ESRF	**Experiment title:** **Soft X-ray diffraction by surface acoustic waves**	**Experiment number**: MI-278
Beamline: ID21	**Date of experiment**: from: 27/11/98 to: 30/11/98	**Date of report**: 25/02/99
Shifts: 12	**Local contact(s)**: Jean Susini	*Received at ESRF:*

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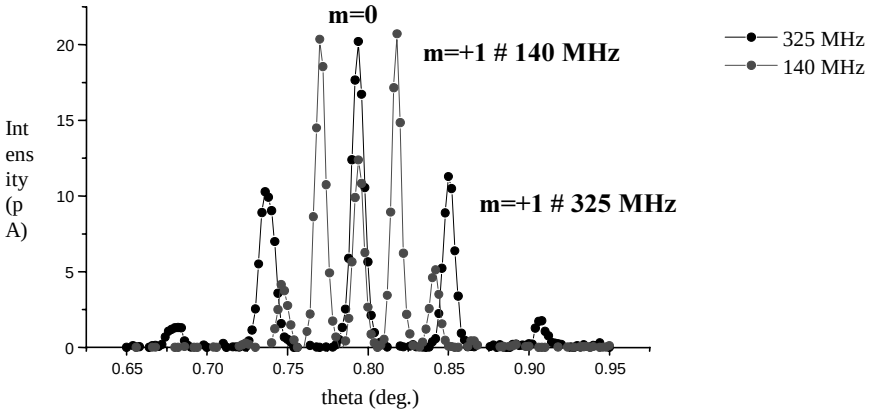
Report: The aim of the experiment was to study the diffraction of soft X-rays by surface acoustic waves. Since the energy range available on ID21 was 2.5 – 7 keV, we have decided to use two different energies: 4 KeV and 2.5 KeV. To increase the critical angles, a thin W layer was coated on the piezoelectric substrate.

For both energies, we were able to study the influence of the incident angle, of the acoustic frequency, and of the acoustic amplitude on the diffraction.

4 keV is more convenient since it has turned out that the flux is high enough to avoid any utilization of helium chamber to decrease the absorption in air.

The next graph shows the influence of the acoustic frequency on the angular positions of the diffraction orders for the 4 keV energy. In this case, two different frequencies were used: 140 and 325 MHz. These curves are rocking curves for the same incident angle : 0.8 deg.



The angular positions of the diffraction orders can be deduced easily from the grating equation. The difference in the satellite intensities for the two frequencies comes from the acoustic amplitude, which is smaller for the 325 MHz frequency (for the same electrical power supplied to the transducer).

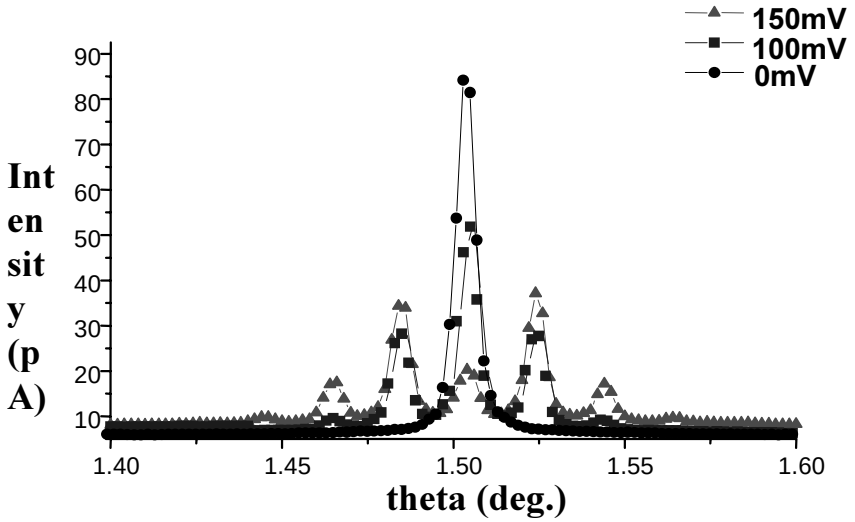


Fig. 2 shows the influence of the amplitude of the acoustic wave on the efficiency of the production of satellites. It can be seen that for an acoustic amplitude of 15 Å (there is a linear relation between the acoustic amplitude and the voltage supplied to the transducer), approximately 20 % for the direct beam intensity can be diffracted in the first diffraction order satellites. There is no way of increasing further up the acoustic amplitude without destroying the emitter.

Conclusion

We have shown that for soft X-rays, surface acoustic waves act exactly as a dynamical grating providing diffraction orders with an efficiency of the order of 20 % for the first ones. It is therefore planned now to repeat the experiment with a focused beam and then to perform scans of satellites by varying the acoustic frequency and to use this technique for soft X-ray scanning imaging.