Megha Data Acquisition at ANU

V.F.E.Pucknell
April 5th 1998

1 Introduction

1.1 Getting Started

On a Sun system or Xterminal login using the id charissa which has the password chari$ma. From the Xterminal startup menu select the host charissa6.anu.edu.au.

From the CDE desktop double click on a t**erminal** icon to open it and execute the command **megha-session**. The **MIDAS** session startup is automatic and takes about 15 seconds on charissa6 (rather longer on charissa2). When the **MIDAS** logo window finally disappears from the centre of the screen the session is ready for use.

All control and monitoring of your experiment is carried out using **megha-session**.

You may run as many copies of **megha-session** on a screen as you wish (normally this means per login session) and there may be as many copies of **megha-session** running as you wish on different screens/login sessions and these may all control and monitor the experiment. The data acquisition software servers will reply to whichever session makes requests and the system allows for changes made from one session to be seen by all others. It is the responsibility of the users to ensure that they do not concurrently carry out conflicting actions.
The on-line sort function is performed within one (or all) of the Sun workstations using the **Sunsort** package supplied by Steven Singer taking its data source from the **megha** data ethernet and using the source REMOTE (rather than Exabyte or disc).

2 Midas

The window titled **Megha Base Frame** contains the main menu for **megha-session**. This window can easily be identified when closed by the gold coloured background of its icon. The **Megha Data Acquisition System** is built from a package of software components and techniques originally developed for Eurogam but now considerably extended and used for a wide range of applications. The package has the name **Midas** which stands for **M**ultiple **I**nstance **D**ata **A**cquisition **S**ystem although you may substitute the word **A**nalysis for **A**cquisition when appropriate. (If you program in C++

you may follow the joke in the name - if you don't you probably won't.) The Instances of **Midas** currently include Eurogam, Euroball, Megha, Tardis, PEX and MEIS.

3 Graphics and the GUI

The **Midas** GUI is based on a script language known as Tcl/Tk but now more formally known as SunScript. Although Sun have sponsored this development in recent years the package is available on a wide range of hardware platforms including Sun Solaris and Microsoft Windows. Tcl/Tk has a Motif-like Graphical User Interface (GUI) which makes it fully compatible with the CDE window manager used on Sun Solaris systems.

3.1 menus

Some menus have a dashed line at the top. This is the tearoff strip. A mouse hit on this area will transform the menu into a separate window.

3.2 buttons

There are three types of button used within the GUI.

Simple buttons which when you release mouse button 1 while over the button initiate an action.

Menu buttons which contain a small indicator (raised rectangular shape) on the button which when you release mouse button 1 (the left hand one) while over the button cause a menu to be displayed. You then move the mouse to the option you require in the menu and click mouse button 1 again. This then initiates the selected action. If you release mouse button 3 (the right hand one) while over the original menu button then the menu is not displayed but the action related to the first option in the menu is initiated.

Option buttons which are rather like a simple button but each click with mouse button 1 causes the next option to be selected and displayed on the button.

The **megha-session** consists of a number of software tasks each of which creates at least one and possibly more windows. If you are having problems with a particular window you can kill the software task in the GUI by placing the mouse over the task window and pressing the Ctrl+Delete keys together. This action will delete the software task and all its associated windows. You can then restart the task from the **Base Frame** and get the automatic setup action for that task.

Warning - When starting an item from the **Base Frame** click once and wait. Using charissa2 in particular response is not always fast (even more so if **SunSort** is busy). If you click twice the window gets created twice. If this happens you will have to kill it and try again.

For more information. From the **Megha Base Frame** select the **Help** menu item and then the **Online Manual** option. This will display the Megha Online Home Page. Select the **about the graphical user interface (GUI)** hyperlink. You will then obtain a page giving further details about the various graphical widgets used and a list of the special keyboard bindings common to all **MIDAS** windows.

4 Access Control

Normally you will not have to use this item. The default item from the menu starts the **Accessing an Experiment** window. This allows you to select which experiment (collection of software components) you wish to use. If you login using the ID charissa then the experiment **Megha** is automatically connected. You should look for the message in the **Session Log** window **You are now working with experiment Megha**. If you do not see this then you will manually have to Join the **Megha** experiment.

To use - select the experiment (**Megha**) from the list; select the **Leave** button if you have a Current Experiment and then select the **Join** button. The selected experiment now becomes your Current Experiment and this can be made the default which you are automatically connected to when **megha-session** starts by selecting the **Save as default** button.

5 System Control

This item from the **Megha Base Frame** starts the primary system control and statistics windows.

The default action **Data Flow...** starts the **Megha System Control** window and the alternative menu item **Statistics...** starts the **System Statistics** window.

5.1 System Control

There are 5 sets of buttons which allow control of the major components of the data collection system.

- **Electronics** These control all the CAMAC modules. **Stop** will perform the STOP action for all CAMAC modules in your configuration. Mostly this implies a hardware disable or reset and the Catch module is disabled. **G**o will perform the GO action for all the modules. This will enable all modules and enable the Catch module. The **Reset** action should only be used when STOPPED and in addition to performing most of the actions as for STOP also sets all adjustable parameters in the CAMAC modules to their default values. If you are having problems with the electronics hardware it may be a good idea to try the **Reset** option.
- **f2vb** These controls the software which drives the f2vb module. **Go** will cause it to be enabled and **Stop** will cause it to be disabled. In the enabled (**GO**) state data will flow from the CAMAC into the f2vb memory. The **Reset** option initializes the hardware and performs a complete software setup. However this action is also performed whenever you **Go** so in general you will not need the **Reset** option.
- **Data Readout** These control the readout of data from the f2vb memory.
- **Data Broadcast** These determines if data from the f2vb is to be written to the data ethernet in order to be available to the Sort program(s) running in the workstation(s). If you do not require an online sort this can be set to **Off**; otherwise it must be set to **On**. Normally the software will attempt to broadcast all data read from the f2vb. However it does not attempt to queue data for the ethernet interface and so the data broadcast may not be 100% of that available. At high data rates it may be useful to limit the fraction of data broadcast. If the **maximum broadcast fraction** is set

to 2 then at most 50% of the available data will be broadcast. Normally this can be left at its default value of 1. The value is reset to 1 whenever you **Go**.

- **Tapes** These control writing of the event data to tape (see section Tape SubSystem). When the tape subsystem is in the **Go** state then it is guaranteed that 100% of the data read from the f2vb will be written to tape.

You will see that the flow of data is thus controlled from the top of the screen (Electronics), to the bottom (Tapes). It is sensible to have a subset of the controls in the **GO** state particularly when setting up. You may set the Tapes to **STOP** if for example you are having problems with the beam (and thus do not want possibly rubbish data written to your tape file) while leaving the rest **GO** in order to monitor the situation possibly using the online sort.

The large **STOP** and **GO** buttons to the right hand side of the window enable all 5 separate controls to be **STOP**ped and **GO**ed with one action. The **GO** action enables starting at Tapes: and working up while the **STOP** action disables starting at Electronics: and working down.

Hint. The maximum block rate which SunSort can handle in charissa6 is about 8 blocks/sec. There is no point in broadcasting the data at a rate greater than this. If you are running at high data rates use the **Maximum broadcast fraction** to limit the data broadcast rate to 8 (/sec). Use the **System Statistics** window to monitor the data rates. If the **Data Rate IN** to the **Data Readout** stage is (for example) 24 (384 Kbytes/sec) then set the **Maximum broadcast fraction** to 3 which will reduce the **Data Rate OUT** from the **Data Broadcast** stage to 8.

5.2 Endrun

This button closes all open tape files on currently associated drives.

5.3 Newrun

This button closes all open tape files on currently associated drives; increments the filename; and then opens new files using this filename.

Hint - Use this feature to increment your tape files between runs. Using the standard file name format (for example run20) just **STOP** Data Acquisition; then **Newrun** will close all your inuse tape files and open using run21 and you are ready to **GO** Data Acquisition.

5.4 Show Scalers

This button starts the CAMAC window for the LeCroy 2551 Scaler Modules.

5.5 Clear Scalers

This button causes all LeCroy 2551 Scaler Modules to be cleared.

5.6 Clear Statistics

This button is equivalent to the **Clear** button in the **System Statistics** window.

5.7 Statistics...

This button starts the **System Statistics** window. This window shows counts of the number of (16 Kbyte) data blocks handled by the system and a data rate associated with each count. There is a **Clear** button to zero the counts and an option to autoupdate the counts at regular intervals.

Note - the Tape Stream block counter is automatically zeroed whenever you start a new tape file and so is the number of data blocks in the current file. It cannot be zeroed manually.

5.8 Redisplay

This button causes the system states to be updated if you suspect they may be out of date. This can happen if another session has STOPped the system.

5.9 f2vb Options

Unless you really know what you are doing DON'T touch.

6 Megha Control

The first (and default) item in the **MEGHA Control** menu in the **Base Frame** starts the **Megha Amplifier Setup & Monitor** window. The other items are diagnostics for the RS485 interface used by the **Megha** Amp Control and RS232 interface used by the CAMAC Control and should be ignored.

When you start the **Megha Amplifier Setup & Monitor** window the software goes through an automatic procedure which starts the RS485 interface software and then probes for Amplifier crates. **Only those crates which show as selected (the button is depressed and the background a golden colour) have been contacted and can be used. All other crates will have a blue background colour and are either not connected or most likely powered off.**

You will see progress messages at the bottom of the **MEGHA Amplifier Setup & Monitor** Window and finally the message **Ready** when finished.

The **Megha Amplifier Setup & Monitor** window has online help linked to the components of the GUI. As you move the mouse around the window the use of the item currently pointed at will be shown at the foot of the window. If you point the mouse at an item and press the **F1** key or **Shift+F1** key you will obtain help on that item. The **Help** button will generate a complete guide to the tape subsystem GUI.

The main amplifier adjustments are now shown in "physical units". The **Threshold** in millivolts; the **Gate Time** in microsecs and the **Fine Gain** as a number (range 0.8 - 2.5). Using the online help (**F1**) you can obtain details of the method of conversion to and from the hardware units.

Hint. To obtain a printout of the amplifier settings for your run book. Select **Act on Crates? All**; click on **Show Settings** and then use **Ctrl+P** to print the contents of the window containing the settings display.

Hint. If you get the warning message **Repeated bad response from amplifier** try clicking on the **Reset Interface** button and then the **Probe for crates** button. This will hardware reset the RS485 interface and check that the crates are responding correctly.

A few words of warning. The RS485 interface to the Amplifier Crate Controllers does not run very fast. Thus it can take up to 10-15 seconds to set a parameter if both the **Act on all crates** and **Act on all amplifiers** checkboxes are selected. Also there is no feedback from the actual amplifier modules to the amplifier crate control module. This means that there is no means of knowing for sure that a particular amplifier setting has in fact been written to the amplifier. The GUI can only display the settings read back from the amplifier crate control module.

7 Tape SubSystem

7.1 Getting Started

To access the tape control system from the **Megha Base Frame** click-on the **Base Frame** menu-item **Tape Control** using mouse button 3 to select the default item (**Drives & Data Streams**). This will start the main **Tape Drive Control** window or open it if it was already running somewhere.

The **Tape Drive Control** window has online help linked to the components of the GUI. As you move the mouse around the window the use of the item currently pointed at will be shown at the foot of the window. If you point the mouse at an item and press the **F1** key or **Shift+F1** key you will obtain help on that item. The **Help** button will generate a complete guide to the tape subsystem GUI.

7.2 Claiming Drives

On startup the **Tape Drive Control** application will contact the Tape Server and display a list of **Claimed drives** (those already in use by your experiment) and **Available drives**. There is also a **Redisplay** button in case you suspect this information is out of date.

If the drive you wish to use is in the **Available** list just select it using the mouse and click-on the **Claim** button. The drive will now appear in the **Claimed** list and the active buttons will change to enable those actions correct at this time. Ensure that the drive you wish to use is highlighted in the **Claimed** list (that is it is the currently selected drive) - if it is not then select it using the mouse

7.3 Initialising Tapes, Mount and Identify

The tape system will accept preinitialised tapes or you may ask it to initialise new tapes or reinitialise used tapes. For tapes with existing labels you can supply the volume name and **Mount** the tape or simply ask the server to **Identify** the tape by reading it and looking for the label. For tapes with existing labels this is the recommended action (the computer is always correct!) and is the default action of the **Mount** button.

The default action of the **Initialise** button is to initialise a new tape. You just have to supply the volume name (maximum 6 alphanumeric characters of which the first is alphabetic) and select the I**nitialise** button in the **Initialise Volume** window. To reinitialised an old tape select the **Reinitialise** option by holding down Button 1 (the left most mouse button) as you select the **Initialise** button on the **Tape Drive Control** window. You will have to supply the existing volume name in the **ReInitialise Volume** window (as a minima security check) but you can reinitialise a tape which is already mounted using the identify function (and hence for which the system has told you the name). Both **Initialise** and **ReInitialise** will by default leave the tape mounted ready for further use.

7.4 Opening Files

You can now open a file by using the **Open** button. Normally select the default action by using mouse button 3. Type in the file name (maximum 8 alphanumeric characters of which the first is alphabetic) and click-on the **Open** button in the **Open File** window.

7.5 Streams and Association

In order to write data onto tape you have to tell the tape system which of your drives it should use and in which manner. In simple cases the system can perform this operation automatically for you when you open a file on a tape. There is an **Auto** checkbutton on the main **Tape Drive Control** window which enables or disables the automatic action. If this default action is what you want to do you can ignore the rest of this section.

First ensure the Server State is **Stop** (ie data is not being written to tape) - if not select the **Stop** button. The data rates from **Megha** (at present) are well within the capability of an Exabyte drive so we need not worry about “stripping” data across several Exabyte drives. Ensure that you do not select the **+** option from the **Join next drive with** choice.

Lastly select the tape or tapes from the Available list which you wish to write a copy of the data to and select the **Associate** button. If the list of drives in the **Association** window is incorrect then use the **Clear** button to start again. You can reverse the effect of the **Associate** function by using the **Dissociate** button.

Megha uses only 1 data stream and so you can and should ignore the **Data Streams** number selection.

7.6 Writing data to tape

If you have got this far successfully then you are now ready to write data to your tapes. You can now enable the Tape System to write to tape by selecting the **Go** button.

7.7 Statistics

There are many windows available which can be started from the **Tape Drive Control** window which give statistics and status information about the tapes and data rates. A good one is obtained by selecting **Status** on the **Tape Drive Control** window and the menu item **Summary** (or just clicking on the **Status** button using mouse button 3).

Note - the **Go** and **Stop** buttons on the **Tape Drive Control** window control only the Tape SubSystem and are a duplication of the Tapes **Go** and **Stop** buttons from the **System Control** window. You may leave the Tape System in the **GO** state while you **STOP** and **GO** the electronics as you wish.

7.8 Close and Dismount

The **Tape Drive Control** window contains a **Close** button to terminate a data file and a **Dismount** button to rewind and unload the tape.

7.9 Suggestions

All tape control functions such as **initialise**, **open**, **close** etc may be performed while the Tape System is in the **GO** state as long as the drive you use is not currently associated to the data stream. If it is you must change the Tape System to the **STOP** state while you change the Associate list. This should only take a few seconds and you can return the Tape System to the **GO** state.

You can overlap Tape Control functions (ie have several tapes in the initialise state at one time) and the system will not get confused although you may!

All abnormal events (such as end of tape or fatal tapes errors) are reported to the tape control windows in summary, may cause an error popup window to appear and are reported on the Exception Monitor window in great detail.

Hint - Always run the **Tape Drive Summary** window to monitor the status of your tape drives. In the event of a fatal device error the **State** will be **device error**. Go to the main **Tape Drive Control** window and select the drive in error from the **Drives Claimed** list. Then select the **Status** menu button and select the **File…** option. This will open the **Current File Status** window for the drive. The **Information** line will give more details about the error. End of Medium means you have reached the end of tape. For all other errors I suggest you at least clean the drive. Repeated errors will require that the drive be replaced and possibly returned for repair.

In all cases of device error use the Close button to end the file (which will be performed if the error is End of Medium) or just to clean up the software state for the drive. You must then start a new tape. You cannot append data to a tape after a device error.

Hint - Monitor the **Tape Errors** using the **Tape Drive Summary**. For Exabyte drives an error rate of 5-10% suggests that you clean the drive at the end of the current tape. An error rate over 10% suggests that you stop now; end the run and clean the drive. An error rate about 15% means that you will get a fatal drive error in the VERY near future.

8 CAMAC

The **CAMAC** item in the **Base Frame** gives access to a large menu which contains a entry for every type of **CAMAC** module in your configuration. The default action opens the main **CAMAC Configuration and Control Frame** which is automatically started and iconized when the session starts.

8.1 Control

The **CAMAC Control** window is the most important of the CAMAC windows. It contains a simple means of generating the CAMAC hardware setup. A default configuration is contained in the file /MIDAS/megha/tcl/camaccontrol.patch.tcl which can be recalled using the button **Default Configuration**.

If an item is selected from the configuration window its parameters are transferred to the 2 rows of choices just below the list. The selected item can be deleted by using the **Delete** button. (Note this causes renumbering of the modules). Parameters of the selected item can be changed by first selecting the new value using the menus and then using the **Replace** button. Additional items can be added (to the end of the list) using the **Add** button. The whole configuration is deleted using the **Clear** button.

Once you have edited the CAMAC configuration as desired then it is necessary to download it into the VME processor. This is performed using the button **Load Configuration into Register Server**. At the same time as downloading the configuration the module definitions are downloaded. This action supplies the software loaded into the VME processor with its knowledge as to how to control the specific CAMAC modules.

The button **Restore Configuration from the Register Server** is useful if a non default configuration has been downloaded from one session since it allows another session in a different workstation to find out what is currently downloaded.

The CAMAC configuration can be saved to or restored from a disc file using the **Save/Restore Configuration** button.

The current CAMAC configuration can normally be restored from the file **latest**.

The settings of all modules in your CAMAC configuration can be saved to or restored from a disc file using the **Save/Restore Setup** button.

8.2 LC2551

This starts the window which controls the **LeCroy 2551 Scaler** Modules and allows access to the scaler values. It is exactly the same as the **Show Scalers** button in the **Megha System Control** window.

8.3 LC2277

This starts the window which controls the **LeCroy 2277 TDC** modules**.** This is essentially a diagnostic window and the module setup should not normally be changed.

8.4 RS232 CC

This starts a window which allows control of the **RS232 CAMAC crate controllers** used by the **Megha** electronics. The status of the currently selected CAMAC Crate is displayed.

If you have for any reason to power off and on a CAMAC crate or if a CAMAC crate has lost power for some reason then you can reinitialise the crate by the **Initialise Controller** button. The Control/Status register should normally show 0x00040C.

The CAMAC crate labelled A is crate 1; the CAMAC crate labelled B is crate 2 etc.

8.5 Other CAMAC Modules

There is a specific window for every type of CAMAC module which allows access to all functions of the module. These are almost exclusively for diagnostic purposes.

9 Exception Monitor

Creation and control of the Exception Monitor window is largely automatic. This window will be used to display messages from the VME processor which are of significance - such as fatal tape errors - in addition to routine logging information.

10 Spectrum Viewer

This button starts a directory browser window which allows you to select spectra stored in the standard **Midas** format. You can then view these spectra in a large number of ways and perform simple analysis functions on the data.

11 Diagnostics

Unless you really know what you are doing DON'T touch.

However a useful diagnostic is started by the **F2VB…** menu item. This enables you to spy on the buffer RAM of the F2VB module and see your raw data. Very useful when the electronics is not working to its normal efficiency.

Ensure the option button shows **display data RAM** and click on the **read** button. 64 32 bit words of the data RAM are displayed. You can set the start address offset or enable the **increment RAM address** checkbox to step through the data RAM. The **format data RAM** button will generate a formatted display (assuming **Megha** hardware format) of the last block of the data RAM displayed.

If the VME system is restarted while this window is open you will need to click on the **define registers** button to reestablish access to the F2VB.

12 Options

This menu item gives access via the **Colours** item in the menu to the **Colour Selection Frame** which allows user specific selection of the colours used for each of the widget types and components. The selection can be saved as the default for that user. Note that use of this option may cause problems with other windows which also use a large number of colours due to hardware limitations.

There is also a **Printers** item which allows selection of the default printer for the session from those available to the system. It is also possible to select a pseudo-printer FILE which will write data to a disc file. This is useful if you want permanent hardcopy of windows on disc for further applications.

13 Hard Copy

You may make a hard copy of the whole screen or a single window. The hard copy is printed to the currently selected printer (which could be FILE). When making a hard copy of a window you will be required to select the window by clicking on it with the mouse. You will be asked to confirm the print operation.

14 Quit

This button initiates the preferred way to terminate **megha-session** because it ensures that all applications are given the chance to tidy up first. Any other method may leave tasks running in your workstation which can cause problems latter. You are asked to confirm or cancel the **QUIT** action.

15 Session and Experiment recovery

15.1 restart megha-session

The data acquisition system will continue to do whatever it is doing (ie collection of data and writing to tape) unless commanded to change state from the **Midas** GUI. Termination of a **megha-session** or logout from the Sun will not change the state of the data acquisition system.

If the data acquisition system is setup and running when you start **megha-session** all you have to do once the session is running is from the **Base Frame** select **CAMAC** and then **Control** (click button 3 on **CAMAC**). When the **CAMAC Configuration & Control Frame** starts click on the button **Restore Configuration from Register Server** to reload the current camac configuration from the VME processor.

15.2 restart VME processor

If the VME processor is restarted then you should remove any tapes from the Exabtye drives and not attempt to add data to them. You may reuse them if they are reinitialised which will lose any data on them.

From the **Base Frame** select **CAMAC** and then **Control** (click button 3 on **CAMAC**). When the **CAMAC Configuration & Control Frame** starts click on the button **Load Configuration into Register Server** to load the current camac configuration into the VME processor.

If you are writing to tape insert a new tape into the Exabyte drive and follow the standard procedure to open a file.

Some of the GUI windows will contain information which will be invalid following a restart of the VME processor. It would be best to close and restart from the Base Frame the Tape Drive Control, CAMAC Control, MEGHA Amp control and F2VB Diagnostics windows. For all others just clicking on the **Redisplay** button will be enough.