ESRF	**Experiment title:** Nuclear Bragg diffraction on a single grain of AlCuFe quasicrystal	**Experiment number**: HS-1023
Beamline: ID18	**Date of experiment**: from: 22.09.1999 to: 05.12.1999	**Date of report**: 27.02.2000
Shifts: 15	**Local contact(s)**: R. Rüffer	*Received at ESRF:*

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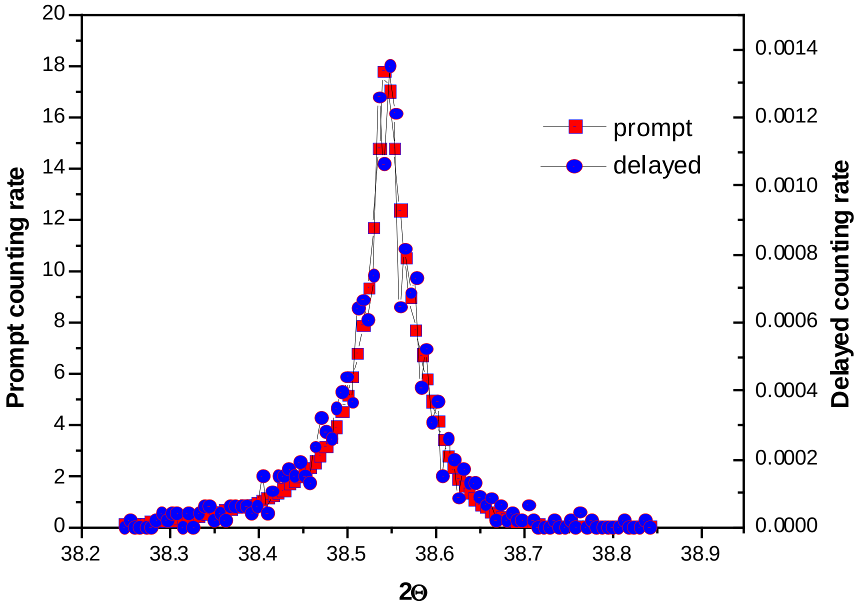
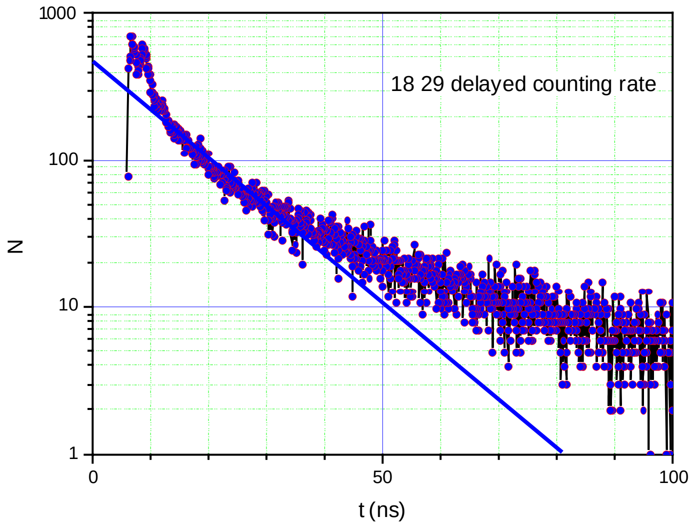
Report:

A single grain icosahedral quasicrystal $Al_{62}Cu_{25.5}{}^{57}Fe_{12.5}$ has been studied by ^{57}Fe nuclear-resonant Bragg diffraction. Because of the difficulty of thinning the crystal, the studies were performed in reflection geometry. The crystal was cut with a two-fold axis perpendicular to one face, making possible diffraction studies over a large region of the reciprocal space. The aim of the experiment was to compare the electronic to the nuclear-resonant relative intensities of Bragg reflections over a wide enough region of reciprocal space in order to be able to test different models of quasicrystalline structure [1]. The nuclear-resonant intensity was measured in delayed-counting channel in 16-bunch time modus, while the prompt channel gave the electronic intensity. The first thing we checked is whether the nuclear-resonant diffraction gave about the same positions and line widths. This is crucial to the experiment as it is not clear whether the same mosaic domains would contribute to both types of reflection. We were able to show that almost all reflections gave the same position and width for the two channels, as shown in the first figure. Next we made a survay in order to estimate the required counting time for the different reflections. One problem is the vastly different intensity between different reflections, as well as between the two different channels. The first figure gives typical results comparing the prompt and delayed counting rates (relative but comparable scales).



Shown is a typical reflection (47, 76) for the prompt (left scale) and delayed (right scale) counting rates. Clearly the same position and line width is obtained in both cases.



Shown is a typical time delayed spectrum (18, 29) reflection). Clearly there is a more complex time structure than simple exponential decay mainly due to a distribution of electric field gradients.

These results are now being analyzed along two lines: (1) the delayed nuclear-resonant counting rates are being used to model the iron decoration on the quasiperiodic lattice [1]. (2) The time structure are being modeled on the basis of the distribution of electric field gradients (EFG). An imortant additional question is whether the effect of the EFG distribution is the same for all reflections.

[1] D. Gratias et al, *et al*., in Proceedings of the Spring School on Quasicrystals, Aussois 2000, in press