Usage of the SI 1100 on the RCC

Logging in

You can use the telescope and the camera via ssh login and screen. See description here: Usage of the screen program

An example for ssh login: `ssh -X user@m5.konkoly.hu` where *user* is your username on `m5`

Or, alternatively, you can use x2go to connect to the RCC control computer, `m5`.

To use x2go, you need the following setup:

- Session:
  - Session name: whatever you want
  - Host: `m5.konkoly.hu`
  - Login: your username on `m5`
  - SSH port: 22
  - Session type: GNOME
  - If you want to connect to `m5` outside of the konkoly network, you have to tick `Use proxy server for SSH connection`.
    - Type: SSH
    - Host: `szombat.konkoly.hu`
    - Port: 22
    - Login: your username on `szombat.konkoly.hu`
- Connection
  - Connection speed: the speed of your internet
  - Compression: 16m-jpeg + image quality 9 usually works just fine.
- Input/output
  - Display: You can choose whatever you prefer here. Usually in a FHD display a costume 1920*1040 resolution works fine. Tick `Set display DPI` and set it to 96.
  - Clipboard mode: Bidirectional
  - Keyboard: Auto detect
- Media
  - Untick everything.
- Shared folders
  - If you want to access a folder on your computer on `m5`, add your folder here.

Starting

Enter your working directory in a console: `cd /data2/user/YYYYMMDD` **Always save your fits files into the /data or /data2 folder!** Attention! It is recommended to use the `/data2` folder with this camera on `m5`!

In a console type: `rcc-test` If everything is green, proceed further. If not, contact the support astronomer.

In a console type: `acectrl --status` If `Main pickoff mirror` is `off`, the telescope is ready for photometric observations. If not, type `acectrl --stop`. Start `ds9`. Check the telescope: http://ccdsh.konkoly.hu/static/tmp/prcc-state.html?refresh=60

Start CCDSH in a console: `ccdsh`

If your .ccdsh_startup file is not prepared for the usage of the SI camera, type in CCDSH: `CCD> source /usr/local/ccdsh/scripts/load-ace-sicamera.ccdsh` This will load the camera driver and the

filter parameters.

Type `CCD> status` in CCDSH. If everything is green, proceed further.

Check the camera temperature in CCDSH: `CCD> get temperature` It should be -115 Celsius. If not, contact the support astronomer!

Cool the guider camera. Type in a console: `rcc-autoguide.qsi --temperature -30` -20 recommended during summer.

Open the dome slit. In CCDSH: `CCD> set dome slit open`

Open the guider cap: `CCD> rcc guidercap open`

Start the tracking: `CCD> set mount track on`

Start the automatic dome rotation: `CCD> rcc dome auto`

Open the tube and mirror covers: `CCD> rcc tubecover open`

After 30 seconds: `CCD> rcc mirrorcover open`

Type `CCD> rcc status`. If everything is opened and green, proceed.

Observing

Slew to your target. In CCDSH: `CCD> slew M31`

Check which filter is in use: `CCD> get filter`

If you want to change the filter, for example R, type: `CCD> set filter R`

Create a 20 second test image: `CCD> acquire -t 20 -x`

Attention! Right now (2019.08.28.) there is NO bin and trim support for this camera! Please do not attempt to trim and bin the image!

The field of view is about 16'x16'. If your target is not where you want it, type in a console: `rccpanel --speed 8 &`

This will bring up a small panel. With the arrows you can move the telescope. Check the position again with a test image. If the target is where you want it, start the autoguide. First, create a test image with the guider. Type in a console: `rcc-autoguide.qsi --exptime 10 -o x.fits && xpaset ds9 fits < x.fits`

If there are more than 10 stars, you can start the autogide with this command in a console: `rcc-autoguide.qsi --exptime 10 --relax 5 --point` This will do a 10 seconds exposure, and wait 5 seconds until the next. And in the meantime it will adjust the position of the telescope.

If you have less than 10 stars in the guider FOV, use the `--fine` option, instead of the `--point`.

Check the focus in CCDSH: `CCD> get focus`

If you are not satisfied, change the focus: `CCD> set focus 79.0`.

The usual focus value with the SI camera is around 78.5-79.2, but it is heavily depending on the temperature! Also, the focuser has some hysteresis, so be careful when setting it. Always check your focus during the night, because it can change! You can use the `fitsh` based **imexam** command in a console, to check your stars, but always set the zoom level to 1 in `ds9`, because `imexam` has a small bug.

If everything is set, you can start your observing sequence. In CCDSH: `CCD> sequence -n M31-%N -V -x -j name=M31 3*([filter=r,time=180])`

This will create 3 images in r filter, with 180 seconds exposure time.

You can use multiple filters: `CCD> sequence -n M31-%N -V -x -j name=M31 3*([filter=r,time=180],[filter=i,time=120],delay=2)`

Attention! The delay is necessary, because right now (2019.08.28.) you CANNOT stop the exposure or your script when the SI camera is in use! You can do that only during the delay time, so please be very careful!)

For more options see `CCD> sequence --help` in CCDSH.

You can use scripts in CCDSH: `CCD> source kedvencscriptem.ccdsh`. But keep in mind, that if you slew to an other target, you have to stop and restart the guiding process!

Closing

When you finished observing, stop the autoguider when it is in a relax state with `ctrl+c`. Also, you can stop a sequence or a script with `ctrl+c`.

Warm up the guider camera. In a console: `rcc-autoguide.qsi --temperature off` or `rcc-autoguide.qsi --temperature 0` (Only if you are sure that it will be used next night too.)

In CCDSH:

- `CCD> set mount track off`
- `CCD> rcc dome manual`
- `CCD> rcc mirrorcover close`
- After 30 seconds: `CCD> rcc tubecover close`
- `CCD> rcc guidercap close`
- `CCD> set dome slit close`
- `CCD> rcc slew 0 47.8`
- `CCD> set dome azimuth=156.3`

After a few minutes, check that everything is ok and closed in CCDSH: `CCD> status; rcc status`

Turn on the lights in the dome: `CCD> set dome light 1 on/off`

Check the telescope on the webpage: http://ccdsh.konkoly.hu/static/tmp/prcc-state.html?refresh=60

Turn off the lights in the dome: `CCD> set dome light 1 off/on`

The SI camera should not be warmed up! Please do not attempt to do it!

Calibration frames

It is highly recommended to make bias and dark frames every night. You should make flat frames at least once a week.

- Some examples
  - Bias:
  - `CCD> sequence -n bias 11*([bias])`
  - Dark:
  - `CCD> sequence -n dark-20sec 11*([dark,time=20])`

NOTE: The SI camera is cooled to -115 Celsius, so in theory the dark current is negligible, therefore, in theory, there is no need for dark frames.

To make flat frames, you should open the tube and mirror covers and turn off the dome lights. Depending on what filter you would like to use, turn on the appropriate flat lamp. In a console: `energenie-manage --flat-faint on`

Or: `energenie-manage --flat-bright on`

Or: `energenie-manage --flat-dimm on`

In CCDSH: `CCD> set dome azimuth=156.3` and `CCD> rcc slew 7 -4.5`

- Recommended exposure times with the bright lamp:

  - B: 120 sec
  - V: 20 sec
  - g: 40 sec
- Recommended exposure times with the faint lamp:
  - R: 20 sec
  - r: 20 sec
  - i: 8 sec
  - z: 8 sec
- Recommended exposure times with the dimm lamp:
  - I: 40 sec
  - E: 20 sec
  - C: 20 sec
- An example flat sequence:
  - `CCD> sequence -n flat -V -j flat -x 11*([filter=B,time=60])`

Always check the exposure times for the flats. A good flat is around 20000-30000 ADU.

When you finished, turn off the flat lamp(s). In a console:

`energenie-manage --flat-faint off`, etc.

Close the mirror and tube covers.

Put the telescope in a vertical position. In CCDSH: `CCD> rcc slew 0 47.8`

Miscellaneous

- The dome light switch is a two way switch, so sometimes the `off` command will turn it on and the `on` will turn it off.
- If you expect any trouble with the camera, please contact the support astronomer immediately! This camera is very sensitive to temperature increase, which can lead to vacuum loss! To check if everything is in order, you can take a look at the windows control program of the camera at `vncviewer 172.31.171.171` **Please do not touch anything here, just check if there is any error messages, or if the control program is running or not!**
- Link to the RCC webcam:
  - http://kisag.konkoly.hu/apal/webcam/rcc-webcam.php?refresh=10
- Sometimes when a minor malfunction occurs, the following command can help. Issue it **twice** in CCDSH:
  - `CCD> criorcc -clearerr`
  - If it not helps, contact the support astronomer.
- RCC axis plot
  - http://ccdsh.konkoly.hu/img/prcc/state/mountaxes.png?refresh=60
- More info on autoguiding
  - RCC autoguiding