**PICAM EGSE**
**User Manual**

The PICAM EGSE consists of two parts: the embedded Linux system and the Graphical User Interface.

The embedded Linux system controls the Space Wire Interface and the Power Simulator. It communicates with the Graphical User Interface (GUI) through Ethernet using TCP/IP protocol. It accepts command from only one GUI program, but it can send data to eight different GUI the same time.

The Graphical User Interface is implemented under Windows operating system. Its task is:

- connect to the embedded system,
- send telecommand to the PICAM device,
- display and store the PICAM telemetry,
- control the space wire interface,
- control the Power Simulator

# Embedded system

The embedded system contains a Space Wire (SPW) interface. It has two lines, and realizes all requirement described in BC-EST-RS-01140_Iss2Rev2-Signed.pdf. The Power Simulator unit is controlled via serial line. The settings are: speed = 9600 Baud, no parity, 1 stop bit, 8 data bits.

The embedded system communicates with the GUI using TCP/IP protocol. Two ports are used: 8040 for input (commands) and 8050 for output (telemetry). The data structures are described in BC-EST-RS-01140-EIDA-Iss1Rev1-Signed.pdf.
There are three types of commands:

- PICAM telecommands are marked in field “apid” with value equal 106,
- Space wire control commands are marked in field “service” with value greater then 1,
- Power Supply commands.

Four bytes long integer 1 value is inserted before the PICAM telecommand. The PICAM telecommands are forwarded to the Space Wire (SPW) interface in reversed byte order.
The SPW control enables the switchover the main and redundant interfaces and set the communication speed.
The Power Supply (PWS) control enables to switch the unit on/off, to set the output voltage and to generate a 30 V pulse.
There are tree types of telemetry data:

- PICAM telemetry marked in field “apid” with value equal 106,
- SPW interface status messages marked in field “destination” with value equal 1,
- PWS messages marked in field “destination” with value equal 0.

In the PICAM telemetry the leading 4 bytes are cut from the received data block and the byte order is reversed.

# Graphical User Interface

The Graphical User Interface runs under Windows operating system. It connects to the embedded system through Ethernet interface using TCP/IP protocol. Port number 8040 is used for output direction (telecommands) and 8050 for input (telemetry). The received data can be stored on disk in files. In off line mode the archived data can be read back and displayed as well. The telemetry data can be visualized in different forms: hexa dump, graphical symbols or chart diagrams are available.
The available PICAM telecommands are stored in an xml control file describing all the commands and their parameters. There is a possibility to compose and store command sequences (script file) and later execute them.
The possibility of controlling the Power Simulator and the Space Wire interface enables testing the PICAM hardware under different circumstances.
Figure 1 shows the main panel of PICAM EGSE after program start.

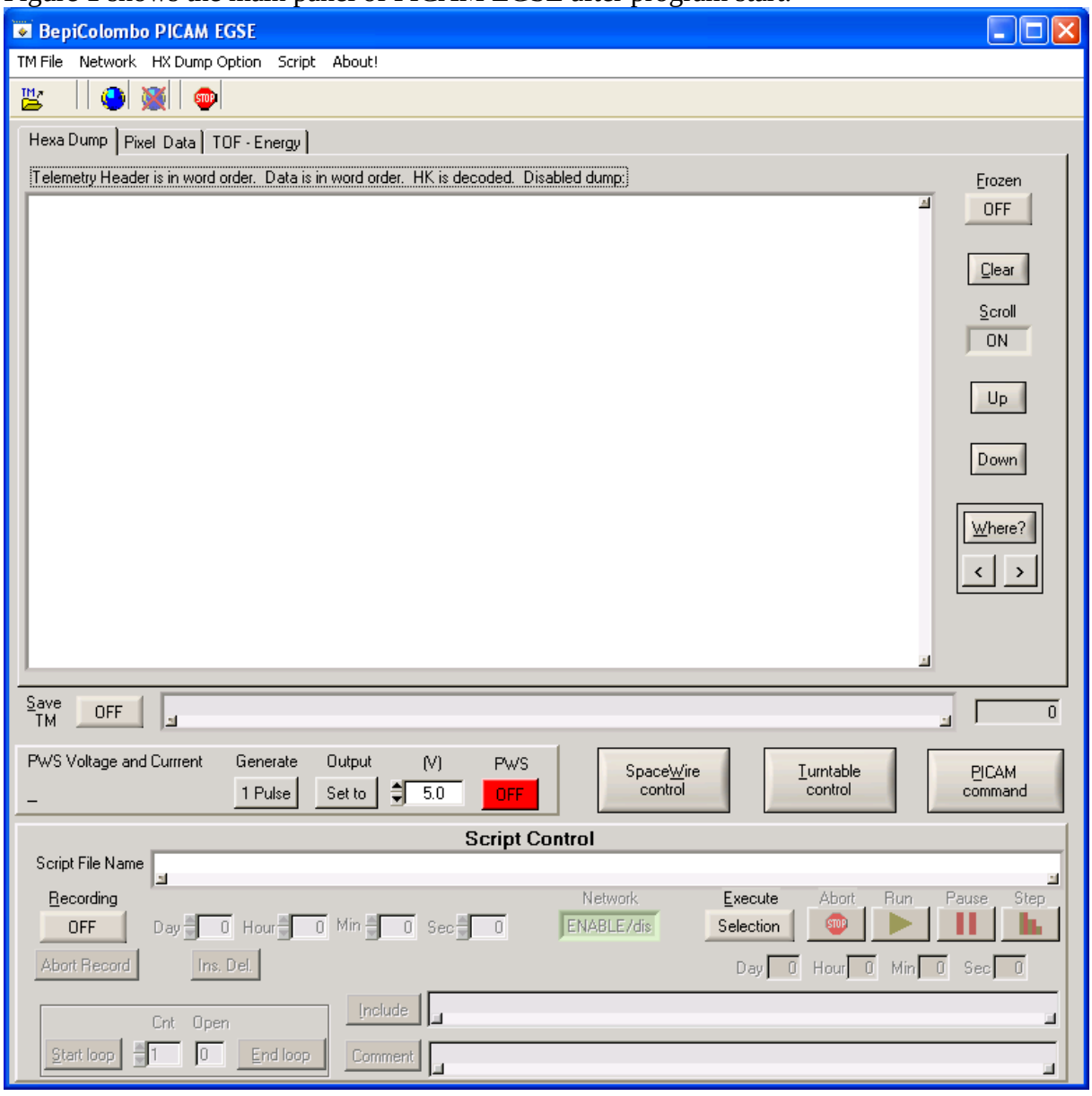

Figure 1 – main panel

## *Working with the GUI*

In offline mode the GUI is not connected to the embedded system. In this mode the replay of previously stored telemetry data is enabled. The telemetry records can be read back one by one or some records can skipped. This feature enables to slow or fasten the original time.

In online mode the GUI is connected to the embedded system. Everything is shown in real time. The Power Simulator and the Space Wire interface can be controlled in this mode. Before switching online the first time the IP address of the embedded system should be set by selection of the "Network" - "Definition of TCP/IP Addresses" menu item. The last setting is stored. To switch online use the network menu or click the globe symbol below it.

The possibility to compose command sequences (scripts) and to test them is enabled both in offline and online modes.

## *Menu line and shortcuts*

There is a menu line on the top of the window and some shortcuts below it. The selection of a menu item displays a pulldown menu. Selecting a line of it starts further actions as

- display a submenu,
- changing a setting,
- activating a panel for file selection or data input.

The selection of a shortcut symbol activates a pulldown menu item.

### TM File menu

The "TM File" menu has the following items:

- Read TM File
- Save TM File
- Log File Size
- Select Default Directory
- Save Default Directory
- Exit

The "TM" shortcut below the "TM File" activates the "Read TM File" menu item as well. A file selection window is displayed as shown on Figure 3. After selection with double-click on the file name or pressing the OK button the "Read TM options" window appears.

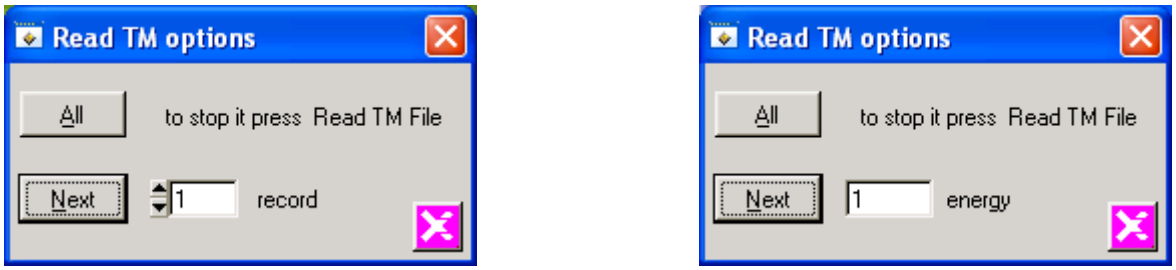


Figure 2 – Read TM options

Pressing the “All” button the records are read without break. To break the program press the “read TM File” again. Pressing the “Next” button the given number of record is read continuously. When “Pixel Data” is displayed and the science data record contains data of more then one energy step the graphical data display stops by each energy step. Pressing the “Next” button displays the data of the next energy step.

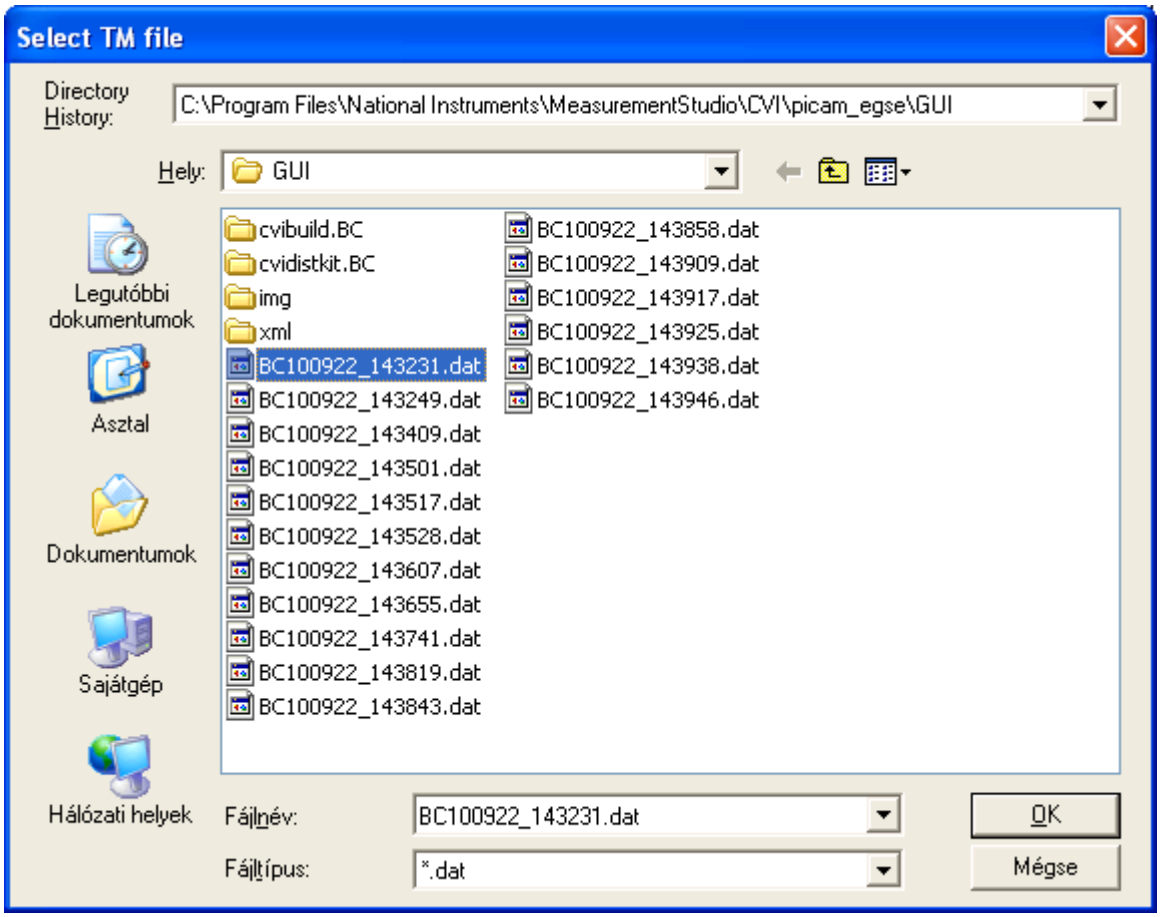


Figure 3 – file selection display

The “Save TM File” menu item activates the recording of telemetry data in file. Pressing the “Save TM” button on left side below the white display area does the same. The file name is generated automatically (“BC” + two digit of year, month, day, hour, minute, second + “.dat”). See also Figure 3.

The selection of “Log File Size” menu item activates the “Log File Size” window (see Figure 4).

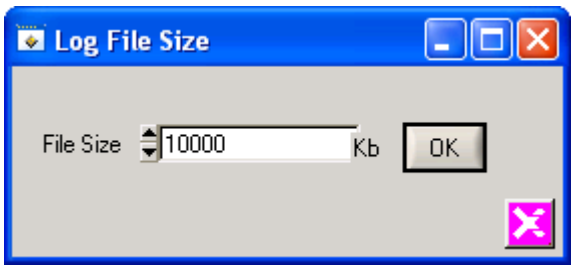


Figure 4 – Log File Size window

The size of the saved TM files is controlled with this value. When the data file reaches this size it is automatically closed and a new file is opened.

The “Select Default Directory” shows a file selection window (title “Select Directory”). It enables to change the directory for telemetry recording. The next menu item stores this directory recognizing it even after program restart.

The “Exit” menu item terminates the GUI program as well as the “Stop” shortcut or Alt/F4 does it.

## Network menu

The “Network” menu has the following items:
- Register to the Device for Telemetry,
- Register to the Device for Commands,
- Register TM & Command Direction or the globe shortcut below “Network”,
- Disconnect Telemetry Direction from Device,
- Disconnect Command Direction from Device,
- Disconnect TM & Command Direction or the crossed globe shortcut,
- Definition of TP addresses.

Use this menu items to connect to the embedded system. The IP address of the embedded system can be set using the last menu item. Figure 5 shows how to do it.

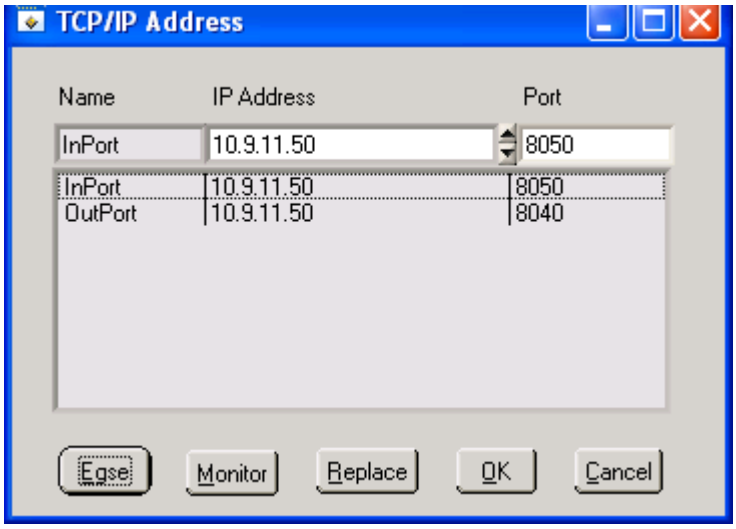


Figure 5 – TCP/IP Address setting

## HX Dump Option menu

This menu controls the decoding of telemetry data. The byte order of header and data part can be controlled separately. The detailed printout of header and data part can be disabled. The xml driven decoding of housekeeping messages can be enabled or disabled too.

## Script menu

The menu contains the following items:

- Record > Save or “Recording” button on left side on underside
- Select > Run or “Execute” button in the same line to the right
- Select Script Directory
- Save Script Directory

The first item starts recording of the commands. The first question is shown on Figure 6. If the answer is no, the commands are not sent to the embedded system i.e. the network output direction is temporally disabled. After it select a file name. An existing file will be overwritten. Before starting the recording fill the “Script comment” window (Figure 7) and press start saving.

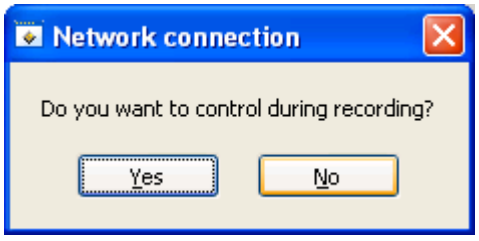


Figure 6 – Control during recording

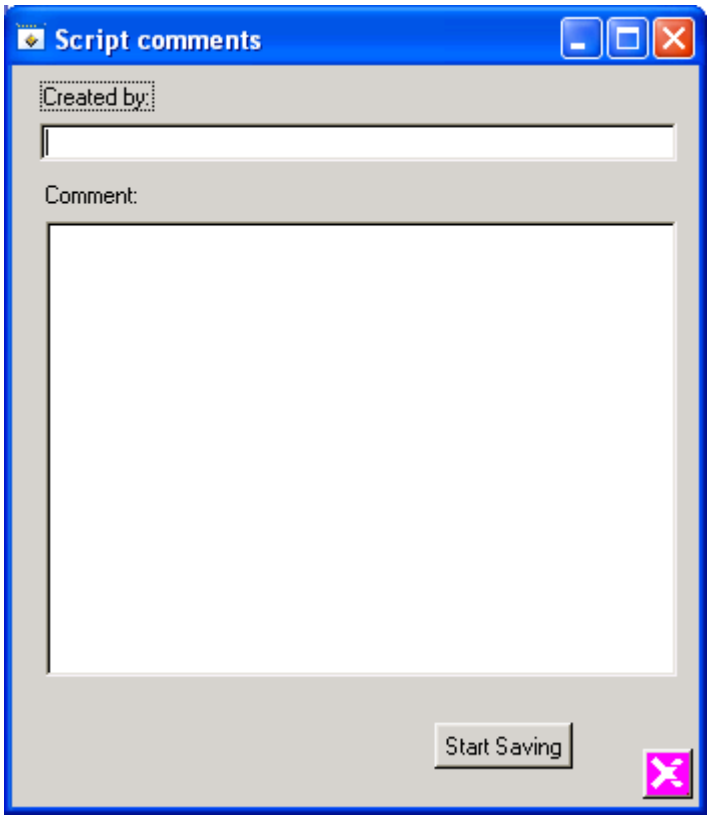


Figure 7 – Script comments

To execute an existing script file use the second menu item. Select a file in the file selection window. Use the “Run” or “Step” button to execute the script.

The default directory of script file can be changed using the “Select Script Directory” menu item and can the setting can be saved with the next menu item.

### About menu

Selection of this menu displays information about the GUI program generation.

## *Display of telemtry data*

There is three mode of displaying telemetry data:
- hexadecimal dump for all type of data,
- graphical display of pixel data and
- the TOF – energy diagram for science data.

### Hexa Dump

The hexa dump display mode is controlled by the HX Dump Option menu. At least one line per packet always appears. It shows the most important fields of the header: the application (PICAM), the sequence count, the data length, the service and subservice type, the source of the message and the time.
If the hexa dump of header is enabled, it is displayed before the decoded header line. The detailed display of the data part can be enabled for science data and for command responses separately.
The decoding of housekeeping messages can be also enabled. The decoding is controlled by the file “tmdata.config”. It contains display control information for different packet categories and process identifiers. Each field is printed in a new line.
The Hex Dump window is a scrolling list. There is possibility to stop the display process pressing the “Frozen” button. In this case the refreshing is inhibited; the new data is not listed. If only the “Scroll” is inhibited, the new packets are listed, but the display window doesn’t jump to the end of list automatically. Using the “Up” and “Down” button the user can manually control the display area. Pressing the “Where?” button there is possibility to define a search string. The first line containing the search string will be displayed on the top. The search process can be continued in forward direction by the “>” button, or backwards by “<”.

## Display of pixel data

Figure 8, 9 and 10 show the tree possibilities of displaying pixel data:

- pixel map,
- TOF bar,
- TOF diagram.

The pixel map is a fast overview. Each pixel is represented by a dedicated TOF index or by the average of the pixel's TOF values. The TOF field serves for selection of the TOF index representing the pixel's value. The index -1 means the average value.
The display mode can be changed by pressing the TOF Bar button or selecting a pixel.

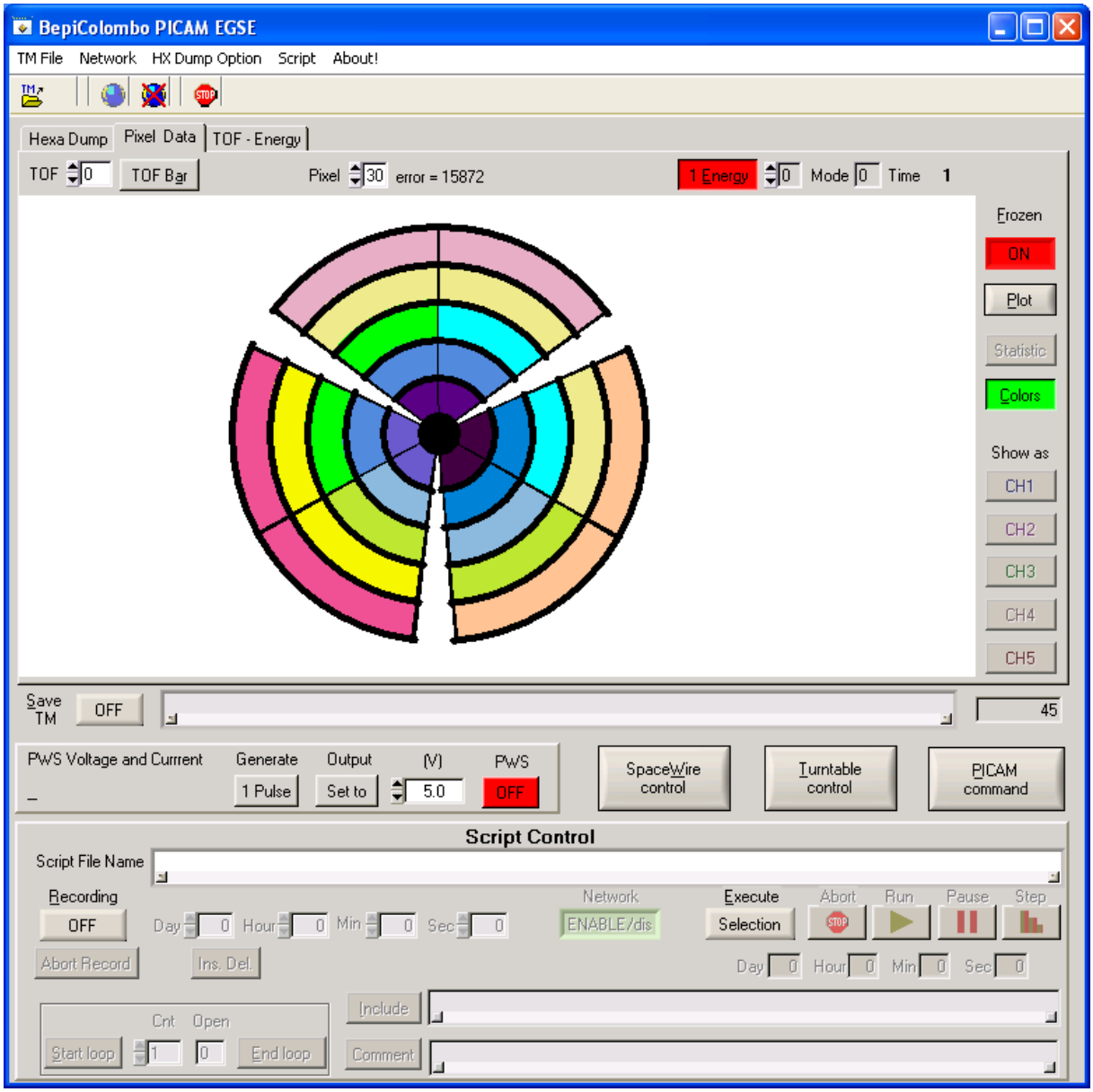

Figure 8 – Pixel map

The TOF bar displays all pixel and TOF data. The Pixel field shows the pixel index of the first line. If the place is not enough to show all the same time, the Next button enables to turn a page forward.
The display mode can be changed by pressing the Pixel Map button or selecting a pixel.

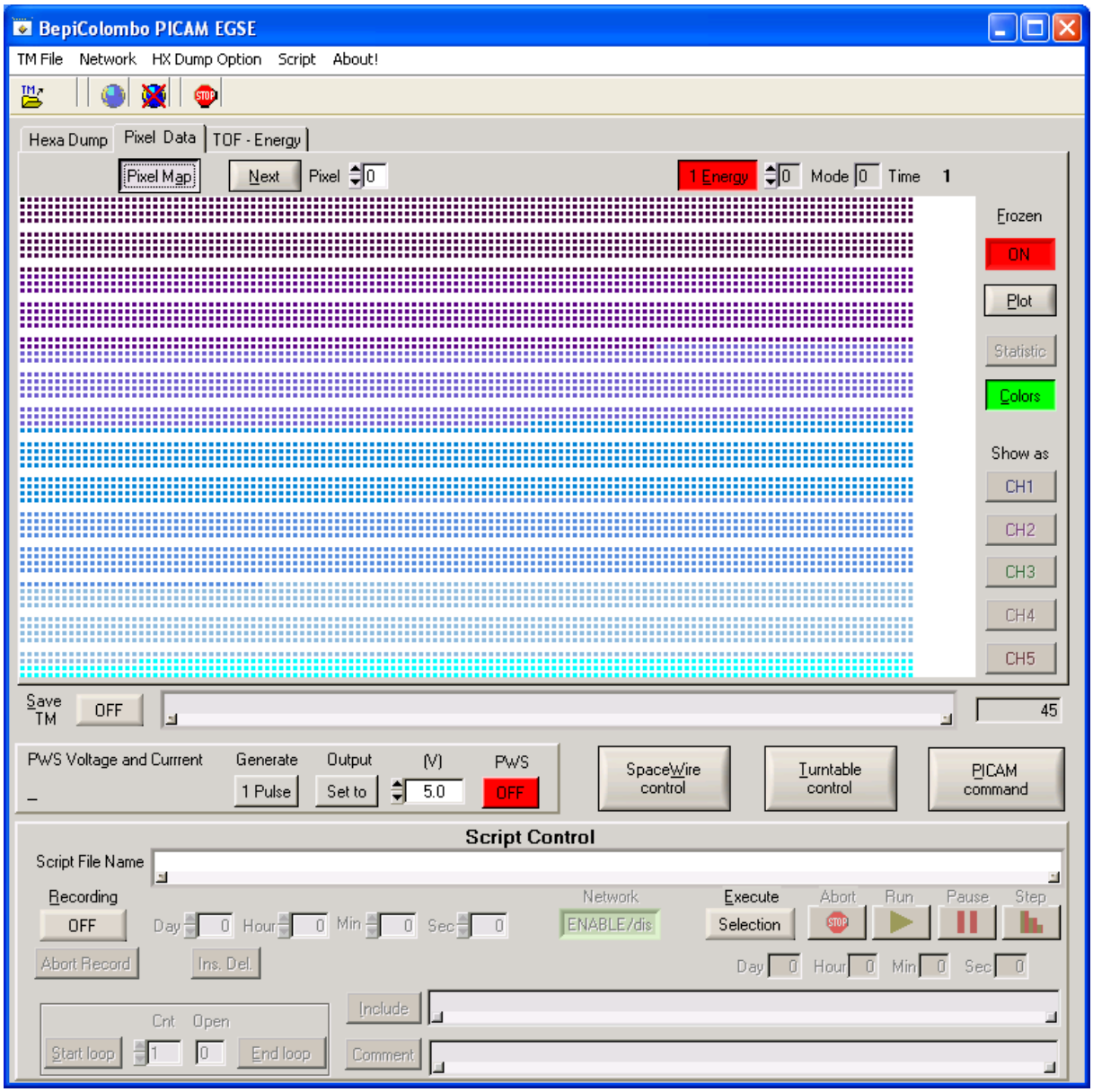

Figure 9 – TOF bar display

The TOF diagram shows all TOF indexes of one selected pixel. If there is only one TOF index per pixel, all pixels are displayed. Using the cursor a TOF index can be selected and its value is displayed. This index can be marked for data collection of Energy data using the "Show as CH…" buttons.

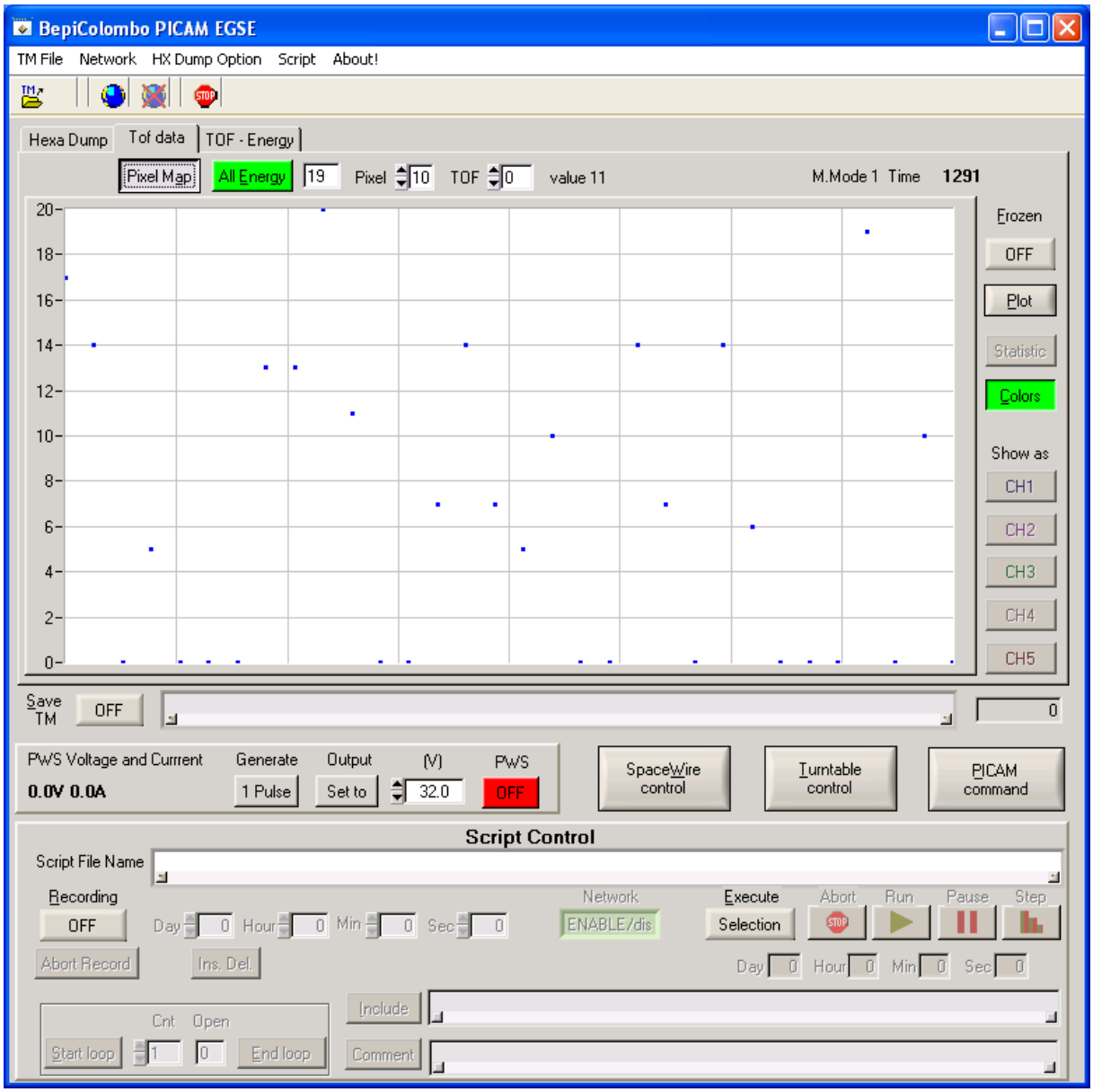


Figure 10 – TOF diagram

The current energy, measuring mode and time is displayed. There is possibility to select only one single energy as shown on the figure or to let refresh the screen whenever data of a new energy arrive (All Energy).
If the screen is frozen, the refreshing of data is inhibited. In frozen mode there is possibility to plot the screen again with different color setting.

The TOF values are represented by colors. The Color setting window is activated by the Color button. On that window there is possibility to change the color's ranges. The maximal value can be set manually or by selection the "Default" button. A steady color scale will appear. The color bars can be moved individual too.

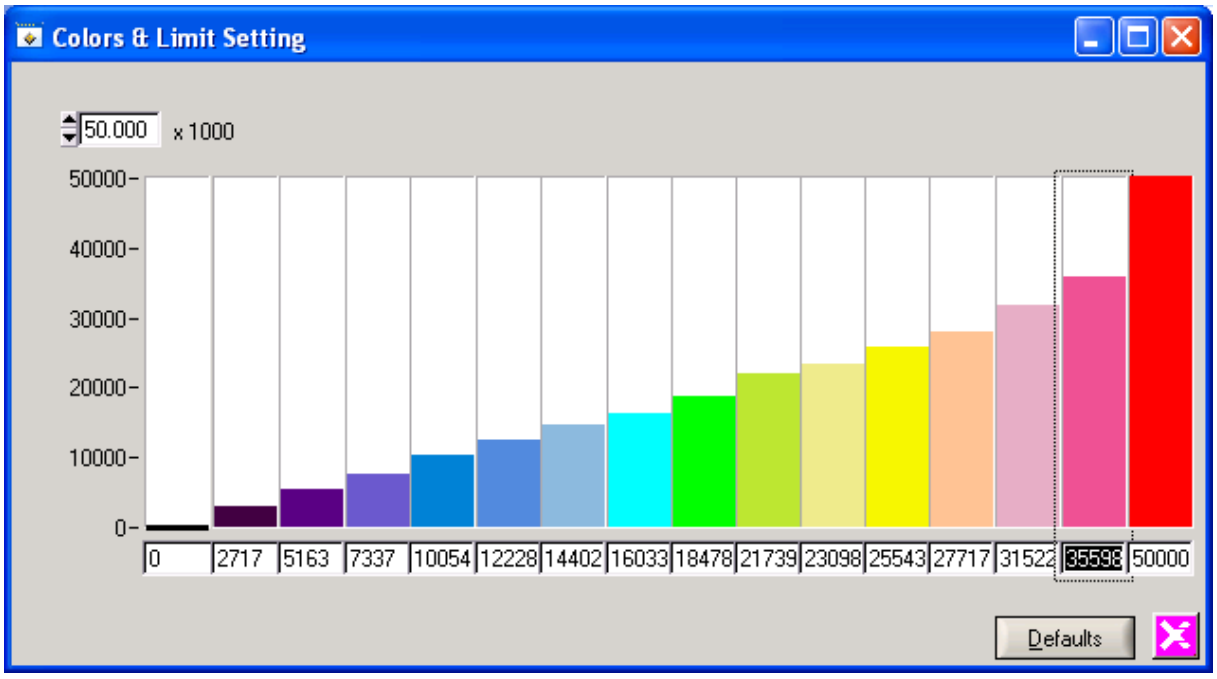


Figure 11 – Color setting

Activating the Statistic window instead of the Color setting shows the distribution of the TOF values of the current pixel data display.

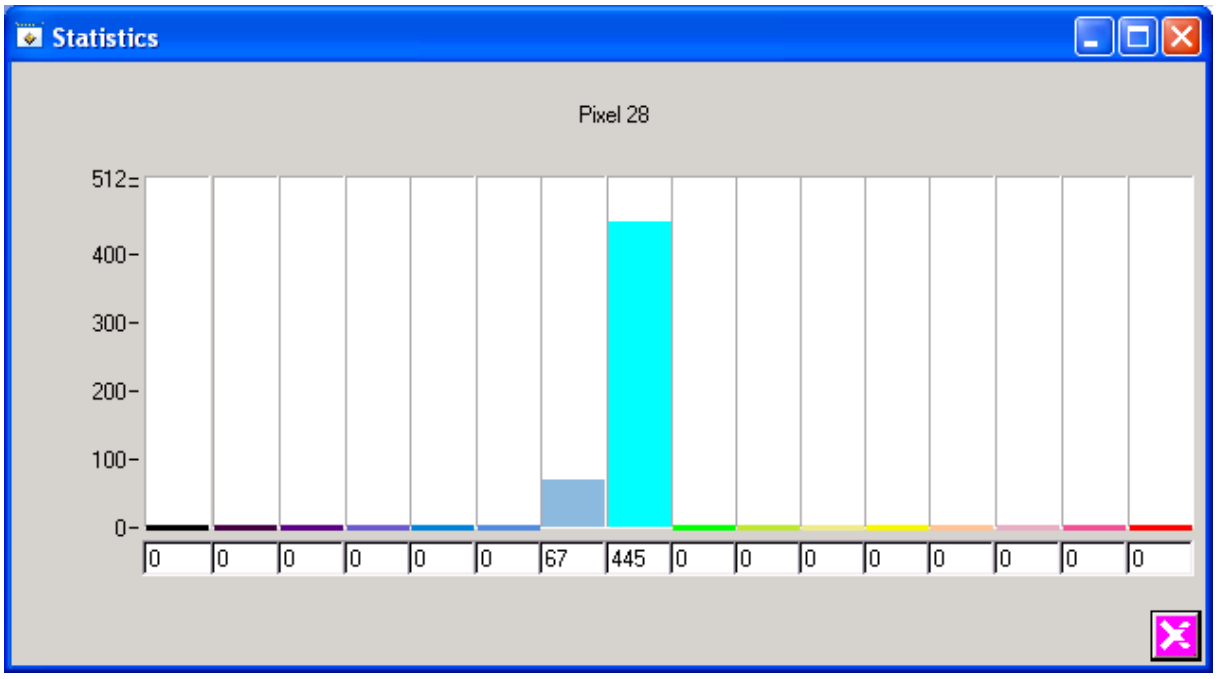


Figure 12 – Statistic

## TOF – Energy diagram

There is possibility to select 5 different TOF data of different pixels to collect. Figure 13 shows the TOF-Energy chart diagram. On the figure there is only the first channel displayed. The 5 channel have different colors (see Figure 10). When data of a new energy arrive, the diagram is shifted to the left by one point.

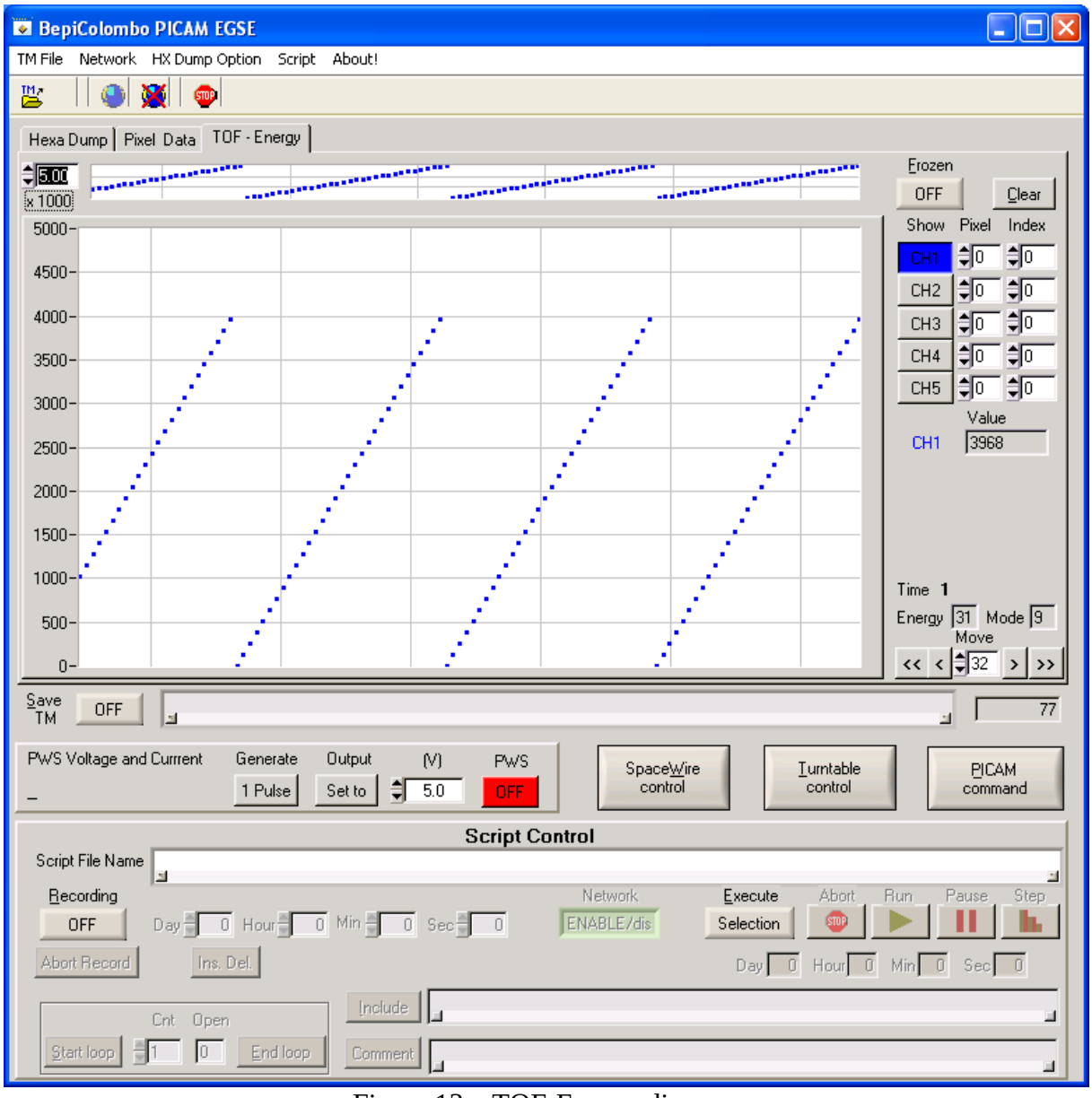


Figure 13 – TOF-Energy diagram

The data buffering can be suspended by the Frozen button. The Clear button deletes the data buffer and the screen.
There is possibility to scan trough the data buffer using the “<<”, “<”, “>”, “>>” buttons (End, Left, Right, Home). When the screen is moved backwards the automatic shifting is disabled. Using the cursor for selection of one point its energy, time, measuring mode and value is displayed.

The upper chart displays the energy.
It is recommended to clean up when the measuring mode or the channel assignment is changed.

## *Commands*

### Controlling the power simulator

The output voltage and current of the power simulator is measured every second. If the output is switched off these values should be zero.
The output voltage of the power simulator can be switch on / off by the “PWS” button. Please set the desired voltage in the “(V)” field and press the “Output Set to” button before switching the power on.
Pressing the “Generate 1 Pulse” button generates a 31 V pulse on the output.

### Controlling the Space Wire interface

The Space Wire control window can be activated by the “Space Wire Control” button (see Figure 14).

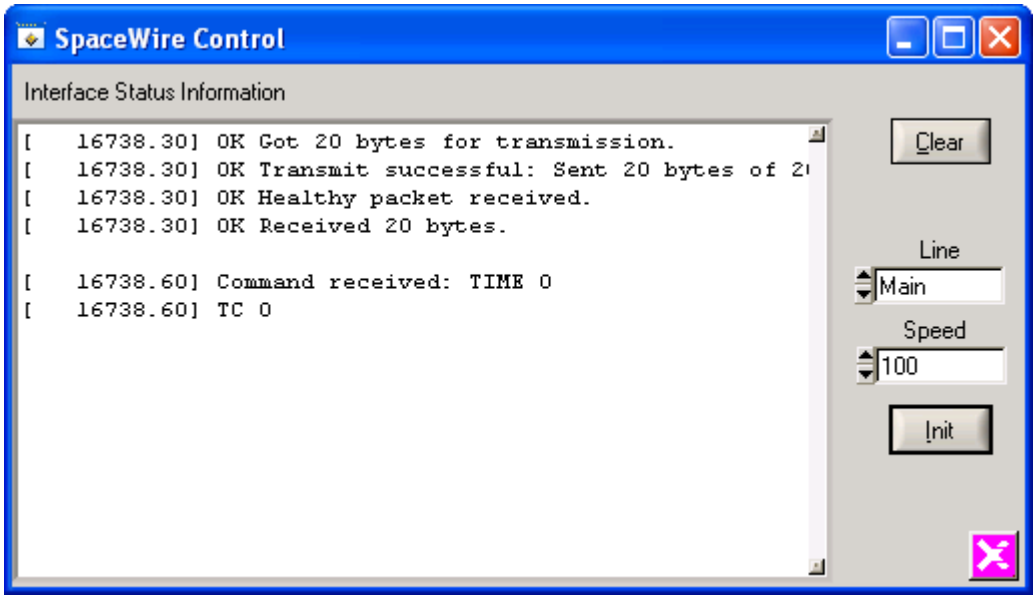


Figure 14 – Space Wire interface control

The list area shows the trace messages of the interface driver program. The list can be cleared. To change the interface settings select the line and the desired speed (click on the input field to see the available values) and press the “Init” button.

### Turntable control

The turntable control window can be activated by the “Turntable Control” button (see Figure 15).

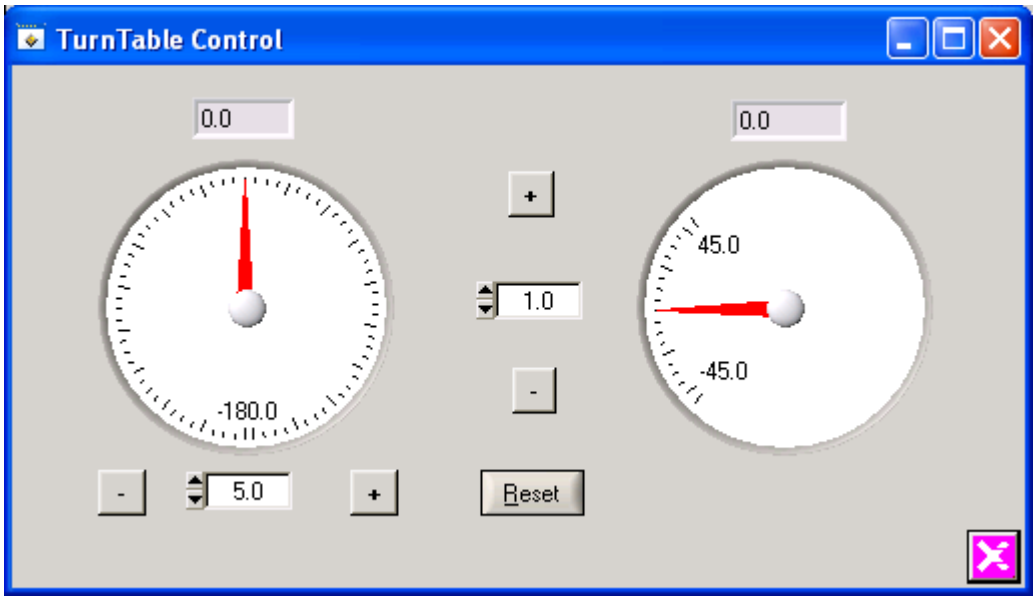


Figure 15 – Turntable control

The turntable control is TBD.

## PICAM commands

The Command window is activated by the “PICAM command” button (see figure 16). The available commands and their parameters are described in the file “command.config”. Choose the desired command and double-click on it. To change a parameter value select it by pressing double-clicks and type in the new value in the bottom line. Select the acknowledgement fields and the source and press “Send” to send the command.

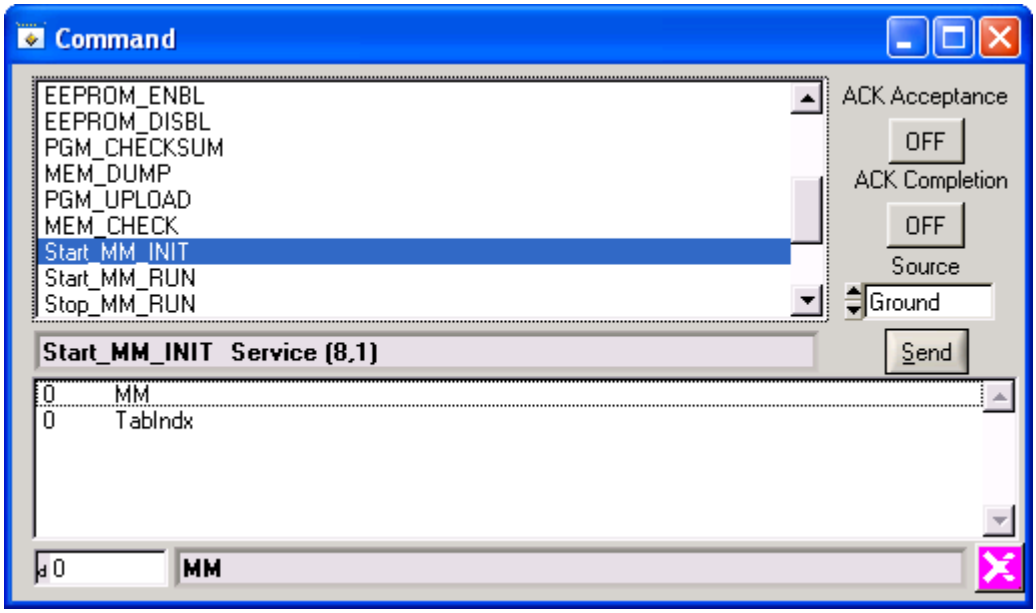


Figure 16 – Generate PICAM command

## *Scripts*

A set of commands can be stored in script files and later executed as described in chapter “Srcipt menu”. The script files are xml files, and can be edited with any text editor too.

### Script generation

The script generation is started from the script menu or by pressing the “recording” button. The script generation is finished by pressing the same button or it can be aborted by the “Abort Record” button. Delay instructions can be inserted between the issued commands using the “Ins. Del.” button. The delay value can be set in range from 1 sec to several days. Even embedded command loops can be defined with fixed repeat count. There is also possibility to include another already existing script file. Using the “Comment” button comments are inserted into the script file.

### Script execution

The script execution is started by the “Execute” button. After the file selection the automatic execution is started by the “Run” button. The color of the “Execute” button changes on green showing that the script is running. The time fields below the Execute buttons show the elapsed time. The time fields above “Ins.Del.” button show the remaining time of a delay instruction.
The execution can be aborted by the “Abort” button or suspended by the “Pause” button. If the execution is suspended, continue the execution with the “Run” button.
There is a possibility to execute a script file step by step using the “Step” button instead of the “Run” button. In this case the delay instruction is skipped.