GSYS : Development and usage of a software to read-in and digitize the graphical data

A. Minoguchi[12], K. Arai[13], N. Otuka[4] and K. Naito[5]

Abstract

"GSYS" is the Java application software, which enables users to digitize graphs easily by the mouse and keyboard and obtain the original numerical data precisely. In this report, we present an overview of GSYS and a typical example for usage of this software. GSYS is available from the web site of Japan Charged-Particle Nuclear Reaction Data Group (www.jcprg.org).

1. Introduction

Japan Charged-Particle Nuclear Reaction Data Group (JCPRG) has developed and improved Nuclear Reaction Data File (NRDF). The amount of the nuclear experimental data kept in NRDF has continued to increase remarkably. In order to develop the high-quality database, it is quite important to accumulate a large amount of the precise numerical data. The best way to compile the precise numerical data is to take it directly from the author of the paper. While most of the data published recently are given from the authors, we often need to use some systems to digitize the data published previously because there are many cases that the author lost the old data or it is impossible to contact the author. Practically, a quarter of the amount of the data kept in NRDF is obtained by digitizing the graphical data. Thus, the data digitizing systems have played an important role in accumulating the numerical data. To digitize as much data as possible with accuracy and rapidity, it is necessary to use a good system which can be operated easily by anyone and read-in the numerical data with high accuracy. GSYS developed by Dr. Arai is the superior Java application software to read-in and digitize the graphical data. GSYS is the operating system independent software and can be run on user's PC on relatively high-speed. Particularly, it has the advanced interface. Users can operate GSYS using not only mouse but also keyboard. And it is possible to zoom in the picture and fine-tune the position of the marker which indicate the data point in the figure easily so that the numerical data is read-in precisely. Additionally, GSYS is available from the web site of JCPRG. In following section, how to use GSYS is described in detail.

2. How to use GSYS

Since GSYS is the application software developed with Java language, it is required to install Java platform ver.1.1 or later on PC before users run GSYS. Java platform can be downloaded from the web site of Sun Microsystems (java.sun.com). About GSYS, users can download the source program, class files and manuals from the web site of JCPRG (www.jcprg.org). The source program of GSYS is Gsys.java and users can run this system by the command "java Gsys". Fig.1 shows the application window of GSYS running on Windows2000. A sample picture file is already loaded. The window of GSYS consists of three parts. The left part of the window is the control panel to operate GSYS, the lower right part the main panel to display the loaded picture and the upper right part the information panel to display the description of the button in the control panel and the coordinate point of the data point when a pointer is on the button or the data point. Prepare a picture file to digitize before using GSYS. The supported graphics formats are GIF, JPEG and PNG.

2.1. How to digitize the original data from a picture

GSYS can be operated with a combination of mouse and keyboard. Some of the operations can be performed using some keys instead of clicking the buttons in the control panel. Correspondence between keys and buttons is shown in Table.1. Now, let us explain how to use GSYS on the basis that users operate GSYS mainly using mouse. In order to read-in the graphical data precisely, we recommend to zoom in the picture and fine-tune the position of the marker on the data point carefully.

[1] Meme Media Laboratory, Hokkaido University
[2] Department of Physics, Hokkaido University
[3] Present Address : Institut d'Astronomie et d'Astrophysique, Universite Libre de Bruxelles
[4] Nuclear Data Center, Japan Atomic Energy Research Institute (JAERI)
[5] KBMJ, Inc. Engineer

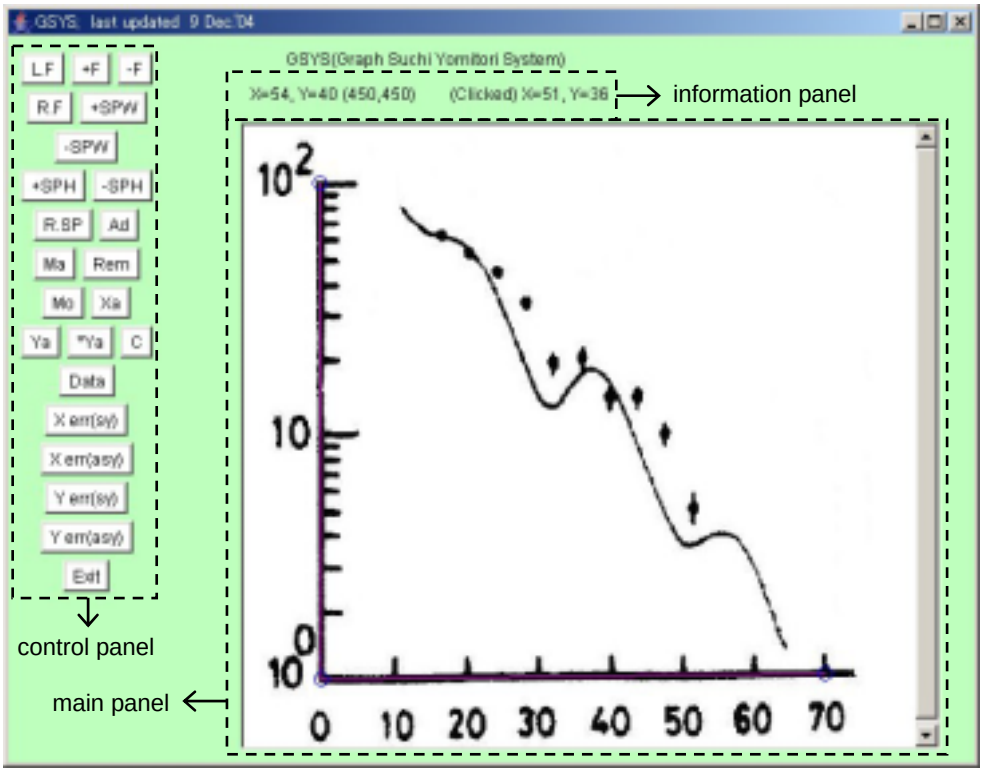

Fig. 1 Application window of GSYS (Sample picture is already loaded.). When "L.F" button is clicked, the dialog box to select a picture file appears. Since the start and end points of X and Y axes (blue open circles) are already determined, X and Y axes are indicated by pink solid lines. The coordinate point of the new point which is pointed by a mouse pointer is displayed in the left side of the information panel. The coordinate point of the last point which is clicked and read-in is displayed in the right side of the information panel.

1) Click "L.F" button on the upper left corner of the control panel to load a picture file. The dialog box to select a picture file appears. The loaded picture is shown in the main panel.
2) Determine the start and end points of X and Y axes of the picture: Click "Xa" button and then click the start and end points of X axis. After that, click "Ya" button and then click the start and end points of Y axis. If the start points of X and Y axes are at the same position on the picture, click "*Ya" button instead of "Ya" button and then click only the end point of Y axis. These points of X and Y axes are indicated by blue open circles and X and Y axes by pink solid lines.
3) Read-in the data points: Click "Ad" button (The color of "Ad" button is changed from white to red.). Click the first data point on the picture and then the point is indicated as a red solid circle. When the new data point is clicked, the new one is indicated as a red solid circle while the former one is as a pink solid circle. The user can point the data points continuously. The pointed data points are indicated as the pink solid circles as shown in Fig. 2. When all the data points are pointed, click "Ad" button again to deactivate the data-input mode (The color of "Ad" button is changed from red to white.) The size of the picture can be enlarged and reduced using "+F" and "-F" buttons, respectively. "R.F" button is used to restore the default size setting of the picture. And also, it is possible to adjust the size of the main panel. The width of the main panel is expanded and narrowed using "+SPW" and "-SPW" buttons. The length of the main panel is extended and reduced using "+SPH" and "-SPH" buttons.
4) In order to mark a given data point, click "Ma" button (The color of "Ma" button is changed from white to red.) and then click the data point. The color of focused data point is changed from pink to red. When "Ma" button is clicked again (The color of "Ma" button is changed from red to white.), the data-focus mode is deactivated. If the position of a data point is to be fine-tuned, mark the data point and then click "Mo" button. Push the arrow keys on a keyboard to move the focused data point every 1 pixels. When "Mo" button is clicked again, the data-move mode is deactivated. To remove a data point, mark the data point and then click "Rem" button to remove the focused data point. Also, the start and end points of X and Y axes can be moved in the way described above. Since, however, the start and end points of X and Y axes cannot be removed in the way described above, the user need to determine

those point again using “Xa”, “Ya” and “*Ya” buttons instead.

5) In order to read-in an error bar, mark the data point with the error bar using “Ma” button. In the case of a symmetric X (Y) error bar, click “X err (sy)” (“Y err (sy)”) button and click the one end of the error bar. In the case of an asymmetric X (Y) error bar, click “X err (asy)” (“Y err (asy)”) button and click the both ends of the error bar. When the position of a data point is moved, that of the error bar is also moved together. To move only the position of a given error bar, mark the data point with the error bar and click “Mo” button. In the next, click any one of “F5”(for symmetric X error bar or one end, which is pointed primarily, of asymmetric X error bar), “F6”(for one end, which is pointed secondarily, of asymmetric X error bar), “F7”(for symmetric Y error bar or one end, which is pointed primarily, of asymmetric Y error bar) and “F8”(for one end, which is pointed secondarily, of asymmetric Y error bar) keys to indicate a red solid circle at the tip of the movable error bar. The error bar is moved using the arrow keys. Since it is impossible to remove only an error bar, remove the data point with the error bar and read-in it anew. .

6) In order to clear all the markers for the start and end points of X and Y axes and focused data points to go back to the process 1), click “C” button.

7) Click “Exit” button to exit out of GSYS.

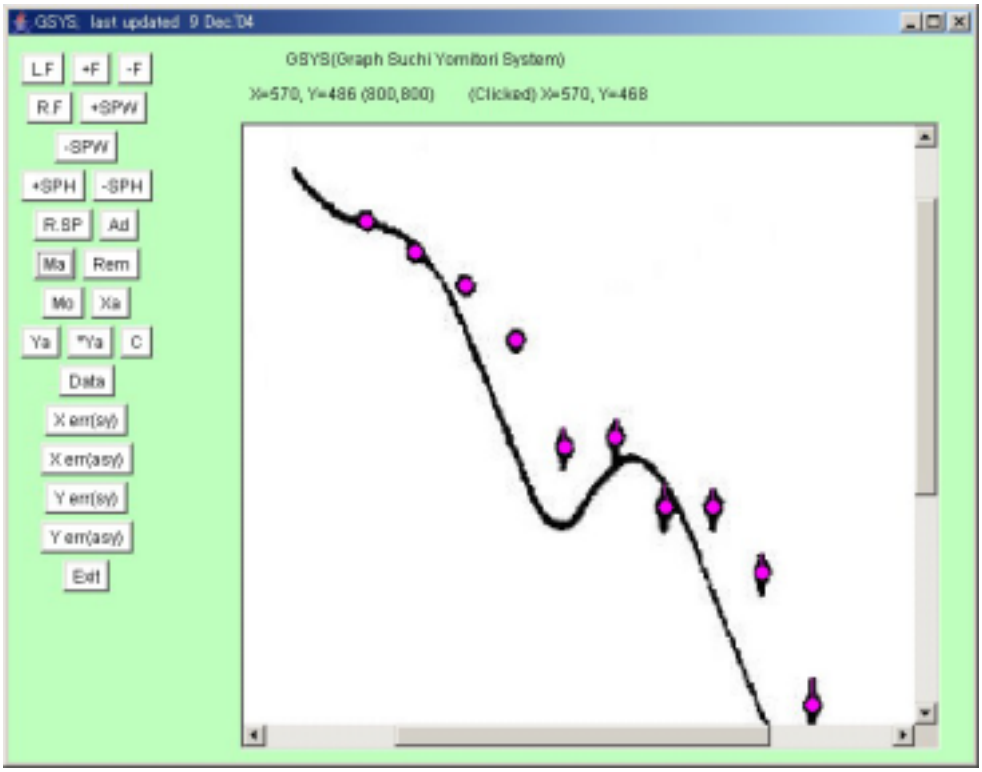

Fig. 2 Sample of reading the data points. The size of the picture is enlarged so that the center of a data point is found precisely. There are four data points without error bars in the left side of the picture and six data points with symmetric Y error bars in the right side of the picture.

Table.1 Correspondence between keys and buttons in the control panel. (*,** : Up and down arrow keys are available for adjusting the size of a picture only if “Mo” button is deactivated.)

Button	*Key*	*Button*	*Key*
+F (zoom in a loaded picture)	**up arrow key***	**Rem** (remove a focused point)	**Esc**
-F (zoom out a loaded picture)	**down arrow key****	**Data** (call data output window)	**O**
R.F (restore default picture size)	**R**	**X err(sy)** (for symmetric X error bars)	**F1**
Ad (activate data-input mode)	**A**	**X err(asy)** (for asymmetric X error bars)	**F2**
Ma (activate data-focus mode)	**M**	**Y err(sy)** (for symmetric Y error bars)	**F3**
Mo (activate data-move mode)	**V**	**Y err(asy)** (for asymmetric Y error bars)	**F4**

2.2. How to give an output of the numerical data

1) Click “Data” button after all the data points are pointed. The new window to output the numerical data appears as shown in Fig.3. The top part is the control panel and the bottom part is the main panel to display the numerical values of the data points. The width and height of the main panel are adjustable by using “+SPW”, “-SPW”, “+SPH” and “-SPH” buttons.
2) Give the numerical values of the start and end points of X and Y axes at the “x(start)=”, “x(end)=”, “y(start)=” and “y(end)=” boxes. Select the type of the form about the error bar from the options (No Error or X Error or Y Error or X & Y Error) and the expression of the error value from the options (Relative or Absolute) in “Error value” boxes. Finally, select the type of the scale of X and Y axes from the options (Linear or Log) in “Scale” boxes.
3) Click “Write” button to give the numerical values of the data points in the main panel. A typical example is shown in Fig.3. It is possible to sort the numerical data set so that the X (Y) values are in ascending order using “Sort X” (“Sort Y”) button. Click “Write” button again to restore the default order.
4) In order to save the numerical data to a file, click “Save” button. Click “Close” button to close this window.

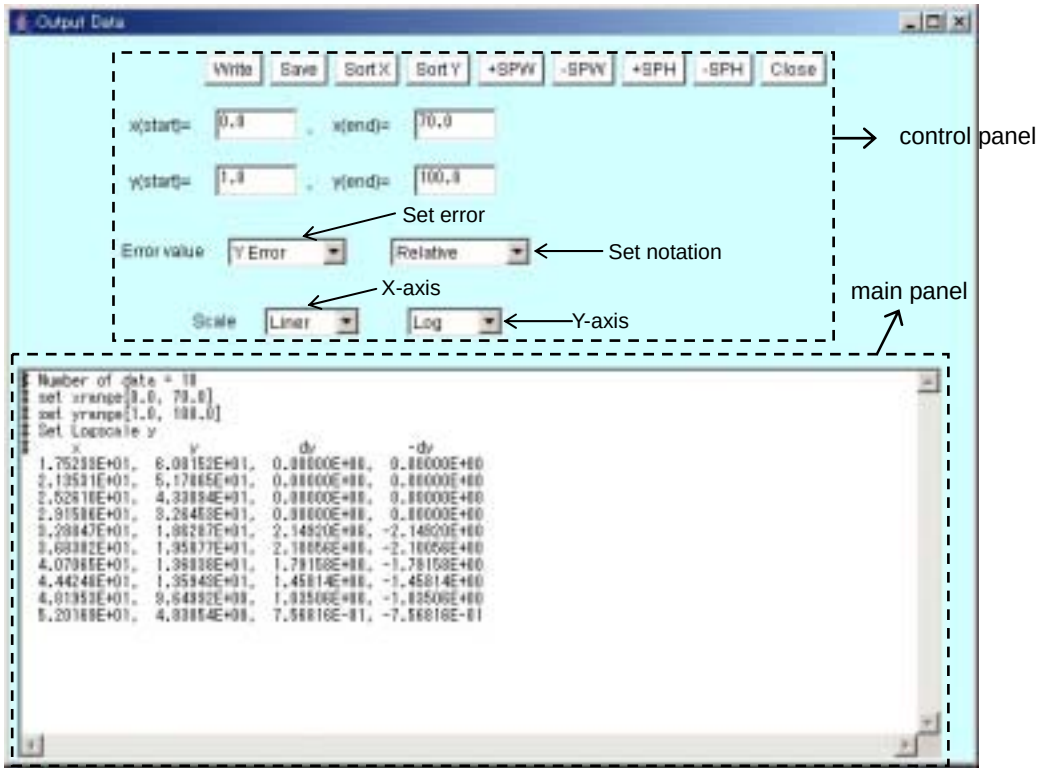

Fig. 3 Sample of output window which displays numerical data values with symmetric Y errors. Starting from the left, X values, Y values and Y error values are displayed in the main panel.

3. Conclusions

In this report, we have present our new system named “GSYS”, which is based on Java and therefore can be operated on any kind of the operating system, for digitizing the graphic data on the printed matter. This system can be lightly worked on your PC and easily operated by the mouse and keyboard.

Further improvement and development of GSYS are now in progress. Moreover, not only the class files but also the source program can be downloaded from the web site of JCPRG so that anyone can improve and modify GSYS.