ESRF	**Experiment title:** EFFECT OF MULTIPLE SCATTERING ON COMPTON PROFILES	**Experiment number:** *HE60*
Beamline: ID15B	**Date of experiment:** from:01.10.96 to: 04.10.96 and 13.12.96 to 16.10.96	**Date of report:** *28.02.97*
Shifts: 15	**Local contact(s):** P. Suortti, T. Buslaps and A. Shukla	*Received at ESRF:* 1 0 MAR. 1997

Names and affiliations of applicants (* indicates experimentalists):

Hani Kouba, LMCP, Universite Paris 6, Paris, France
Christophe Bellin, Universite Paris 6, Paris, France
Genevieve Loupias, Universite Paris 6, Paris, France

Alexandre Simionovici, ESRF
Abhay Shukla, ESRF
Thomas Buslaps, ESRF

Report:

Measurements have been performed during two periods (October and December), using the high resolution spectrometer. The scattering angle was settled at 161" and the energy of monochromatized beam was equal to 57.7 keV.

We have measured samples of different thicknesses and with different angles for the incoming photons, with respect of entrance surface (designated by symmetric and asymmetric geometries in the proposal) and on different samples (silicon, a:Si and germanium). Nevertheless, in order to obtain a correct statistical accuracy, we have just begun the study of Multiple Scattering (MS), as a function of sample shape.

The main aim of the proposal was to check the multiple scattering profile in the conditions of an usual Compton measurement, using the BL 15B spectrometer, because of the very important effects due to the polarization of scattered beam Bragg analyzed trough a crystal (J. Chomilier, G. Loupias & .I. Felsteiner, NIM A235, 603 (1985) and .I. Felsteiner & F. Bell, Symposium on Fermiology and CP, Krakow (1993)). At least for the moment, we have no way to discriminate the photons multiply scattered. As a consequence, when we are processing the data, in order to lead to a "true" Compton

profile i. e. due to single processes, we have to remove the profile due to multiple scatterings (MS) from the experimental profile. This MS profile is obtained by a Monte-Carlo simulation, but under a lot of assumptions.

During the experiments HE 60, several quantities have been taken under consideration:

*** crystallinity of the material,** in order to evaluate the ratio of elastic processes ***versus*** inelastic ones. It is for this reason that we have decided to measure **silicon samples,** both **single crystal and amorphous** powdered samples. At the early time, we have done the following assumption: in the case of photons scattered more than one time, by elastic and/or inelastic processes, the probability for a crystal to fulfil1 Bragg conditions is low compared to the probability for a photon to be elastically scattered by an amorphous sample. This assumption leads to a very low (even zero) probability to find photons elastically scattered in a single crystal sample. The experiments performed last fall at ESRF (HE 60) must be able to help us.

*** effective path of photons in the material,** scattered more than one time, is dominated by the absorption cross-section. We have measured Compton profiles, on the same material, but with specimens of **different thicknesses,** 0.3, l.0mm and up to 4mm. Nevertheless, in order to maintain a convenient resolution of the focusing spectrometer, we have increase the effect of photoelectric absorption by using **germanium** samples which has the same structure than silicon but an higher Z.
In addition, the outgoing scattered electron path is different for different orientations of the sample with respect of incoming beam: we have measured the same silicon single crystal sample, using **2 different orientations.**

*** different shapes of the sample** allow different stories for the photons scattered more than once. We have done only 2 experiments (square and rectangular samples with respect of the same beam spot). It is almost hopeless to have enough information to check new Monte-Carlo simulation: our previous simulation assumes a cylindrical shape of the sample.

If the assumptions done in the Monte-Carlo simulation, taking care of the geometry of the BL 15B focusing spectrometer, the results of HE 60 experiments must give us the same “true” Compton profile for the material after subtraction of the corresponding MS profile whatever are the values of the different parameters (thickness, crystallinity and orientation with respect of beam), as far as we have get rid of all experimental corrections (background subtraction, absorption in the sample, air, etc...)

We have, in first, processed the data in which the assumptions are less hazardous, i.e. in amorphous samples (we are considering the elastic and inelastic cross-sections), the results are “stable”. “Stable” means that we have the same “true” Compton profile, whatever is the sample thickness.
For the moment, we are processing all the other data and, at same time, simulating the MS profiles, for the different geometries of the sample.