



**Experiment title:** Measurement of momentum space densities of  $\text{Cu}_{1-x}\text{Al}_x$  by means of high resolution Compton scattering

**Experiment number:**  
**HC321**

**Beamline:**  
BL 25

**Date of Experiment:**  
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**Shifts:**  
18

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**Report:**

We performed measurements of directional Compton profiles  $J(p_z)$  on Cu and  $\text{Cu}_{0.953}\text{Al}_{0.047}$  for  $\vec{q} \parallel [100]$ ,  $[110]$  and  $[111]$ , respectively, at the scanning Compton spectrometer of BL 25.

For each spectrum we scanned 360 data points in an energy range from 41 – 53 keV at an incident energy of 58 keV, representing the intervall  $-11 \text{ au.} \leq p_z \leq 8 \text{ au.}$  in momentum space.

The number of counts of the directional Compton profiles was as follows:

	$\vec{q} \parallel [100]$	$\vec{q} \parallel [110]$	$\vec{q} \parallel [111]$
Cu	$3.2 \times 10^7$	$3.0 \times 10^7$	$3.1 \times 10^7$
$\text{Cu}_{0.953}\text{Al}_{0.047}$	$3.6 \times 10^7$	$3.5 \times 10^7$	$3.5 \times 10^7$

One part of the Compton profiles ( $-2.5 \text{ a.u.} \leq p_z \leq -1 \text{ a.u.}$ ) is spoiled by a parasitic(551) reflection of the analyzer crystal.

Figure 1 shows the difference of the directional Compton profiles of Cu and  $\text{Cu}_{0.953}\text{Al}_{0.047}$  for  $\vec{q} \parallel [100]$ .

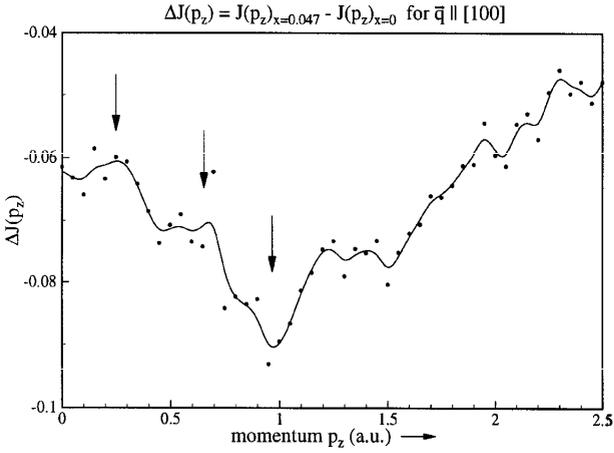


Figure 1:  
Compton profile difference in  $\text{Cu}_{1-x}\text{Al}_x$   
for  $\vec{q} \parallel [100]$ .  
 $\Delta J(p_z) = J(p_z)_{x=0.047} - J(p_z)_{x=0.00}$

Theoretical Compton profile differences are available by KKR-CPA calculations performed by S. Kaprzyk (to be published). Fig. 2 presents the calculated Compton profile difference for  $\vec{q} \parallel [100]$ . The experimental profile difference follows the general shape of the theoretical curve (see arrows) whereas the peak at  $p_z = 0.6$  au. in the calculated profile difference decreases to a shoulder in the experimental curve.

In order to improve the significance of the results with respect to Fermi surface parameters, we intend to measure Compton profiles for additional directions of  $\vec{q}$ , providing the possibility of a full 3dimensional reconstruction of the momentum space density.

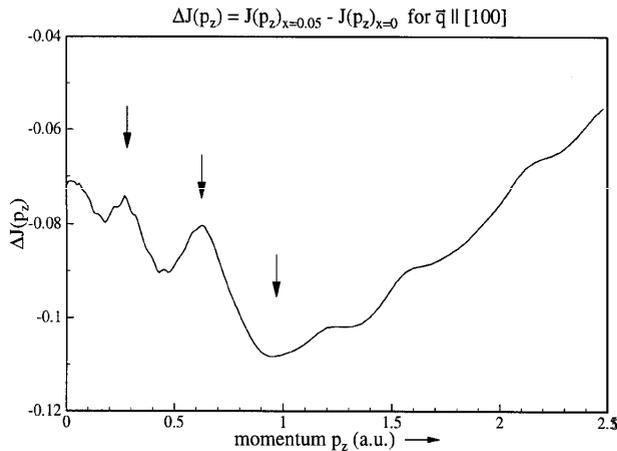


Figure 2:  
KKR-CPA calculation of the Compton profile difference in  $\text{Cu}_{1-x}\text{Al}_x$  for  $\vec{q} \parallel [100]$ , convoluted with the experimental resolution of 0.1 au.