Department of information technology and Media
Börje Norlin

ET072G: PROJECT - XOP simulation

This is an individual simulation project. There is no specific scheduled laboration time, the task should be done during the course. An individual written report (one student) on the simulation project should be handed in. This report contributes to the grading of the course, it should hence be a report containing:

- *Background*
- *Description of tools*
- *Results*
- *Conclusions*

. The report should be handed in before January 25:th.

EL004A: Station 4. Simulation of radiation shielding

This station has no specific scheduled laboration time, the task should be done during the course. A written report on the simulation project should be handed in. The report can be done by a group. The report expected is a "simple report" describing the results brief conclusions. The report should be handed in before January 25:th.

MAIN TASK

You should develop you skill to be able to do radiation simulations using free softwares. Two software are to be used, "Rad Pro Calculator" and XOP.

Rad Pro Calculator

Rad Pro Calculator is found on http://www.radprocalculator.com/ , it can either be used as a web interface or downloaded as a windows application.

- Use your measurements from station 3 of unshielded activity for the Am-241, Sr-90 and Cs-137. Use the Rad Pro Calculator to calculate the dose rate (in mSv) achieved by a student that directs the source to his/hers body at a distance of 10 cm. (Use Dose-Rate\Gamma Activity and Dose-Rate\Beta Activity.)
- The maximum legal dose for a worker or student in radiation physics is 50 mSv/year. Calculate the maximum time the student can be exposed to the each of the source in the previous example. (Use Dose-Rate\Alara Calculations.)

Activity is measured in Bq, referring to counts/second. Am241 has a gamma particle with energy 59 keV. How is the intensity of Alfa-particles influenced by 10 cm air?

XOP

The simulation software XOP is a freeware for calculation of energy dependent X-ray and Gamma-ray attenuation. It can be downloaded from:
http://www.esrf.eu/Instrumentation/software/data-analysis/xop2.3
To get XOP working for Windows 7 (64 bit), unzip this file from:
http://apachepersonal.miun.se/~bornor/sensor/bin.x86.zip and replace the folder bin.x86 in your installation.

- Use XOP to calculate the attenuation achieved when shielding the Cs gamma source used in the dosimetry task in the lab course. Compare with your measurements. *The Cs-137 decay change has a gamma emission with energy 662 keV.*

- Use XOP to calculate the attenuation of the gamma contribution from the Am alfa source used in the same lab. *Am241 has a gamma emission with energy 59.5 keV. Discuss how this peak is affected by the absorption in the sensor compared to the Alfa-peaks.*
- Use XOP to achieve the attenuation graph for the three sensor materials Si, CdTe and GaAs.
- Calculate the necessary thickness of a sensor of each material that should absorb at least 10% of the gammas for Cs-137 and Am-241 gammas respectively.

Use XOP to calculate

- The spectrum of the X-ray source 60 keV and 100 keV (tungsten target)
- The spectrum of the X-ray source after a 1 mm Aluminium filter
- The spectrum of the X-ray source after a 500 µm thick silicon sensor.
- The spectrum of the X-ray source after absorbed in a 500 µm thick CdTe sensor.
- The spectrum of the X-ray source after absorbed in a 500 µm thick GaAs sensor.

Discuss how much the spectrum is distorted for each sensor material. Discuss what spectrum will actually be measured.

Save the tube output using Xtube_W\File\Write files for xop/optics and change source in XPOWER to xop/source Flux. Show Cumulative transmission Intens after oe #1.