

EGS PARTICLE TRAJECTORY AND GEOMETRY DISPLAY PROGRAM CGVIEW

Y. Namito, H. Hirayama

High Energy Accelerator Research Organization (KEK)
Oho, Tsukuba-shi, Ibaraki-ken, 305-0801 Japan
yoshihito.namito@kek.jp; hideo.hirayama@kek.jp

A. Takamura and T. Sugita

Science System Lab.
1342-6 Sumiyoshi, Tomobe, Nishi-Ibaraki Ibaraki-ken 309-17 Japan
gb1t-sgt@asahi-net.or.jp

ABSTRACT

The EGS Shower Display system (cgview) is developed to display three-dimensional particle trajectories of electrons, positrons and photons together with the geometry. The geometry systems which cgview can handle are CG (combinatorial geometry), cylinder-slab, 3-dimensional slabs and spheres of co-center. The data of particles' trajectories are calculated by using the EGS code system. 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. Cgview runs on a windows PC and Linux.

Key Words: EGS, Trajectory display, CG, cgview

1 INTRODUCTION

The first EGS4 [1] 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 EGS4 particle trajectory display system for MS-DOS PC was developed at KEK [3], and updated for the windows PC [4, 5]. 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 [6]. The EGS Shower Display system (cgview) [7] is developed to display three dimensional particle trajectories of electrons, positrons and photons together with the geometry described in CG on a windows PC. Cylinder-slab, three-dimensional slabs and spheres of co-center can be handled by cgview also. Cgview version 1.2 [8] is developed to run on a windows PC and Linux. Geometry check function is added to cgview 1.2. It is possible to check if the geometry is properly input or not on a three dimensional display using cgview 1.2. The time to prepare the geometry may be reduced by using cgview.

2 OUT LINE OF CGVIEW

2.1 Develop Environment and System Requirement

Object Pascal is used as development language. Borland Delphi 7 is used as development tool. For a PC/AT-compatible machine, OS must be Windows 98 or later. Video card should work for Open GL. For a LINUX machine, X-Window system is necessary (Red Hat 8.0 is recommended). Open GL library is also necessary.

2.2 Functions of Cgview

2.2.1 Functions for the geometry display

1) The following 4 kinds of geometry data are displayed: CG (Combinatorial geometry), Cylinder-slab, Three dimension slabs, Spheres of co-center.

2) Method of display is either plane or wire-frame.

3) Level of display. The following 3 levels can be specified for displaying the geometry: Body, Zone and Material.

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.

5) Area of the display is automatically set using input data.

6) Axis for the display can be selected from Z-X, Y-Z, X-Z and X-Y. Eye point can be changed by mouse operation.

2.2.2 Functions regarding particle trajectory display

1) Photons, electrons and positrons are displayed. History region and energy region for display can be selected. Line color, type and width for each kind of particles can be specified. Display of Each kind of particles can be turned on/off.

2) Particle weight can be used to control line width.

3) It is possible to control the turning on/off display by using a flag for each history. LATCH value can be as a flag.

2.2.3 Functions using mouse

Eye point can be changed using mouse. Zoom in/out, parallel movement and rotation is equipped.

2.2.4 Functions 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. User input geometry data of the EGS code to cgview, and check them in a 3-dimensional figure on the screen. Also, user can save created data and used it as a CG input file in EGS calculation.

2.2.5 Functions to check geometry data

Cgview can be used to help check geometry data for an EGS calculation. User specifies start position and direction for pseudo particle. Cgview checks a geometry data at middle point of boundaries. Cgview prints an error message when zones overlap (Figure 1-a), no zone is defined for some point (Figure 1-b), or material number of outside zone is not 0 (Figure 1-c). By using this function geometry error can be checked before running real Monte Carlo simulation. So time for geometry set up can be reduced.

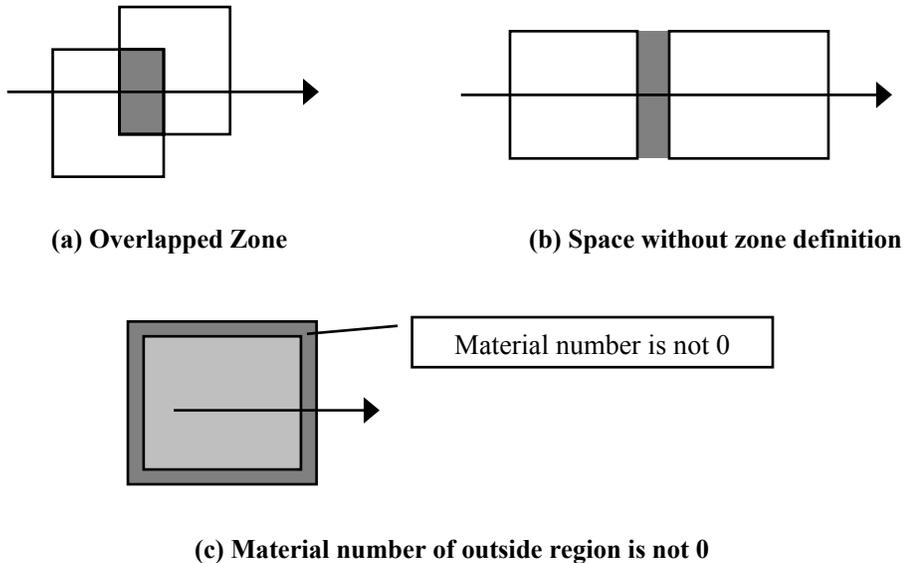


Figure 1. Examples of error in zone definition

3 RELATIONSHIP BETWEEN EGS AND CGVIEW

EGS and Cgview run independently. Figure 2 shows the outline of the relationship between EGS and cgview. The EGS user code needs to be changed so that it can output particle information at each interaction and geometry data to external file called as “pict file”. Cgview reads in this pict file and display particle trajectory and geometry to a terminal.

Cgview have a function to create dos-window or xterm window to run EGS calculation. EGS calculation to update pict file and updating particle trajectory display using cgview can be switched by pushing one button in cgview. Thus EGS-Cgview operation can be performed semi-interactively also.

Alternative way of using cgview is CG data creation. User input CG data to cgview and check it by three dimension display. Then user checks geometry by using pseudo particle. Here overlap of zone, no definition of zone and non-zero material number of most outer zone can be checked. Then the created geometry data is saved and used as EGS geometry data.

4 EXAMPLE OF DISPLAY

Examples of display are shown in figure 3 and figure 4. Combinatorial geometry which consists of cylinder and sphere is shown in figure 3. Three dimension slab geometry is shown in figure 4. Language of tool bar can be selected from English and Japanese. Japanese tool bar is shown in figures 3 and 4.

5 REFERENCES

1. W. R. Nelson, H. Hirayama and D. W. O. Rogers, "The EGS4 Code System," *Stanford Linear Accelerator Center Report*, **SLAC-265** (1985).
2. A. F. Biewlajew and P. E. Weibe, "EGS-Windows – A Graphical Interface to EGS," *NRCC Report*, **PIRS-0274** (1991).
3. H. Hirayama, Y. Namito, S. Ban and R. Ikeda, "EGS Shower Display System (1) MS-DOS Version," *KEK report*, **KEK Internal 94-4** (1994).
4. H. Hirayama, Y. Namito, S. Ban, R. Ikeda and Y. Tokuda, "EGS Shower Display System, EG S4PICT(2), Windows Version," *KEK report*, **KEK Internal 94-10** (1994).
5. H. Hirayama, Y. Namito, S. Ban, R. Ikeda and Y. Tokuda, "EGS Shower Display System (EG S4PICT) Windows Version 2.0," *KEK report*, **KEK Internal 96-9** (1996).
6. T. Torii and T. Sugita, "Development of PRESTA-CG Incorporation Combinatorial Geometry in EGS4/PRESTA", *Japan Nuclear Cycle report*, **JNC TN1410 2002-001** (2002).
7. Y. Namito, H. Hirayama, A. Takamura and T. Sugita, "EGS4 Particle Trajectory and Geometry Display Program cgview," *KEK report*, **KEK Internal 2003-9** (2003).
8. Y. Namito, H. Hirayama, A. Takamura and T. Sugita, "EGS4 Particle Trajectory and Geometry Display Program cgview (Version 1.2)," *KEK report*, To be published as **KEK Internal**.

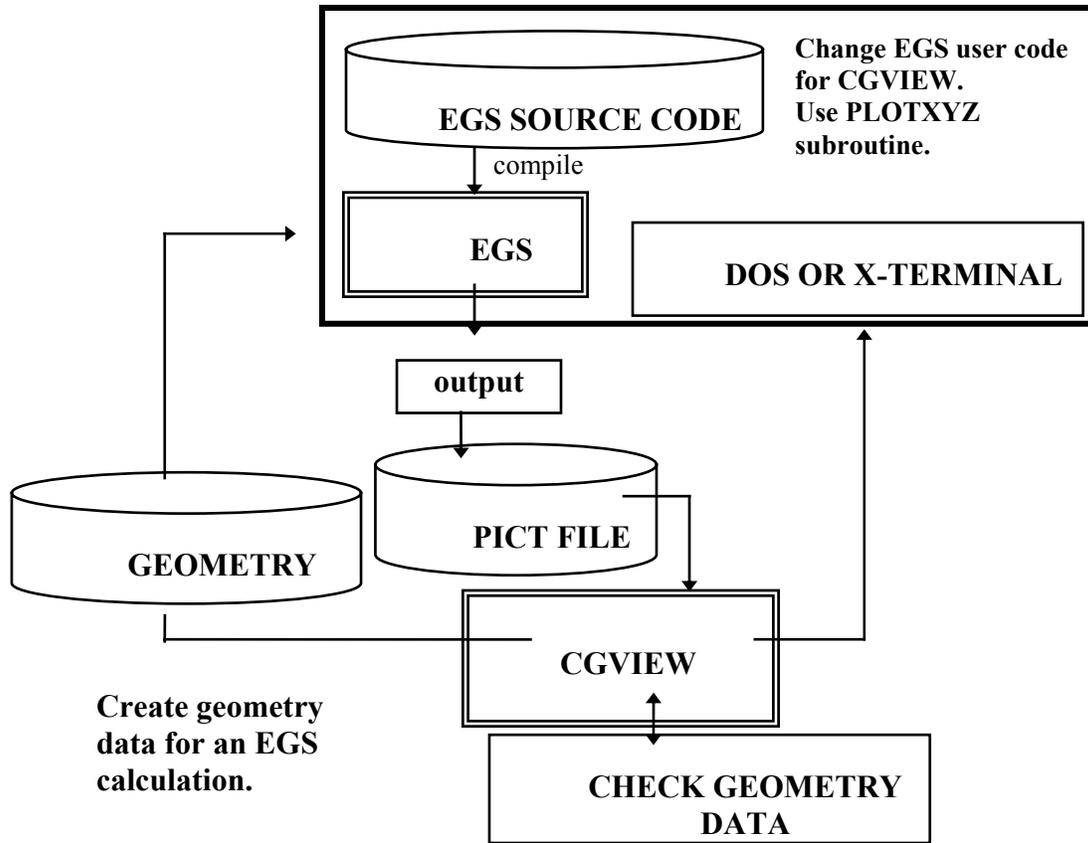


Figure 2. Outline of relationship between EGS and cgview

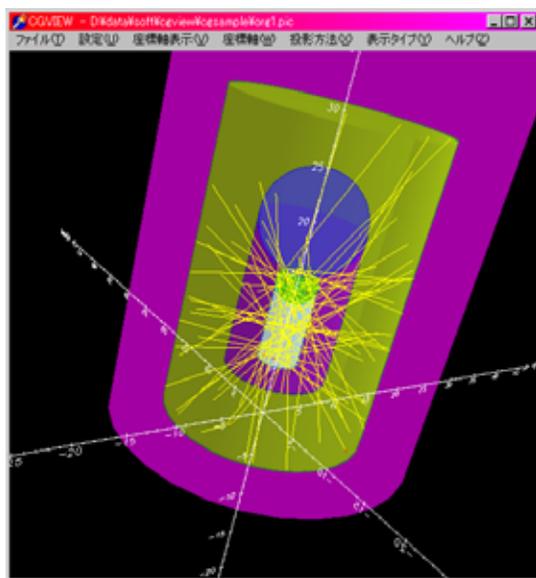


Figure 3. Example 1 of display.

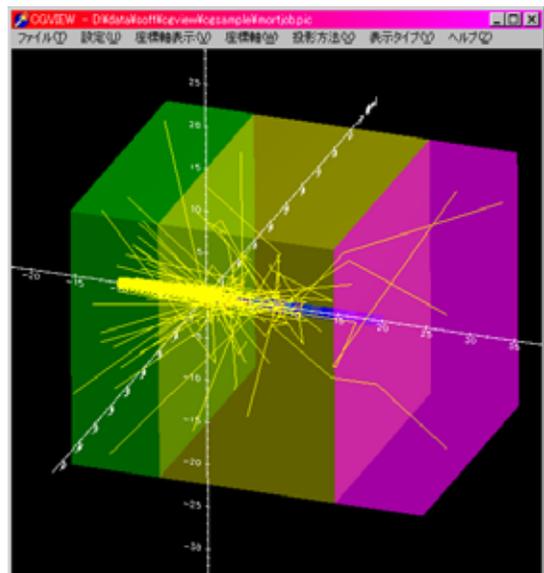


Figure 4. Example 2 of display.