ESRF	**Experiment title:** Methodology of determination of the partial coherency of ID32 and D32 using small mirrors	**Experiment number:** MI97
Beamline: ID32	**Date of experiment:** from: 02/14th/96 to: 02/20th/96	**Date of report:** 02/27th/97
Shifts: 15	**Local contact(s):** F : Comin	*Received at ESRF:*

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Report:

The aim of the experiment was twofold:

1. To measure the spatial coherence of synchrotron radiation, the 2 mirrors acting as variable Young slits
2 To start using the 2 mirror system to study 1 dimensional mesoscopic structures , consisting in a few mm size terraces with steps in the range IO-50 nm deposited on one of the mirrors.

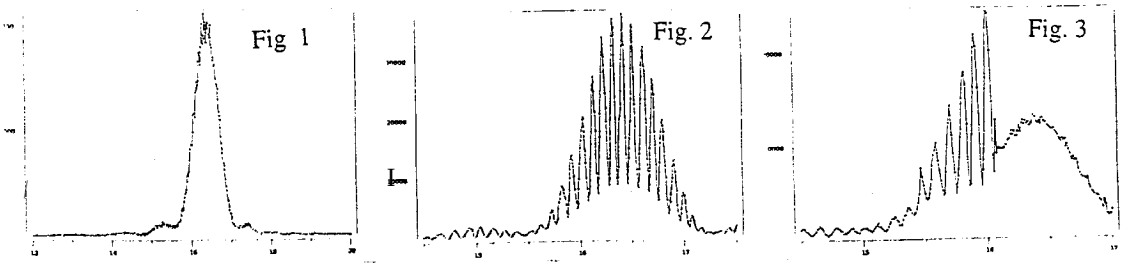
The first part of the work has been quite successful and has been published: see attached article[l].

For the second part, several difficulties appeared:

- The mirrors alignment was done using 3 piezoelectric actuators under vacuum, The tilt motion of 2 piezo-actuated systems broke during the experiment and it was necessary to move the mirrors manually: open the vacuum chamber, align, make vacuum several times. This costed a lot of time. Even increasing coherence, by putting small slits, the interference fringes are tilted in case of misalignment of the mirrors, and are averaged by the detector (Fig 1, 2).
- The lower flux (small slits) resulted in longer time per scan and gave rise to additional problems : the piezo-actuators were not stable enough, and he interference fringes were smoothed out by time averaging ; in addition, sudden changes occurred in piezo position destroying the interference pattern (Fig. 3).

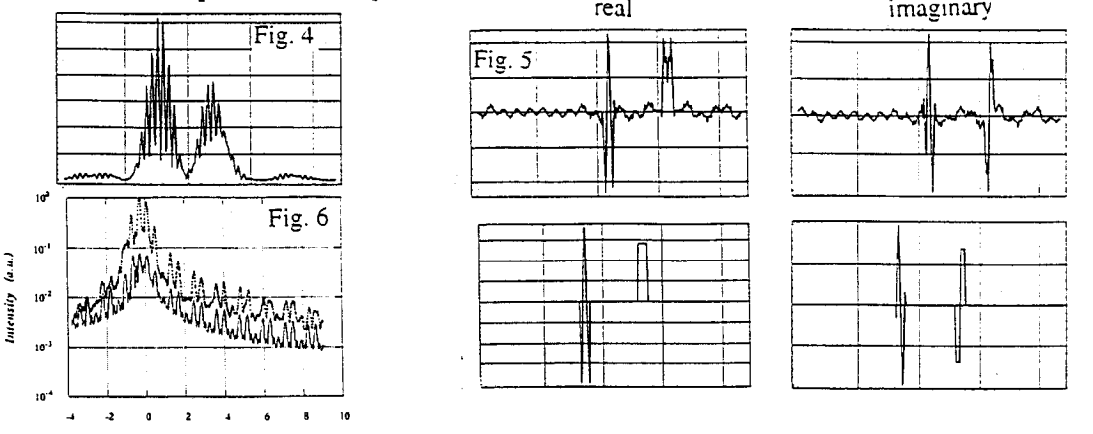
- The VCT6 electronics timed out very frequently, so that 1/3 of the scans were interrupted.
- To make holographic reconstruction of the structured mirrors it is necessary to measure the interference pattern at relatively large angles, where the intensity was very low

After the experiment, several discussions with the firm of thePZT-actuated mirror (Melles Griot) help it to design and fabricate a truly UHV compatible PZT actuated system, which we have now in hand.



Intensity as a function of the detector height (mm) : Fig 1 Low visibility due to misalignment of the mirrors. Fig. 2 Better alignment and increased coherence by reducing the slits size. Fig. 3 Sudden change of the piezoelectric position.

We have performed computer simulated interference patterns (fig 4), which show that holographic reconstruction (fig 5) of the structure deposited on one mirror (even the simplest structure) is possible only with wider scans, where the intensity is lower, and thus requiring a longer acquisition time. However comparison of the experimental and the simulated far field pattern (fig. 6). shows clearly that the effect of the structures on the pattern is well reproduced.



Simulations and comparison : Fig. 4 simulated holographic pattern of the structured mirrors. Fig. 5 Comparison of the simulated and reconstructed field reflected by the mirrors (in the near field) : imaginary and real part. Fig. 6 comparison of the simulated and measured far field pattern of mesoscopic structures deposited on a single Si mirror.

[1] K. Fezzaa et al., « X-ray Interferometry using two coherent beams from Fresnel mirrors », to be published in Journal of X-ray Science and Technology