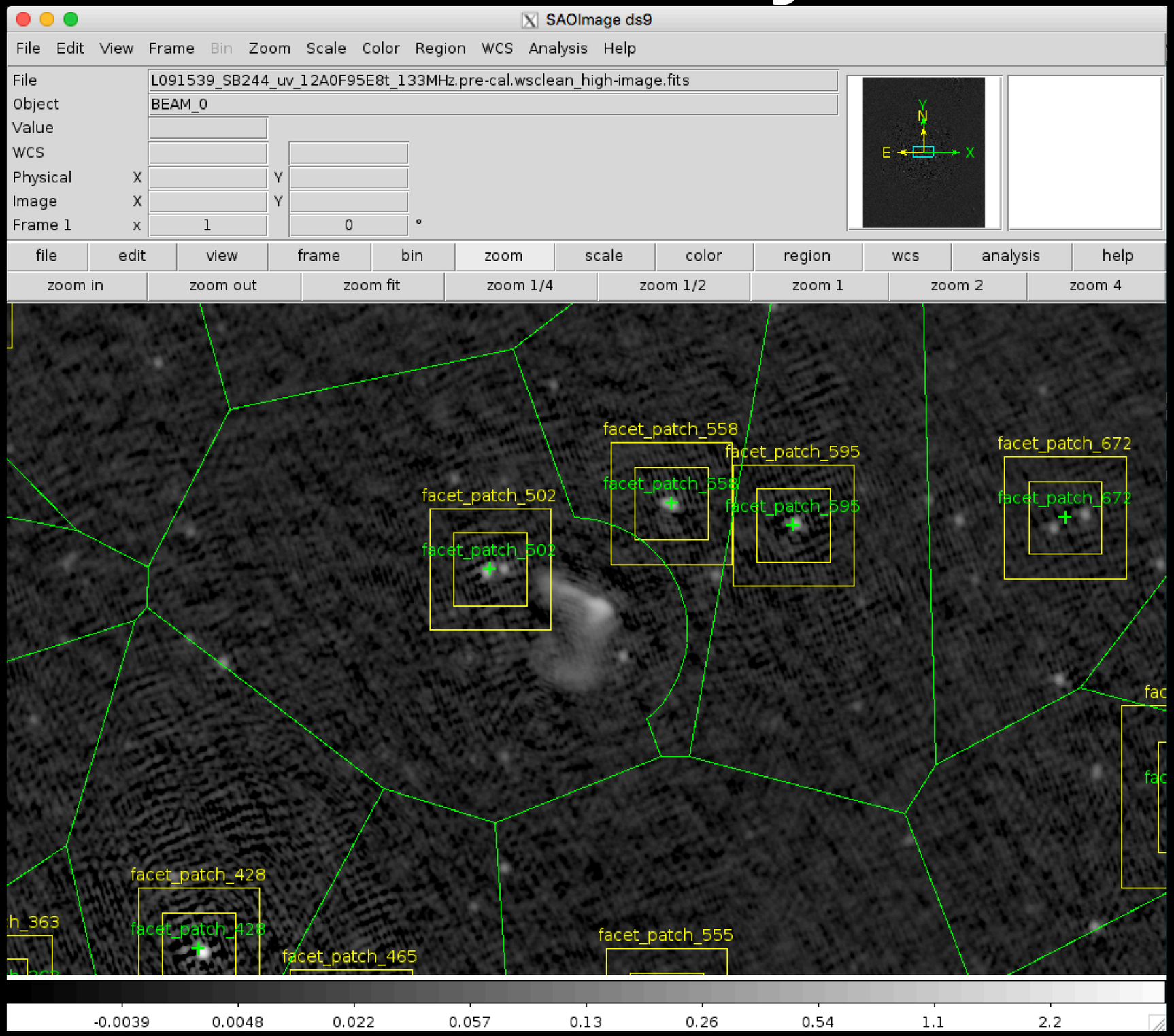
Tutorial:
Direction-Dependent Calibration
Part 2

Previously…


SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File L091539_SB244_uv_12A0F95E8t_133MHz.pre-cal.wsclean_high-image.fits
Object BEAM_0
Value
WCS
Physical X Y
Image X Y
Frame 1 x 1 0 °
N
E
X
file edit view frame bin zoom scale color region wcs analysis help
zoom in zoom out zoom fit zoom 1/4 zoom 1/2 zoom 1 zoom 2 zoom 4
facet_patch_558
facet_patch_595
facet_patch_672
facet_patch_502
facet_patch_428
facet_patch_465
facet_patch_555
-0.0039 0.0048 0.022 0.057 0.13 0.26 0.54 1.1 2.2

Continuing the Run

- Now that DDE calibrators and facet layout have been checked, we can restart Factor

- Edit the parset and set:

```
[global]
interactive = False
```

- Now restart Factor with the same command as before:

reattach to the screen (if needed)

```
$ screen -r
[Answer “n” to prompt if you haven’t already done so]
$ runfactor -v factor.parset
```

Selfcal Strategy

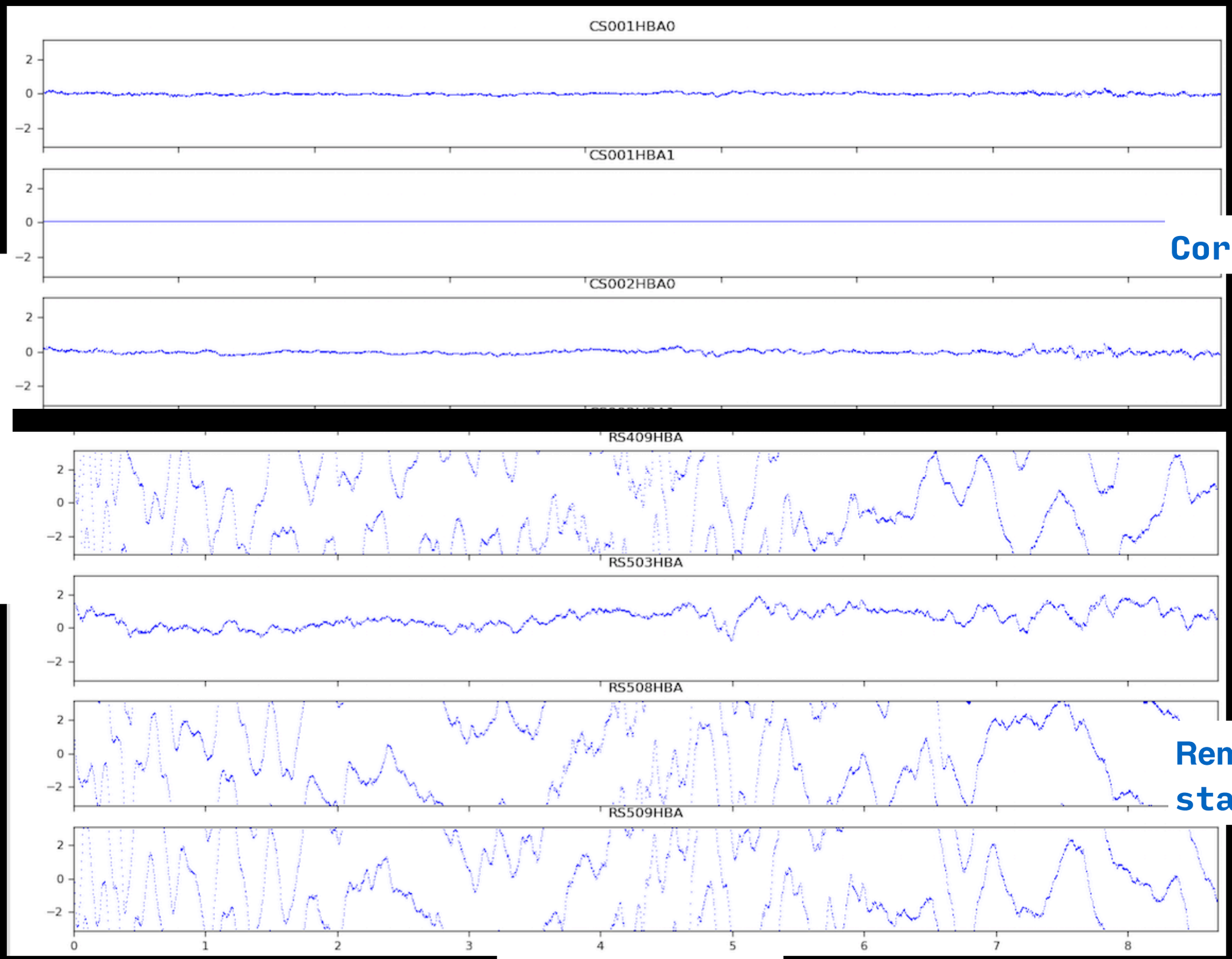
- Selfcal is done on each calibrator to improve its model and DDE corrections

- Factor minimizes the number of free parameters solved for during selfcal in order to avoid overfitting:

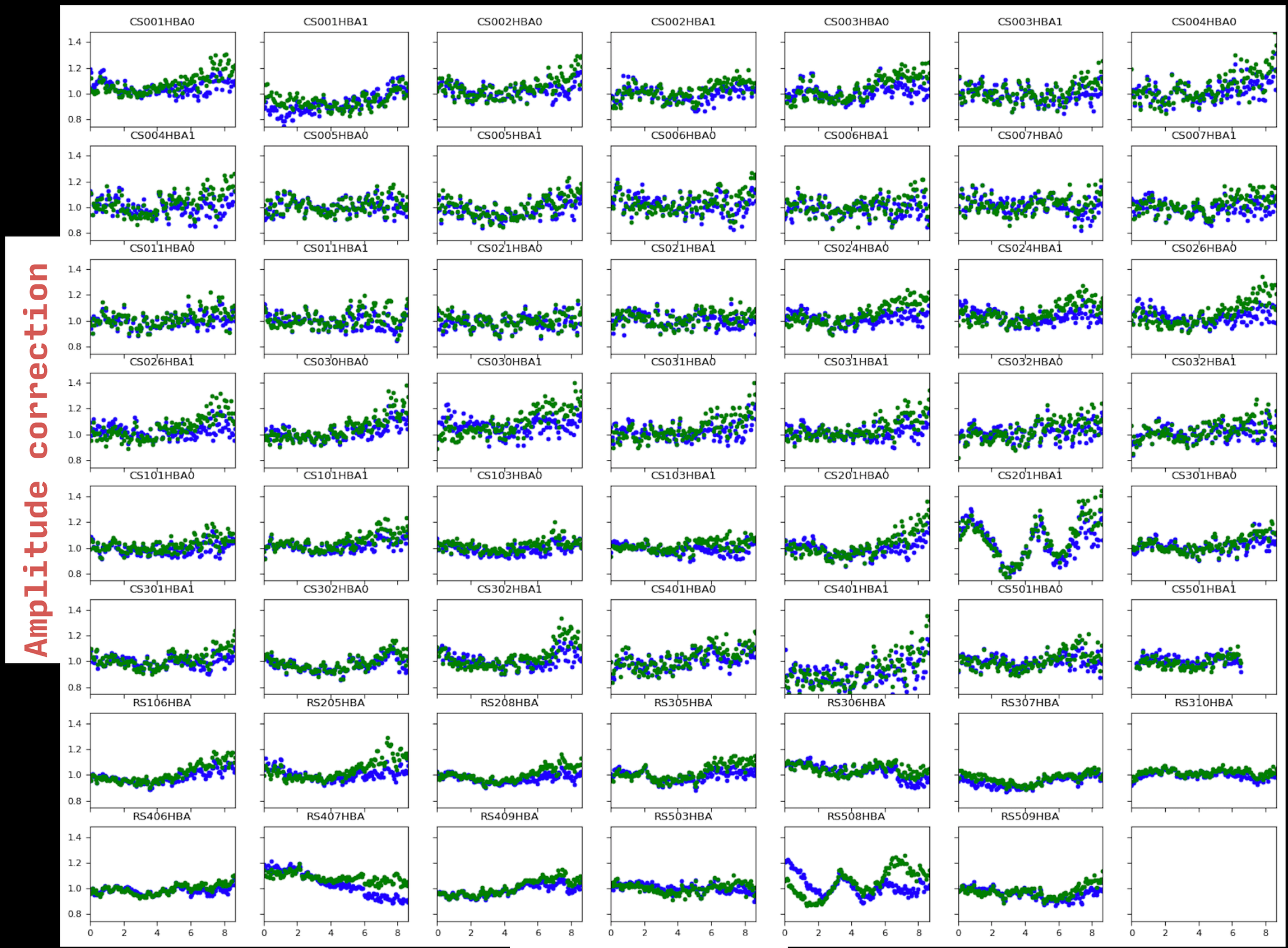
  - **Fast phases** (TEC): one solution every ~10-20 seconds and ~10 MHz to track rapid changes due to ionosphere

  - **Slow gains** (amp + phase): one solution every ~10-20 minutes and ~2 MHz to correct for beam effects

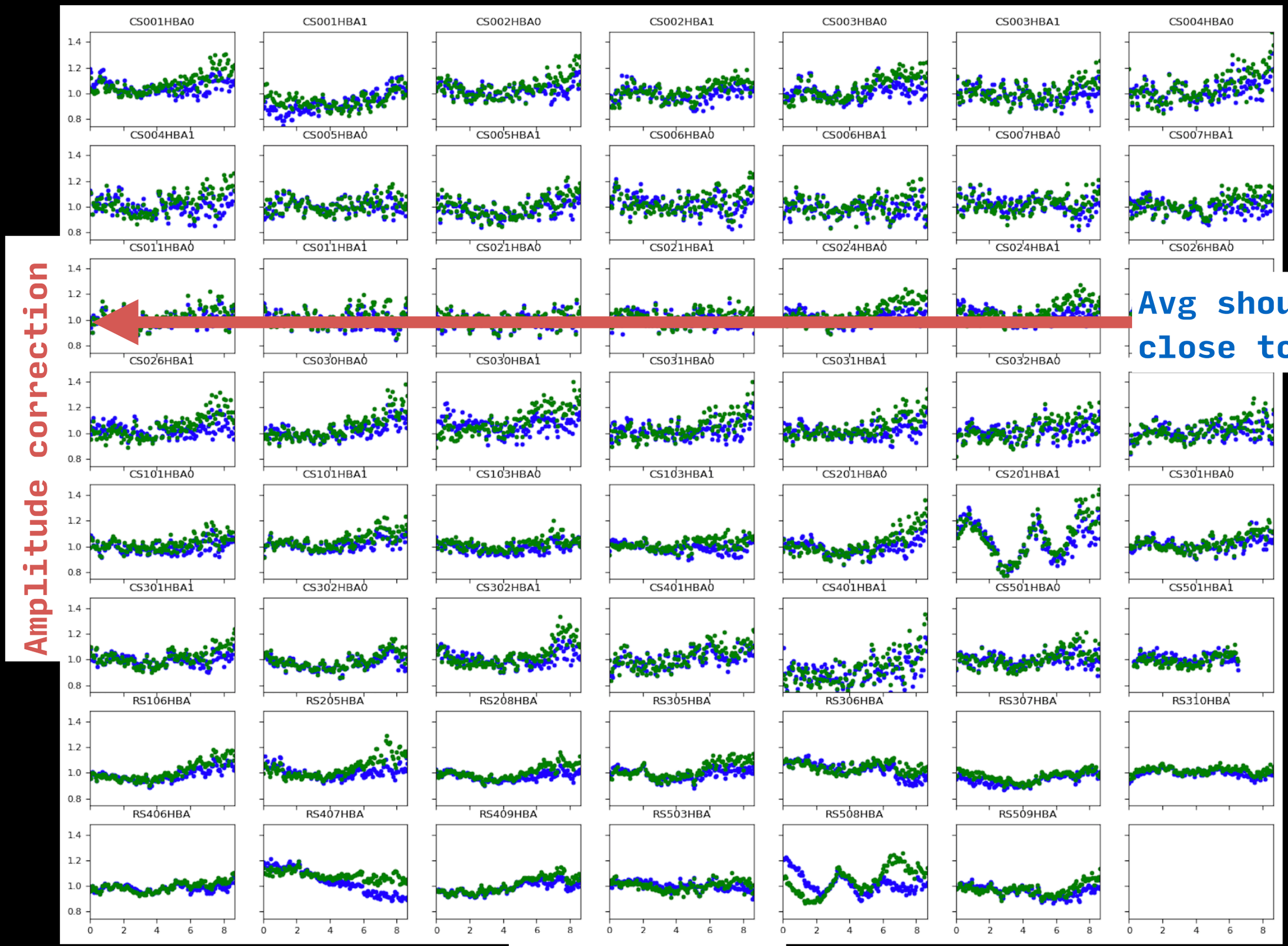
TEC (from fast-phases): correction for ionospheric effects



Amplitudes (from slow-gains): correction for beam effects

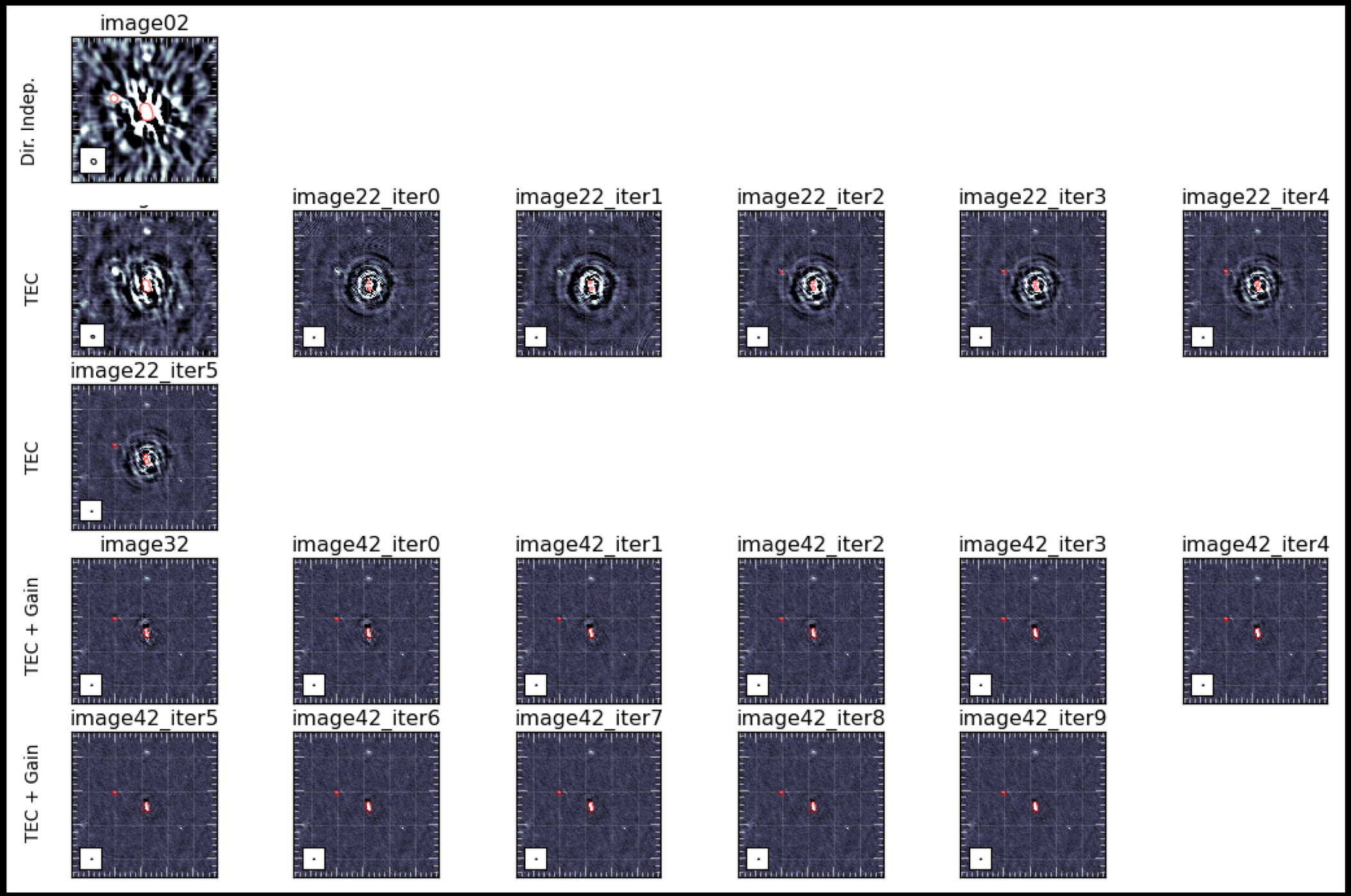


Amplitudes (from slow-gains): correction for beam effects



Self Calibration

Self Calibration



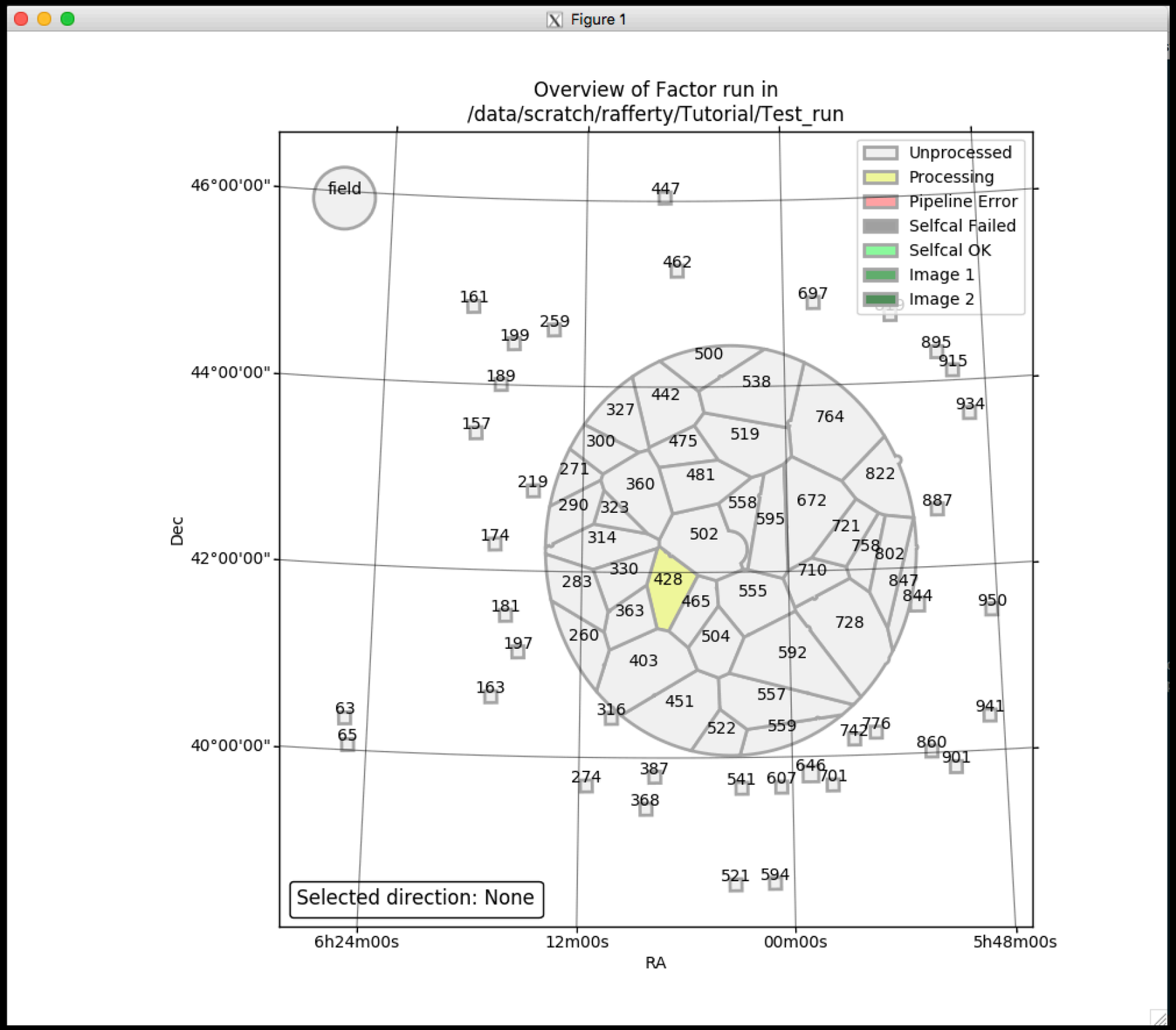
Checking Progress

- Once Factor has started, you can check the progress of a run with the **`checkfactor`** tool:

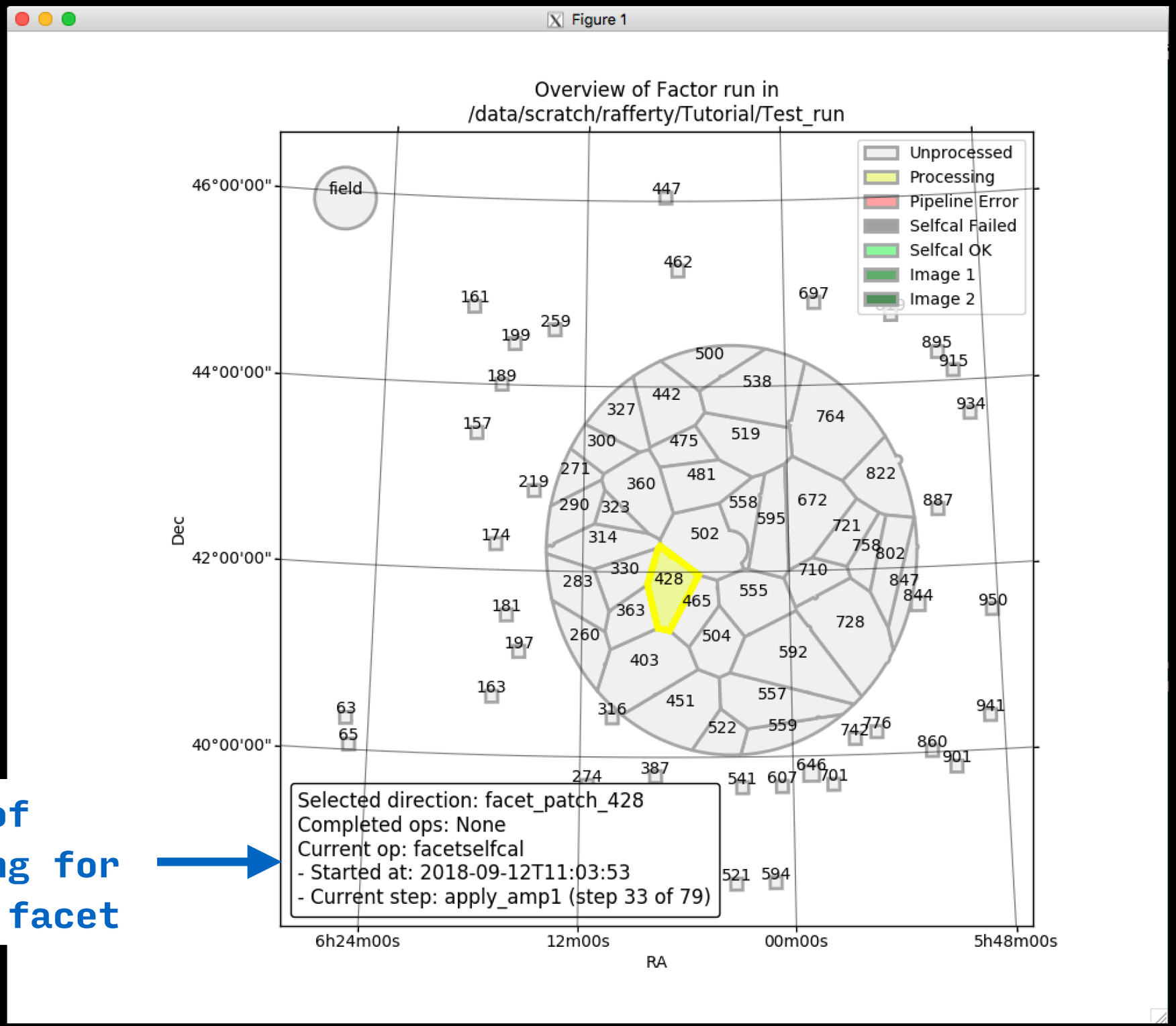
```
[Outside of screen - exit with CTRL-A CTRL-D if needed]
$ checkfactor factor.parset &

INFO - factor:progress - Plotting directions...
INFO - factor:progress - Left-click on a direction to select it and see its current state
INFO - factor:progress - Right-click on a direction to deselect it
INFO - factor:progress - (In both cases, pan/zoom mode must be off)
INFO - factor:progress - Press "c" to display calibrator selfcal images for selected direction
INFO - factor:progress - Press "i" to display facet image for selected direction
INFO - factor:progress - Press "v" to display facet verify image for selected direction
INFO - factor:progress - Press "t" to display TEC solutions for selected direction
INFO - factor:progress - Press "g" to display Gain solutions for selected direction
INFO - factor:progress - Press "u" to update display (display is updated automatically every minute)
INFO - factor:progress - Press "h" to repeat these instructions on this terminal
```

- After a short time, a window should appear showing the facet layout

Checking Progress



Checking Progress



Summary of processing for selected facet

Checking Progress

- Click on the yellow facet (the one currently being processed)
- Hit the “c” key to see the calibrator images made during selfcal

Checking Progress

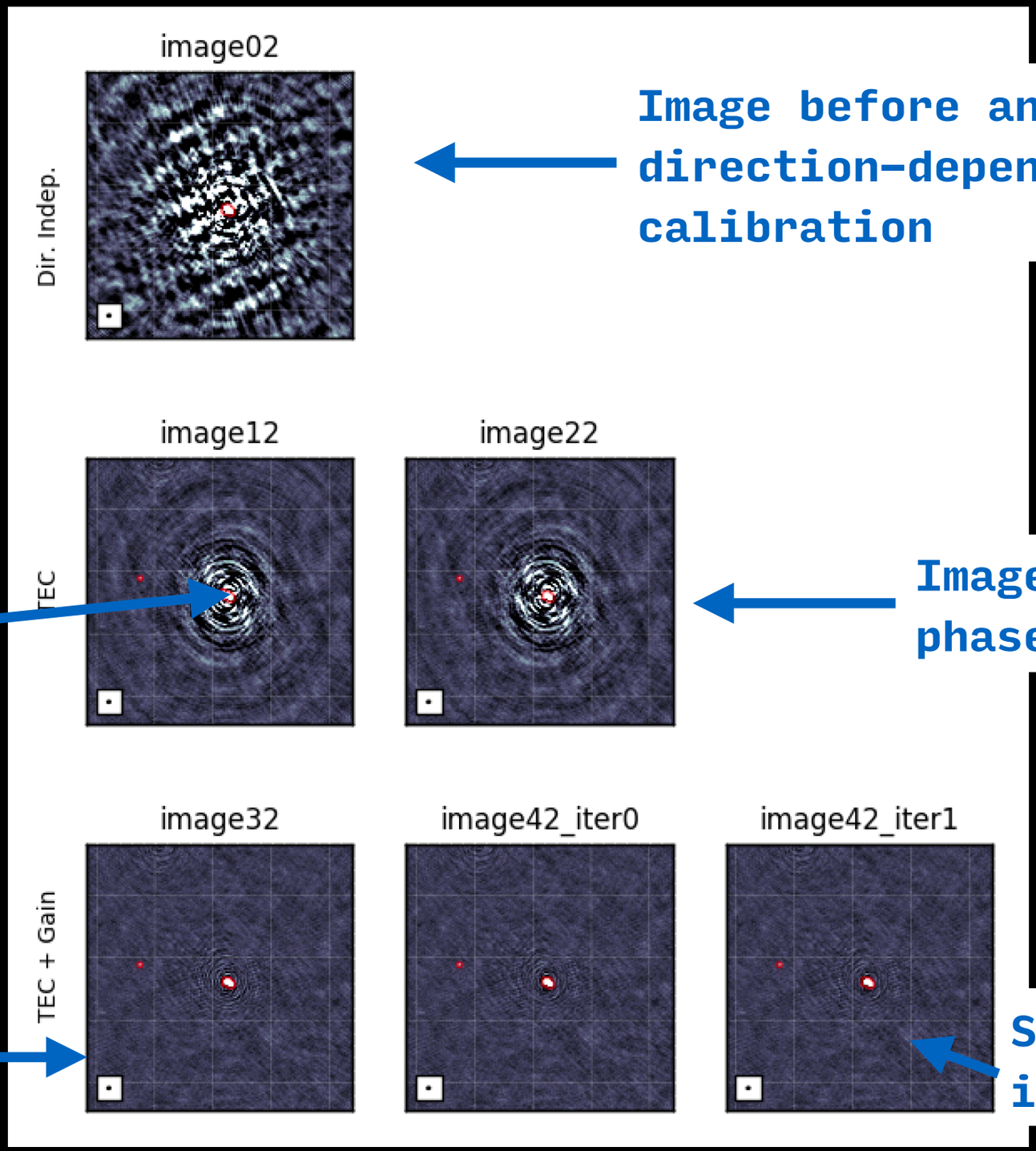


Image before any direction-dependent calibration

Images after fast-phase calibrations

clean mask in red

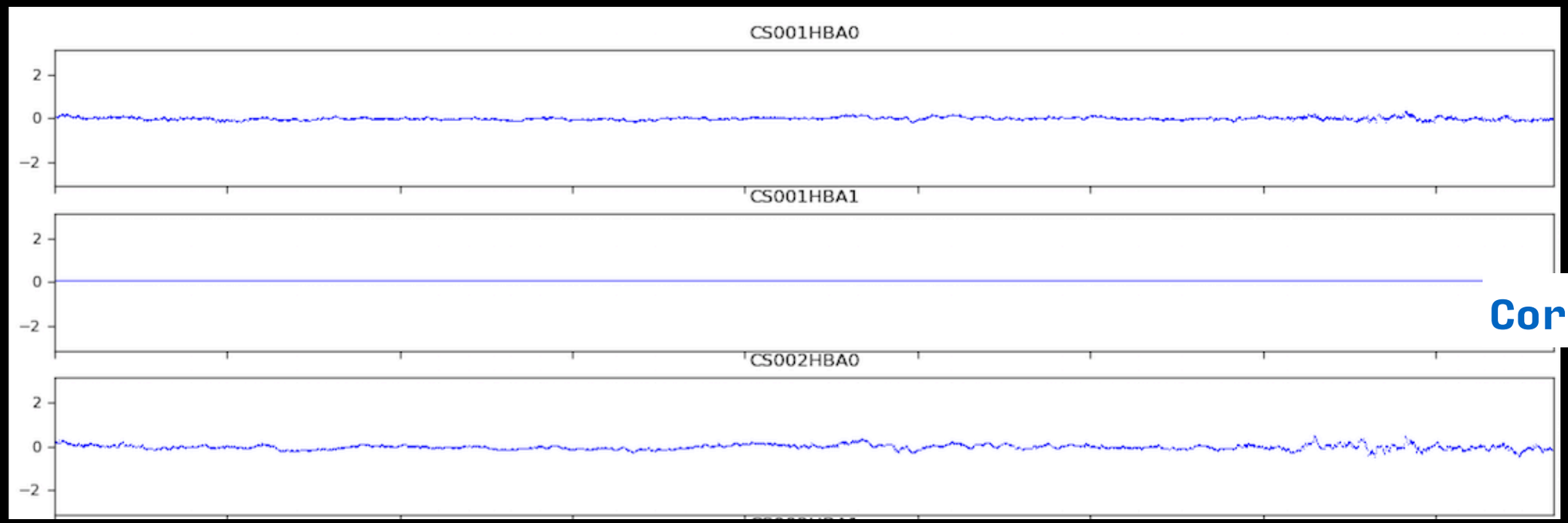
Images after three slow-gain calibrations

Stops after no more improvement is seen

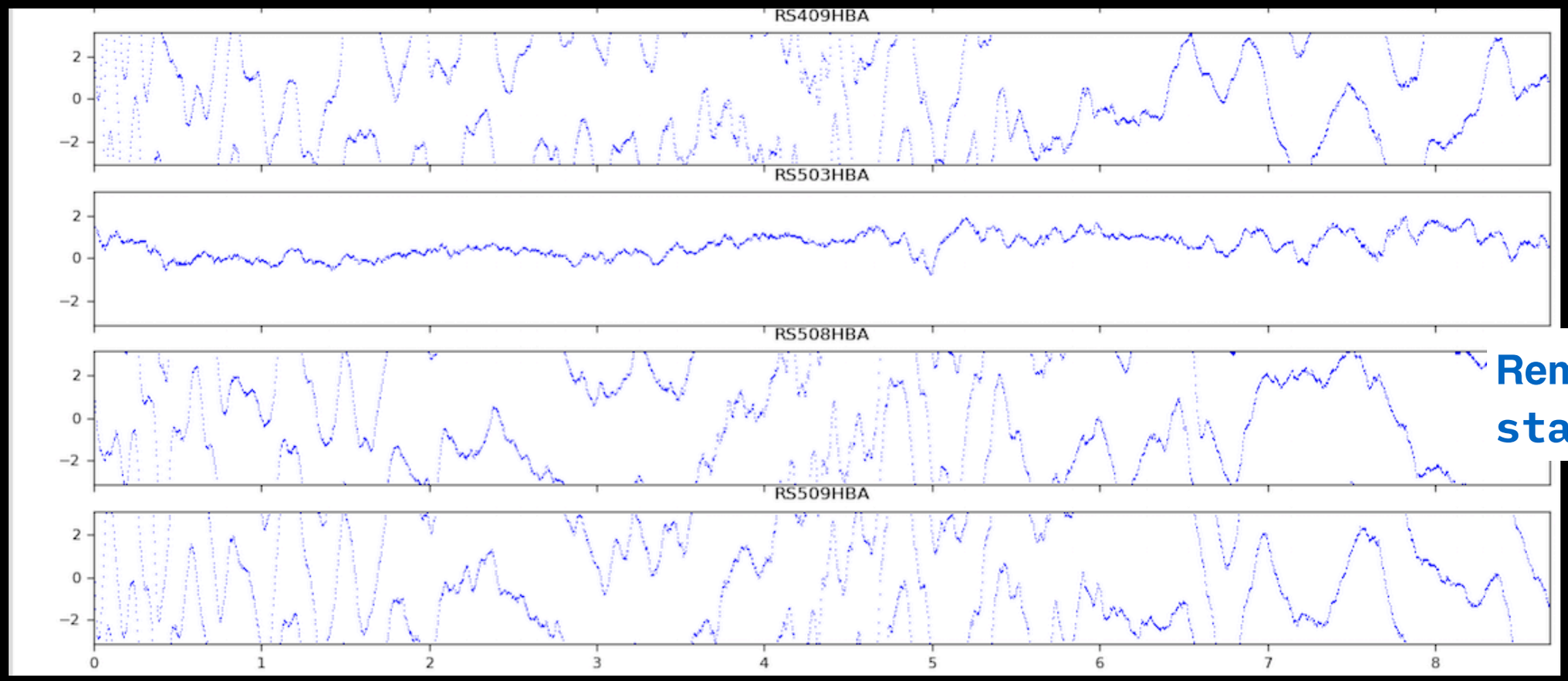
Checking Progress

- Hit the “t” key to see the TEC solutions made during selfcal (the main selfcal loop must be finished first)

TEC (from fast-phases): correction for ionospheric effects

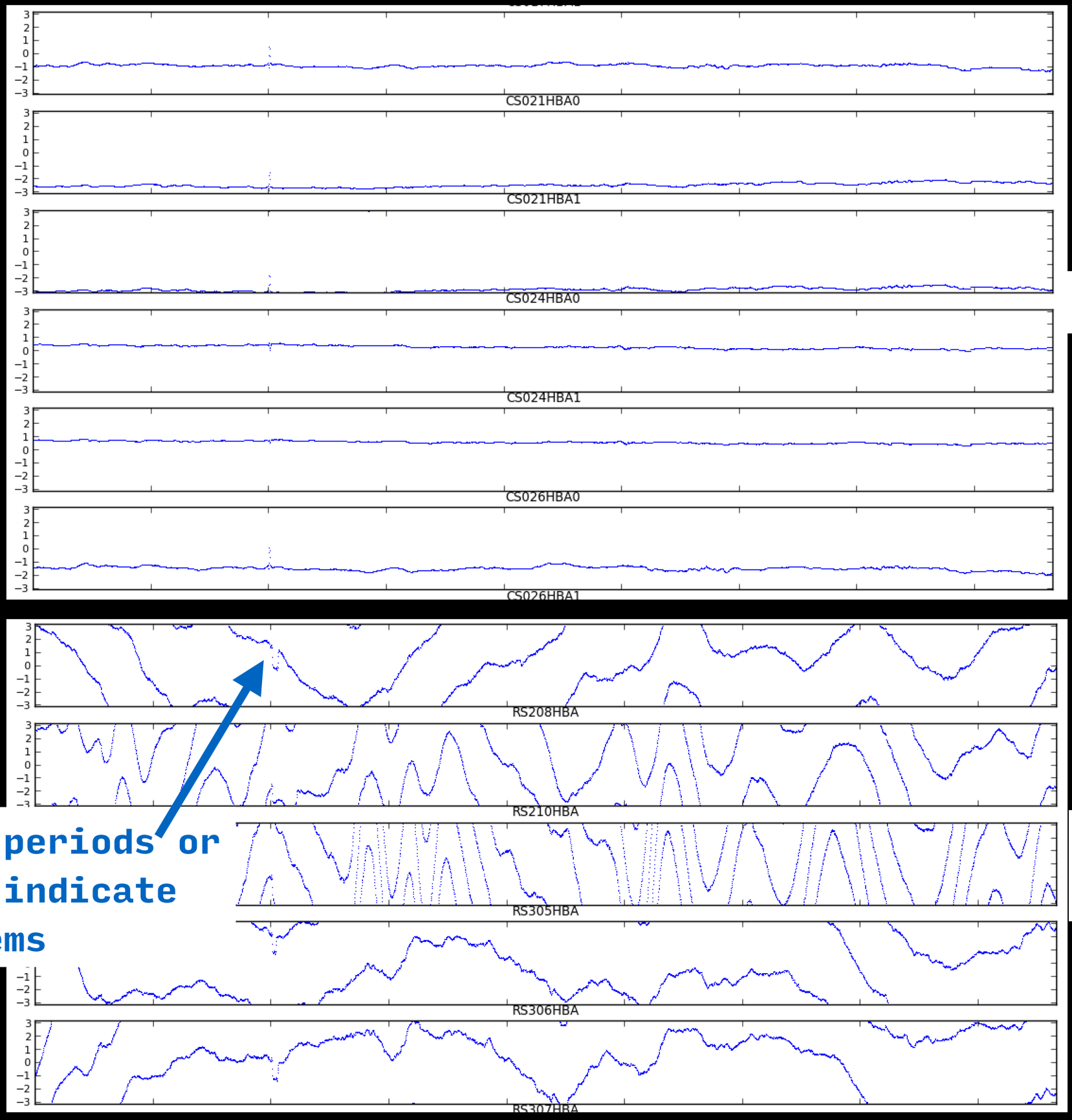


Core stations



Remote stations

TEC (from fast-phases): correction for ionospheric effects



Core stations

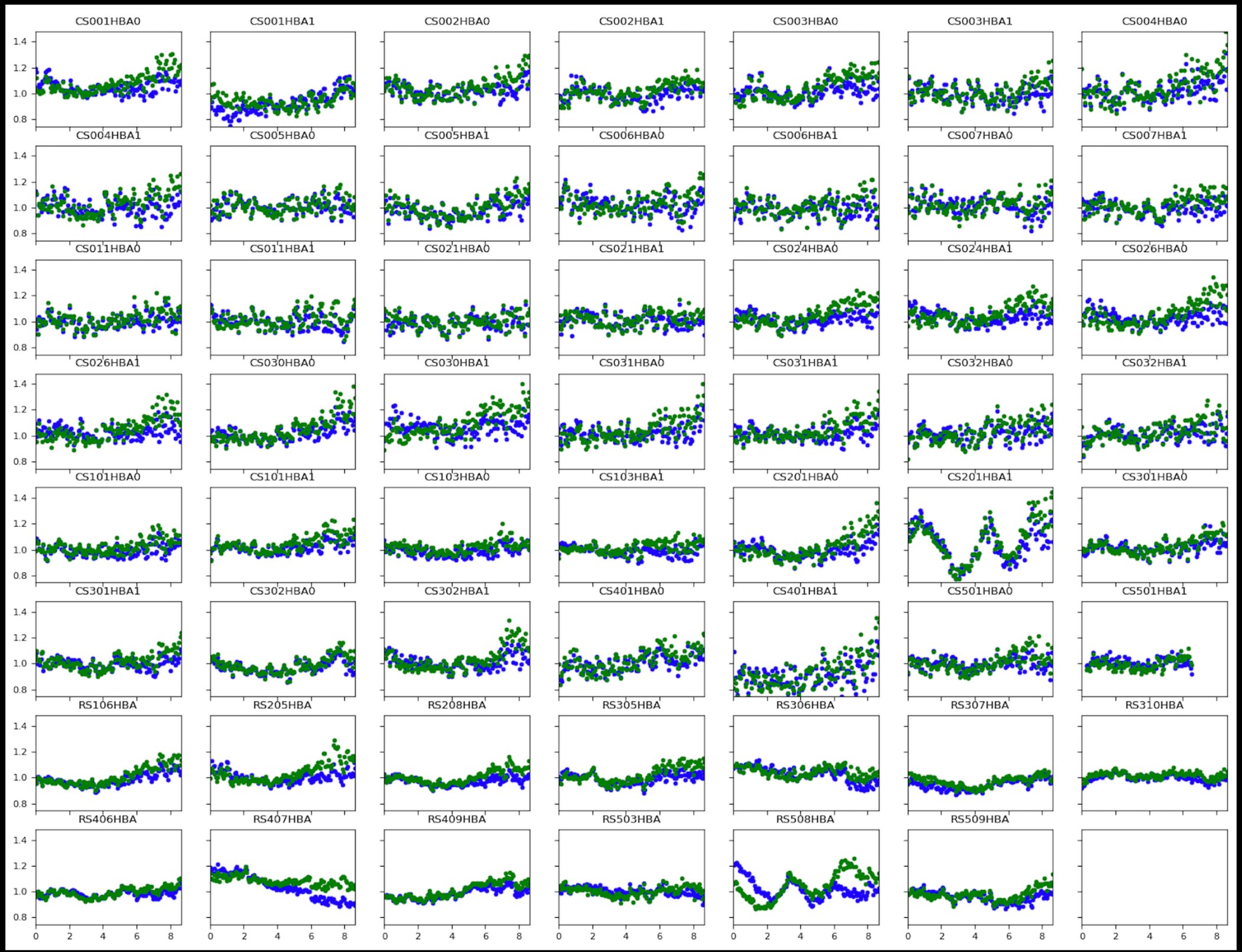
Noisy periods or jumps indicate problems

Remote stations

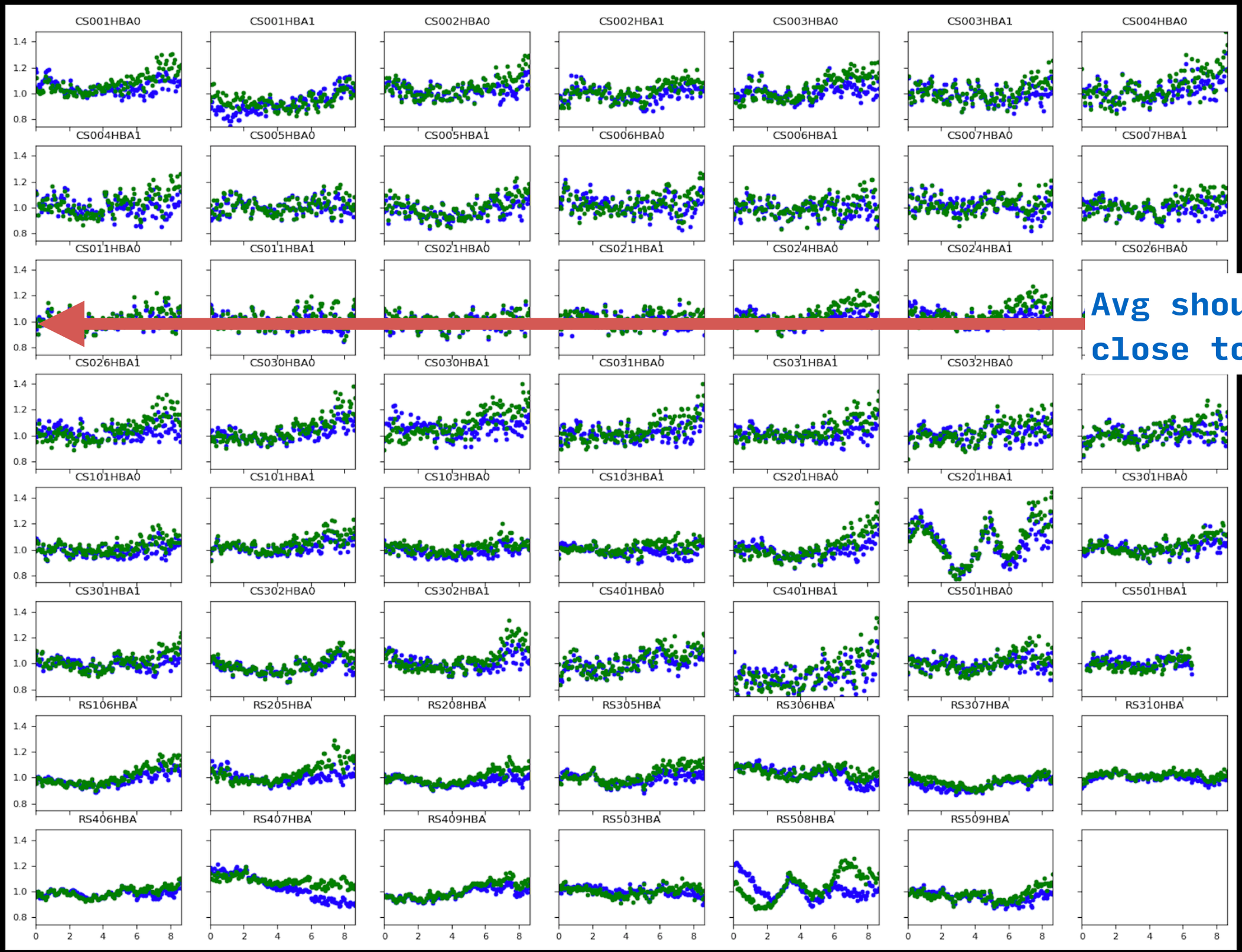
Checking Progress

- Hit the “g” key to see the Gain solutions made during selfcal (the main selfcal loop must be finished first)

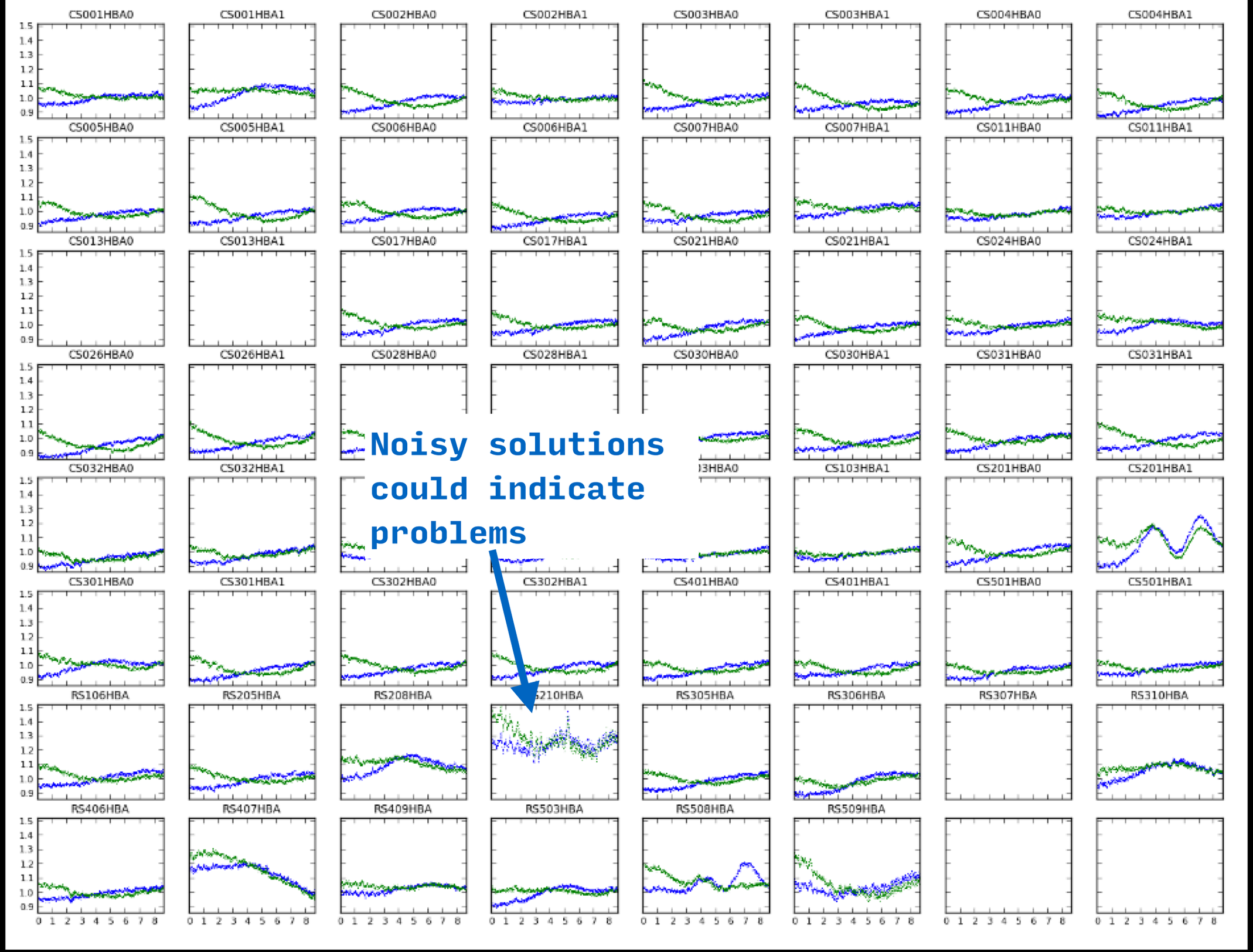
Amplitudes (from slow-gains): correction for beam effects



Amplitudes (from slow-gains): correction for beam effects



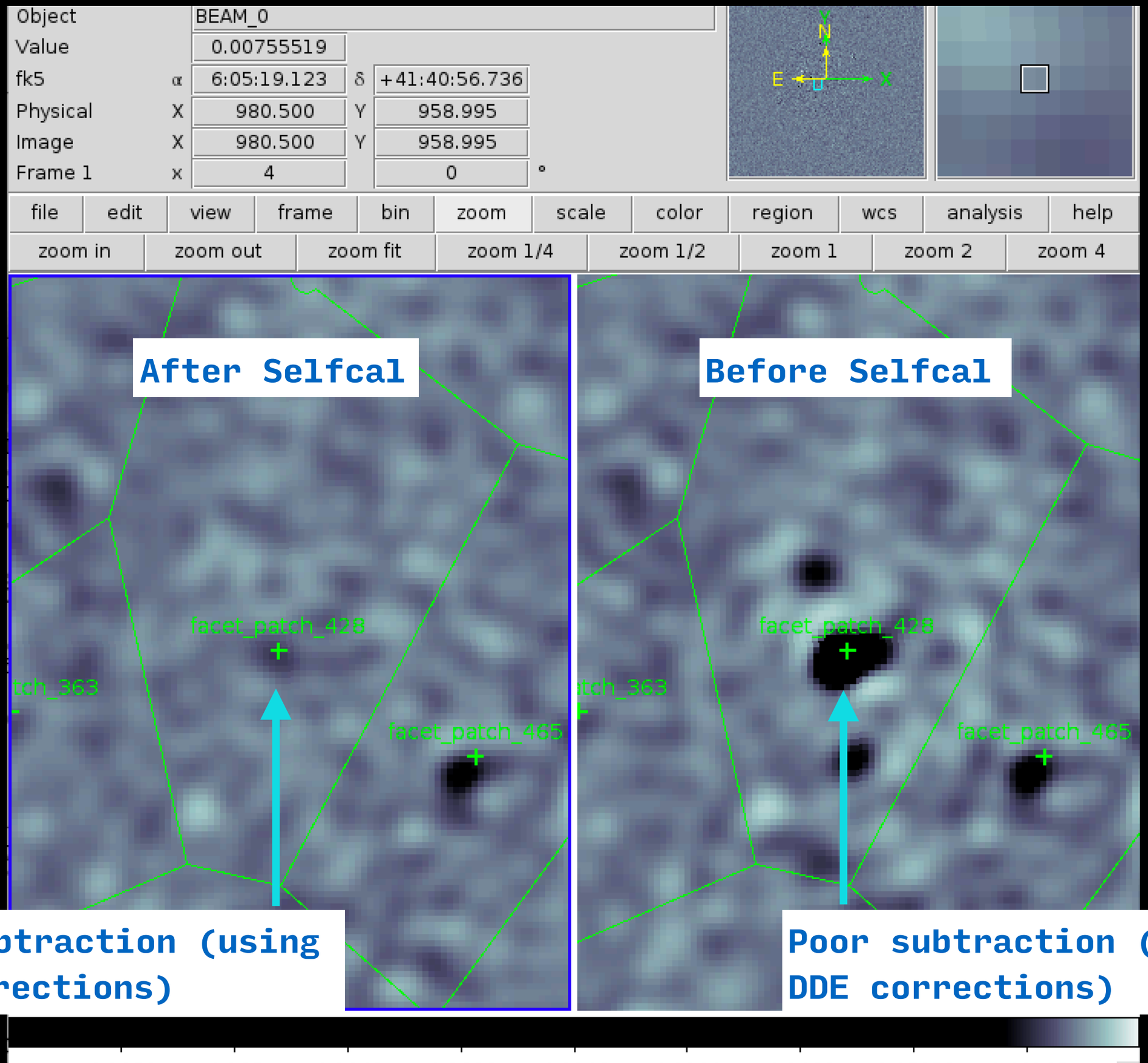
Amplitudes (from slow-gains): correction for beam effects



Verifying Selfcal

- Hit the “v” key to open the selfcal verification image in ds9 (the facetselfcal operation must be finished first). This may take a few seconds…

Residual (source-subtracted) images



Continue Processing

- Let Factor continue to process in the screen overnight
- It will selfcal three directions, image them, and stop
- In the morning, we can start from there…