

Analysis in the *uv*-plane



Arancha Castro-Carrizo

image plane

uv plane

brightness (x,y)

$\longleftrightarrow \mathcal{FT} \longrightarrow$

visibility (u,v)

What we want
to obtain

What we
obtain with an
interferometer

Calibration
Gridding
FFT
Cleaning

image plane

brightness (x,y)

uv plane

visibility (u,v) ^{instr}

$\approx$

Calibration

brightness (x,y) ^{uv}

Gridding

FFT

Cleaning

visibility (u,v)

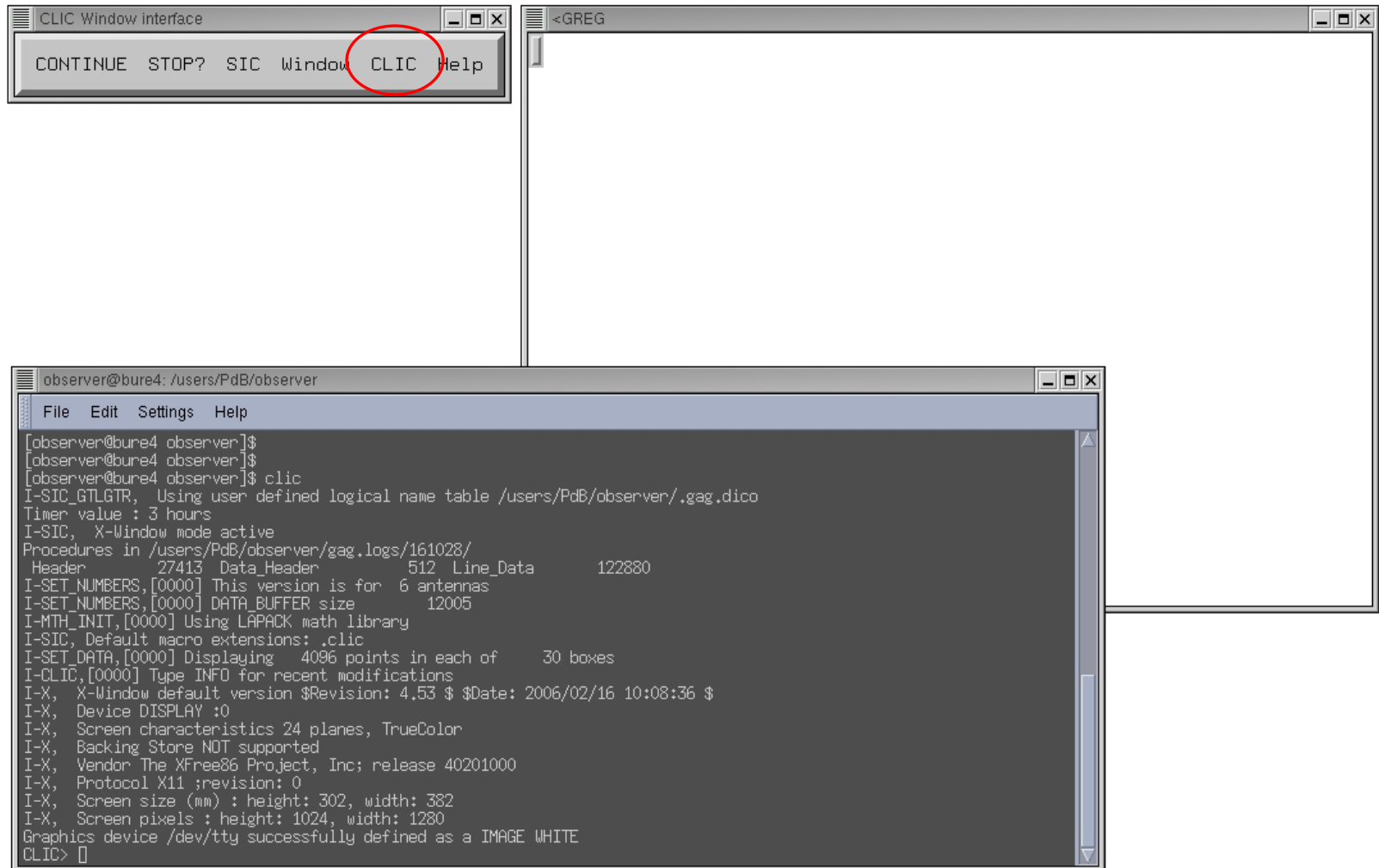
- Data processed enough to have removed all instrumental contribution

- Data raw enough to access to observational characteristics: baseline, scan, weight, etc

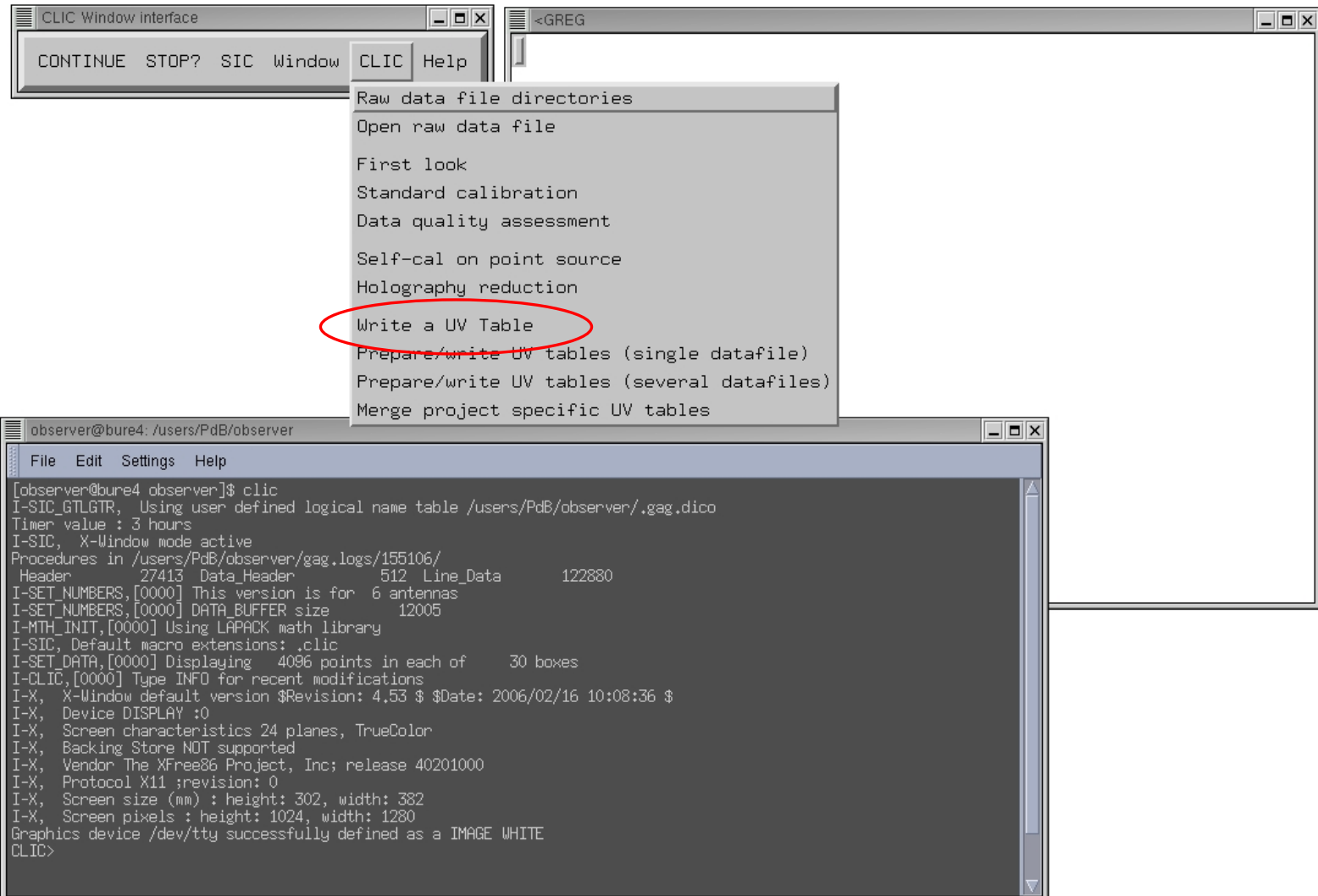
- Data not yet affected by the 'imaging process': assumptions, interpolations, computations, etc

Let's create a table ("mytable".uvt),
in CLIC

Creating a *uv*-table; **CLIC**



Creating a *uv*-table; CLIC



Creating a *uv*-table; CLIC

Simple UV Table creation

GO ABORT HELP

CREATE THE TABLE

Use atm. phase correction? ☐ Yes

Input Data File Name ? /project/qd12/20-oct-2006-qd12.hpb File

Output UV Table Name ? ~/arancha/mitabla

New Table? ☐ Yes

Source Name ? Betelgeuse

R.A. & Dec. Offsets (for Mosaics)? 0 0

First and last scan ? 0 1000

Min. Data quality ? AVERAGE Choices

Receiver number ? 1 Choices

Line or Continuum ? LINE Choices

Band Used ? USB Choices

Use L01 ? ☐ Yes

Use L02 ? ☐ Yes

Use L03 ? ☐ No

Use L04 ? ☐ No

Use L05 ? ☐ No

Use L06 ? ☐ No

Change line parameter ? ☐ No

Resample spectral data ? ☐ No

Line parameters Line Line parameters Help

Resampling parameters Resampling Resampling parameters Help

CLIC Window

CONTINUE

observer@

File Edit

[observer@b
[observer@b
I-SIC_GTLGT
Timer value
I-SIC, X-W
Procedures
Header
I-SET_NUMBE
I-SET_NUMBE
I-MTH_INIT,
I-SIC, Defa
I-SET_DATA,
I-CLIC,[000
I-X, X-Win
I-X, Devic
I-X, Scree
I-X, Backi
I-X, Vendo
I-X, Proto
I-X, Scree
I-X, Scree
Graphics de
CLIC>
CLIC>]

```
emacs@bure4
File Edit Options Buffers Tools Help

mitabla.uvt-table.clic

file in "/project/qd12/13-sep-2006-qd12.hpb"

set default
set scan 0 10000
set offset 0 0
set receiver 1
set quality AVERAGE
set weight tsys on
set weight calibration on
set phase antenna atmospher internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on
!
set selection LINE USB 101 and 102
find /proc corr /sou Betelgeuse
table ~/arancha/mitabla.uvt new /resample 40 20 -30 2 V

--:-- mitabla.uvt-table.clic (Text)--L3--All-----
Wrote /users/PdB/observer/arancha/mitabla.uvt-table.clic
```

CLIC Window inte
CONTINUE S

```
observer@bure4
File Edit Set
[observer@bure4
[observer@bure4
I-SIC_GTLGTR, L
Timer value : 3
I-SIC, X-Window
Procedures in /L
Header
I-SET_NUMBERS,[C
I-SET_NUMBERS,[C
I-MTH_INIT,[0000
I-SIC, Default
I-SET_DATA,[0000
I-CLIC,[0000] T
I-X, X-Window c
I-X, Device DIS
I-X, Screen cha
I-X, Backing St
I-X, Vendor The
I-X, Protocol >
I-X, Screen siz
I-X, Screen pi
Graphics device
CLIC>
CLIC> ]
```

Simple UV Table creation

GO ABORT HELP

CREATE THE TABLE

Use atm. phase correction? ☐ Yes

Input Data File Name ? /project/qd12/31-nov-2006-qd12.hpb File

Output UV Table Name ? ~/arancha/mitabla

New Table? ☐ No

Source Name ? Betelgeuse

R.A. & Dec. Offsets (for Mosaics)? 0 0

First and last scan ? 0 1000

Min. Data quality ? AVERAGE Choices

Receiver number ? 1 Choices

Line or Continuum ? LINE Choices

Band Used ? USB Choices

Use L01 ? ☒ Yes

Use L02 ? ☐ Yes

Use L03 ? ☐ No

Use L04 ? ☐ No

Use L05 ? ☐ No

Use L06 ? ☐ No

Change line parameter ? ☐ No

Resample spectral data ? ☐ No

Line parameters Line Line parameters Help

Resampling parameters Resampling Resampling parameters Help

CLIC Window

CONTINUE

observer@

File Edit

[observer@b
[observer@b
I-SIC_GTLGT
Timer value
I-SIC, X-W
Procedures
Header
I-SET_NUMBE
I-SET_NUMBE
I-MTH_INIT,
I-SIC, Defa
I-SET_DATA,
I-CLIC,[000
I-X, X-Win
I-X, Devic
I-X, Scree
I-X, Backi
I-X, Vendo
I-X, Proto
I-X, Scree
I-X, Scree
Graphics de
CLIC>
CLIC>]

2nd data set

```
emacs@bure4
File Edit Options Buffers Tools Help

mitabla.uvt-table.clc

file in "/project/qd12/13-sep-2006-qd12.hpb"
!
set default
set scan 0 10000
set offset 0 0
set receiver 1
set quality AVERAGE
set weight tsys on
set weight calibration on
set phase antenna atmospher internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on
!
set selection LINE USB 101 and 102
find /proc corr /sou Betelgeuse
table ~/arancha/mitabla.uvt new /resample 40 20 -30 2 V
!
file in "/project/qd12/13-oct-2006-qd12.hpb"
!
set default
set scan 0 10000
set offset 0 0
set receiver 1
set quality AVERAGE
set weight tsys on
set weight calibration on
set phase antenna atmospher internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on
!
set selection LINE USB 101 and 102
find /proc corr /sou Betelgeuse
table ~/arancha/mitabla.uvt █

--:-- mitabla.uvt-table.clc (Text)--L38--All-----
Wrote /users/PdB/observer/arancha/mitabla.uvt-table.clc
```

The image shows a screenshot of an Emacs editor window. The title bar at the top reads "emacs@bure4". Below the title bar is a menu bar with the following items: "File", "Edit", "Options", "Buffers", "Tools", and "Help". Underneath the menu bar is a toolbar containing various icons for file operations like opening, saving, and deleting, as well as editing tools like undo, redo, and search. The main text area of the window contains a configuration file named "mitabla.uvt-table.clic". The file starts with a dashed line, followed by the filename. Then, it contains a series of "set" commands for configuring the observation, including scan range, offset, receiver, quality, weights, and phase. It also includes a "find" command for Betelgeuse and a "table" command to create a new table with specific frequency and resampling parameters. The last line of the configuration is another dashed line. At the bottom of the window, a status bar shows the current file name "mitabla.uvt-table.clic", the file type "(Text)", and the current line and column information "--L9--A11--".

```
mitabla.uvt-table.clic

file in "/project/qd12/13-sep-2006-qd12.hpb"

set default
set scan 0 10000
set offset 0 0
set receiver 1
set quality AVERAGE
set weight tsys on
set weight calibration on
set phase antenna atmospher internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on
!
set selection LINE USB 101 and 102
find /proc corr /sou Betelgeuse
table ~/arancha/mitabla.uvt new /freq C0(1-0) 115271.204 /resample 40 20 -30 2 V
!
```

--:-- mitabla.uvt-table.clic (Text)--L9--A11--

```
observer@bure4: /project/qa26
File Edit Settings Help
CLIC> help table
CLIC\TABLE Name [OLD|NEW] [/COMPRESS tmax uvmax]
[/RESAMPLE nc ref val inc code shape width] [/FFT]
[/FREQUENCY name rest-freq] [/DROP n1 n2]
[/NOCHECK [SOURCE|POINTING|PHASE|EPOCH]]

This command will create an UV data Table from the current index. is
not given, the most recently created table will be extended. Next argu-
ment may be OLD (default value if not specified) to extend an existing
table, or NEW to create a new table.

The bands and subbands used must have been given by the command SET SE-
LECTION. The weighting mode can be modified by the command SET WEIGHTS.

TABLE /RESAMPLE nc ref val inc code [shape width /FFT]

Option /RESAMPLE enables to resample data on a new spectral grid
(for line data). 'nc' is the output number of channels, 'ref' the
reference channel, 'val' the value of velocity or frequency offset
(with respect to the rest frequency) at the reference channel, 'inc'
the resolution, 'code' is "V" if the value 'val' and the resolution
'inc' are in velocity units, "F" for frequency units.

The reference channel thus corresponds to the given 'val' velocity,
or to the offset 'val' in MHz from the rest frequency present in the
header or modified by option /FREQUENCY.

Resampling is done by default through linear interpolation of input
channel data. Resampling may also be done (using option /FFT) in
Fourier space by cut-off or extrapolation (by zeroes) of the Fourier
components, after deconvolution by the channel response of the cor-
relator (due to on-line apodization), and followed by reconvolution
to produce frequency channels of the given 'shape' and 'width'. Al-
lowed shapes are:
TBox = a box in delay space (unapodized correlator)
Ppar = a parabola in delay space (apodized correlator) (the de-
fault)
FBox = a box in frequency space (square filter)
FTri = a triangle in frequency space (Hanning smoothed square fil-
ter)
The width is the channel width in units of channel separation (de-
fault 1).

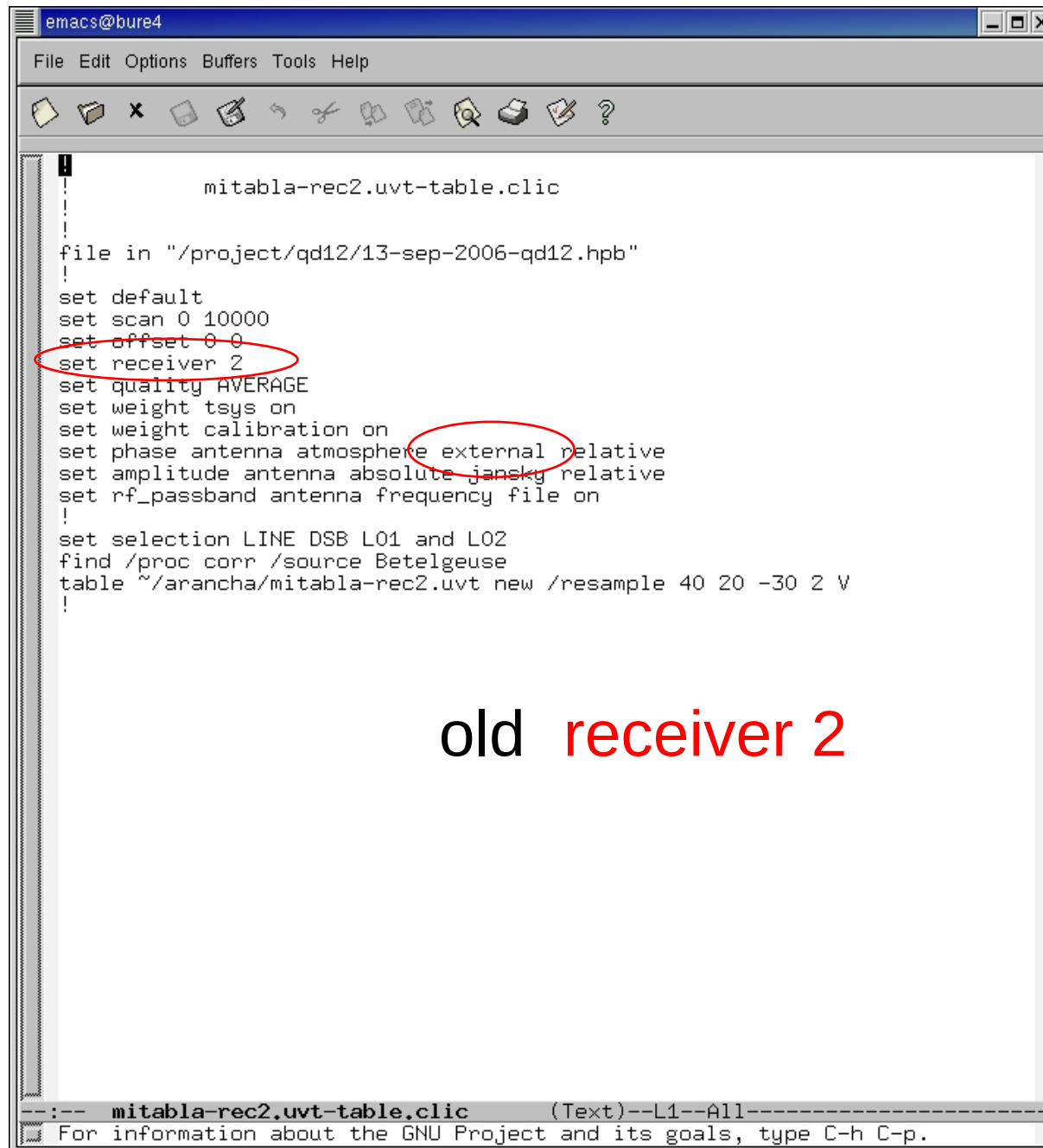
Option /FFT is not recommended when joining together several sub-
bands to produce a single spectrum, with a limited number of broad
channels. In those cases using the FFT could produce a spectrum
with "holes" at the points between subbands with limited overlap.

TABLE /FREQUENCY name rest-freq

Option /FREQUENCY is used to redefine the rest frequency (in MHz)
and line name for the output table. The velocity scale is computed
accordingly. This rest frequency will correspond to the reference
channel in option RESAMPLE.

TABLE /NOCHECK [SOURCE|POINTING|PHASE|EPOCH]

When processing each scan, CLIC checks whether a number of position
```

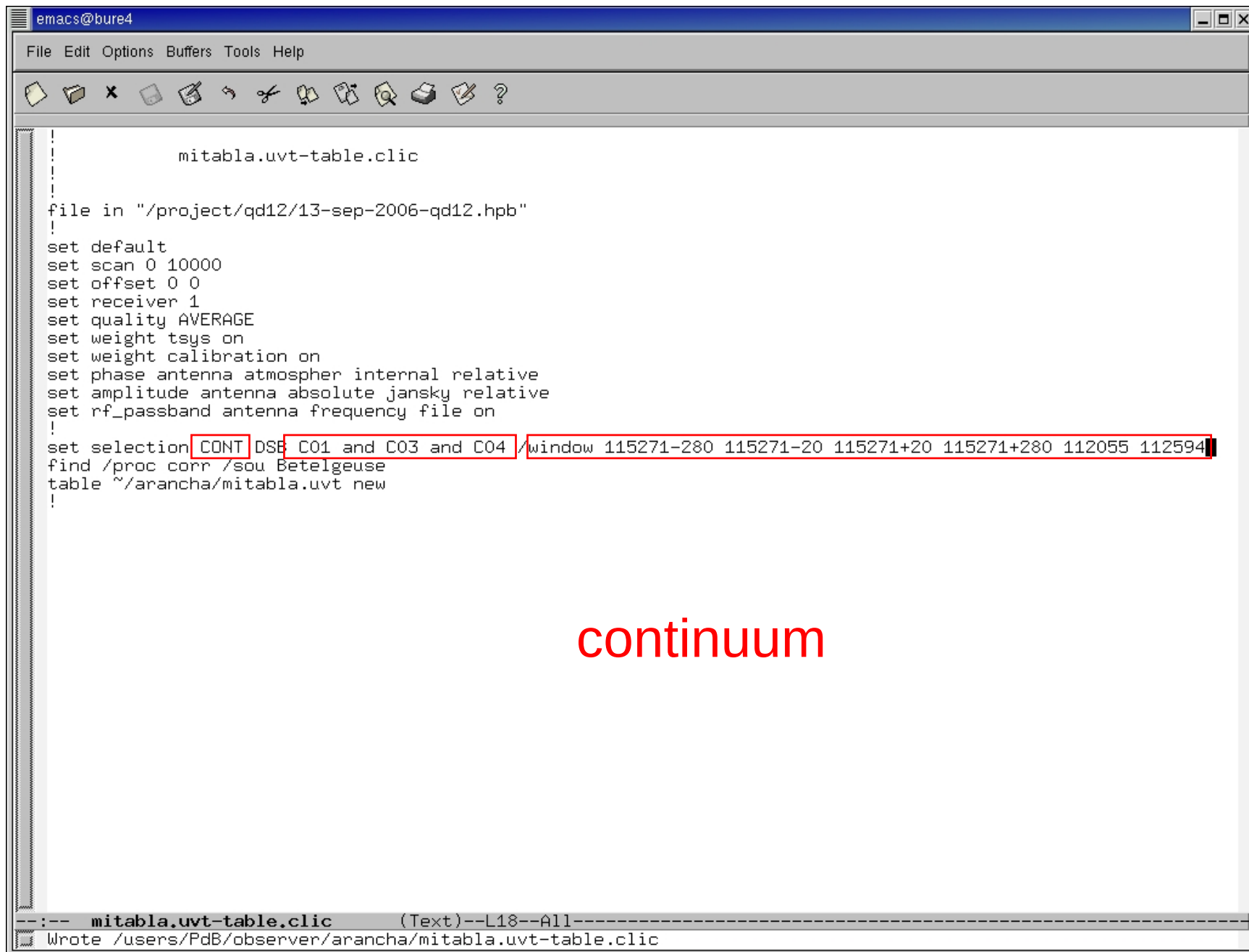
```
emacs@bure4
File Edit Options Buffers Tools Help

mitabla-rec2.uvt-table.clic

!
...
file in "/project/qd12/13-sep-2006-qd12.hpb"
!
set default
set scan 0 10000
set offset 0 0
set receiver 2
set quality AVERAGE
set weight tsys on
set weight calibration on
set phase antenna atmosphere external relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on
!
set selection LINE DSB L01 and L02
find /proc corr /source Betelgeuse
table ~/arancha/mitabla-rec2.uvt new /resample 40 20 -30 2 V
!
```

old receiver 2

--:-- mitabla-rec2.uvt-table.clic (Text)--L1--All--
For information about the GNU Project and its goals, type C-h C-p.



The image shows a screenshot of an Emacs editor window. The title bar at the top reads "emacs@bure4". Below the title bar is a menu bar with "File", "Edit", "Options", "Buffers", "Tools", and "Help". Underneath the menu bar is a toolbar with various icons for file operations like opening, saving, and printing. The main editing area contains a text file named "mitabla.uvt-table.clic". The file's content is a configuration script for a radio telescope, starting with "file in" and followed by several "set" commands for parameters like scan, offset, receiver, quality, weight, and phase. The final line of the script is "set selection CONT DSB C01 and C03 and C04 /window 115271-280 115271-20 115271+20 115271+280 112055 112594", where the selection and window parameters are highlighted with red boxes. The status bar at the bottom of the window shows the current file name, buffer name, and line number.

```
mitabla.uvt-table.clic

file in "/project/qd12/13-sep-2006-qd12.hpb"
!
set default
set scan 0 10000
set offset 0 0
set receiver 1
set quality AVERAGE
set weight tsys on
set weight calibration on
set phase antenna atmospher internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on
!
set selection CONT DSB C01 and C03 and C04 /window 115271-280 115271-20 115271+20 115271+280 112055 112594
find /proc corr /sou Betelgeuse
table ~/arancha/mitabla.uvt new
!
```

--:-- mitabla.uvt-table.clic (Text)--L18--All-----
Wrote /users/PdB/observer/arancha/mitabla.uvt-table.clic

continuum



A table for each offset
“tablename”-“i”.uvt

```
emacs@bure4
File Edit Options Buffers Tools Help

file in "/project/headers/09-jul-2005-qf12.hpb"
find offset 8.36 9.96
  table iktau10-1 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find offset 12.8 2.26
  table iktau10-2 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset 11.26 -6.5
  table iktau10-3 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset 4.45 -12.22
  table iktau10-4 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset -4.45 -12.22
  table iktau10-5 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset -11.26 -6.5
  table iktau10-6 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset -12.8 2.26
  table iktau10-7 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset -8.36 9.96
  table iktau10-8 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
find /offset 0 13
  table iktau10-9 NEW /frequency 12co10 1.15271204E+05 /resample 30 15 35 2 V
!
-----
file in "/project/headers/25-dec-2005-qf12.hpb"
find /offset 8.36 9.96
  table iktau10-1 OLD
!
find /offset 12.8 2.26
  table iktau10-2 OLD
!
find /offset 11.26 -6.5
  table iktau10-3 OLD
!
find /offset 4.45 -12.22
  table iktau10-4 OLD
!
find /offset -4.45 -12.22
  table iktau10-5 OLD
!
find /offset -11.26 -6.5
  table iktau10-6 OLD
!
find /offset -12.8 2.26
  table iktau10-7 OLD
!
find /offset -8.36 9.96
  table iktau10-8 OLD
!

--:-- mosaic.clic (Text)--L30--25%--
```

Mosaic

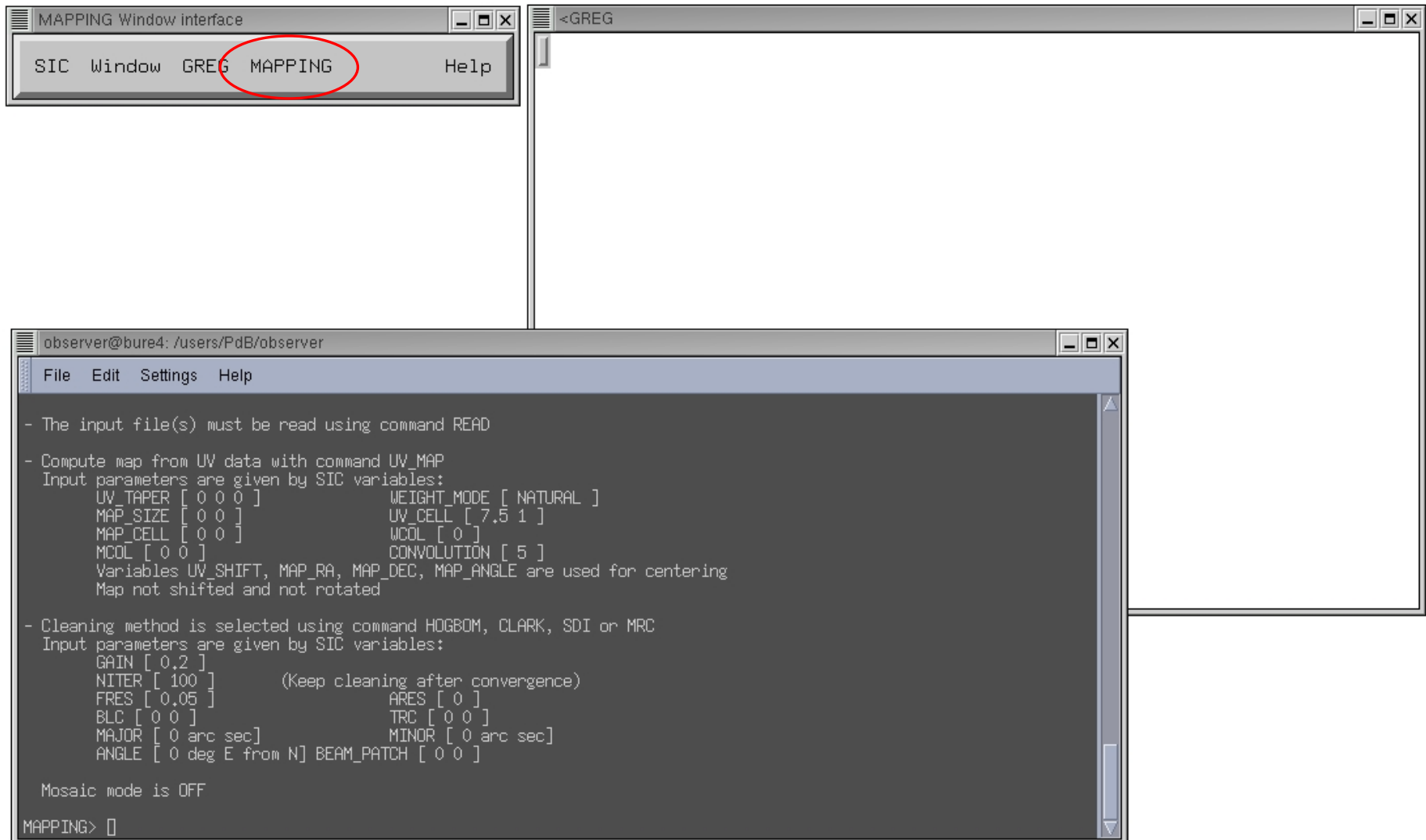
2nd data set

Created “mytable”.uvt, in CLIC

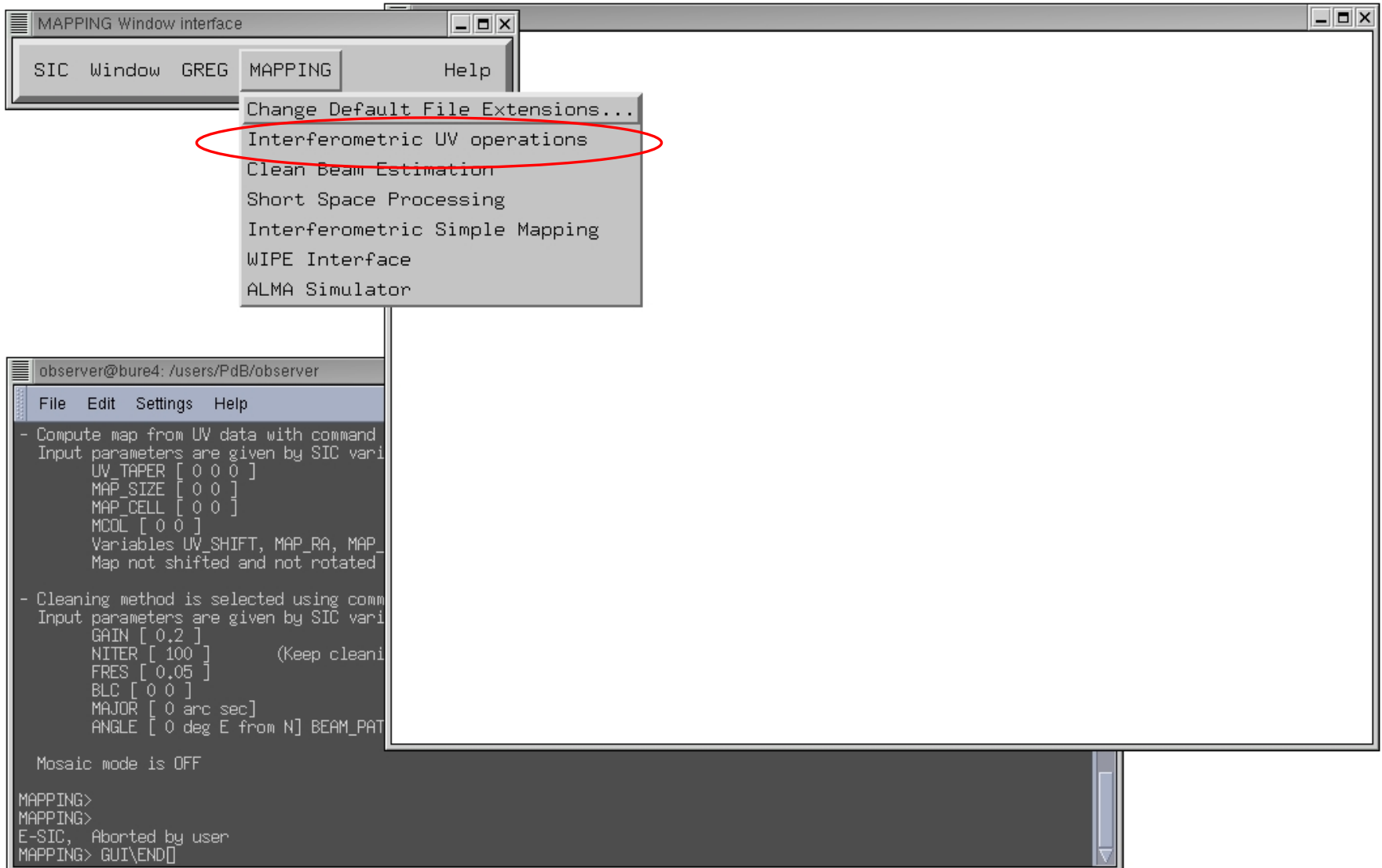


Analyze the data, in MAPPING

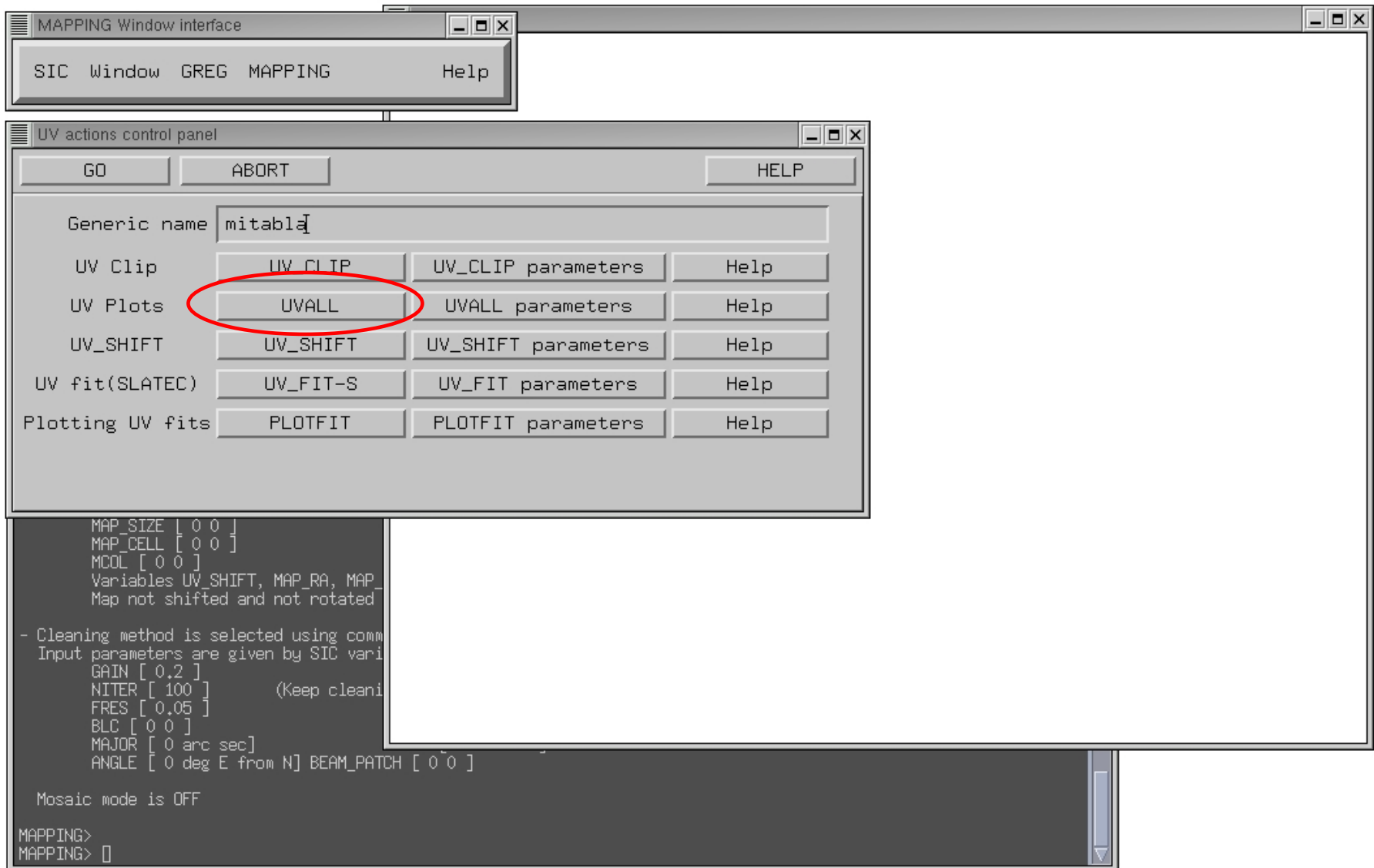
Data analysis in the *uv*-plane; **MAPPING**



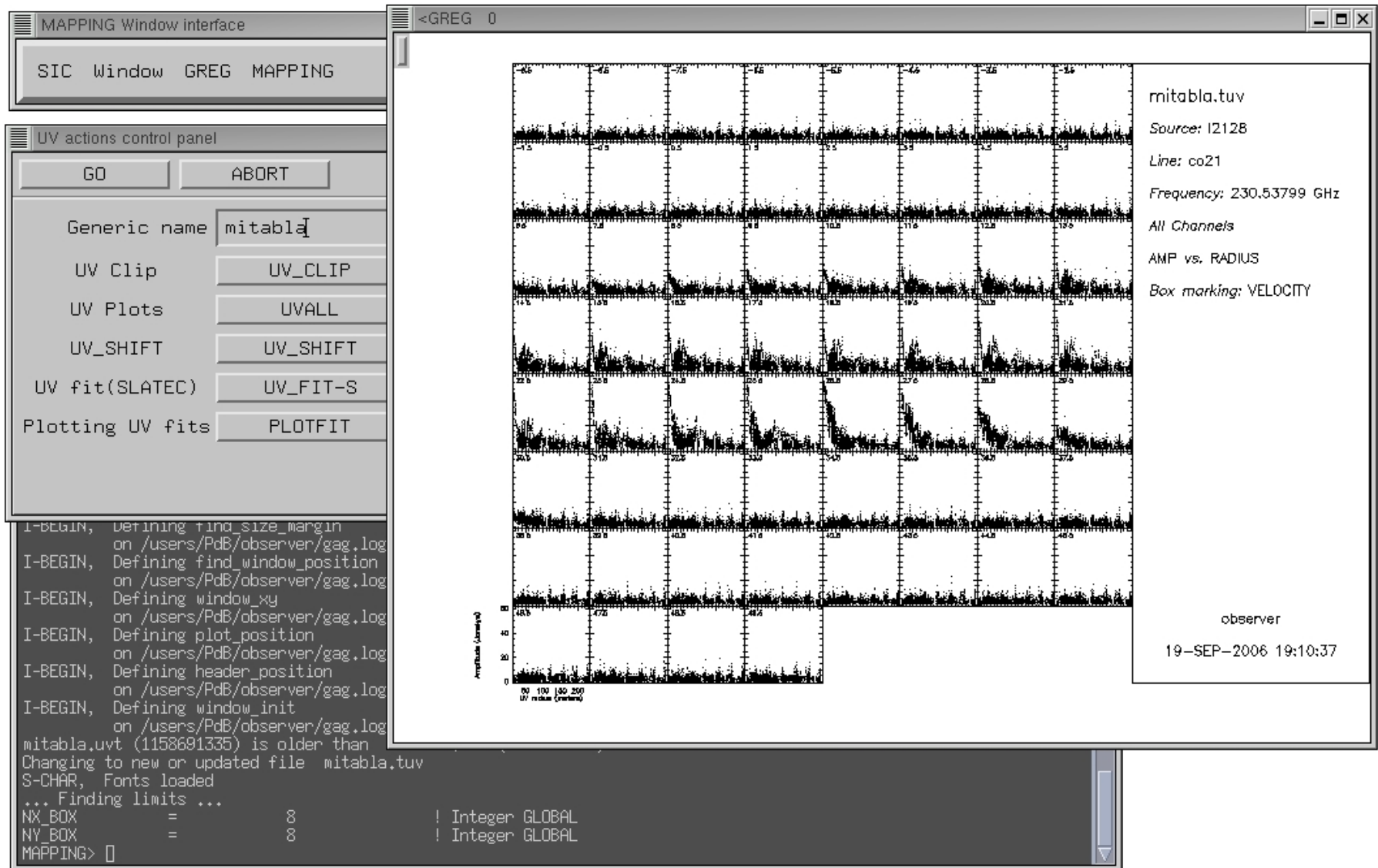
Data analysis in the *uv*-plane



Inspection of the data in the *uv*-plane



Inspection of the data in the *uv*-plane



The screenshot displays the MAPPING software interface. At the top, a window titled "MAPPING Window interface" contains a menu bar with "SIC", "Window", "GREG", and "MAPPING". Below this is a large window titled "<GREG 0". In the foreground, a dialog box titled "uv_compress" is open, featuring three buttons: "GO", "ABORT", and "HELP". The dialog box contains three input fields: "Input UV table" with the value "mitabla.uvt", "Output UV table" with the value "mitabla-c.uvt", and "Number of channels to average" with the value "3". To the right of the dialog box, a window titled "mitabla.tuv" displays a plot of "AMP vs. RADIUS" with a box marking labeled "VELOCITY". Below the plot, the text "observer" and "19-SEP-2006 19:12:28" are visible. At the bottom, a command prompt window shows a series of "MAPPING>" prompts, with the command "run uv_compress" highlighted by a red circle, followed by "Waiting ...".

SIC Window GREG MAPPING

<GREG 0

Box marking: VELOCITY

19-SEP-2006 19:12:28

GO

ABORT

HELP

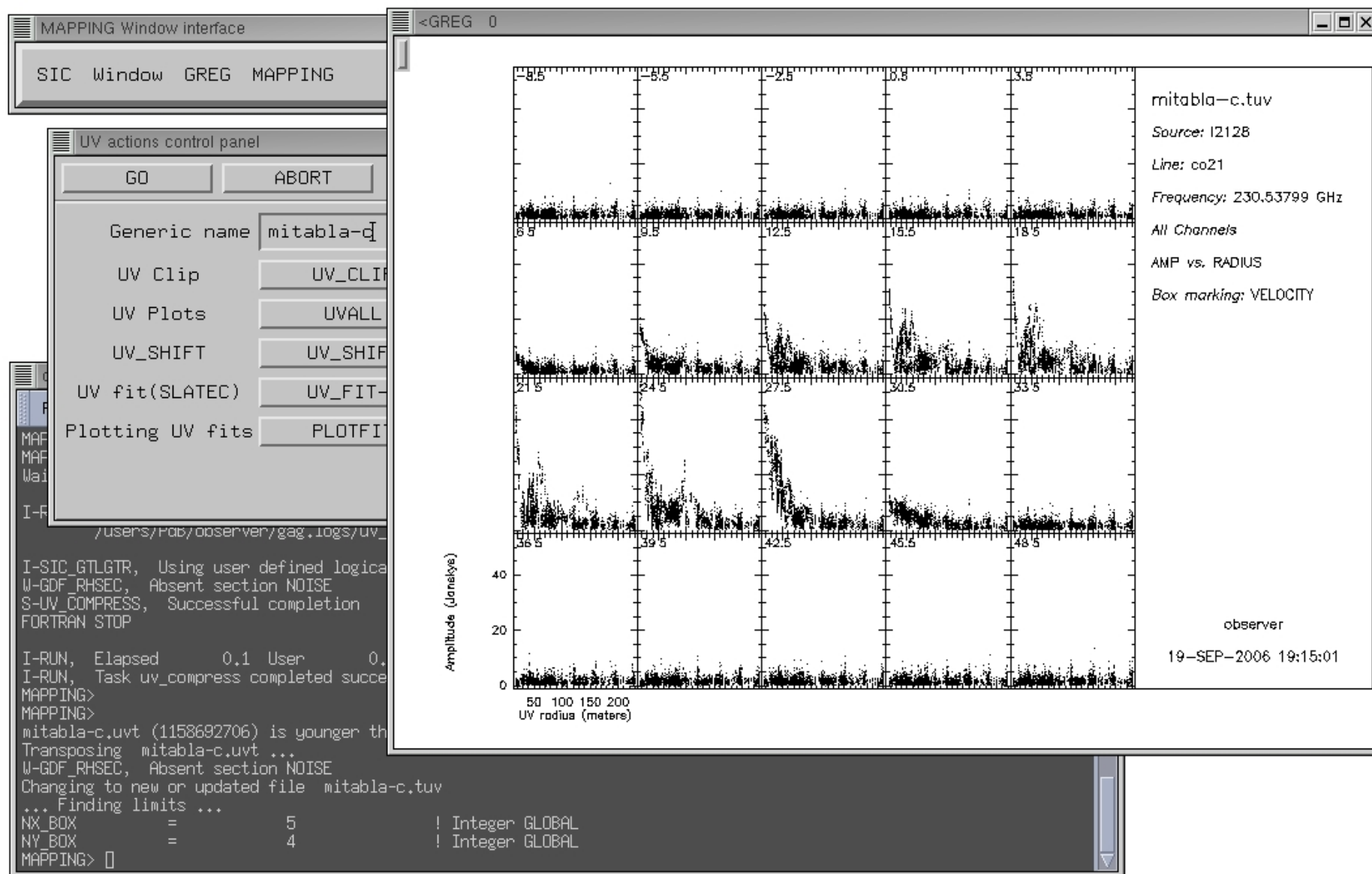
Input UV table	mitabla.uvt
----------------	-------------

Output UV table	mitabla-c.uvt
-----------------	---------------

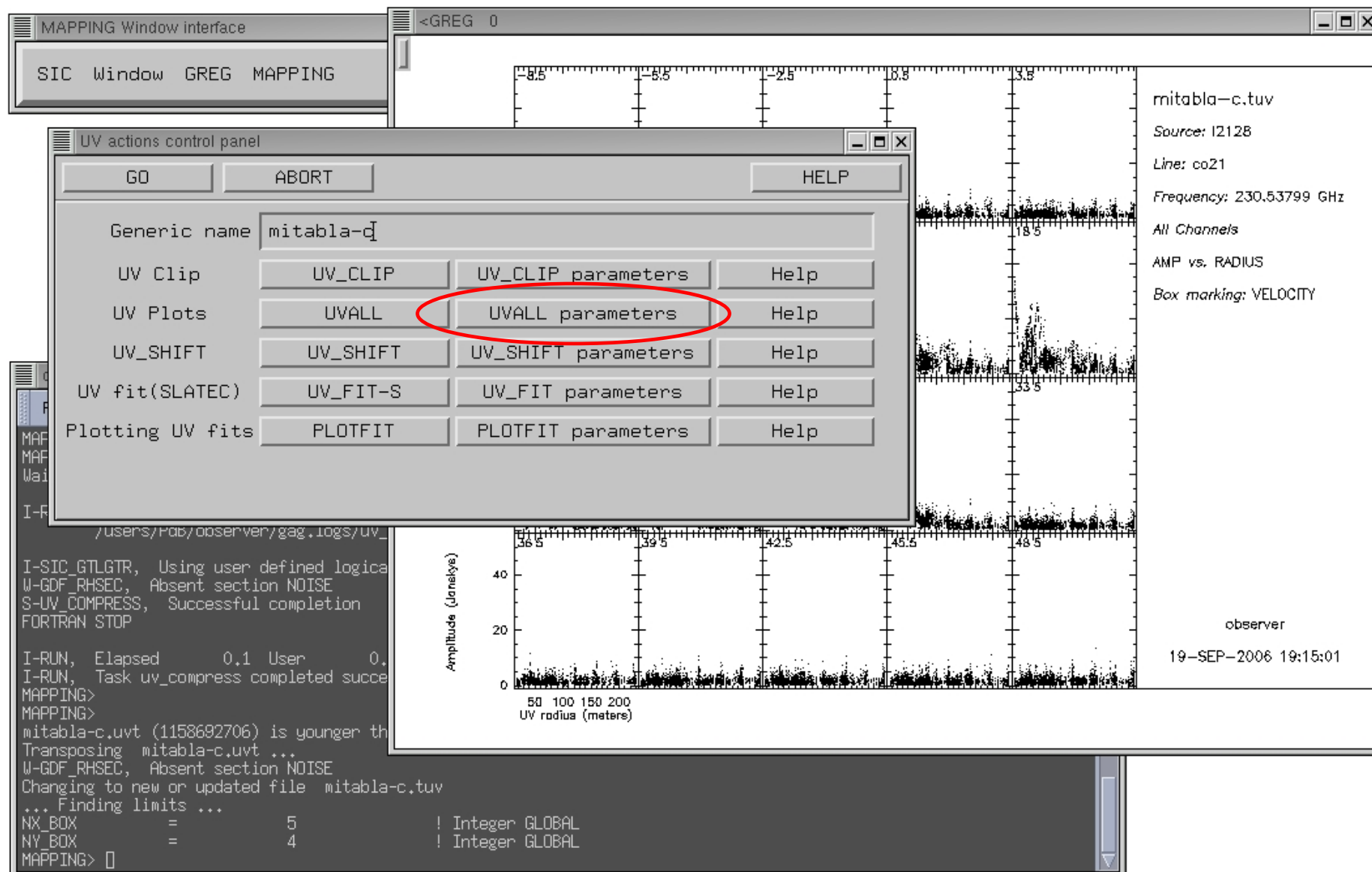
Number of channels to average 3

[illegible]

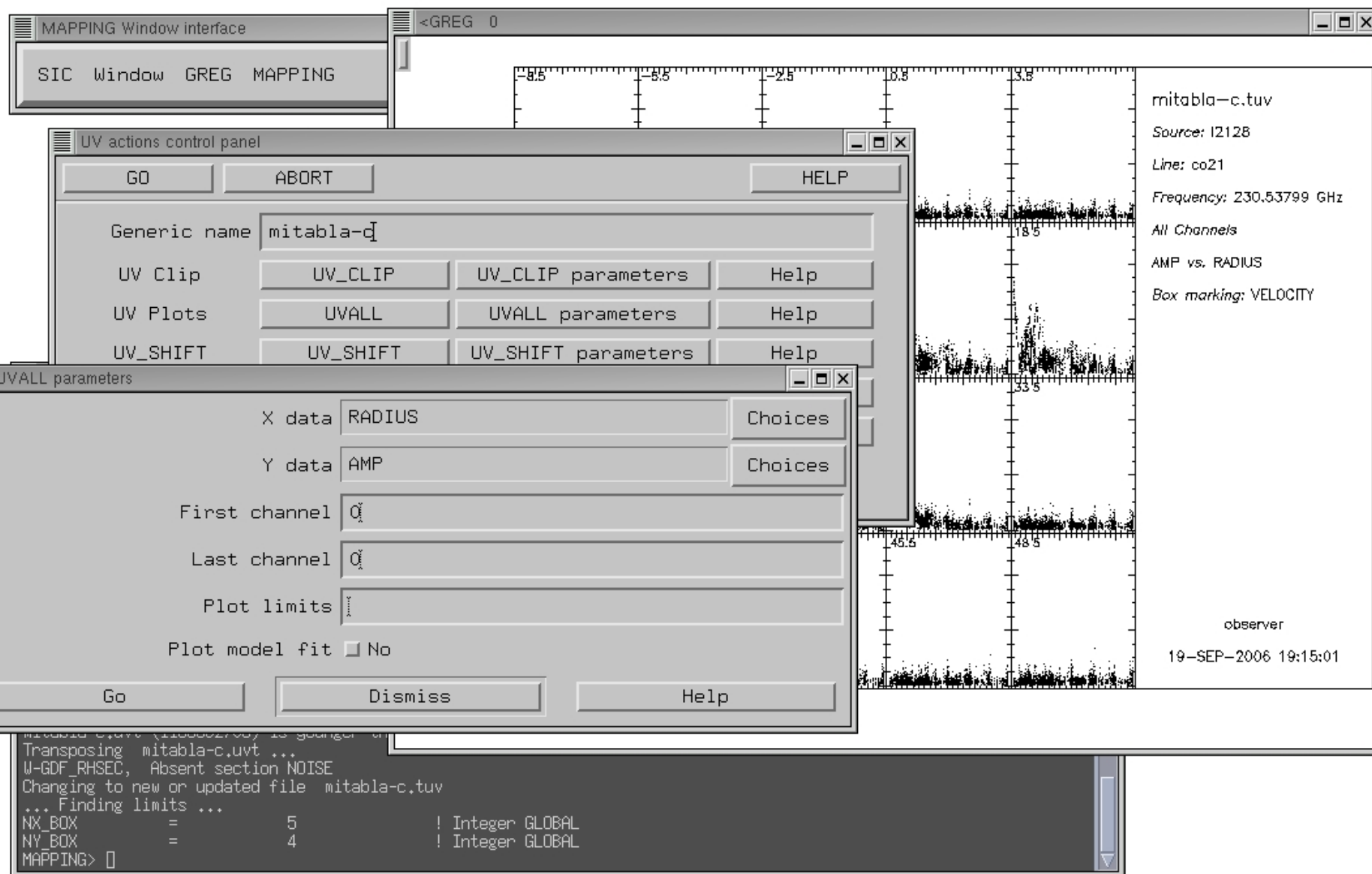
Inspection of the data in the *uv*-plane



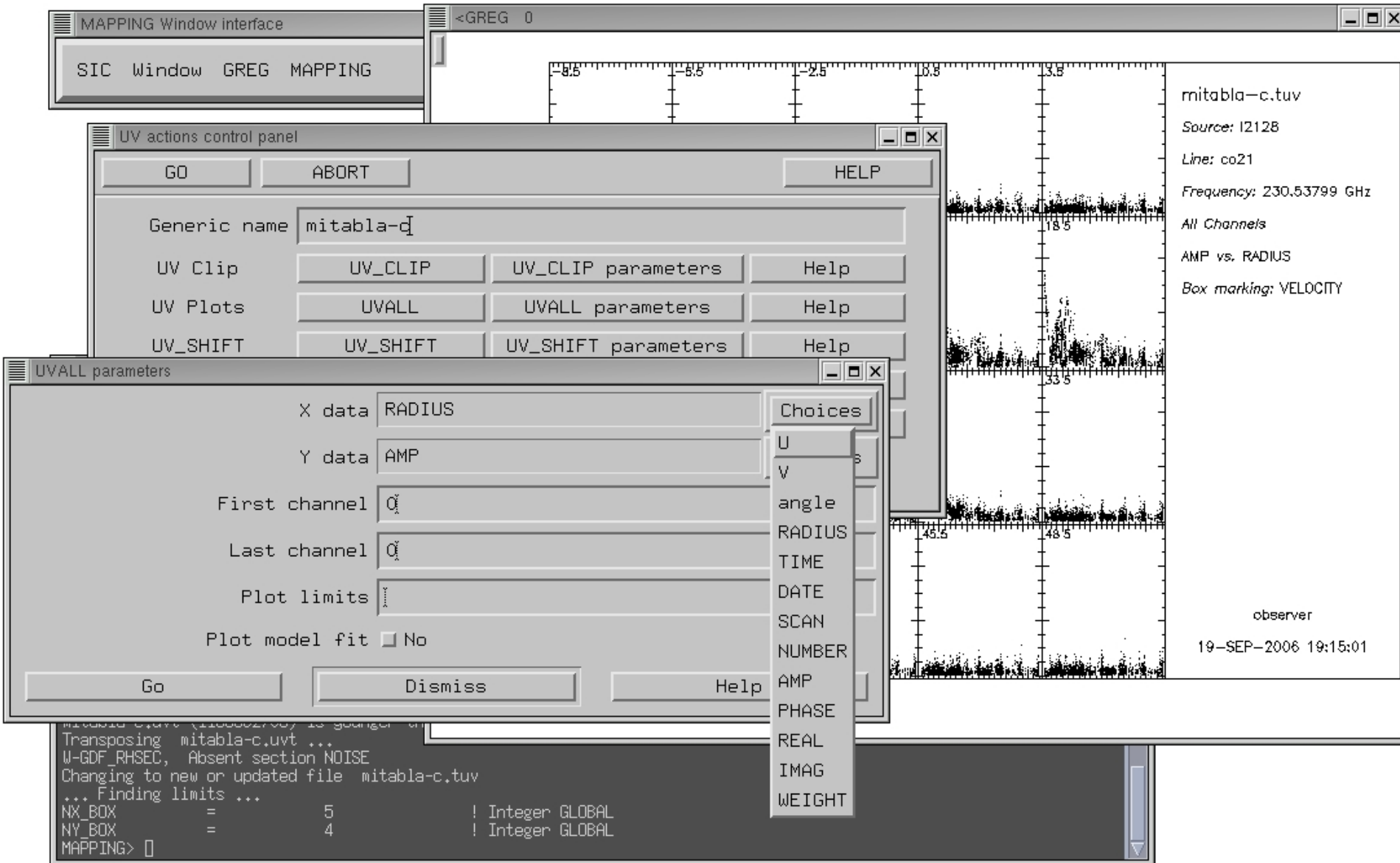
Inspection of the data in the *uv*-plane



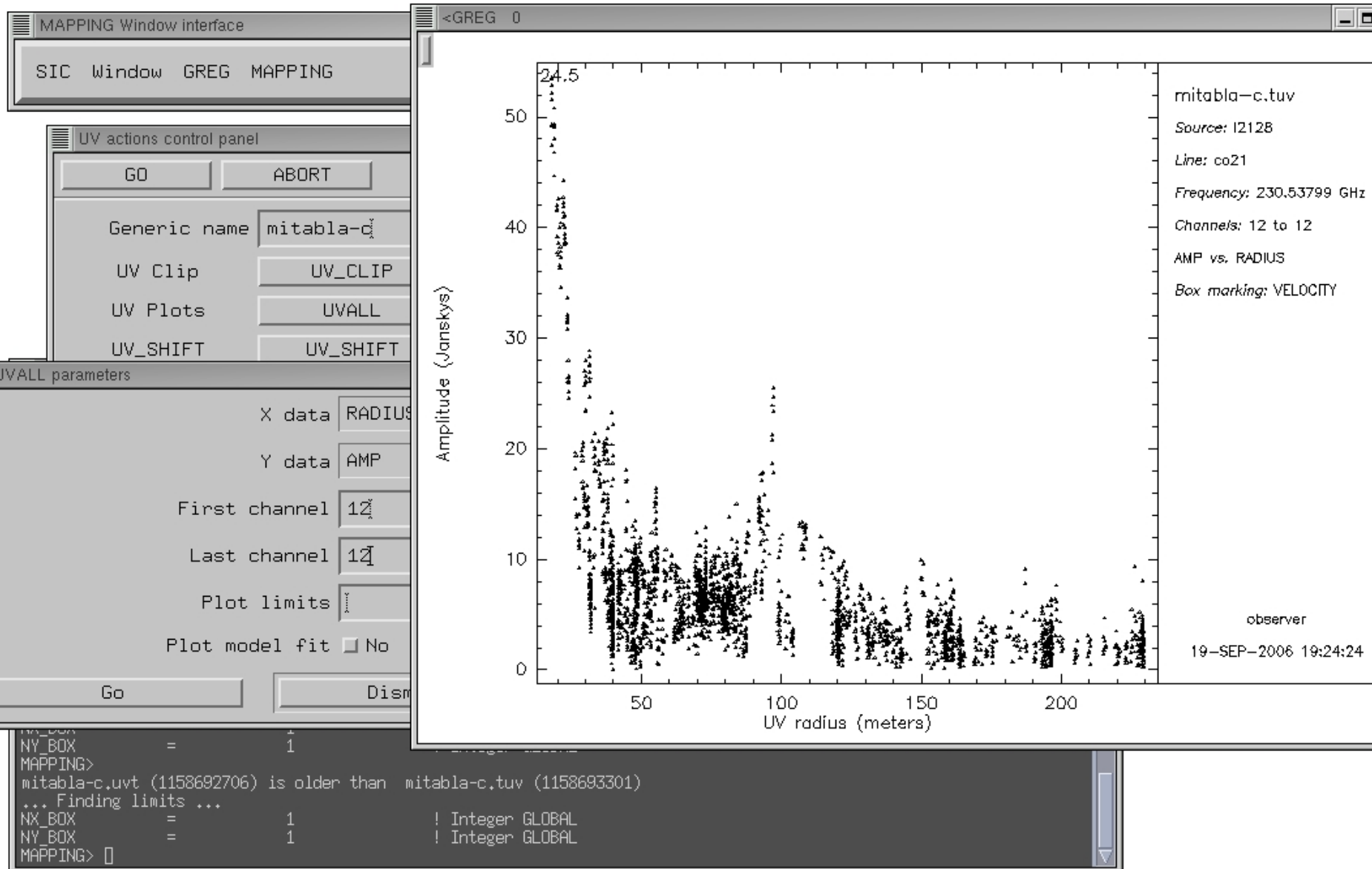
Inspection of the data in the *uv*-plane



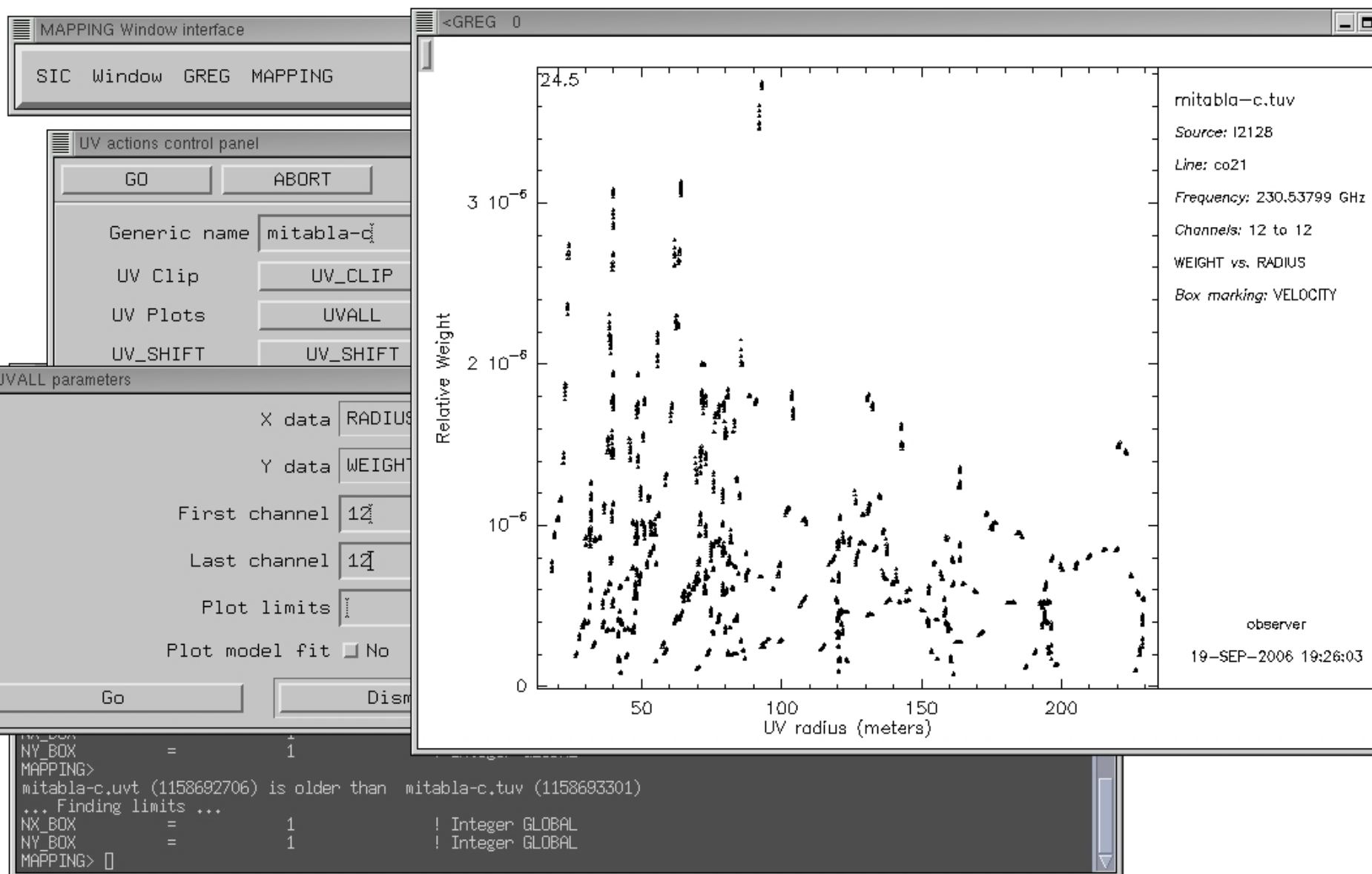
Inspection of the data in the *uv*-plane



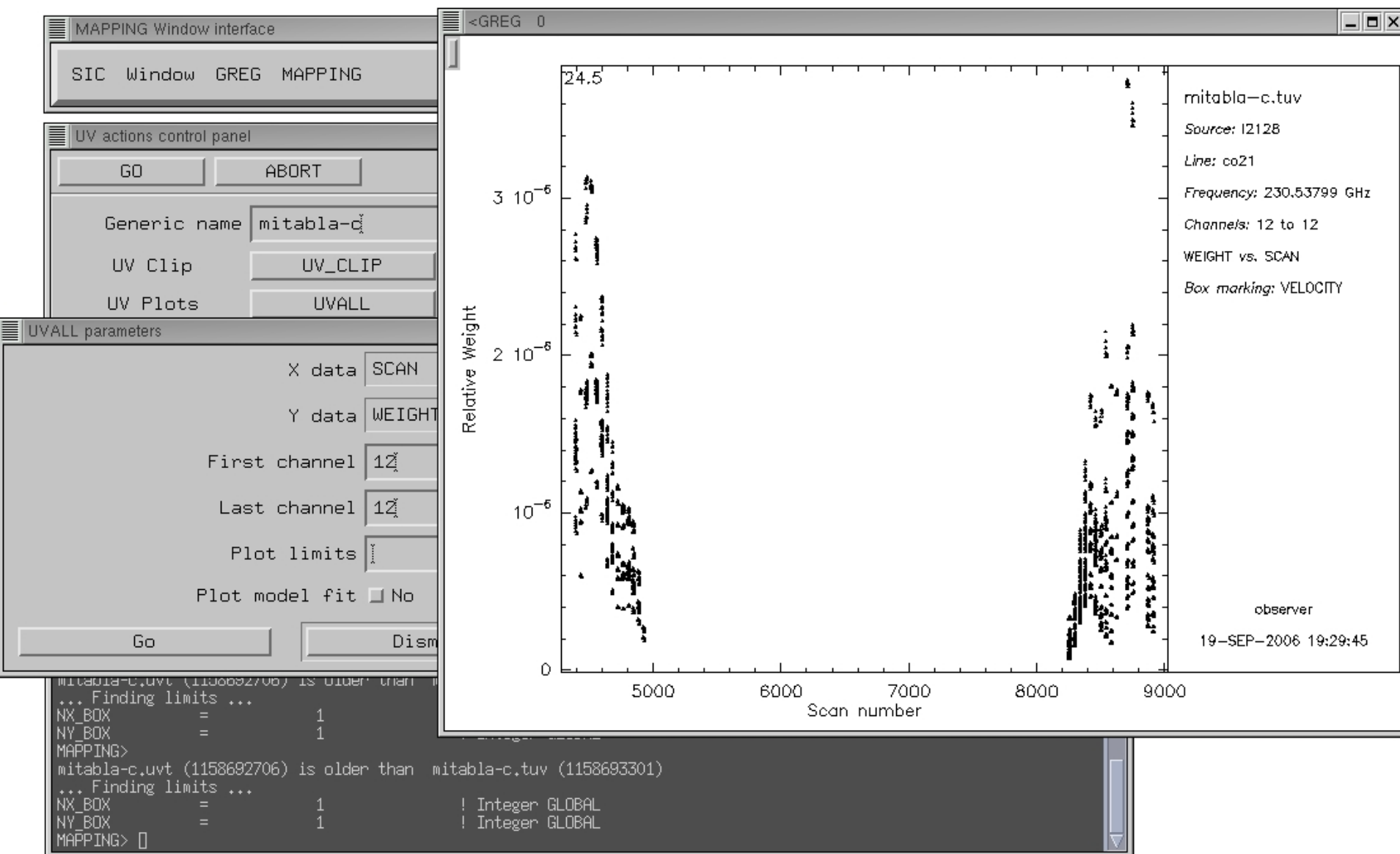
Inspection of the data in the *uv*-plane



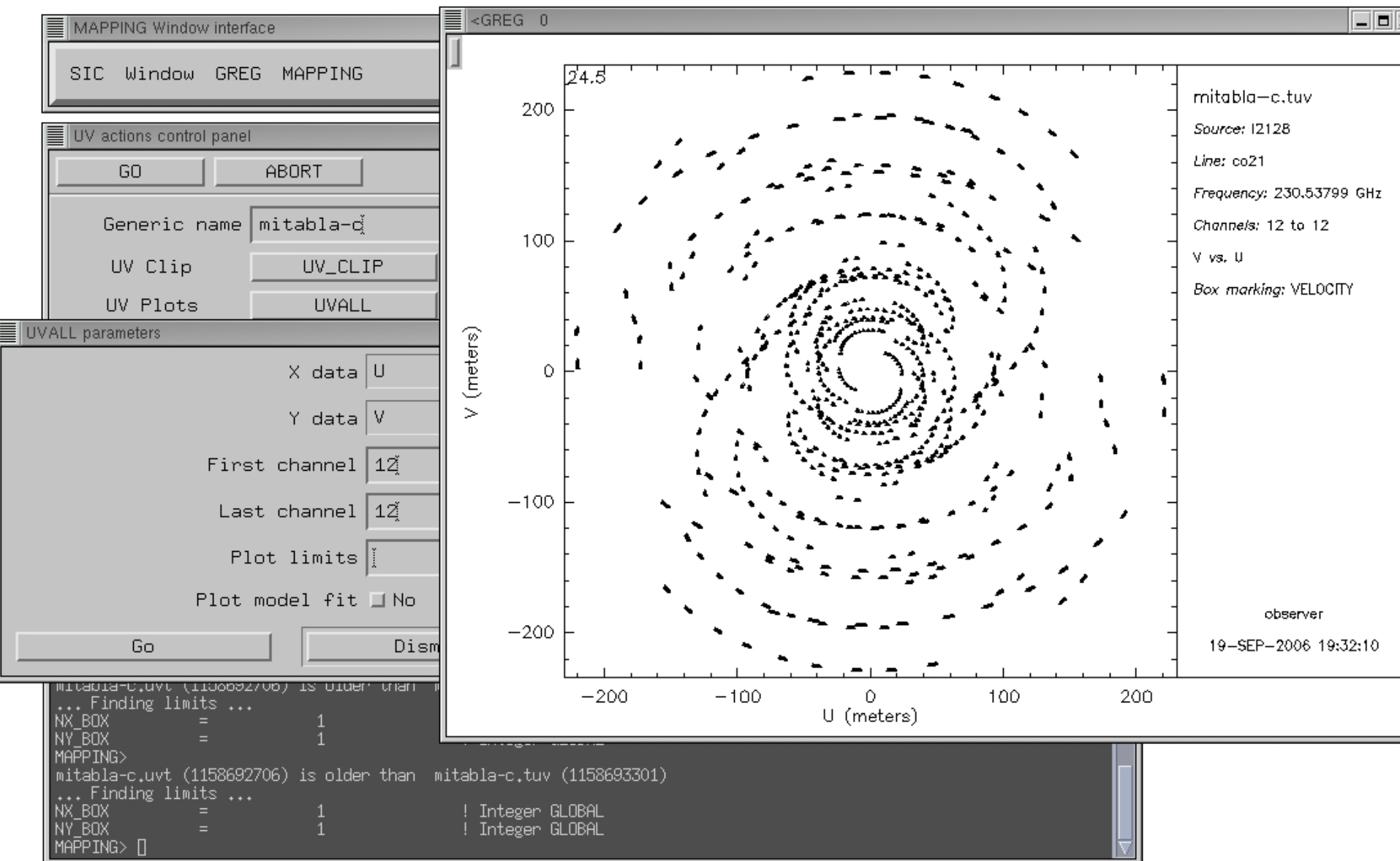
Inspection of the data in the *uv*-plane



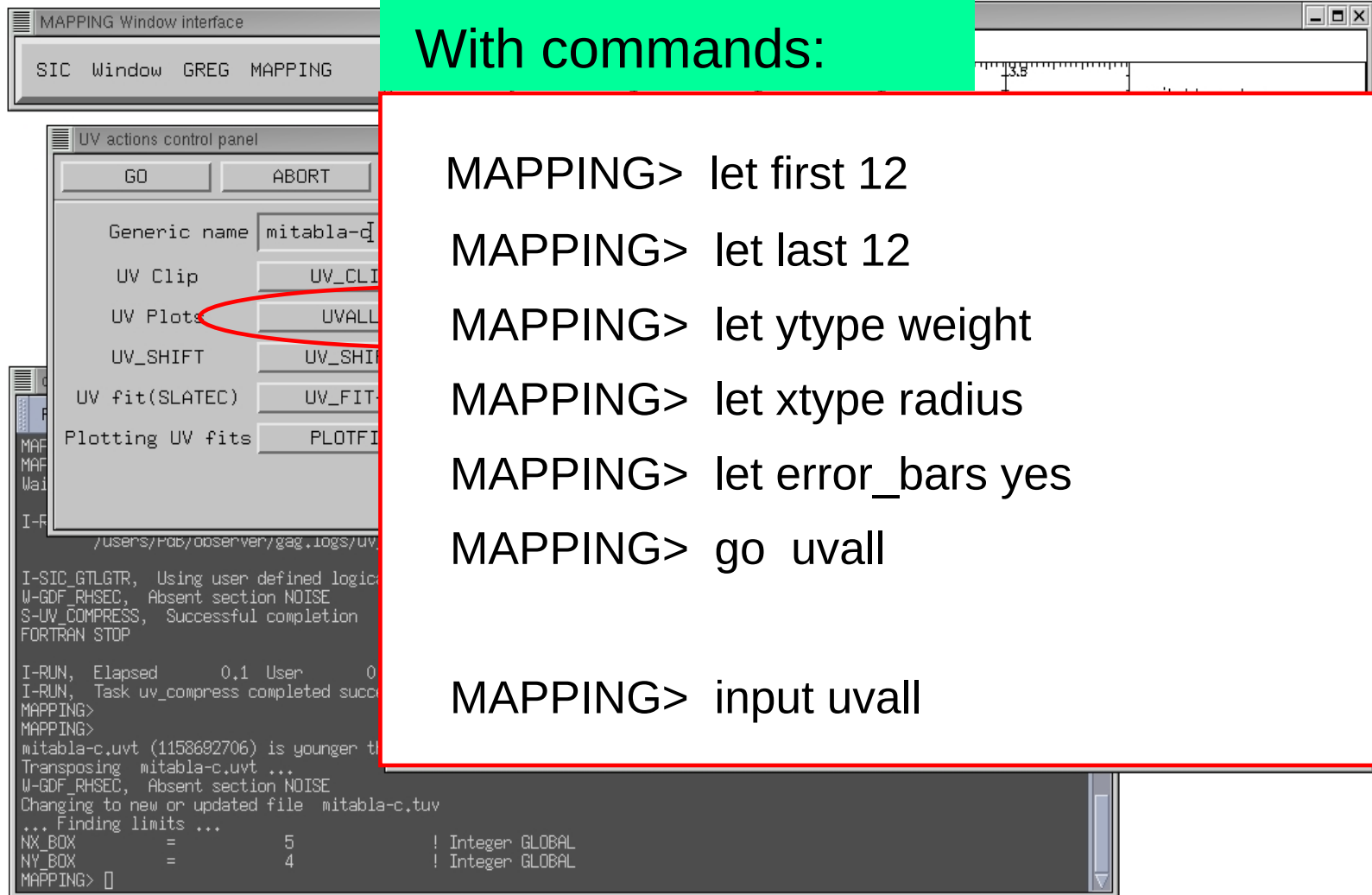
Inspection of the data in the *uv*-plane



Inspection of the data in the *uv*-plane



Inspection of the data in the *uv*-plane



The screenshot displays the MAPPING software interface. At the top, a window titled 'MAPPING Window interface' contains the text 'SIC Window GREG MAPPING'. Below this is the 'UV actions control panel' with buttons for 'GO' and 'ABORT'. A list of actions includes 'Generic name' (mitabla-c), 'UV Clip' (UV_CLIP), 'UV Plots' (UVALL, which is circled in red), 'UV_SHIFT' (UV_SHIFT), 'UV fit(SLATEC)' (UV_FIT), and 'Plotting UV fits' (PLOTFIT). At the bottom, a terminal window shows the following output:

```
I-SIC_GTLGTR, Using user defined logic
U-GDF_RHSEC, Absent section NOISE
S-UV_COMPRESS, Successful completion
FORTRAN STOP

I-RUN, Elapsed 0.1 User 0
I-RUN, Task uv_compress completed succ
MAPPING>
MAPPING>
mitabla-c.uvt (1158692706) is younger th
Transposing mitabla-c.uvt ...
U-GDF_RHSEC, Absent section NOISE
Changing to new or updated file mitabla-c.tuv
... Finding limits ...
NX_BOX = 5 ! Integer GLOBAL
NY_BOX = 4 ! Integer GLOBAL
MAPPING> []
```

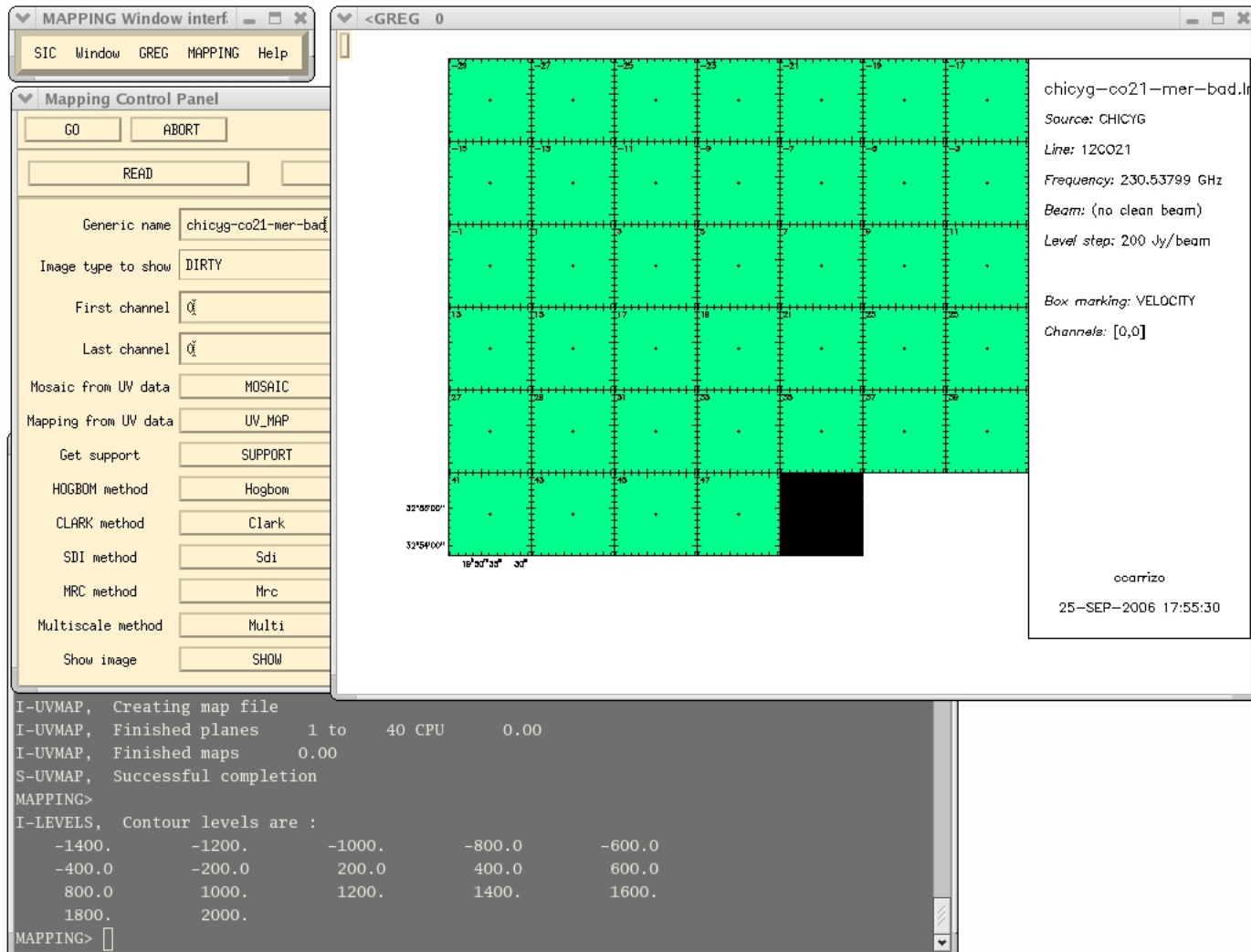
With commands:

- MAPPING> let first 12
- MAPPING> let last 12
- MAPPING> let ytype weight
- MAPPING> let xtype radius
- MAPPING> let error_bars yes
- MAPPING> go uvall
- MAPPING> input uvall

Mapping takes shorter
if previously
we have had a look at the data in
the uv -plane

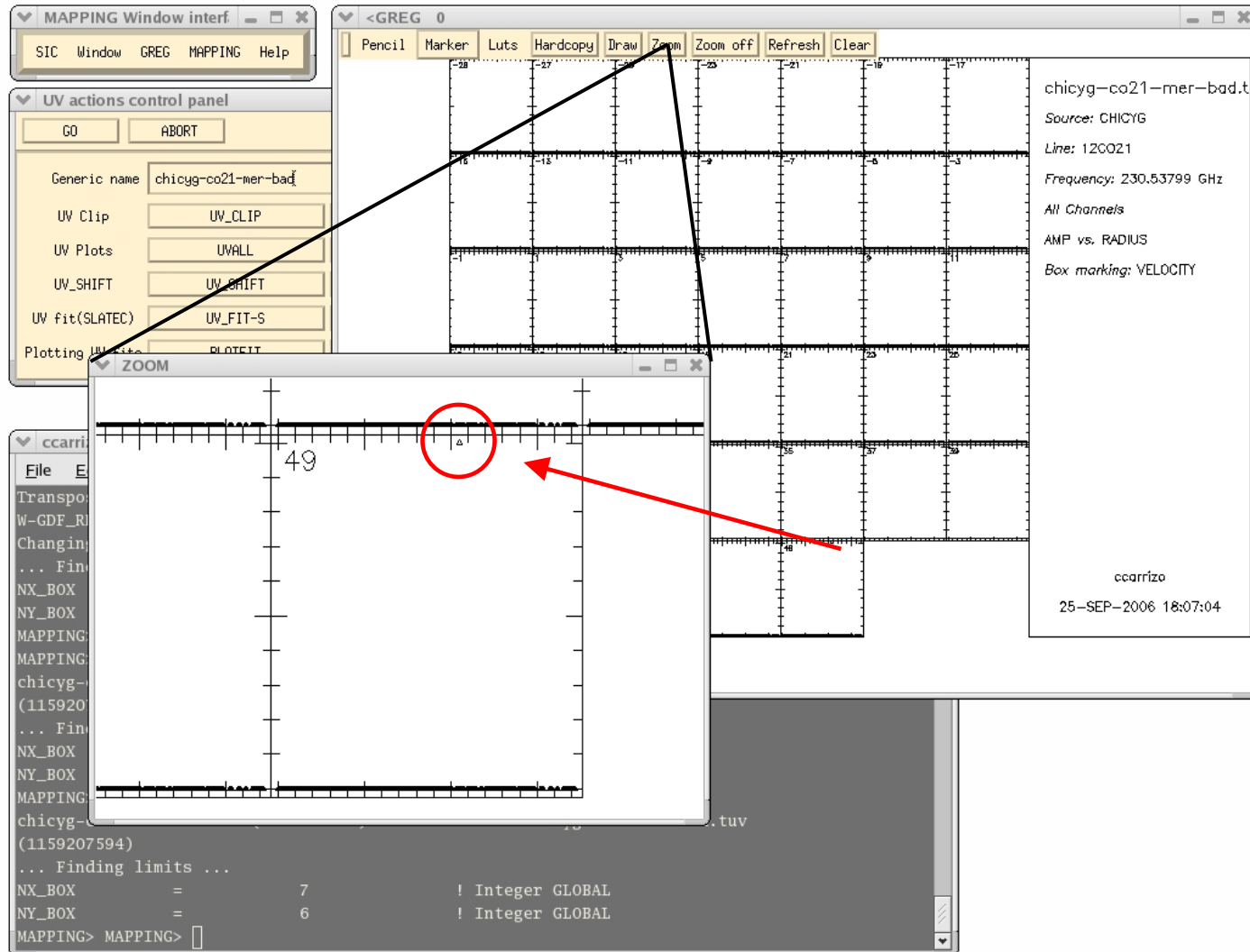
(1) Passing directly from hpb → mapping

It may happen...



(1) Passing directly from hpb → mapping

It may happen...



(1) Passing directly from hpb → mapping

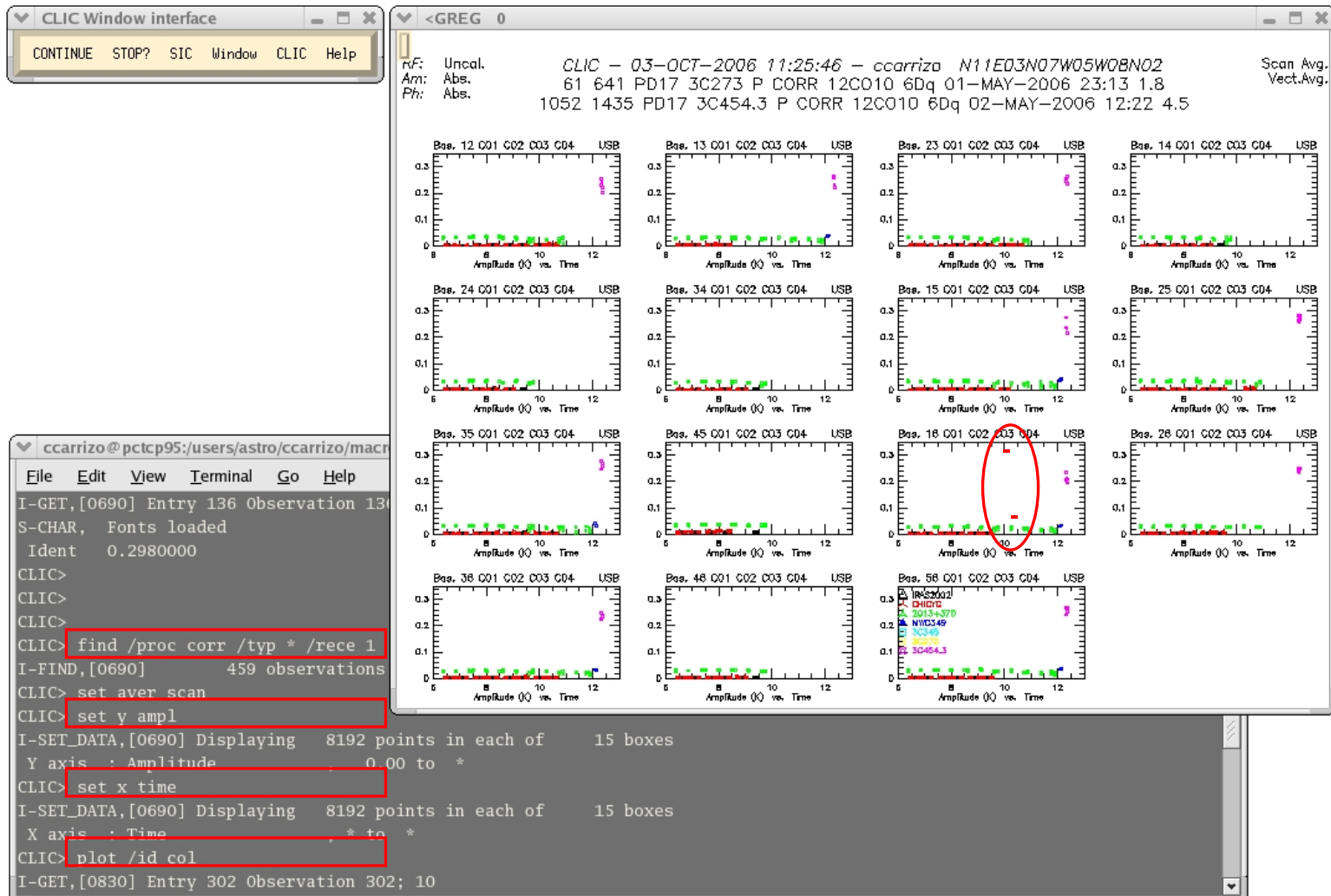
It may happen... that it remains a wrong visibility

```
MAPPING> uv_flag
```

Return to CLIC to identify the wrong visibility(ies) and flag them in the hpb file

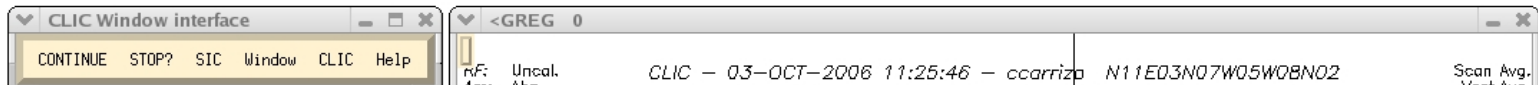
(1) Passing directly from hpb → mapping

It may happen... that you must go back



(1) Passing directly from hpb → mapping

It may happen... that you must go back



```
CLIC> find /proc corr /sou Betel /rece 2 /scans 1245 1255  
CLIC> store quality 9
```

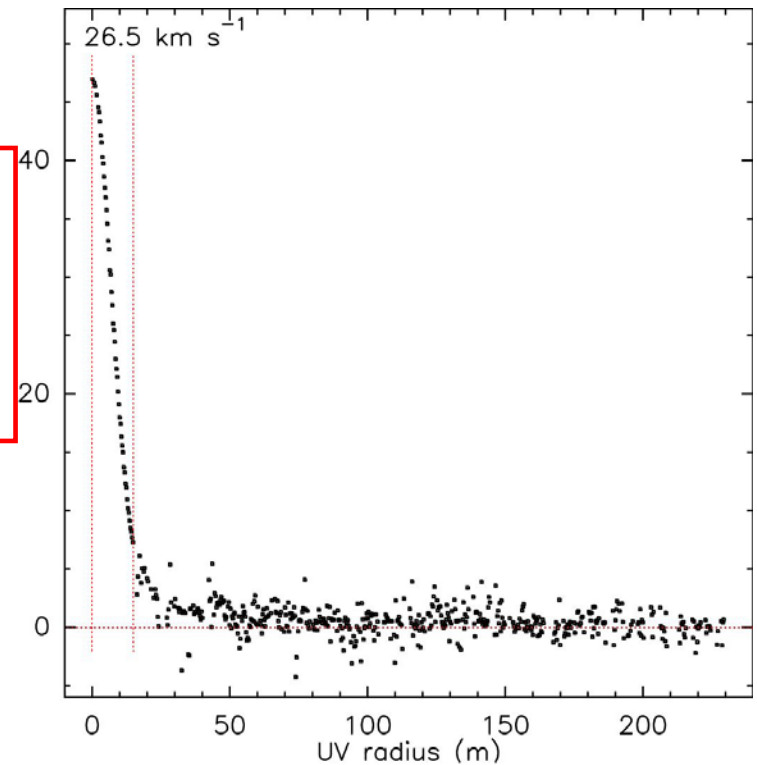
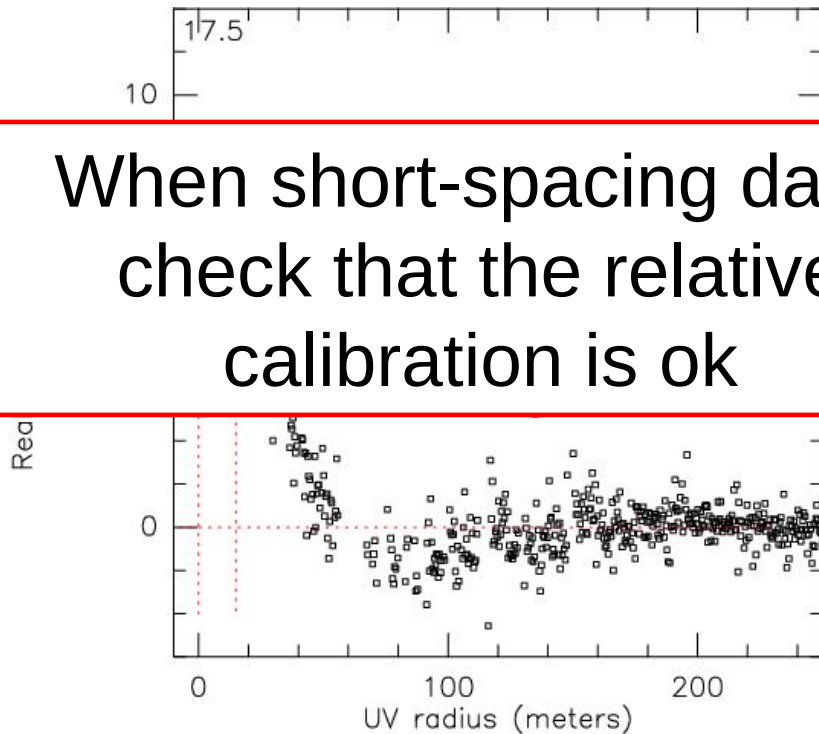
Scans identified and removed from the hpb !!

(if doubts, ask your Local Contact)

A screenshot of the CLIC command prompt showing a list of observation entries. The entries are: 'I-GET,[0694] Entry 140 Observation 140; 11', 'I-GET,[0693] Entry 139 Observation 139; 11', 'I-GET,[0692] Entry 138 Observation 138; 11', 'I-GET,[0691] Entry 137 Observation 137; 11', and 'I-GET,[0690] Entry 136 Observation 136; 11'. Below these is 'Ident 0.2980000'. The prompt 'CLIC>' is followed by a red box containing the word 'cursor'.

(2) Passing directly from hpb → mapping

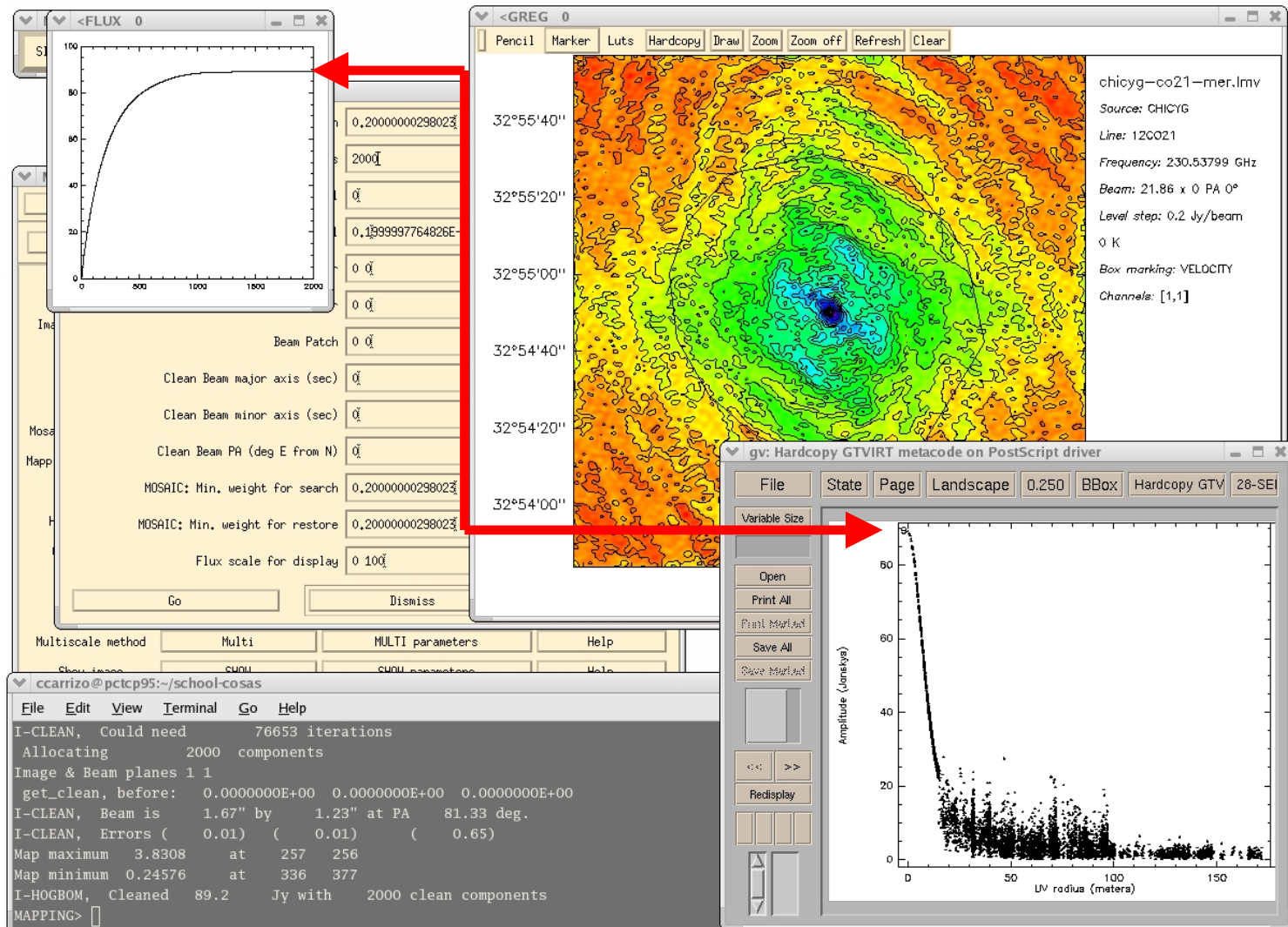
When short-spacing data,
check that the relative
calibration is ok



+ Short-spacing data

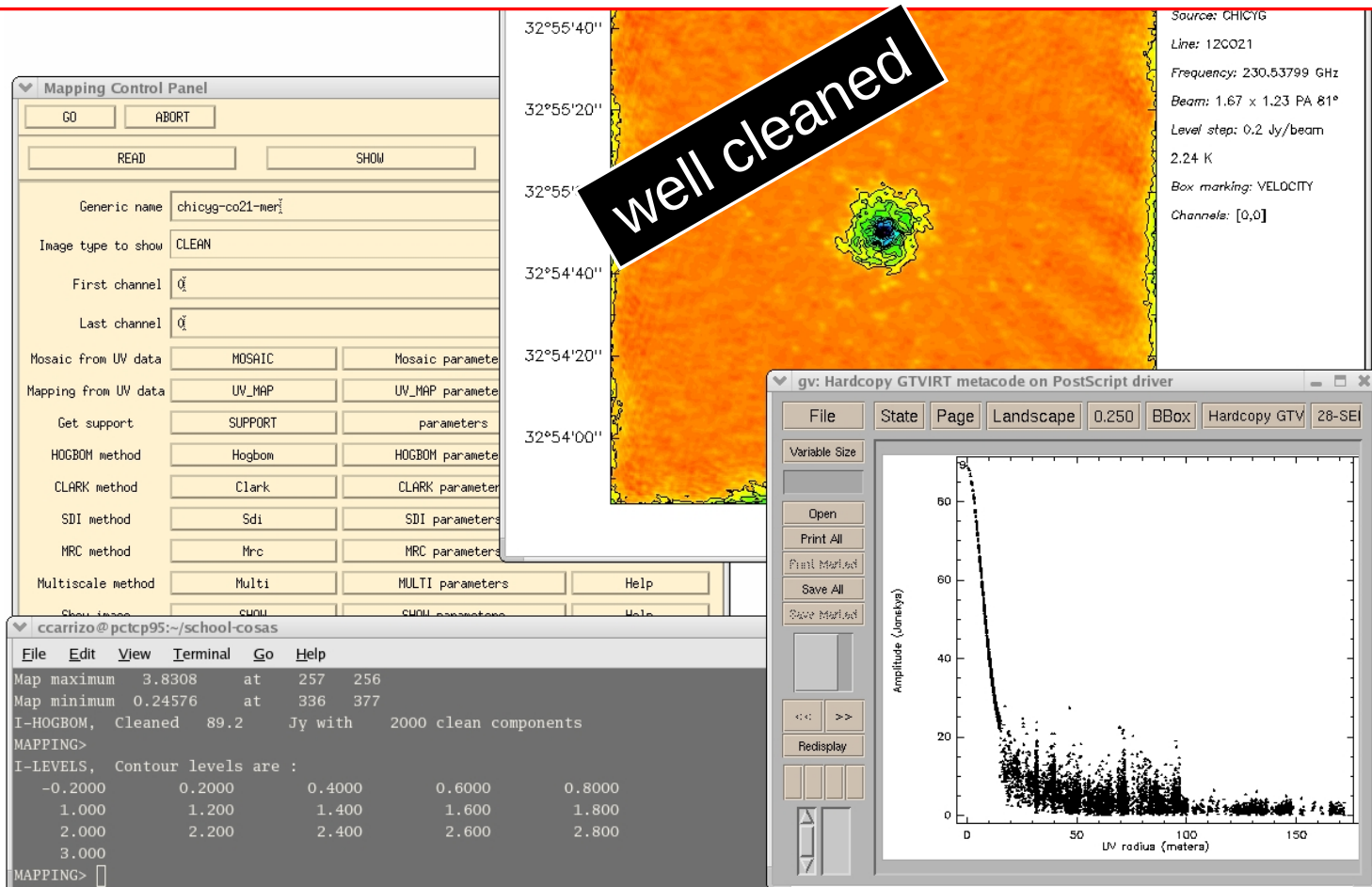
(3) Passing directly from hpb → mapping

Good practice: When cleaning (extended sources)...



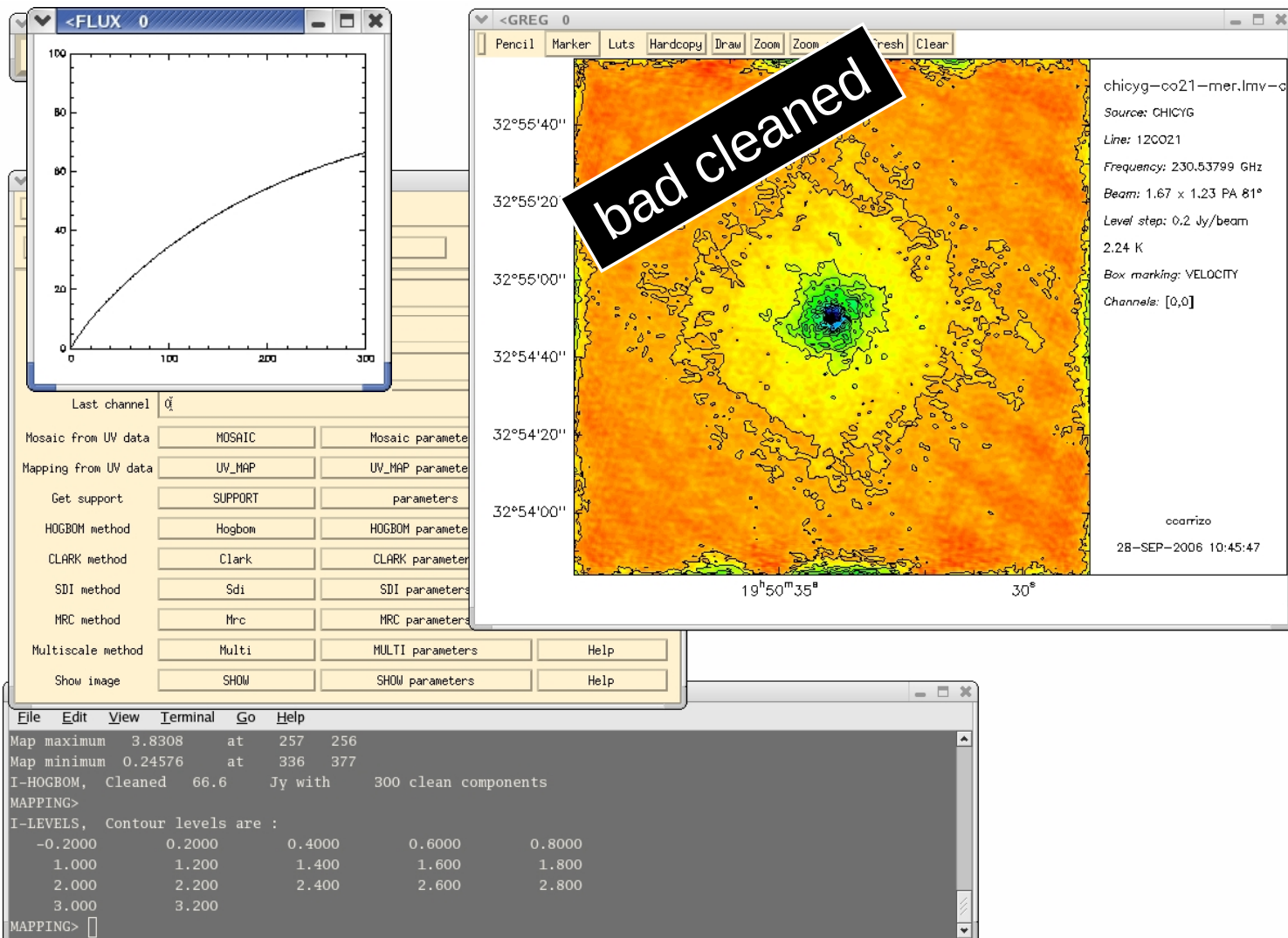
(3) Passing directly from hpb → mapping

When cleaning (specially extended sources or with supports)
**verify that the flux in the image plane coincides with that at
the zero-spacing**



(3) Passing directly from hpb → mapping

If not, it may happen...



We all agree now:

An inspection of the data in the
uv-plane saves time

Data analysis in the *uv*-plane

procedures and tasks

```
MAPPING> go uvall
```

```
MAPPING> input uvall
```

```
MAPPING> run uv_compress
```

```
MAPPING> help uv_compress
```


Data analysis in the *uv*-plane

```
MAPPING> run ...
```

```
MAPPING> help ...
```

uv_applyphase	uv_dft	uv_merge	uv_solve
uv_ascal	uv_extract	uv_mflag	uv_sort
uv_atm	uv_fidelity	uv_model	uv_splitfield
uv_average	uv_fit-s	uv_mult	uv_stat
uv_cal	uv_flag	uv_noise	uv_subtract
uv_ccmodel	uv_fmodel	uv_observe	uv_table
uv_cct	uv_gain	uv_pointing	uv_timeaverage
uv_center	uv_hanning	uv_selfcal	uv_timebase
uv_circle	uv_hybrid	uv_shift	uv_track
uv_clip	uv_list	uv_short	uv_track_phase
uv_compress	uv_map	uv_single	uv_zero
uv_cuts	uv_mcal	uv_sinusphase	

Data analysis in the *uv*-plane

uv_applyphase

uv_ascal

uv_atm

uv_average

uv_cal

uv_ccmodel

uv_cct

uv_center

uv_circle

uv_clip

uv_compress

uv_cuts

uv_lst

uv_map

uv_mcal

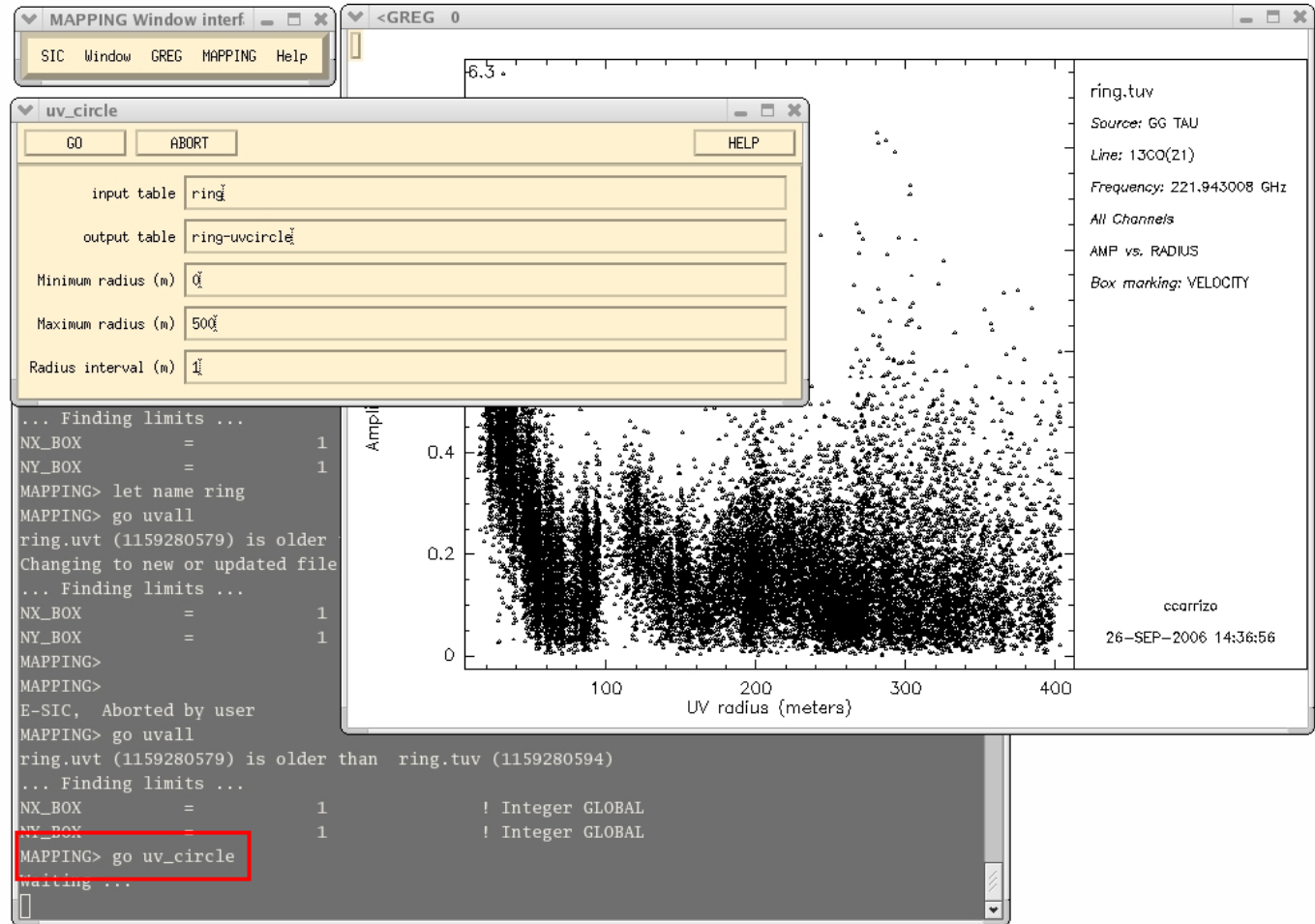
uv_short

uv_single

uv_sinusphase

uv_track_phase

uv_zero



Data analysis in the *uv*-plane

uv_applyphase

uv_ascal

uv_atm

uv_average

uv_cal

uv_ccmodel

uv_cct

uv_center

uv_circle

uv_clip

uv_compress

uv_cuts

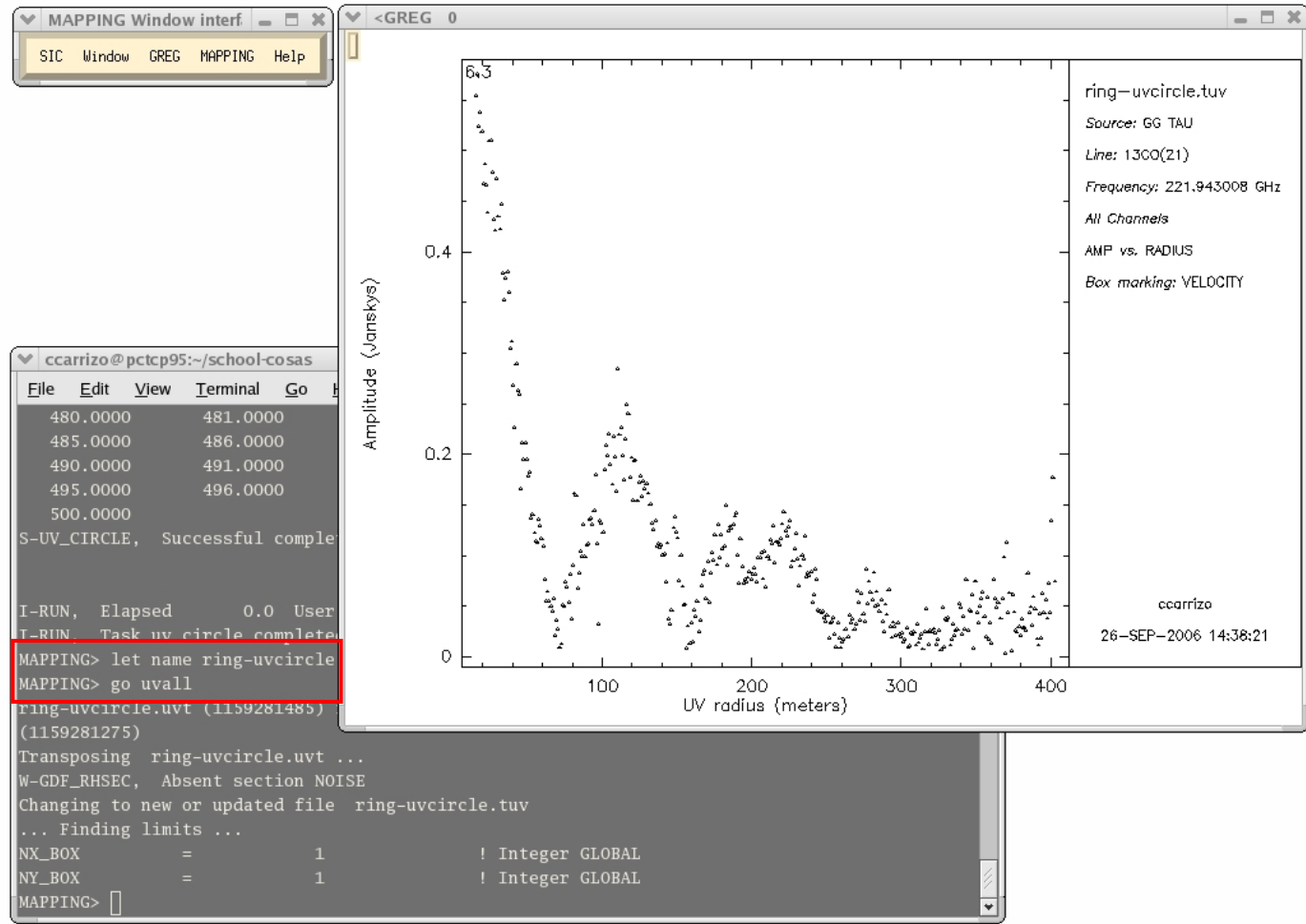
uv_map

uv_mcal

uv_single

uv_sinusphase

uv_zero



Data analysis in the *uv*-plane

The screenshot displays the **uvfit** software interface. The main window shows a plot of the *uv*-plane with data points and a fitted model. The **UV_FIT parameters** dialog box is open, showing the following settings:

- Generic name: `ring`
- UV Clip: `UV_CLIP`
- UV Plots: `UVALL`
- UV_SHIFT: `UV_SHIFT`
- UV fit(SLATEC): `UV_FIT`
- Plotting UV fits: `PLOTFIT`
- First channel: `0`
- Last channel: `0`
- UV range(min, max) (meters): `0 500`
- Number of Functions (1 or 2): `1`
- Function 1: `POINT`
- Parameters: `0 0 0 0 0 0`
- Starting range: `0 0 0 0 0 0`
- numb. of starts: `0 0 0 0 0 0`
- Subtract function: ☐ No
- Function 2:
- Parameters: `0 0 0 0 0 0`
- Starting range: `0 0 0 0 0 0`
- numb. of starts: `0 0 0 0 0 0`
- Subtract function: ☐ No

The **Choices** dropdown menu is open, showing the following options: `POINT`, `C_GAUSS`, `E_GAUSS`, `C_DISK`, `E_DISK`, **`RING`** (highlighted with a red circle), `EXP`, `POWER-2`, `POWER-3`, and `U_RING`.

The **uv_fit-s** label is circled in red in the bottom right corner of the image.

uv_compress

uv_map

uv_single

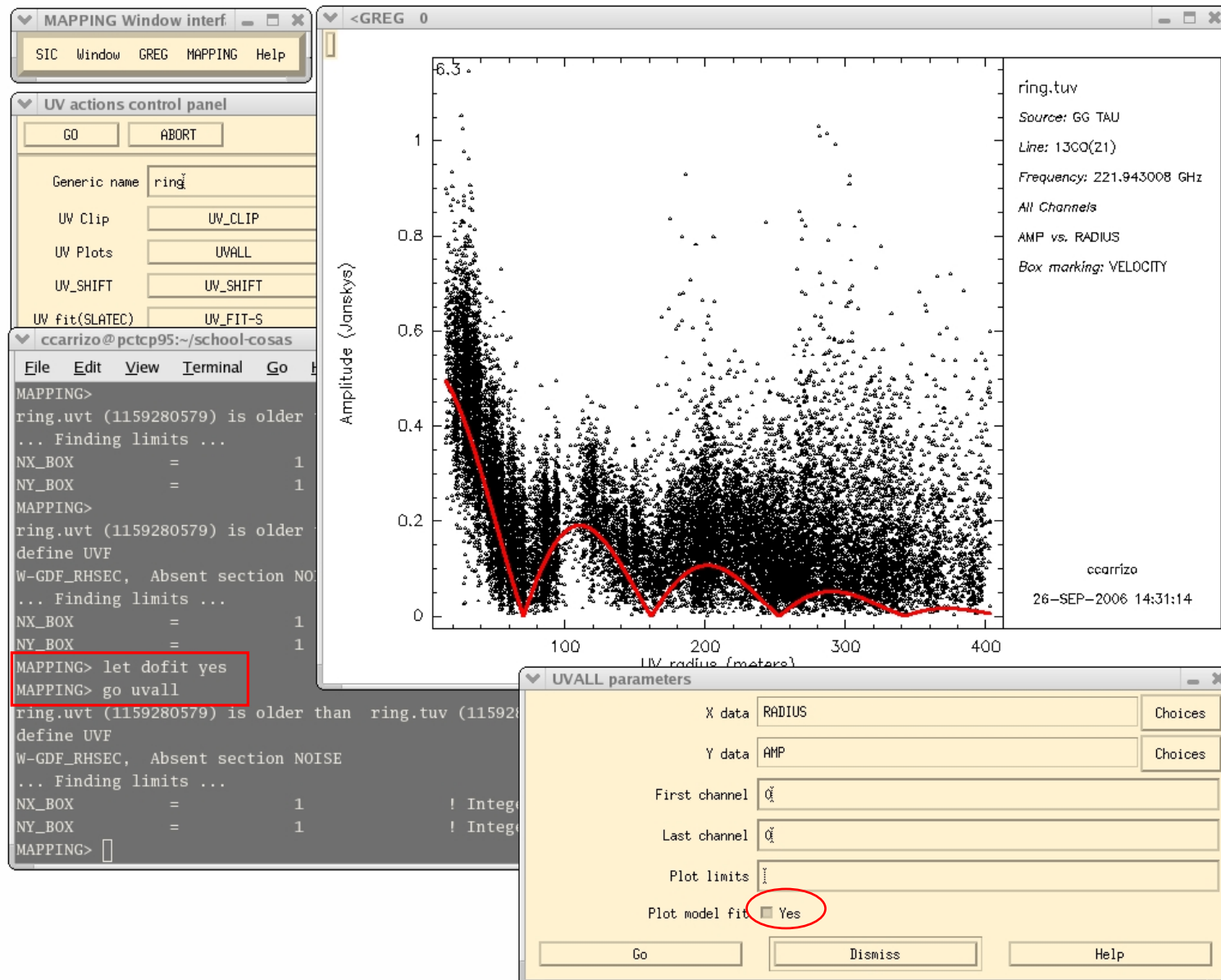
uv_zero

uv_cuts

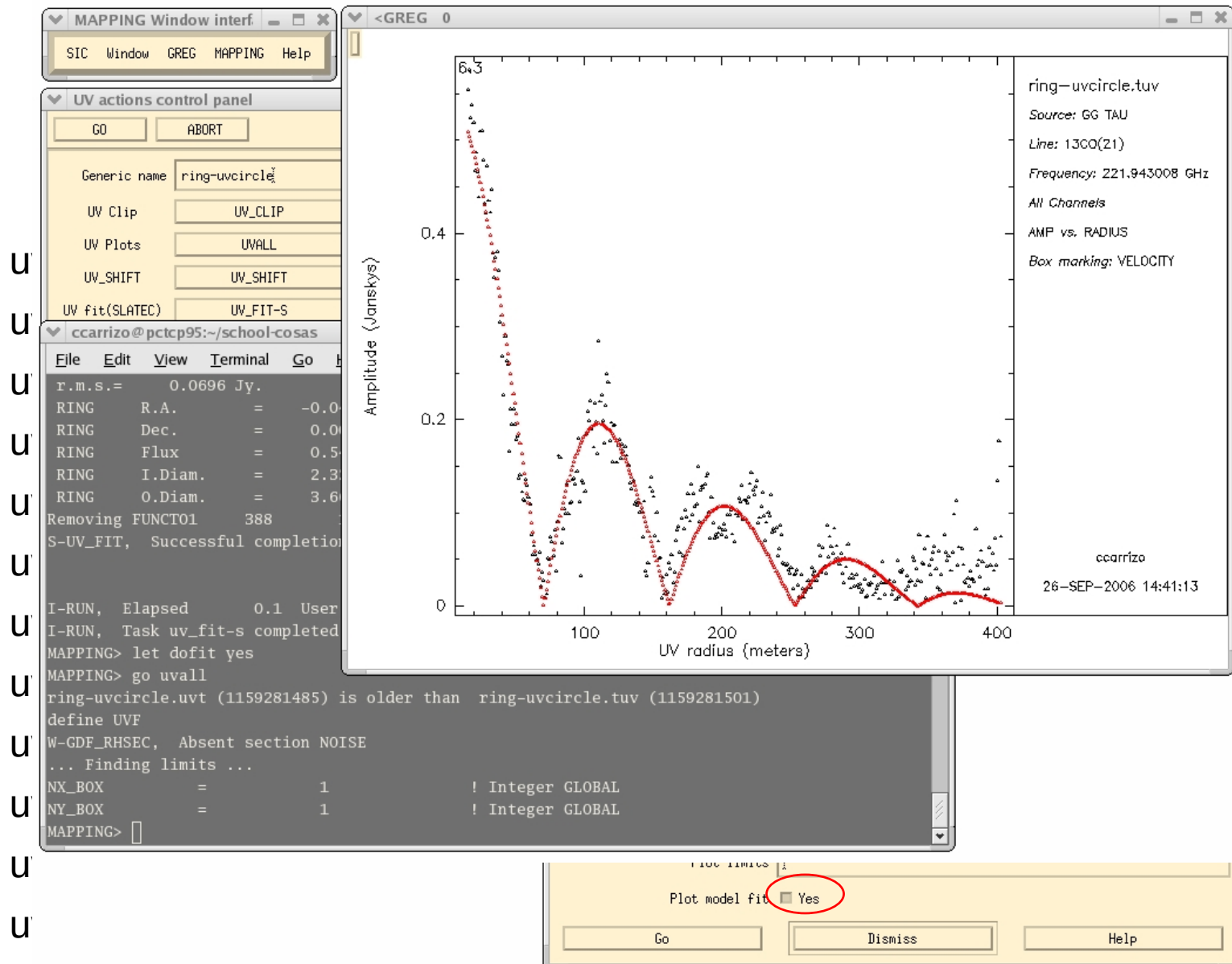
uv_mcal

uv_sinusphase

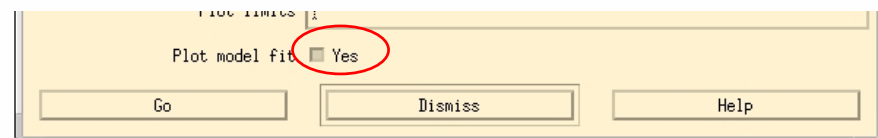
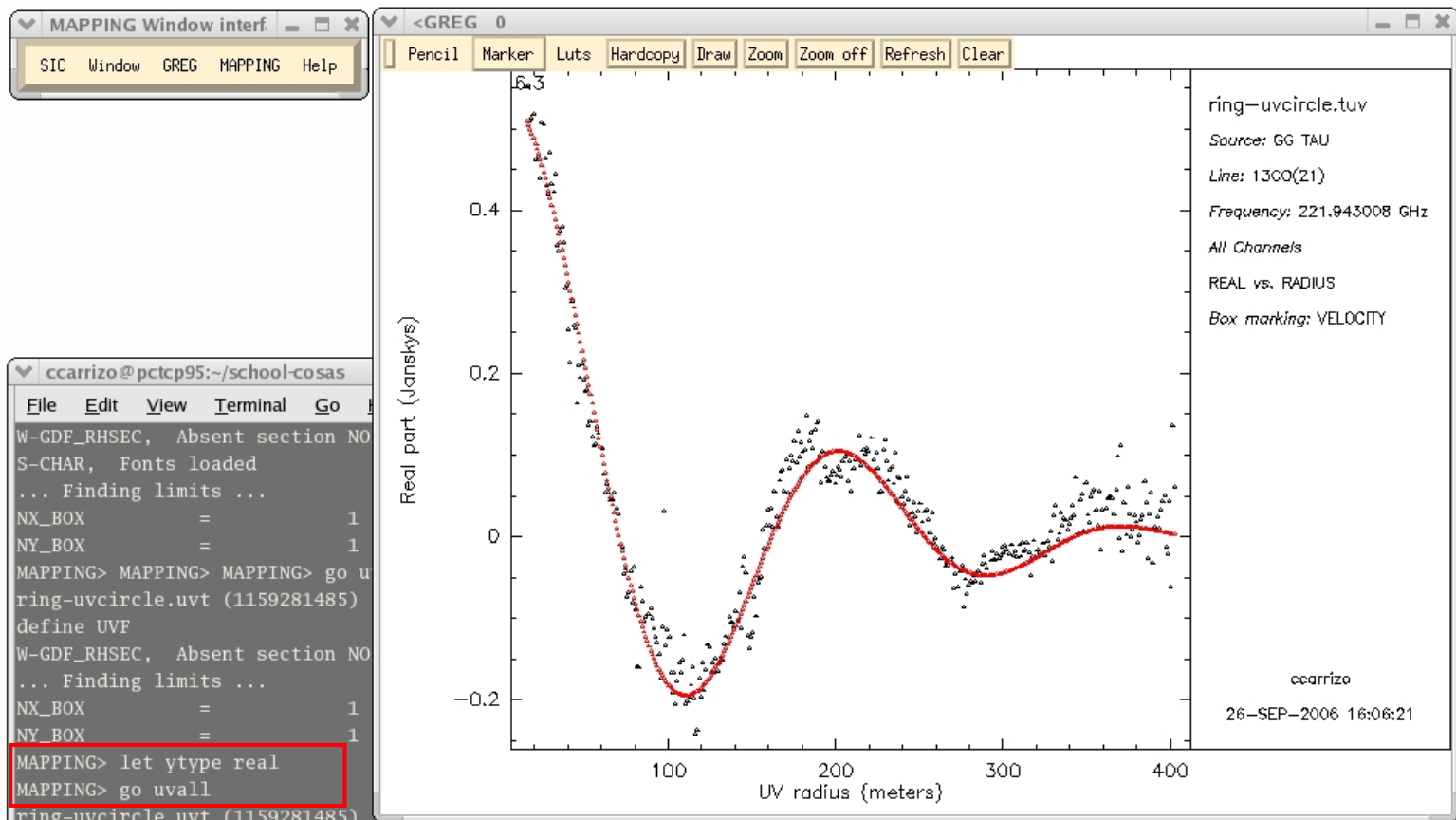
u u u u u u u u u u



Data analysis in the *uv*-plane



Data analysis in the *uv*-plane



Data analysis in the *uv*-plane

The screenshot displays the MAPPING software interface with several windows open. The 'MAPPING Window interf' window at the top left has a menu bar with 'SIC', 'Window', 'GREG', 'MAPPING', and 'Help'. The '<GREG 0' window in the background shows a grid of UV plane plots. The 'UV actions control panel' window is in the foreground, featuring buttons for 'GO', 'ABORT', and 'HELP'. It lists various actions: 'Generic name' (point2), 'UV Clip' (UV_CLIP), 'UV Plots' (UVALL), 'UV_SHIFT' (UV_SHIFT), and 'UV fit(SLATEC)' (UV_FIT-S, which is highlighted with a red box). The 'UV_FIT parameters' dialog is also open, showing settings for 'First channel' (0), 'Last channel' (0), 'UV range(min, max) (meters)' (0 500), and 'Number of Functions (1 or 2)' (1). The 'Function 1' dropdown is set to 'POINT' (highlighted with a red box), and the 'Parameters' field shows '0 0 0 0 0 0'. The 'Starting range' and 'numb. of starts' fields also show '0 0 0 0 0 0'. The 'Subtract function' checkbox is unchecked. The 'Function 2' section is empty. At the bottom of the dialog are 'Go', 'Dismiss', and 'Help' buttons. In the bottom left, a terminal window shows the command prompt 'ccarrizo@pctcp95:~/school-cosas' and the output of the UV fitting process, including the generic name 'point2' and the results of the minimization.

MAPPING Window interf

SIC Window GREG MAPPING Help

<GREG 0

point2.tuv
Source:
Line: h41a
Frequency: 92.034438 GHz

UV actions control panel

GO ABORT HELP

Generic name point2

UV Clip UV_CLIP UV_CLIP parameter

UV Plots UVALL UVALL parameter

UV_SHIFT UV_SHIFT UV_SHIFT parameter

UV fit(SLATEC) **UV_FIT-S** UV_FIT parameter

UV_FIT parameters

First channel 0

Last channel 0

UV range(min, max) (meters) 0 500

Number of Functions (1 or 2) 1

Function 1: **POINT** Choices

Parameters 0 0 0 0 0 0

Starting range 0 0 0 0 0 0

numb. of starts 0 0 0 0 0 0

Subtract function ☐ No

Function 2: Choices

Parameters 0 0 0 0 0 0

Starting range 0 0 0 0 0 0

numb. of starts 0 0 0 0 0 0

Subtract function ☐ No

Go Dismiss Help

ccarrizo@pctcp95:~/school-cosas

File Edit View Terminal Go Help

I-UV_FIT, Starting minimization on channel 10
-757.4877

I-UV_FIT, Starting from 0.0000 0.0000 0.0000
r.m.s.= 0.5298 Jy.

POINT R.A. = 1.10933 (0.00215) 20:32
POINT DEC. = -0.17432 (0.00238) 40:39
POINT FLUX = 0.89026 (0.00315)

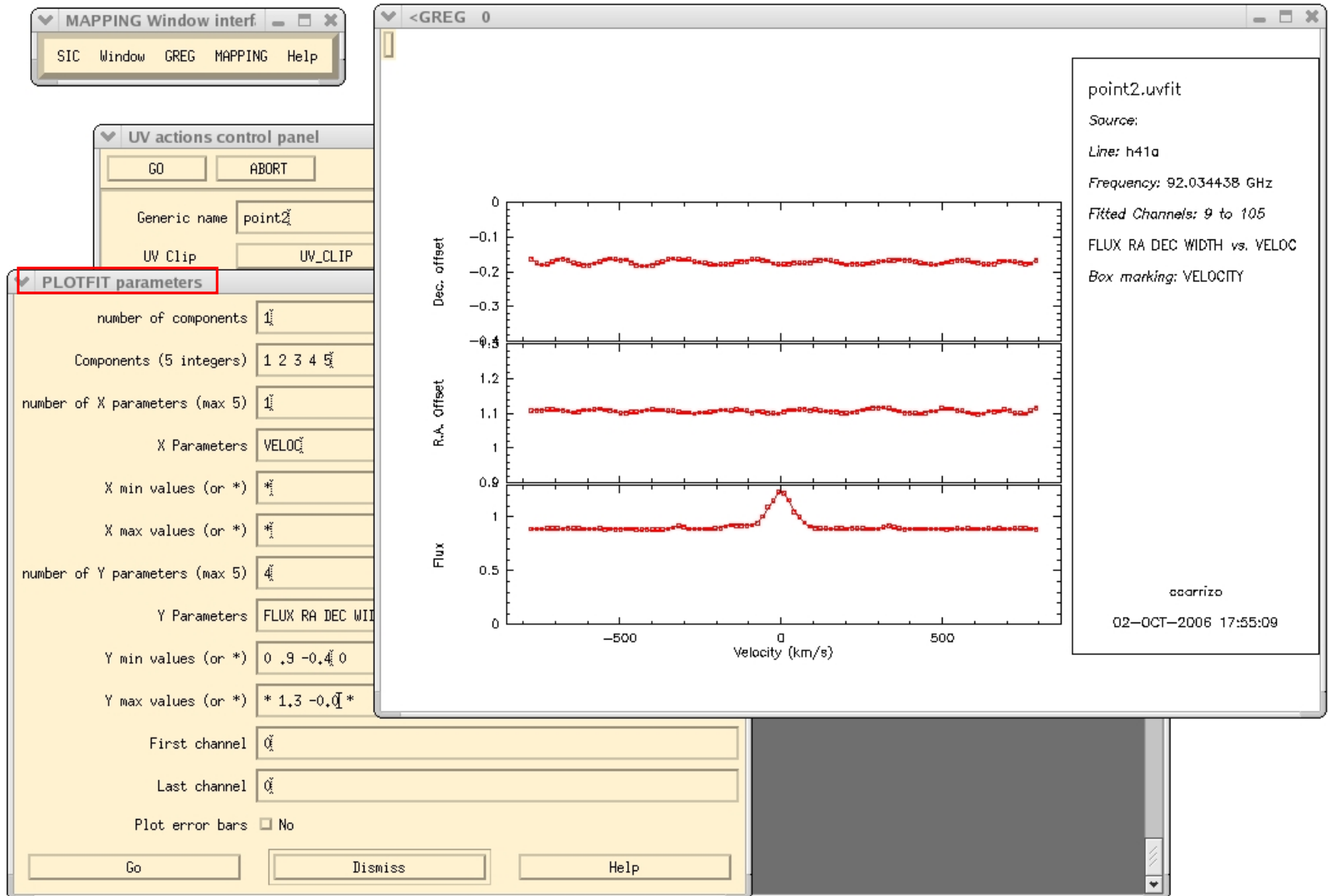
I-UV_FIT, 6570 data points for channel
I-UV_FIT, Starting minimization on channel 10
-773.7747

I-UV_FIT, Starting from 0.0000 0.0000 0.0000
r.m.s.= 0.5262 Jy.

POINT R.A. = 1.10746 (0.00214) 20:32
POINT DEC. = -0.16240 (0.00237) 40:39
POINT FLUX = 0.88733 (0.00313)

W-UV_FIT, No data for channel 106

Data analysis in the *uv*-plane



Data analysis in the *uv*-plane

The screenshot displays the MAPPING software interface with several windows open:

- MAPPING Window interf**: A menu bar with options: SIC, Window, GREG, MAPPING, Help.
- <GREG 0**: A window showing a plot of the uv-plane.
- UV actions control panel**: A panel with buttons for GO, ABORT, and HELP. It contains a Generic name field (point2) and a table of UV parameters. The UV fit(SLATEC) row is highlighted, showing UV_FIT-S and UV_FIT parameters.
- UV_FIT parameters**: A dialog box for configuring the fit. It includes fields for First channel, Last channel, UV range(min, max) (meters), Number of Functions (1 or 2), Function 1 (C_GAUSS), Parameters, Starting range, numb. of starts, Subtract function (No), Function 2, and buttons for Go, Dismiss, and Help.
- Terminal**: A window showing the output of the UV fit process. It displays the results of the fit for channel 0, including the r.m.s. value (0.5282 Jy) and the parameters of the C_GAUSS function.

point2.uvfit
Source:
Line: h41a
Frequency: 92.034438 GHz
Fitted Channels: 9 to 105

UV actions control panel

GO ABORT HELP

Generic name point2

UV Clip UV_CLIP UV_CLIP param

UV Plots UVALL UVALL param

UV_SHIFT UV_SHIFT UV_SHIFT param

UV fit(SLATEC) UV_FIT-S UV_FIT param

UV_FIT parameters

First channel 0

Last channel 0

UV range(min, max) (meters) 0 500

Number of Functions (1 or 2) 1

Function 1: C_GAUSS Choices

Parameters 0 0 0 1 0 0

Starting range 0 0 0 0 0 0

numb. of starts 0 0 0 0 0 0

Subtract function ☐ No

Function 2: Choices

Parameters 0 0 0 0 0 0

Starting range 0 0 0 0 0 0

numb. of starts 0 0 0 0 0 0

Subtract function ☐ No

Go Dismiss Help

ccarrizo@pctcp95:~/school-cosas

File Edit View Terminal Go Help

I-UV_FIT, Starting from 0.0000 0.0000 0.0000

r.m.s.= 0.5282 Jy.

C_GAUSS R.A. = 1.10683 (0.00223) 20:

C_GAUSS Dec. = -0.17808 (0.00243) 40:

C_GAUSS Flux = 0.95585 (0.00557)

C_GAUSS F.W.H.P. = 0.40077 (0.01392)

I-UV_FIT, 6570 data points for channel

I-UV_FIT, Starting minimization on channel

-757.4877

I-UV_FIT, Starting from 0.0000 0.0000 0.0000

r.m.s.= 0.5259 Jy.

C_GAUSS R.A. = 1.10728 (0.00222) 20:

C_GAUSS Dec. = -0.17311 (0.00242) 40:

C_GAUSS Flux = 0.95381 (0.00554)

C_GAUSS F.W.H.P. = 0.39541 (0.01404)

I-UV_FIT, 6570 data points for channel

I-UV_FIT, Starting minimization on channel

Data analysis in the *uv*-plane

Before concluding on a certain source extent, check that the relative flux calibration between tracks with longer and shorter baselines is correct



UV Clip UV_CLIP

PLOTFIT parameters

number of components 1

Components (5 integers) 1 2 3 4 5

number of X parameters (max 5) 1

X Parameters VELOC

X min values (or *) *

X max values (or *) *

number of Y parameters (max 5) 4

Y Parameters FLUX RA DEC

Y min values (or *) 0 .9 -0.4

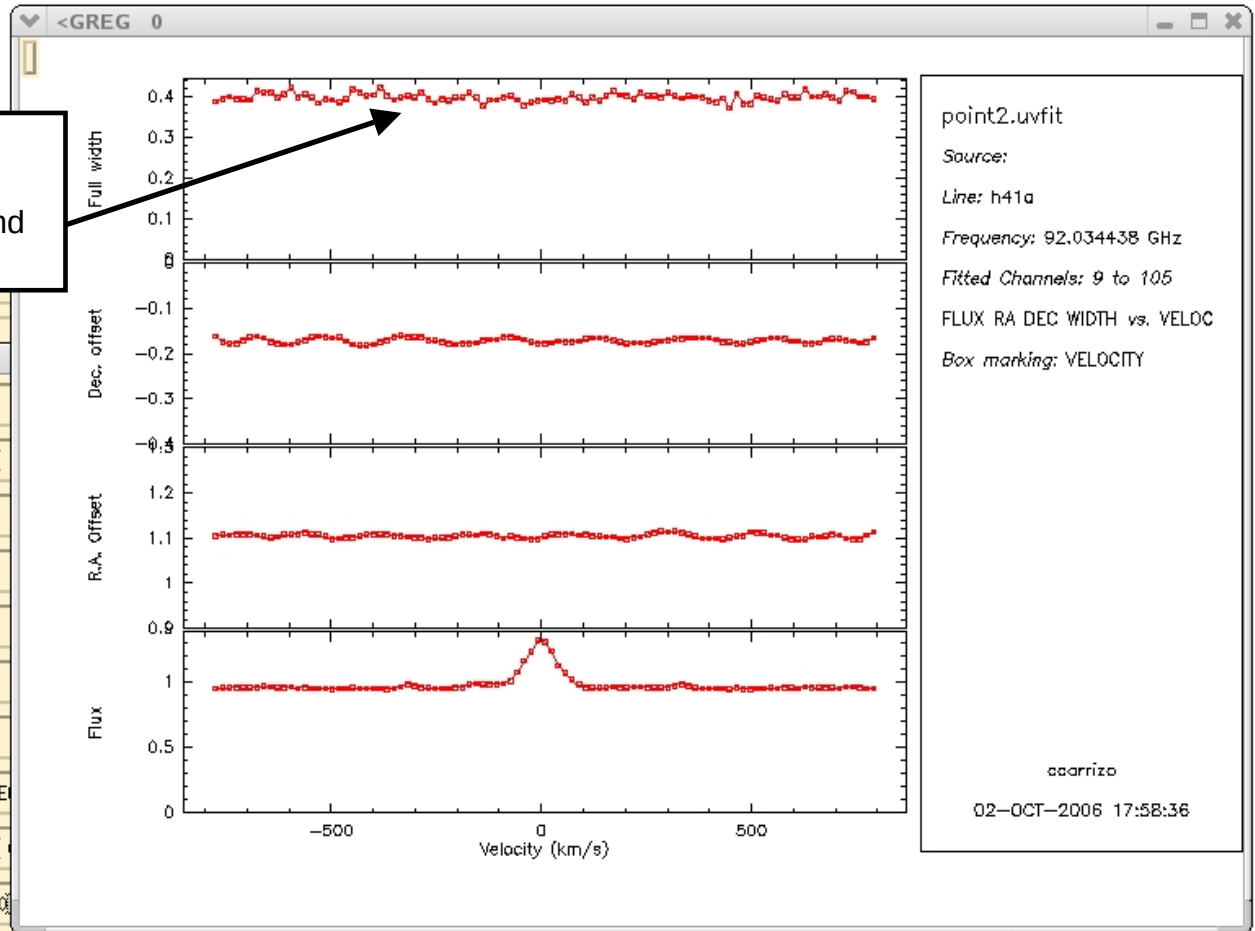
Y max values (or *) * 1.3 -0.0

First channel 0

Last channel 0

Plot error bars ☐ No

Go Dismiss Help



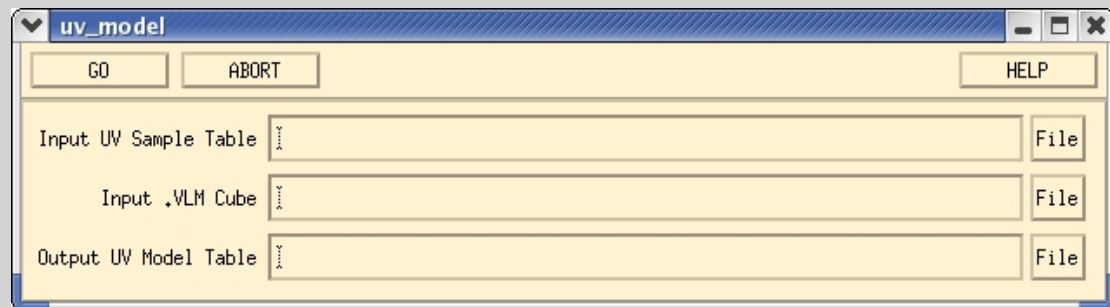
Data analysis in the *uv*-plane

```
MAPPING> run ...
```

```
MAPPING> help ...
```

uv_applyphase	uv_dft	uv_merge	uv_solve
uv_ascal	uv_extract	uv_mflag	uv_sort
uv_atm	uv_fidelity	uv_model	uv_splitfield

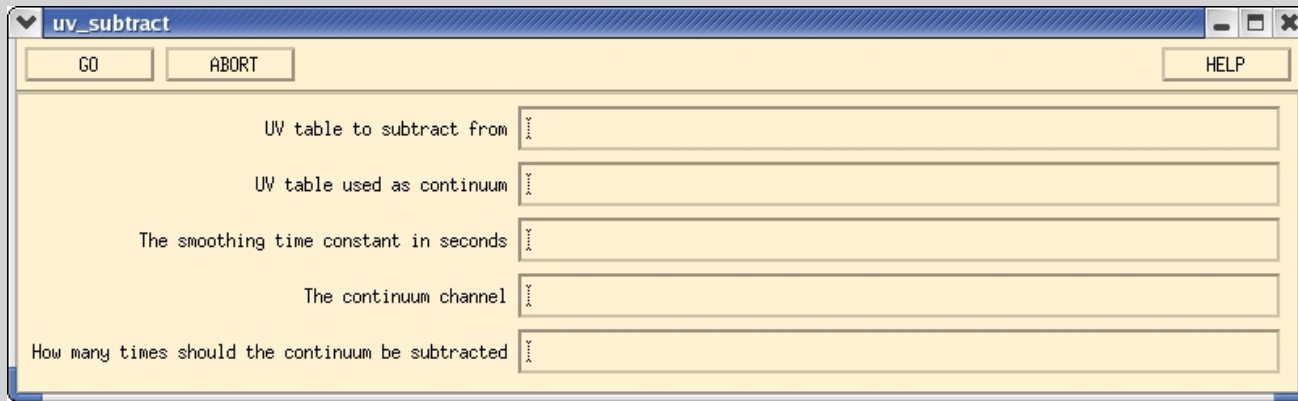
uv_averag
uv_cal
uv_ccmod
uv_cct
uv_center
uv_circle
uv_clip



To create a *uv* table from an image, e.g. a model

uv_compress	uv_map	uv_single	uv_zero
uv_cuts	uv_mcal	uv_sinusphase	

Data analysis in the *uv*-plane



The screenshot shows a dialog box titled "uv_subtract". It has a yellow background and a blue title bar. At the top, there are three buttons: "GO", "ABORT", and "HELP". Below the buttons, there are five input fields, each with a label to its left. The labels are: "UV table to subtract from", "UV table used as continuum", "The smoothing time constant in seconds", "The continuum channel", and "How many times should the continuum be subtracted". Each input field has a small "Browse..." button to its right. The dialog box is part of a larger window with a red border.

To subtract a time-averaged continuum *uv* table

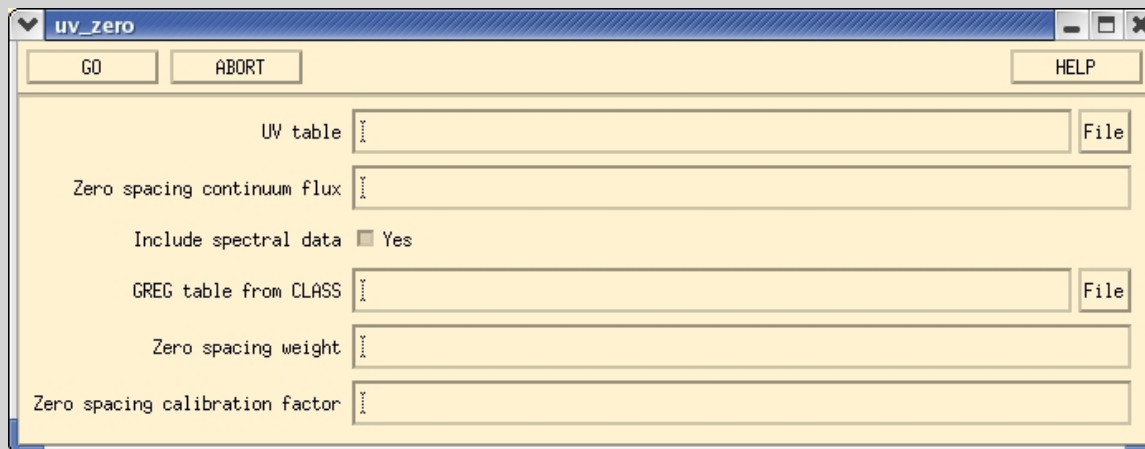
— solve
— sort
— splitfield
— stat

uv_cal	uv_flag	uv_noise	uv_subtract
uv_ccmodel	uv_fmodel	uv_observe	uv_table
uv_cct	uv_gain	uv_pointing	uv_timeaverage
uv_center	uv_hanning	uv_selfcal	uv_timebase
uv_circle	uv_hybrid	uv_shift	uv_track
uv_clip	uv_list	uv_short	uv_track_phase
uv_compress	uv_map	uv_single	uv_zero
uv_cuts	uv_mcal	uv_sinusphase	

Data analysis in the *uv*-plane

MAPPING> run ...

MAPPING> help ...



To add a single-dish zero-spacing spectrum

solve

sort

splitfield

stat

subtract

table

timeaverage

timebase

uv_track

uv_track_phase

uv_zero

uv_circle

uv_clip

uv_compress

uv_cuts

uv_hybrid

uv_list

uv_map

uv_mcal

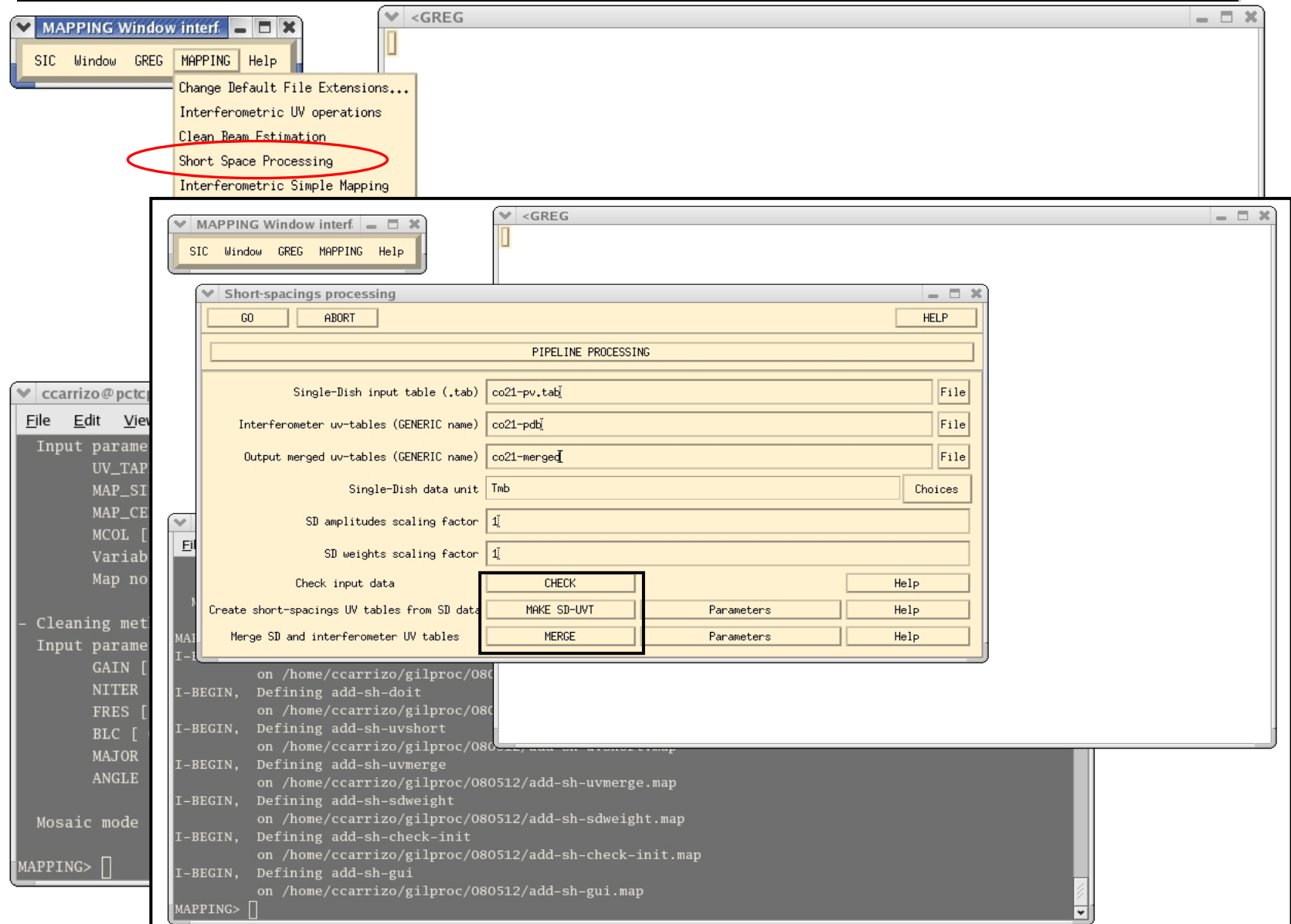
uv_smooth

uv_short

uv_single

uv_sinusphase

Data analysis in the uv -plane



Data analysis in the *uv*-plane

uv tables are fully editable

uv table [visib dimension, # visibilities]

Each visibility contains:

visib dimension = $7 + 3 \times (\# \text{ channels})$

- u in meters
- v in meters
- scan number
- observation date (CLASS number)
- time in seconds (since date above)
- start antenna in the baseline
- end antenna in the baseline

7 visib. characteristics

- real part for 1st channel
- imaginary part 1st channel
- weight 1st channel

data at 1st channel

- real part for 2nd cha
- imaginary part 2nd cha
- ...

```
mapping> define table aa mytable.uvt write
mapping> let aa[8,2380] 6000
mapping> delete /variable aa
```


To conclude:

- Always an inspection of data in the uv -plane
- A more detailed analysis can be performed in the uv -plane: detection, modeling of simple structures, relative calibration to be checked, etc