ESRF	**Experiment title:** High Resolution Compton Scattering Study of Be	**Experiment number:** HE-208
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Report:

We measured the Compton profiles of four different Be single crystals for different energies and different crystal orientations. The aim of the experiment is to gain better understanding of different processes that are important for the explanation of Compton profiles. Namely, electron-electron correlation, crystal effects, breakdown of impulse approximation, final state effects and multiple scattering.

The data was collected at the inelastic scattering beamline ID16 by using the medium energy resolution set-up with overall energy resolution of 1.8 eV. The radiation from two undulators operating simultaneously was monochromatized with Si111 pre-monochromator. No optical elements were used to focus the beam. The radiation scattered from the sample was analyzed with Rowland circle spectrometer utilizing Sill1 spherically bent crystal close to backscattering geometry to minimize the source size effects. The momentum resolution is mainly determined by the size of the spherically bent analyzer crystal and by slitting it down we were able to reach up to 0.01 a.u. of momentum resolution.

The Compton profiles were measured by keeping the energy of the scattered photons fixed while scanning the incident energy. The advantage of this technique is that the complicated energy dependent corrections for the analyzer are constant. The drawback, however, is that while the incident energy is scanned the undulator gap has to be adjusted accordingly because the harmonic is not broad enough. Furthermore, the intensity profile at the sample can vary dramatically when the energy is tuned away from the undulator peak. Therefore, both undulator gaps were synchronously adjusted while changing the incident energy. This procedure turned out to work satisfactory and we were able to normalize the data.

During the experiment we measured the Compton profiles using Si 444, 555 and 777 reflections corresponding to Compton peak energies of about 8, 10 and 14 keV. We do not see any dramatic change in the profiles between these energies suggesting serious deviation from the impulse approximation. We have recently measured the same Compton profiles at 30 keV and 50 keV at ID15B and careful data analysis to study the energy dependence is in process. We also measured the Compton profile along c-direction from “thin” and “thick” crystal in order to study the effect of multiple scattering. The profiles, however, looked very much identical suggesting that the multiple scattering cannot explain the observed smearing of the Fermi surface.

The figure on the left shows an experimental Compton profile along one of the principal directions compared with theoretical calculation based on KKR-method. The overall agreement is extremely good. The figure on the right shows the anisotropy in comparison with the calculation. The main features in the anisotropy are well explained by the calculation but the observed amplitude is evidently less. The structure at 1 a.u. is due to the Fermi break and is the significantly smeared in the experimental data. Presently there is vast theoretical interest and several experimental studies in process to explain the observed anomaly.