



<b>Experiment title:</b> High resolution Compton scattering study of high temperature superconductors	<b>Experiment number:</b> HC-581	
<b>Beamline:</b> ID 15-BL25	<b>Date of experiment:</b> from: 10 April 96 to: 18 April 96	<b>Date of report:</b> 30.08.96
<b>Shifts:</b> 21	<b>Local contact(s):</b> Thomas Buslaps	<i>Received at ESRF:</i> 20 SEP 1996

**Names and affiliations of applicants (\* indicates experimentalists):**

Manninen\*, S. and Hamalainen\*, K., University of Helsinki, Department of Physics, Helsinki, Finland

Cooper\*, M. J., Dixon\*, M. and Lawson\*, P. K., University of Warwick, Department of Physics, Coventry, U.K.

Cardwell, D. A., IRC in Superconductivity, University of Cambridge, Cambridge, U.K.

---

**Report:**

The basic electronic properties of high temperature superconductors  $\text{YBa}_2\text{Cu}_3\text{O}_7$  (YBCO) and  $\text{Bi}_{1.6}\text{Pb}_{0.4}\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_{10-x}$  (BiSCO) have been studied using high resolution Compton scattering. Both polycrystalline and single crystal samples have been used and measurements have been made at 100 K and 50 K. The samples were made and characterized at the Interdisciplinary Research Center in Superconductivity (IRC), University of Cambridge.

First measurements on polycrystalline YBCO samples were made to repeat an earlier experiment by Priftis et al. [1] who found surprising y large differences in the Compton profiles, measured below and above the transition temperature. Although both low resolution (solid state detector) and high resolution spectrometers were used, the observed Compton profile were the same within the statistical error. Also the use of the single crystal samples gave the same result; no temperature effect was found . This can be seen in Fig. 1, where the Compton profile differences (J(50 K) - J(100 K)) in BiSCO (measured with solid state detector) and YBCO (measured with crystal spectrometer) are shown.

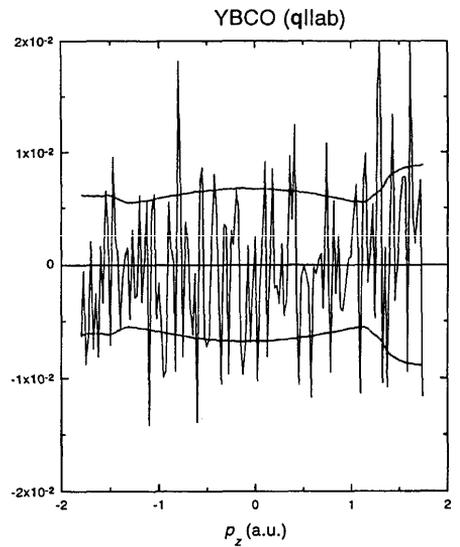
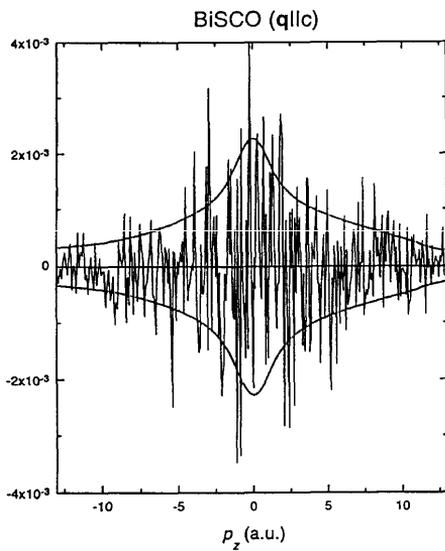


Figure 1.

The present experiment was mainly designed for the anisotropy study of the electron momentum distribution in high temperature superconductors. For that purpose YBCO and BiSCO single crystals were measured at two temperatures (50 K and 100 K) with the scattering vector parallel to the c-axis and in the basal (a-b) plane. The anisotropy and the possible temperature dependence is expected to identify whether the superconducting wave function is s or d-like in nature and give information about the Fermi surface features. Compared with the results obtained using other techniques, like angular correlation in positron annihilation and photoemission, Compton scattering is not sensitive to various sample dependent effects. The anisotropy was measured using both solid state detector (high statistical accuracy but lower resolution) and crystal spectrometer (high resolution but lower statistical accuracy). In order to obtain full information the observed anisotropy has to be compared with a proper band structure calculation. This calculation is in progress and the results being prepared for publication.