	Experiment title: **Local structure of Ga and As in InGaAsN quantum wells by DAFS**	**Experiment number**: HS 1708
Beamline: BM 02	**Date of experiment**: from: 17/4/02 to: 22/4/02	**Date of report**: 17/8/02
Shifts: 15	**Local contact(s)**: Dr. H. Renevier	*Received at ESRF:*

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Report:

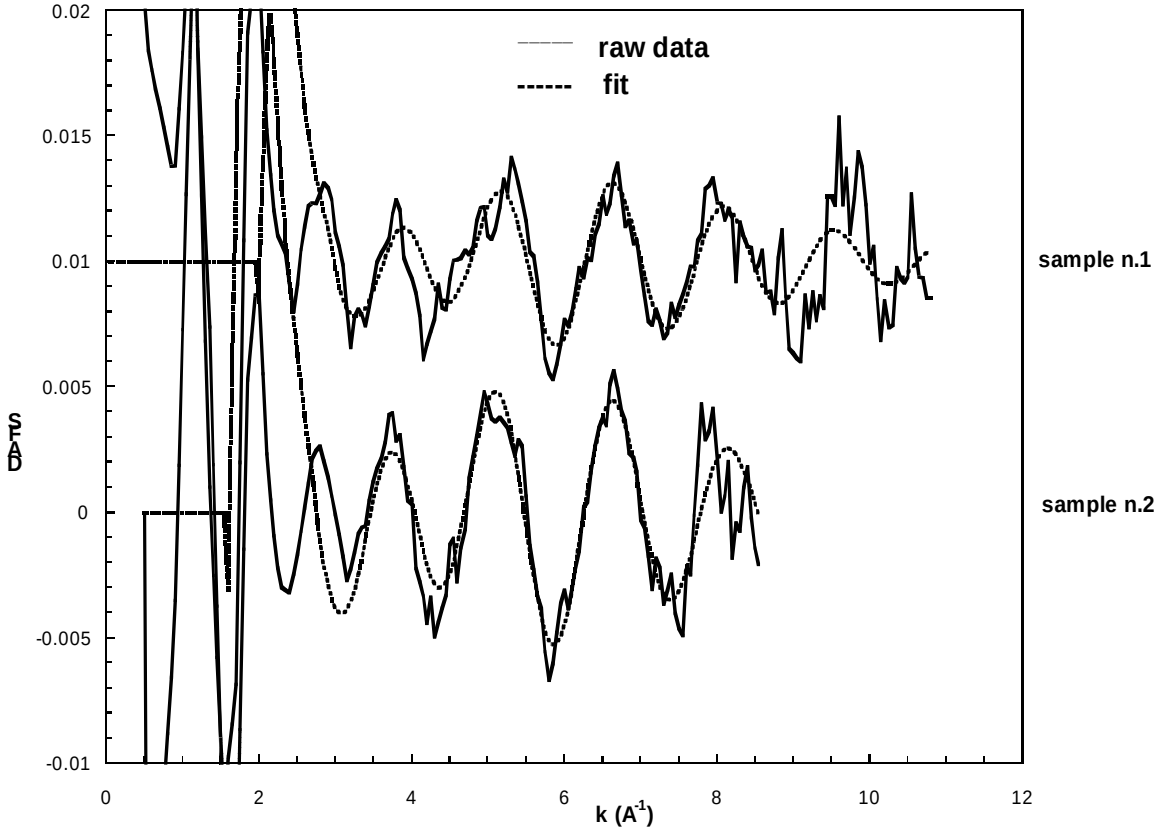
The aim of this experiment was to study local order and structural deformations in InGaAsN/GaAs single quantum wells using Diffraction Anomalous Fine Structure at the Ga edge, in order to clarify the structural origin of the anomalous electronic properties of this kind of alloy. Use of a high-brilliance SR source was mandatory in order to perform these measurements on 6 nm epilayers.

The interest in InGaAsN alloys is twofold. On the applicative side this quaternary alloy can be grown lattice matched to GaAs while varying the optical gap in the range 0 – 1.5 eV; hence it is used for the construction of laser diodes with improved temperature characteristics compared to more common InGaAsP/InP heterostructure diodes.

On the more fundamental side this material has intriguing physical properties which derive from the large mismatch between the dimensions of the N atom and the other constituents. The most obvious anomaly is that the optical band gap actually decreases, rather than increasing, with N concentration. Physical properties have been observed to be strongly non-linear with the N concentration and a strong dependence on atomic ordering of the constituent atoms has

been observed or predicted. Recently (Kim and Zunger, Phys. Rev. Lett. 86, 2609 (2001)) it has been predicted that there is a preference for In – N and Ga – As bonds, relative to the random case.

The experiment, recently conducted, was successful thanks to the advanced facilities present at ESRF: good quality data was obtained, despite the very low thickness of the InGaAsN layer. On the other hand multiple diffraction effects, due to the very high crystalline quality of the samples, made the alignment time-consuming and didn't allow us to measure all the samples we planned. A quantitative data analysis is in progress. In the figure we show the background subtracted DAFS oscillations for two samples and the fits performed in the k-space by using, at the present, only first shell paths. The reproduction of experimental spectra is good.



This kind of analysis will provide us with information on the relative Ga-As and Ga-N coordination numbers and on the bond length strain around Ga. This information will be complementary to that already obtained on the same samples by XAFS at the In edge (exp. number HS 1408), which gave evidence of a N enrichment around Indium.