Statement of Intent

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Experiment: Compton Scattering

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The Statement of Intent should address the following four points about the experiment you are about to undertake:

1. What is the aim of the experiment?
2. What measurements will be made and how?
3. How will the final result be obtained from the experimental data?
4. What are the main safety concerns with the experiment and precautions that should be taken?

The statement should be reviewed by a member of staff before you begin the experiment.

1. The aim of this experiment is to show relate theoritcal data for compton interaction to experimental results in the context of compton scattering and its related relativistic theory.

2. Measurements will be made in two sections. The first measurements will be made using a Caesium 137 source protected by lead, a scattering source will be placed directly in front of the aperture, with the aperture only being used when the source is in use. A NaI detector placed on a swing arm will be pivoted about the point where scattering sample is placed. The swing arm is first set to 20 degrees with the aperture then opened and spectra is recorded until 10,000 net counts are obtained under the photopeak.
Then for 5 degree increments between 20 and 90 the energy of the scattered gamma ray is recorded.

For the second section of the experiment for an array of different sources the compton edge and photopeak were measured. Each sources is placed in on the detector and measured until a clear spectrum is obtained here it's possible to identify compton edge and photopeak energies.

3. Firstly the energy data is plotted against 1 - cos(angle) along with theortical prediction, a straight line should be observed from this. Then from this straight line of best fit the slope and y intercept needs to be determined.

For the second section of the experiment investigation the photopeak is plotted against the compton edge and fitted with a line using the equations outlined in the lab manual the rest energy for an electron is determine this is then plotted against the various sources used to compare classical and relativistic interpertations of compton scattering and the differences between them.

By the end of the experiment there should be a succesfully plotted linear relationship between scattering angle and energies with comparison to theortical model. Then the data is used to show relationship between differential cross section and angles of scattering, again comparing with the theortical model.

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Second area of the experiment is related to the energy momentum relationship as described by relativity. Comparing the rest energies of the electron in a classical and relativistic context. By doing this it should it should show the change in rest mass (increases) as Compton edge also increases. The relativistic result should produce a rest mass that is in and around a constant value (taken into account uncertainties). Finally energy momentum relation is confirmed in the relativistic context by plotting energies against relativistic velocities. Demonstrating a dependence on momentum, total electron energy and Lorentz factor.

4. For this experiment there needs to be a substantial amount of care when dealing with radioactive sources all precaution and protective equipment should be used in the lab environment at all times when conducting this investigation.