	Experiment title: Magnetic Compton scattering at high pressure on ID15a	**Experiment number**: HE-1580
Beamline: ID15a	**Date of experiment**: from: 26.11.03 to: 02.12.03	**Date of report**: 25/08/05
Shifts: 18	**Local contact(s)**: Nozomu Hiraoka	*Received at ESRF:*

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Report:

This experiment was a project to develop studies of magnetic systems and their interactions under high pressures using high energy magnetic Compton scattering. The proposal requested a long term project in order achieve this goal, and an allotment of 18 shifts of beamtime was awarded as a result. A considerable amount of progress was made during the experiment. A spin-polarised Compton profile from a sample of Fe_3Pt in the pressure cell was collected: these data were consistent with data taken with a normal large bulk sample. Beam focussing was attempted but found not to be beneficial for this application: the attenuation losses negated the gain achieved by focussing, partly because only a small cross-section incident beam could be used for the focussing device. Whilst further testing would be useful, this experiment has demonstrated that high pressure magnetic Compton scattering experiments are possible on ID15.

The technical objective of this proposal was to implement high pressure magnetic Compton scattering measurements on ID15a. This project has been made possible by the recent development of high energy x-ray beam focussing on ID15. Furthermore, we have recently obtained a research grant to help with the instrumental development that is needed for these experiments. Spin polarised Compton scattering provides a direct method of measuring the spin moment and has proved a useful technique in understanding the

magnetic properties of many materials. Furthermore since the profile samples all spin polarised electrons in the system, it is a useful corollary to spin polarised electron structure calculations. In the experiment we tried to use a lens system to focus the beam to a spot ~30 by 30 microns. However, the system could only take an incident beamsize of 1 by 1 mm. It became apparent that the gain achievable by focussing was negated by the attenuation in the material of the lenses: a substantial number were required in order to focus the 170keV beam required for this experiment. Further measurements were made without the lenses.

During this experiment, we chose to use Fe_3Pt for our test sample. This was chosen for technical reasons: it has a large spin moment; the measurement can be made at room temperature; the Pt x-ray fluorescence from the sample enables straightforward alignment of the apparatus. In figure 1, data taken using the pressure cell are presented. Here, a sample of approximately 300x300x100 μm was used, edge on to the incident beam. This geometry was chosen to maximise the effective sample volume on the basis that the incident beam would be focussed to smaller than 100μm. However, as described above, the focussing was not useful in this experiment, and was not used when collecting the data presented in figure 1. These data represent approximately 12 hours of data collection, and agree very well with previous data, taken using a bulk sample on a conventional setup. Clearly, the data do not have the statistical accuracy of the previous data. However, the we expect to obtain better quality data during experiments, and we would not expect to match the statistics obtained on bulk samples. Even data of this quality would be sufficient to enable us to comment on changes in the high pressure phase. We are therefore very optimistic that the method will be successful.

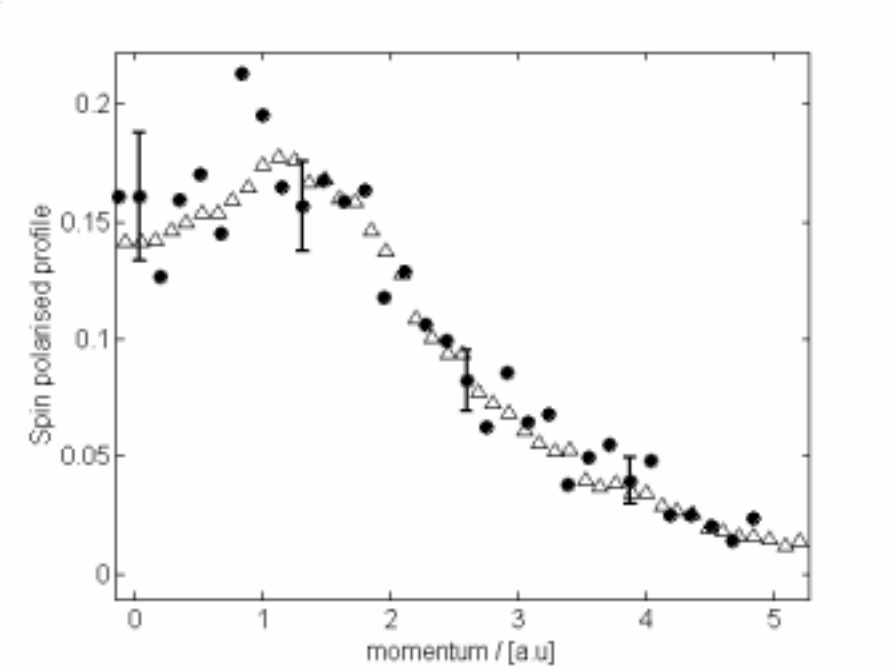

Figure 1. Spin density of Fe_3Pt, measured on ID15. Triangles represent our previous bulk measurement. Circles represent a measurement made in our pressure cell, albeit at ambient pressure, during experiment HE-1580.