

EGS4 PARTICLE TRAJECTORY AND GEOMETRY DISPLAY PROGRAM

-- CGVIEW --

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1. Introduction

In a calculation using the EGS4 code ¹⁾, it is important and convenient to check the geometry for the calculation and particle trajectory visually for validating the of calculation conditions. Also, a graphical interface is useful for understanding the interactions. For these purposes, EGS4 particle trajectory and geometry (ex, PRESTA-CG ²⁾) 3D-display program cgview is made³⁾.

2. Environment

Hardware: PC/AT-Compatible machine
OS: Windows98 or later

3. Outline of functions

3.1 Function for the geometry display

1) The following 4 kinds of geometry data are displayed:

- Spheres of co-center.
- Cylinders of co-center line.
- 3-dimensional slabs.
- CG (combinatory geometry)

2) Method of display (default is plane)

- Plane display
- Wire-frame display

3) Level of display

The following 3 levels can be specified for displaying the geometry:

- Body ...Display of each body can be turned ON/OFF with a specified color.
- Zone ...Display of each zone can be turned ON/OFF with a specified color.
- Material ...Display of each material can be turned ON/OFF with a specified color.

4) Hide a part of the geometry

By specifying a virtual box, it possible to hide a part of the geometry which overlaps with the virtual box. Please specify the minimum and maximum of x-, y- and z-directions of a virtual box. If some of them are left blank, the minimum and maximum values are automatically set from the data being displayed.

5) Axis for the display

The axis for the display can be selected from the following 4 sets. A right-hand system of coordinates is adopted:

- Z-Y... Z-axis plus in right direction, Y-axis plus for upper direction (default).

- Y-Z ... Y-axis plus in right direction, Z-axis plus in upper direction.
- X-Z ... X-axis plus in right direction, Z-axis plus in upper direction.
- X-Y ... X-axis plus in right-direction, Y-axis plus in upper direction.

6) Specification of the background color

It is possible to select the background color (default color is black).

7) Specification of the character color

It is possible to select the character color (default color is white). Characters are used in the axis, title, memo etc.

8) Correction option in specifying zones

Zone may not be properly displayed due to a numerical problem of the computer. This tends to happen when subtraction of the body is performed. To correct this, the size of the subtracting body is made bigger. The amount of correction is calculated from the following items and equation:

- Correction factor ... A correction is specified as ratio to the original length (default = 1E-6).
 - Correction value ... Specify a correction value directly (default=0.005cm).
- Corrected length = original length + original length * correction factor + correction value

3.2 Function regarding particle trajectory display

1) The following 3 kinds of particles are displayed:

- Photon (γ , x)
- Electron (e^-)
- Positron (e^+)

2) The following items can be specified:

- History region ... By inputting the upper and lower boundaries of the history, the area of history to be displayed is specified. If not specified, the minimum and maximum history numbers are automatically used. Also, by specifying the number of the last history, that number of the last part of the history is displayed.
- Line color ... Specify for each kind of particle.

Default value Photon - Yellow
Electron - Red
Positron - Blue

- Line type ... Select line type from the following 4 types for each particles: The default value is the solid line for all particles.

[Solid, Chain, Dot-chain, Double dot chain]

- Line width ... Possible to select the line width for each particle. The default is 1.
- Turn ON/OFF ... Displaying each kind of particle can be turned ON/OFF.
- Energy region ... By specifying the energy region for each kind of particle, it is possible to turn off displaying particles whose energies are outside of the specified energy region. If not specified, 0 and 1E+15 are specified as the lower and upper boundary, respectively.

3) Particle weight

It is possible to modify the line width using WEIGHT information of each particle. The width of each particle is set as the line width for each kind of particle * WEIGHT. If the WEGHT value is not written in the input data, 1 is specified for all points.

4) LATCH

It is possible to control the turning ON/OFF display by using a flag for each history. Also, turning ON/OFF latch function can be specified.

3.3 Function using mouse

The following 3 functions are related to mouse operation:

- 1) Zoom in/out ... Move mouse while pushing the right button of the mouse.

Zoom in and out by moving the mouse downward and upward, respectively.

- 2) Parallel movement ... Move the mouse while pushing both the right and left buttons or the central button of the mouse.
- 3) Rotation ... Move the mouse while pushing the left button of the mouse.

3.4 Peripheral functions

1) Functions on the displaying axis

- Turning ON/OFF of axis
- Unit of scale ... Unit of scale for the axis (default is cm).
- Interval of scale ... Interval of the scale line (default value = 1).
- Scale length ... Length of the scale line for the axis (default value = 0.25).
- Arrow size ... Arrow size at the top of the axis (default value = 1)
- Character size ... Character size for a scale label (default value = 1)
- Character space ... Character space for a scale label (default value = 5)

2) Functions on displaying a title box and memo box

It is possible to add a title box and a memo box in a displayed figure. The user inputs the contents of the box. The position of box can be changed using the mouse. (Multi-line input is allowed for the box.)

3) Functions on displaying a legend

It is possible to add a legend of particles in a displayed figure. The contents of the legend are:

- Region of history being displayed
- Line type and color for each particle

4) Functions on the printing figure

It is possible to print a figure displayed on the screen.

5) Functions on saving a figure

It is possible to save a figure displayed on the screen in a bit map file.

6) Open a DOS window

It is possible to open a DOS window from the main window of cgview.

7) Read a file in again

It is possible to read in the current data file. Specification of file name is not necessary. After an EGS4 calculation is finished, the data file can be read in again to see the calculated result. Using this function a semi-interactive use of EGS4 and cgview is possible.

8) Initialization of a specification

It is possible to clear the specifications for the display and use default values.

9) Help function

3.5 Function to create geometry data

CGVIEW can be used to help create geometry data for an EGS4 calculation. Only CG data are supported for this function. Input geometry data of the EGS4 code to CGVIEW, and check them in a 3-dimensional figure on the screen. Also, it is possible to save created data. This data can be used as a CG input file in an EGS4 calculation.

4. The relation between EGS4 and cgview

The relation between EGS4 and cgview is shown in Fig.1.

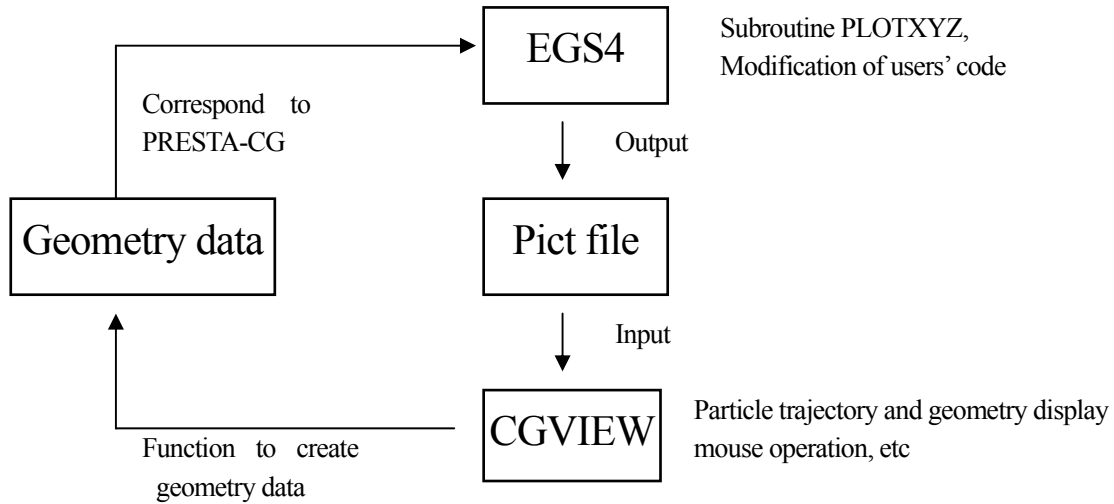


Fig. 1 The relation between EGS4 and cgview

5. Example of display

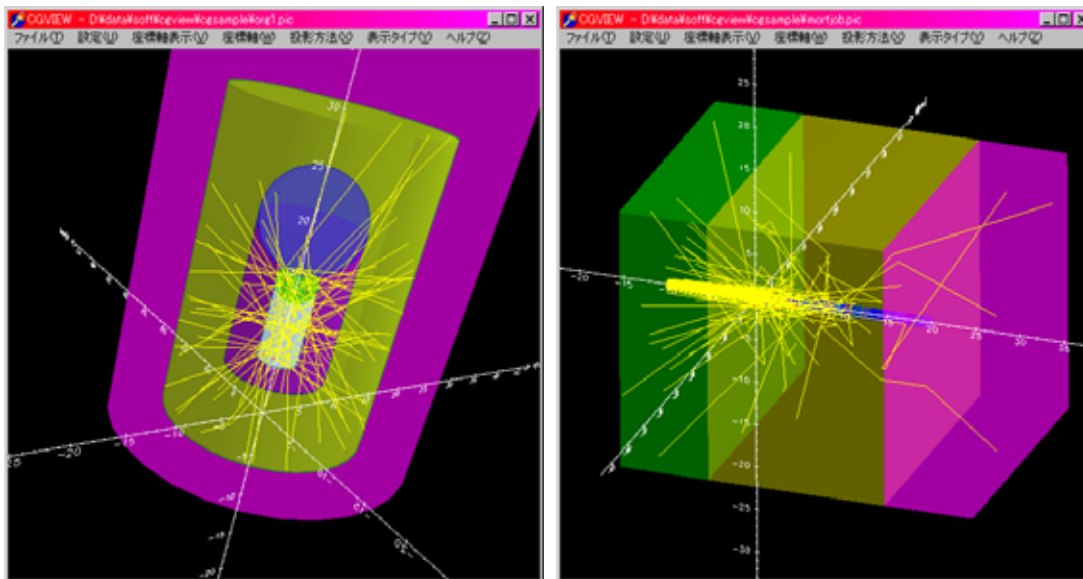


Fig. 2. Example of particle trajectory and geometry display

Example of particle trajectory and geometry display is shown in Fig.2

References

- [1] W. R. Nelson, H. Hirayama, and D. W. O. Rogers, SLAC-265, SLAC (1985).
- [2] T. Torii et al, JNC TN1410 2002-001.
- [3] Y. Namito, H. Hirayama, A. Takamura and T. Sugita, "EGS4 Particle Trajectory and Geometry Display Program cgview", KEK Internal (In press).