REPORT FOR EXPERIMENT 02-02-846 (BM2, gonio)

A temperature study of the ordering second-order trasition of the AuAgZn2 alloy has been carried out with a high resolution. This system has an Heussler-type transition which is studied in the vicinity of the 1/2 1/2 1/2 Bragg position.

Experiment used the pixel detector of the beamline (130 micron resolution). A typical result is shown in Fig. 1. This figure was obtained after careful normalisation of the measured frame,. The black dots correspond to pixels which were discarded after a study of the defects of the detector.

This figure corresponds to ~Tc+1K, and we observe a large peaking intensity, due to pre-transitional ordering, essentially connected to surface, and an isotropic diffuse intensity, connected to critical fluctuations.

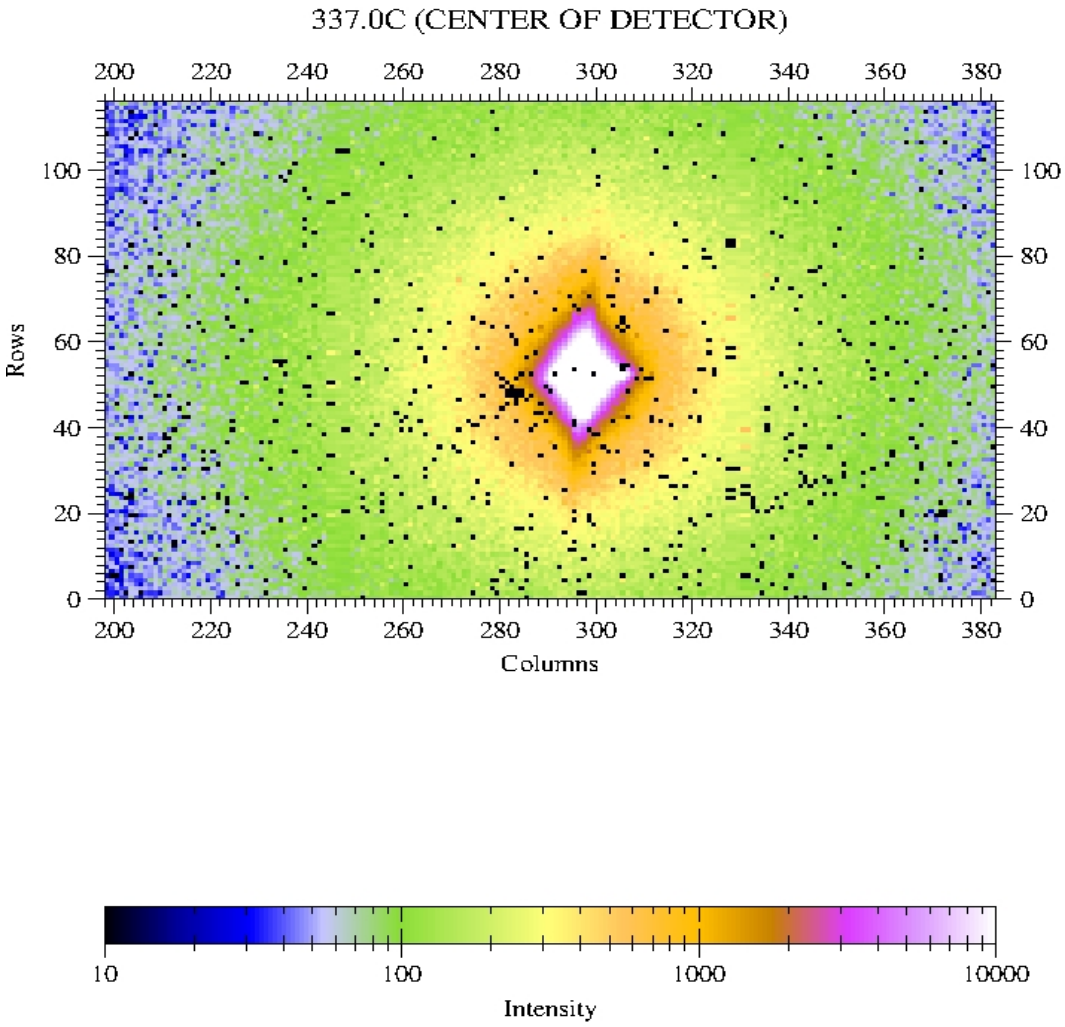

Fig. 1 A typical image of the scattering after corrections (~Tc+1K)

The measured intensities were circularly averaged, and for a large range of q-vectors, this intensity can be given the simple analytical shape:

$$I(q)=S(0)/(1+(q\xi)^{1.97})+B/(1+(q/q0)^2)^2$$

Fig 2 shows the result of this fit at 337°C (Tc+1K). We observe that this fit is excellent, except in a very narow region, where the pre-transitional scattering is strongly peaking and is also strongly anisotropic (see Fig. 1).
Close to Tc, S(0) diverges like the susceptibility, with the exponent 1.241 and $\xi \sim (|T-T_c|)^{-0.631}$ is the diverging fluctuation length.

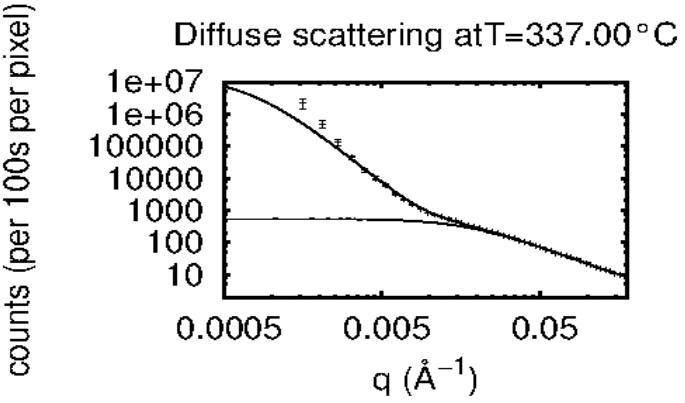

Fig. 2. A typical fit for estimating the critical fluctuations

This behaviour of the fluctuation length can be checked in Figures 3 and 4, where $\xi^{-1.585}$ has been plotted vs the temperature. The linear behaviour observed here is a check that this

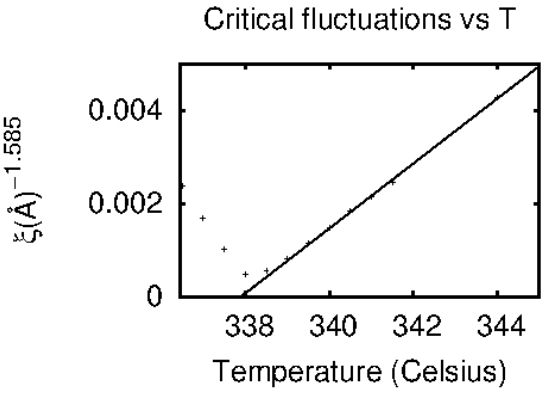

Fig. 3. The critical fluctuations: Tc=337.90(9)°C

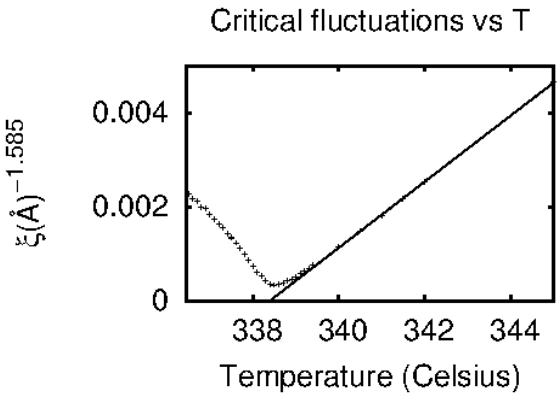

Fig. 4. The critical fluctuations: Tc=338.40(3)

alloy is an Ising-type system. We notice that these two curves provide very precise estimates of the critical temperature, and that they are different (an increase of 0.5°C in ~10 hours). This appears to be connected to some migration of Al atoms in the surface vicinity: it is observed that adding Al to the nominal $AuAgZn_2$ sample increases T_c. We also observe some "rounding" of the transition in the very vicinity of T_c and also that the high counting rate of the detector provides us with an observation of the critical scattering under Tc, though there is here a strong Bragg peak.

We here conclude that the pretransitional peak is connected to some Al migration: the Al layer sputtered on the sample was two times 70 Angtröms thick, much thicker than the alumina protecting layer (~32 Angtröms from literature). This thickness will be reduced in further experiments.