SHARP Cheat Sheet

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Note: This is a conglomeration of the SHARC-II Cheat sheet (found on the web at: `http://www.submm.caltech.edu/~sharc/`), a hard copy SHARP cheat sheet compiled by G. Novak, and Melanie Leong's DSOS user procedure manual (`http://www.cso.caltech.edu/dsos/DSOSusersproc.html`).

1 Cycle Dewar

This can be done remotely from HP, or you can ask the day crew to do it. (Cycle takes 1-2 hours.)

2 Basic checks

- check that the detector temperature is < 0.5 K
- fill LN2 (daily) and LHe (every other day) if day crew not present
- walkabout to check for obstructions

3 SHARC II Power-up

NOTE: You log into the unix machines as "sharp" for data analysis (typically puuoo) and "sharc" for IRC stuff (typically kilauea). The password for sharc (works for sharcii, puuoo/kilauea, etc) is written on walls; password for sharp is NGC1333!

3.1 Start uip

- Open up an xterm on kilauea
- Type "uip" at the prompt. Then you should see a uip prompt ("UIP>").
- UIP> pundit true (uip prompt should now be bold)
- **UIP**> inst sharc2
- **UIP**> cat sharccal
- **UIP**> cat sharp

3.2 Open dome and make sure pointing east

- pull red emergency stop
- **UIP**> shutter /open
- open to 70 percent, unless sun is still high.
- **UIP**> az 40 (winter) OR az 110 (summer)
- **UIP**> za 45 (for DSOS initialization)

3.3 Check mirror position, optical path and filter wheel

- ensure filter wheel is at appropriate wavelength
  250: 350 μm
  500: 450 μm
  750: 850 μm
- ensure tertiary is in nasmyth2 position. If not, type:
  UIP> za 25
  UIP> tertiary /nasmyth2
- make sure cal wheel is not in beam. If it is, type:
  UIP> vane /out
- make sure that there will be no collisions when slewing (see 2)

3.4 Power up sharcii and sharp

NOTE: There are times when you may want to go through this start up procedure even though SHARC-II is not cycled, just to test out whether the computers are all talking. (This is discussed in more detail in the SHARP setup instructions.) In this case, you should skip part of this step (step 3.4) and all of the next step (step 3.5). Specifically, for the present step you should turn on the HWP (and HWP heaters if necessary) but you should not turn on the alidade power controller nor the instrument power switch. Note also that when operating in this mode, you will not see the "12 12s" when resetting the SHARC DSP (step 3.6).

- alidade power controller (charge→operate)
  - at instrument, will get two green lights and a yellow
- throw power switch on instrument to "ON"
  - this should light up an additional two red lights on instrument
- Turn on power switch of HWP control box. By about a minute later, both the Rx and Tx lights should be flashing
- Turn on both heaters for the HWP module, and set them both to the same voltage as given below:

daytime	V < 10 V
nighttime	T=0 C → 22 V each
	T=5 C → 15 V each
	T=10 C → 10 V each

  (NOTE: Normally the heater power supplies are set to read voltage, not current. They can be set to read current, but one of them has a broken current meter.)

3.5 Configure amplifier electronics and multiplexer

NOTE: This and the previous step ("power up ...") can be skipped if only sharcii computer testing is desired

- open up 3 new xterms on kilauea or puuoo (as sharc). In window 1:
  - ssh sharc@sharcii (password 350mu_m)
  - cd ∼/fpga
  - go

3.6 Reset sharcii DSP

Normally the client and server is shut down at the end of a night. If not, see SHARC cheat sheet webpage In window 2:

- ssh sharc@sharcii
- cd ~/DSP
- sharcDSP
- s2
- status (should have 12 12's and 2 36's)
- status (check to make sure UT is updated)
- quit

If the UT is not updating, try again a few times. If that still doesn't work, go to DSP help page: `http://www.submm.caltech.edu/~sharc/operating/manual.htm#DSP_reset`

3.7 Set Gain

Type "all_gain hi" in the fpga window (window 1). This ensures that the gain is set in HI mode, just in case someone has been doing SHARC-II cold load tests.

3.8 DSOS Stuff

Open two more windows to be used for DSOS stuff (Windows 4 and 5). Do the following in window 4:

- ssh visitor@128.171.86.102 (passwd = D1shm3)
- DSOSdaemon (activate the daemon)
- DSOSserver (activate the remote server)

3.9 Start IRC

On window 2:

- cd ~/irc
- sharcServer or sharcServerTest (check with Darren to see which to use; sharcServer for Sept. 2009)
- wait one minute (you should see the message 'Startup Completed')

On window 3 (place on separate desktop, sharc on kilauea):

- cd ~/irc
- ./sharcClient or ./sharcClientTest (again, check which one to use; sharcClientTest for Sept. 2009)
- Wait about 7 minutes for it to actually start (hopefully this gets fixed in the future so it will start faster). When you get the warning about blocking unsafe components, click "no" (do not block).

In the sharcClient, click on "level hardware".

Fill out the fields in IRC widow: "observers"; "project"; etc

4 DSOS Start-Up

Don't start this step until the dome has been open for at least 1 hour and the sun has set. The procedures in this section (which should take about 20 minutes) can be done simultaneously with starting the chopper.

4.1 Verify flow to dish heat exchangers

- verify that Neslabs for dish are set to 0.0-0.1 °C
- verify gauges on manifolds are working
  - 11-12 psi on side near computer, 8 psi on other side

4.2 Set telescope zenith angle to 45 degrees (if not there already)

- **UIP**> za 45

4.3 Initialize and create the night's baseline setting (window 4)

- Start SHARCII client and server if you haven't yet (see above)
- DSOSinit (initialize; only do this once a night)

4.4 Set up monitoring for active surface corrections (window 5)

Make this window a big one so that there is room for the display

- ssh visitor@128.171.86.102 (passwd = D1shm3)
- DSOSmonitor

4.5 Power to drive amplifiers on 3rd floor

The start-up procedcures for the DSOS have changed. You no longer need to manually set the values on the power supplies.

- Turn on power to the 8 power supplies in groups of two. These are on the 3rd floor. Don't do anything else, just turn them on.
- Switch the DSOSmonitor to the power supply status page by typing 'p' in window 5.
- Enable the outputs by typing './DSOSpower on' in window 4 (no quotes)
- Wait about 15 minutes for the values to settle in window 5. The measured voltage should be 15 V, and the measured current should be less than 9 amps, but greater than zero.
- Switch the DSOSmonitor back to the dish status page by typing '1' in window 5 (no quotes)

4.6 Wait for temperatures to settle in window 5

All but one or 2 temperatures should be white

4.7 Get present ZA from antenna computer by typing the following (window 4)

- DSOSagent

4.8 Wait for temperatures to settle in window 5

Only 1 or 2 temperatures should be highlighted. If you want to rebaseline, or if there are problems, see Melanie Leong's 10/05 memo

4.9 (optional step, usually omitted) If you would like to have the antenna monitor on your screen

- Open up terminal
- ssh cso@hau (passwd: kartek)
- amon

Before starting to take data, make sure the dome is open all the way!

5 SHARP Sweep-Mode Observing

For focusing, pointing, getting RGM data

5.1 To help pick calibrator, on kilauea:

- orrery &

5.2 How to focus:

Until 7:30 pm or so check the focus every 30-45 min. If your source appears elongated in the 2 o'clock to 8 o'clock direction, make your focus more negative. If it is elongated in the 4 o'clock to 10 o'clock direction make your focus more positive. Also check the FWHM, amplitude (if tau is stable), and appearance.

Jupiter's moons Callisto and Ganymede can be good calibrators if they are far away from the planet. You can check the current positions of the moons here:
`http://www.skyandtelescope.com/observing/objects/javascript/jupiter#`
Another alternative site for this info is here:
`http://pds-rings.seti.org/tools/tracker2_jup.html`

- **UIP**> focus /offset 0.10

5.3 How to acquire sweep-mode data:

- start the sweep:
  UIP> sweep 30 20 /y 20 14.142 /alt
  (this is "s5", a scan that should work for most purposes)
- stop the chopper:
  UIP> sec /stop
- go to the new source, e.g.
  UIP> planet uranus
  UIP> observe cal_crl2688
  UIP> planet callisto (if you can't point at Jupiter's moons see troubleshooting item 8.5)
  NOTE: All fixed calibrators have names that start with CAL_ so you can type **UIP**> verify CAL_* to see all of them
- Make sure that chop azoff on the UIP display is zero. If not:
  UIP> azo /chop 0
  in case this doesn't work, "**UIP**> OBSERVE" seems to fix it
- set the integration time in the irc client: 180 sec is typical

- level the hardware before starting a new exposure

  optional: can level software in sharc control window (display leveling "constant", grab leveling frame). Offset from a bright calibrator to level hardware if needed (you need to do this for Jupiter Saturn and Mars):
  UIP> azo 300 (offset by 300 arcseconds)
  UIP> azo 0 (get back on source)

- Push "Start" on the irc

5.4 Analyzing sweep-mode data

See the separate document on data analysis (SHARP documentation page). The basic routine is:

sharp_both NNNNN

If that doesn't work try following it with:

fitgauss NNNNN.fits ix0 XX iy0 YY

where XX and YY are estimated FITS image pixel numbers for the peak.

5.5 To update the fazo and fzao

- **UIP**> fazo -101.2
- **UIP**> fzao -12.0

5.6 To enter a new source in the UIP catalog

With the introduction of the "new UIP" in 2009, the method for entering coordinates of sources has changed. The coordinates are stored in a file now. The file that we use for SHARP targets is called "sharp.cat" and it is kept on kilauea at the following location:

- sharc/.uip/cat

For details, consult section 3.1 of the following link:
`http://www.cso.caltech.edu/uip/User_Guide.html`

6 SHARP Chop-Nod Mode Observing

6.1 Turn off the sweep

UIP> SWEEP /STOP

6.2 Start the chopper

UIP> SEC 300 0.925925925 4 4
or:
UIP> SEC /restart # *restart the chopper with the last tuning*

Replace 300 with the desired chopper throw in arcseconds. At the beginning of the run you will also have to set the PIDG knobs in the sidecab room, according to the values given by the UIP computer or in an excel spreadsheet from a past run. Note that you will be asked whether you want to use an older solution. Say "no" if this is not the first time, because it takes around 10 minutes to find a new solution.

Wait until chopper values stop flashing on the display (can watch on the oscilloscope).

6.3 Move to new target

UIP> observe source_name

6.4 Observing Pattern

Usually you will be doing a "coarse dither". In this case, go to observing proc. → coarse dither on the IRC. Before starting an observation, set the dither offsets to what the science PI wants (the default is -20, -20, 40, 40) and set the chop throw correctly. Before each new dither you must (a) do the hardware level and (b) update the zenith angle before pushing "Run" on the IRC.

IMPORTANT: make sure that the chopper offsets are updating on the UIP screen. (The chopper offsets are called "CHOP AZO" and are toward the left side of the UIP screen.) If the chopper offsets are not updating, Hiro or Ruisheng should be consulted. See also SHARP setup instructions for more details.

6.5 Data reduction, and monitoring the performance

See also separate notes on reduction (SHARP documentation page).

6.5.1 Adjust Chop Throw

While taking data make sure to adjust the chop throw in the coarse dither parameters so that it matches the sharpinteg/dointeg output. This usually needs to be done each time you start a new dither.

6.5.2 Also keep an eye on the HWP angles

Run the following command in the process directory:

```
idl> readsharc, '../data/sharc2-099999.fits', data, tag='HWP_ANGLE'
```

See "SHARP trouble-shooting : HWP Problems" if you have problems.

6.5.3 Check other outputs from dointeg, just in case

- The length of each left and each right should be 18-19, but typically the first left of the first HWP angle is $\sim$ 14. (This info is given in the sharpinteg output.) If it drops below 11-12, see "SHARP troubleshooting" item C.
- Keep an eye on the chopper efficiency. In a perfect world it should be $> 35\%$ for a $5'$ chop, higher for shorter chops. This doesn't always happen in reality however.

6.5.4 (optional) Inspect the images produced by dointeg

- You can use the dointeg script to look at the photometry map from each file. In this way you will be able monitor the pointing, if the source is bright and compact. This is done by seeing if the peak moves around on the 12x12 array in a consistent way during the dithering.
- Another thing one can do with the images resulting from the dointeg script is to monitor the sky noise (which shows up as DC offsets on the I maps).
- Yet another thing that one can do with the dointeg script is to monitor the signal strength, as a check for any abnormal behavior. The signal should be rougly 0.003 for a 5 Jy per beam source in good tau.

6.5.5 Miscellaneous

- You should do a scan mode pointing check every 1.5-2.0 hours, unless you have verified that the pointing is fine by running your polarimetry files through sharpinteg_2 (e.g., using the dointeg script) as described above.
- keep an eye on the DSOS to make sure all boxes are white.
- Periodically push the "save" button on the excel spreadsheet
- (optional) Polarimetry analysis: Run "doall2". This script lives in the bin directory of user sharp. You will probably have to edit the flags to get it to work. Please don't modify "doall2". Instead, make your own copy (call it "doallN" where N > 2) and modify that one. NOTE: In 2009 it was discovered that the sharpcombine code called by doall2 does not work on puuoo, so you have to ssh to kilauea to run this. Set this up in a separate window so you can check each file by just changing one number.

7 SHUTDOWN

7.1 Close the dome.

Press 'Close cycle enable'. This step takes the longest.

7.2 Park the telescope

Once it is safe to swing to the east, park the telescope:
UIP> STOW

7.3 Power off sharcii and sharp

- power switch on instrument to OFF
- power switch on HWP control box to OFF
- turn both of the HWP heaters OFF, or turn both to 5V
- alidade power controller to charge mode

7.4 DSOS

- ctrl-c to quit out of DSOSagent (window 4)
- Type: DSOSbase, then wait 10 minutes
- ctrl-c to quit out of the DSOSmonitor (window 5)
- Type: 'DSOSpower off' in window 4
- Power down driver power supplies via front panel switches 4 in each rack, 8 total

7.5 quit IRC

- exit sharcClient with File→Quit in Instr. Rem. Control window
- Type "exit" in sharcServer window (window 2)

7.6 Stop observing

UIP> SWEEP /STOP or
UIP> SEC /STOP

7.7 ^{3}He cycle

If the staff isn't doing the ^{3}He cycle, set up a delayed cycle.

7.8 Observatory problems

Report any observatory problems to the staff, SHARC II instrument problems to *sharc@submm.caltech.edu*.

7.9 Push the red observatory stop button before you leave.

8 SHARP Troubleshooting

8.1 HWP problems

The half-wave plate motion has some known failure-modes, as of Aug. 2007:

1. "analog output offset" problem: symptom is that the stored hwp angles are correct except for an offset as big as 30 degrees. This has not caused loss of data since sharp-integ will not complain.

2. "repeated angles" problem: shows up as two identical successive angles stored in the file. We think this is a PM-4 to EDAS miscommunication so that in fact the angle **did** change. This means that if the problem only happens once and goes away immediately then the data is actually fine, but it cannot be analyzed as sharp-integ will complain. This problem shows up at least once on most (but not all) nights. It seems to go away on its own, usually in a few minutes so that only one file is affected. But in June 2007 it wiped out a whole dither one night.

3. loose motor set screw: This happended in Jan 2006 and again in April 2007. The symptom is increasingly inaccurate hwp moves, eventually resulting in "-4" output on IRC screen, when the error exceed the nominal threshhold. (When the system is working, the moves are good to 0.2 degrees.) Megan and Giles know how to disassemble the system and re-tighten the set screw. Spare set screws and special Allen wrenches are available (see inventory).

4. temperature too low: The brass ring that forms the rotor of the hwp should be room temp or slightly below. Otherwise moves will be inaccurate. The only way to distinguish this problem from problem #3 is that this problem can be fixed by increasing the heat. Note that there is a concern that over-heating the hwp module may be bad for the encoder, so feel that brass surface with your hand before increasing heat beyond the recommended values.

5. "rough spots": we restrict motion to 50 117.5 because of rough spots near 0 degrees and 180 degrees. The motor usually gets stuck if it gets into these rough spots. Occasionally one of the other hwp failure modes can cause the motor to get into a rough spot. In this case, you have to get it out by turning the hwp with your hand.

6. "encoder bit-flipping": The symptom is that the encoder values flip between the correct value and multiples of 2 times the correct value. This occurred during the November 2006 run and during both of the April 2007 runs, but not in the August 2007 run. It seems intermittent. Swapping to the spare encoder in late April 2007 did not eliminate the problem.

NOTE: The IRC has a "coarse dither with iterations" script that you can run instead of "coarse dither" in case the half-wave plate acts up. This may get you through the run if the hwp set screw is getting loose and there is no expert on hand to fix the problem. There is a special sharpinteg_2 flag needed to analyze these data, however.

8.2 First "left" of first HWP position too short

SHARP IRC scripts are discussed in a separate posted document. Here are instructions for changing a parameter that should affect the length of the first "left":

On kilauea/puuoo, edit file polarimeterSingleFile.py in sharc/irc/. Change this line: "overhead = 20 # seconds before data stats" Restart IRC client and server. Use "sharcClientTest".

8.3 Chopper Problems

- bad waveform

  If you don't like the chopper waveform you can always use the /force flag in the chopper command that will force it to look for a new solution. To force the chopper to find a new solution: "sec 300 0.925925925 6 6 /force"

- mismatch between chop and nod

  If sharpinteg_2 is refusing to analyze a data file because the chop throw is too different from nominal (nominal is what you input into the IRC coarse dither window) but you want it to analyze the file anyway, then you can add the "-nc" flag to the sharp_integ2 call. This will bypass this particular check.

- If its flashing "FIXED" on the UIP screen, you might typing "FOCUS /constant" at the UIP prompt.

- typing any `sec` command returns the phrase TRANSIENT.

  You can restart the antenna computer.
  UIP> ant /restart
  This will fix the chopper, but you will need to restart at least the sharcServer, sharcClient, and the DSOS stuff.

8.4 Problems with the SHARC-II camera

These can often be solved by consulting the SHARC-II web page (link is given at the top of the first page of this document).

8.5 Can't point at Jupiter's moons Callisto and Ganymede

Try appending the /jpl flag

8.6 Intruder alarm goes off and there is no intruder

shutter /alarmoff

8.7 Problems with the SHARC-II camera

Problems with SHARC-II can often be solved by consulting the SHARC-II web page (link is given at the top of this document).

8.8 Problems with focusing

If focusing doesn't seem to work, make sure you have focus mode constant on the display. If not, type:
UIP> focus /constant