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# VIRGO Data Display Users's Manual

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**VIR-SPE-LAP-5400-108**

Version: v9r05

Date : March 1, 2004

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# 1 Introduction

The output of the Virgo Online Acquisition is numerical data structured as Frames [1]. Those frames contain raw data (for instance ADC values) as well as processed data (h values, results of online monitoring or online analysis, ...). To view and plot such data, the VIRGO experiment uses the dataDisplay software described in this note.

The data Display gives the possibility to dump data, to plot data, to select the data to be viewed, to edit plots, using an easy to use Graphical User Interface (GUI) and taking advantage as much as possible of standard graphical tools used in Virgo. We have chosen:

- Xforms [2], a light and quite easy GUI: a free software with many useful GUI objects and a convivial GUI designer.
- Some modified parts of the Siesta library [3].
- The graphical tools of ROOT [4] to view the plots. This adds user's facilities like modifying the size of the plots, zooming in and out, getting X and Y values pointed on the plot by the cursor, adding any comment, saving plots under various formats (ps, eps, gif,...), changing colors of plots, etc...  
From version v8r07, you can also save the data of a plot in an ASCII file, by clicking with right mouse button on the plot line and choosing "ExportAscii" in the menu. Up to version 7, Hplot (PAW) was used instead of ROOT.

## 2 User's Manual


### 2.1 Starting dataDisplay

Command is just *dataDisplay*, once you got the Virgo environment. When starting dataDisplay, you can provide optional arguments:

- arg1 = name of a configuration file. This configuration file is a siesta \*.car file.
- arg2 = number of frames to read.
- arg3 = debug level

If argument 1 (configuration file) is provided, dataDisplay creates its *dd.car* file and starts immediately to read frames according to the configuration provided.

Each time the button "Start" is pushed, a configuration file *dd.car* is created in the directory where the dataDisplay was started. Each time the button "Stop" is pushed, a ROOT file *dd.root* containing the current plots is created in the directory where the dataDisplay was started. If you do not have write permission in this directory, *dd.car* and *dd.root* are put in your home directory.


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## 2.2 Bug fixes and new functionalities from v9r05

- Possibility to Scale as last on Y axis of a plot (Zoom Y as last but respecting the local scale of the plot).
- Possibility to zoom the Stat box of all the plots.
- Possibility to rescale a plot on Y axis (menu scale when clicking on the plot).
- Possibility to rescale a signal in a plot around its Y mean value.
- Possibility to superpose the differential on the plot.
- Possibility to superpose the integral summed from the end of the plot.
- Possibility to superpose the integral summed from the start the plot.
- Possibility to redo operations on signals without starting dataDisplay always from the same directory. Macros containing the operations on the signals are kept by default in /virgoData/DyAlgo.
- Possibility to superpose plots even for signals of different sampling frequencies.
- Possibility to do plots with signals that have sampling frequencies not submultiple of the fastest signal.
- Possibility to change the order of the plots, using the + and - buttons close to the plots browser.
- Possibility to visualize a 1D-time plot showing the evolution in time of the 1D distribution of a signal.
- Possibility to superpose the rms curve (integration of the spectrum starting at the Nyquist frequency) over the spectrum plot. (rms is not in units/sqrt(Hz)).

## 2.3 Bug fixes and new functionalities from v9r04

- Update of channels list (button "Update Channels") according to the GPS start value.
- Explicit use of ffl (frame files list) files to access huge amount of data.
- Possibility to visualize the raw values of a data vector (FrVect) of 1 or 2 dimensions. This allows to visualize Cameras images or to plot spectra data versus frequency that could be present in a FrProcData structure of a frame [?].
- Possibility to plot spectra in 1/Hz units instead of 1/sqrt(Hz).

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## 2.4 New functionalities from v9r00

- Possibility to do operations on signals before doing plots (for instance, you will be able to do a plot on the variable "Pr\_B1\_ACq \* Pr\_B1\_ACp / sin(Pr\_B5\_DC)". (blue button USERFCT above the proc data browser, and button USER FONCTIONS of the mainpanel).
- Possibility to propagate zoom on X or Y axis on all the plots
- Possibility to superpose several signals on the same plot (buttons SAME and UN-SAME near the plots browser)
- Possibility to exchange the two variables in a plot 2D, a plot TrFct (transfert function plot) or Cohe (coherence function plot). (button EXCHANGE near the plots browser)
- Possibility to visualize also Sim data, in addition to Adc, Proc and Sms data.
- Possibility to update the list of channels with respect to the GPS start time. (button UPDATE CHANNELS under the simdata browser)
- A predefined list of servers to connect to, when using dataDisplay online. (button PREDEFINED near the Cm servers browser).
- Date indicated in the mainpanel under the start GPS time is now in UTC and is updated directly when you change the start GPS time.


## 2.5 The main panel

The main panel (fig. 1) is made of the following buttons and fields:

- **Help:** A short help to start using the data display.
- **QUIT:** Quit data display if you answer "Yes" to the warning message.
- **Input Menu:** To choose the dataDisplay's source of data (under frame format). This is the first action to do.
- **Config Menu:** To save or load a configuration file. This configuration is for now a \*.car file (siesta).
- **Data and Plots:** Once a first frame has been read from the source you selected, the adc data or slow monitoring data it contains are shown in the "Data and Plots" panel. Then, you can dump or plot those adc or sms channels.
- **Dumped Data:** To see the current dump of the data you selected.
- **Cleaning:** Remove the graphical windows from the screen.
- **Reset All:** Reset all and put the data display in a "just started" state. Except the list of plots in the mainbrowser panel.



- **start Run# / Frame#:** To set run and frame numbers of the first frame to read.
- **start GPS time / duration:** To set the GPS time of the first frame to read. If used, then "Start Run# / Frame#" are put to -1 and 0 and are not used. Duration is the number of seconds of data over which you want the display to run once you have pushed the button "Start". Negative value means infinite.
- **start UTC date:** same as "start GPS time" but in explicit UTC date format. You can modify this field instead of "start GPS time" and the "start GPS time" field will be updated automatically.
- **Run# / Frame#:** run number and frame number of the current frame read.
- **GPS Time / Size:** GPS time and size (bytes) of the current frame read.
- **UTC date:** GPS time (in explicit UTC date format) of the current frame read.
- **Data Source:** the current frames source (file, directory or a process accessed through the network). The first message on this line is "Give me input data...".
- **noTOC:** on/off button to read frames without the files TOC (Table of Contents). In this case, reading of frames is slower but independent of any TOC failure.
- **Start:** Start the data display. It creates the configuration file (a siesta cards file): "dd.car" and starts a Siesta like job, interactive with the data display GUI.
- **Stop:** Stop the read of data. A file "dd.hsto" containing the plot is created.
- **Pause:** Pause the read of data.
- **Next Refresh:** Continue to read data up to the next plot refresh.
- **Continue:** Continue to read data.
- **Next Frame:** Continue to read data up to the next frame.
- **Help Ballons:** Check this button to get online information about each button, browser or input field of each panel of the data display.
- **Checks:** Used only for debugging, so only for developpers. Close to this button, a white square allows to set the debug level.
- **Info Line:** This line, at the bottom of the main panel, informs you about the last action made or the current status of the data display.

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## 2.6 Input Menu


This menu allows you to select the source of the frames (files or Cm server). among the following options:

- **Read FFL:** Take a set of ffl files (frame files list) as frames source. A file selector allows you to select several files in a row, to search in directories (first line) and to put a tag on the files names (second line). Default tag is in this case "\*.ffl". Each time you select this type of source, the files are added to an internal list of files that you can view and modify using the option "File List" of this "Input Menu".
- **Read File:** Take a set of files as frames source. A file selector allows you to select several files in a row, to search in directories (first line) and to put a tag on the files names (second line). Each time you select this type of source, the files are added to an internal list of files that you can view and modify using the option "File List" of this "Input Menu".
- **Read Directory:** Add all the files of a directory. When asked, just select one file of the directory you want to add.
- **Read Files Online:** Take data online from a directory where frames are currently written in files. There is a condition for using this option: all the files in the directory must have the same generic name containing an incremented number. When asked, just select one file of the directory you want to add.
- **Read Shared Memory:** Take data from a shared memory. If you select this menu item, you get an input field where you must provide the name of the producer of the shared memory to which you connect.
- **Connect to a Cm Server:** Take data online from a Cm server. If you select this menu item, you get the list of Cm servers available and you must choose one of them.
- **Declare to Cm:** Declare the data Display to the Cm Name Server. If you select this menu item, you are asked for a Cm name (default is your login name or the last Cm Name used).
- **Files List:** It opens a panel showing the list of input files that have been selected up to now and that are going to be read by the data Display once button "Start" has been pushed.

## 2.7 Config Menu

In this menu, you can "Load" a configuration, "Save" the present configuration with the name previously used or "Save as" the present configuration using an other name.

Each configuration file produced by the data Display is a \*.car (Siesta cards) file. Each time you push the Start button, the current configuration is automatically saved in a file "dd.car". This is independant of what you do in the Config Menu items.

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## 2.8 Data and Plots

This panel is the central part of the data Display. It shows buttons and browsers to select some frame's channels and to create plots.

### 2.8.1 The data browsers and buttons

- **Slow Monitoring Stations:** the list of slow monitoring stations (sms) contained in the frames. Selecting one gives you the list of data channels it contains.
- **SMS data:** the list of channels of the selected sms. You can select one or several of them and push a plot button (TIME, 1D, FFT, ...). It will create a plot for each channel selected. To deselect a channel, click on it. To deselect all the channels, use the button "deselect all". A small input box under the browser allows you a fast search of a name in the browser.
- **ADC:** the list of frame's adc channels. You can select one or several of them and push a plot button (TIME, 1D, FFT, ...). It will create a plot for each channel selected. To deselect a channel, click on it. To deselect all the channels, use the button "deselect all". A small input box under the browser allows you a fast search of a name in the browser.
- **Processed Data:** the list of frame's proc channels. This is where you can find any processed (reconstructed) data. You can select one or several of them and push a plot button (TIME, 1D, FFT, ...). It will create a plot for each channel selected. To deselect a channel, click on it. To deselect all the channels, use the button "deselect all". A small input box under the browser allows you a fast search of a name in the browser. A "delete" button allows to delete new channels produced with the "User Fct" button.
- **Simulated Data:** the list of frame's sim channels. This is where you can find any simulated data. You can select one or several of them and push a plot button (TIME, 1D, FFT, ...). It will create a plot for each channel selected. To deselect a channel, click on it. To deselect all the channels, use the button "deselect all". A small input box under the browser allows you a fast search of a name in the browser.
- **Processed Data:** the list of frame's proc channels. This is where you can find any processed (reconstructed) data. You can select one or several of them and push a plot button (TIME, 1D, FFT, ...). It will create a plot for each channel selected. To deselect a channel, click on it. To deselect all the channels, use the button "deselect all". A small input box under the browser allows you a fast search of a name in the browser. A "delete" button allows to delete new channels produced with the "User Fct" button.
- **User Fct:** This button provides a menu. First item of this menu allows the user to define its own operation on the signals and to create new proc signals that can be used to do plots. The other items are predefined functions that apply on the adc, sim or proc signals previously selected.



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## 2.8.2 The plots browsers and buttons

Clicking on one of those buttons creates a plot, if at least one data channel was selected.

- **TIME**: A time plot of each selected channel is created.
- **CORR**: A correlation plot between var2 and var1 is created.
- **FFT**: A spectrum plot of each selected channel is created.
- **FFTTIME**: A time-frequency plot for each selected channel is created.
- **TR.FCT**: A transfert function plot between var2 and var1 is created.
- **COHE**: A coherence plot between var2 and var1 is created.
- **1D**: A distribution plot of each selected channel is created.
- **1DTIME**: A time-1D plot of each selected channel is created.
- **2D**: A 2d plot is created, showing var2 (y axis) versus var1 (x axis).
- **RAW**: A plot is created, showing raw values of a data vector (1d or 2d).
- **AUDIO**: Selected channel can be hear over a given duration, after button Stop has been pressed.
- **DUMP**: Put the selected channels in the list of data channels to dump while reading frames.

Selecting one channel and pushing one of these buttons creates a plot (or audio or dump) with default parameters, that you can change using the "Edit" button of the plots browser. Selecting several channels of "SMS data", "ADC" or "Processed Data" browsers and pushing one of those buttons creates as many plots (or audio or dump) as there are channels selected. If you push "2D", "TRFCT", "COHE", or "CORR" button, the selected channels are taken 2 by 2, from upper to lower. If a channel is pending, it is taken as Y variable, and the data display will take as X variable the channel you select just after.

- **plots**: this browser shows the list of plots created. You can select one or several plots and edit or remove them. The button "Clear" removes all the plots.
- **Save**: using this button, you can also save the current plots (after "Stop" button has been pushed).
- **Edit**: this button allows to change the parameters of the plots selected.
- **Edit Clone**: this button do the same as "Edit" but the parameters you changed are cloned to all the plots of the same type as the one you edited. This is convenient when you want to change for instance the time window size of all the time plots.

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- **Edit Gene:** this button do the same as "Edit" but the parameters you changed are cloned to all the plots. This is convenient when you want to change for instance the time window size or the resampling frequency of all the plots.
- **Same:** this button put together (in the same root pad) the plots selected.
- **Unsame:** this button separate (put in different root pad) the plots selected.
- **Exchange:** this button exchange the variables of the 2D, TRFCT or COHE plots selected.
- **-:** move up in the list all the plots selected.
- **+:** move down in the list all the plots selected.
- **undisplayed:** when selected, this button allows to make all the plots without viewing them. Once dataDisplay has been stopped, resulting plots can be find, as usual, in the file *dd.hsto*.

## 2.9 The editing plot panels

To edit a plot, select it in the browser and click on "Edit". A panel is displayed, where you can edit the various parameters and plot options, depending on the plot's type. For more help about it, you can also use the Help Ballons button in the data Display.

### 2.9.1 Edit panel of TIME plot

- **Name:** the name of the plot. By default, it is derived from the channels name. Do not put any blank in the plot name, this is not managed by Siesta cards.
- **Time Window:** number of seconds of data that are displayed in the time plot.
- **Sampling Freq.:** The new frequency at which you resample the data in order to view at larger scales the time evolution. This field contains by default the initial sampling frequency of the channel.
- **Time Shift:** Percentage of the time window used to shift the time plot visualization.
- **y min:** Minimal value of the time plot on vertical axis.
- **y max:** Maximal value of the time plot on vertical axis.
- **Filter Band (fmin/fmax):** Min and max frequency of the pass-band filter applied on the data before time plot visualization.
- **logx:** on/off button to set log scale on horizontal axis.
- **logy:** on/off button to set log scale on vertical axis.
- **gridx:** on/off button to set grid lines along horizontal axis

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- **gridy**: on/off button to set grid lines along vertical axis
- **autoY**: on/off button to have an automatic set of ymin and ymax, while plotting the data.
- **unitsY**: on/off button to set right units on the vertical axis.
- **noDC**: on/off button to set removal of mean value (DC component) of the signal.
- **Default**: Put the default values for all the fields or on/off buttons.
- **OK**: Acknowledge the changes you made. Those changes will affect all the plots of the same type if you used "Edit Clone" instead of "Edit".
- **Cancel**: Cancel all the changes you made.

### 2.9.2 Edit panel of FFT plot

- **Name**: the name of the plot. By default, it is derived from the channels name. Do not put any blank in the plot name, this is not managed by Siesta cards.
- **Time Window**: number of seconds of data that are displayed in the time plot.
- **Sampling Freq.**: The new frequency at which you resample the data in order to view at larger scales the time evolution. This field contains by default the initial sampling frequency of the channel.
- **Time Shift**: Percentage of the time window used to shift the time plot visualization.
- **Number of FFT to average**: number of spectra you average. Visualization is done each time you add a spectrum, so you can see the progression of the averaging.
- **Zoom freq min**: Minimal frequency, just for visualization.
- **Zoom freq max**: Maximal frequency, just for visualization.
- **logx**: on/off button to set log scale on horizontal axis.
- **logy**: on/off button to set log scale on vertical axis.
- **gridx**: on/off button to set grid lines along horizontal axis
- **gridy**: on/off button to set grid lines along vertical axis
- **autoY**: on/off button to set automatically the right vertical edges.
- **unitsY**: on/off button to set right units on the vertical axis.
- **noDC**: on/off button to set removal of mean value (DC component) of the signal.
- **1/Hz**: on/off button to set vertical axis in 1/Hz units instead of 1/sqrt(Hz).
- **rms**: on/off button to superpose the rms (integrate FFT starting from Nyquist frequency) on the FFT plot.

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- **Default:** Put the default values for all the fields or on/off buttons.
- **OK:** Acknowledge the changes you made. Those changes will affect all the plots of the same type if you used "Edit Clone" instead of "Edit".
- **Cancel:** Cancel all the changes you made.

### 2.9.3 Edit panel of FFTTIME plot


- **Name:** the name of the plot. By default, it is derived from the channels name. Do not put any blank in the plot name, this is not managed by Siesta cards.
- **Time Window for Time/Freq plot:** number of seconds of data that are displayed in the time-frequency plot.
- **Time Window for FFT calculation:** number of seconds of data over which FFT is computed.
- **Sampling Freq.:** The new frequency at which you resample the data in order to view at larger scales the time evolution. This field contains by default the initial sampling frequency of the channel.
- **Time Shift:** Percentage of the FFT time window used to shift in time before computing next FFT.
- **Number of FFT to average:** number of spectra you average to produce one time slice of the time-frequency plot. Visualization is done each time a time slice is ready (average computed). Take care: if you choose for instance 10, the value real time window for plot visualization will be 10 times the value you put in the field "Time window for Time/Freq plot".
- **refresh Percent:** Percentage of the time window used to shift along time (horizontal axis) the time-frequency plot visualization.
- **Zoom freq min:** Minimal frequency, just for visualization.
- **Zoom freq max:** Maximal frequency, just for visualization.
- **Z max:** Z value threshold (used for color scale).
- **logx:** on/off button to set log scale on horizontal axis.
- **logy:** on/off button to set log scale on vertical axis.
- **logz:** on/off button to set log scale on colors axis.
- **gridx:** on/off button to set grid lines along horizontal axis
- **gridy:** on/off button to set grid lines along vertical axis
- **gridz:** on/off button to set log scale on colors axis.

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- **noDC:** on/off button to set removal of mean value (DC component) of the signal.
- **unitsZ:** on/off button to set right units on the colors axis.
- **Default:** Put the default values for all the fields or on/off buttons.
- **OK:** Acknowledge the changes you made. Those changes will affect all the plots of the same type if you used "Edit Clone" instead of "Edit".
- **Cancel:** Cancel all the changes you made.

#### 2.9.4 Edit panel of 1D plot

- **Name:** the name of the plot. By default, it is derived from the channels name. Do not put any blank in the plot name, this is not managed by Siesta cards.
- **nBin:** number of seconds of data that are displayed in the time plot.
- **Refresh Period:** Number of seconds of data between two plot visualization refreshes.
- **x min:** Minimal value of the plot on horizontal axis.
- **x max:** Maximal value of the plot on horizontal axis.
- **logx:** on/off button to set log scale on horizontal axis.
- **logy:** on/off button to set log scale on vertical axis.
- **gridx:** on/off button to set grid lines along horizontal axis
- **gridy:** on/off button to set grid lines along vertical axis
- **stat:** on/off button to get statistics number on the plot.
- **autoX:** on/off button to have an automatic set of xmin and xmax, while plotting the data.
- **unitsX:** on/off button to set right units on the HORIZONTAL axis.
- **Default:** Put the default values for all the fields or on/off buttons.
- **OK:** Acknowledge the changes you made. Those changes will affect all the plots of the same type if you used "Edit Clone" instead of "Edit".
- **Cancel:** Cancel all the changes you made.

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### 2.9.5 Edit panel of 1D TIME plot

- **Name:** the name of the plot. By default, it is derived from the channels name. Do not put any blank in the plot name, this is not managed by Siesta cards.
- **Time Window:** number of seconds of data that are displayed in the 1d-time plot.
- **Time Window for statistics:** number of seconds of data over which 1D distribution is done.
- **Sampling Freq.:** The new frequency at which you resample the data in order to view at larger scales the time evolution. This field contains by default the initial sampling frequency of the channel.
- **refresh Percent:** Percentage of the time window used to shift along time (horizontal axis) the time-frequency plot visualization.
- **nBin:** Number of bins of the 1D distribution (each vertical line of the plot)
- **Min:** Minimal value of the y axis (if autoY not selected).
- **Max:** Maximal value of the y axis (if autoY not selected).
- **Z max:** Z value threshold (used for color scale).
- **logx:** on/off button to set log scale on horizontal axis.
- **logy:** on/off button to set log scale on vertical axis.
- **logz:** on/off button to set log scale on colors axis.
- **gridx:** on/off button to set grid lines along horizontal axis
- **gridy:** on/off button to set grid lines along vertical axis
- **gridz:** on/off button to set log scale on colors axis.
- **noDC:** on/off button to set removal of mean value (DC component) of the signal.
- **unitsY:** on/off button to set right units on the Y axis.
- **Default:** Put the default values for all the fields or on/off buttons.
- **OK:** Acknowledge the changes you made. Those changes will affect all the plots of the same type if you used "Edit Clone" instead of "Edit".
- **Cancel:** Cancel all the changes you made.

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### 2.9.6 Edit panel of 2D plot


- **Name:** the name of the plot. By default, it is derived from the channels name. Do not put any blank in the plot name, this is not managed by Siesta cards.
- **x nBin:** number of bins on horizontal axis.
- **x min:** Minimal value of the plot on horizontal axis.
- **x max:** Maximal value of the plot on horizontal axis.
- **y nBin:** number of bins on vertical axis.
- **y min:** Minimal value of the plot on vertical axis.
- **y max:** Maximal value of the plot on vertical axis.
- **Shift (n samplings):** shift in number of data samples between varX and varY. (varX can be identical to varY).
- **Refresh Period:** Number of seconds of data between two refreshes of the plot visualization.
- **stat:** on/off button to get statistics number on the plot.
- **logx:** on/off button to set log scale on horizontal axis.
- **logy:** on/off button to set log scale on vertical axis.
- **logz:** on/off button to set log scale on colors axis.
- **gridx:** on/off button to set grid lines along horizontal axis
- **gridy:** on/off button to set grid lines along vertical axis
- **gridz:** on/off button to set grid lines along colors axis
- **autoX:** on/off button to have an automatic set of xmin, xmax, ymin and ymax, while plotting the data.
- **unitsY:** on/off button to set right units on the horizontal and vertical axis.
- **color:** on/off button to use 2D plot with colors on third axis.
- **cont:** on/off button to use 2D plot with colored contours on third axis.
- **lego:** on/off button to use 3D plot with squares in each bin.
- **surf:** on/off button to use 3D plot with interpolated surface.
- **scat:** on/off button to use 2D plot with scattered points.
- **Default:** Put the default values for all the fields or on/off buttons.
- **OK:** Acknowledge the changes you made. Those changes will affect all the plots of the same type if you used "Edit Clone" instead of "Edit".
- **Cancel:** Cancel all the changes you made.

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## 2.10 General informations about the plots

- **Time plot:** In the time plots, a blue vertical line is present each time at least one frame is missing, a green vertical line is present each time the channel is missing, a red line is present each time a data sample is corrupted (NaN, etc...).
- **FFT plot:** Units on the vertical axis are (channel units)/sqrt(Hz).
- **2D plot:** When title of the plot is var1\_vs\_var2, it means that var1 is on the vertical axis and var2 on the horizontal axis.
- **TrFct plot:** When title of the plot is var1\_over\_var2, it means that the Transfert Function plot is  $\text{FFT}(\text{var1})/\text{FFT}(\text{var2})$ .
- **Cohe plot:** When title of the plot is var1\_vs\_var2, it means that the Coherence Function plot is  $\text{FFT}(\text{var1} \cdot \text{conj}(\text{var2})) / (\text{—FFT}(\text{var1})\text{—} * \text{—FFT}(\text{var2})\text{—})$ .



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## 2.11 Three typical uses of the data Display

### 2.11.1 Read frames offline from a file


Suppose you would like to look at the Spectrum of a microphone signal. Data are under frame format in a file "toto.dat". First, in the main panel, select the item "Read File" of "Input Menu". Then, a Xforms predefined browser will ask you to select the file you want to read. The main browser panel is then displayed. You see in it a list of channels in the adc browser. Select the channel corresponding to the microphone and push the button FFT. The plot is made (with default parameters) as you can verify in the white bottom status line of the main panel. If you trust the default parameters, just push "Start" to read the frames and get the FFT plot. If you prefer to check or change the parameters, select your plot in the plots browser and push the button "Edit". A panel containing the name of the plot and its parameters is displayed. Change the parameters as you want and push "OK". Then, you can "Start". Once frames reading is finished or if you pushed the "Stop" button, the FFT plot has been recorded under PAW format in the file "dd.hsto".

### 2.11.2 Read frames online from files

Suppose you would like to look at the FFT of a microphone signal. Data are currently written under frame format as several frames per file in a directory "totoDir". You would like to look at the data while they are created. First, in the main panel, select "Read Files Online" from "Input Menu". A browser is displayed where you can select any file of the directory "totoDir". The main browser panel is then displayed. You see in it a list of channels in the adc browser. Select the adc corresponding to the microphone, and push the button "FFT". The plot is made (with default parameters) as you can verify in the white bottom status line of the main panel. If you trust the default parameters, just push "Start" to read the frames and get the FFT plot. The data Display will read the last frame of the files already present in the directory and will wait for the next file to be written in this directory, until you push the "Stop" button. For now, the data display is only able to read online files whose name is made of a generic name with an incremented number in it (for instance "FR12.dat", "FR22.dat", "FR32.dat" or "myframe\_43", "myframe\_44" ...).

### 2.11.3 Read frames online from a Cm server

Suppose you would like to get frames from a Cm server (a Frame Builder for instance). Choose "Connect to a Cm Server" in the "Input Menu". Select one Cm server in the list presented and double-click on click on OK. Then, list of channels is get or one frame is read and the "Data and Plots" panel should show the list of available channels. Then, once you created your plots, push the "Start" button. You should normally get frames from the Cm server and view the desired plots online.

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## 3 The Developer's Manual

### 3.1 Overview and Installation

The data Display version described here can be found in the `/virgoApp/Dy` directory, organized as the following:

- in *src*, *src/mysiesta*, *src/xform* directories: source code and header files.
- in *mgr* directory: the compilation Makefiles
- in *doc* directory: this documentation and some gif pictures showing dataDisplay.

data Display package uses ANSI C language compiled with `cc` and `cxx` under Unix OSF1 v5 (alpha workstations) platforms, and `gcc` under Linux platforms. It is based at least on the Xforms library (GUI), on the Frame library and on the Root library. So, the installation of dataDisplay needs at least:

- Xforms library: `/virgoApp/Xform` [2]
- ROOT library: `/virgoApp/root` [4]
- Frame library: `/virgoApp/Fr` [6]

For an online use of the dataDisplay, you need also:

- Cfg package: `/virgoApp/Cfg` [8]
- Frame Distribution package: `/virgoApp/Fd` [7]
- CSet package: `/virgoApp/CSet` [9]
- Cm package: `/virgoApp/Cm` [10]

For more informations about the packages used, you can have a look at the Web page: <http://wwwcascina.virgo.infn.it/sDoc/esdoc.html>


Some modified source code of the siesta package [3] is also used. The source files are in the directory *mysiesta*: `URPlot.c` (replace `UHistoL.c`), `UFrameL.c`, `UJobL.c`, `UArrayL.c`, `UMathL.c`, `USignalL.c` and their header files, and `c_hbook.h`.

There are two global structures defined in `dataDisplay.h`: `DyTool` and `DyPlots`, and an external structure for each Xforms panel (see header files in `src/xform` directory).

### 3.2 Compilation scripts in directory mgr

In *mgr* directory, Makefiles dedicated to specific platforms are available:

- *Makefile.VIRGO.osf1.cxx6*: compile under OSF1, in Virgo environment.

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- *Makefile.LAPP.osf1.cxx6*: compile under OSF1, in LAPP environment.
- *Makefile.DAMIR.linuxppc.gcc*: compile under RedHat Linux v7 on a PowerPC of MacG3.
- *Makefile.LAPP.linux.egcs*: compile under RedHat Linux v7, on alpha workstations or on a HP-Vectra PC.
- *Makefile.sun\_nocm*: compile under sunOS a "nocm" version of the dataDisplay.

The command is for instance *gmake -f Makefile.VIRGO.osf1.cxx6*.

There are also Makefiles with suffix "\_nocm" (like *Makefile.VIRGO.osf1.cxx6\_nocm*). They compile an offline version of the dataDisplay (uses only Frame, Root and Xforms libraries) that take input frames only from files or shared memory.

All the Makefiles contain an include of the file "Make-macros", which contains the common parts, "independant" of the platform, and an include of the file "Make-requirements" which contains the maximal list of the needed packages.

In *cmt* directory, thanks to JM Teuler and F. Carbognani, an updated requirements file is available. To use it, you need to have installed first the CMT package or to be already in the Virgo standard software environment. Under OSF1 or Linux, just go into the *cmt* directory and do the command *cmt config* followed by the command *gmake*.

### 3.3 The main functions and structures


This data Display package uses two global C structures *DyTool* and *DyPlot*, pointed respectively by the pointers *Dy* and *Plot[i]*.

- **DyTool**: It contains general parameters useful for most of the data display functions. For instance, *Dy->Order* is the status of the data Display (Stop, Pause, Start...). Each parameter of this structure is described in the header file *dataDisplay.h*.
- **DyPlot**: It contains the parameters of each plot, one *DyPlot* structure per plot, pointed by *Plot[i]*. Each parameter of this structure is described in the header file *dataDisplay.h*.

The two previous structures are used in almost all the functions. Here is a non exhaustive list of the data display functions (still to be updated!):

- **main**: Arguments can be passed to this function: the name of the configuration file, the number of frames to read and the debug level. In function *main*, the Xform library is initialized. Rest of the initialization is done by the function *DyInit()*, the panels are set and the main panel is displayed before entering the infinite *fl\_do\_forms()* GUI events loop.

- **DyReadFirstFrame:** It reads a first frame of the files list or from the Cm server and uses it to build the variables lists of the "Data and Plots" panel. This function is called each time you get a new configuration ("Config Menu") or a new source of frames ("Input menu").
- **DyMakeSiestaFile:** called when you save a configuration or most commonly by the DyStart function (that is called when you push the button "Start"). Using the structure \*Plot, the data source, and the clocks list, DyMakeSiestaFile builds the configuration file (Siesta cards file) dd\*.car that will be used when you push the "Start" button. It calls successively *DyMakeClockString*, *DyMakeFileString* and *DyMakePlotString*.
- **DySiestaLike:** called by DyStart, just after the call to DyMakeSiestaFile. It does the same job as the central part of Siesta (siesta.c) but includes some modification to allow interaction between the siesta loop and the Xforms events loop.
- **DyInteractionSim:** this function is called by DySiestaLike each time a new frame is read. In addition, it updates the current run and frame numbers displayed in the main panel. It gives the possibility to the user to interact with the GUI while frames are read, (for instance to use the Stop or Pause buttons).
- **DyStart:** called when the "Start" button of the main panel is pushed. It calls the functions *DyMakeSiestaFile* and *DySiestaLike*.
- **DySetPlot:** called each time you push a button like 1D, 2D, TIME, ... of the "Data and Plots" panel. It looks at the channels you selected and for each of them add a plot in the plots list (DyUpdatePlotBrowser) and sets its default parameters (DyPutDefaultInPlot).
- **DyEditPlot:** It does the same kind of job but this function is called when the "Edit" button of the plots browser is pushed. It opens the plot panel. Once you changed the plot's parameters, you push the button "Ok" and the function *DyEditPlotCallBack* is called. In this editing process, the following functions have been called: *DyEditPlot*, *DyPlotToPanel*, *DyRaisePanel*, *DyEditPlotCallBack*, *DyPanelToPlot*, *DyUpdatePlotBrowser*, *DyClosePanel*.
- **DyUpdatePlotBrowser:** called each time you add or delete a plot in the list.
- **DyPlotToPanel:** called each time you edit a plot. It puts values from the \*Plot structure to the edition panel.
- **DyPanelToPlot:** called each time you have edited a plot. It puts values back from the edition panel to the \*Plot structure.
- **DyPutDefaultInPlot:** called each time you create a new plot by pushing button 1D, 2D, TIME, ... in the "Data and Plots" panel.
- **UFrIFileCmIni, UFrIFileCmSim:** These are modified copies of the functions used in siesta to get frames from the network. Some added lines allow to interact with the data Display event loop. Are also available "UFrIFileOnlineSim" to read

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frames online and "UFrIFileDdIni, UFrIFileDdSim" to get frames from the Data Distribution server.

- **DyGetConfigfile:** called when you push the button "Load Config" of the Config File panel. This function calls DyGetConfig.
- **DyGetConfig:** This function reads a \*.car file using the functions *DyGetClocksFromConfig*, *DyGetFilesFromConfig* and *DyGetPlotFromConfig*. When you give to DyGetConfig a Siesta cards file, it only look at the siesta cards beginning with keywords UJMasterClocks, UFrIFile, UFrIFileOnline, UFrIFileCm, UFrIFileDd or UFrUnpack cards. Moreover, after a UFrUnpack card, there must be always a card beginning with UHplot1D, UHPlot2D, UHplotTime, UHplotFFT, UHpTfct or UH-sound.
- **DySetVar:** This function is called by the *DySetPlot* function or each time you select a channel in the "Data and Plots" panel. It takes the channel name and type (adc or sms data), used when a plot is created.
- **DyRaz:** It is called by the Clear buttons of some browsers and by the buttons "Cleaning" and "Reset All" of the main panel. Depending on the argument passed, it resets the input files list (arg=1), the plots (arg=2) (that means plots list, clocks list except the frame clock, and all the \*Plot structure variables), the list of data to dump (arg=3), the dumped data panel (arg=4), the PAW graphical windows only (arg=5), or all the previously cited items plus the frame clock (arg=0).

### 3.4 Example of data display working steps

In the function main, *fl\_do\_loop()* is called within an infinite loop. This means that Xforms is indefinitely waiting for an X event (any change in the currently displayed panels). Once you got a configuration file (read via the *DyGetConfig* function) or once you got a frames source (whose first frame is read by *DyReadFirstFrame*), and once you set and edited your plots (*DySetPlot* and *DyEditPlot*), you can push the "Start" button (*DyStart* that calls *DySiestaLike*).

This action has a first consequence: the building of a configuration file "dd.car", This is a Siesta cards file, which is then read by the function *DySiestaLike*. Within the DySiestaLike loop, a periodic call to the function *DyInteractionSim* allows interactivity with the user. Each time you push the "Stop" button while DySiestaLike is running, a plots file "dd.hsto" is written to disk, and the DySiestaLike loop is stopped.


## References

- [1] Final Design Report, May 1997
- [2] Xforms library (open source since 2001): documentation can be found at <http://world.std.com/~xforms> or at <http://bloch.phys.uwm.edu/xforms>
- [3] Siesta: see documentation in `/virgoApp/siesta/xxx/doc`

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- [4] ROOT: documentation can be found at <http://root.cern.ch>
- [5] PAW: documentation can be found at <http://asdwww.cern.ch/pl/paw/index.html>
- [6] Frame Library: see documentation in `/virgoApp/Fr/xxx/doc`
- [7] Frame Distribution Library: see documentation in `/virgoApp/Fd/xxx/doc`
- [8] Cfg package: see documentation in `/virgoApp/Cfg/xxx/doc`
- [9] CSet package: see documentation in `/virgoApp/CSet/xxx/doc`
- [10] Cm package: see documentation in `/virgoApp/Cm/xxx/doc`


*Data Display*

**Help**    Help Ballons

**QUIT**

**Data and Plots**   **Dumped Data**   **User Functions**   **Cleaning**   **Reset All**

| Run# / Frame#        | GPS Time / Size      | GPS time             | noTOC                | Checks               |
|----------------------|----------------------|----------------------|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

**Next Frame**   **Stop**   **Sound Vol.**   **0.50**   

**Next Refresh**

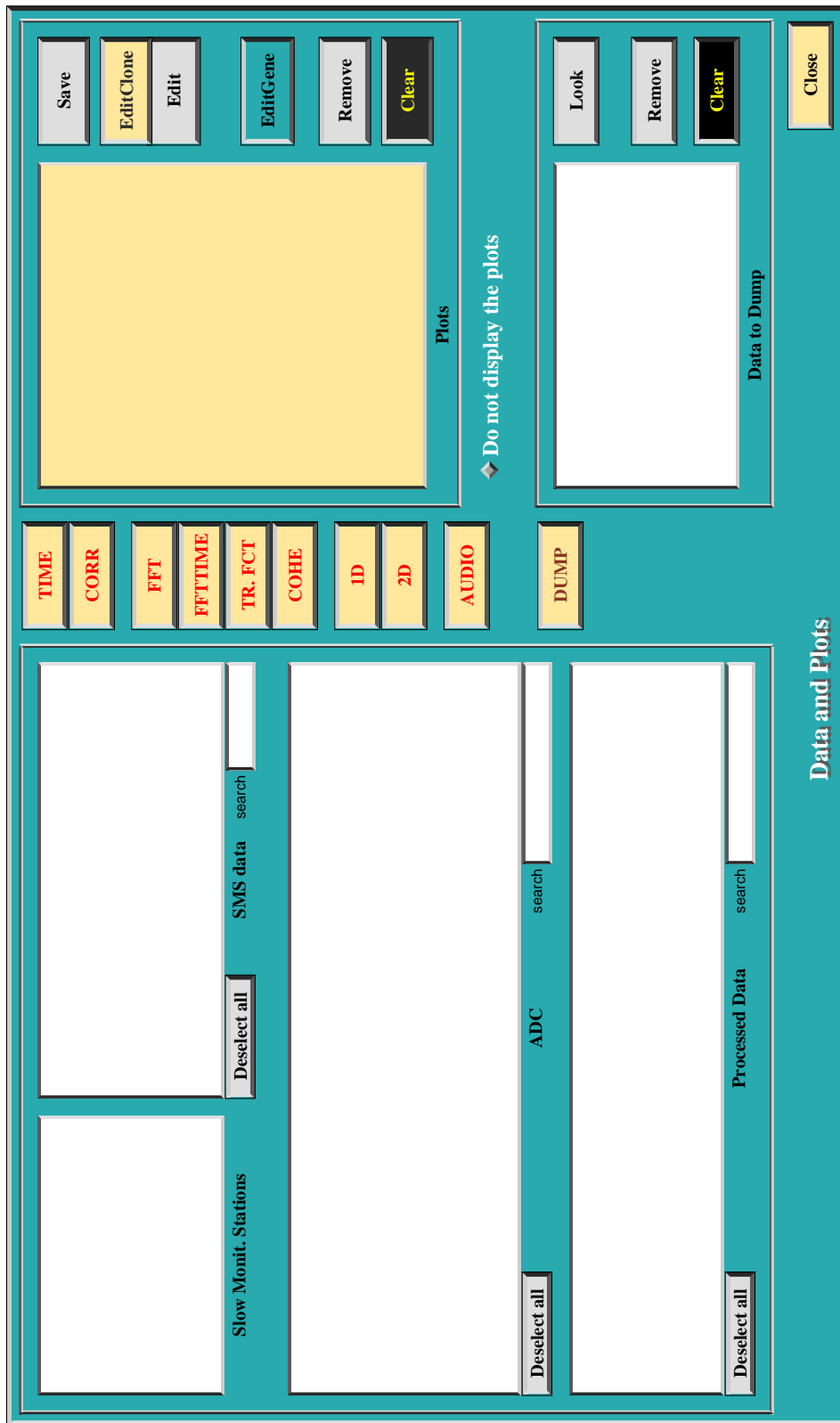
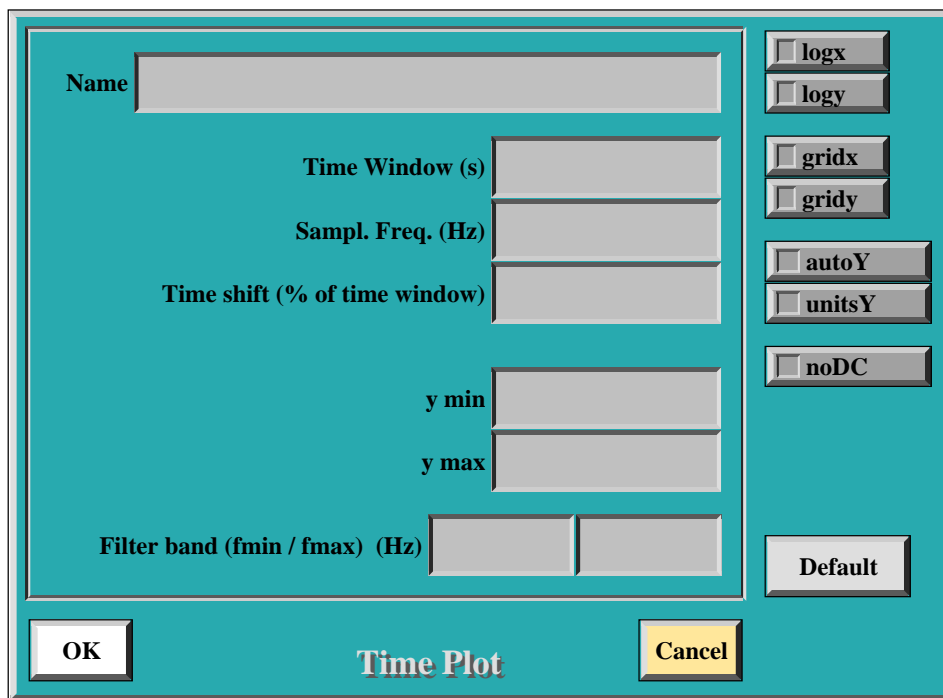


Figure 2: The "Data and Plots" panel of the Virgo Data Display.





The figure shows a graphical user interface for editing a TIME plot. The panel has a teal background and contains several input fields and checkboxes. On the left side, there are labels for 'Name', 'Time Window (s)', 'Sampl. Freq. (Hz)', 'Time shift (% of time window)', 'y min', 'y max', and 'Filter band (fmin / fmax) (Hz)'. Each label is followed by a corresponding input field. On the right side, there are seven checkboxes labeled 'logx', 'logy', 'gridx', 'gridy', 'autoY', 'unitsY', and 'noDC'. At the bottom left is an 'OK' button, at the bottom right is a 'Cancel' button, and in the center bottom is a 'Default' button. The text 'Time Plot' is centered at the bottom of the panel.

Figure 3: *The TIME plot edit panel.*