ESRF	Experiment title: Nuclear Bragg-Diffraction from a singlegrain Al-Cu-Fe quasicrystal	Experiment number: HS-441
Beamline: ID18	Date of Experiment: from: 08-Oct-97 to: 10-Oct-97	Date of Report: January 6, 1998
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Names and affiliations of applicants (*indicates experimentalists):

* Richard A. Brand Laboratorium für Angewandte Physik, Gerhard-Mercator-Universitgt Duisburg, D-47048 Duisburg, Germany
* Gerrit Coddens, Laboratoire Leon Brillouin, CEA/CNRS F-91191 Gif-sur-Yvette. France
• Francoise Hippert. Laboratoire de Physique des Solides, Universite de Paris-Sud. Orsay France
* Maria Capitan. ESRF

Report:

WC studied a $Al_{62}Cu_{25.5}{}^{57}Fe_{12.5}$ single-grain quasicrystal on the nuclear beamline. Previously (September, HS-441 as well) we had found that the single-grain sample yielded narrow lines in electronic Bragg diffraction, and that it would be possible to study the sample using nuclear Bragg diffraction. These further experiments are intended to study several of the strongest reflections (for electronic and neutron diffraction) in nuclear resonant mode. They are meant as trial experiments to prove the feasability to study further reflections.

It has been shown that the reflections can be indexed using two integers N and M [l]. N determines the relative phase between the node and node-prime sites, while M determines the phase between node and body-centred sites. Thus, important for the study of the different decoration models is the comparison of the (N/M)-combinations even-even, even-odd, odd-even and odd-odd.

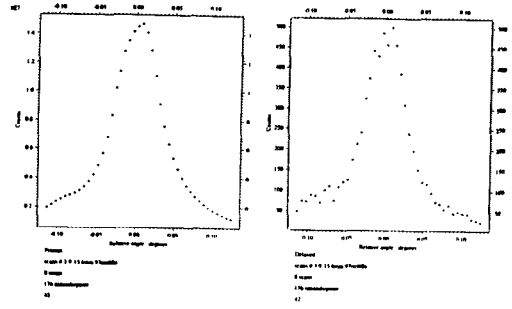
We have now studied the single-grain sample in nuclear Bragg-diffraction, measuring three different reflections, (20/32), (72/116) and (18/29) (a fourth was checked but there was insufficient time to measure it in detail). We have found that while the counting rate is low (and the ring was in single-bunch mode), it is possible to study different Bragg lines of interest in this project. We have performed mainly rocking-curve sweeps over the reflections (w-scans) to see if the width and position of the nuclear Brags reflections agrees with those from electronic Bragg diffraction. The positions and relative intensities of these reflections have been determined. The time spectra have been determined as well (important for the determination of the effective cross-section - "thickness" - as well as the hyperfine parameters).

In the past, only very special single crystals could be used for such an experiment because of the very small rocking-curve width necessary. This is the first time that this experiment on "usual" high-quality single-grain samples has been achieved at ESRF. This opens the way for many new studies using nuclear Bragg diffraction. Now we must make a detailed study of the different reflections and their relative intensities in nuclear as compared to atomic Bragg diffraction. Next time we will choose reflections in order to investigate the iron occupation on the different lattice sites.

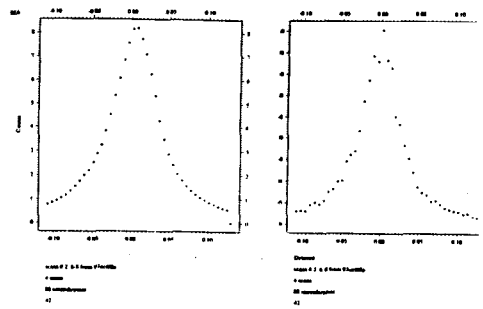
Results for several reflections are shown below.

[l] M. Cornier-Quiquandon et al., Phys. Rev. B 44 (1991) 2071.

18/29 electronic nuclear



20/32 electronic nuclear



72/116 electronic nuclear