SRT procedures Documentation

Release 1

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Contents

Welcome to the user cookbook!

These pages are intended to support the observer when performing observations with SRT. For a complete documentation on the user guide *Observing at SRT with Discos*, please click here.

A picture of the SRT control room layout is provided in Fig.4.1.

Before observing, check that the system is ready. Then select the **observation mode** you want, a menu will appear with the different receivers (**C-**, **K-** and **L-bands**) and the associated backends (**Total Power**, **SARDARA**, **Xarcos**, **DFB**, **Roach1**). You can simply follow the different steps in order to carry out safety observations.

CHAPTER 1

Before observing

1.1 Important checks

Some checks need to be performed before starting the observations.

Important: Before observing, check that the `emergency stop button` is not pressed.

1.1.1 On discos-manager (ACS)

Check that all of the **35 containers** are active on ACS (Fig.4.2).

Warning: If the number of containers is 0 instead of 35 in ACS, you have to start ACS (see the *Restart Discos* procedure in the Discos from Scratch section).

1.1.2 On discos-console (observer computer)

On the CONSOLE virtual desktop, check the presence of the 9 panels (Fig.4.10):

- **operatorInput** (Fig.4.11)
- **AntennaBoss** (Fig.4.12)
- **GenericBackend** (Fig.4.13)
- **Mount** (Fig.4.15)
- **Observatory** (Fig.4.17)
- **Receivers** (Fig.4.18)
- **Scheduler** (Fig.4.21)

- **MinorServo** (Fig.4.23)
- **ACS custom logging client** (Fig.4.8)

Check also that:

- the interface of the **Meteo client** is open to check the wind velocity in real time (it should be < 60 km/h) (Fig.4.9). If the interface is closed, type `$ meteoClient &` on a shell;
- the **quicklook** is open. If it is closed, open it by clicking on the

  quicklook.html icon on the desktop of discos-console;
- the **active surface** is green (Fig.4.4).

Warning: The active surface does not work properly if a large fraction (a whole sector) becomes red. It is a problem in K-band observations (Fig.4.42);

Warning: If the **calibrationtool client** is already open or if you need to open it later during your observation to perform pointing and/or focus optimization, remember, do not close it during the whole session. To open it, type `$ calibrationtoolclient MANAGEMENT/CalibrationTool &` on a shell.

Upload your shedules (.scd, .lis, .bck and .cfg files) and check them:

From your computer:

```
$ scp [schedulename.*] [projectID]@discos-console:./schedules/
```

On discos-console:

```
$ ssh -X [projectID]@discos-console
$ cd /home/[projectID]/schedules
$ scheduleChecker [schedulename.scd]
```

Warning: Check also the update and temporary modifications

CHAPTER 2

Observation modes

2.1 Continuum

2.1.1 C-band

Total Power

- start-obs
- check-obs
- get-data
- stop-session

SARDARA

- start-CoCSa
- check-obs
- get-data
- stop-session

2.1.2 K-band

Total Power

- start-CoKTP
- check-obs

- get-data
- stop-session

SARDARA

- start-CoKSa
- check-obs
- get-data
- stop-session

2.1.3 L-band

Total Power

- start-CoLTP
- check-obs
- get-data
- stop-session

SARDARA

- start-CoLSa
- check-obs
- get-data
- stop-session

2.2 Pulsar observations

2.2.1 C-band

DFB

- start-PuDFB
- check-obs
- get-data
- stop-PuDFB

2.2.2 L-band

DFB

- start-PuLDFB
- check-obs
- get-data
- stop-PuDFB

ROACH1

- start-PuLRO
- check-PuRO
- get-PuRO
- stop-PuRO

ROACH1

- bef-PuMRO
- start-PuMRO
- check-PuRO
- get-PuRO
- stop-PuMRO

ROACH1 + DFB

- start-PuLDR
- check-PuRO
- get-PuRD
- stop-PuRD

2.2.3 P-band

ROACH1

- start-PuPRO
- check-PuRO
- get-PuRO
- stop-PuRO

ROACH1

- bef-PuMPRO
- start-PuMPRO
- check-PuRO
- get-PuRO
- stop-PuMRO

2.2.4 LP-bands

ROACH1 + DFB

- start-PuLPDR
- check-PuRO
- get-PuRD
- stop-PuRD

ROACH1 P-band + DFB L-band

- bef-PuMPRO
- start-PuRD
- check-PuRO
- get-PuRD
- stop-PuRD

2.2.5 Notes

Notes about the ROACH1 backend

The ROACH1 has the capability to process 32 x 16 MHz bands = 512 MHz of bandwidth, therefore the entire L-band and P-bands. It is not adequate for observing in C-band or K-band unless one wants to observe a smaller portion of the total bandwidth. With the current setup of being linked to an 8-node CPU cluster (the "LEAP cluster"), it can only process 8 x 16 MHz bands = 128 MHz of bandwidth. It is therefore adequate for LEAP observations, which observe only a portion of the total L-band, or for the entire P-band. In the near future (later part of 2019), a second ROACH1 board (ROACH1_GPU) will be linked to the SARDARA GPU cluster and will be able to process the entire L-band (512 MHz).

We have two sets of instructions. The main set of instructions includes the use of the SEADAS sofware tool, which controls both the antenna and the backends, while the second set includes manual instructions (useful for using the ROACH1 in "piggy-back mode").

With regard to the manual instructions: in this configuration, where the ROACH1 is used in piggy-back mode, the ROACH1 is not "integrated" into the DISCOS antenna control system. DISCOS is used only to point at the sources, while with the use of the externalClient, the ROACH1 follows the antenna in an automated way. To tell DISCOS to track sources, the observer can use manual instructions or load a standard DISCOS schedule. To tell the ROACH1 to start/stop data acquisition, the observer can launch the automated system on the LEAP cluster which follows what the antenna is doing (start of data acquisition when the antenna is TRACKING and stop when the antenna is SLEWING).

In case of problems with the externalClient, the start and stop of data acquisition can also be done manually on the LEAP cluster.

For more information, contact D. Perrodin.

SEADAS

For instructions on how to create the schedules with SEADAS, please visit this page at the session "Pulsar Observations with the SRT".

We can find the complete documentation of SEADAS here.

2.3 Spectral lines

2.3.1 C-band

SARDARA

- start-SLCSa
- check-obs
- get-data
- stop-session

Xarcos

- start-SLCXa
- check-obs
- get-data
- stop-session-Xarcos

2.3.2 K-band

SARDARA

- start-SLKSa
- check-obs
- get-data
- stop-session

Xarcos

- start-SLKXa
- check-obs
- get-data

- stop-session-Xarcos

2.3.3 L-band

SARDARA

- start-SLLSa
- check-obs
- get-data
- stop-session

2.4 Spectro-polarimetry

2.4.1 C-band

SARDARA

- start-SPCSa
- check-obs
- get-data
- stop-session

2.4.2 K-band

SARDARA

- start-SPKSa
- check-obs
- get-data
- stop-session

2.4.3 L-band

SARDARA

- start-SPLSa
- check-obs
- get-data
- stop-session

2.5 VLBI

Follow the procedure here

Important: At the end of the session, please fill the LOG file.

CHAPTER 3

Troubleshooting

3.1 Problems during the observations

3.1.1 Problem identification

Depending on the problem, you can be able to resolve it. The first thing is to identify the origin of the error. Check the presence of error messages on the different monitor panels, the jlog, ACS and the ACU control panel.

MinorServo

Errors, warning and failure of the MinorServoBoss can be related to the crash of the server that manages the minor servos: MSCU. Check first if the server crashed and restart it if needed. Ask the project friend to complete the procedure from viewer01 (VLBI console). The instructions are on this link: https://srtsupervisoronduty.readthedocs.io/it/latest/sd/srt/procedures/minor_servo.html#mscu-restart.

After restarting the server it is necessary to restart the containers of the minor servos on the discos-manager computer.

Quicklook

If the Quicklook stop running correctly and is frozen to a previous session, you can restart it from a terminal with the user "observer":

```
$ su - discos service quicklook restart
```

Please, ask the project friend to complete the procedure with the password.

Monitor panels

Look at the 9 panels. The error messages usually come out in red.

Attention: operatorInput

Check that the command you have insterted is written correctly. If the error is not related to a typo, try to identify the origin of the problem. Check the different panels (Scheduler, MinorServo, Receivers, etc. . .) and the jlog.

Attention: Scheduler

srt-scheduler when the schedule is not running correctly. If the Scan/SubScan number is proceeding correctly, the FAILURE can be associated with skipped scans because of the too high or too low elevation of the source (> 85° or < 5°).

Solution: Stop the schedule with `> stopSchedule` and check the elevation of the target with CASTIA. Then start again the schedule with `> startSchedule=[projectID]/[schedulename].scd,[N]` when the target is visible.

Attention: Receivers

If the local oscillator (LO) value is set to 0 on the **Receivers** panel while you have inserted a correct value (in MHz) on the operatorInput, the LO container is probably down (check also the operatorInput and jlog errors). Contact the person in charge of the observations (observer's friend) to resolve the problem.

Jlog

Attention: LoggingClient

Error messages on the LoggingClient appear in red while warning are in yellow. If the **Subscan skipped** message appears, the scheduler is skipping subscans because of a too high or low elevation of the target (see previous section).

ACU control panel

If one or different boxes appear in yellow (warning) or red (error), put the mouse on the box and read the associated message.

Attention: Servo DC warning

If the **wa_Servo_DC_Warn** label appears on the yellow warning box, the observations must be **immediately** interrupted. Give the following commands to stow the antenna:

```
> antennaPark
> servoPark
> asPark
```

Communicate the problem to the person in charge of the observations, as indicated by your project friend.

Attention: Servo system and axis errors

After the stow of the antenna, errors related to the main servo system or to the azimuth/elevation axes may occur.

To solve the problem, give the following commands in the operatorInput console:

```
> antennaReset
```

```
> antennaTrack
```

Wait 10 seconds. If the errors disappear, you can proceed to the observations by setting first the minor servo setup `> servoSetup[code]`, with `[code=LLP,PPP,CCB,KKG]`.

Instead, if the errors remain, give again the previous commands:

```
> antennaReset
```

```
> antennaTrack
```

Wait 10 seconds. If the errors disappear, you can proceed to the observations. Please, set first the minor servo setup as indicated before.

If the errors persist:

- push the **emergency stop button**
- release the **emergency stop button**

```
> antennaReset
```

```
> antennaTrack
```

At this point, the problem should be resolved. You can proceed with the observations. Please, set first the minor servo setup as indicated before.

If the problem persits, please contact the person in charge of the observations (observer's friend).

Attention: Power errors

In the case of **err_Power_Error** label, look at the jlog window. The **MAIN POWER ERROR** message should appear, being assigned a CRITICAL priority. To resolve the problem, give the following commands in the operatorInput console:

```
> antennaReset
```

```
> antennaTrack
```

If the error message is different or the problem still unresolved, contact the person in charge of the observations (observer's friend).

Wind velocity

Attention: MeteoClient

Check regularly the wind velocity using the `$> meteoClient &` on a shell of nuraghe-mng. For observations in K-band, the wind speed should not exceed 30 km/h (value to be checked) otherwise the pointing accuracy will probably be lost.

Attention: Unstow of the antenna

The antenna is automatically stowed when the wind speed exceeds 60km/h. If you want to continue the observations without redoing the setup from the beginning (receiver, bandwidth, attenuations, etc...), you can simply unstow the antenna and start again the observations where you left off, following the sequence of commands:

> `antennaUnstow`

> `antennaTrack`

> `startSchedule=[schedulename].scd,[N]` where you were previously.

Stow of the antenna

Attention: Put the antenna in stow with the green button

In the case the control software has some problems or is disable and you cannot communicate anymore with the antenna, you can use the `green button` to park the antenna. The green button is located close to the red emergency stop button in the control-room.

When the antenna is parked, look at the ACU monitor, wait until **Axis blocked** appears in red (Fig.4.37). Only at this moment, you can press on the `emergency stop button` (Fig.4.38).

3.1.2 Unresolved problems

If you do not find the origin of the problem or the problem is too complex to be resolved, please contact the person in charge of the observations (observer's friend).

3.2 Discos from Scratch

Discos is the control software produced for the Sardinia Radio Telescope, Medicina and Noto. It is a distributed system based on ACS (ALMA Common Software), commanding all the devices of the telescope and allowing the user to perform single-dish observations.

If the system has some problems that cannot be resolved with the help of the previous section, you probably need to restart Discos.

Before restarting Discos, you have to follow the procedure of shutdown of Discos.

3.2.1 Shutdown of Discos

From the **discos-console computer**, close discos :

```
discosConsole -c
```

Close also all the graphic panels, including those related to the **active surface**, the **meteo client** and the **calibration tool client**.

From the **discos-manager computer**, go on the ACS command center and click on `kill`. Wait the prompt (the graphic panel of ACS will close automatically).

3.2.2 Restart Discos

1. On the **discos-manager computer**, open a terminal and give the following command:

   ```
   discos -start
   ```

   The graphical interface of the ACS Command Center appears (Fig.4.3).

   Check that `remote` and `use native ssh` are correctly selected in the **Common settings** panel.

   Click on `Start` in the **Acs suite** panel.

   In the **Containers** panel, click on the global green triangle located below the individual triangles to open all of the containers.

   On the **Deployment Info** panel, check that the 35 containers appear progressively.

2. On the **discos-console computer**, open a terminal and give the following command:

   ```
   discosConsole
   ```

   The 9 panels appear:

   - **operatorInput** (Fig.4.11)
   - **AntennaBoss** (Fig.4.12)
   - **GenericBackend** (Fig.4.13)
   - **Mount** (Fig.4.15)
   - **Observatory** (Fig.4.17)
   - **Receivers** (Fig.4.18)
   - **Scheduler** (Fig.4.21)
   - **MinorServo** (Fig.4.23)
   - **ACS custom logging client** (Fig.4.8)

   From a virtual desktop, open a new terminal to start the **active surface** and write:

   ```
   SRTActiveSurfaceGUIClient &
   ```

   The related graphical interface is now open. Wait a few minutes until the single squares (representing the attuators) become green. The status of the active surface is in the "WARNING" configuration (Fig.4.7).

   From a virtual desktop, open two new terminals to start the panels related to the **Meteo Client** and the **Calibration Tool Client** (if necessary) and write, rispectively:

   ```
   meteoClient &
   ```

   ```
   calibrationtoolclient MANAGEMENT/CalibrationTool &
   ```

   The graphical interfaces related to the meteo Client (Fig.4.9) and the calibration Tool Client (Fig.4.27) are now open and updated in real time.

CHAPTER 4

Indices and figures

4.1 Figures

4.1.1 Check figures

Control Room

ACS Command Center

ACS Command Center

Active Surface

Active Surface

Active Surface

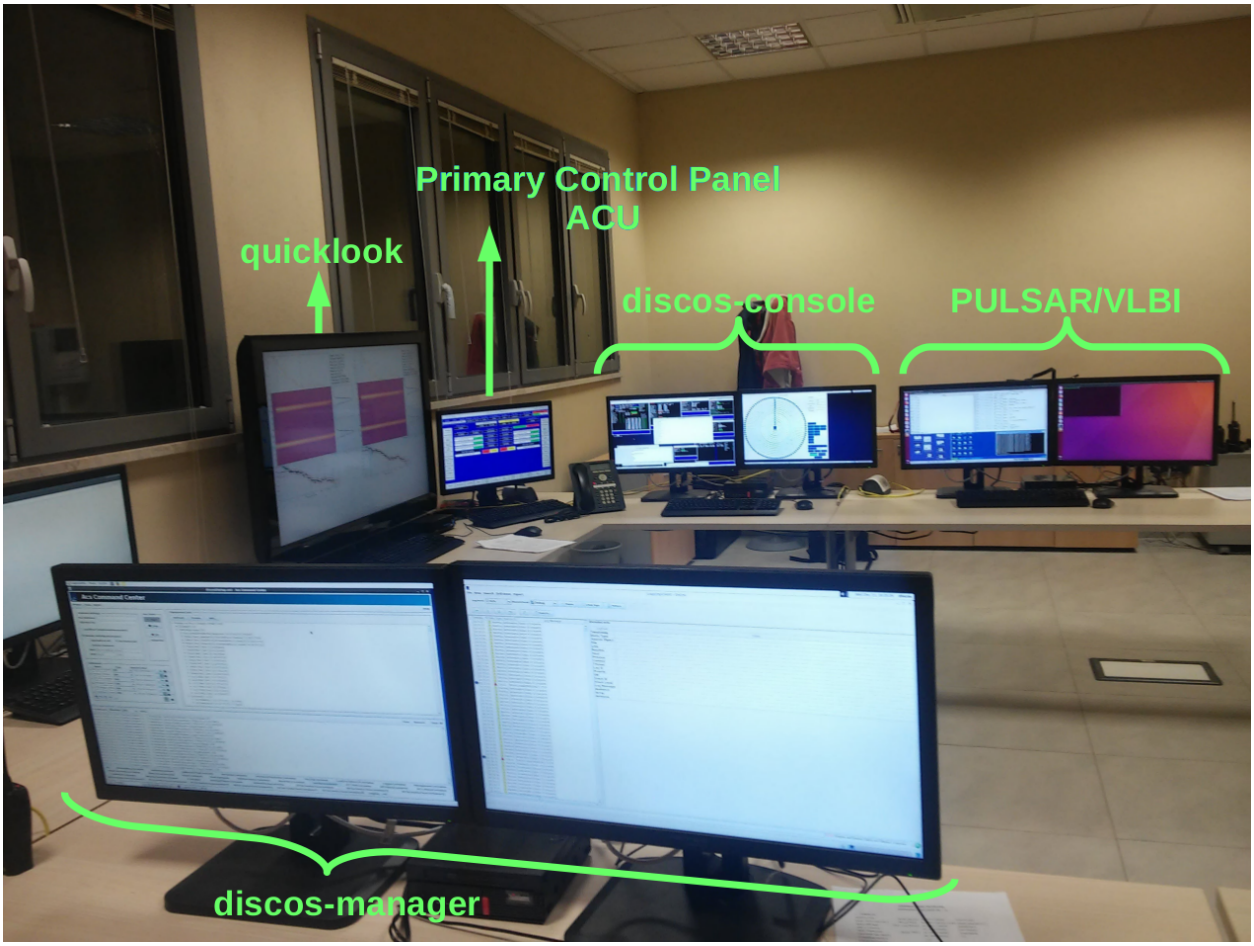

Fig.4.1: SRT control room layout.

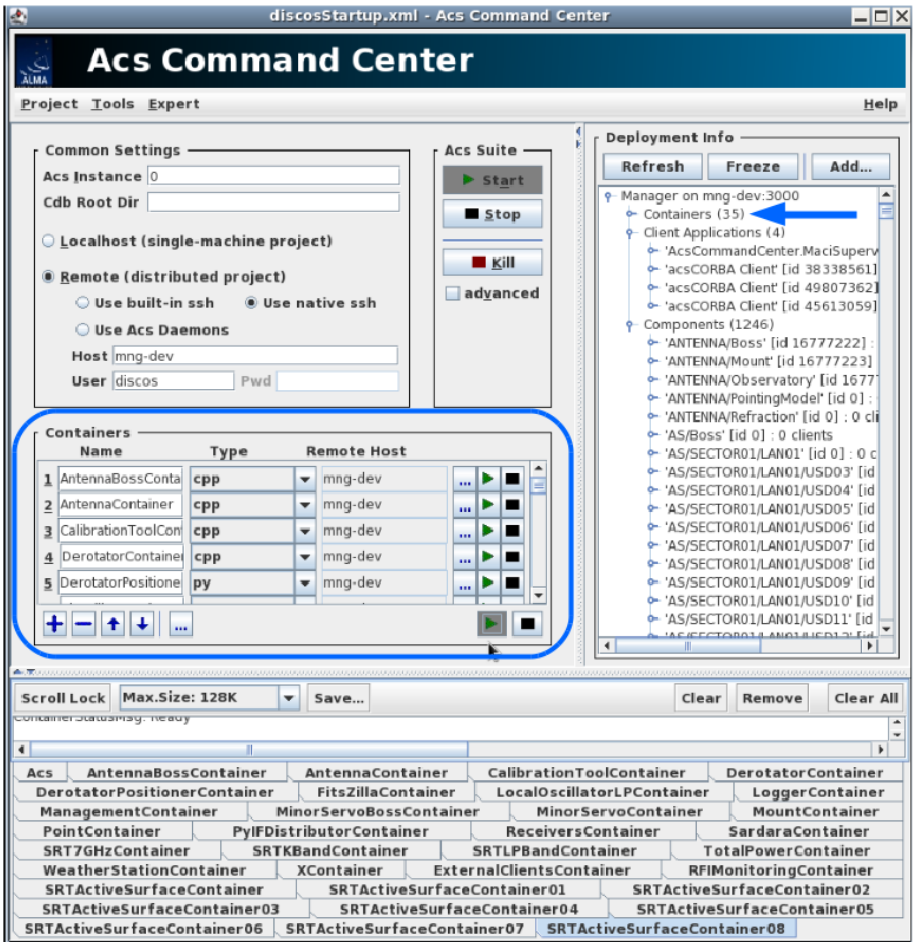

Fig.4.2: The **ACS** monitor shows the state of the containers related to each DISCOS component. The state of each container can be verified in the section highlighted in blue. The blue arrow indicates the number of containers (35 when the system is ready).

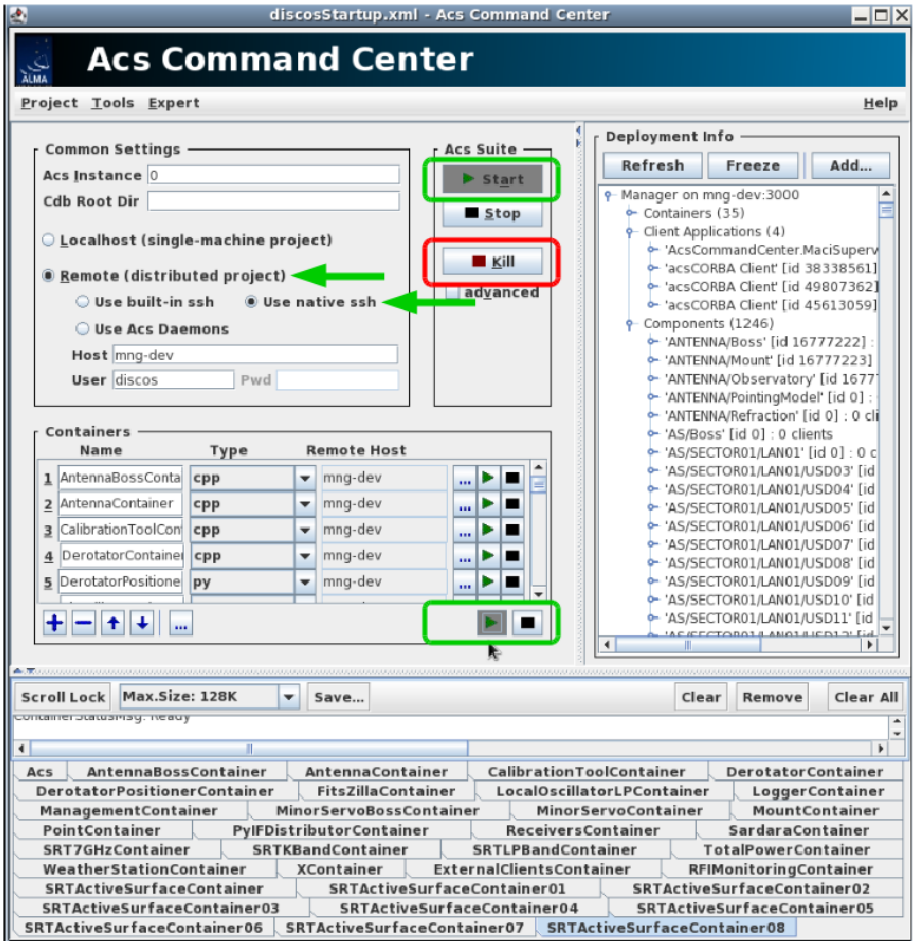

Fig.4.3: In the **Common settings** panel of the ACS monitor, the `remote` and the `use native ssh` items must be selected as indicated by the green arrows. The `Start` and the `global green triangle` buttons highlighted in green must be used to restart the **Acs suite** and the **Containers**, respectively. The `Kill` button highlighted in red must be used to close the ACS panel during the Shutdown of Discos.

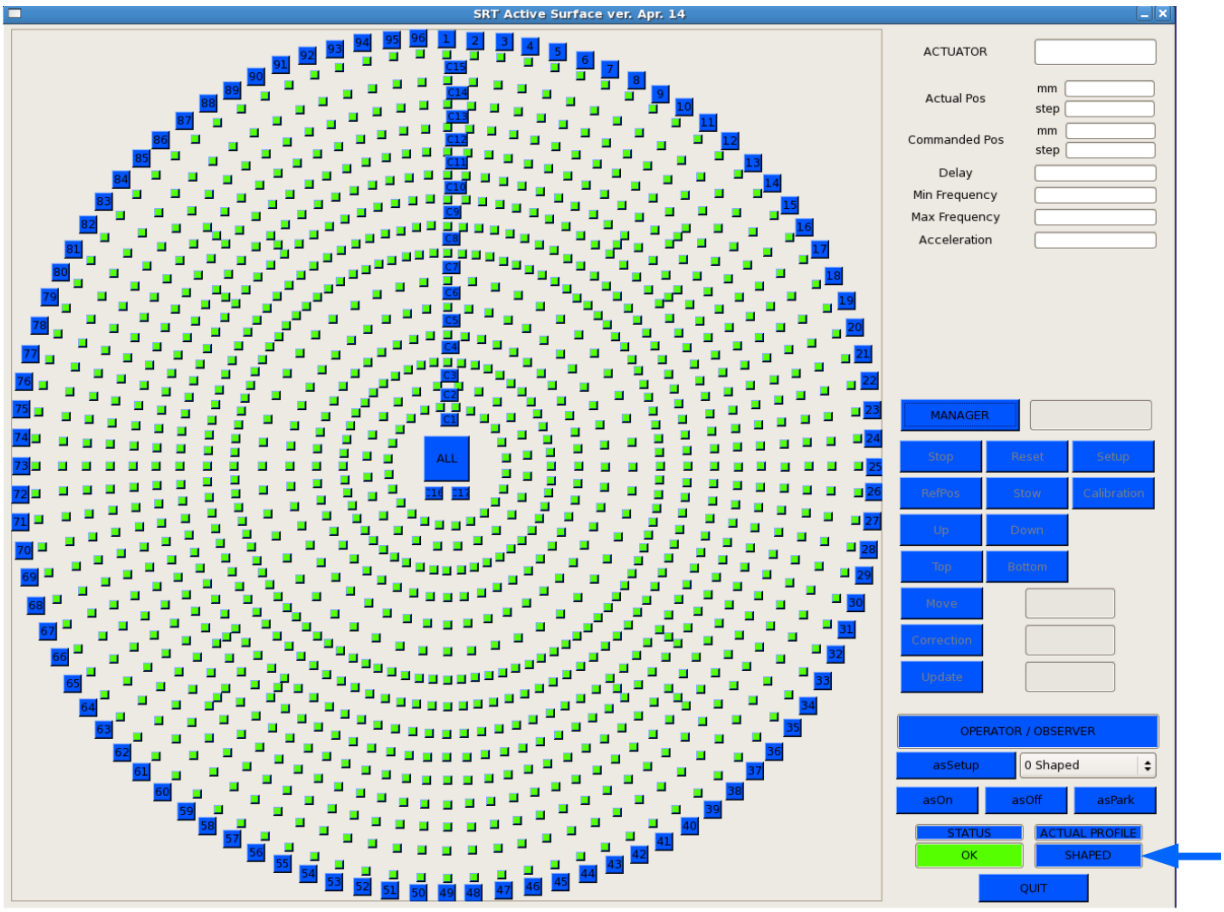

Fig.4.4: This monitor shows the status of the actuators in a graphical representation of the **Active Surface** and its configuration.

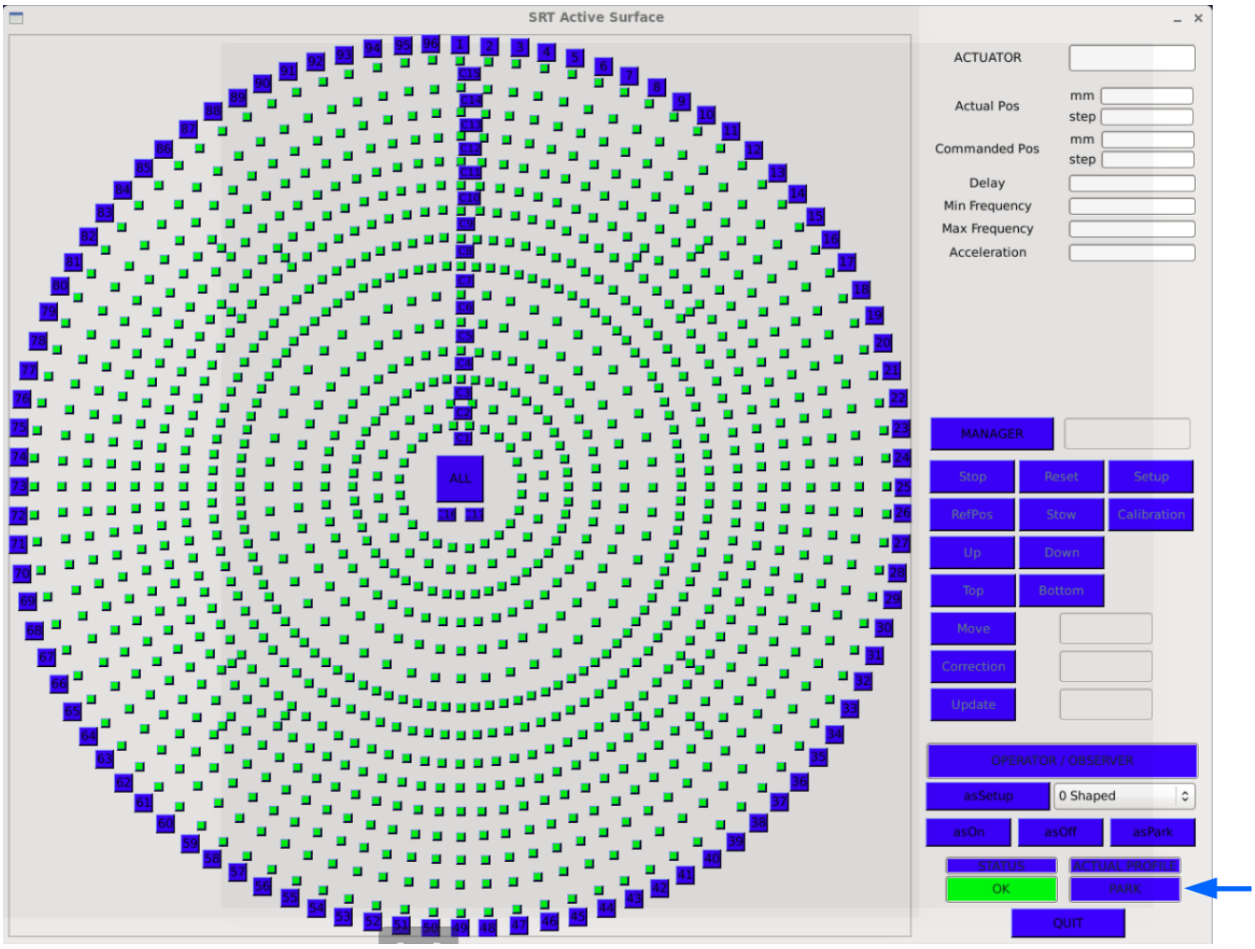

Fig.4.5: After parking the active surface by using `> asPark`, in the **Active Surface** monitor the status of the `Actual Profile` box is `Park`.

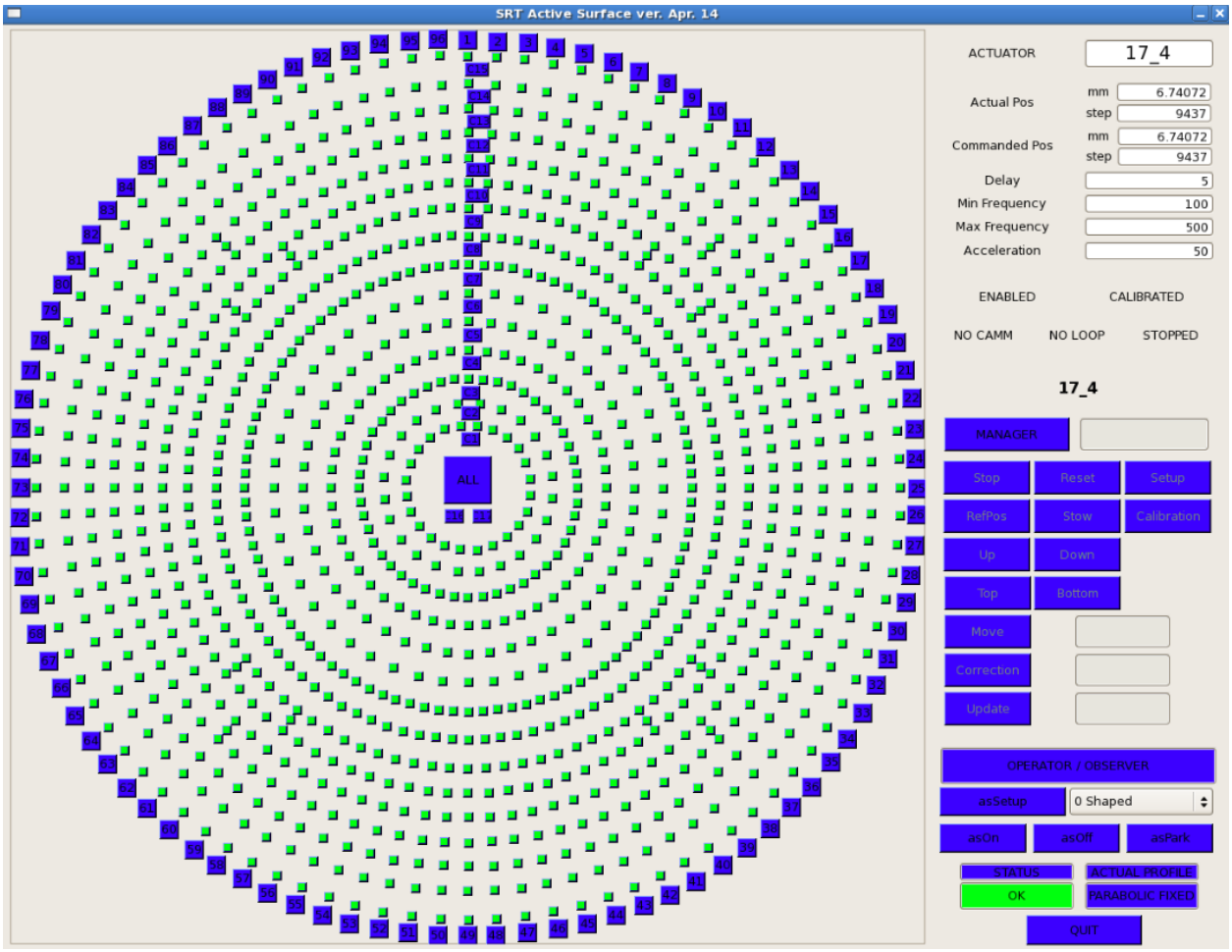

Fig.4.6: The **Active Surface** monitor in the parabolic configuration.

Active Surface

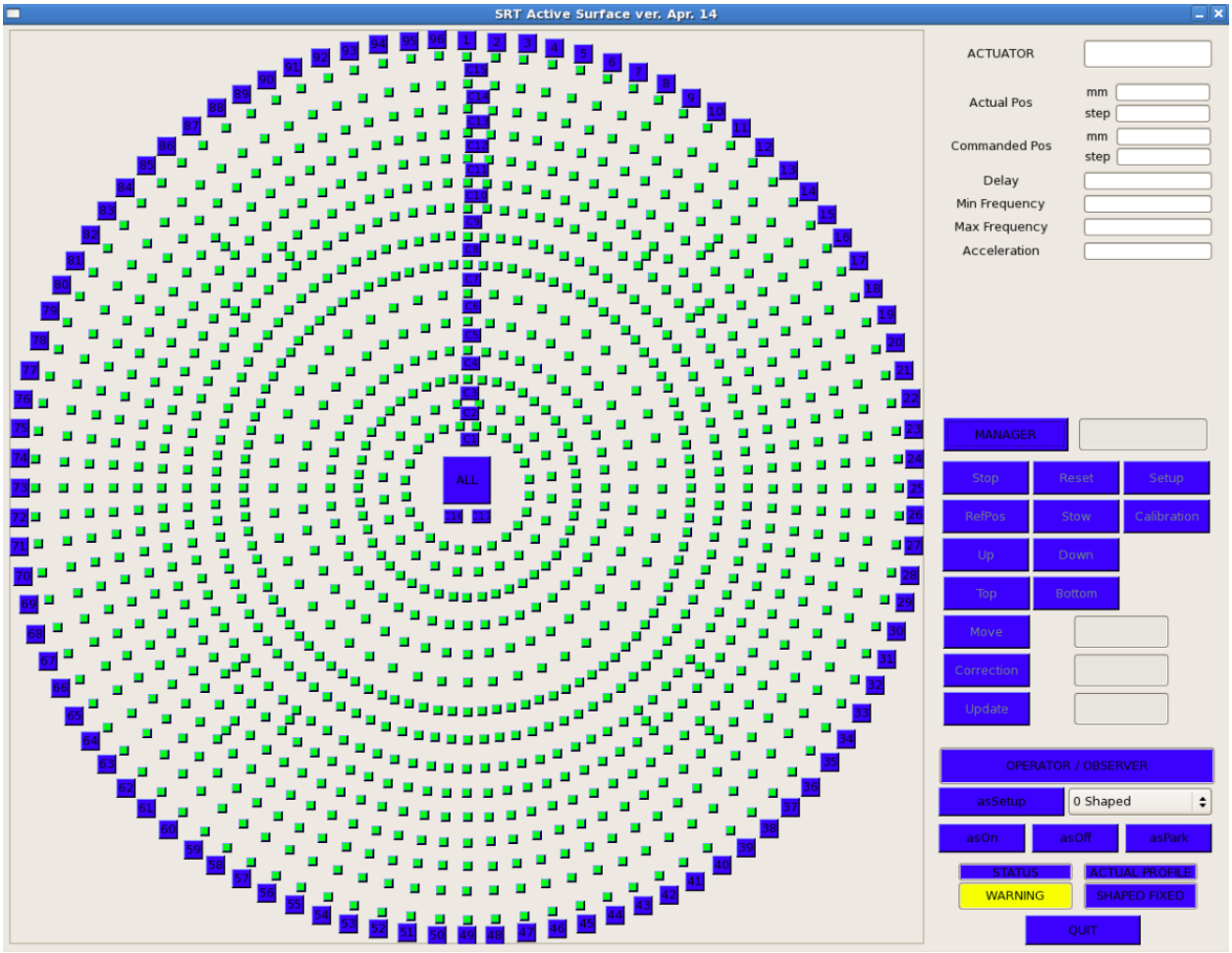

Fig.4.7: The status of the **active surface** is `WARNING` after the "Restart Discos" procedure.

Logging Display

Meteo Client

Discos-console

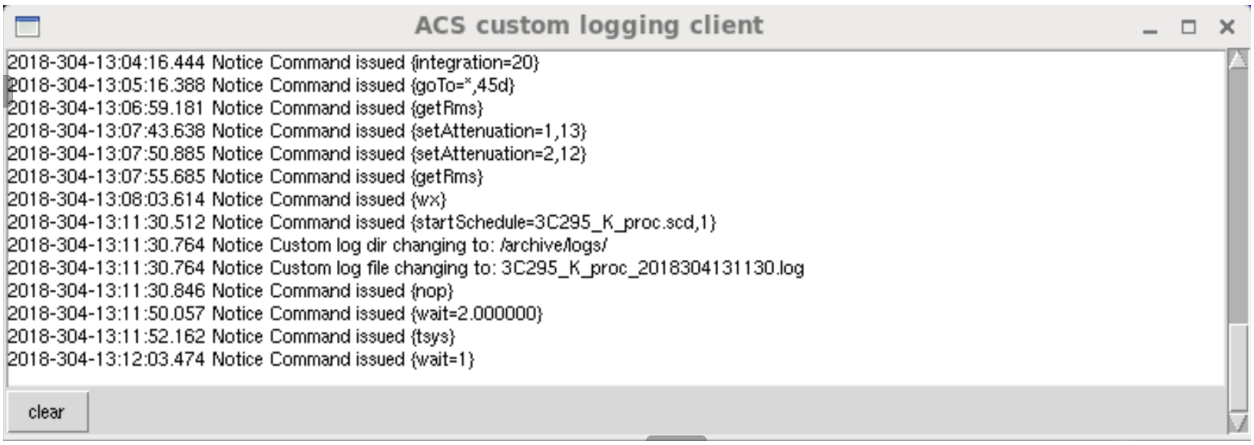

Fig.4.8: The **Logging Display** shows the log messages related to the observation. New messages are shown over the previous ones.

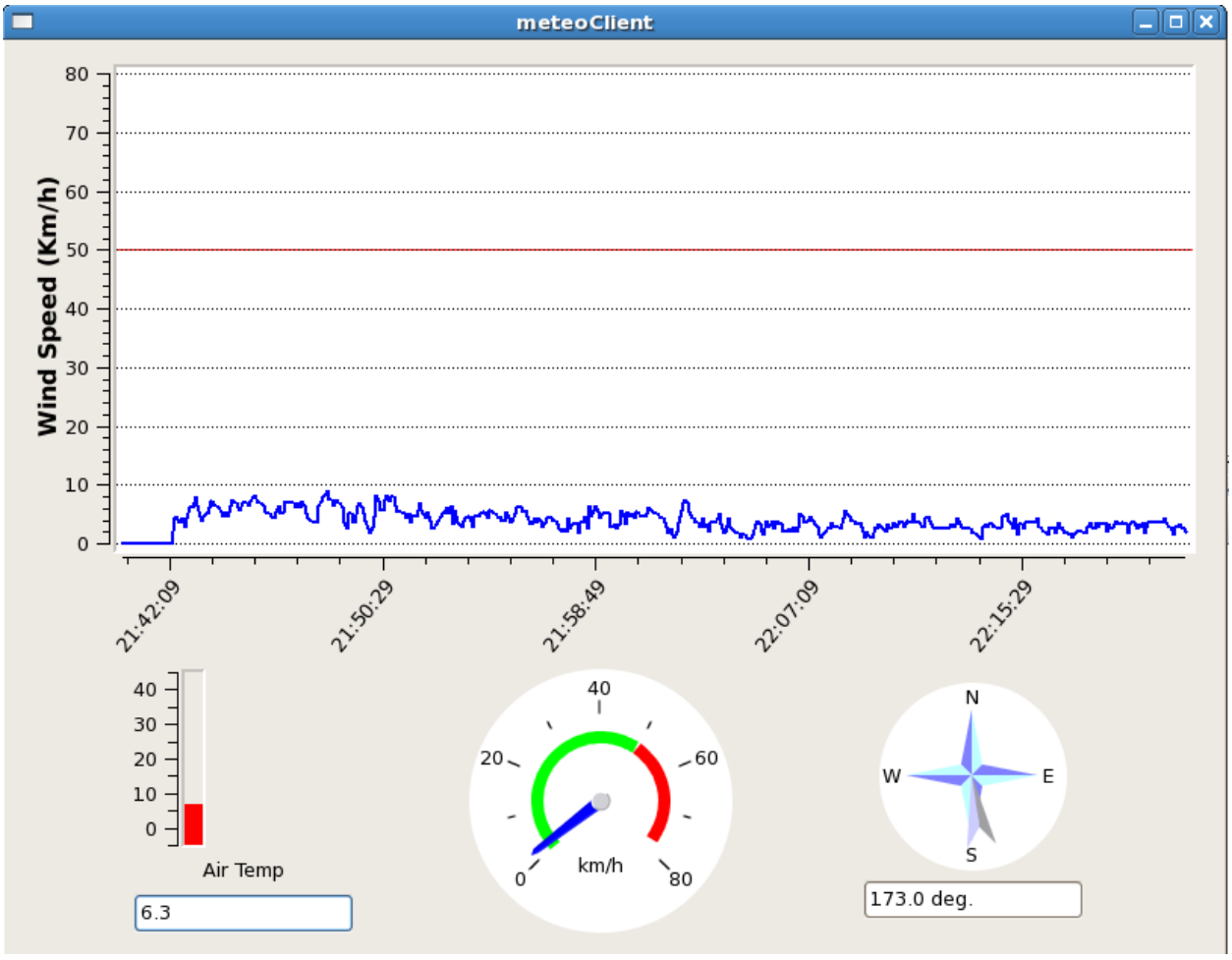

Fig.4.9: The **Meteo Client** window shows the atmospheric temperature and wind parameters (including wind direction) using a graphic interface.

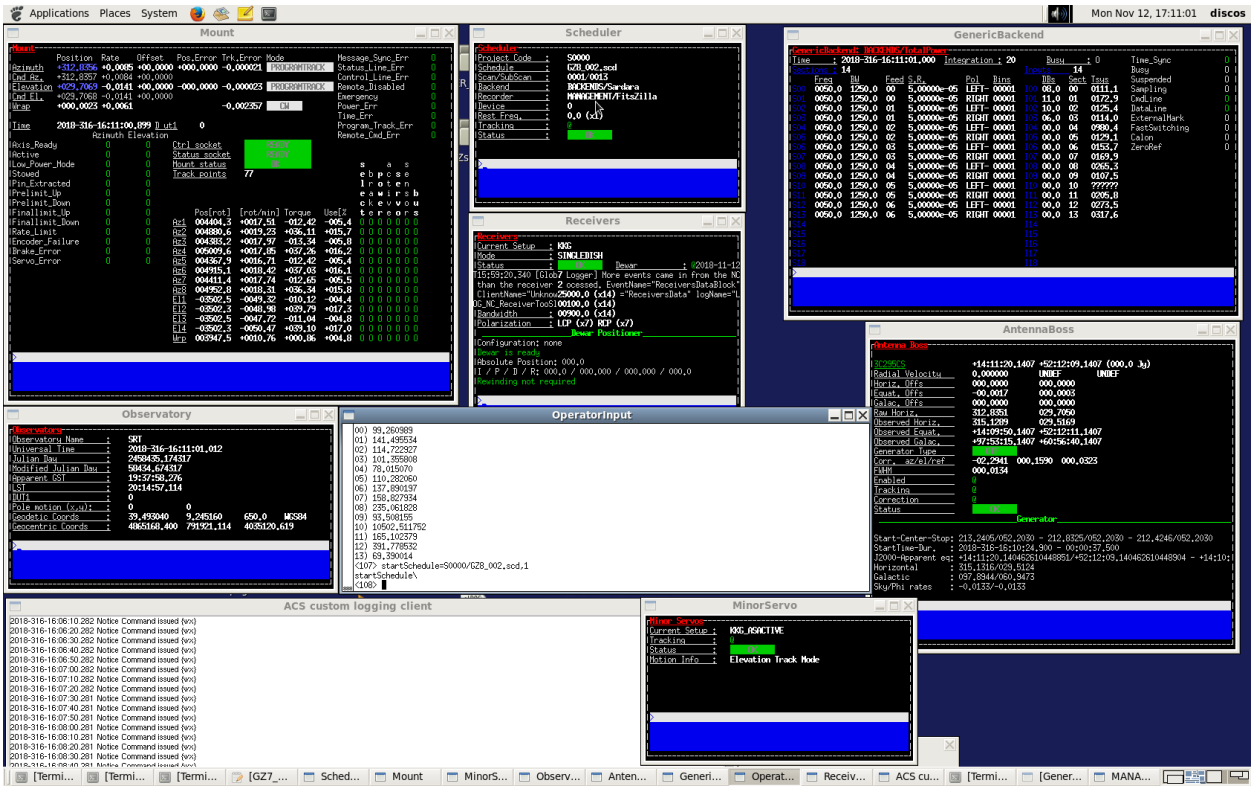

Fig.4.10: **Discos-console** is the machine where you run the system and where you should find the input terminal and all the monitors. It is also the destination for your schedules.

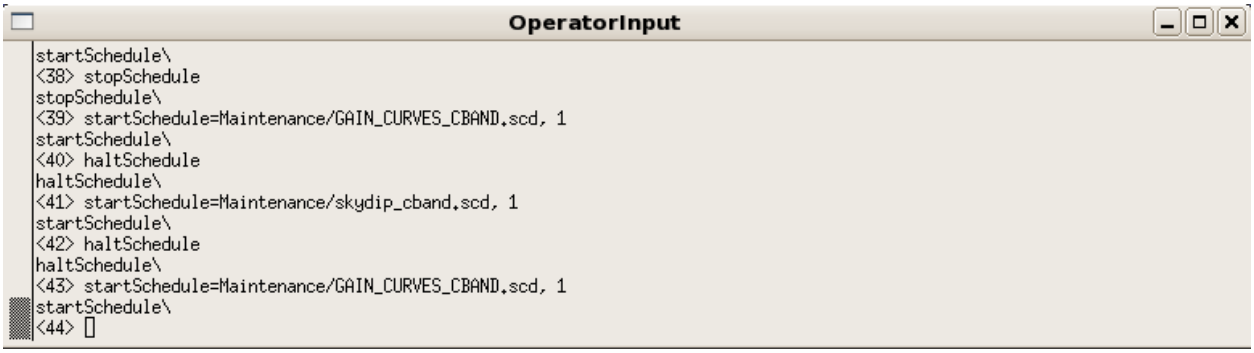

Fig.4.11: In the **input console** the users can write Nuraghe commands. The prompt is just a sequential number enclosed in <>. If a command is properly read, the system replies by repeating the command itself, followed by the operation results (if they are foreseen).

OperatorInput

AntennaBoss

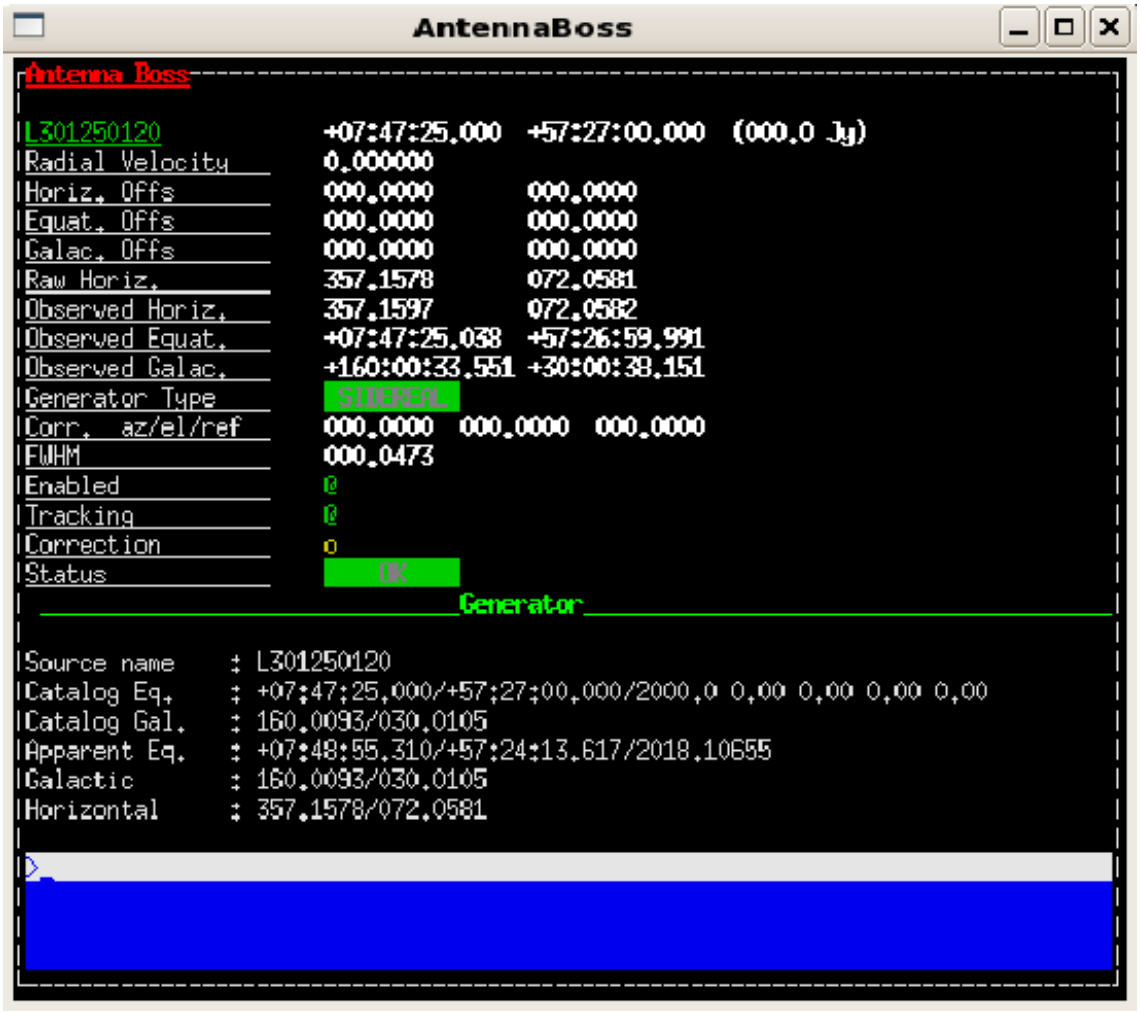

Fig.4.12: The **AntennaBoss** monitor shows the target info, indicating the commanded and actual positions pointed by the antenna. It also gives a feedback on the pointing accuracy and on the overall antenna status.

GenericBackend

Mount

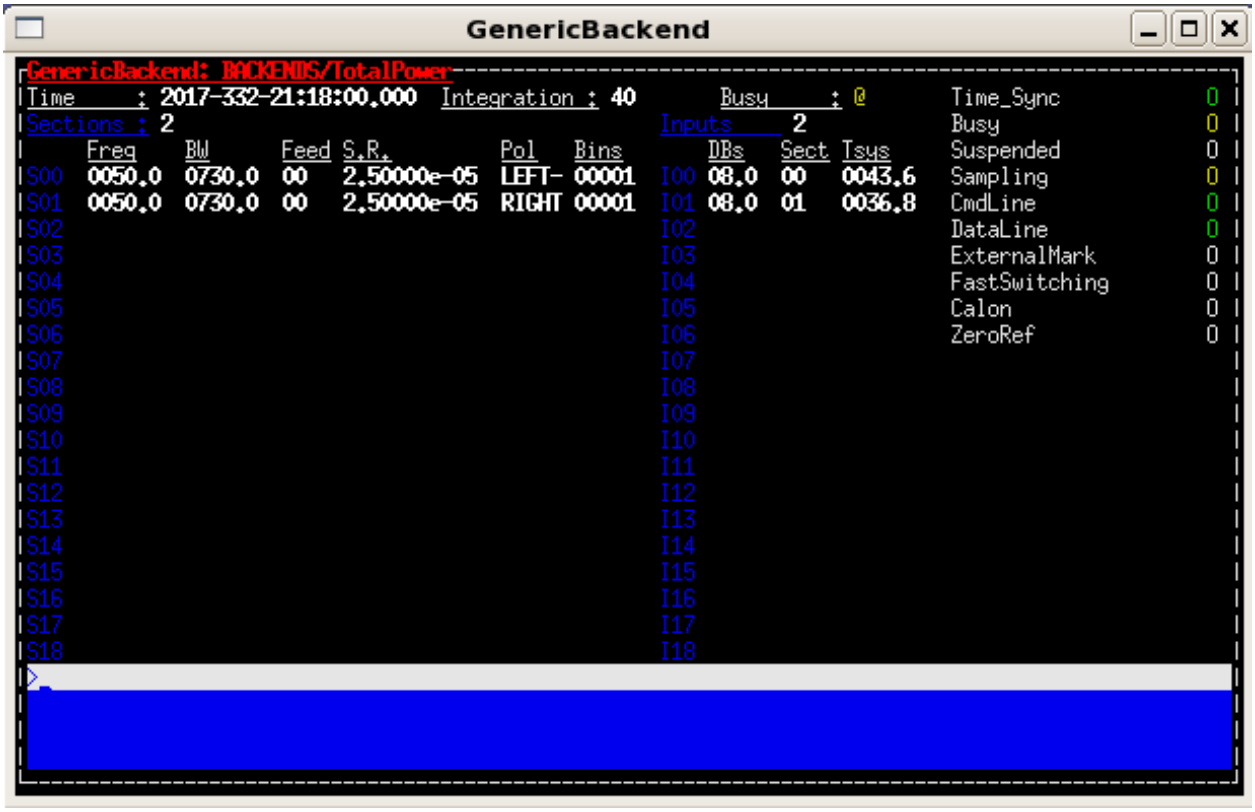

Fig.4.13: The monitor **GenericBackend** shows the backend setup parameters related to each section.

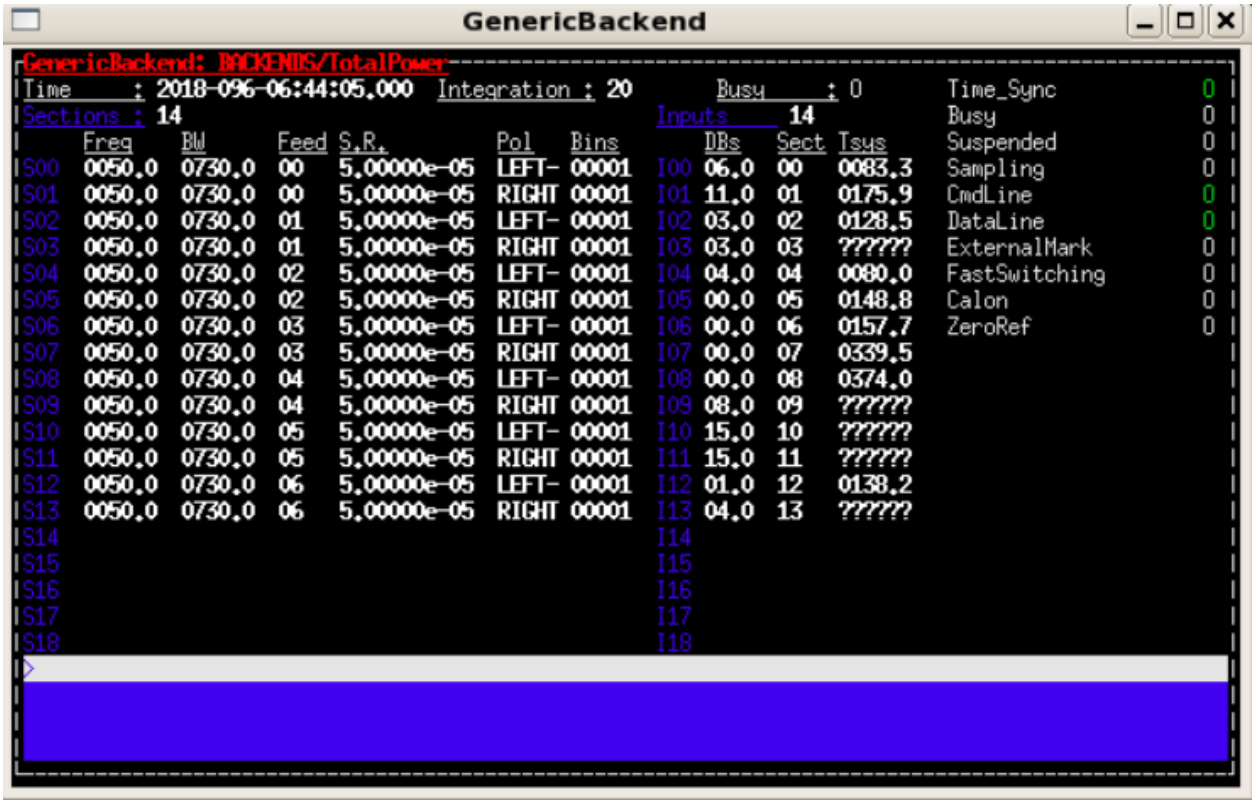

Fig.4.14: The monitor **GenericBackend** in the K-band configuration.

Observatory

ReceiversBoss

Scheduler

MinorServo

Calibration tool client

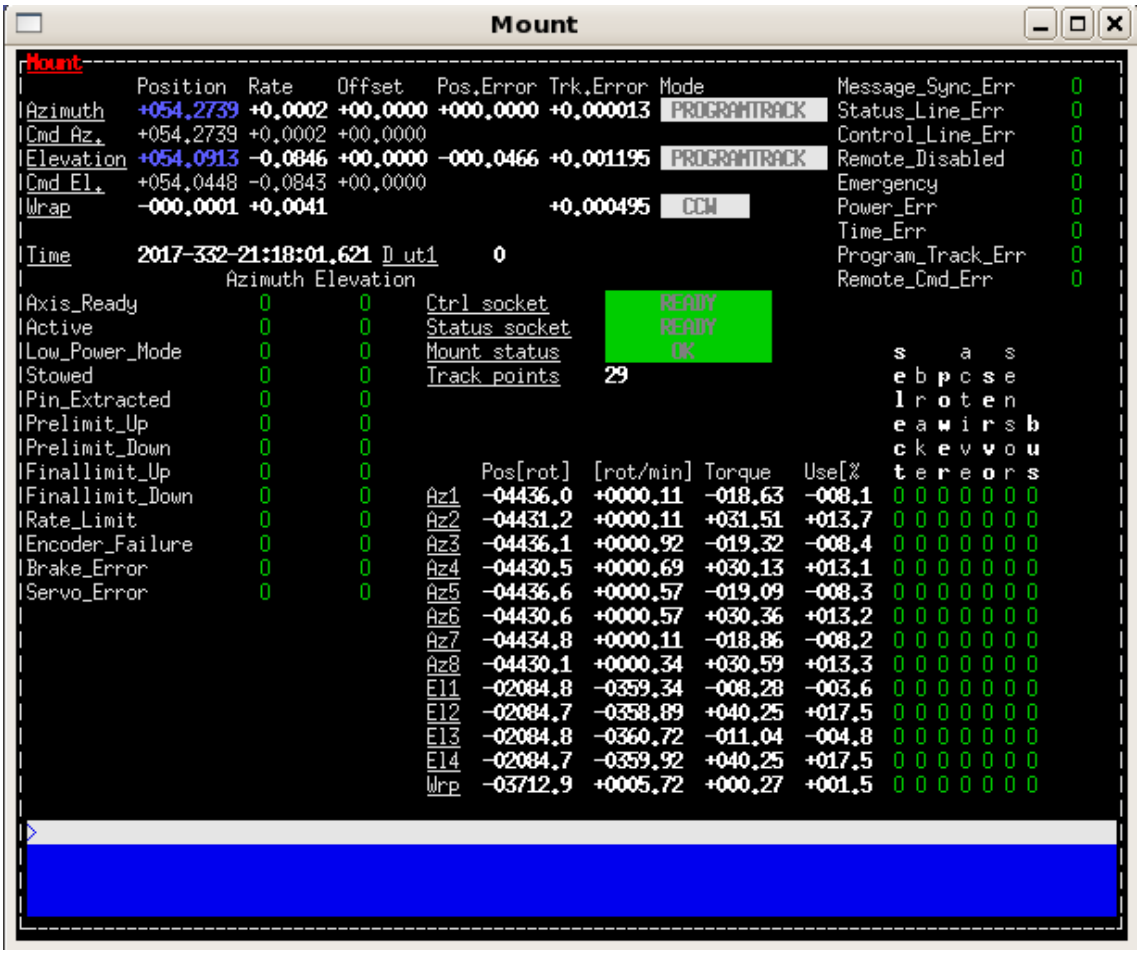

Fig.4.15: Observers need to focus only on the **Mount** status (indicated by the green box) and on the actual position of the axis expressed in Azimuth and Elevation (shown in blue), compared to the commanded positions (actual positions with the label "Cmd Az." and "Cmd El.").

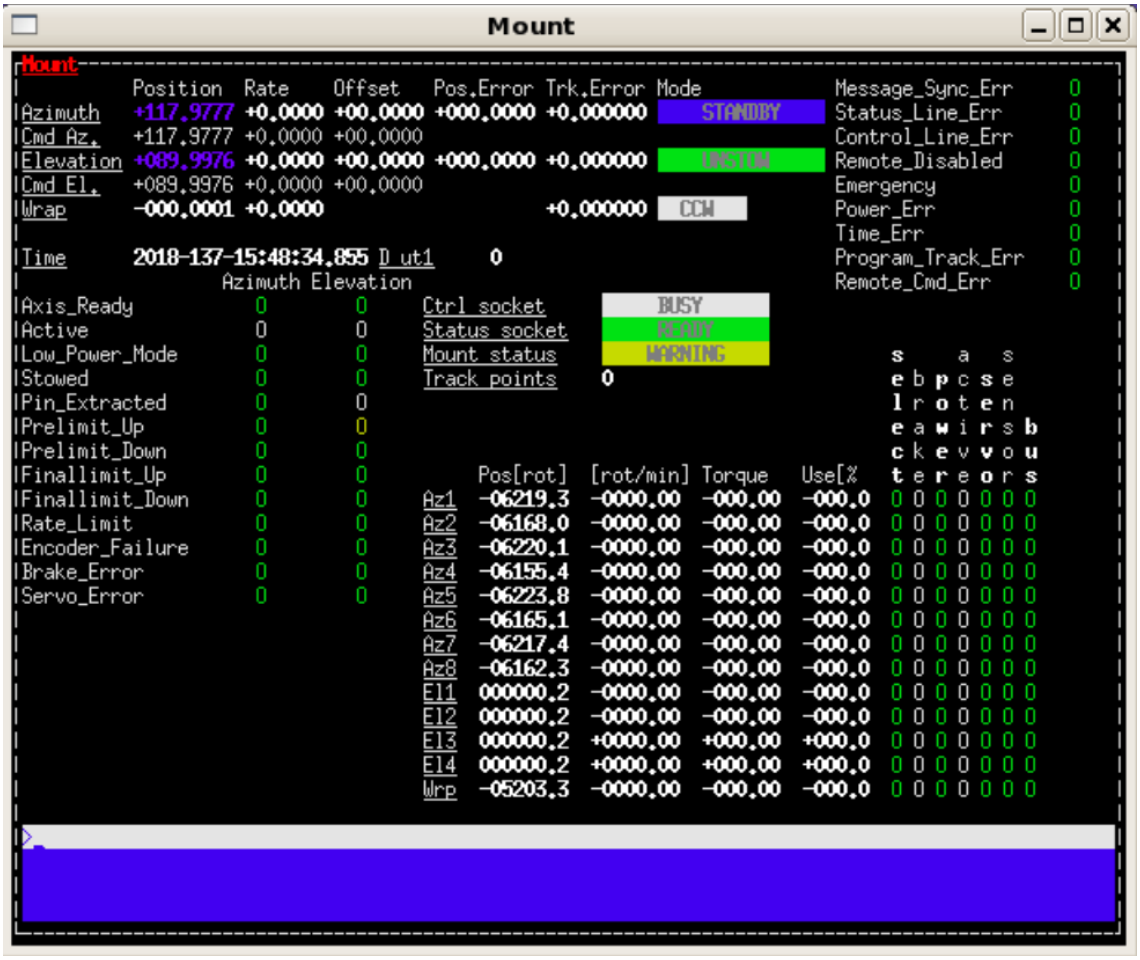

Fig.4.16: The **Mount** monitor after the park of the antenna by using > `antennaPark`

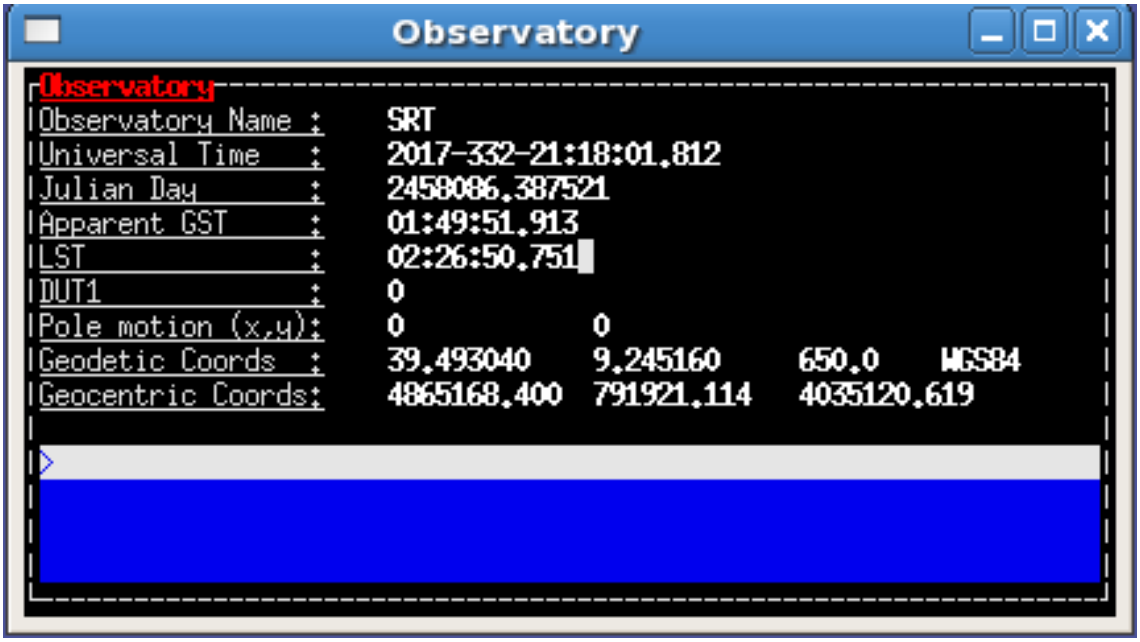

Fig.4.17: The **Observatory** monitor shows the station time and coordinates.

GenericBackendX

Primary Control Panel ACU

SEADAS

4.1.2 Error messages

Primary Control Panel ACU

At the end of your observations, do not press the emergency stop button when the **Stow Pin Motion** is yellow as below.

Wait until **Axis blocked** appears in red before pressing the emergency stop, as in the following figure:

When the emergency stop button is pressed, different messages are in red, as indicated in the following figure:

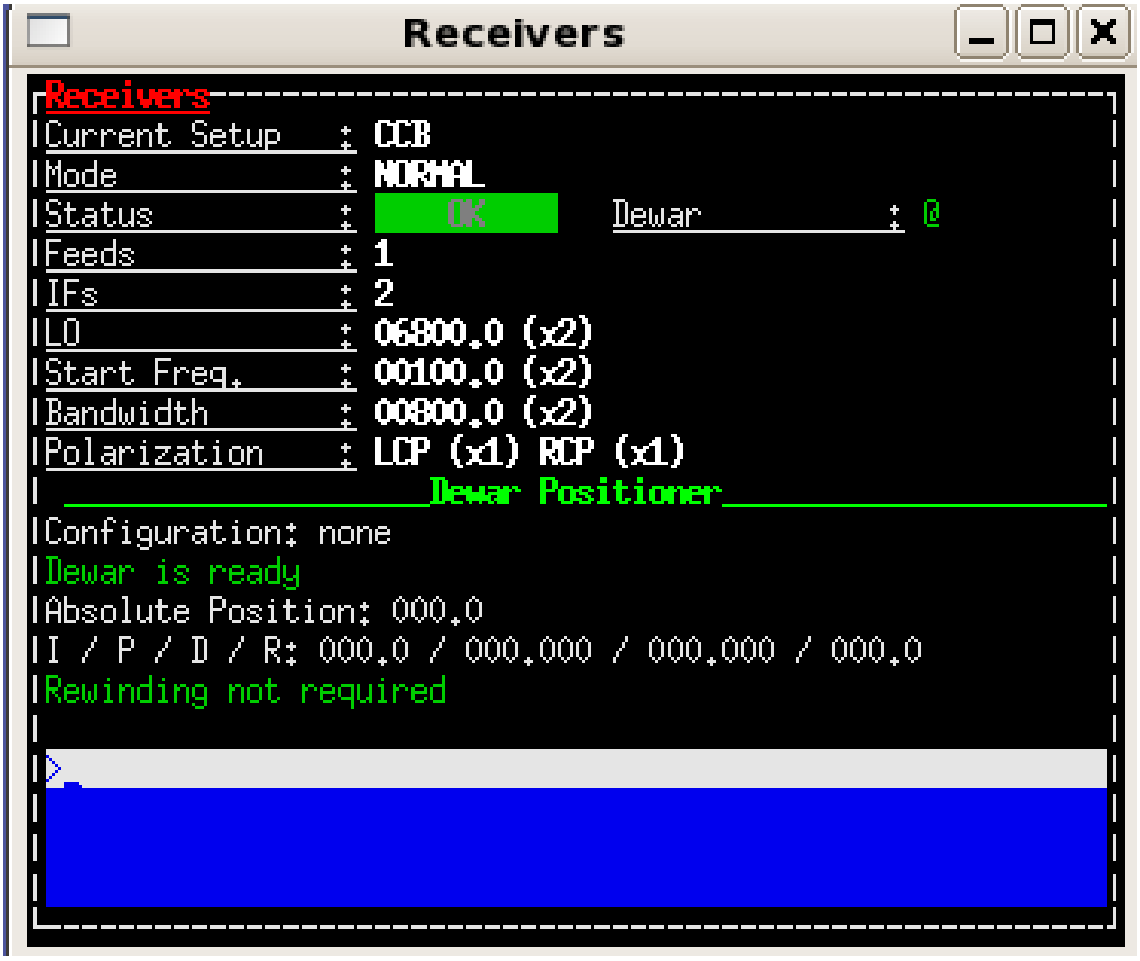

Fig.4.18: The **ReceiverBoss** monitor summarizes the frontend setup parameters. The bottom part is devoted to the derotator (dewar positioner), when available.

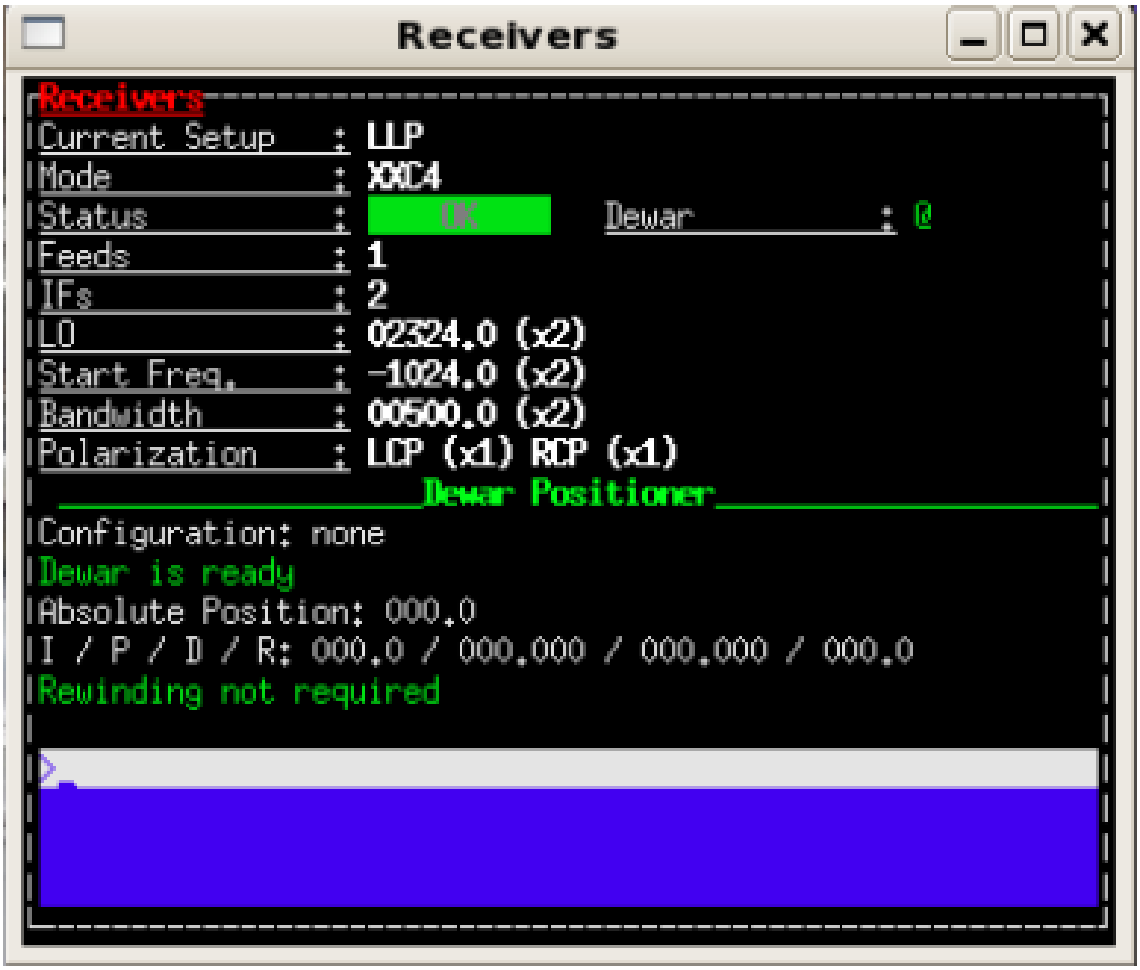

Fig.4.19: The **ReceiverBoss** monitor in the L-band configuration.

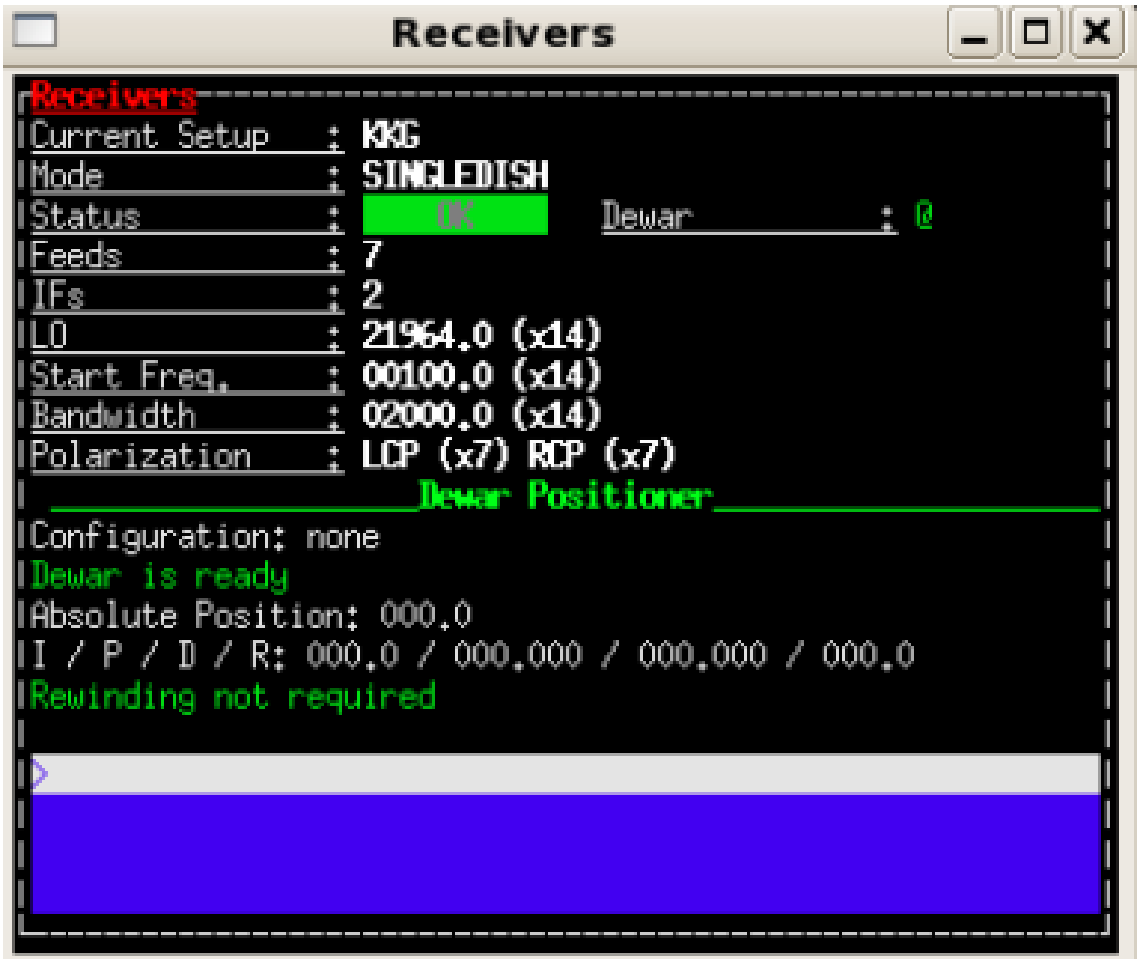

Fig.4.20: The **ReceiverBoss** monitor in the K-band configuration.

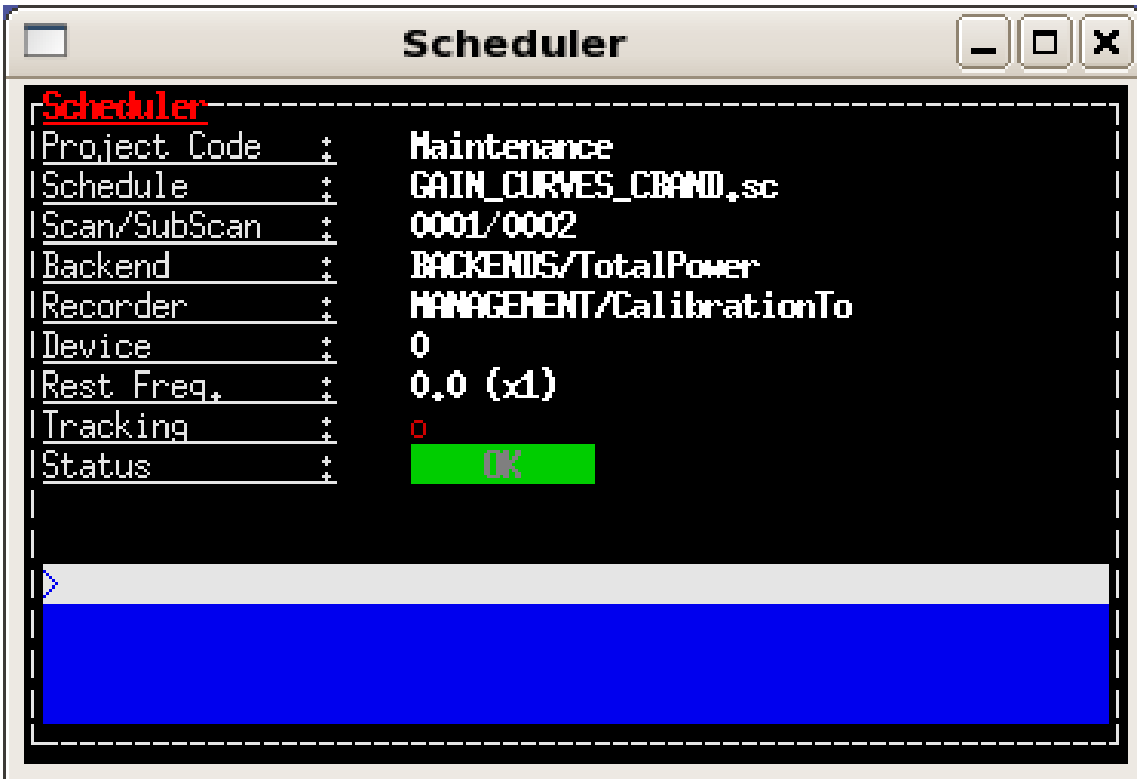

Fig.4.21: The **Scheduler** monitor shows the details on the selected data acquisition devices and on the running schedule, if any.

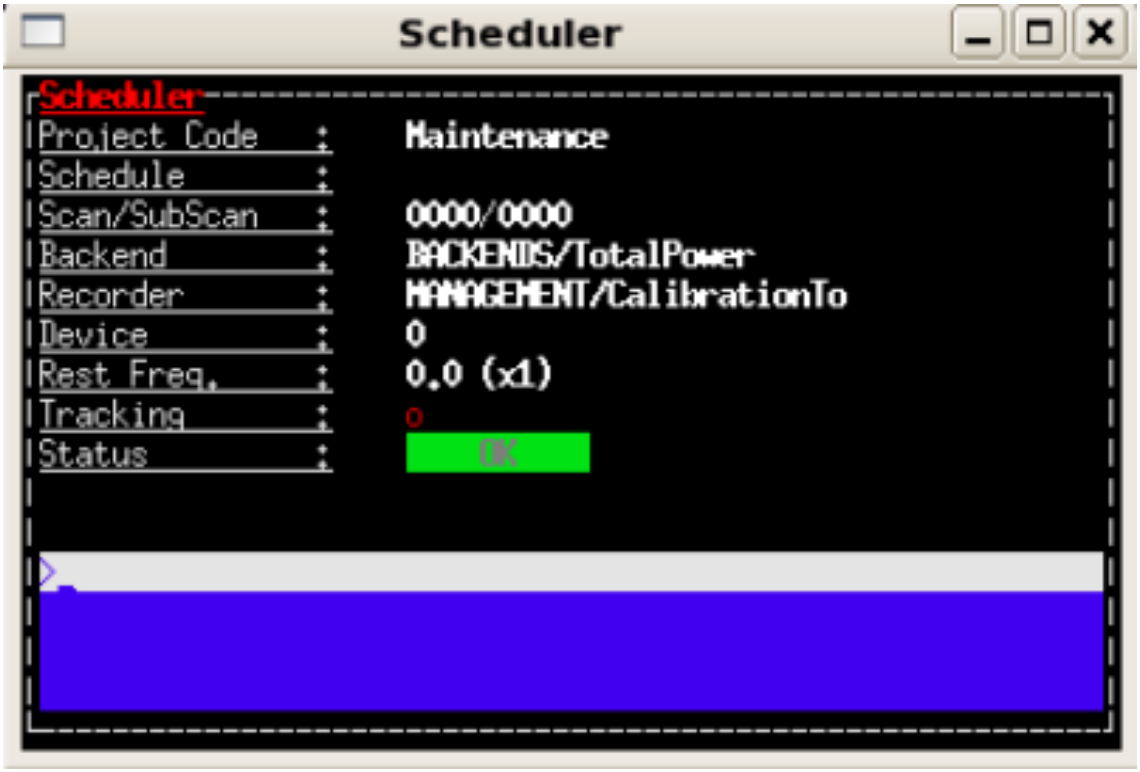

Fig.4.22: The **Scheduler** monitor after the interruption of the current subscan by using `> stopSchedule` or `> haltSchedule`

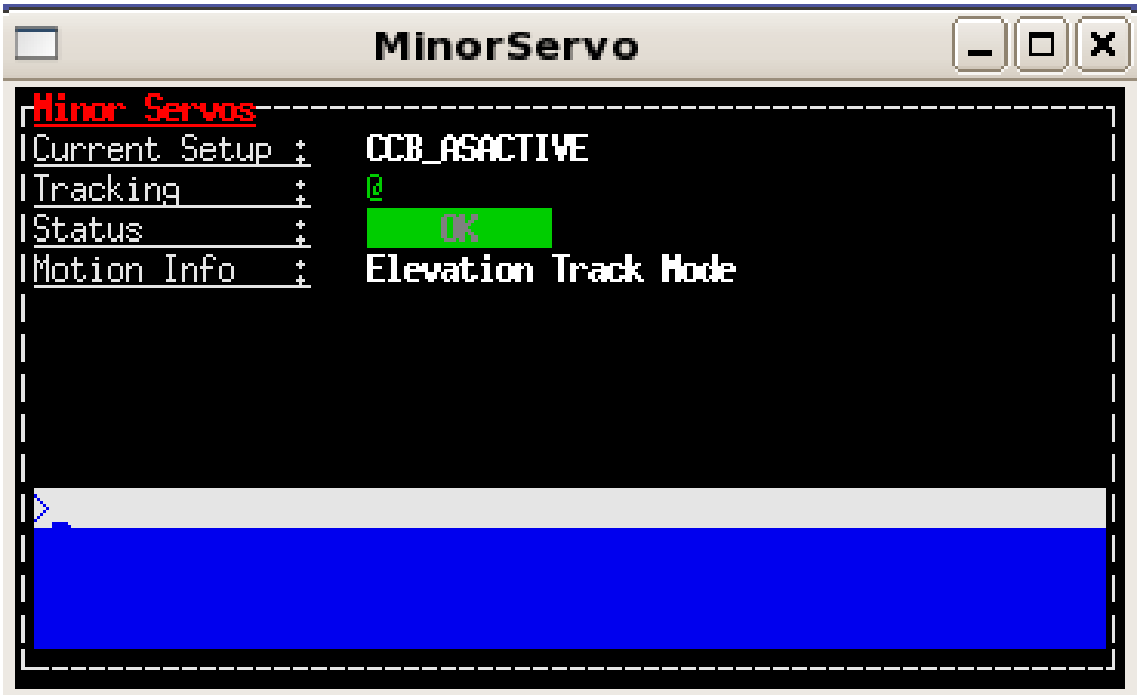

Fig.4.23: The **MinorServo** monitor shows the current setup code and the minor-servo status and movement. In this case the image refers to the C-band configuration.

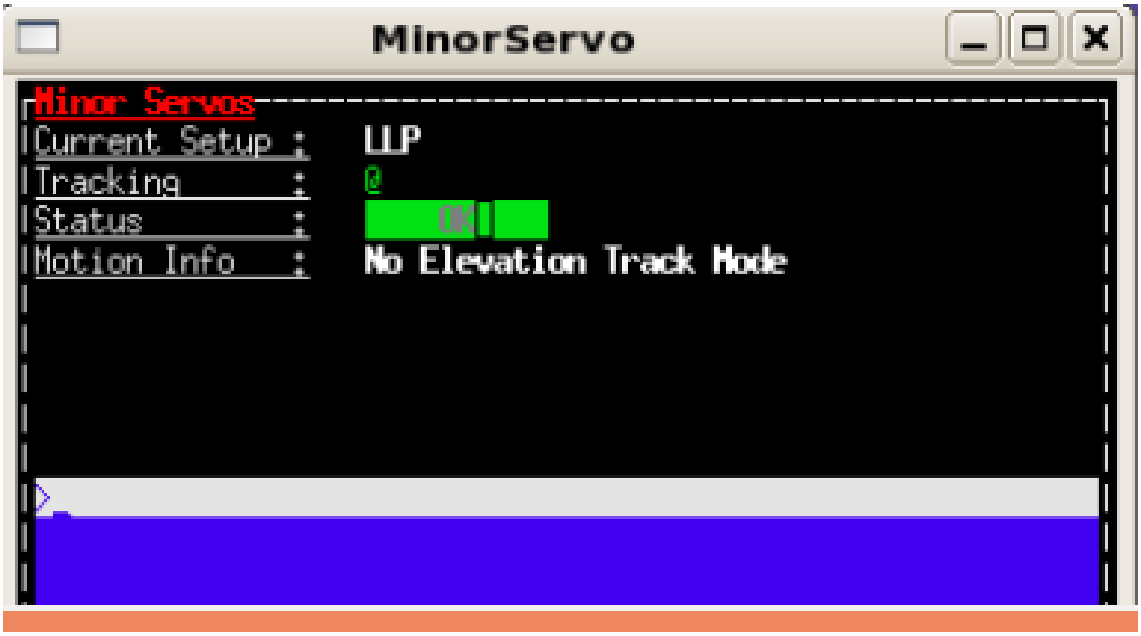

Fig.4.24: The **MinorServo** monitor in the L-band configuration.

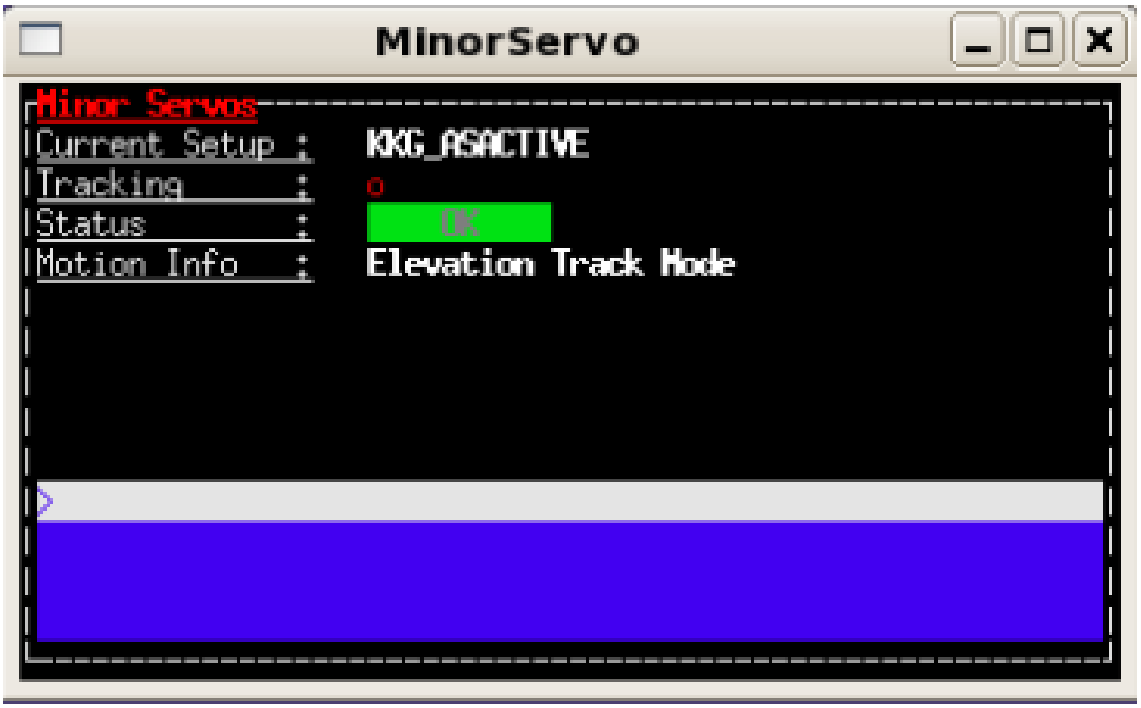

Fig.4.25: The **MinorServo** monitor in the K-band configuration.

Fig.4.26: The **MinorServo** monitor after the park of the minor servos by using > `servoPark`

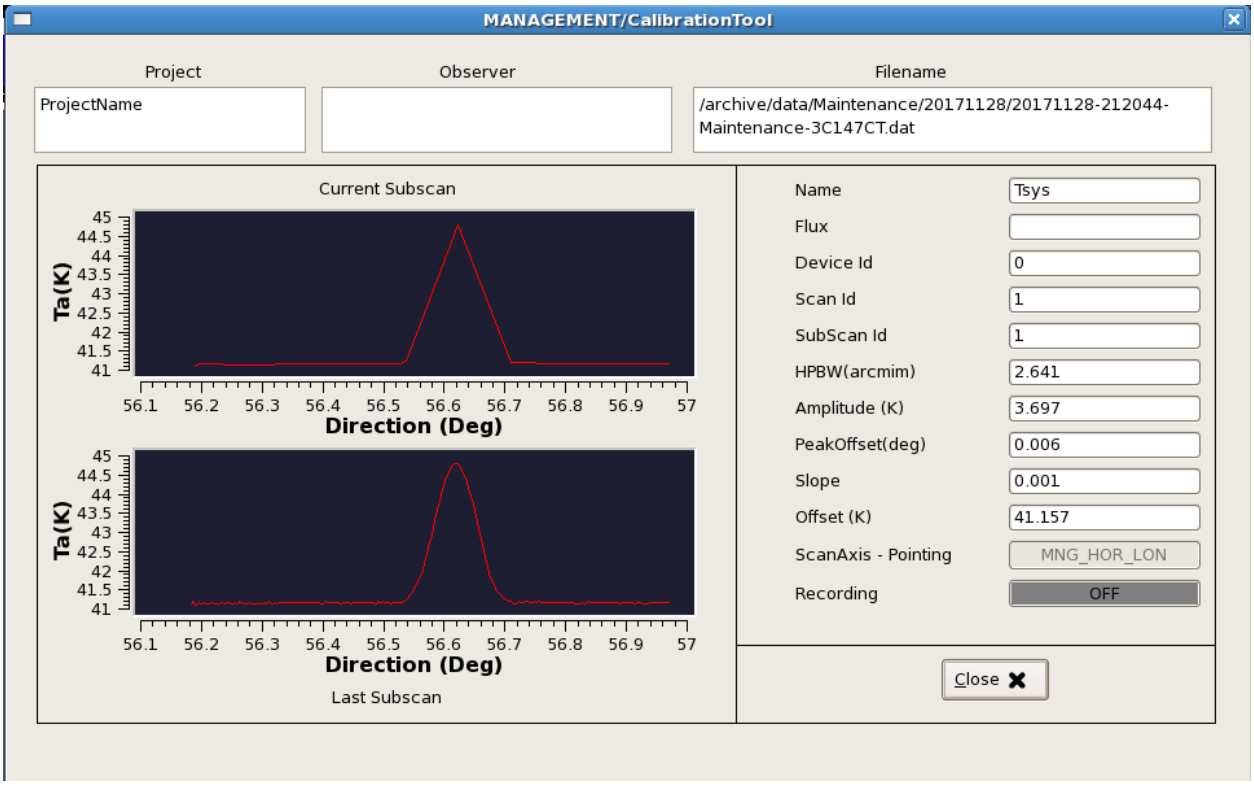

Fig.4.27: In the **Calibration tool client** window the subscan currently being acquired is shown in real-time (upper plot), even if in a low-resoltution. In the lower plot, the last completed subscan - in its full sampling - is shown. We can read the information about the pointing of focus offsets ("peakoffsets"), the beam size ("HPBW"), etc.

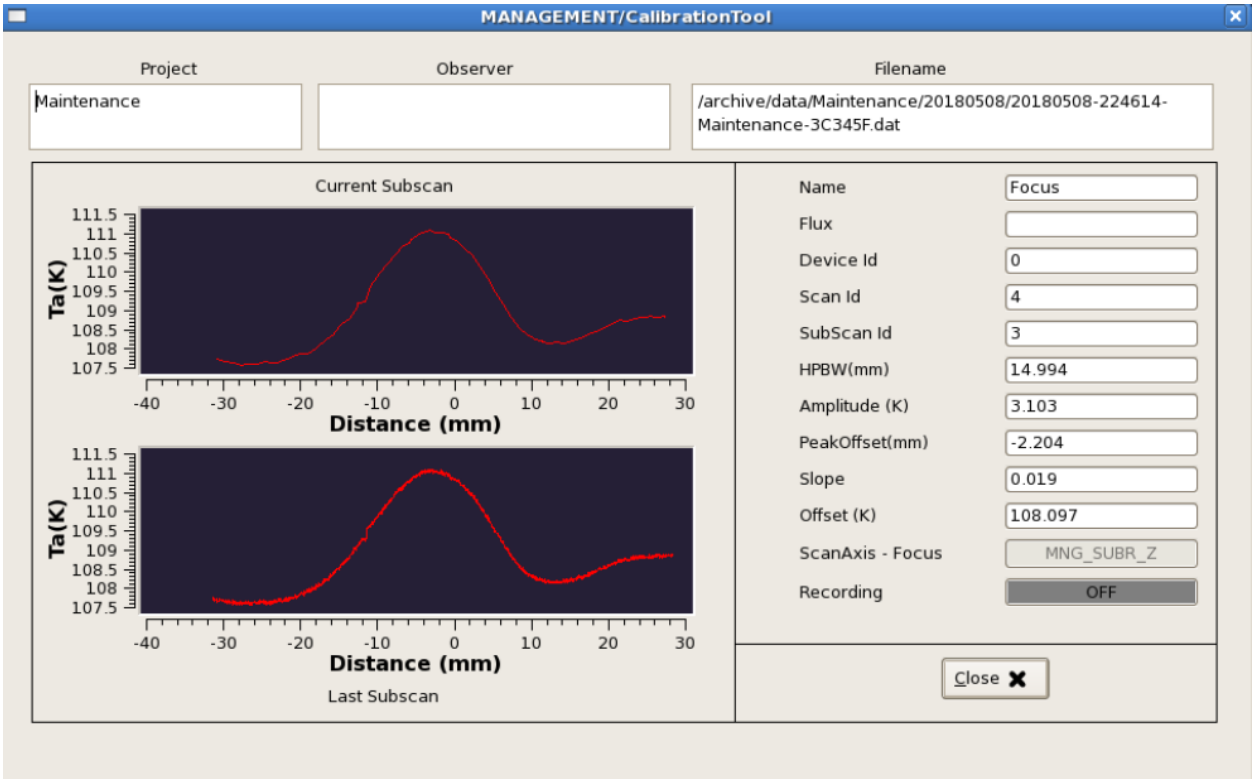

Fig.4.28: **Calibration tool client** window related to a focus subscan.

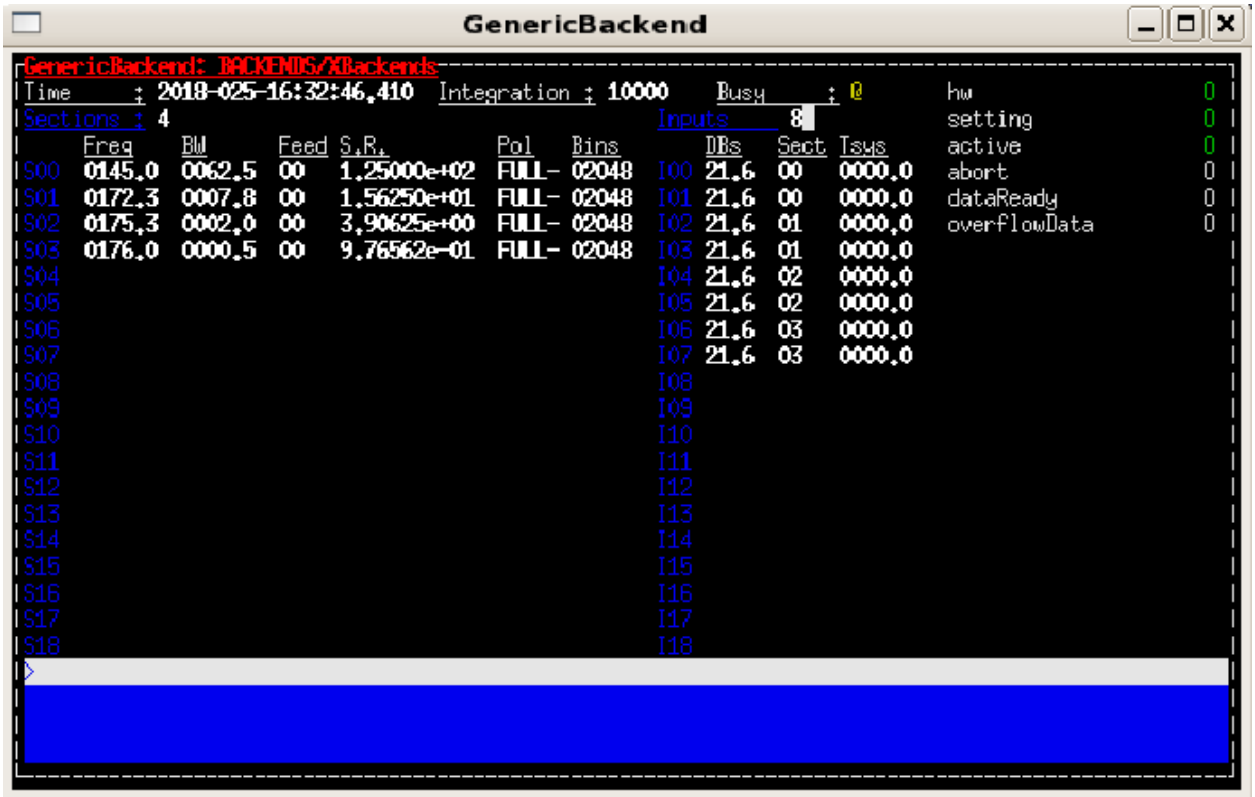

Fig.4.29: A second **GenericBackend** panel shows the setup parameters of each section of Xarcos.

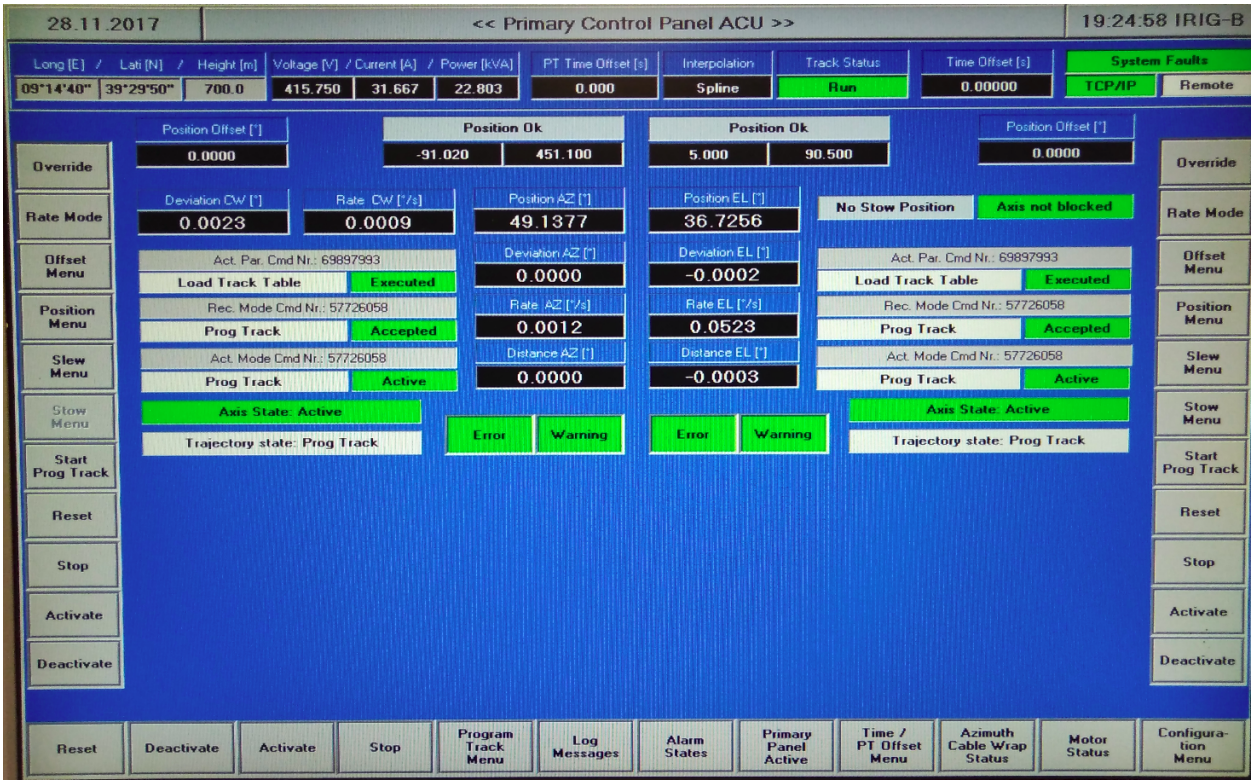

Fig.4.30: Primary Control Panel ACU.

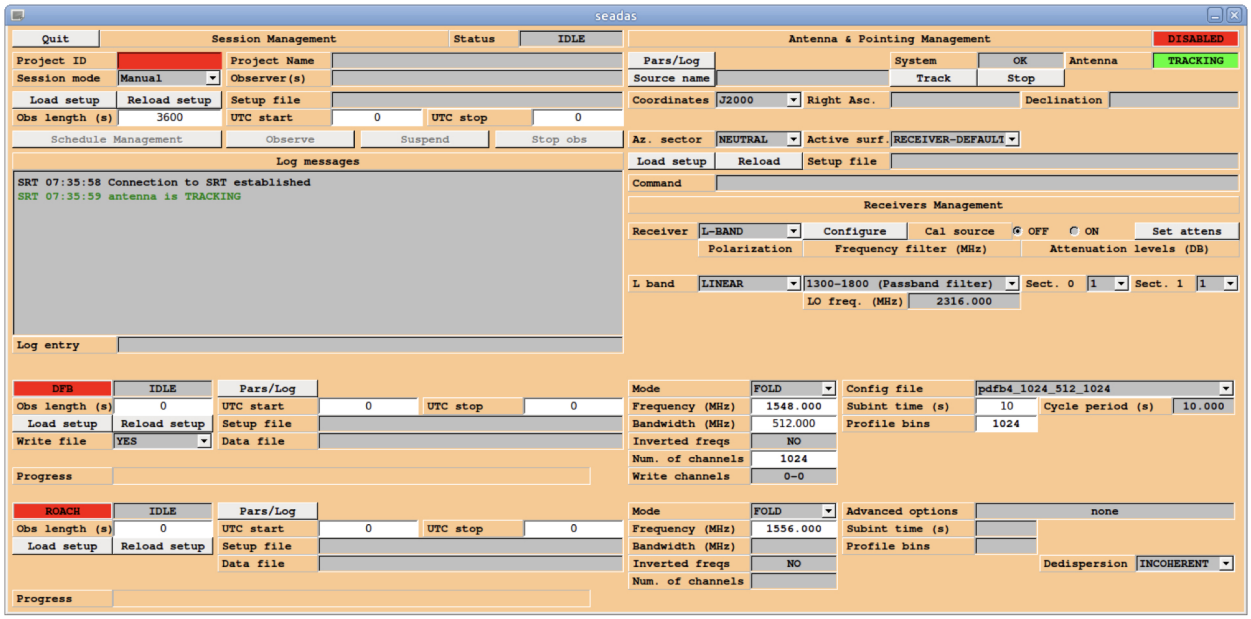

Fig.4.31: Seadas GUI. On the top right, the red box signals that the control of the antenna is DISABLED.

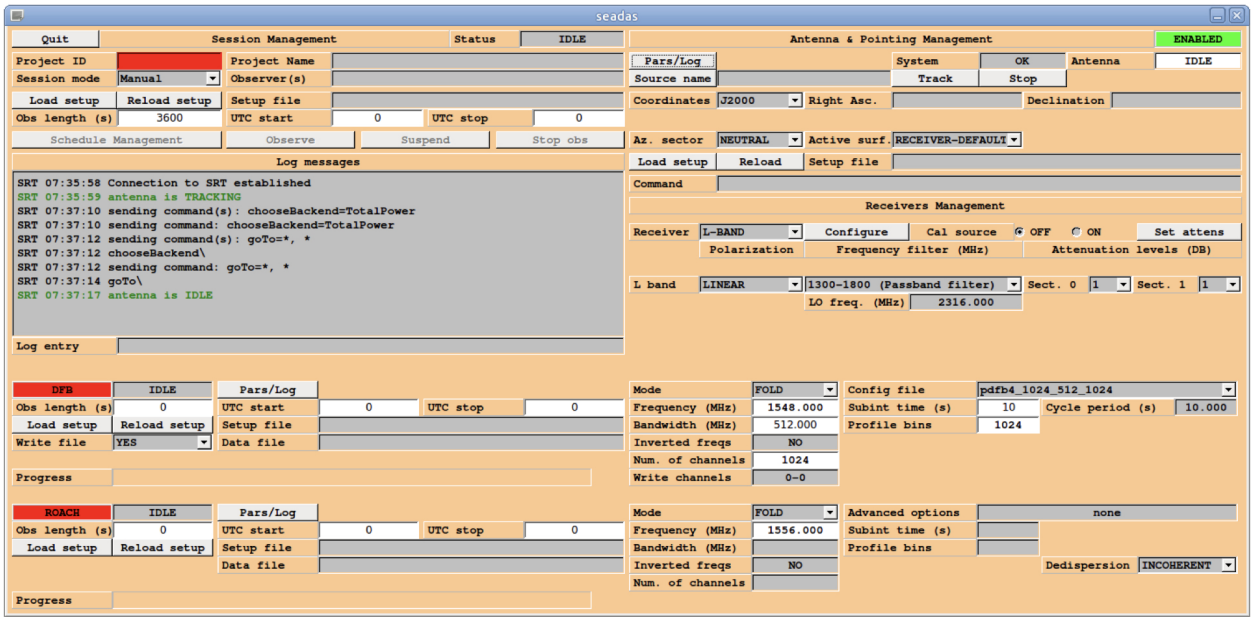

Fig.4.32: Seadas GUI. On the top right, the green box signals that the control of the antenna is now ENABLED.

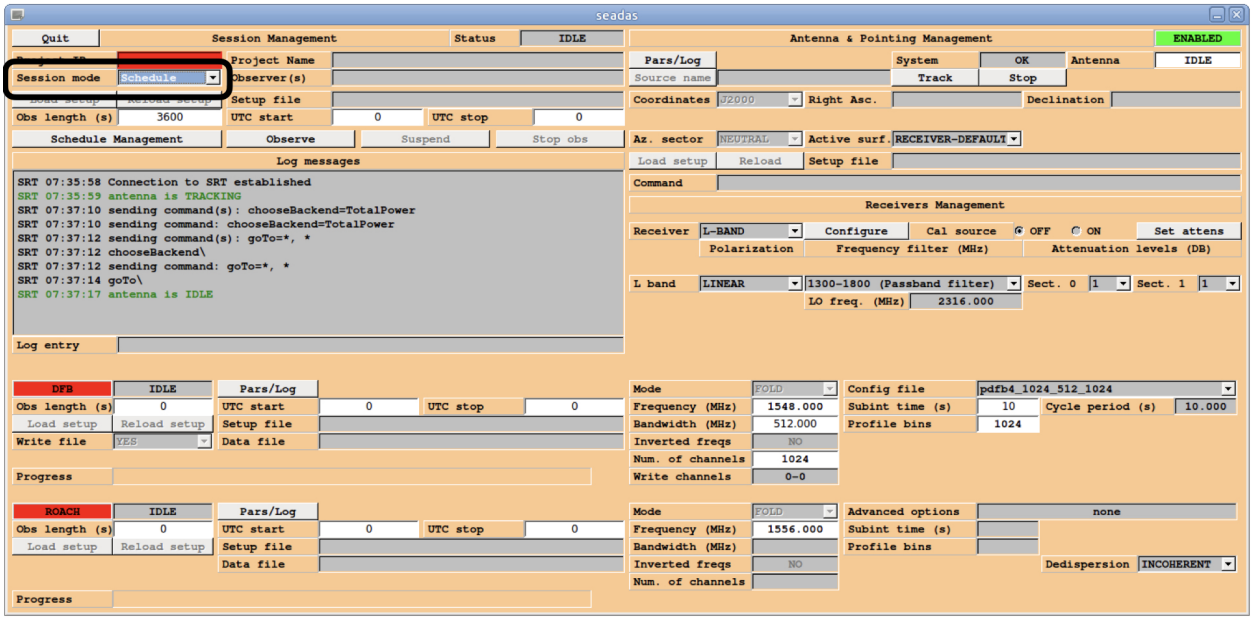

Fig.4.33: Seadas GUI. On the top left, circled in black, the Session Mode combo box where the option Schedule needs to be selected in order to start the observations through your pre-prepared schedule.

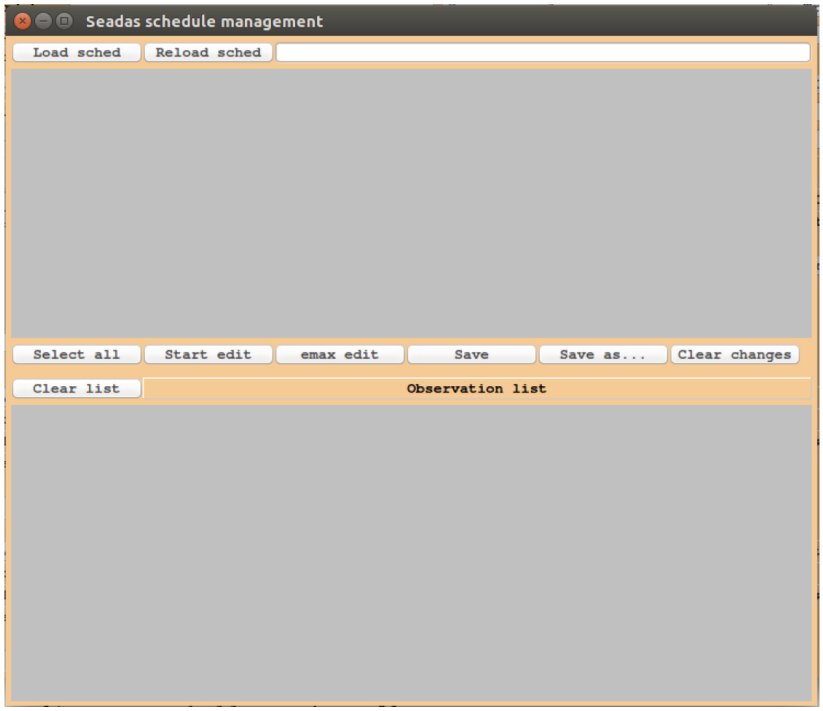

Fig.4.34: Seadas GUI. Pop-up window where the schedule can be uploaded by clicking on the button *Load sched*.

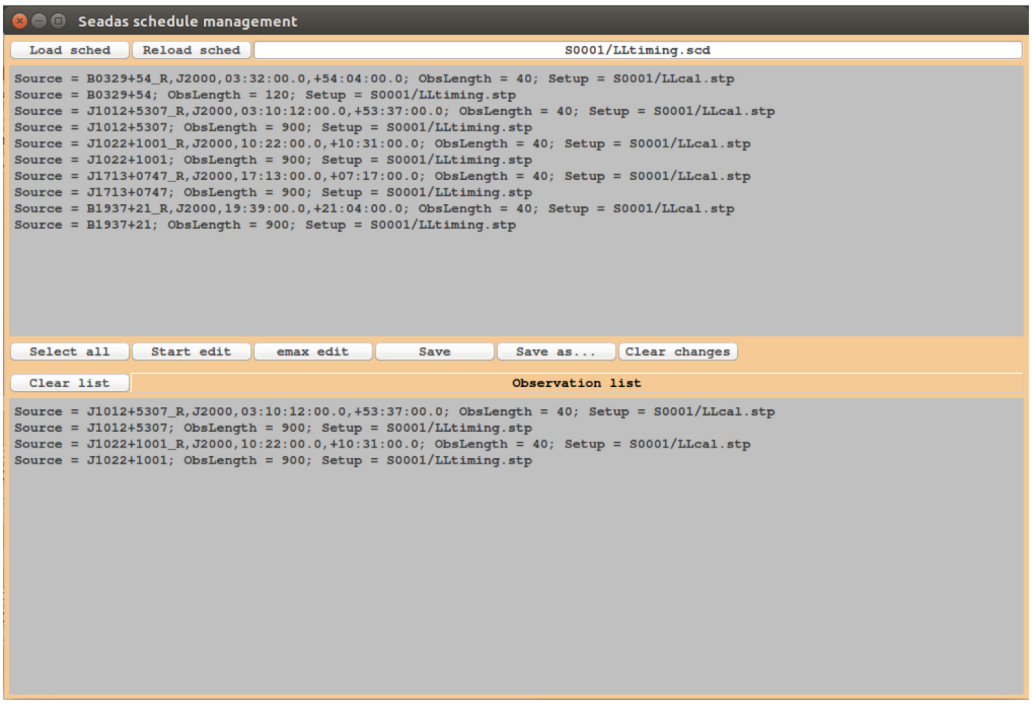

Fig.4.35: Seadas GUI pop-up window for schedule management. The uploaded schedule lines will appear on the top panel. The ones selected for observations will appear in the bottom panel.

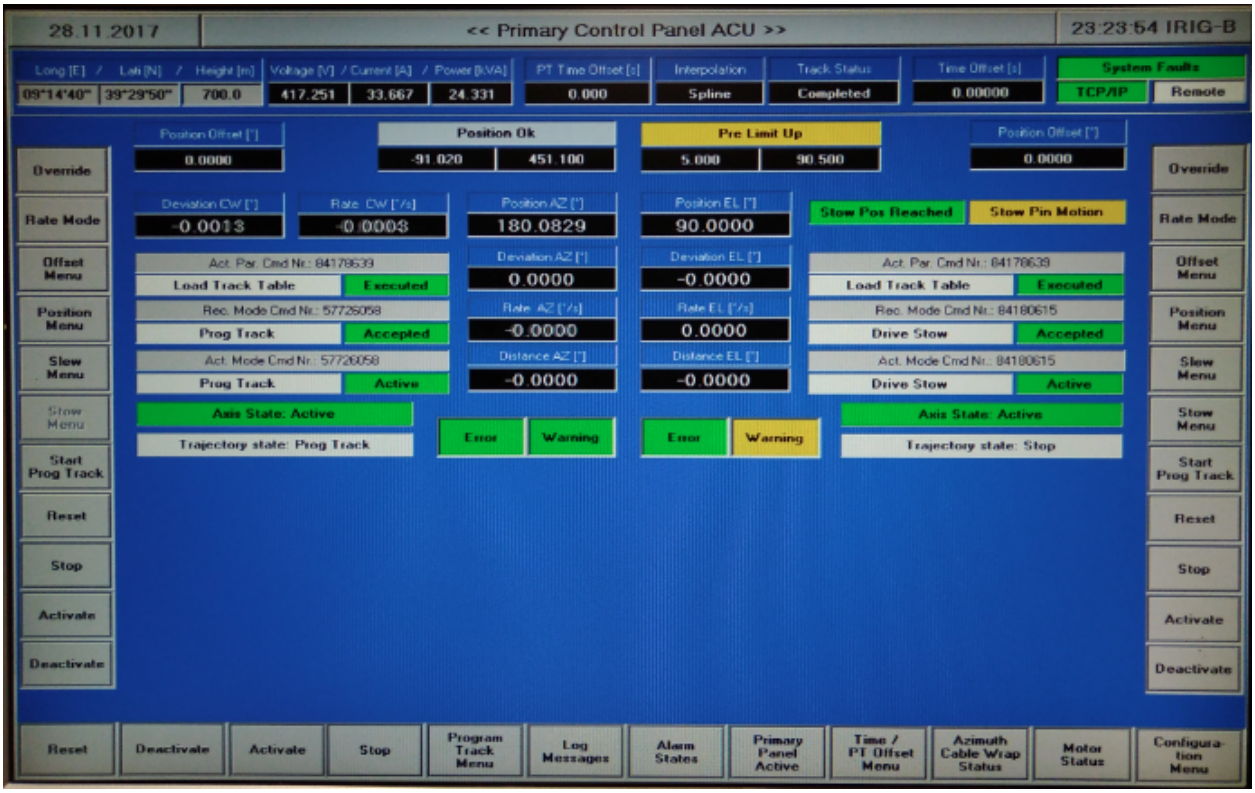

Fig.4.36: ACU panel after > `antennaPark`.

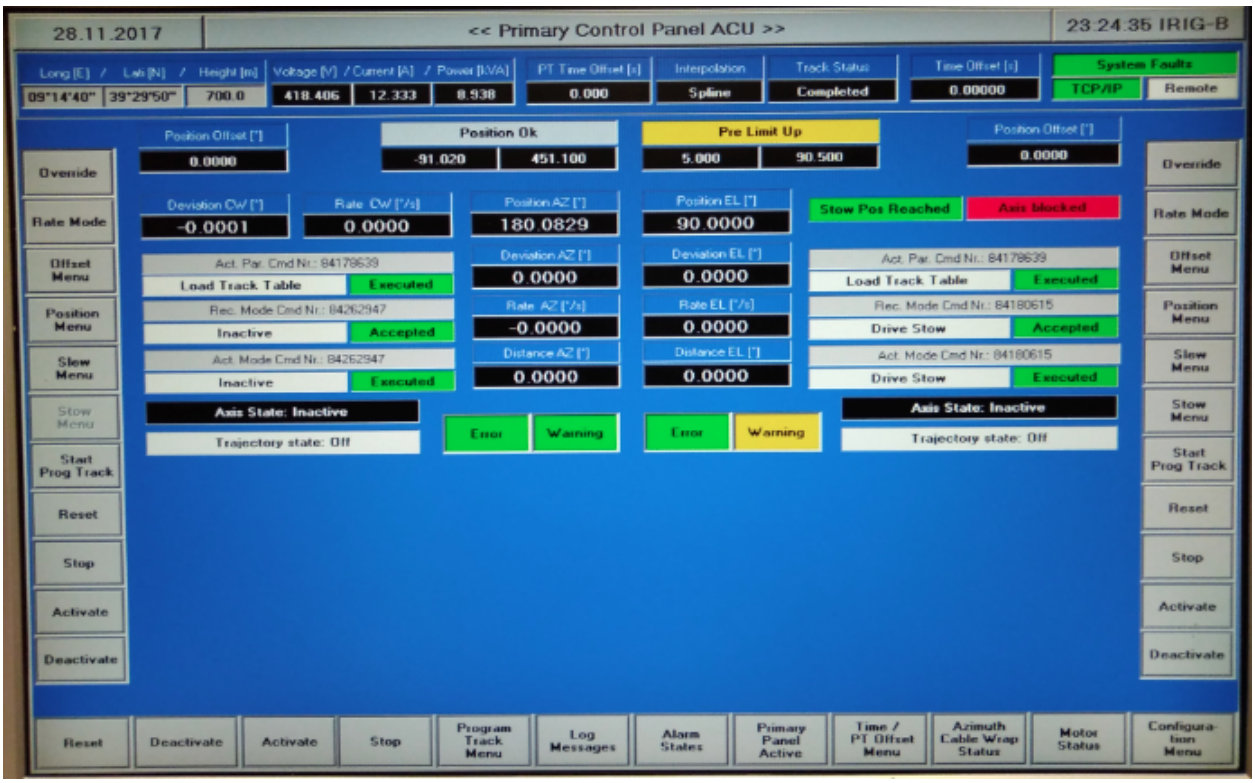

Fig.4.37: ACU panel when the antenna is correctly parked.

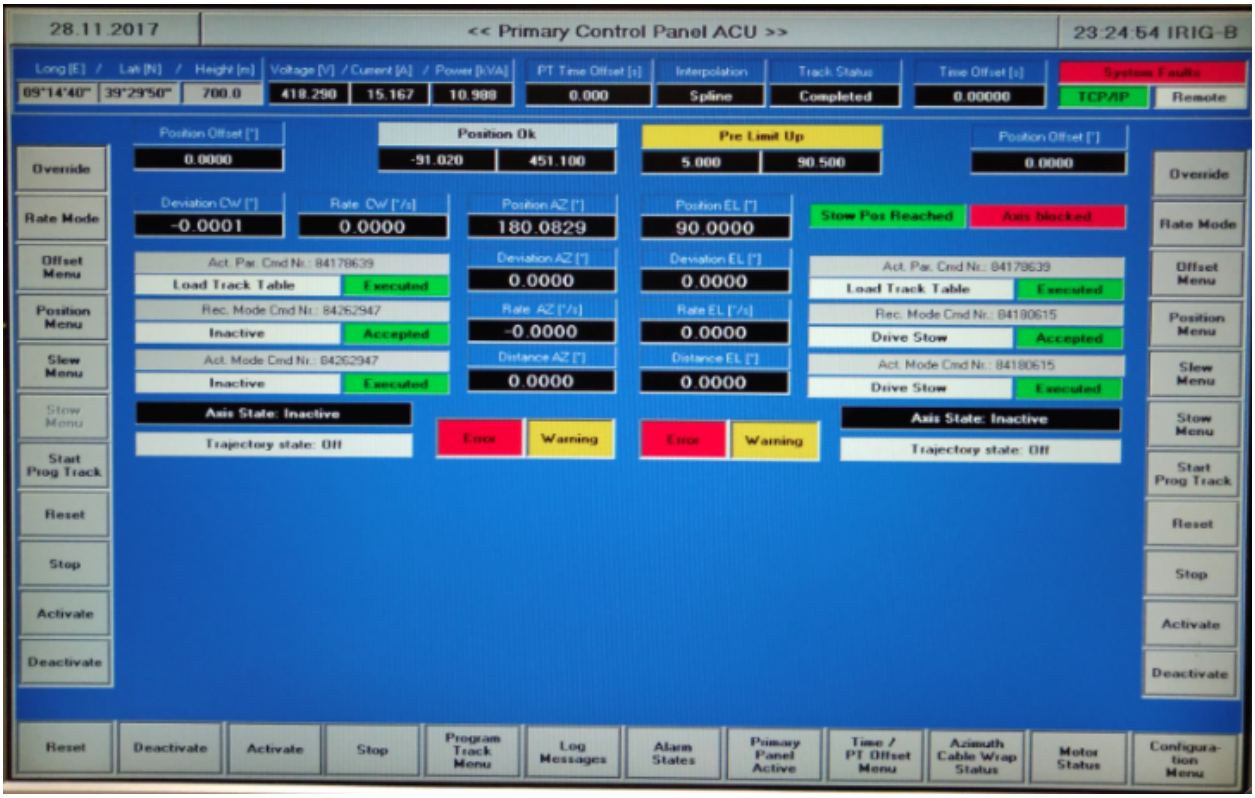

Fig.4.38: ACU panel when the emergency button is pressed.

AntennaBoss

Observatory

Mount

GenericBackend

ReceiversBoss

Scheduler

The antenna is not in tracking when the @ is red. Note that it can also be red when the antenna is in slewing (to reach the position of a target).

When the status of the scheduler is in FAILURE and the scan/subscan number is frozen, stop the schedule.

MinorServo

Logging Display

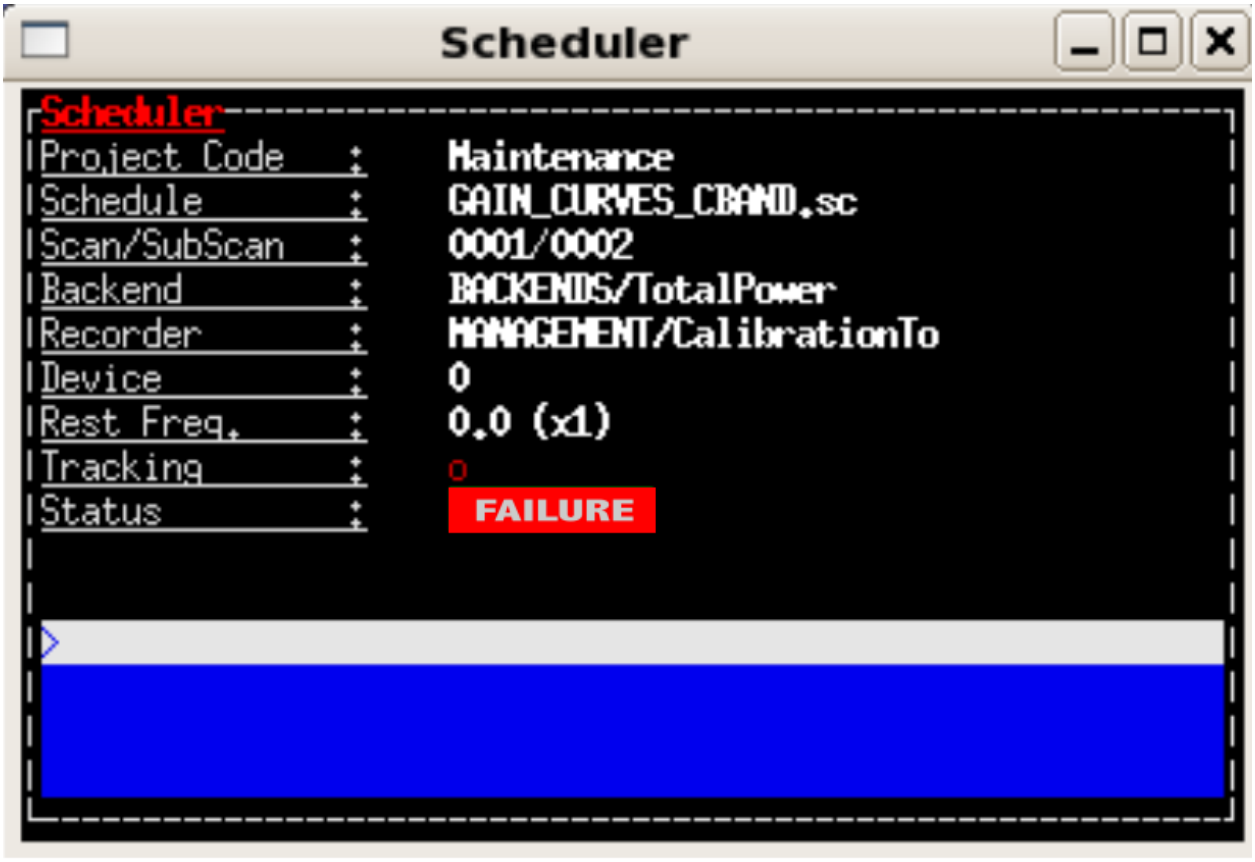

Fig.4.39: The scheduler status is in FAILURE

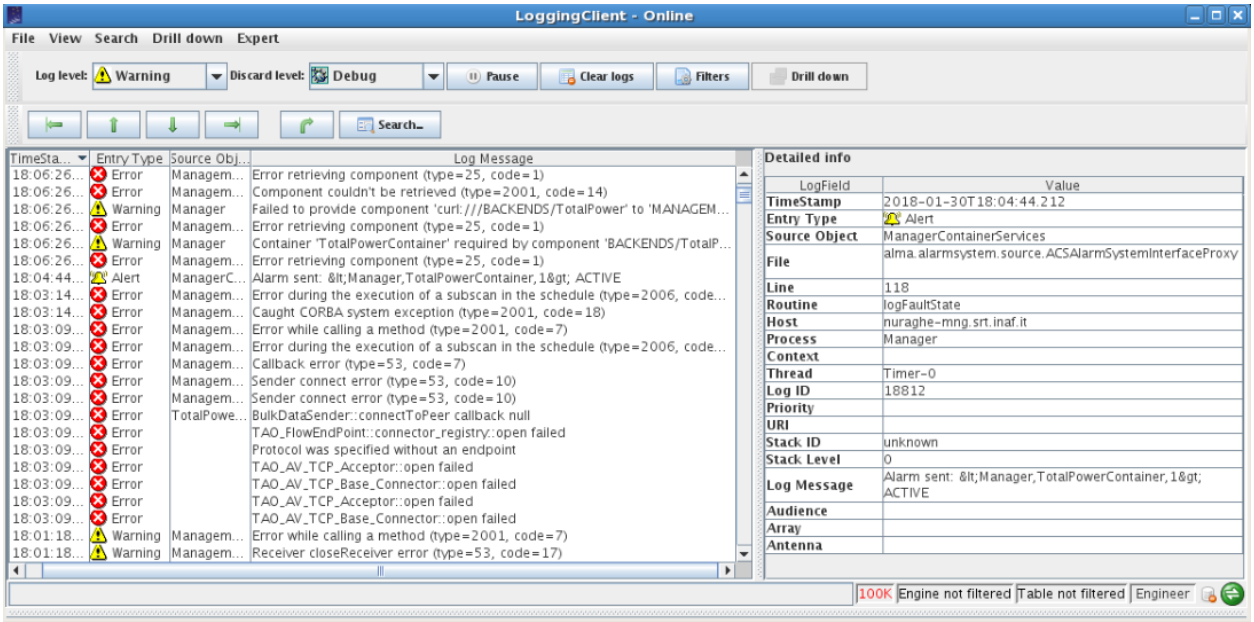

Fig.4.40: The error messages are show in the Logging Display with a short explanation of the related problem.

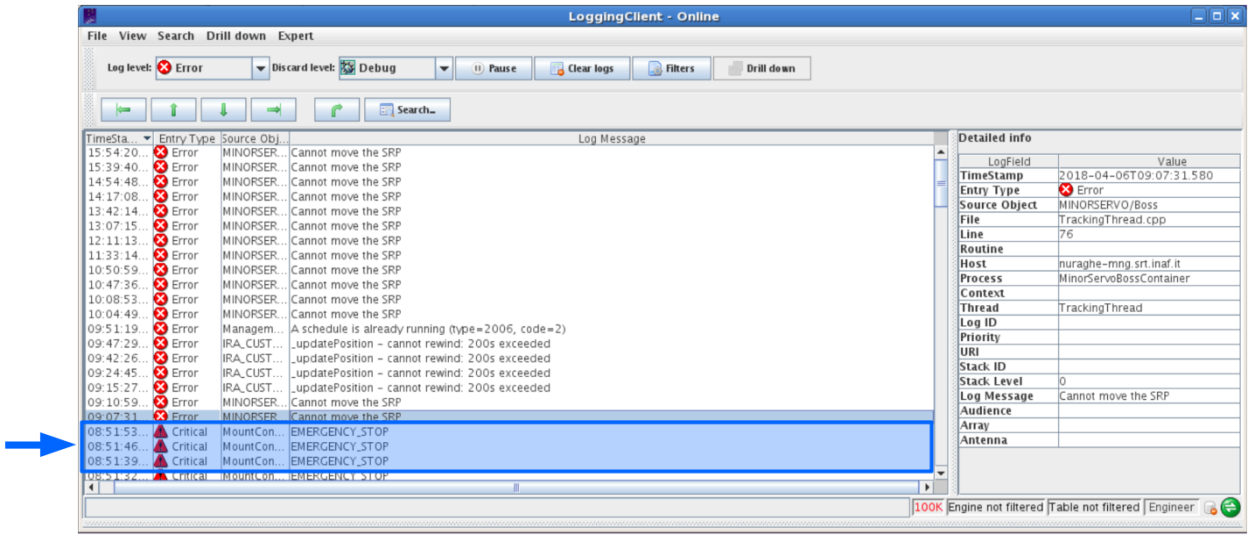

Fig.4.41: The warning message indicated by the blue arrow automatically appears when the emergency stop button is pressed.

Active Surface

The active surface does not work properly if a large fraction (a whole sector) becomes red. It is a problem in K-band observations.

MeteoClient

The real-time monitoring of the wind velocity is performed with the meteoClient on a nuraghe-mng shell: `$ meteoClient`. The red horizontal line corresponds to 60 km/h, the limit for observing with SRT.

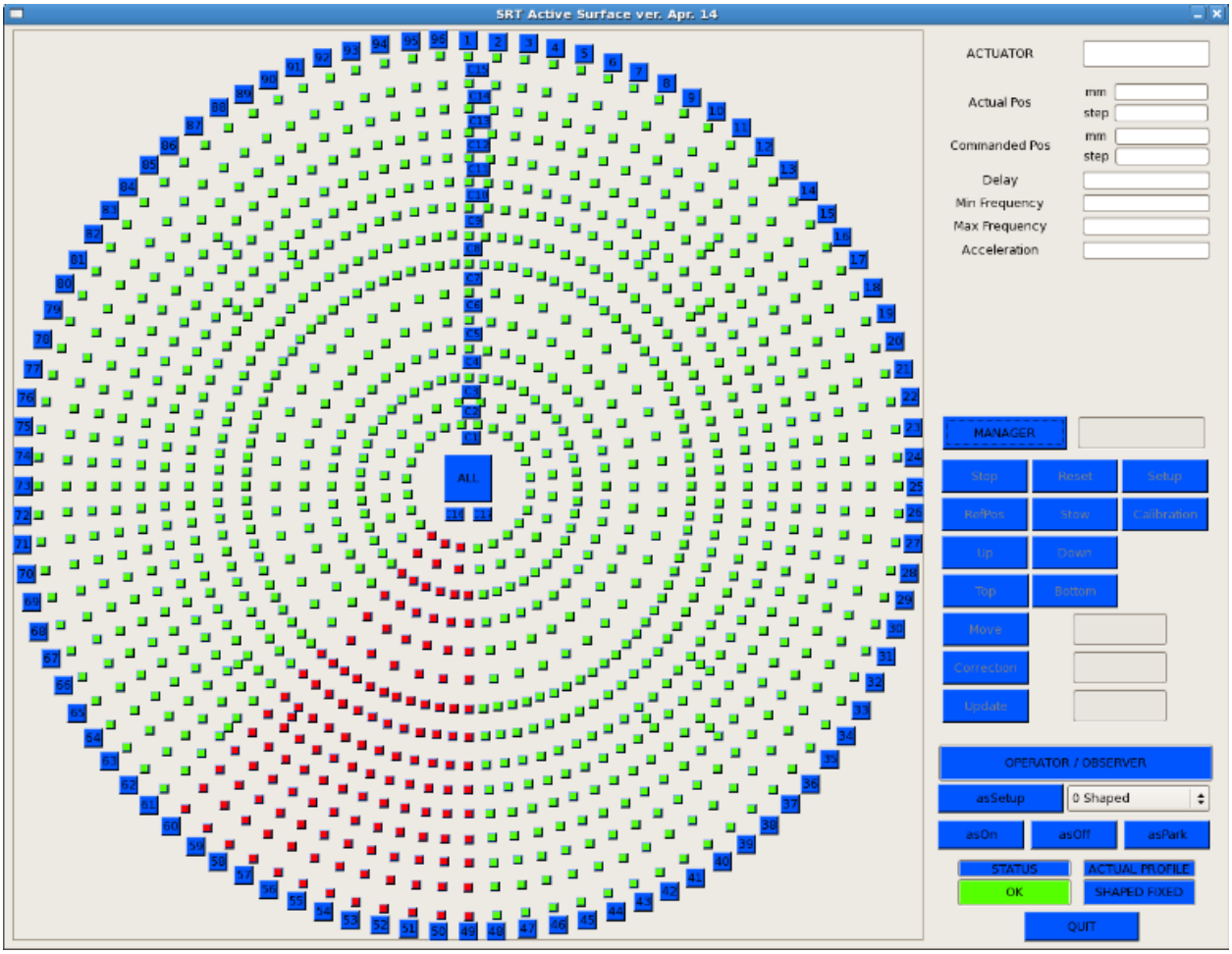

Fig.4.42: A fraction of the active surface (red squares) does not work properly.

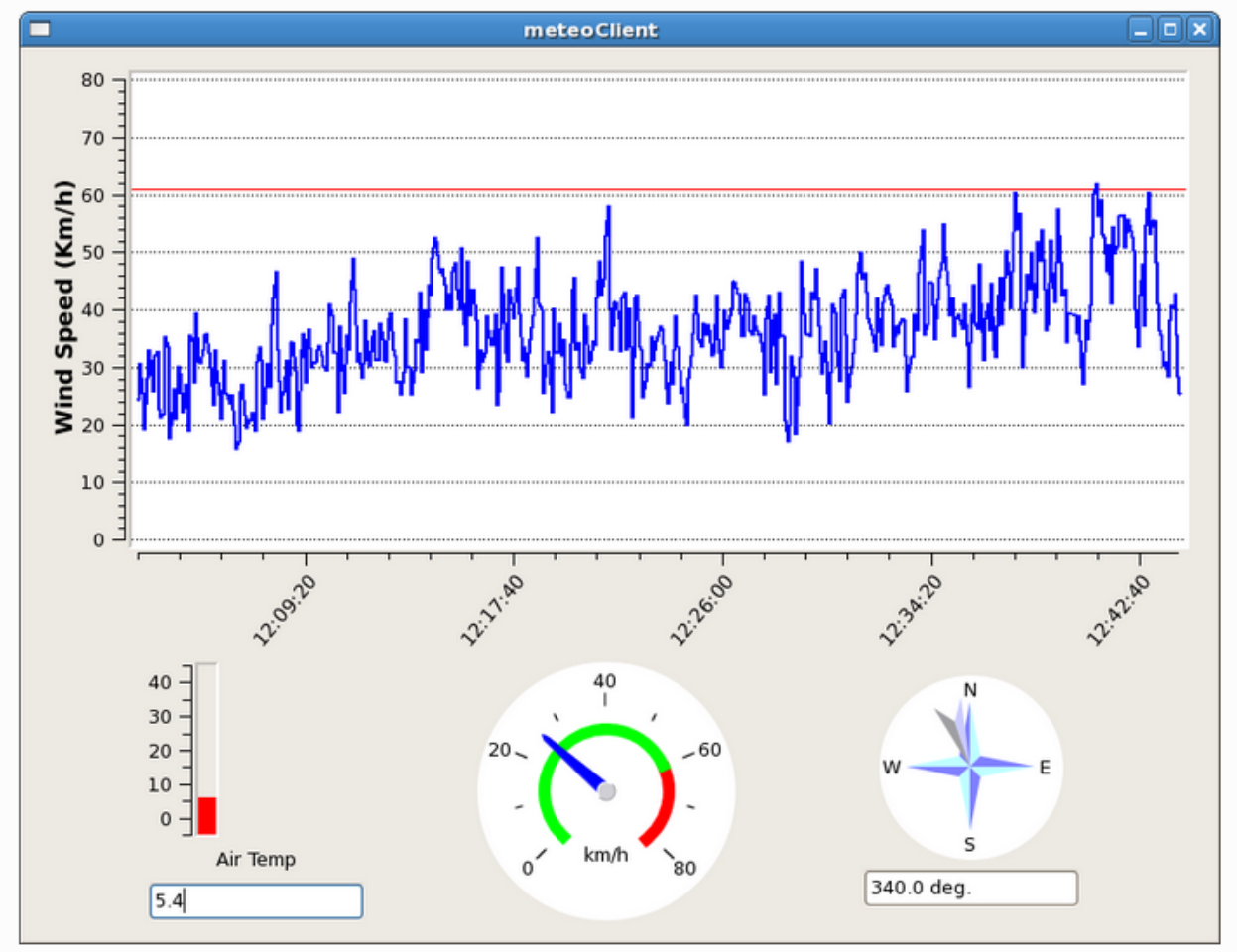

Fig.4.43: The antenna is automatically stowed when the wind speed exceeds 60km/h.