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Introduction

The following document is a reference to the CTIO 60 inches CHIRON scripting. It provides a way of understanding the tools that allow to make scrips to handle the complete CHIRON/CHIRTEMP applications.

Scripting is an alternative way to the GUI for handling the Chiron software. It has the advantage, or the potential, for building much more complex tasks than the GUI. It provides also a way of pretty much “automate” a good part of the work.

When using a script, if the GUI is opened (as it will usually be) it will show what the software is doing, so the GUI is still useful to have a feedback on what is going on.

The scripts will talk directly to the application, not to the GUI; the GUI runs “in parallel” to the scripts, in the sense that they both talk to the main application, and the GUI knows and reflect the activities only because it receives -as the normal operation of the GUI- asynchronous messages.

All the application is ascii-commands driven, which means that everything can be done with scripts -taking images, handling lamps and temperatures, even moving the telescope-

The philosophy is simple: the user can use any script he likes. There are no constrains in the language or the scripting type. This is possible because the software receives the commands in raw tcp/ip sockets, so:

a) any language than can handle a socket would do (scripts like python, pearl, tcl, and any compiled programming language)
b) The software provides wrappers that can be called as any system call, which make possible for scripting languages that cannot handle sockets as easily to also handle the system (csh, bash, cl, etc)

Since these wrappers are provided, a language like python can also use them instead of handling the socket directly (just by making a simple OS system call to these wrappers). This makes possible, of course, to send a command manually using any terminal.

Note: the term “app_root” that will appear repeatedly in the next pages is, for this application, /home/observer. Also, in the commands syntax description there will appear some symbols:

< >: encloses a mandatory field
[]: encloses an optional field, or a field that may or may not be present
Chapter 1: The wrappers

1.1 Brief internal description

We will explain a bit how the wrappers work; this is not needed for the maker of scripts. We will explain it just for the ones that like to know the implementation details. For those who are not interested in these details, please skip this and go directly to 1.2

In the bin directory specific to the Chiron application (/app_root/apps/CHIRON/bin) there is a binary called “sendsockcmd”. This is a small binary that, when called, opens a socket, sends the given argument to that socket, wait for the response and when received, print the response out, in the standard output -the screen. Finally it closes the socket channel.

The Chiron software has a device which its only job is to listen for tcp/ip messages, send those messages into the SML-world (internal protocol of the application) and then transmit the response back into the tcp/ip socket. This device is called SYNCDEV (see CHI60S-2X, software architecture). Every time the application is started (“start_CHIRON) it creates, on the fly, a csh script called CHIRON, on app_root/apps/bin

This is the main and primary wrapper, because it allows to talk to any device, or part of the application. It is a very simple script, and looks similar to this:

```csh
#!/bin/csh -f
#This script is automatically generated
#else edition to this file will be lost!
set command = ""
while ($#argv > 0)
    set command = "$command $argv[1]"
    shift argv
end
/home/observer/apps/bin/sendsockcmd -h localhost -p 1325 "$command" -t 40000
```

The service port “1325” here, is read directly from the SYNCDEV configuration file. So as it is easy to see, it just passes to “sendsockcmd” any argument given. All the other wrappers are based on this one, and they are, actually, not really necessary.
1.2 CHIRON

This is the first and primary wrapper. It allows to send any command to any available device. The syntax for the commands is:

\[ \text{CHIRON } \text{<device>} \text{<command>} \text{<args ....>} \]

where

device: any available device in the application:

- PAN: detector and temperature commands (PANDEV)
- LAMP: lamps commands (ECHLAMP)
- TCS: Telescope Control System (TCS) commands (TCSCT60DEV)
- IODCELL: Iodine Cell motor commands (IODCELLDEV)
- SLICER: Slicer motor commands (SLICERDEV)
- FOCUS: Focus motor commands (FOCUSDEV)

command: any command for the specified device

The response syntax is:

\[ <\text{DONE} | \text{ERROR}>[\text{message}] \]

or the requested information

For examples, please see chapter 2. For the detailed commands for each device, see Appendix A or CHI60S-2.X document, with the detailed description of each device.

1.3 dhe or DHE

This is a wrapper for all the PAN (or DHE: detector head electronics) commands. The syntax is:

\[ \text{dhe } \text{<command>}[\text{args ...}] \]

where

command: any available PAN (and panview) command (see Appendix B for panview commands)

This is the same as

CHIRON DHE <command> [args ...] or
CHIRON PAN <command>[args ...]
1.4 lamp or LAMP

This is a wrapper for all the LAMP commands. The syntax is

\texttt{lamp <command>}[\texttt{args ...}]

where

\textit{command:} any available LAMP command

This is the same as:

CHIRON LAMP <command>[\texttt{args ...}]

1.5 tcs or TCS

This is the wrapper for all the TCS commands. The syntax is

\texttt{tcs <command>}[\texttt{args ...}]

where

\textit{command:} any available TCS command

This is the same as:

CHIRON TCS <command>[\texttt{args ...}]

1.6 pan

This wrapper talks directly to panview, actually bypassing the application itself. This is not bad just because panview sends async. Messages to the application, so the application will know anyway. Using “pan” is the same as using.

The syntax is

\texttt{pan <command>}[\texttt{args ...}]

where

\texttt{<command>:} any available panview (PAN) command. See Appendix A for a summary of the most useful panview commands.
Using this wrapper produces the same effect as using:

CHIRON PAN <command> [args ...]

1.7 panview macros

Panview has the capability of handling simple macros. A “macro” is basically a set of valid commands, one per line, that are executed in order, just as if they were sent through the command line. Panview can then read the macro file, execute all the commands in it, and then return with a final, unique response. The macro files are identified by the extension “.mc”. The file can be specified using an absolute path or a relative one. If using a relative path, it will assume as the “basepath” a default macros directory defined in its configuration file. If the macro in the default directory, then just giving the name is enough. To invoke the command execution:

\texttt{pan appmacro }<\texttt{macro\_name}> \texttt{ or CHIRON PAN appmacro }<\texttt{macro\_name}>

For example

\texttt{pan appmacro speed\_fast}

will look for the macro file called speed_fast.mc on the default macro directory. The default macro directory in this application is \texttt{$HOME/panview/fpas/_chiron/config/DETECTOR}.

The command

\texttt{pan appmacro /home/observer/bin/mymacro}

will actually execute the macro mymacro.mc on \texttt{/home/observer/bin}.

The macros can be called recursively (i.e., inside a macro there can be another macro call). Using macros is an easy way of saving time. Of course an alternative is writing a script instead of a macro. Another option, usually better, is a combination of both (scripting and macro calling). See the \textit{Chapter 3} for examples on this.

Also, the Chiron software implements important functions through macros and scripts. See \textit{CHI60S-6.0} on panview setup.

\textit{Chiron scripting reference / CTIO 60 inches Chiron CHI60S-3.1}
Chapter 2: the sockets and the protocol behind the scenes.

This chapter may be useful only to those who would like to skip the wrappers and handle the sockets directly. This allows for a more efficient handling (it is possible to have more than one action at a time, while with the wrappers this is it possible.

For those who are not interested in the internals of the protocol and are not planning to handle the sockets directly, please skip this chapter and go directly to Chapter 3: Examples.

2.1 The protocol

The protocol that we will describe here is the general protocol of the commands and the messages between the devices; handling the socket directly requires having a basic knowledge of this protocol.

We are not talking here about SML, but just the command / response syntax.

First, some terminology.

- Command: a requested action
- immediate response: the immediate response sent in return of a command. This response should not last more than about 5 secs to be received
- Callback: this is a later, final response for commands that take long time in finishing (like exposing an image or offset the telescope). This are then messages associated to an original command
- asynchronous messages: these are messages not associated to any specific command, but spontaneously generated, usually to indicate “abnormal” conditions, like an alarm, etc

The protocol has two communication channels:

a) command / response: this is a bidirectional channel. Here the client send the command and receives the immediate response

b) asynchronous: this is a unidirectional channel, from server to client. Here are returned the callbacks and also the asynchronous messages.

There are two types of commands:

a) short commands: the requested action is finished when the response is returned

b) long commands: the requested action will take some time, so it is first returned an immediate response, and then a callback when the action is actually done. See point 2.1.2 (responses)
The system implements two tcp servers, in two different ports (command/response and asynchronous). The client will use the asynchronous channel to receive only any message going from the client to the server in the asynchronous channel will be ignored. Both servers support multiple clients.

2.1.1 Commands

The command syntax is

<device> <command> [args ...]

where

device: device to which the command is directed

command: command to send

args: optional command arguments

The available devices for this application are: PAN, TCS and LAMP. In Appendix A and B are the lists of the available commands for each device. This is also on document ECH60S-2.0 (software architecture). In Chapter 3 there are some examples

2.1.2 Responses

The response syntax is

short commands

on success: DONE | <requested information>

on error: ERROR <error_message>

long commands

on success:

- immediate response: OK <estimated_action_time_in_msecs>
- callback: DONE [message] (<device:<command>>)

on error
For the long commands, then, it is first returned an “OK” with an estimation of the time it will take to finish the action. This number could be used by the client to implement their own timeout mechanisms, although this is not recommended since the system has already timeouts included, and it should, normally return the timeout error. The final callback is received through the asynchronous channel with the device and command reference at the end. Example

DONE image_Done (DHE:EXPOSE)

Note that the PAN commands may return the ID as “DHE” (Detector Head Electronics).

2.1.3 Asynchronous messages

The syntax for the callbacks was explained below, so here we will explain the truly asynchronous messages (not associated to a command):

ASYNC <message> [<< ID]

The message will always start with the ASYNC key (remember that in this channel also the callbacks are received, and those will never start with this key). Then it will come the body of the message, and at the end it may appear the ID of that who generated the message. The only one that, in general, will add its ID is panview (so, messages coming from PANDEV)

2.2 Handling it

So, now that we know the basics, the client that want to handle the system directly (without the provided wrappers) will need to open two sockets, one to the command/response server port and one to the asynchronous server port. It will need to send the command and parse the immediate responses in the first, and handle the async. Messages and callbacks in the second. The actual service ports in use are in app_root/apps/CHIRON/config/DEV_SYNC.cfg

Chiron scripting reference / CTIO 60 inches Chiron CHI60S-3.1
(this is also explained in CHI60S-2.0). Inside this file, the keywords are

[COMMS]
port=command/response port>
asyncport=asynchronous port>
blockport=blocking port>

The “blocking port” is an special port that “blocks” the long commands. It basically hides all the command/response/async. Protocol; when the client sends a command -even if it is long- the server will block until the action is done. This allows a much easier handling, but of course the truly asynchronous messages are ignored -lost-. **This is indeed the port that the wrappers use, so no need of multiple sockets handling if using this port.** The disadvantage is that it is of course less efficient, since the client needs to wait for the action to be finished before requesting a new one (so things like moving the telescope while the data is being read cannot be done using this port or, for the same reason, using the wrappers).

Note that any of this ports can be set in the config file as environmental variables, allowing more flexibility in the handling of the system.
Chapter 3: Examples

This chapter provides short examples on scripting.

3.1 csh

Csh is a very common scripting language. It is easy to use when an easy operations are required. A very simple example is the following script, build to set the system in a very specific operation mode. The script is called “geom_Iodine”

```
#!/bin/csh -f

# Setting detector size
echo "setting detector size ..."
pan appmacro set_roi full

# Setting detector binning
echo "setting detector binning ...
pan appmacro set_binning 3 1

# Setting detector speed
pan appmacro speed_fast

# Positioning slicer motor to slicer position
CHIRON2 SLICER MOVE slicer
set pos = `CHIRON2 IODCELL get iodine`'"'
if ("$pos[2]" == "OFF" || "$pos[2]" == "OUT") then
    echo "moving iodine cell IN ..."
    CHIRON2 IODCELL set iodine IN
else
    echo "iodine cell already IN"
endif

# Setting geometry mode
echo "setting geometry mode ...
pan dbs set geom_mode Iodine STR
pan dhe async GUIUPDATE geometry Iodine
```
This script is used to set the software in “iodine” mode. Note that the script calls some panview macro (speed_fast, set_binning and set_roi).

The last line is just so the GUI gets updated (updates itself when it receives that command)

It get obvious by now that any scripting language can be used by calling the wrappers. We will still see another example, in CL

### 3.2 CL

CL is the scripting language from iraf. Using it has the advantage of acquiring and reducing (using iraf tasks) without the need of calling outside languages (acquire and reduce in iraf). Of course this can also now be done using pyraf, which allows to use pythin language and yet being able to call iraf tasks (and python tasks!). The following example is just cl iraf scripting. It uses an iraf task called “socksend” to send the command to the application (through a socket). The following script can takes biases, darks and flat (calibration) as specified

```
# echcal.cl

procedure echcal()

    bool   bias     {"yes",  prompt="Take bias images?")
    int    biasnum  {"5",      prompt="Number of bias images")
    bool   flat     {"yes",  prompt="Take flats?"
    int    flatnum  {"5",      prompt="Number of flats")
    real    flatet  {"50.0",  prompt="camera flat exposure time")
    string  lamp    {"QUARTZ", enum="QUARTZ|TH-AR",  prompt="Lamp to use"

    bool   dark     {"no",    prompt="Take dark images?")
    int    darknum  {"5",      prompt="Number of darks")
    real    darket  {"300.0",  prompt="camera dark exposure time")

    begin
        int timeout = 200000000

```
printf ("\n")
printf ("Please make sure that the dome is dark\n")
printf ("<ENTER> to continue\")
soksend.host = get_arcinfo.ssvrhost
soksend.port = get_arcinfo.ssvrport
if (bias) {
    printf("Setting title to Bias\")
soksend(command="DHE set image.title bias")
printf("Setting type to Bias\")
soksend(command="DHE set obs.obstype bias")
printf("Setting basename to Bias\")
soksend(command="DHE set image.basename bias")
printf("Setting exposure time to 0.0\")
soksend(command="DHE set obs.exptime 0.0")
printf("Setting number of bias images to %d\", biasnum)
soksend(command="DHE set obs.nimages " // biasnum)
soksend(command="DHE expose", timeout=timeout)
}
if (flat) {
    printf("Setting title to domeflat\")
soksend(command="DHE set image.title domeflat")
printf("Setting type to Calibration\")
soksend(command="DHE set obs.obstype Calibration")
printf("Setting basename to flat\")
soksend(command="DHE set image.basename flat")
printf("Setting exposure time to %5.1f\", flatet)
soksend(command="DHE set obs.exptime " // flatet*1000)
printf("Setting number of domeflats to %d\", flatnum)
soksend(command="DHE set obs.nimages " // flatnum)
printf("Turning %s on\", lamp)
soksend(command="LAMP set " // lamp // " on")
soksend(command="DHE expose", timeout=timeout)
printf("Turning %s off\n", lamp)
soksend(command="LAMP set " // lamp // " off")
}
if (dark) {
printf("Setting title to dark\n")
soksend(command="DHE set image.title dark")
printf("Setting type to dark\n")
soksend(command="DHE set obs.obstype dark")
printf("Setting basename to dark\n")
soksend(command="DHE set image.basename dark")
printf("Setting exposure time to %5.1f\n", darket)
soksend(command="DHE set obs.exptime " // darket*1000)
printf("Setting number of darks to %d\n", darknum)
soksend(command="DHE set obs.nimages " // darknum)
soksend(command="DHE expose", timeout=timeout)
}
soksend(command="DHE set obs.obstype object")
soksend(command="DHE ASYNC SEND UPDATE")
end

The task “soksend” just sends, through a socket, the specified command to the software
Appendix A: available commands

The description of this command can be found on the ECH60S2.0 document, in a device-by-device description. Here we will just present a quick reference. In the examples, the “>” symbol represents just the line prompt of the terminal (as if typed manually).

A.1 TCS

info: gets the current information

example:

> CHIRON TCS info

A.2 LAMP

list

gets the list of available names (lamps, manual switches, motor)

example:

> lamp list

> name= QUARTZ

name = TH-AR
name = SW_TH-AR
name = SW_QUARTZ
name = MOTOR

set <TH-AR | QUARTZ > <on | off>

example:

> lamp set QUARTZ on

> DONE
get <TH-AR | QUARTZ | SW_QUARTZ | SW_TH-AR | MOTOR>

example:

> lamp get QUARTZ
> ON

status

shows the status of the device and of all the available “names” in it, as “name <on | off> status”

example:

> lamp status
> IDLE
TH-AR OFF OK
QUARTZ ON OK
SW_QUARTZ OFF OK
SW_TH-AR OFF OK
MOTOR ON OK

A.3 IODCELL

list

gets the list of available names (iodine cell, manual switch)

example:

> CHIRONE IODCELL list
> name= IODINE
name = SW_IODINE

set IODINE <in | out>

example:

> CHIRON IODCELL set IODINE in
> DONE
get <IODINE | SW_IODINE>

   example:
        > CHIRON IODCELL get IODINE
        > ON

status

   shows the status of the device and of all the available “names” in it, as “name <on | off> status”
   (on=IN, off=OUT)

   example:
        > CHIRON IODCELL status
        > IDLE
            IODINE OFF OK
            SW_IODINE OFF OK

A.4 SLICER

HOME

   starts a homing procedure of the slicer motor

   example:
        > CHIRON SLICER HOME
        > DONE HOME

READ position

   reads the current position (in mm)

   example:
        > CHIRON SLICER read position
        > 2.4213 mm
**MOVE <position>**

move to the specified position (in mm) or predefined position:

example1:

> CHIRON SLICER MOVE 2.8
> DONE MOVE

example2:

> CHIRON SLICER MOVE slit
> DONE MOVE

**A.5 FOCUS**

**HOME**

starts a homing procedure of the focus motor

example:

> CHIRON FOCUS HOME
> DONE HOME

**READ position**

reads the current position (in mm)

example:

> CHIRON FOCUS read position
> 16.5221 mm

**MOVE <position>**

move to the specified position (in mm)

example:

> CHIRON FOCUS MOVE 18.8
> DONE MOVE
**A.6 PAN (panview)**

This is a very long list. Following there is a quick summary. Any of this commands can be invoked using the “pan” or “CHIRON PAN” wrappers:

example (very first listed command):

```plaintext
> pan set obs.exptime 5000
> DONE
```

The following list describes briefly the command and parameters available for the detector controller electronics. For a more detailed description on the parameters, please see the complete DHE command list

Here is presented only a reduced list to setup observations and observe. The low level and engineering commands are not listed. NIR-related commands are also not listed

The meaning of the used symbols is:

< > : holds a parameter which is necessary (mandatory)

[ ] : holds a parameter which is optional

| : separates possible values for an enumerated type.

### A.3.1 Observation setup

**SET / GET (dhe set / dhe get)**

All the following parameters can be set or read, unless specifically stated.

#### obs parameters

<table>
<thead>
<tr>
<th>complete command</th>
<th>alternates &quot;short&quot;</th>
<th>description</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>obs.exptime &lt;uint</td>
<td>exposuretime,</td>
<td>exposure time in msecs, or secs if specified ([s])</td>
<td>dhe set obs.exptime 22.0 [s]</td>
</tr>
<tr>
<td>float&gt; [[s]]</td>
<td>exptime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>obs.numreads &lt;uint</td>
<td>imagestoread</td>
<td>number of images to read in the next sequence</td>
<td>dhe set obs.numreads 2</td>
</tr>
<tr>
<td>obs.autowrit &lt;on</td>
<td>write_to_disk,</td>
<td>writes the images to disk or not</td>
<td>dhe set autowrite off</td>
</tr>
<tr>
<td>off&gt;</td>
<td>autowrite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>obs.observer &lt;string&gt;</td>
<td>-</td>
<td>observer field (for image headers)</td>
<td>dhe set obs.observer Burrus</td>
</tr>
<tr>
<td>obs.obstype &lt;string&gt;</td>
<td>type</td>
<td>obstype field (for image headers).</td>
<td>dhe set obs.obstype</td>
</tr>
</tbody>
</table>
Only "dark" has real meaning (no shutter)  
dark

<table>
<thead>
<tr>
<th>obs.roi &lt;xstart&gt;&lt;ystart&gt;&lt;xlen&gt;&lt;ylen&gt;</th>
<th>Region Of Interest (subwindow). Coords. in unbinned units, from lower left corner</th>
<th>dhe set roi 513 513 1024 1024</th>
</tr>
</thead>
<tbody>
<tr>
<td>progress</td>
<td>returns the progress of the image/exposure. (READ ONLY)</td>
<td>dhe get progress</td>
</tr>
<tr>
<td>obs.autoobsid autoobsid</td>
<td>sets auto observation ID on/off</td>
<td>dhe set obs.obsid off</td>
</tr>
<tr>
<td>obs.obsidbase</td>
<td>sets the basename for the obs. ID</td>
<td>myObs</td>
</tr>
<tr>
<td>obs.obsidcounter</td>
<td>sets the initial value for the obsID counter</td>
<td>dhe set obs.obsidcounter 10</td>
</tr>
</tbody>
</table>

image parameters

<table>
<thead>
<tr>
<th>complete command</th>
<th>alternates &quot;short&quot;</th>
<th>description</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>image.title &lt;string&gt;</td>
<td>imagetitle</td>
<td>image title, to be the &quot;object&quot; field on the headers</td>
<td>dhe set title M51</td>
</tr>
<tr>
<td>image.comment &lt;string&gt;</td>
<td>imagecomment</td>
<td>image comment, to appear on the headers</td>
<td>dhe set imagecomment this is a test</td>
</tr>
<tr>
<td>image.directory &lt;abs path&gt;</td>
<td></td>
<td>directory where image will be stored</td>
<td>dhe set image.directory /home/i mages/</td>
</tr>
<tr>
<td>image.basename &lt;string&gt;</td>
<td></td>
<td>basename for image name</td>
<td>dhe set image.basename junk</td>
</tr>
<tr>
<td>image.rootname &lt;directory/basename&gt;</td>
<td>rootname</td>
<td>complete rootname, which is directory + basename</td>
<td>dhe set rootname /home/images/ junk</td>
</tr>
<tr>
<td>image.prefix &lt;string&gt;</td>
<td>imprefix</td>
<td>prefix for basename</td>
<td>dhe set imprefix red_</td>
</tr>
<tr>
<td>image.sufix &lt;string&gt;</td>
<td>imsufix</td>
<td>suffix for basename</td>
<td>dhe set imsufix _red</td>
</tr>
<tr>
<td>image.number &lt;uint&gt;</td>
<td>imagenumber, number</td>
<td>number for next image, or initial image if a sequence</td>
<td>dhe set imagenumber 22</td>
</tr>
<tr>
<td><strong>image.next</strong> &lt;on</td>
<td>off&gt;</td>
<td>multipleextensions, extensions</td>
<td>image will be single or MEF fits file</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>image.modifiers</strong> &lt;key1 val1 ... keyN valN&gt;</td>
<td>-</td>
<td>data sections of image, like prescan, overscan, etc</td>
<td>dhe set modifiers prescans 22 overscan 50</td>
</tr>
<tr>
<td><strong>image.autoexpid</strong> &lt;on</td>
<td>off&gt;</td>
<td>autoexpid</td>
<td>sets auto exposure ID</td>
</tr>
<tr>
<td><strong>image.expidbase</strong></td>
<td>sets the base of the expID (auto if undef)</td>
<td>dhe set image.expidbase myexpID</td>
<td></td>
</tr>
<tr>
<td><strong>image.expidcounter</strong></td>
<td>sets initial counter for the expID</td>
<td>dhe set image.expidcounter 1</td>
<td></td>
</tr>
</tbody>
</table>

### dhe parameters

<table>
<thead>
<tr>
<th><strong>complete command</strong></th>
<th><strong>alternate &quot;short&quot;</strong></th>
<th><strong>description</strong></th>
<th><strong>example</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>dhe.binning &lt;xbin&gt;&lt;ybin&gt;</td>
<td>-</td>
<td>binning in x and y (OPTICAL ONLY)</td>
<td>dhe set binning 2 3</td>
</tr>
<tr>
<td>dhe.autoshutter &lt;on</td>
<td>off&gt;</td>
<td>-</td>
<td>opens shutter automatically when exposure starts or not (ex, &quot;off&quot; for darks)</td>
</tr>
<tr>
<td>dhe.shutter &lt;open</td>
<td>close&gt;</td>
<td>-</td>
<td>opens or close the shutter manually</td>
</tr>
<tr>
<td>dhe. readmode &lt;string&gt;</td>
<td>-</td>
<td>readmode. The readmode must be supported by the hardware</td>
<td>dhe set readmode lower_left</td>
</tr>
<tr>
<td>dhe.timing</td>
<td>timinginfo</td>
<td>information on frame and pixel time (READ ONLY)</td>
<td>dhe get timinginfo</td>
</tr>
<tr>
<td>dhe.geometry</td>
<td>-</td>
<td>information on geometry - topology - (x and y size, etc) (READ ONLY)</td>
<td>dhe get geometry</td>
</tr>
<tr>
<td>dhe.config</td>
<td>controllerconfig</td>
<td>information on controller configuration (READ ONLY)</td>
<td>dhe get dhe.config</td>
</tr>
<tr>
<td>status</td>
<td>-</td>
<td>information on current status of the controller (READ ONLY)</td>
<td>dhe get status</td>
</tr>
</tbody>
</table>
### A.3.2 Observation control

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPOSE</td>
<td>starts the exposure sequence</td>
</tr>
<tr>
<td>ABORT</td>
<td>aborts all activity (current exposure/readout/sequence). Current image get lost</td>
</tr>
<tr>
<td>STOP [sequence</td>
<td>stops sequence but waits for current exposure/readout to finish (sequence)</td>
</tr>
<tr>
<td>or exposure]</td>
<td>or stops the current integration and reads out (exposure)</td>
</tr>
<tr>
<td>PAUSE</td>
<td>pauses exposure, closing the shutter and stopping the exposure count.</td>
</tr>
<tr>
<td>RESUME</td>
<td>resumes a paused exposure (OPTICAL ONLY)</td>
</tr>
<tr>
<td>RESET &lt;controller</td>
<td>resets controller or PCI card</td>
</tr>
</tbody>
</table>

### A.3.3 Fits commands

The “key add” and “key delete” commands are permanent, because they affect the actual file template.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>fits key add &lt;KEY&gt;</td>
<td>Adds (or edit if key already exists) the specified KEY to the specified value (and datatype) and comment</td>
<td>fits key add TEST FLOAT 2.0 // this is a test</td>
</tr>
<tr>
<td>&lt;datatype&gt; &lt;value&gt; //</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;comment&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fits key delete &lt;KEY&gt;</td>
<td>Deletes the specified KEY from the template</td>
<td>Fits key delete TEST</td>
</tr>
<tr>
<td>Fits key get preview [ext]</td>
<td>Shows how the headers will look like for the next image (keywords, values, comments and datatypes). If MEF fits, the extension can be specified (starting from 0)</td>
<td>Fits get preview</td>
</tr>
<tr>
<td>Fits key get all</td>
<td>Shows the actual template (the KEYS and sources, not the current values as the preview)</td>
<td>Fits key get all</td>
</tr>
<tr>
<td>Fits get hdrfile [-full]</td>
<td>Shows the header file template. If “-full” is specified shows the complete (absolute) path to the template</td>
<td>Fits get hdrfile -full</td>
</tr>
</tbody>
</table>
References

- panview documentation