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SIMPLE USE OF EGS4 BY EXCEL MACRO FILE

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Abstract

We make an Excel Macro file to use EGS4 easily. This file is collected a sequence of operation ,which is data input of a calculation condition and execution of calculation and data reading of result. Although calculation conditions are limited, users are able to execute EGS4 simulation without making user code by using this file. And we introduce two examples of EGS4 application. One is for development of a radiation detector. The other is an answer of question for environmental γ-ray mesurement.

1. Introduction

User code is necessary for a simulation of EGS4 code [1]. But making user code is difficult for beginners. So we think a method of EGS4 simulation without making user code. As we mainly use PC (Windows), we make an Excel Macro file for this purpose. We name this file "EGS4run.xls". We explain specifications and use of this file from the next section.

2. Specifications

We show below specifications of this Macro file.

OS : Microsoft Windows 95/98/2000
Excel 97 or 2000 installed
HDD : 3Mbyte

Ⅰ. Input data

1. geometry of detector 1. cylinder 2. slab
2. incident energy MeV unit (0.001～10.0)
3. history number
4. size of energy bin MeV unit (0.001～1.0)
5. Maximum value of energy spectrum MeV unit (0.1～10.0)
6. source direction 1. Z-axis direction 2. isotropic
7. material of detector 1.NaI 2.Si 3.Ge 4.Plastic 11. CZT 12.CdTe
8. energy resolution %(FWHM at 662keV photon)
9. incident particle -1:electron 0:photon 1:positron
10. dimension of each region cm unit
11. environmental material of every region
    5.Air 6.water 7.Al 8.Pb 9.Cu 10. Fe 0. vacuum

cylinder geometry : 5 division of R-axis direcrion and 8 division of Z-axis direction (Figure 2.)
slab geometry : 5 division of X-axis direction 5 division of Y-axis direction

4 division of Z-axis direction (Figure 3.)

12. initial position of source (X,Y, Z) cm unit from Zero point
13. region number of initial source position

Ⅱ. Output data

1. incident energy
2. energy spectrum
3. total counts
4. efficiency
5. statistical error

3. Use of EGS4RUN

1. User inputs data of conditions in worksheet for input data and excecution of calculation. (Figure 1.)
2. After input data, user puts on "Set up calculation condition" command-button.
3. User puts on " Excection of calculation" command-button, Calculation start. (Figure 4.)
4. Calculation end, (DOS window closed) user moves "Data reading of result" worksheet.
   And user puts on "Data reading " command button, data are renewal. (Figure 5.)

4. Application Examples of EGS4 Simulation

4-1. Development of radiation detector

NaI scintillation detector for environmental γ-ray measurement has high response for low energy. When dose rate is high, its linearity is wrong because of dropping counts by high counts rate. We developed the NaI detector with the filter that holes adequately to improve this weakness. We did EGS4 simulation this time with changing parameters that is kind of material, thickness of the filter, and hole size. The result of this simulation, we could choose the adequate filter without experiments.

4-2. Answer of technical question.

There is a question that why is background dose rate higher in snowing weather than fine weather. To investigate this cause we tried subtracting background energy spectrum in fine weather from in snowing weather. And we found out subtracted energy spectrum having several peaks. We assumed that this caused mainly Rn-222 nuclei being in nature and simulated energy spectrum of Bi-214 nuclei that was a daughter of Rn nuclei by EGS4.
Comparing both energy spectrum, the figure of enegy spectrum is similar each other. (Figure 6.)
As a result, we found that this assumption was right. Thus we could answer the question.

5. Conclusion

It is able to use EGS4 easily by this Excel-Macro file. When we develop radiation detector, it contributes cost and time of development. And we may answer technical questions from user speedy.

References

[1] W. R. Nelson, H. Hirayama and D. W. O Rogers, SLAC Report 265 (1985).

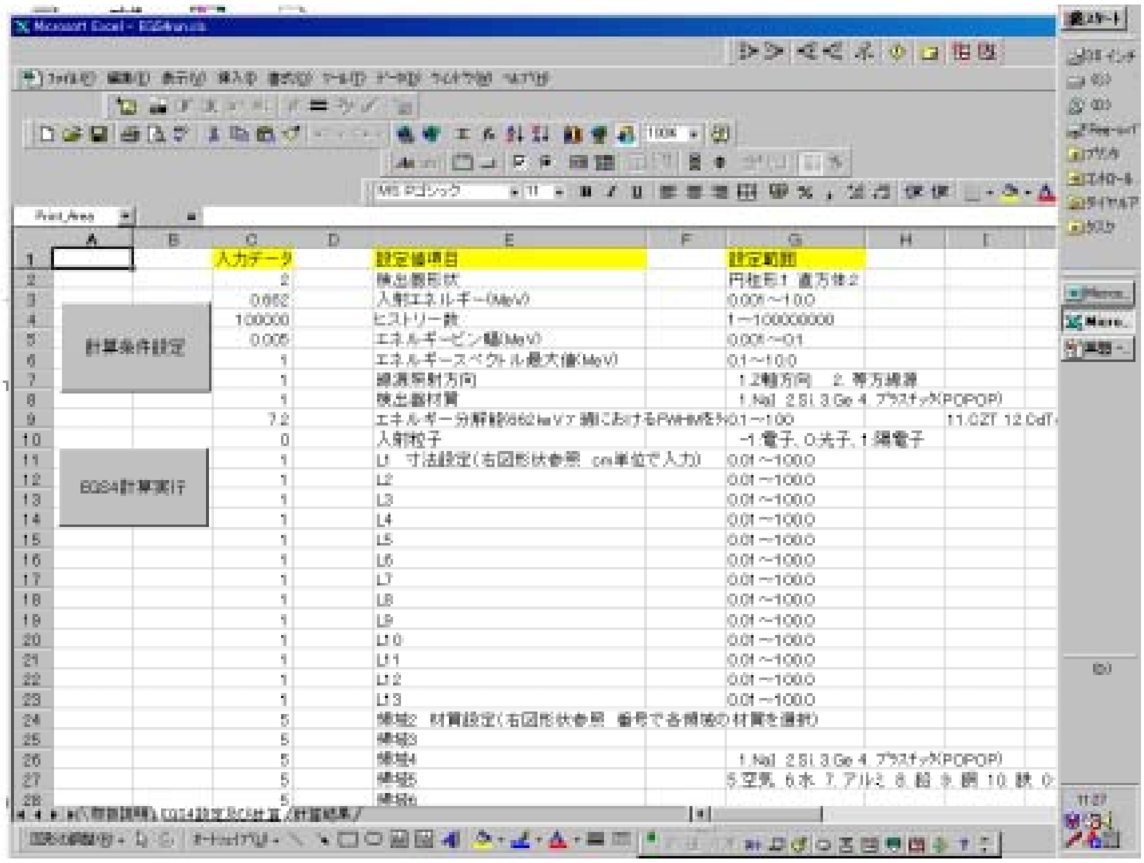

Figure 1. Excel worksheet for data input and calculation excecution (for Japanese only).

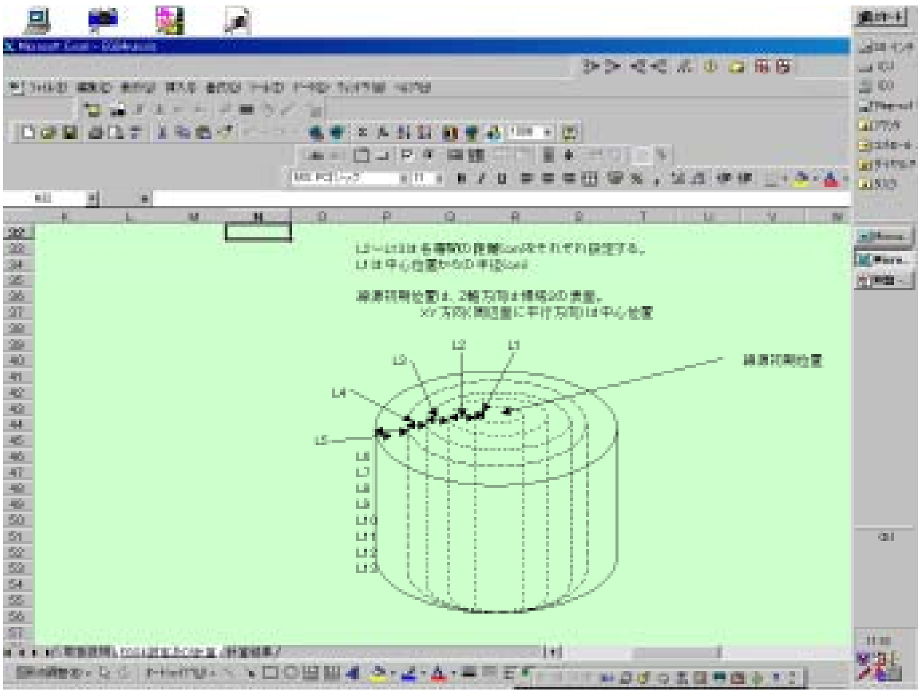

Figure 2. A schematic of cylinder geometry.

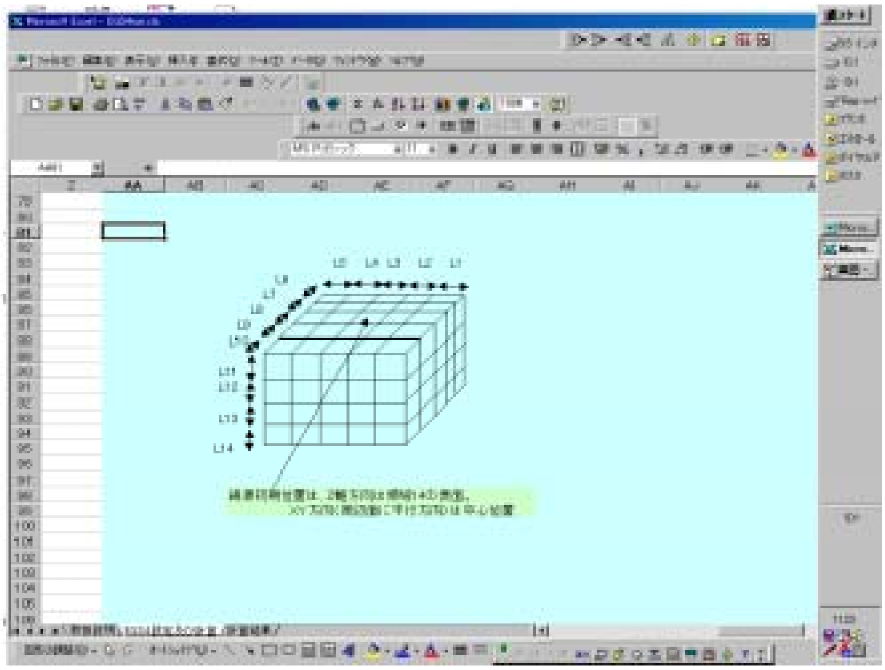

Figure 3.　A schematic of slab geometry.

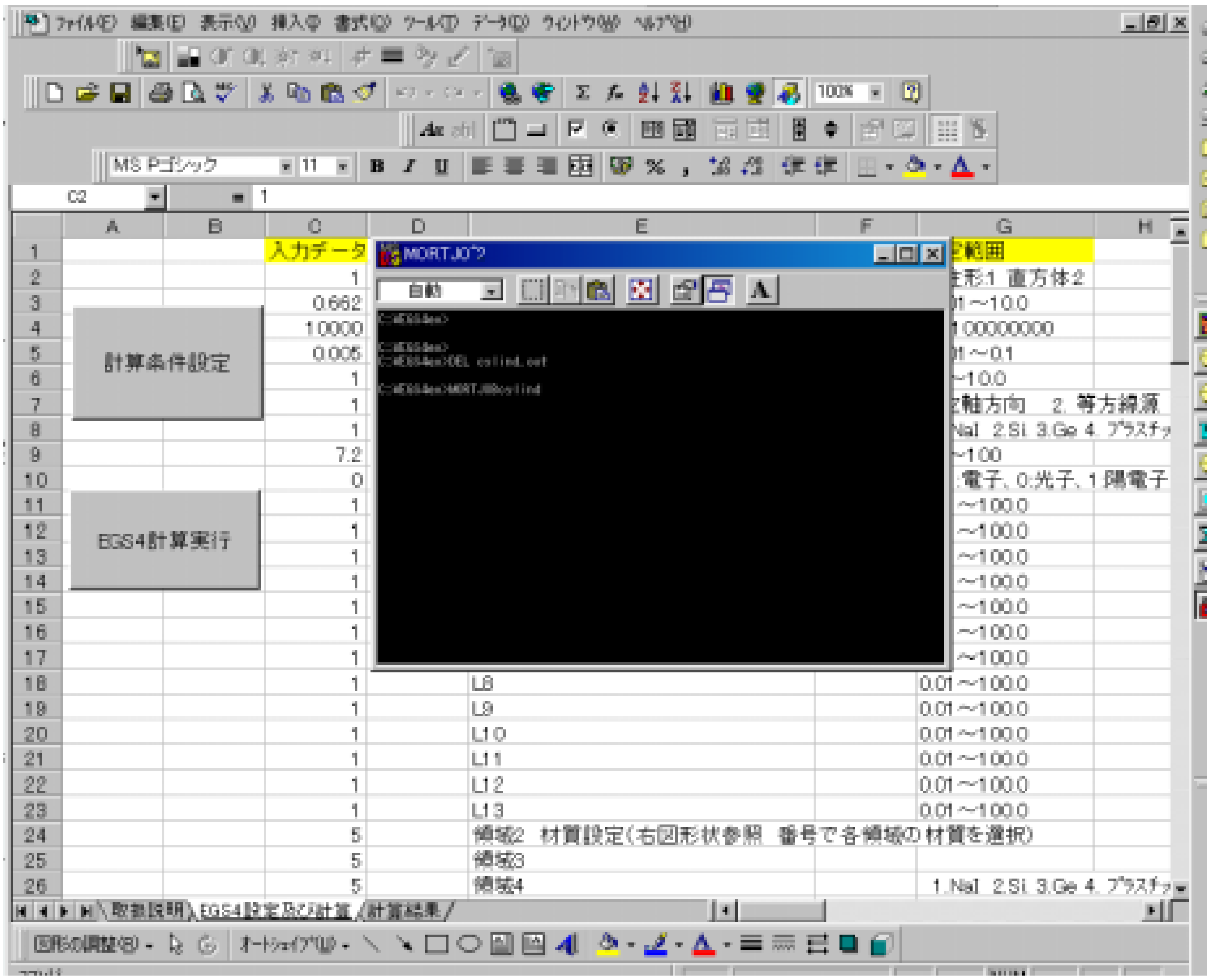

Figure 4.　A picture of Excel worksheet in calculation execution.

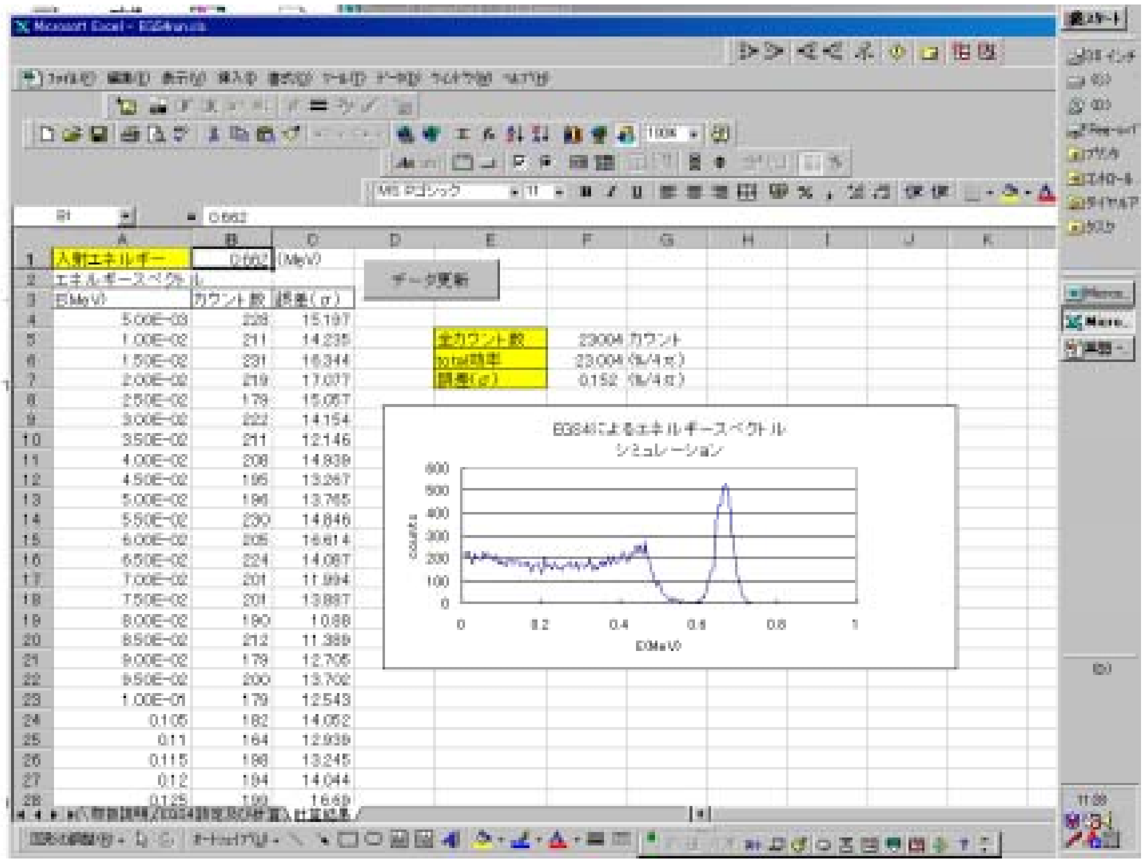

Figure 5.　Excel worksheet for data reading.

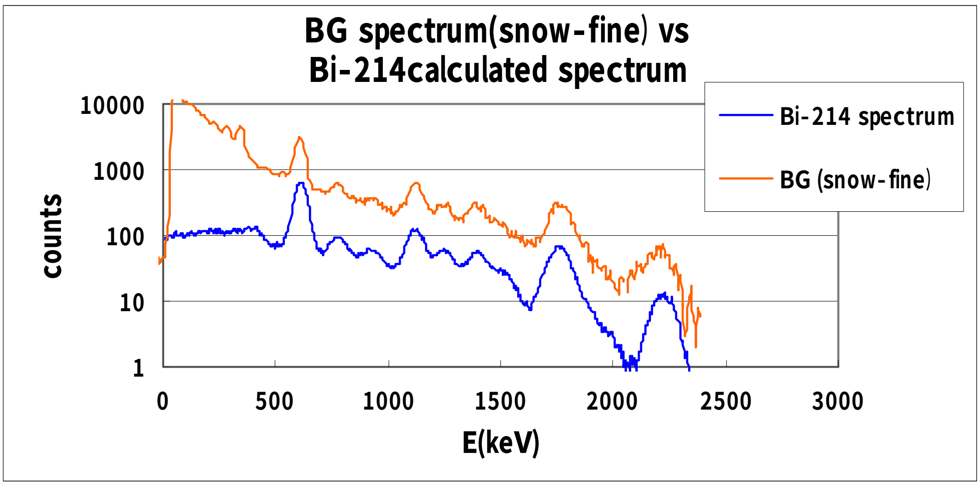

Figure 6.　BG measurement spectrum(subtracted fine weather from snow weather) and Bi-214 calculated spectrum.