.5 μm^2. We found a flux of about 100,000 photons/sec/100mA/μm^2 for the Si(l11) monochromator at 13 keV and without focusing.

The set-up of the slits turned out to be very straightforward, and changing the slit opening between narrow and wide was easy and reproducible within a pm. The flexibility of these slits are one of the "main advantages for there use as a pinhole. When setting up an experiment, it's often convenient to have a large flux available. As soon as that is done, a coherent beam can be generated by simply slitting down. Also the trade-off between intensity and illuminated sample area can conveniently be made.

We subsequently tried to observe the speckle in the specularly reflected beam from the steps on a Ge(l 11) surface. Unfortunately, we encountered a number of problems with the sample preparation, which lead to both a loss in the expected reflected signal and to a loss of time. We learned that the available flux is not quite sufficient to observe the speckle in the real out-of-phase condition (l = 1.5). However, reducing the phase difference between the steps (l = 0.5) should still allow the observation of the speckle pattern while the intensity goes up by about a factor 50.