

# **CGVIEW**

**Particle Trajectory and Geometry Display Program**

MANUAL

Ver3.0

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## SECTION 1 Introduction

The EGS Shower Display system (CGVIEW) is used to display three-dimensional particle trajectories of electrons, positrons and photons on a windows PC. The data of particles' trajectories are calculated by using the EGS code system.

The first EGS particle trajectory display system was developed for a graphic terminal of an IBM main-frame computer. Then, EGS4\_Windows\_2 was made using the PHIGS package on a UNIX workstation. The EGS particle trajectory display system for MS-DOS PC was developed at KEK, and updated for the windows PC. However, only the cylinder and slab geometry can be displayed on this system.

It is possible to describe a complicated geometry using "Combinatorial Geometry (CG)" in the EGS calculation. The EGS Shower Display system (CGVIEW) is used to display three-dimensional particle trajectories of electrons, positrons and photons together with the geometry described in CG. It is possible to check if the geometry is properly input or not on a three-dimensional display using CGVIEW. The time to prepare the geometry may be reduced by using CGVIEW.

Sections 2 to section 10 of this report describe the computer environment, installation and operation of CGVIEW. Users can understand the function of CGVIEW by reading this part while running CGVIEW with sample data. Section 11 describes the structure of the particle trajectory and geometry data. This data is sent from EGS to CGVIEW. Section 12 describes the EGS user code used to produce this data.

## SECTION 2 Environment

- Hardware : PC/AT-Compatible machine
- OS : Windows2000/XP
- Video Card : Should work for OpenGL  
Drivers with an older version may not work for Open GL. Please download a new driver from the video card maker if the system does not run properly.
- Display color : It is recommended to use 32 bit (TRUE COLOR).  
Please use 16 bit if the system does not run.
- OpenGL : It is necessary OpenGL library(Using CGVIEW2.4). (Only Linux)  
if library is not in computer, please install MESA library(OpenGL like). URL <http://www.mesa3d.org/>

## SECTION 3 Outline of functions

### 3.1 Functions 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 is 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) Area of the display

The area of the display is automatically set using input data.

6) 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: (default Z-Y)

- Z-Y : Z-axis plus in right direction, Y-axis plus for upper direction.
- 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.

7) Specification of the background color

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

8) 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.

9) Line Width

It is Possible to Geometry Line Width. (only Wire-frame display)

10) 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 ( $\gamma$ , 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.

Photon - Yellow(Default)

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.

5) Animation display

You can be showing an animation that be split by the lifetime of particle.

### 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.

4) Specified Range

Move Mouse while pushing the shift key and right button. Zoom Out Range specified White Frame Area.

### 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

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

#### 3) Functions on displaying the memo box

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

#### 4) 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

#### 5) Functions on the printing figure

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

#### 6) Functions on saving a figure

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

#### 7) Open a DOS window

It is possible to open a DOS window from the main window of CGVIEW. (Linux is X Terminal)

#### 8) Read a file in again

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

#### 9) Initialization of a specification

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

values.

### 3.5 Function to create geometry data

CGVIEW can be used to help create geometry data for an EGS calculation. Only CG data are supported for this function. Input geometry data of the EGS 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 EGS calculation.

### 3.6 Function to check geometry data

CGVIEW can be used to help check geometry data for an EGS calculation. Input Start Position and Direction for particle. CGVIEW checks a geometry data at middle point of boundaries. if zones overlap, no define zone or outside zone's material number is not 0 then CGVIEW prints an error message.

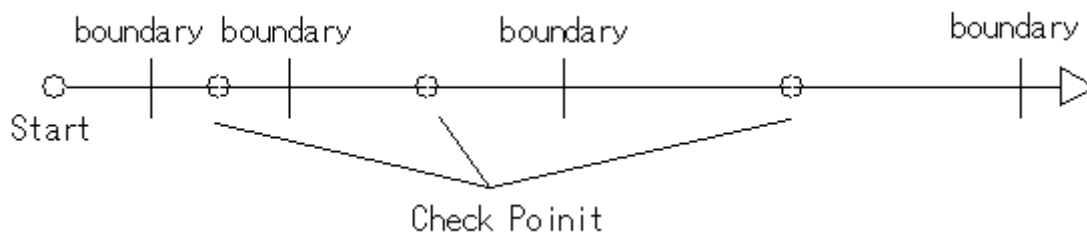


Fig. 3.6 Check Geometry

### 3.7 Function to calculate the volume of regions

It is used to calculate the volume of regions.

A particle with vertical vector is started at yz, xz and xy surface that are divided equally. The volume of region is evaluated by summing the value that multiply the length is including in the region and the area data of divided surface. The validation of values be getting by checked the three volume data and three convergence data.

## SECTION 4 Installation

### 4.1 WINDOWS System

- 1) Copy "cgview-\*\*\*-eng.zip(\*\*\* is version)" in the install medium to a folder that you want to install and unzip.

## 4.2 Linux

Using CGVIEW2.4.

## SECTION 5 Start up

The following main window appears on the screen after CGVIEW starts properly.

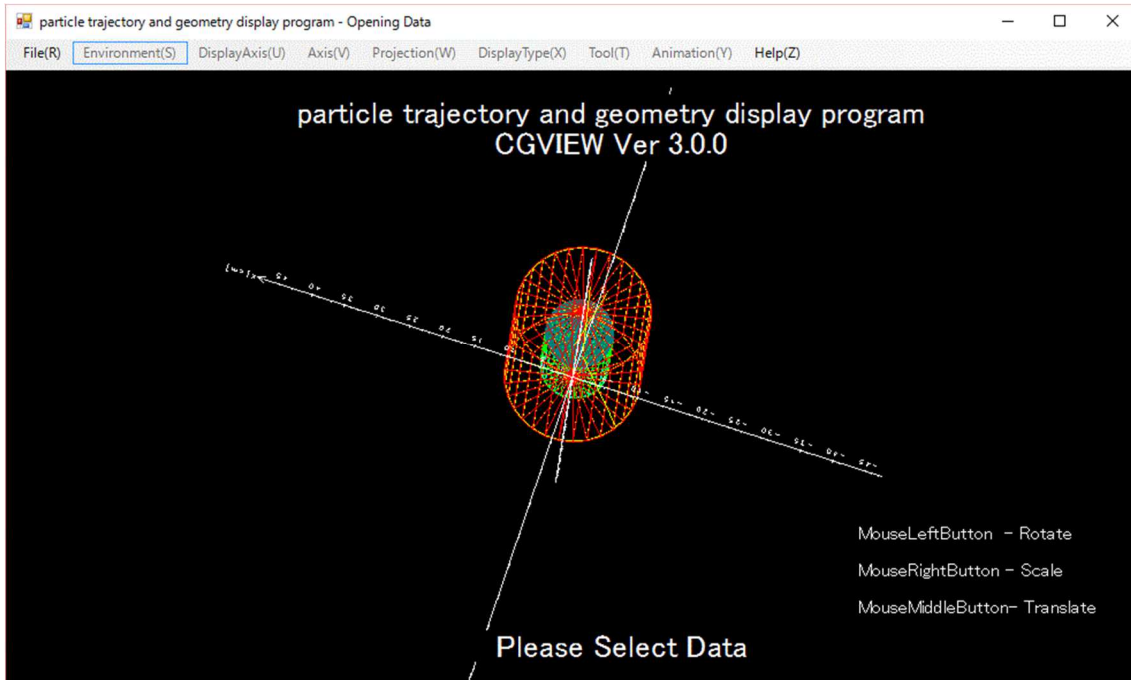


Fig. 5.1 main



## 5.1 WINDOWS System

Double click “cgview.exe” in bin folder in install folder.

## 5.2 Linux

Using CGVIEW2.4.

## SECTION 6 Basic Operation

### 6.1 Read in data file

To read in file, select [File]-[Read geometry/trajectory data] in the main menu. Then, file dialog is displayed. Specify the file to be read in.

caution)Maximum number of particle trajectory is limited to specified history number. Default is 1000.If necessary, please edit cgview.ini.

Edit) [Particle] ReadMax=1000 <-This value is Max History Number.

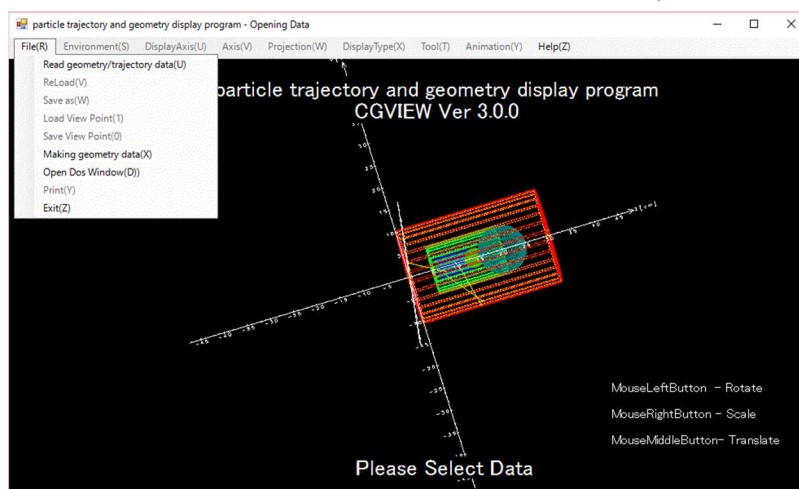


Fig. 6.1 [Read geometry/trajectory data] menu

### 6.2 Read in data file again

When the current data file is modified by an EGS calculation, it is possible to read in the current data again. To read in again, please select [File]-[ReLoad]. By using this function, the semi-interactive use of CGVIEW and EGS is possible.

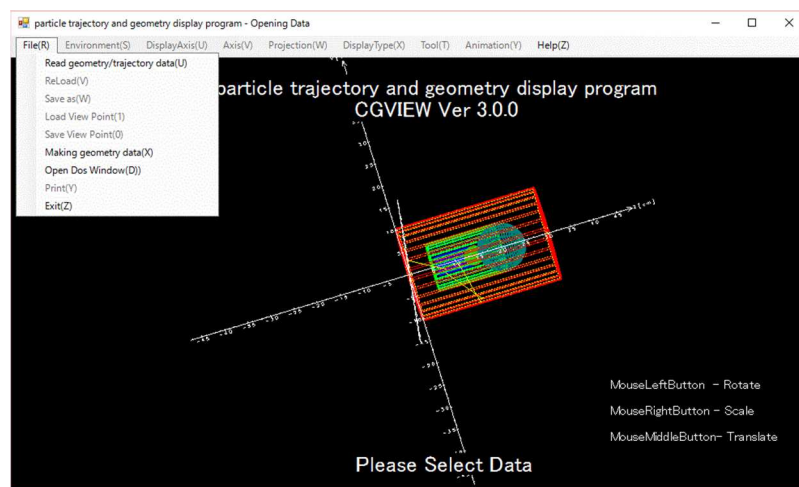


Fig. 6.2 [ReLoad] menu

### 6.3 Save displayed particle trajectory

It is possible to capture a currently displayed particle trajectory picture and save it. The file type for the saving is a bitmap (extension is bmp) or jpeg(extension is jpg). In the main menu, select **[File]-[Save as]**. Then, file dialog appears to input the file name. Input the file and click “Save”, and then the displayed picture is saved.

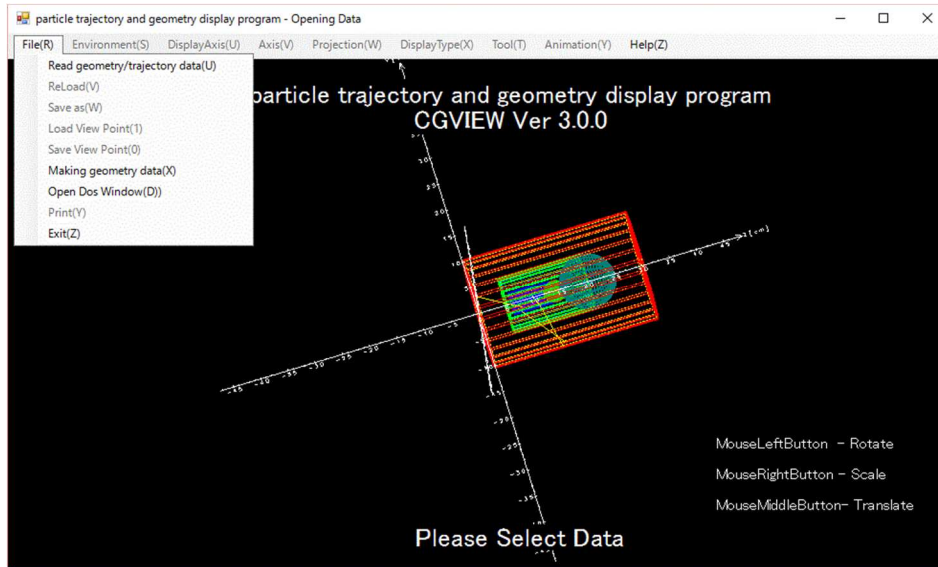


Fig. 6.3 [Save as] menu

## 6.4 Open a DOS window(Open X-Terminal Window)

When a user needs to open a DOS window to run an EGS calculation, select **[File]-[Open DOS window(Linux is Open X-Terminal Window)]** in the main menu. Then command prompt window shows up, as indicated in the lower figure.

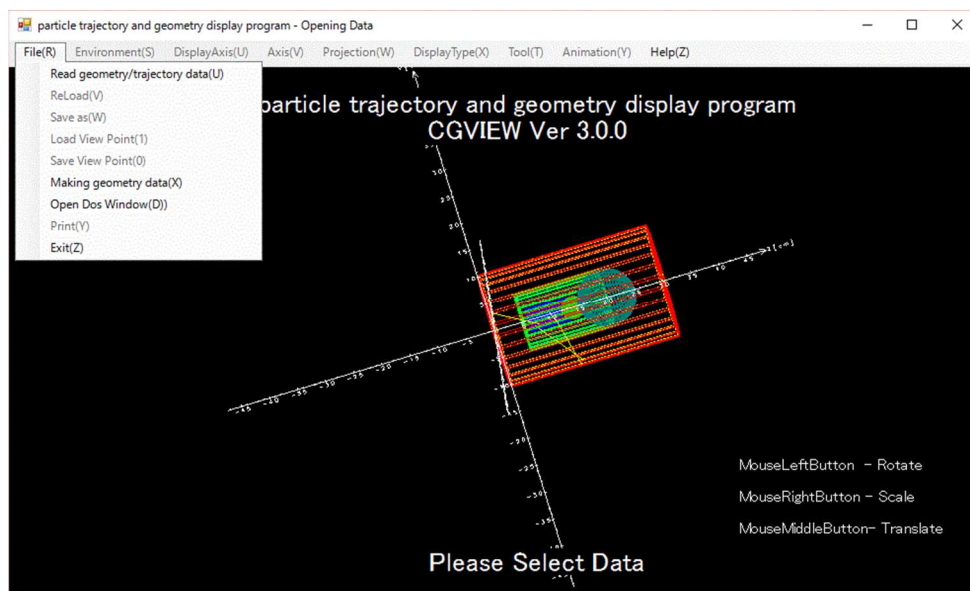


Fig. 6. 4-1 [Open DOS Window] menu

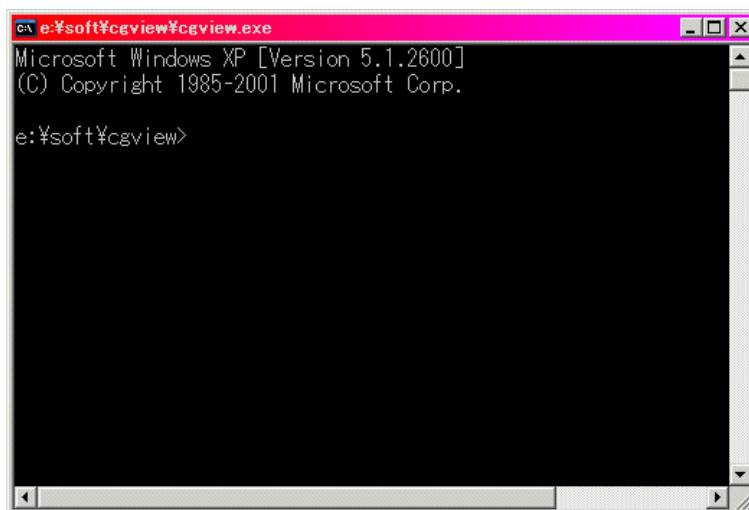


Fig. 6. 4-2 DOS Window

Here, please execute cygwin.bat. Then DOS window is changed into cygwin window and you can run egs5 which is installed on cygwin.

If your computer does not have path to a directory where cygwin.bat exists, please type in "cygwin.bat" with directory where cygwin is installed.

For example, please type in

C:\cygwin\cygwin.bat

## 6.5 Print a picture

It is possible to print a currently displayed picture of a particle trajectory and geometry. In the main menu, select **[File]-[Print]**. A dialog appears to select a printer. Select a printer and click OK. Then the picture is printed out. (Only Windows)

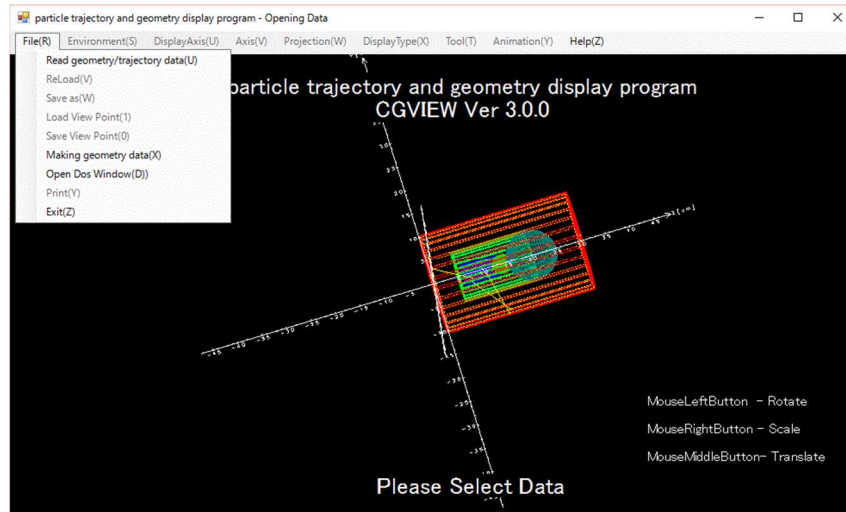


Fig. 6.5 [Print] menu

## 6.6 Indicates help on how to use CGVIEW

When a user needs to indicate help on how to use CGVIEW, select **[Help]-[Usage]** in the main menu. Then table of contents of help shows up. The user may read/print out the necessary items.

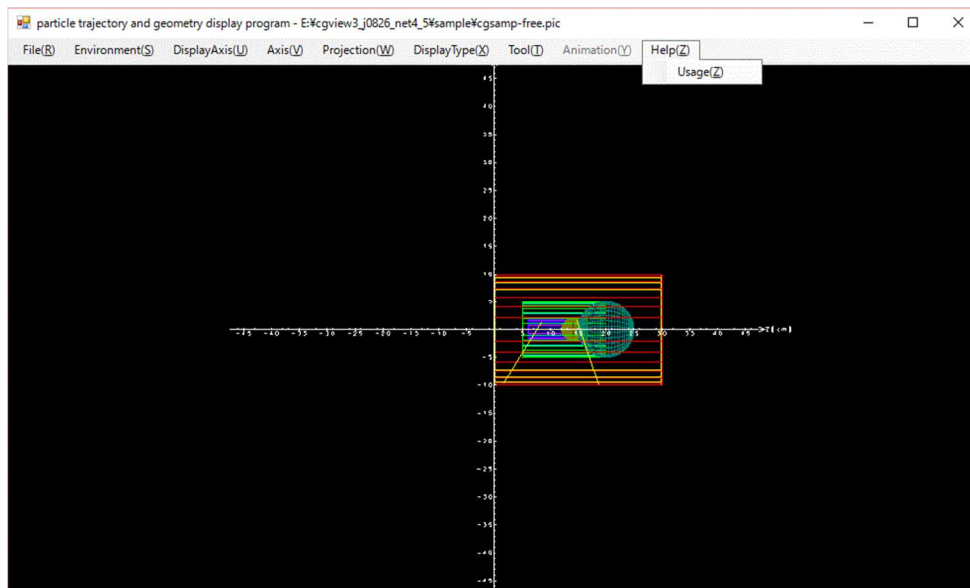


Fig. 6.6 [help] menu

## 6.7 Termination of an application

Select [File]-[Exit] in the main menu.

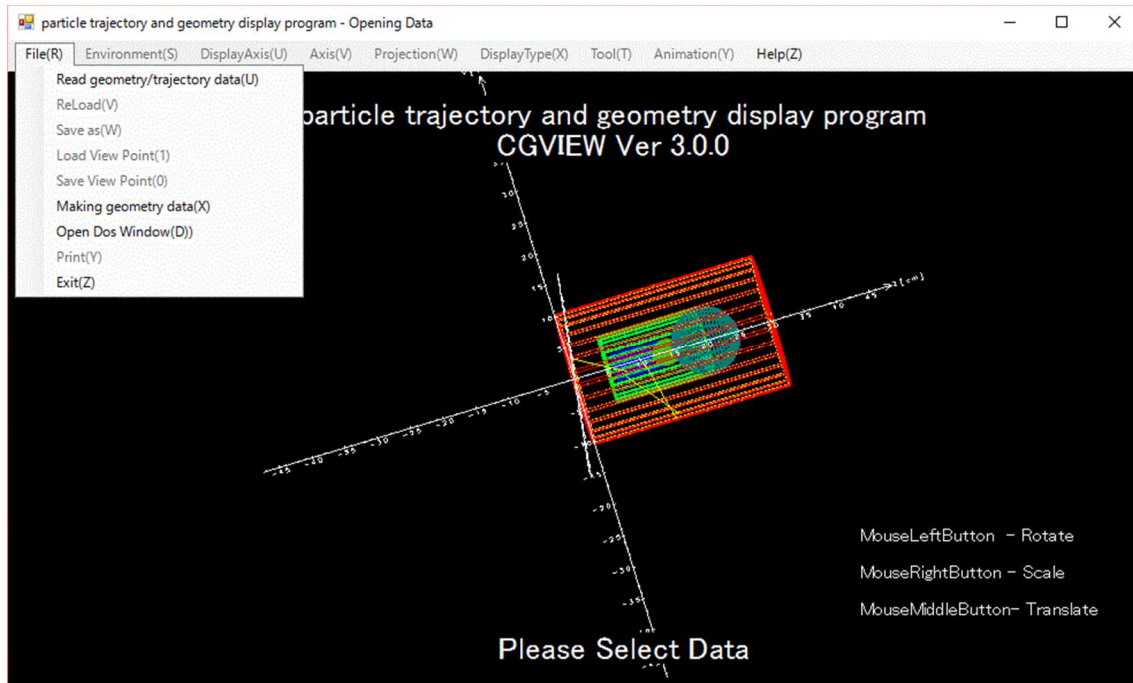


Fig. 6.7 [Exit] menu

## 6.8 Load View Points form file

Select [File]-[Load View Point] in the main menu.

## 6.9 Save View Points to file

Select [File]-[Save View Point] in the main menu.

## SECTION 7 Specification of the environment for the display

### 7.1 Turning ON/OFF the displaying axis

- Turning on the displaying axis -> Select [Display Axis]-[ON] in the main menu.
- Turning off the displaying axis -> Select [Display Axis]-[OFF] in the main menu.

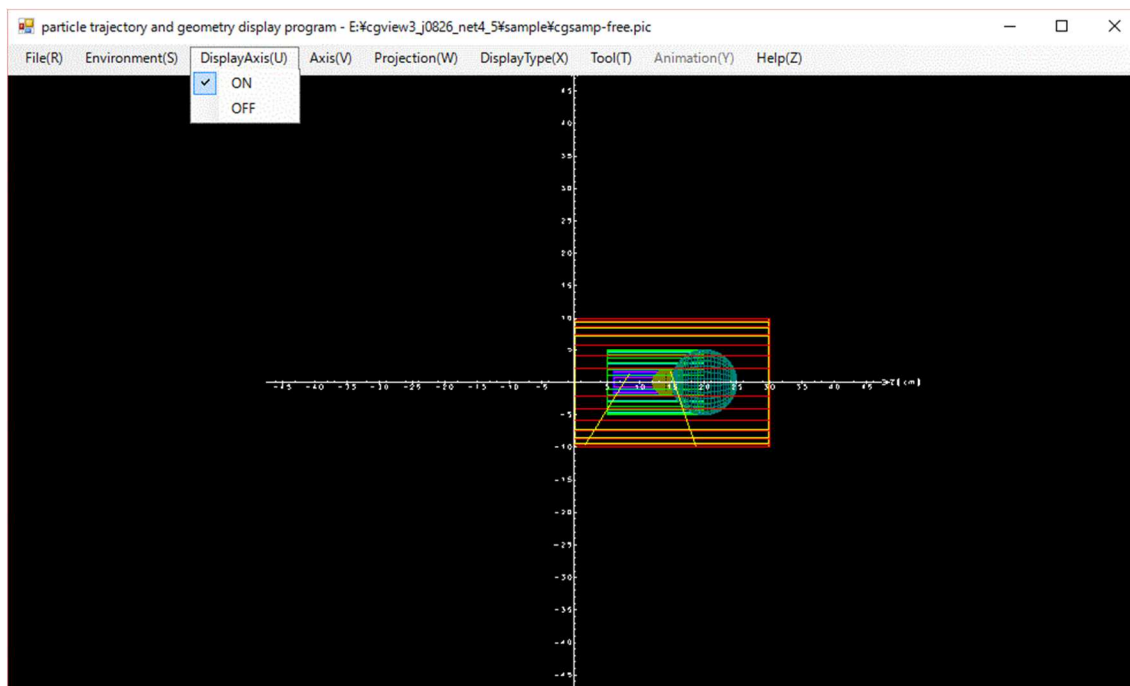


Fig. 7.1 [Display Axis] menu

### 7.2 Changing the displayed axis

By specifying the axis, the eye point is moved and the direction of the displayed coordinate is changed.

- Z-axis plus in the right direction, Y-axis plus in the upper direction in the window

-> Select [Axis]-[Z-Y] in the main menu

- Y-axis plus in the right direction, Z-axis plus in the upper direction in the window

-> Select [Axis]-[Y-Z] in the main menu

- X-axis plus in the right direction, Z-axis plus in the upper direction in the window

-> Select [Axis]-[X-Z] in the main menu

- X-axis plus in the right direction, Y-axis plus in the upper direction in the window

window

-> Select [Axis]-[X-Y] in the main menu

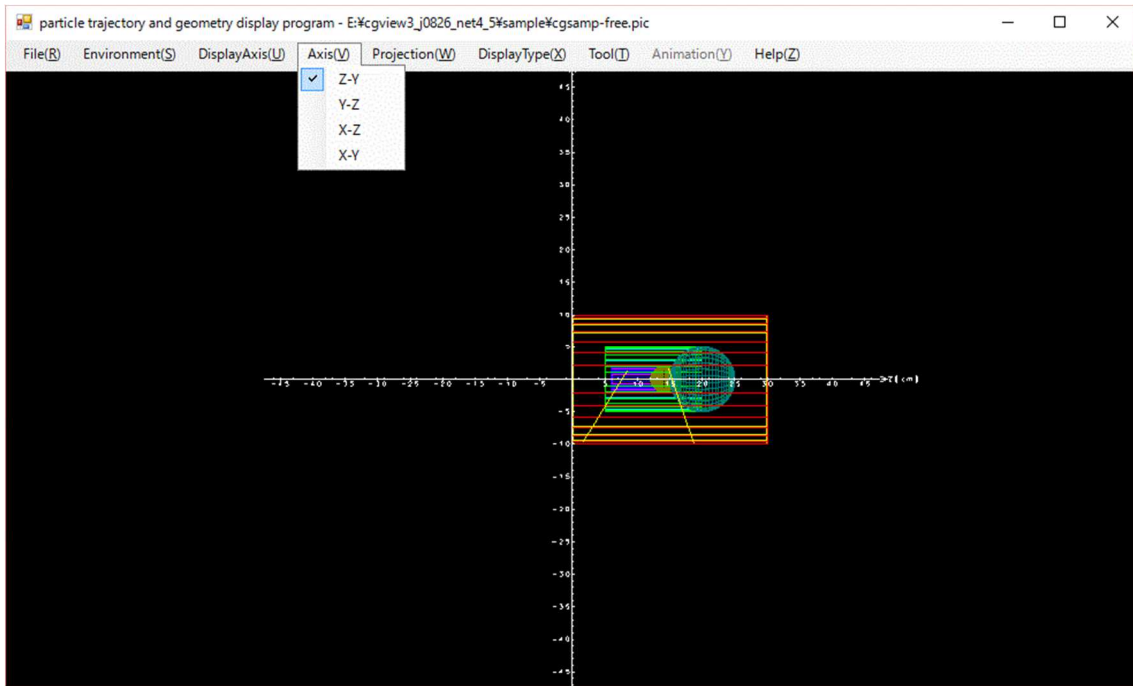


Fig. 7.2 [Axis] menu



### 7.3 Changing the projection type

The following two types of projections can be specified:

-Ortho

Projection lines toward the projection plane are parallel. Bodies at far points and near points are indicated using the same size.

Select **[Projection]-[Ortho]** in the main menu to specify this type.

-Perspective

Projection lines from the object converge at the eye point. Just as people see things, a body at a far point is indicated as being smaller and a body at a near point is indicated as being larger. The user can feel the perspective.

Select **[Projection]-[Perspective]** in the main menu to specify this type.

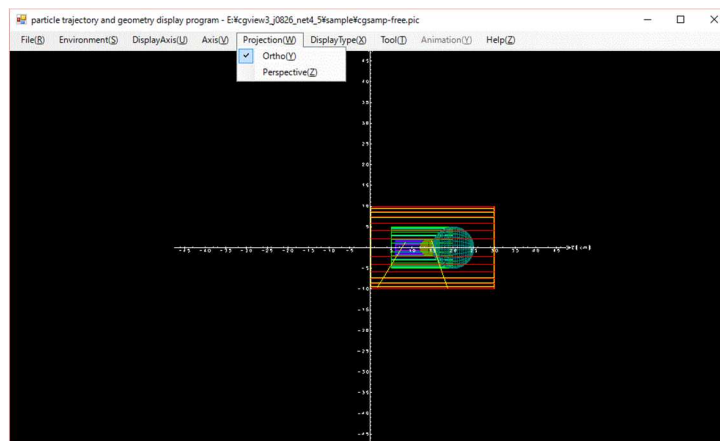


Fig. 7.3 [Projection] menu

### 7.4 Changing the geometry display type

The geometry display type can be changed.

- Polygon ... Select **[Display Type]-[Polygon]** in the main menu.

- Wire frame ... Select **[Display Type]-[Line]** in the main menu.

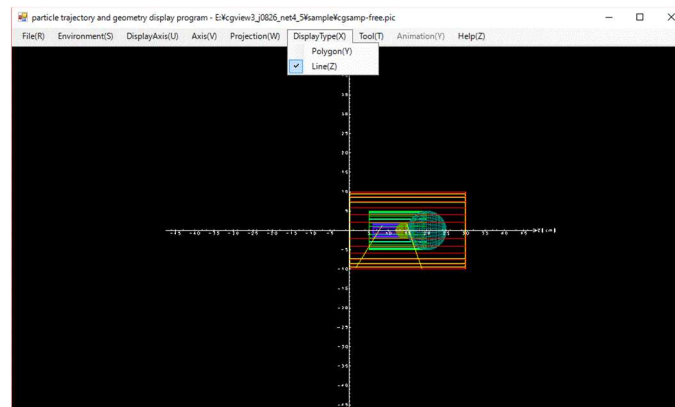


Fig. 7.4 [Display Type] menu

## 7.5 Tool menu

Can do OPENGL view information store, return.

### 7.5.1 OPENGL view information store

Current viewpoints can save any Slot10 from Slot1.

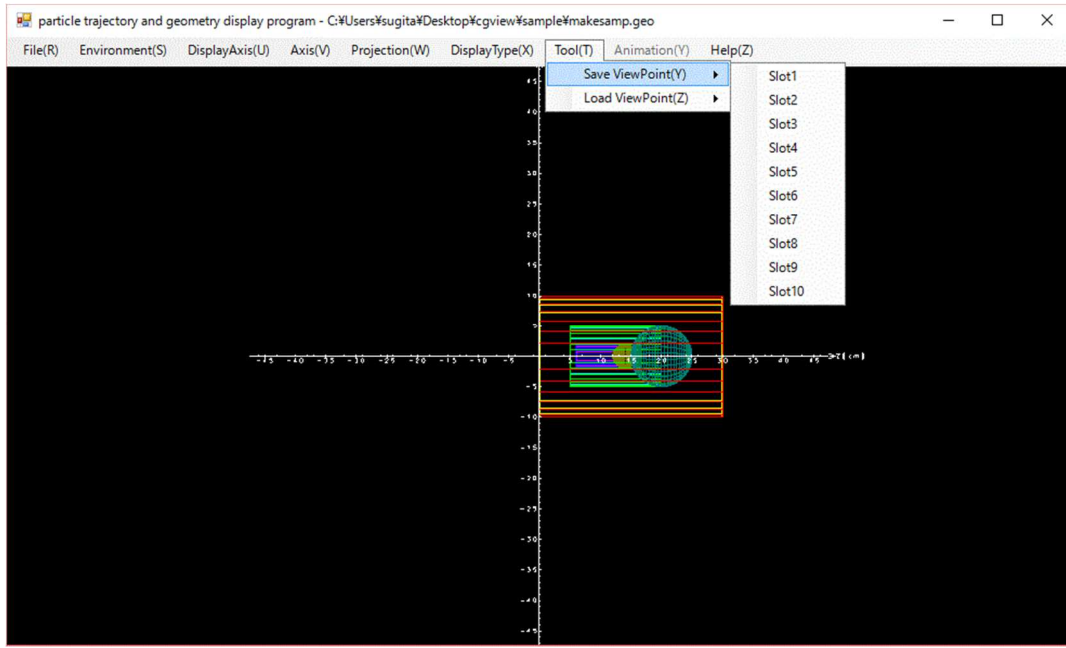


Fig.7.5-1 OPENGL view information store

### 7.5.2 OPENGL view information return.

From previously saved Slot1 Slot10 any recovery point of view information.

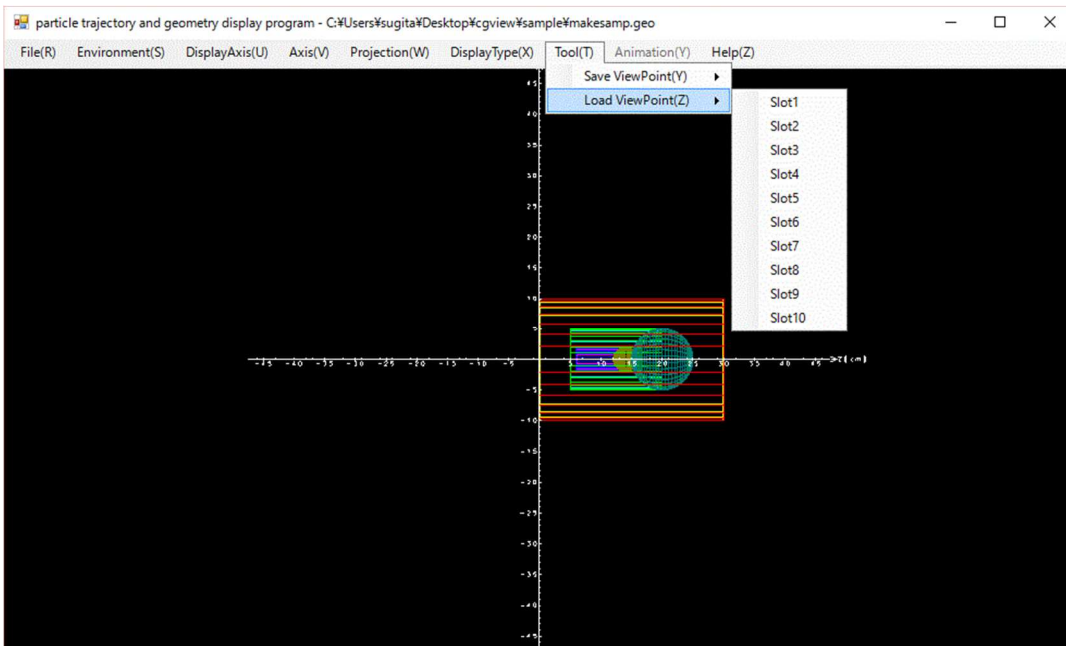


Fig.7.5-2 OPENGL view information return

## 7.6 Showing an animation

You can look an animation using pic-file with timing data (ex. cgsamp-free-time.pic).

Start showing an animation ... Select [Animation]-[Start] in the main menu.

Stop showing an animation ... Select [Animation]-[Stop] in the main menu.

Restart showing an animation ... Select [Animation]-[Restart] in the main menu.

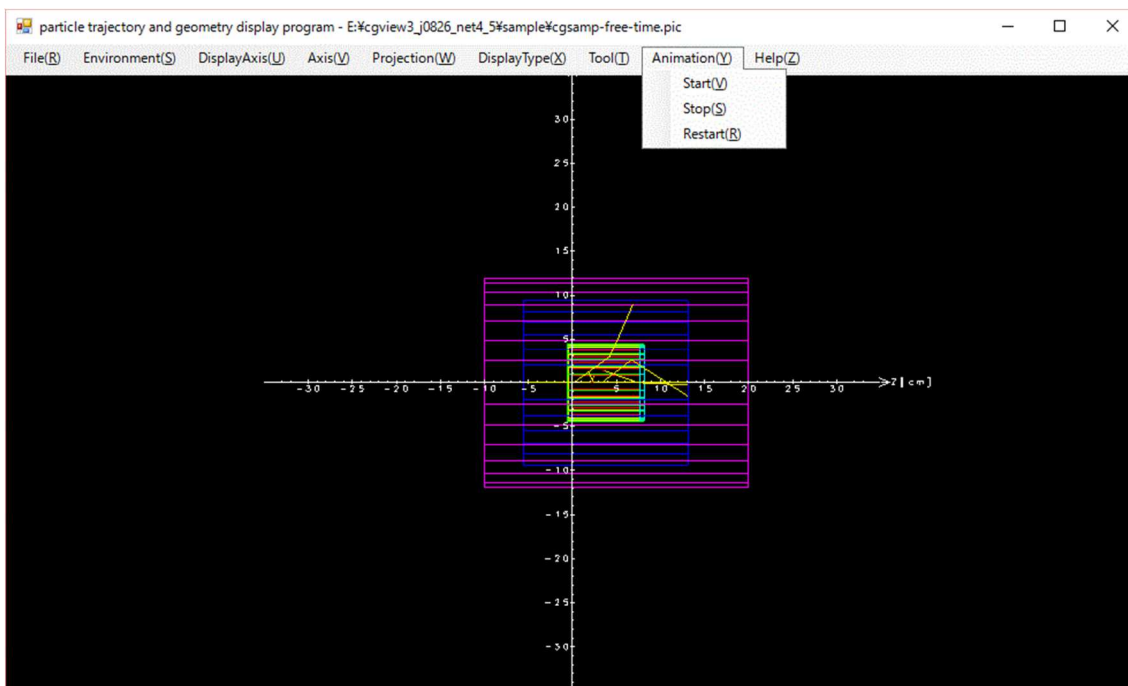


Fig. 7.6 [Animation] menu

## 7.7 Changing the level of the geometry display

The level of the geometry display can be selected from the following 3 levels:

- Body : Each body is displayed.
- Zone : Each zone is displayed.

(The zone is a combination of bodies and is called “region” in EGS)

- Material : Each medium is displayed.

(Group of the region with identical material.)

Turning ON/Off and changing the color is possible for each item at each level.

Select [Environment]-[Environment for Display] in the main menu. Then, a window (Fig.7.7-2) shows up. Please select [geometry display] from the tabs at the upper part.

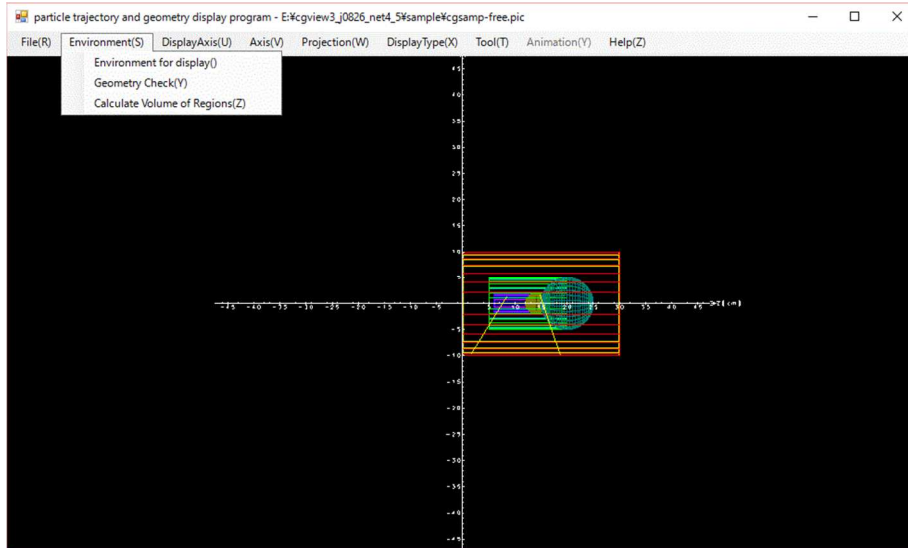


Fig.7.7-1 [Environment for Display] menu

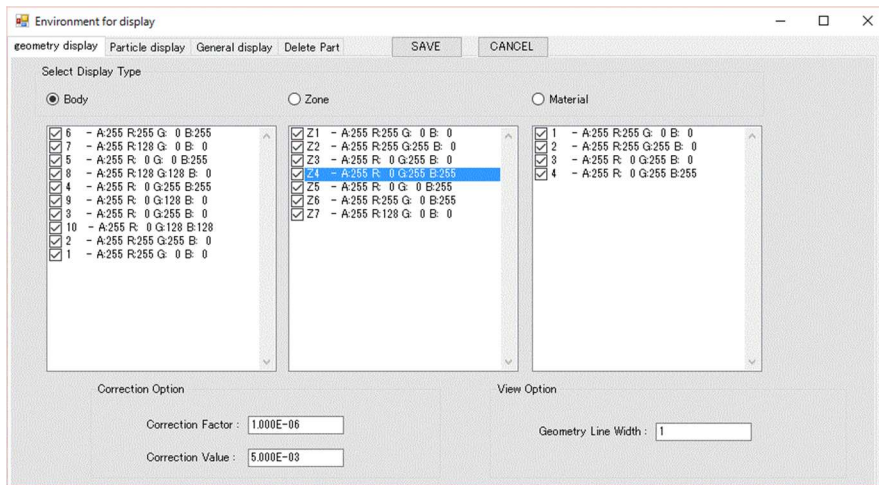


Fig.7.7-2 Window for specifying the geometry display

### 7.7.1 Changing the level for the geometry display

Please select the level for the geometry display from the items in [Select Display Type], as shown in Fig.7.7-2.

### 7.7.2 Selection of body, zone and material number for the display

A list of data is indicated under each level for the display. These data correspond to the geometry information in the current data file. By putting “check” for each body, zone and material number, the display or no display can be controlled.

Checked : Display

Uncheck : No display

Also, click the right button of the mouse for all display or no display. Here, a popup menu like in Fig.7.7-3 shows up. Select [All Check] for all displays or [All UnCheck] for no display in the menu.

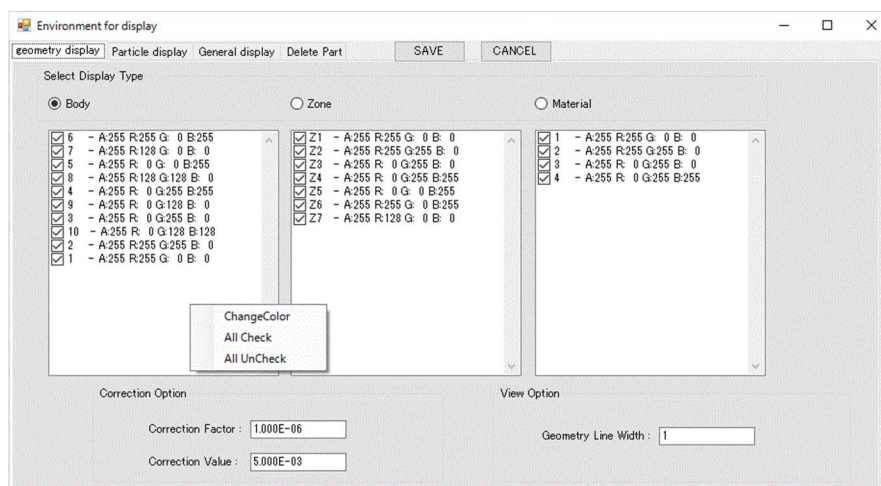


Fig.7.7-3 Popup menu

### 7.7.3 Changing the display color

The color for each body, zone and material number can be changed.

Select an item in the list by a left click of the mouse. When an item is selected, the color for the item becomes reverse, as shown in Fig.7.7-3. Then click the right button of the mouse to indicate the popup menu.

**Caution) Here, be careful to select an item by a left click first. Otherwise an illegal operation may be caused.**

When [Change Color] is selected in the pop up menu, a dialog box for color selection shows up. Please select a color for the item. When the color is selected properly, the color ID code in the list is changed to the selected one.

## 7.7.4 Correction option for displaying zone

The zone may not be properly displayed due to a numerical problem of the computer. This tends to happen when the subtraction of a body is done, as shown in the figure below.

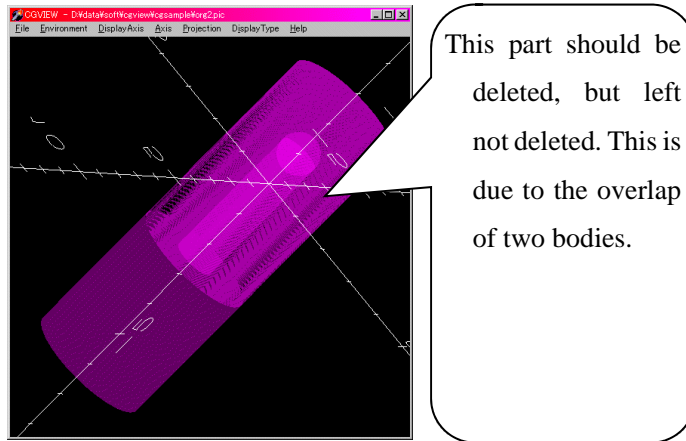


Fig.7.7-4 before correction

To correct this, the size of subtracting body is made larger. The following two items are specified for this purpose as shown in Fig.7.7-2.

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

The size of a subtracting body is calculated by the following equation:

$$\text{Corrected length} = \text{Original length} * (1 + \text{Correction factor}) + \text{Correction Value}$$

After a correction, the zone is properly shown, as indicated in the figure below.

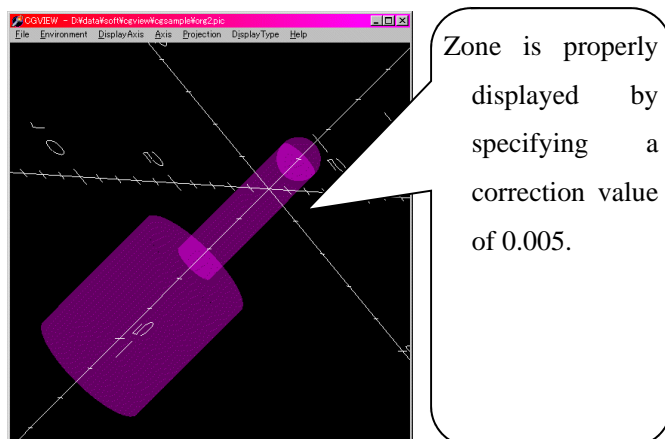


Fig.7.7-5 after correction

## 7.8 Changing the specification regarding a particle trajectory display

The following items can be changed regarding the particle trajectory display: history region, line color and line type for each kind of particle, and energy region.

Select **[Environment]-[Environment for Display]** in the main menu to make a change. Then, a window, as shown in Fig.7.8-1, appears. Select **[Particle display]** among the tabs at the upper part of the window.

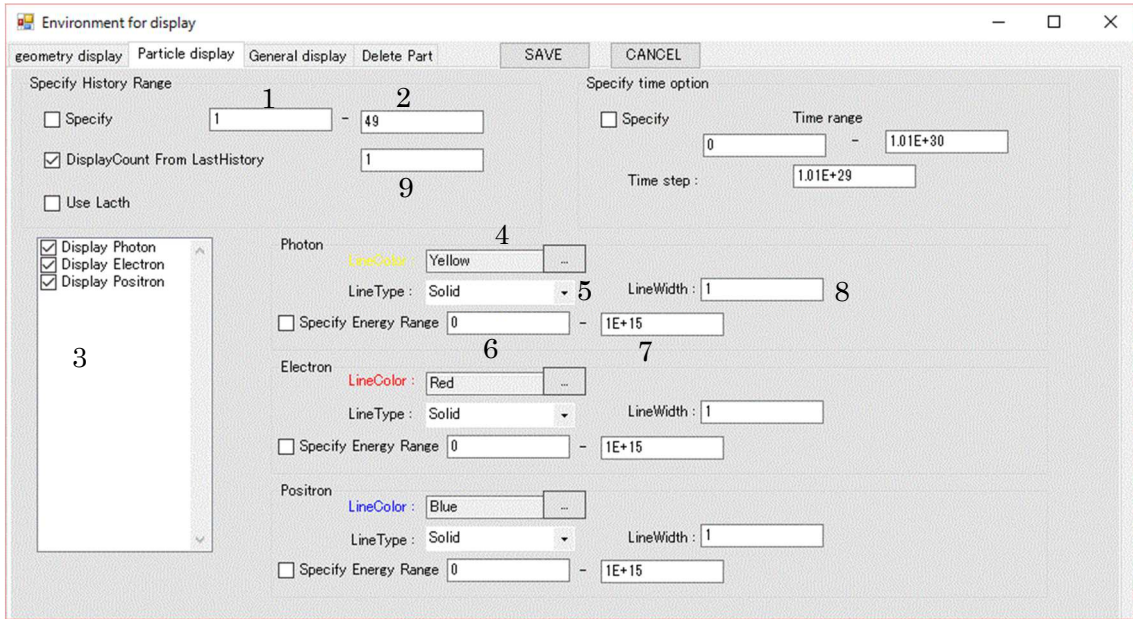


Fig.7.8-1 Window to specify a particle display

### 7.8.1 Specification of a history region

If a user specifies a history region, only the particles within this history region are displayed. The user can select one of the following two possible methods:

- Specify the history region

**[Specify]** is indicated in the **[Specify History Range]** frame in Fig.7.8-1.

Checks this → Specify history range

Does not check this → Not specify history range

If the history range is not specified, all of the particles are displayed.

To specify the range, input the lower limit of the range (Box with 1) and the upper limit of the range (Box with 2) in the textbox at the right-hand side of the **[Specify]** check box. If either box is left blank, the minimum or maximum history number of the data is assigned as the lower or upper value, respectively.

- Specify the number of displaying histories from the last history

**[Display Count from Last History]** is indicated in the **[Specify History Range]** frame in Fig.7.8-1.

Checks this → Specify the number of displaying histories from the last history.

Does not check this → Number of displaying histories is not specified.

All of the history is displayed when the history range for the display is not specified.

Type in the number of displaying histories in the box with 9 (Default = 1).

### 7.8.2 Specify the type of particle for display

The following 3 kinds of particles are indicated in CGVIEW:

- Photon ( $\gamma$ , x)
- Electron ( $e^-$ )
- Positron ( $e^+$ )

Displaying each kind of particle is specified by checking each item in the 3 list box To suppress displaying a kind of particle, delete the check sign for that particle.

### 7.8.3 Changing the line color for a particle trajectory

The line color for a particle trajectory can be changed. Click button 4 to change the line color. Then, a dialog box to select the color appears. Select



a color. The color ID code in the box is changed to the selected one when the color is selected without any trouble. Also, the line color of electrons and positrons can be changed by clicking the button in each box.

#### 7.8.4 Changing the line type for the particle trajectory

The line type for a particle trajectory can be changed. The following 4 types of lines can be used:

- Solid line
- Dashed line
- Single dot chain line
- Double dot chain line

Select the line type in the pull-down menu.

#### 7.8.5 Specifying the line width

The line width for the standard weight particle is specified. Default=1. Because the default line width is 1 pixel, the line of width N is indicated as N pixel line. Input a positive integer to textbox 8.

#### 7.8.6 Specifying energy range

By checking [**Specify Energy Range**] in a frame of each particle in Fig.7.8-1, the energy-range specification is enabled. In this case, a particle is displayed only if its energy is within a specified range. If this button is not checked, the energy range is not specified.

Type in the lower and upper energy in text boxes 6 and 7, respectively, to specify the energy range. If either of these boxes is left blank, 0 and  $1e15$  are automatically assigned for the lower and upper energy, respectively. Unit is [MeV].

#### 7.8.7 WEIGHT

The width of the particle trajectory line is automatically modified using particle WEIGHT data (which is read in from the input data file). The line width is set as the line width described in section 7.8.5 x WEIGHT.

#### 7.8.8 LATCH function

By checking [**Use Latch**] in [**Specify History Range**] frame in Fig.7.8-1, the LATCH function is enabled. In this case, a history with -1 of the latch flag is not displayed. If this button is not checked, the LATCH function is cancelled.

### 7.8.9 Specify time option

By checking **[Specify]** in **[Specify time option]** frame in Fig.7.8-1, the Animation display is enabled with a file including lifetime data. Time range of the animation is specified by values in "Time range". Time width of one picture is specified by an absolute value of "Time step". If "Time step" is a negative quantity then the starting time is always fixed as starting time which is specified in "Time range". In this case, particle trajectory is displayed as if it is growing as time passes. The unit is same as a file using unit.

## 7.9 Changing the window design

The conditions of the display, the background color, title and axis etc, can be changed.

Select [Environment]-[Environment for display] in the main menu. Then, a window, as shown in Fig.7.9-1, appears. Select [General display] among the tabs in the upper position.

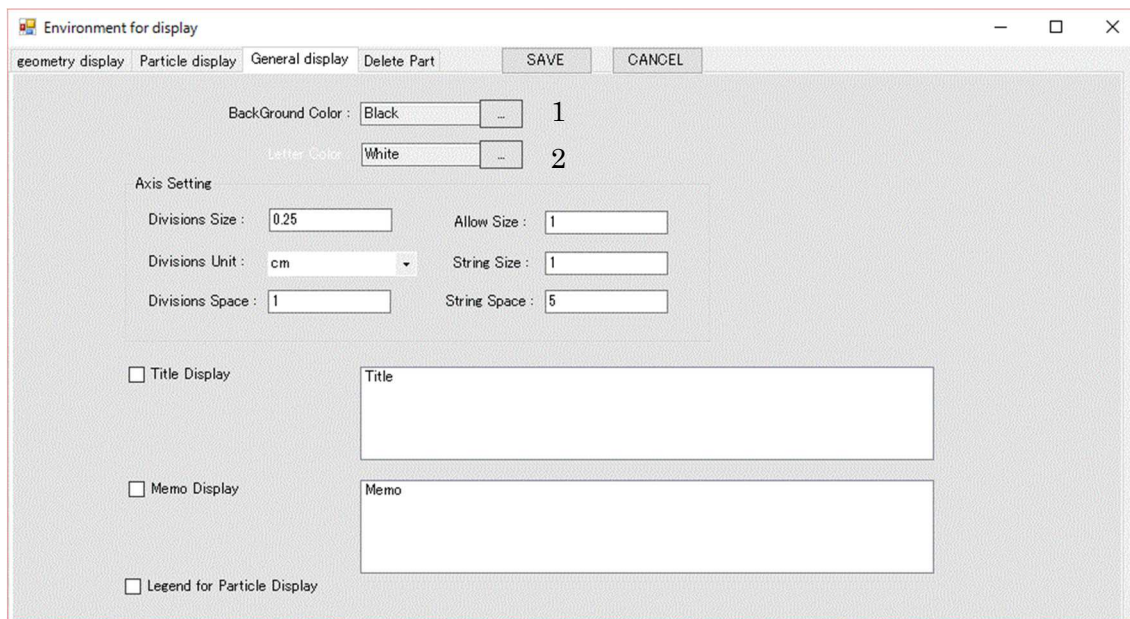


Fig.7.9-1 Window to change the conditions for the window design

### 7.9.1 Changing back ground color

It is possible to change the background color. Click 1 button. A dialog box appears to select the color. Please select a color. The color ID code in the box is changed to the selected one when the color is selected without any trouble.

### 7.9.2 Changing the character color

It is possible to change the colors of the axis, title, memo and legend. Click button 2. Then, a dialog box to select the color appears. Select a color. The color ID code in the box is changed to the selected one when the color is selected without any trouble.

### 7.9.3 Changing the setting of the axis

The following items can be changed. Type in the values to text boxes for each item in the [Axis Setting] frame:

- Divisions Size : Length of the division line at the axis

- Division Unit : Division unit at the axis
- Divisions Space : Interval of divisions at the axis
- Allow Size : Size of allow at the top of the axis
- String Size : Size of character for the division label
- String Space : Spacing for the division label character

#### 7.9.4 Displaying a title

A title can be displayed in a window. Please check **[Title Display]** in the General display. Then, a sample title appears in an input box, as shown in the following figure. The title can be typed in here.

Also, a displayed title can be moved inside the main window by a left click.

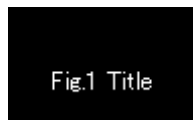


Fig. 7. 9-2 Title

#### 7.9.5 Displaying memo

Memo can be displayed in the window. Check **[Memo Display]** in the General display. Then, a sample memo appears in an input box, as shown in the following figure. A memo can be typed in here.

Also, a displayed memo can be moved inside the main window by a left click.



Fig. 7. 9-3 Memo

#### 7.9.6 Displaying a legend

A legend can be displayed in the window. As shown in the following figure, the contents of the legend include the range of history number, the line color and the line type for each kind of particle.

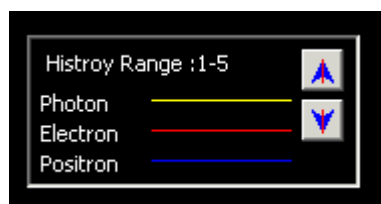


Fig. 7. 9. 4 legend

### 7.9.7 Set html browser name for help

It is Specify html browser name for view help. (Only Linux) Click [...] Button.  
Then, a dialog box to select the browser appears.

## 7.10 Hiding a part of the geometry

To display a cut view of the geometry, or to show the inside geometry, it is possible to hide a part of the geometry. Select **[Environment]-[Environment for display]** in the main menu. Then, a window appears, as shown in Fig.7.10-1. Select **[Delete part]** among the tabs at the upper part of the window.

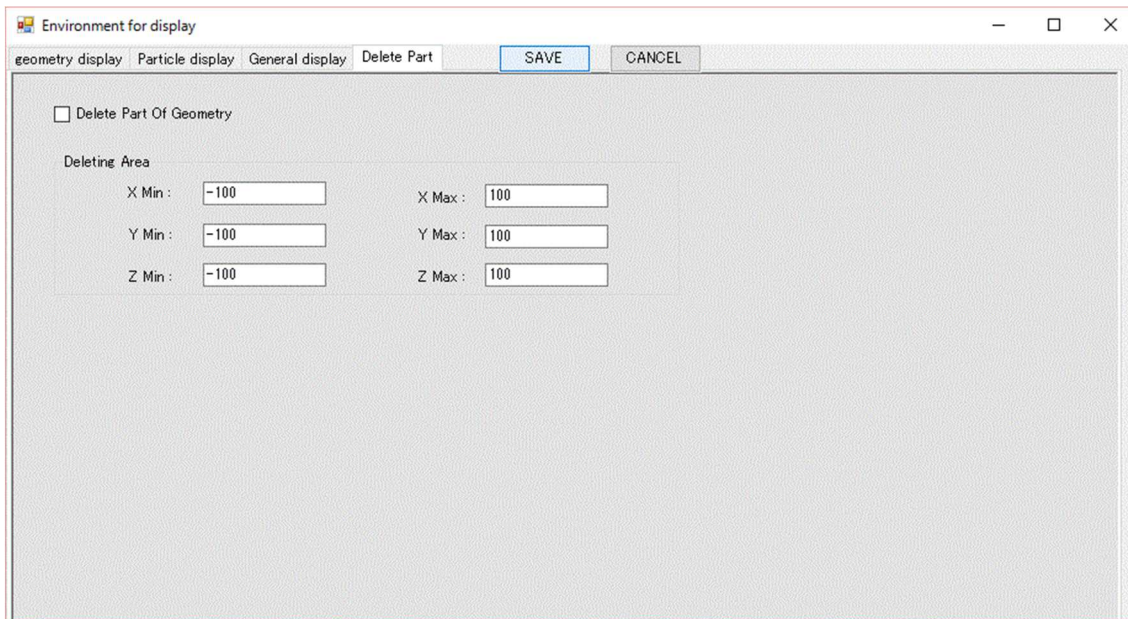


Fig.7.10-1 Window to set a deleting part

Please check **[Delete Part of Geometry]**. The range for the deleting part is specified in a frame of **[Deleting Area]**. Type in the values to specify a virtual box. The geometry inside the virtual box is not displayed. The meanings of the input items are as follows (Unit is in [cm]).

- X Min : Minimum value for X (If left blank, automatically set from data.)
- X Max : Maximum value for X (If left blank, automatically set from data.)
- Y Min : Minimum value for Y (If left blank, automatically set from data.)
- Y Max : Maximum value for Y (If left blank, automatically set from data.)
- Z Min : Minimum value for Z (If left blank, automatically set from data.)
- Z Max : Maximum value for Z (If left blank, automatically set from data.)

## 7.11 Returns to the initial setting

The environment returns to the initial setting by pushing the **[DEFAULT]** button in Fig. 7. 10.

## SECTION 8 Function using the Mouse

The response of the application may become slow if much geometry data is displayed. Turn off displaying insignificant geometry data before operating the mouse in this case. After the eye point is set, turn on displaying all geometry data.

### 8.1 Rotation

Move the mouse while clicking the **left button** to **rotate** the displayed objects.

### 8.2 Parallel movement

Move the mouse while clicking both the **left and right buttons** to **move** the displayed object. The **central button** of a 3-button mouse can also be used for movement.

### 8.3 Zoom-in objects

Move the mouse downward while clicking the **right button** to **zoom in**. Also Move the mouse downward while clicking the left button and pushing SHIFT to zoom range select.

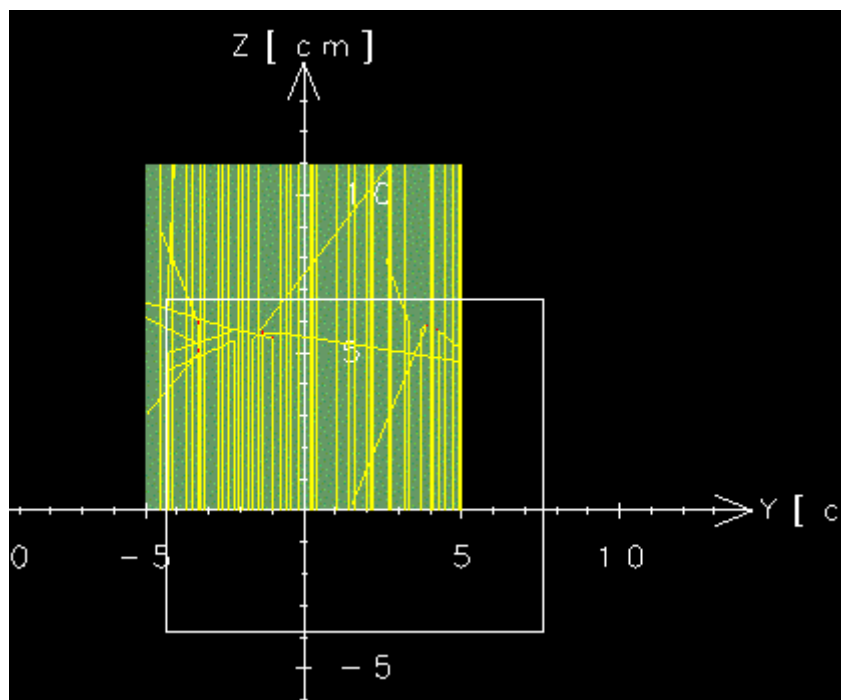


Fig.8.3 Zoom in range

### 8.4 Zoom-out objects

Move the mouse upward while clicking the **right button** to **zoom-out**.

## SECTION 9 Creating geometry data

The CGVIEW can be used to help create geometry data for an EGS calculation. In CGVIEW, CG geometry data of the EGS code can be created, and these data are immediately displayed in 3-D figures on the screen for checking. Also, it is possible to save created data. This data can be used as a CG input file in an EGS calculation.

### 9.1 Opening a window to create geometry data

Select [File]-[Making geometry data] in the main menu to open a window to create geometry data. Then, a window as shown in Fig.9.1-2 appears.

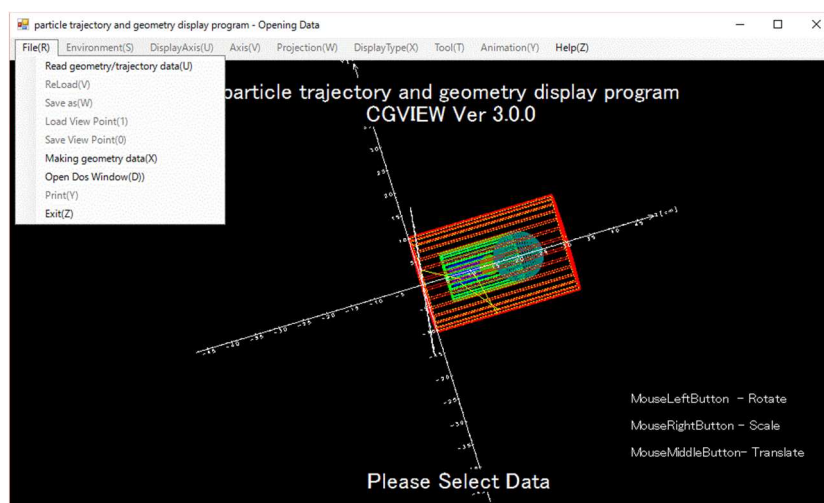


Fig.9.1-1 [Making geometry data] menu

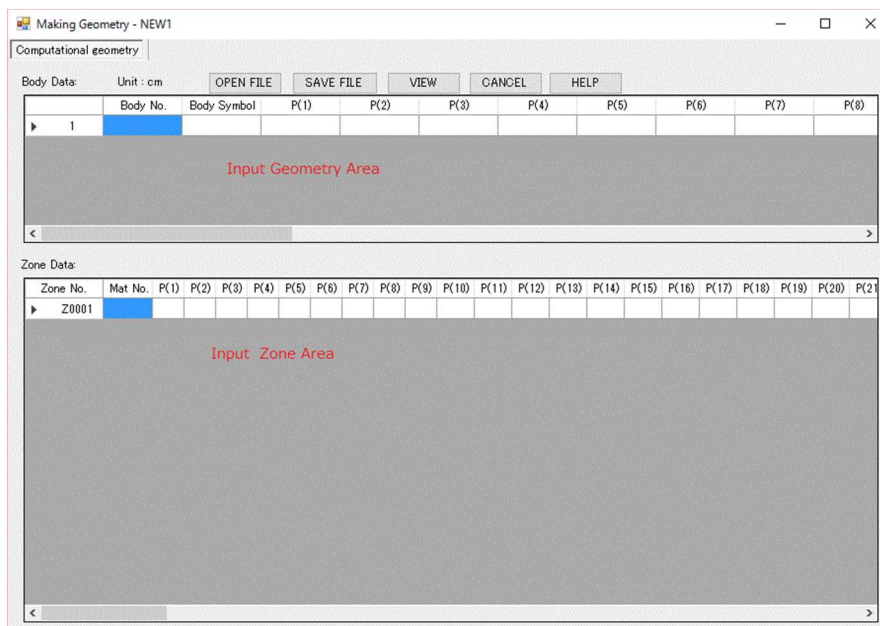


Fig.9.1-2 Window to create geometry data



## 9.2 Input Geometry Data

Only CG(Combinatory Geometry) data are supported for this function. Click **[OK]** button to display the geometry for the input data.

### 1) Input Body Data

Body Data composed Symbol, Number and Parameter. Number specify from 1 to 99999. CG Body Parameter see to Section 9.6.

### 2) Input Zone Data

[Zone Number]

Number is 5 char and 1st Char is "Z". Number is auto.

[Material Number]

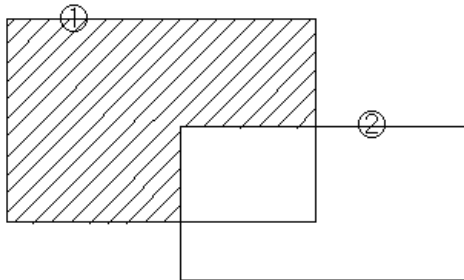
Material Number in EGS user code.

[Other]

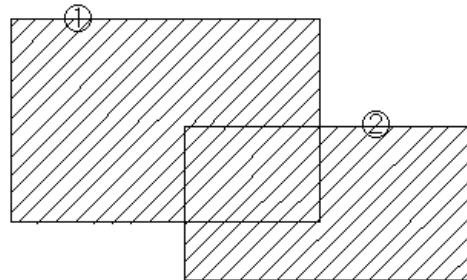
One Zone make Combination Few Body. Combination is +,-,OR and Body number.

+1 is inside Body 1,-1 is outside Body 1. (+1 -2) is inside Body 1 and outside Body 2. (+1 OR +2) is inside Body 1 or outside Body 2.

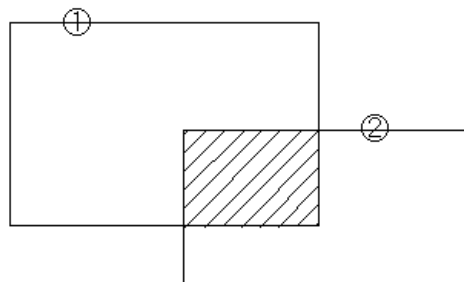
+1 -2



+1 OR +2



+1 +2



+1 -2 OR +2 -1

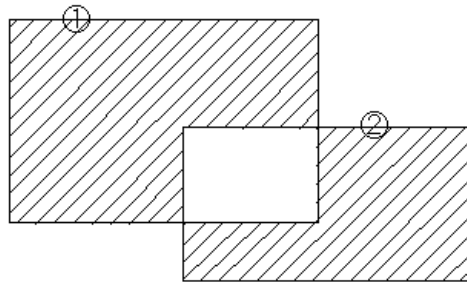


Fig.9.2 CG ZONE

### 9.3 Saving created data

Click the [Save File] button. Then, a file dialog to save a file appears. Input the file name. The default file extension is (\*.geo).

If file extension is not (\*.csv) then Free Format.

If file extension is (\*.csv) then CSV Format.

### 9.4 Opening created data

Click the [Open File] button. Then, a file dialog to open a file appears. Select a file to open. The default file extension is (\*.geo).

If file extension is not (\*.csv) then Free Format.

If file extension is (\*.csv) then CSV Format.

### 9.5 CG Data viewer

Click the [View] button. Then, you can check the geometry on the screen.

### 9.6 Edit File of Excel

Extension is (\*.csv) used Working on Excel.

Body Symbol	Body Number	Body Parameter							
RCC	6	0	0	6.1	0	0	7.9	1.9	
SPH	7	0	0	14	1.9				
RCC	5	0	0	6	0	0	8	2	
SPH	8	0	0	14	2				
RCC	4	0	0	5.1	0	0	14.9	4.9	
SPH	9	0	0	20	4.9				
RCC	3	0	0	5	0	0	15	5	
SPH	10	0	0	20	5				
RCC	2	0	0	0.1	0	0	29.8	9.9	
RCC	1	0	0	0	0	0	30	10	
END									
Z0001	6 OR 7								
Z0002	5	-6 OR	7	8	-7	-5			
Z0003	4	-5	-8 OR	9	-4				
Z0004	3	-4 OR	10	-9	-3				
Z0005	2	-3	-10						
Z0006	1	-2							
Z0007	-1								
END									
	4	2	4	3	4	0			

Annotations in the image include:

- Box: Body Symbol
- Box: Body Number
- Box: Body Parameter
- Box: Body Data END
- Box: Zone Number
- Box: Zone Data END
- Box: Material, from Z0001,Z0002...
- Box: Zone Parameter

Fig. 9.6 Work on Excel

## 9.7 CG Format

### 1) Right Parallelepiped (RPP)

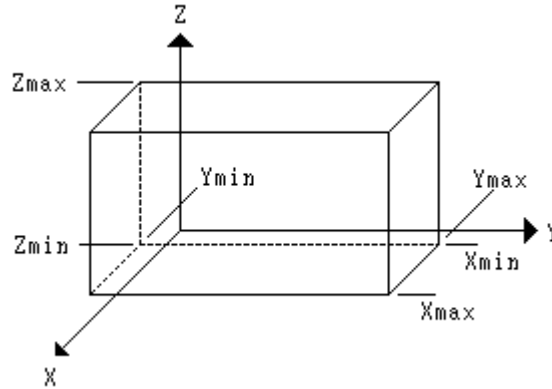


Fig. 9.7-1 RPP

[ Format ] Xmin(1) Xmax(2) Ymin(3) Ymax(4) Zmin(5) Zmax(6)

(caution) Number in ( ) is parameter number in Make Geometry. (1) is input Parameter Column 1 in table in Fig9.1-2. (and so fourth)

Xmin, Xmax : termimi of box sides normal to X

Ymin, Ymax : termimi of box sides normal to Y

Zmin, Zmax : termimi of box sides normal to Z

### 2) Right Circular Cylinder (RCC)

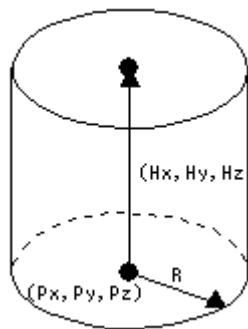


Fig. 9.7-2 RCC

[ Format ] Px(1) Py(2) Pz(3) Hx(4) Hy(5) Hz(6) R(7)

Px, Py, Pz : X, Y, Z coordinates of center of base

Hx, Hy, Hz : cylinder axis vector

R : Radius

### 3) Sphere (SPH)

center P and Radius R makes Sphere.

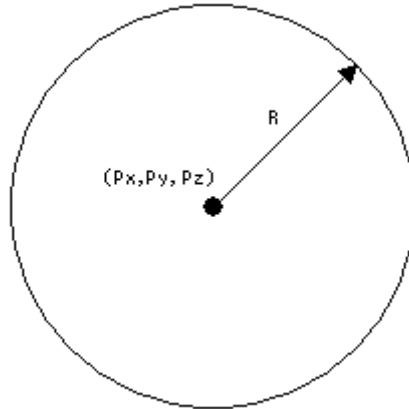


Fig. 9.7-3 SPH

[ Format ]  $P_x(1)$   $P_y(2)$   $P_z(3)$   $R(4)$

$P_x, P_y, P_z$  : X, Y, Z coordinates of center

$R$  : Radius

### 4) Truncated Right Cone (TRC)

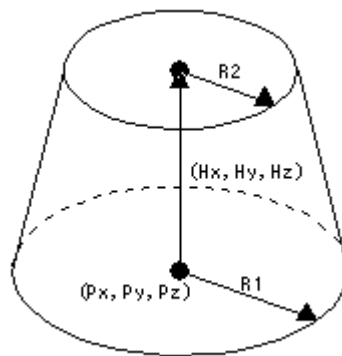


Fig. 9.7-4 TRC

[ Format ]  $P_x(1)$   $P_y(2)$   $P_z(3)$   $H_x(4)$   $H_y(5)$   $H_z(6)$   $R_1(7)$   $R_2(8)$

$P_x, P_y, P_z$  : X, Y, Z coordinates of center of Cone Bottom

$H_x, H_y, H_z$  : cone axis height vector

$R_1$  : radius of lower cone base

$R_2$  : radius of upper cone base

5) Torus (TOR)

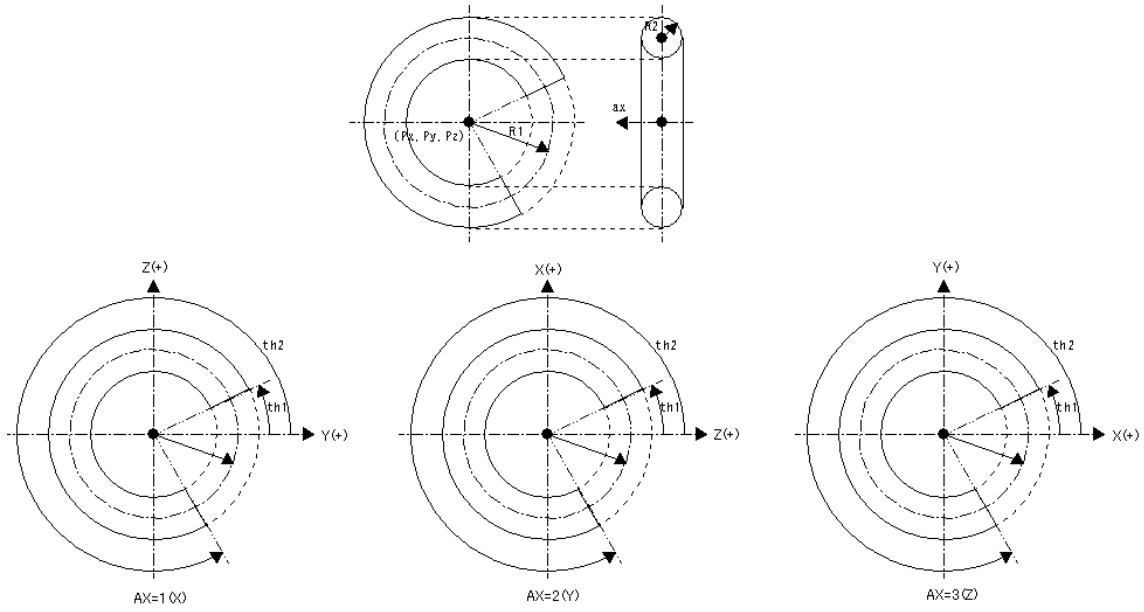


Fig. 9. 7-5 TOR

[ Format ] Px(1) Py(2) Pz(3) R1(4) R2(5) th1(6) th2(7) ax(8)

Px,Py,Pz : X,Y,Z coordinates of center of Torus

R1 : ring radius

R2 : pipe radius

th1,th2 : start angle, end angle (Degree)

ax : center axis(1=X 2=Y 3=Z)

6) Box (BOX)

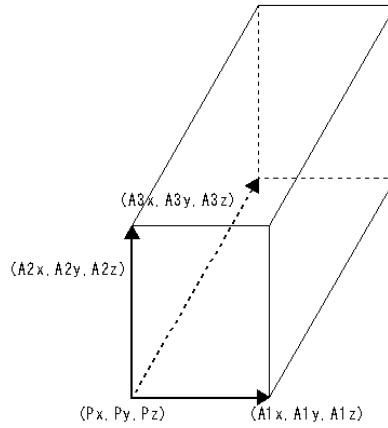


Fig. 9. 7-6 BOX

[ Format ] Px(1) Py(2) Pz(3) A1x(4) A1y(5) A1z(6) A2x(7) A2y(8) A2z(9)  
 A3x(10) A3y(11) A3z(12)

Px,Py,Pz : X,Y,Z Coordinates of corner

A1x,A1y,A1z : vector of 1st Side

A2x,A2y,A2z : vector of 2nd Side

A3x,A3y,A3z : vector of 3rd Side

7)Right Elliptical Cylinder (REC)

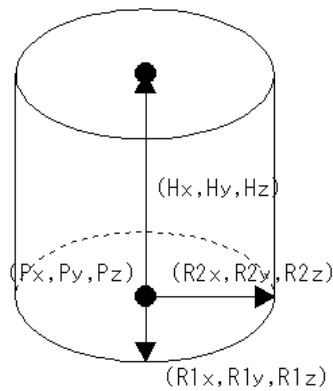


Fig. 9. 7-7 REC

[ Format ] Px(1) Py(2) Pz(3) Hx(4) Hy(5) Hz(6) R1x(7) R1y(8) R1z(9)  
 R2x(10) R2y(11) R3z(12)

Px,Py,Pz : X,Y,Z coordinates of cylinder bottom

Hx,Hy,Hz : cylinder axis height vector

$R1x, R1y, R1z$  : ellipse major axis vector (normal to  $Hx, Hy, Hz$ )  
 $R2x, R2y, R2z$  : ellipse minor axis vector (orthogonal to  $Hx, Hy, Hz$ )

8) Truncated Elliptical Cylinder (TEC)

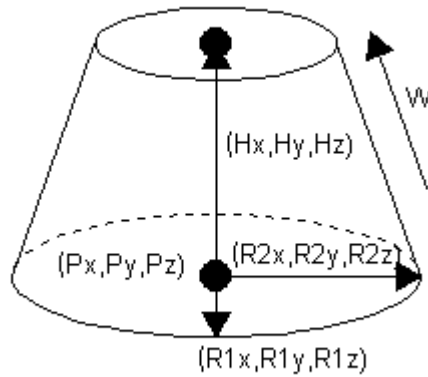


Fig. 9. 7-8 TEC

[ Format ]  $Px(1) Py(2) Pz(3) Hx(4) Hy(5) Hz(6) R1x(7) R1y(8) R1z(9)$   
 $R2x(10) R2y(11) R2z(12) w(13)$

$Px, Py, Pz$  : X, Y, Z coordinates of cylinder bottom

$Hx, Hy, Hz$  : cylinder axis height vector

$R1x, R1y, R1z$  : ellipse major axis vector (normal to  $Hx, Hy, Hz$ )

$R2x, R2y, R2z$  : ellipse minor axis vector (orthogonal to  $Hx, Hy, Hz$ )

$w$  : ratio = top/bottom

9) Ellipsoid (ELL)

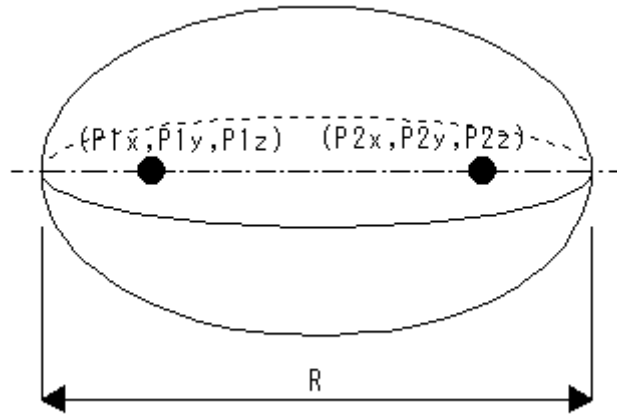


Fig. 9. 7-9 ELL

[ Format ] P1x(1) P1y(2) P1z(3) P2x(4) P2y(5) P2z(6) R(7)

P1x,P1y,P1z : 1st foci coordinate

P2x,P2y,P2z : 2nd foci coordinate

R : length of major axis

10) Wedge (WED)

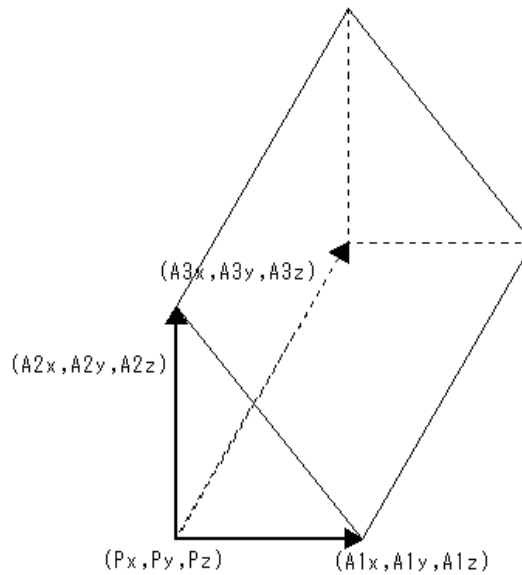


Fig. 9. 7-10 WED

[ Format ] Px(1) Py(2) Pz(3) A1x(4) A1y(5) A1z(6) A2x(7) A2y(8) A2z(9)

A3x(10) A3y(11) A3z(12)

Px,Py,Pz : X,Y,Z coordinates of wedge vertex



$A_{1x}, A_{1y}, A_{1z}$  : vector 1st side of triangler base  
 $A_{2x}, A_{2y}, A_{2z}$  : vector 2nd side of triangler base  
 $A_{3x}, A_{3y}, A_{3z}$  : height vector

11) Arbitrary Polyhedron (ARB)

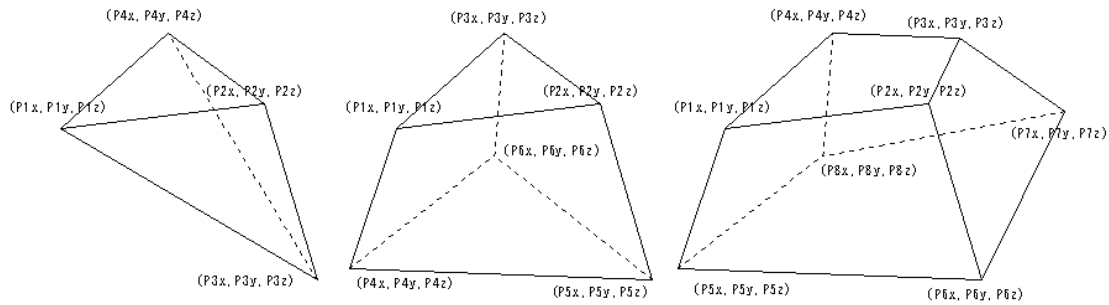


Fig. 9. 7-11 ARB

[ Format ] P1x(1) P1y(2) P1z(3) P2x(4) P2y(5) P2z(6) P3x(7) P3y(8) P3z(9)  
P4x(10)

P4y(11) P4z(12) P5x(13) P5y(14) P5z(15) P6x(16) P6y(17) P6z(18)  
P7x(19)

P7y(20) P7z(21) P8x(22) P8y(23) P8z(24) S1(25) S2(26) S3(27) S4(28)  
S5(29) S6(30)

$P_{1x}, P_{1y}, P_{1z}$  : X, Y, Z coordinates of 1st corner of polyhedron  
 $P_{2x}, P_{2y}, P_{2z}$  : X, Y, Z coordinates of 2nd corner of polyhedron  
 $P_{3x}, P_{3y}, P_{3z}$  : X, Y, Z coordinates of 3rd corner of polyhedron  
 $P_{4x}, P_{4y}, P_{4z}$  : X, Y, Z coordinates of 4th corner of polyhedron  
 $P_{5x}, P_{5y}, P_{5z}$  : X, Y, Z coordinates of 5th corner of polyhedron  
 $P_{6x}, P_{6y}, P_{6z}$  : X, Y, Z coordinates of 6th corner of polyhedron  
 $P_{7x}, P_{7y}, P_{7z}$  : X, Y, Z coordinates of 7th corner of polyhedron  
 $P_{8x}, P_{8y}, P_{8z}$  : X, Y, Z coordinates of 8th corner of polyhedron  
 $S_1, S_2, S_3, S_4, S_5, S_6$  :

four-digit number describing a side of the polyhedron in terms of it' s  
 corresponding two corners. (e.g. S1=1278 is a plane / side bounded by  
 corners 1, 2, 7 & 8)

12) Harf Space with a planer surface(HAF)

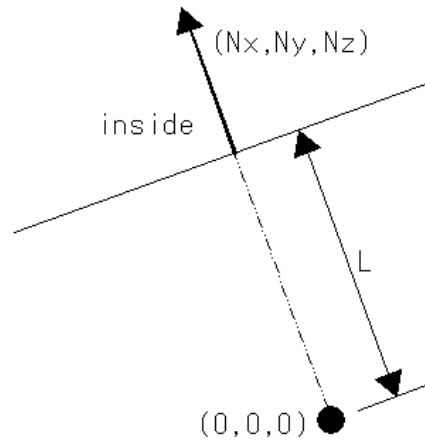


Fig. 9. 7-12 HAF

[ Format ]  $N_x(1)$   $N_y(2)$   $N_z(3)$   $L(4)$

$N_x, N_y, N_z$  : vector of inner region

$L$  : length of the coordinate axes parallel to  $N$

13) Hexagonal Prism (HEX)

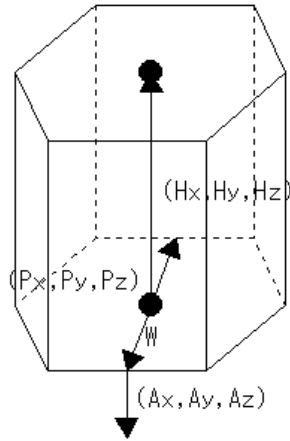


Fig. 9. 7-13 HEX

[ Format ]  $P_x(1)$   $P_y(2)$   $P_z(3)$   $H_x(4)$   $H_y(5)$   $H_z(6)$   $W(7)$   $A_x(8)$   $A_y(9)$   $A_z(10)$

$P_x, P_y, P_z$  : X, Y, Z coordinates of the bottom of the hex

$H_x, H_y, H_z$  : vector from the bottom to the top

$W$  : width of the hex

$A_x, A_y, A_z$  : vector of normal surface

14) General Ellipsoid (GEL)

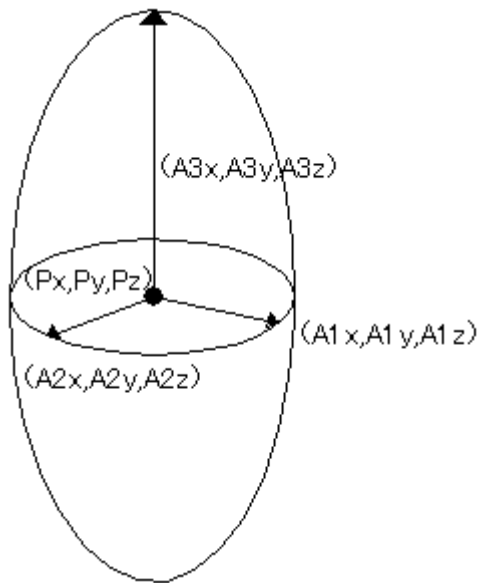


Fig. 9.7-14 GEL

[ Format ]  $P_x(1)$   $P_y(2)$   $P_z(3)$   $A_{1x}(4)$   $A_{1y}(5)$   $A_{1z}(6)$   
 $A_{2x}(7)$   $A_{2y}(8)$   $A_{2z}(9)$   $A_{3x}(10)$   $A_{3y}(11)$   $A_{3z}(12)$

$P_x, P_y, P_z$  : X, Y, Z coordinates of center

$A_{1x}, A_{1y}, A_{1z}$  : 1st foci coordinate

$A_{2x}, A_{2y}, A_{2z}$  : 2nd foci coordinate

$A_{3x}, A_{3y}, A_{3z}$  : 3rd foci coordinate

## SECTION 10 Check geometry data

Select [Environment]-[Geometry Check] in the main menu to open a window to check geometry data. Then, a window as shown in Fig.10.2 appears.

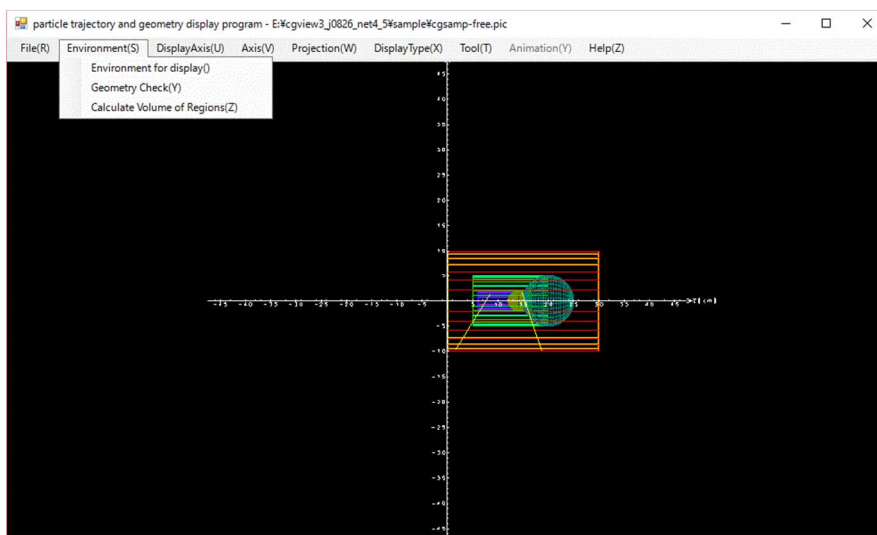


Fig.10-1 [Geometry Check] menu

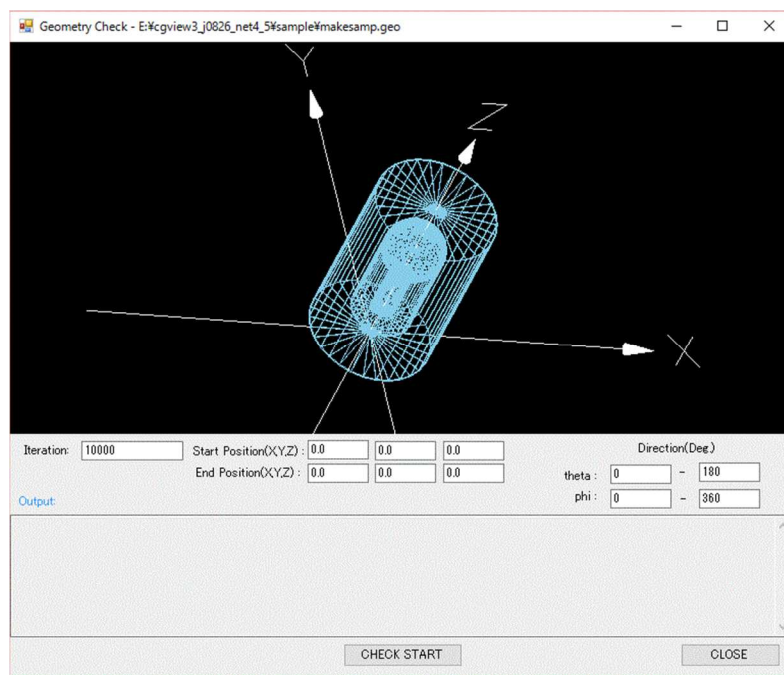


Fig.10-2 Window for geometry check

Click [Check Start] button to start check geometry data.

StartPosition: Specifying Start Position.

(default value  $x = 0 - 0$   $y = 0 - 0$   $z = 0 - 0$ )

the range specification is enabled. In this case, a position is

randomly selected in specified range.

Direction : Specifying Direction [degree].

(default value theta= 0 - 180 phi= 0 - 360)

the range specification is enabled. In this case, a direction is randomly selected in specified range.

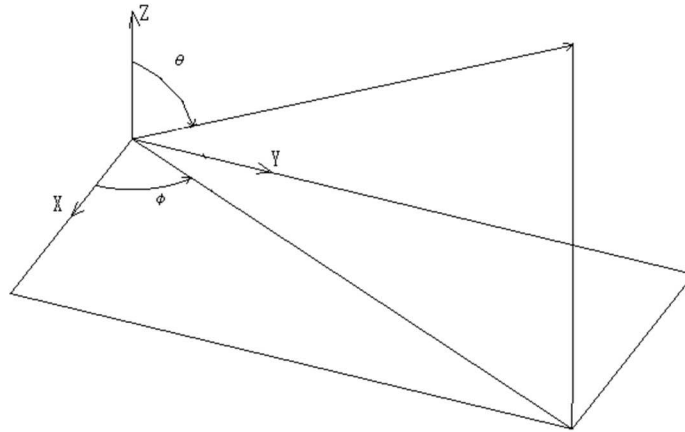


Fig.10-3 Direction

Iteration : Specifying number of particle (default=100000)

[CHECK START]Button is [CHECK STOP] in executing and Click Button is Check Stop.

If error then a message is printed in output and they are displayed by white lines. (error max is 10)

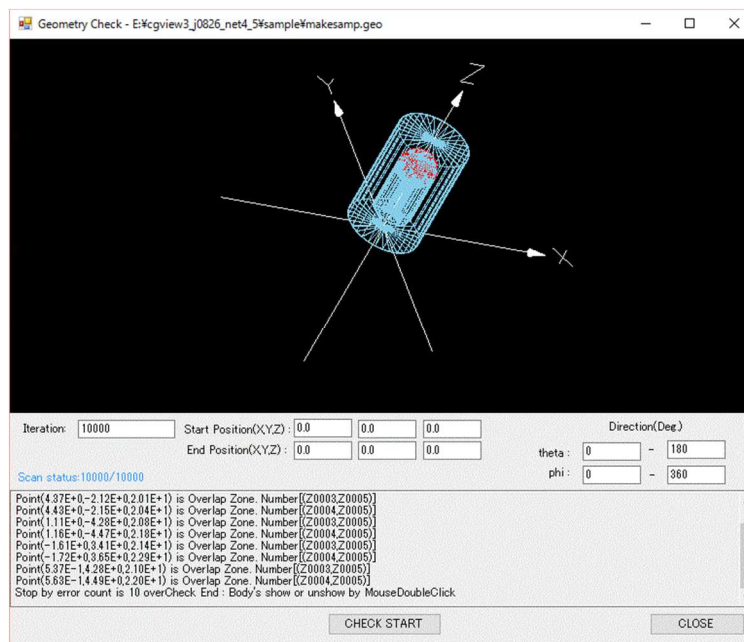


Fig.10-4 Output

Or hide or show a shape by double-clicking the mouse.

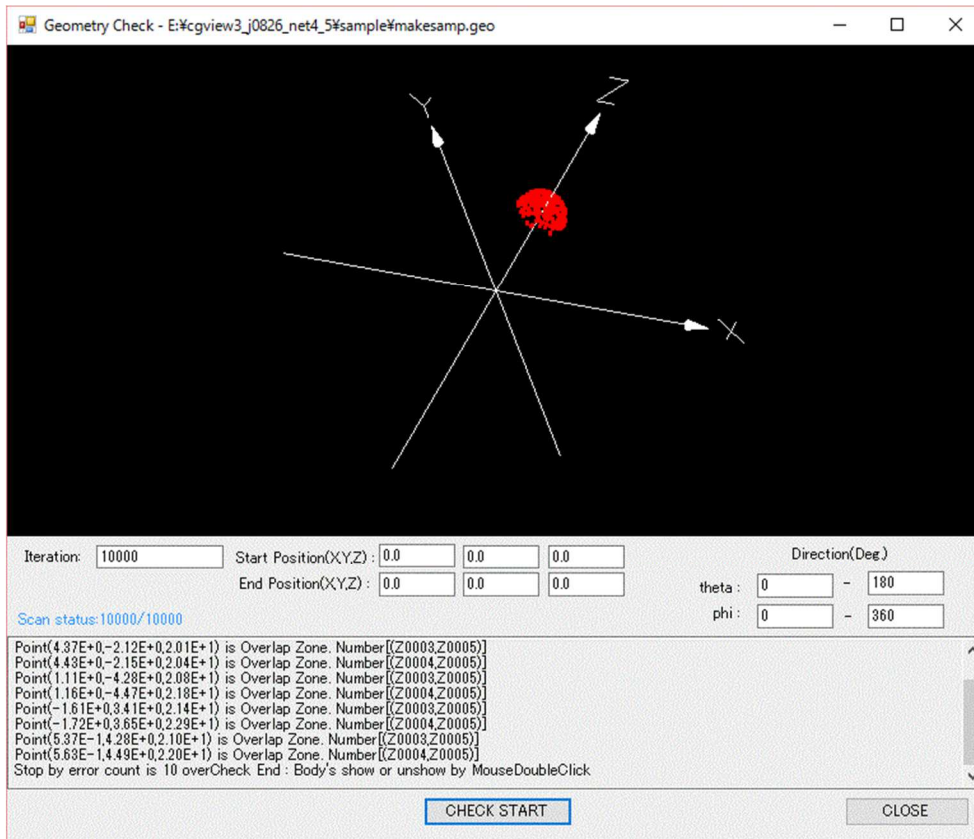


Fig. 10-5 Sample display

## SECTION 11 Calculate the volume of regions

Select [Environment]-[Calculate Volume of Regions] in the main menu to open a window to calculate the volume of regions. Then, a window as shown in Fig.11.2 appears.

It is used the next method to calculate the volume of regions.

A particle with vertical vector is started at yz, xz and xy surface that are divided equally. The volume of region is getting by summing the value that multiply the length is including in the region and the area data of divided surface. The validation of values be getting by checked the three volume data and three convergence data.

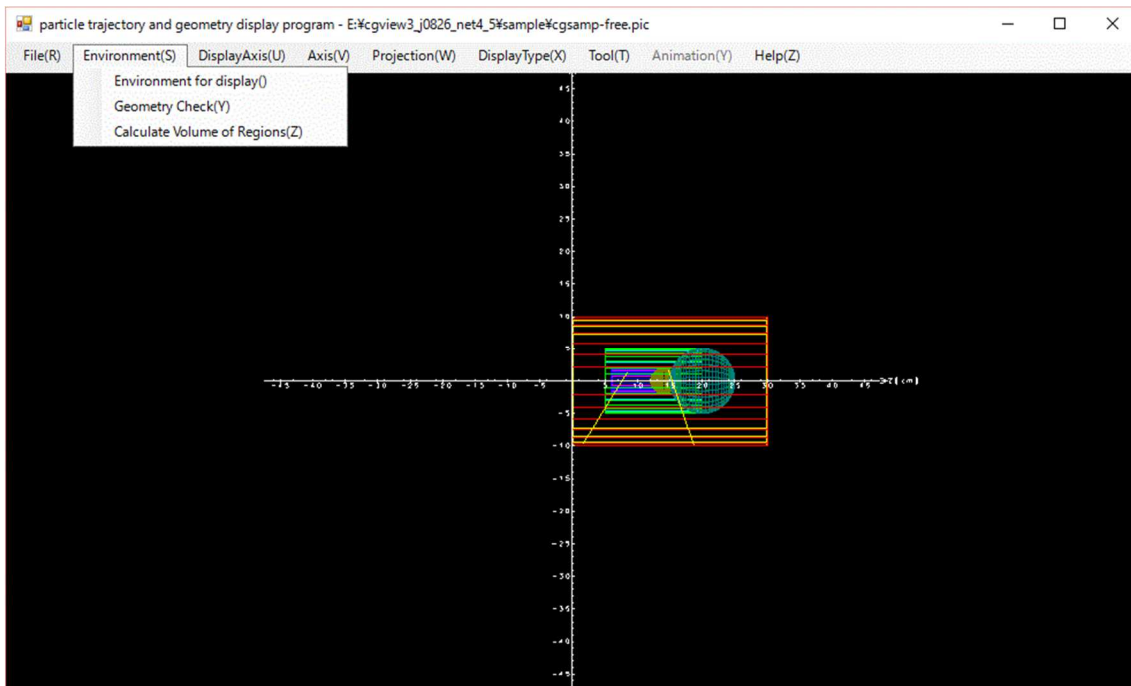


Fig.11-1 [Calculate Volume of Regions] menu



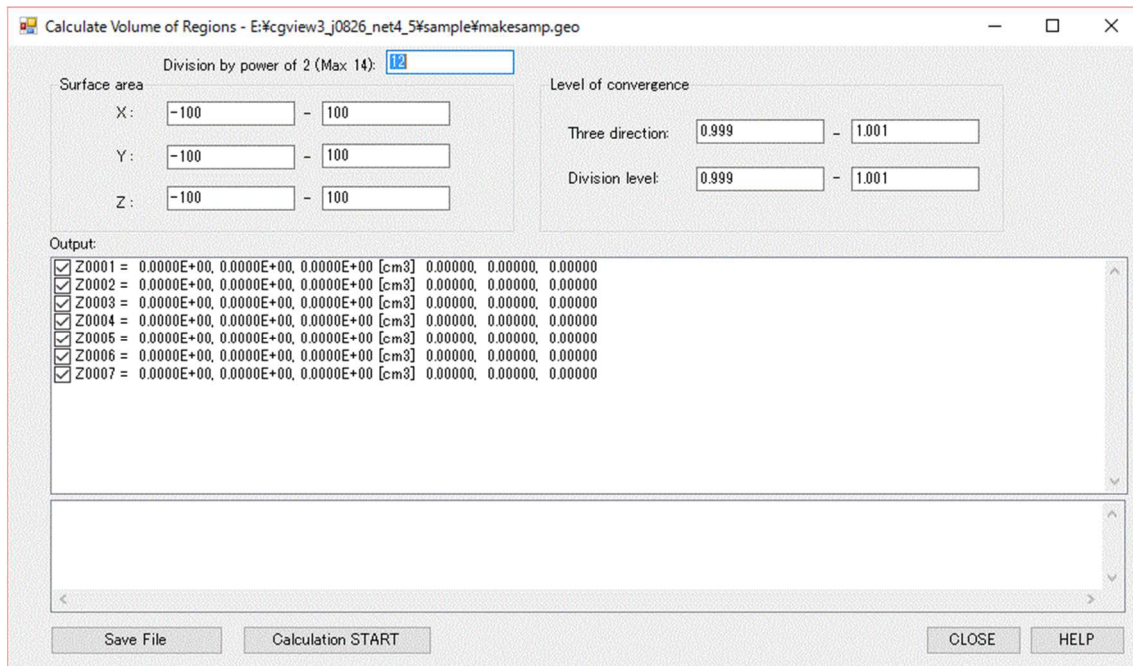


Fig.11-2 Window for calculation the volume of regions

### 11.1 Setting of division by power of 2

You should be setting the Division level at [Division by power of 2]. The Maximum value is 14 and the default value is 12.

### 11.2 Setting the surface area

You should be setting the surface areas that include the checked regions at [Surface area]. An unit is cm.

### 11.3 Setting the level of convergence

You can set the level of convergence at [Level of convergence].

Three direction : checking the convergence between yz, xz and xy surface.

Division level : checking the convergence between now division level and before division level.

### 11.4 Showing the calculated data

The output data are region number(z), the calculated volume (yz, xz and xy surface) and the convergence data of division level (yz, xz and xy surface) . The checked regions are the target region of checking convergence.

## 11.5 Monitoring data

The Monitoring data are outputted. There are the calculated rate, the division level(nlp), the number of division(nlpent) and the calculating point (the outer loop(ilp) and the inner loop(jlp)) .

## 11.6 Saving calculated data

Click the **[Save File]** button. Then, a file dialog to save a file appears. Input the file name. The default file extension is (\*.dat). Next data are saving in the file.

Zone_No.,	average,	x_direction,	y_direction,	z_direction
,	(cm3),	(cm3),	(cm3),	(cm3)
Z1,	1.0395E+002,	1.0395E+002,	1.0395E+002,	1.0396E+002
Z2,	1.3347E+001,	1.3356E+001,	1.3356E+001,	1.3329E+001
Z3,	1.2529E+003,	1.2529E+003,	1.2529E+003,	1.2530E+003
Z4,	6.9723E+001,	6.9787E+001,	6.9787E+001,	6.9595E+001
Z5,	7.7361E+003,	7.7363E+003,	7.7363E+003,	7.7357E+003
Z6,	2.4868E+002,	2.4844E+002,	2.4844E+002,	2.4915E+002
Z7,	8.5841E+002,	1.2876E+003,	1.2876E+003,	0.0000E+000

## 11.7 Start of Calculation

Click the **[Calculation START]** button. Then, you can start to calculate the volume of regions and **[Calculation START]** button is changed **[Calculation STOP]** button. If you want to cancel of calculation, please click the **[Calculation STOP]** button.

## 11.8 Close the window

Click the **[CLOSE]** button. Then, you can return to the main menu window.

## 11.9 Show the help message

Click the **[HELP]** button. Then, you can show the help message.

## SECTION 12 File Format

Geometry and particle trajectory data are created in an EGS calculation and read in by CGVIEW. The structure of the geometry, particle trajectory data is described.

### 12.1 Particle trajectory file format

a) geometry data

[CG System]

(1)CSTA

write CG data input start Symbol

CSTA = Fixed Format      CSTA-TIME = Fixed Format with lifetime data

CSTA-FREE = Free Format    CSTA-FREE-TIME = Free Format with lifetime data

CSTA-CSV = CSV Format      CSTA-CSV-TIME = CSV Format with lifetime data

(2)CSYM

write CG Body Symbol (RPP, RCC, SPH etc). (2) to (4) is 1 set data(plural data).

(3)CNUM

write CG Body Number (5 digit and positive number). (2) to (4) is 1 set data(plural data).

(4)CPRM[ ]

write CG Body Parameter. (2) to (4) is 1 set data(plural data).

(5)END : write CG Body Data input finish Symbol "END"

(6)ZNUM

write CG Zone Number(Z0001 etc). (6) to (7) is 1 set data(plural data).

(7)ZPRM[ ]

write CG Zone Parameter(OR and Body Number). (6) to (7) is 1 set data(plural data).

(8)END : write CG Zone Data input finish Symbol "END"

(9)CEND : write CG Data input finish Symbol "CEND"

[Spheres of co-center]

(1)GSTA

write except CG data input start Symbol

GSTA = Fixed Format      GSTA-TIME = Fixed Format with lifetime data

GSTA-FREE = Free Format    GSTA-FREE-TIME = Free Format with lifetime data

GSTA-CSV = CSV Format      GSTA-CSV-TIME = CSV Format with lifetime data

(2)SPHR : write Spheres of co-center Data input start Symbol "SPHR"

- (3)GCNT : Spheres of co-center count(>1)
- (4)GPRM[ ] : Spheres of co-center radius (GCNT)
- (5)GEND : write except CG data input finish Symbol "GEND"

[Cylinders of the co-center line]

- (1)GSTA
  - write except CG data input start Symbol
  - GSTA = Fixed Format      GSTA-TIME = Fixed Format with lifetime data
  - GSTA-FREE = Free Format   GSTA-FREE-TIME = Free Format with lifetime data
  - GSTA-CSV = CSV Format      GSTA-CSV-TIME =CSV Format with lifetime data
- (2)CYLS : write Cylinders of the co-center line Data input start Symbol "CYLS"
- (3)GCNT1 : Cylinders of the co-center line count(>1)
- (4)GCNT2 : A Section of Z Axis Count(>1)
- (5)GPRM1[ ] : Cylinders of the co-center line radius (GCNT1)
- (6)GPRM2[ ] : A Section of Z Axis Position(GCNT2)
- (7)GEND : write except CG data input finish Symbol "GEND"

[Three-dimensional slab]

- (1)GSTA
  - write except CG data input start Symbol
  - GSTA = Fixed Format      GSTA-TIME = Fixed Format with lifetime data
  - GSTA-FREE = Free Format   GSTA-FREE-TIME = Free Format with lifetime data
  - GSTA-CSV = CSV Format      GSTA-CSV-TIME =CSV Format with lifetime data
- (2)SLAB : Three-dimensional slab Data input start Symbol "SLAB"
- (3)GCNT1 : A Section of X Axis Count(>1)
- (4)GCNT2 : A Section of Y Axis Count(>1)
- (5)GCNT3 : A Section of Z Axis Count(>1)
- (6)GPRM1[ ] : A Section of X Axis Position(GCNT1)
- (7)GPRM2[ ] : A Section of Y Axis Position(GCNT2)
- (8)GPRM3[ ] : A Section of Z Axis Position(GCNT3)
- (9)GEND : write except CG data input finish Symbol "GEND"

b)Material data

- (1)MSTA : write material data input start Symbol "MSTA"
- (2)MCNT : write input material count(equal Zone Count)
- (3)MMAT[ ] : Material Number correspondence a Zone(>=0)
- (4)MEND : write material data input finish Symbol "MEND"

c)Particle trajectory data

- (1)0 : write 1 particle history data input start Symbol "0"
- (2)PHIS : particle history number (>=1)
- (3)PTYP  
write particle kind ( 4=photon 5=electron 6=positron). (3) to (11) is 1 set data(plural data).
- (4)PX  
write X coordinate of particle reaction point. (3) to (11) is 1 set data(plural data).
- (5)PY  
write Y coordinate of particle reaction point. (3) to (11) is 1 set data(plural data).
- (6)PZ  
write Z coordinate of particle reaction point. (3) to (11) is 1 set data(plural data).
- (7)PENR  
write particle reaction energy. (3) to (11) is 1 set data(plural data).
- (8)PZON  
write particle reaction region. (3) to (11) is 1 set data(plural data).
- (9)PWGT  
write particle weight. (default 1) (3) to (11) is 1 set data(plural data).
- (10)PTIME  
write particle lifetime. (only using time option) (3) to (11) is 1 set data(plural data).
- (11)PSTP  
if Particle reaction is finish then write "-1 ". (3) to (11) is 1 set data(plural data).
- (12)9 : write 1 particle history data input finish Symbol "9"
- (13)PLAT  
History' s Latch. (usually 1. this History un show is -1)

## 12.2 Particle trajectory file free format

Free Format mark off by a space.

## 12.3 Particle trajectory file CSV format

CSV Format mark off by a comma.

## 12.4 Particle trajectory file Fixed format

Fixed Format need input data with decide Format.

a) geometry data

[CG]

(1) Format ('CSTA')

(2) Format (1h, 2x, a3, i5, 1p8e12.4) CSYM, CNUM, CPRM[ ]

Format (1h, 2x, 3x, 5x, 1p8e12.4) CSYM, CNUM, CPRM[ ] (A Case of CPRM 8 over)

(3) Format (1h, 'END')

(4) Format (1h, 2x, a3, 5x, 1x, 10(a2, i5, 1x)) ZNUM, ZPRM[ ]

(a2 is "OR" or space, i5 is Body number)

Format (1h, 2x, 3x, 5x, 1x, 10(a2, i5, 1x)) ZPRM[ ] (A Case of ZPRM 10 over)

(5) Format ('END')

(6) Format ('CEND')

[Spheres of co-center]

(1) Format ('GSTA')

(2) Format ('SPHR')

(3) Format (3i6) GCNT

(4) Format (4E15.7) GPRM[ ]

(5) Format ('GEND')

[Cylinders of the co-center line]

(1) Format ('GSTA')

(2) Format ('CYLS')

(3) Format (3i6) GCNT1, GCNT2

(4) Format (4E15.7) GPRM1[ ]

(5) Format (4E15.7) GPRM2[ ]

(6) Format ('GEND')

[Three-dimensional slab]

(1) Format ('GSTA')

(2) Format ('SLAB')

(3) Format (3i6) GCNT1, GCNT2, GCNT3

(4) Format (4E15.7) GPRM1[ ]

(5) Format (4E15.7) GPRM2[ ]

(6) Format (4E15.7) GPRM3[ ]

(7) Format ('GEND')

b) Material data

- (1) Format ('MSTA')
  - (2) Format (i4) MCNT
  - (3) Format (15i4) MMAT[ ]
  - (4) Format ('MEND')
- c) Particle trajectory data
- (1) Format ('0', i5) PHIS
  - (2) Format (i1, 1p3E13.6, 1pE10.3, i4, 1p2E10.3)  
PTYP, PX, PY, PZ, PENR, PZONO, PWGT, PTIME
  - (3) Format ('-1')
  - (4) Format ('9', i5) PLAT

## 12.5 Make geometry file

- (1) CSYM  
write CG Body Number (RPP, RCC, SPH etc). (1) to (3) is 1 set data (plural data).
- (2) CNUM  
write CG Body Number (5 digit and positive number). (1) to (3) is 1 set data (plural data).
- (3) CPRM[ ]  
write CG Body Parameter. (1) to (3) is 1 set data (plural data).
- (4) END : write CG Body Data input finish Symbol "END"
- (5) ZNUM  
write CG Zone Number (Z0001 etc). (5) to (6) is 1 set data (plural data).
- (6) ZPRM[ ]  
write CG Zone Parameter (OR and Body Number). (5) to (6) is 1 set data (plural data).
- (7) END : write CG Zone Data input finish Symbol "END"
- (8) MMAT[ ] : Material Number correspondence a Zone (>=0)

## 12.6 Make geometry file Free Format

Free Format mark off by a space.

## 12.7 Make geometry file CSV Format

CSV Format mark off by a comma.



## SECTION 13 EGS users code

For drawing the trajectories of the particles, it is necessary to obtain a series of data, which include the type of particle as well as its position and energy. If only one particle of the same kind is calculated, the particle trajectory can be obtained by joining the points. In the EGS calculation, one or two particles is emitted in an interaction, and a particle having a smaller kinetic energy is followed first after the interaction. When the type of particle followed is different from that of the incident particle, or a new particle is emitted, the group of data must be written on the output file. SUBROUTINE PLOTXYZ is utilized for this purpose.

When SUBROUTINE GEOMGT is used to read in CG information, echo back of the information is output. This echo back is output to the geometry and trajectory data file. The material number of each region is also output to the geometry and trajectory data file. Information about the cylinder, slab geometry is output to the geometry and trajectory data file by utilizing SUBROUTINE GEOMOUT, which was developed for EGSPIC.

The lines to output the geometry, trajectory information in EGS users code are described.

### 13.1 Main Program

The format of a line of particle information and geometry information are controlled by the value of NPRECI, as shown in Table.13.1. XMIN-ZMAX is used to specify the minimum and maximum values of each coordinate in non-CG geometry (ex. cylinder-slab geometry). XMIN-ZMAX is not used in CG. FNORM is always not used.

Table.13.1 Control of Format by NPRECI

NPRECI	Cylinder -Slab	CG	Medium	Format of particle information	Program
0	○	×	×	I5	EGSWIN32
1	○	×	×	I8	EGSWIN32
2	○	○	○	1PE13.6	CGVIEW (Fixed Format)
3	○	○	○	1PE14.6	CGVIEW (Free Format)

NPRECI=3, is specified for CGVIEW.

```
NPRECI=3;
```

Define the file name to which the data for the shower display are written.

```
open(UNIT=39, FILE=' egs5job. pic', STATUS=' unknown' )
ifto = 39
```

The following lines are added before and after a line of "CALL GEOMGT;" to obtain CG information.

```
write(ifto, fmt=" (' CSTA-FREE' )" )
write(ifto, 110)
110  FORMAT(' CEND' )
```

The material number assigned for each region is output.

```
write(ifto, 310)
310  FORMAT(' MSTA' )
write(ifto, 320) nreg
320  FORMAT(I4)
write(ifto, 330) (med(i), i=1, nreg)
330  FORMAT(15I4)
write(ifto, 340)
340  FORMAT(' MEND' )
```

This line is used to indicate a start of history. Output "0", which indicates the start of the history and history number.

```
if(npreci.eq.3) then
  if (i.le.imax) write(ifto, 197) i
endif
197  format(' 0', I12)
```

Tell to the SUBROUTINE PLOTXYZ that all of the histories are finished. If the first argument is 99, all of the data that are not written on the output file are output.

```
if (i.le.imax) call plotxyz(99, 0, 0, 0. D0, 0. D0, 0. D0, 0. D0, 0, 0. D0)
```

This line is used to indicate the end of history. Output "9", which indicates the end of the history. -1 is output after 9 when displaying of this particle is suppressed using the LATCH function.

```

        if(nppeci.eq.3) then
            if (i.le.imax) write(ifto,207)
        endif
207  FORMAT('9  1')

```

Close the file to which the data for shower display are written.

```
close(UNIT=ifto)
```

### 13.2 SUBROUTINE AUSGAB

Each time when the SUBROUTINE AUSGAB is called, IARG, the stack number (NP), the type of particle (NP), the type of particle (IQ), the position of the particle (X, Y, Z), the energy of particle (E), current region (IR), weight (WT) are transferred to the SUBROUTINE PLOTXYZ by the following statement:

```

        if (i.le.imax) then
            call plotxyz(iarg,np,iq(np),x(np),y(np),z(np),e(np),ir(np),wt(np))
        end if

```

### 13.3 SUBROUTINE PLOTXYZ

SUBROUTINE PLOTXYZ was written based on SUBROUTINE PLOTXYZ developed at SLAC for the 2-dimensional display of a shower picture. In a version of PLOTXYZ for EGS4WIN32, particle information was output in integer form to reduce the file size. SUBROUTINE PLOTXYZ was modified to output particle information in real numbers. The output format is controlled by a variable NPRECI, as shown in Table 13.1.

## SECTION 14 Make Geometry Sample with CG

An Explanation of gamma detector For Make Geometry File(\*.data) With CG in EGS.  
 A condition for making. (This data is g-detector.geo in sample directory.)

- A-Pos is (0,0,0), and Z-axis plus in the upper direction.
- Making Region of A and upward.
- Material number is AIR=1, ACRYLIC=2.

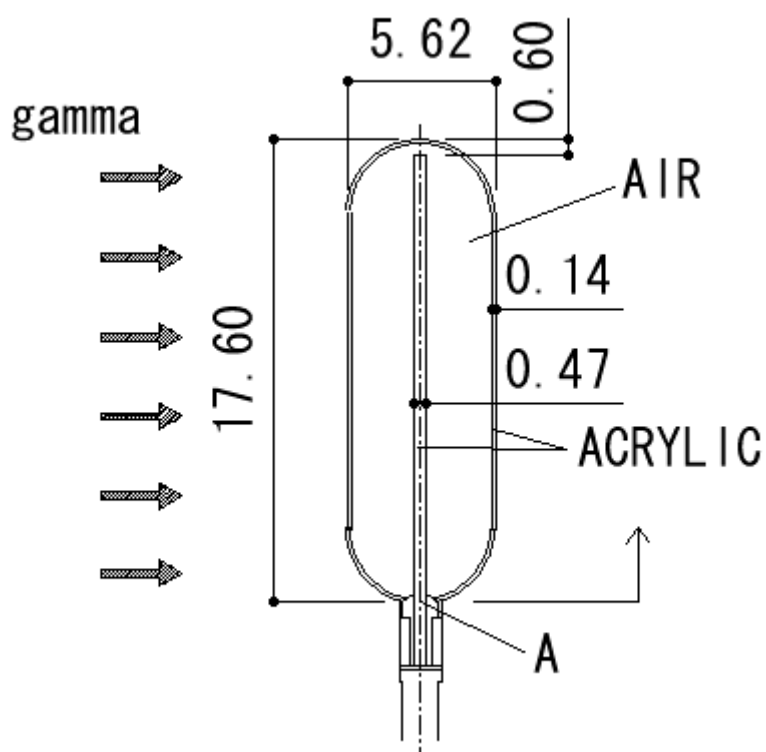


Fig.14-1 gamma detector sample

Zone1 ---- Detector (ACRYLIC)

Detector use RCC Model.

Use Body

RCC 1 0.0 0.0 0.0 0.0 0.0 17.0 0.235

Use Zone

Z0001 2 +1

Zone2 ---- Inside Detector(AIR)

Inside Detector use RCC and, SPH Model. Then necessary for zone1 minus.

Use Body

RCC 2 0.0 0.0 2.81 0.0 0.0 11.98 2.67

SPH 3 0.0 0.0 2.81 2.67

SPH 4 0.0 0.0 14.79 2.67

Use Zone

Z0002 1 +2 -1 OR +3 -1 OR +4 -1

Zone3 ---- Cover(ACRYLIC)

Cover use RCC and, SPH Model. Then necessary for zone1 and 2 minus.

Use Body

RCC 5 0.0 0.0 2.81 0.0 0.0 11.98 2.81

SPH 6 0.0 0.0 2.81 2.81

SPH 7 0.0 0.0 14.79 2.81

Use Zone

Z0003 2 +5 -2 OR +6 -5 -3 -1 OR +7 -5 -4

Zone4 ---- OutSide Detector(AIR)

Necessaly for make air region outside detector. Air region is SPH in Radius 100.0.

Use Body

SPH 8 0.0 0.0 0.0 100.0

Use Zone

Z0004 1 +8 -5 -6 -7 -1

Zone5 ---- Calculate Finish Region

Necessaly for Calculate Finish Region for EGS+CG. Calculate Finish Region is material number 0, and if arrival particle in this region, then Calculation Stop.

Use Body

SPH 9 0.0 0.0 0.0 101.0

Use Zone

Z0005 0 +9 -8

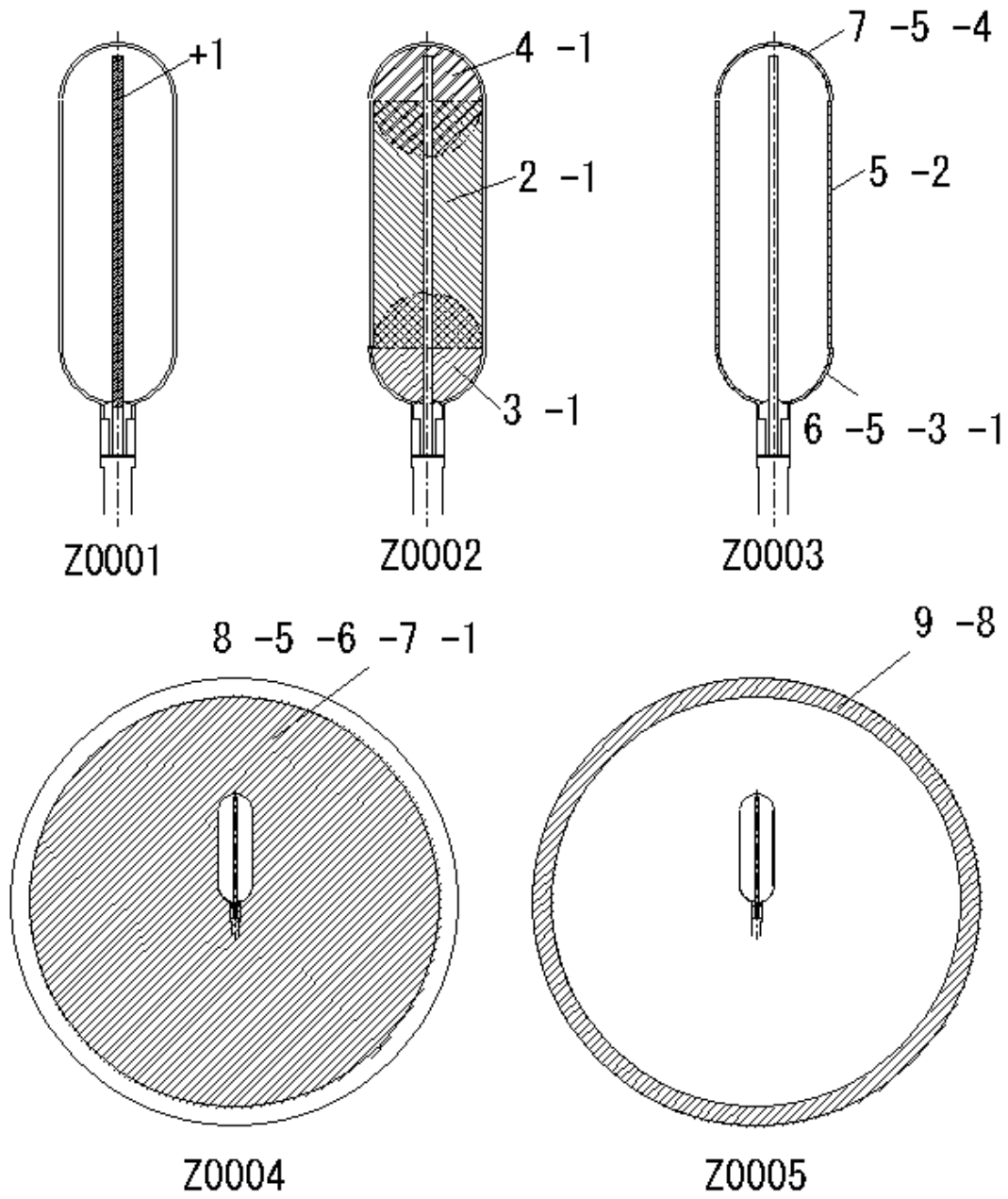


Fig. 14-2 Zone Region