

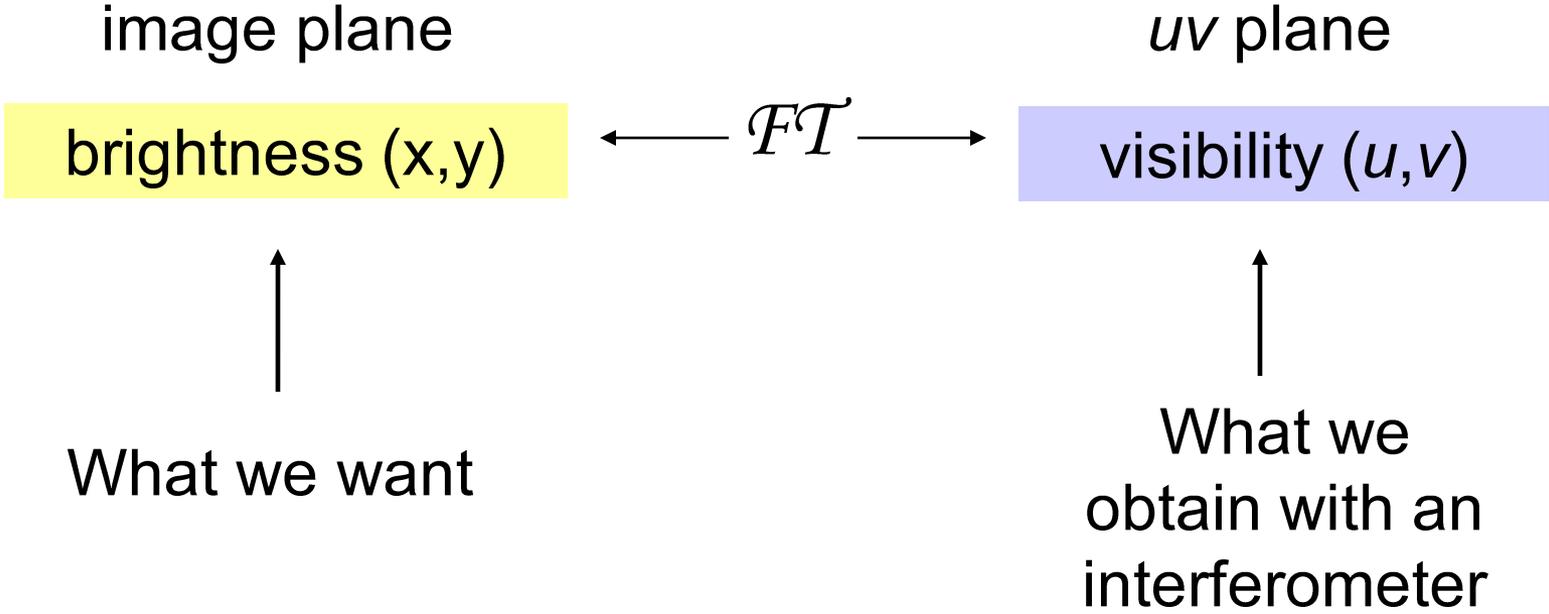
# NOEMA *uv*-data analysis in practice



Miguel Montargès

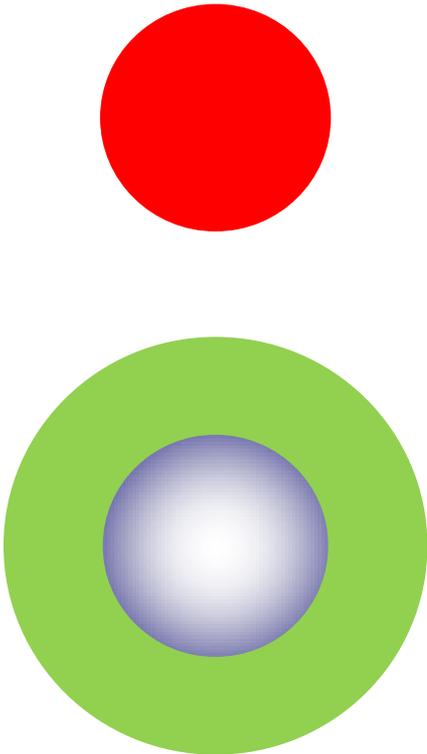
(slides available here, only today : <http://www.iram.fr/~montarges>)

# General Picture

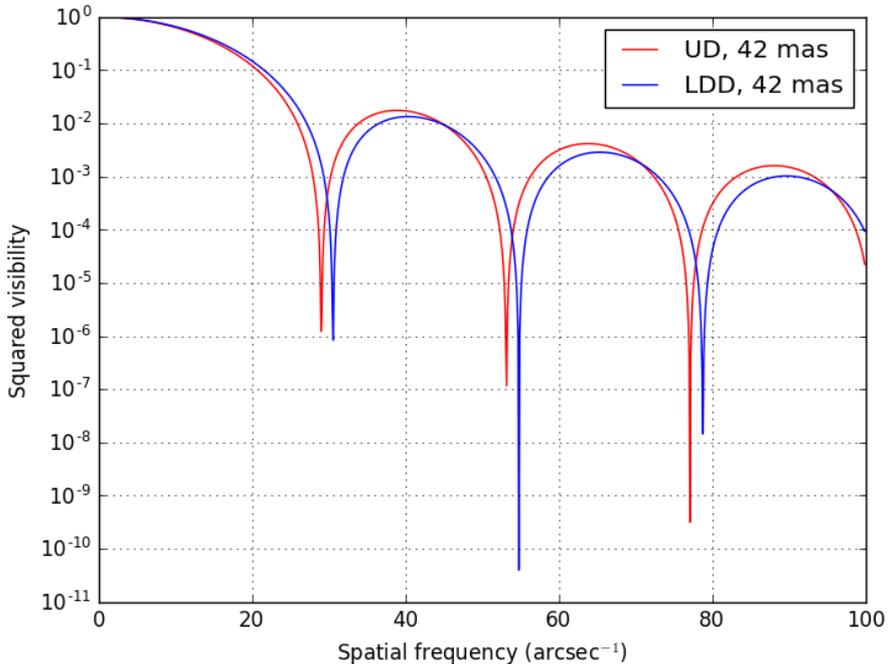


# General Picture

image plane



*uv* plane



# General Picture

image plane

brightness  $(x,y)$

$uv$  plane

visibility  $(u,v)$  <sup>instr</sup>

**IPB data**



Calibration



**hpb files**

visibility  $(u,v)$  <sup>obs</sup>

**uv-table**

Gridding

FFT

Cleaning

**Imv\* (gdf)**

brightness  $(x,y)$  <sup>uv</sup>

• 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.

## Structure of uv tables

Each visibility contains:

$uv$  table [ visib dimension, # visibilities ]

- $u$  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

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

7 visib. characteristics

- real part for 1<sup>st</sup> channel
- imaginary part 1<sup>st</sup> channel
- weight 1<sup>st</sup> channel

data at 1<sup>st</sup> channel

- real part for 2<sup>nd</sup> channel
- imaginary part 2<sup>nd</sup> channel
- ...

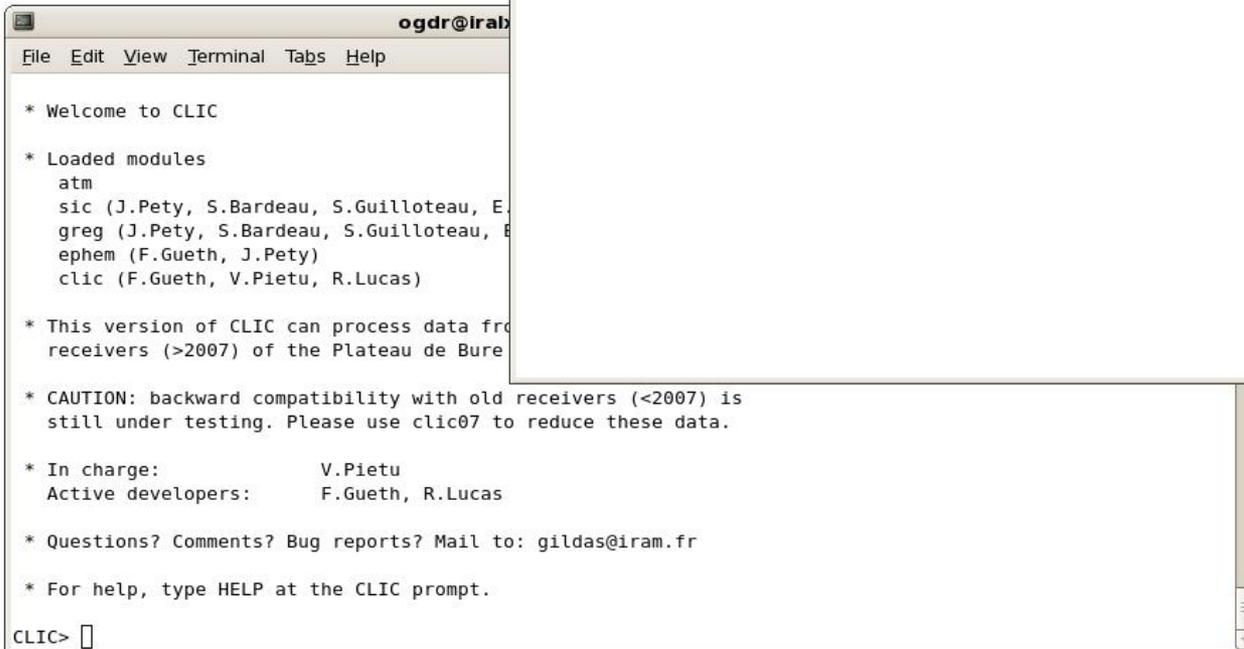
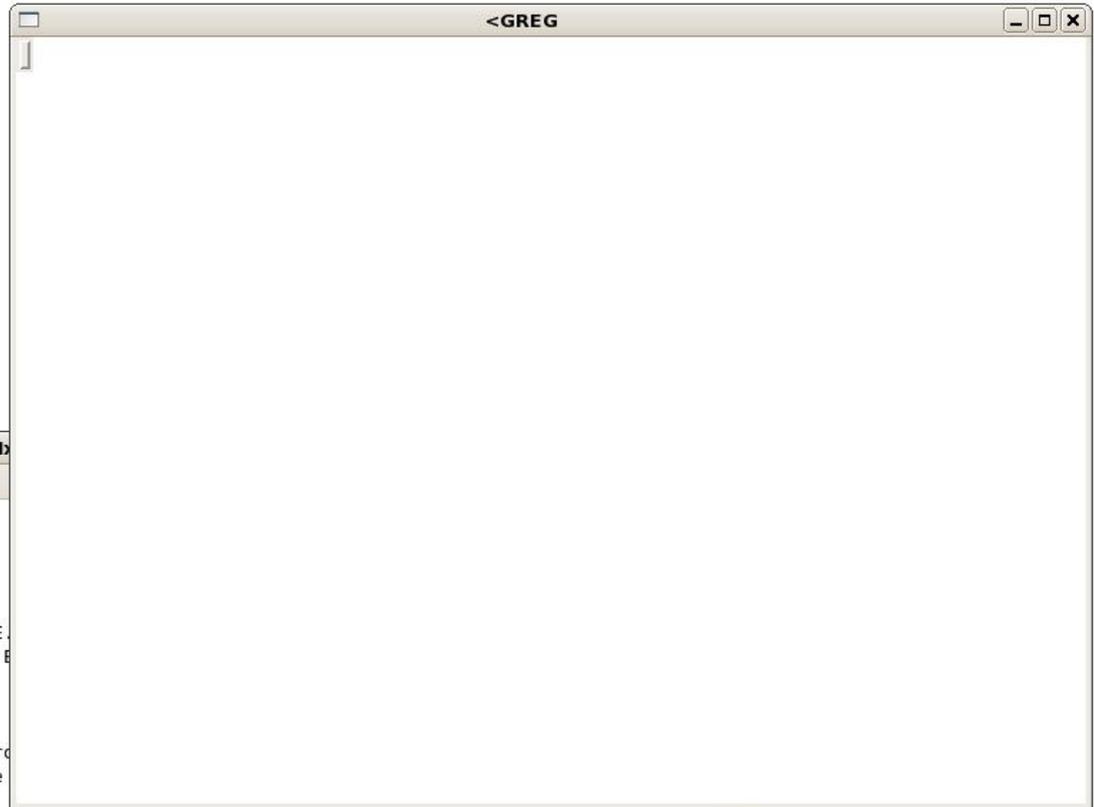
data at 2<sup>nd</sup> channel

# Summary

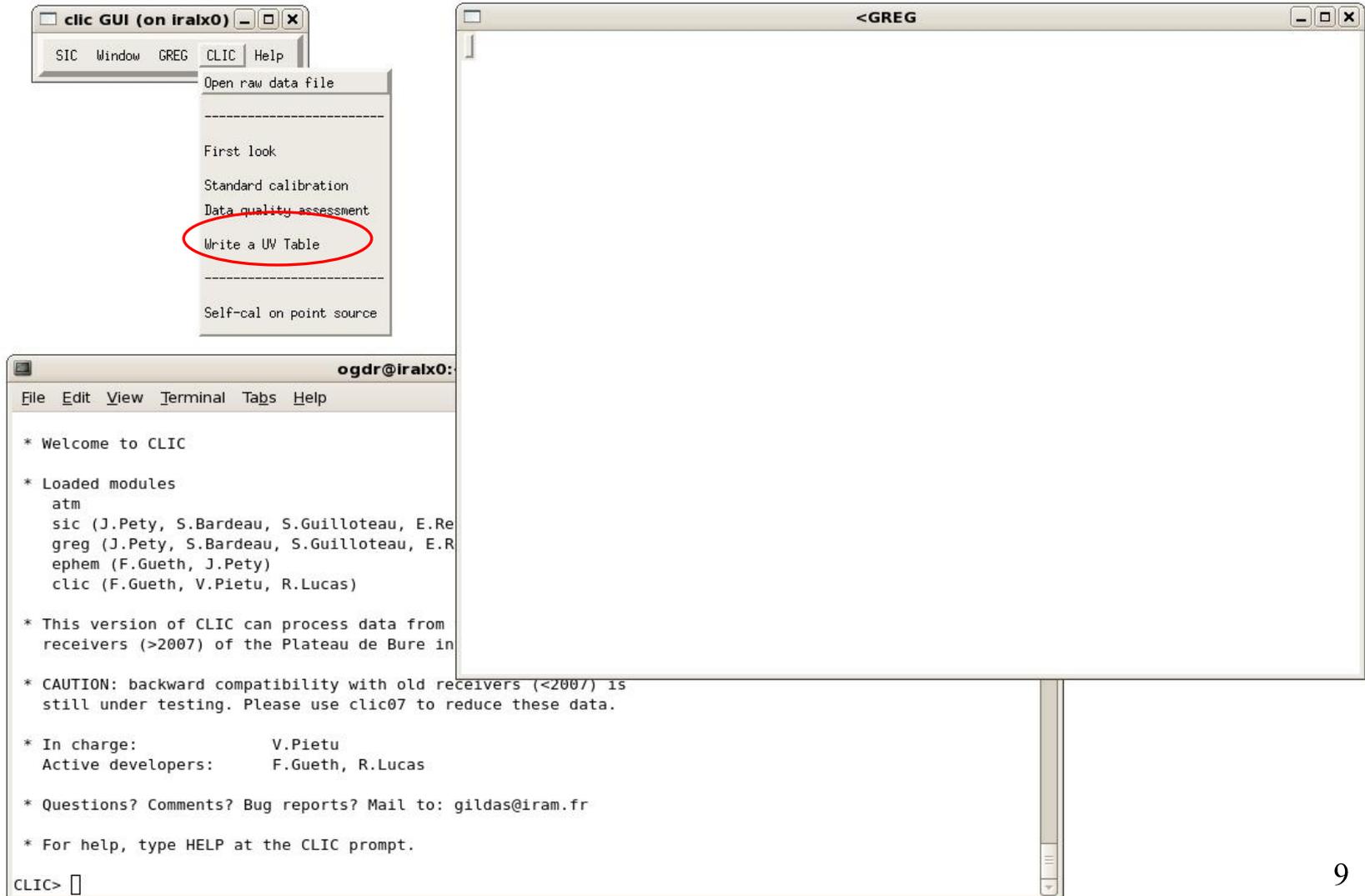
1. Let's create a  $uv$ -table, in **CLIC**
2. Data analysis, in **MAPPING**
  - Data analysis in the  $uv$ -plane
  - An inspection of the  $uv$ -data needed

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

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



# Creating a *uv*-table; CLIC



The image shows a graphical user interface for CLIC. The main window is titled '<GREG' and is currently empty. A smaller window titled 'cllc GUI (on iralx0)' is open, showing a menu with the following options: 'Open raw data file', 'First look', 'Standard calibration', 'Data quality assessment', 'Write a UV Table' (highlighted with a red circle), and 'Self-cal on point source'. Below the GUI is a terminal window titled 'ogdr@iralx0:' with the following text:

```
File Edit View Terminal Tabs Help

* Welcome to CLIC

* Loaded modules
  atm
  sic (J.Pety, S.Bardeau, S.Guilloteau, E.Re
  greg (J.Pety, S.Bardeau, S.Guilloteau, E.R
  ephem (F.Gueth, J.Pety)
  clic (F.Gueth, V.Pietu, R.Lucas)

* This version of CLIC can process data from
  receivers (>2007) of the Plateau de Bure in

* CAUTION: backward compatibility with old receivers (<2007) is
  still under testing. Please use clic07 to reduce these data.

* In charge:          V.Pietu
  Active developers:  F.Gueth, R.Lucas

* Questions? Comments? Bug reports? Mail to: gildas@iram.fr

* For help, type HELP at the CLIC prompt.

CLIC> 
```

# Creating a *uv*-table; CLIC

The screenshot displays the 'Simple UV Table creation (on iralx0)' GUI. The window title is 'Simple UV Table creation (on iralx0)'. It features a 'CREATE THE TABLE' tab and buttons for 'GO', 'ABORT', and 'HELP'. The main area contains several input fields and checkboxes:

- Use atm. phase correction?  Yes
- Input Data File Name: /users/PdBdata/ogdr/ischool/2010/wide/20-jun-2010-wide.hpb [File]
- Output UV Table Name: wide-co21.uvt
- New Table  Yes
- Source Name: MFS-10
- R.A. & Dec. Offsets (for Mosaics): 0
- First and last scan: 0 10000
- Receiver number: 2 [Choices]
- Line or Continuum: LINE [Choices]
- Band Used: LSB [Choices]

Below these fields is a list of receiver options (L01-L12) with checkboxes:

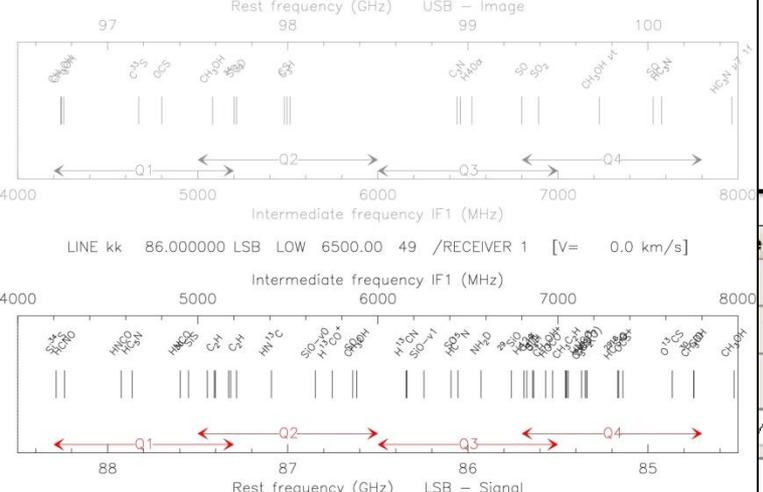
- L01  Yes
- L02  No
- L03  No
- L04  No
- L05  Yes
- L06  No
- L07  No
- L08  No
- L09  No
- L10  No
- L11  No
- L12  No

At the bottom, there are buttons for 'Line parameters' (Line, Line parameters, Help) and 'Resampling parameters' (Resampling, Resampling parameters, Help).

On the left, a terminal window shows the CLIC command line interface with the following output:

```
CLIC>  
I-GREG, Re-alloc  
CLIC>
```

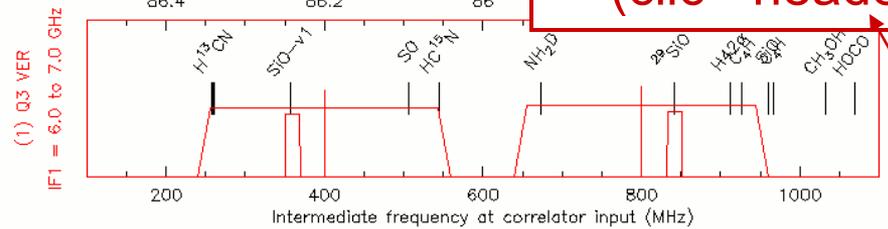
Two green circles highlight the receiver options L01 and L05, which are checked. A green text label 'Narrow band Corr' is positioned to the right of the first circle, and another green text label 'WideX' is positioned to the right of the second circle.



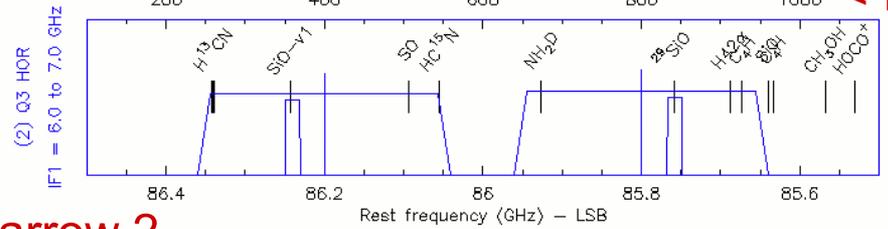
# Creating a u

astro> line + plot  
 clic> header /plot  
 (clic> header)

narrow 1



narrow 2



New Table?  Yes

Source Name? MFS-22

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

First and last scan? 0 10000

Min. Data quality? AVERAGE

Receiver number? 1

Line or Continuum? LINE

Band Used? LSB

Use L01?  No

Use L02?  No

Use L03?  No

Use L04?  No

Use L05?  Yes

Use L06?  No

Use L07?  No

Use L08?  No

Change line parameter?  Yes

Resample spectral data?  No

Line parameters

Resampling parameters

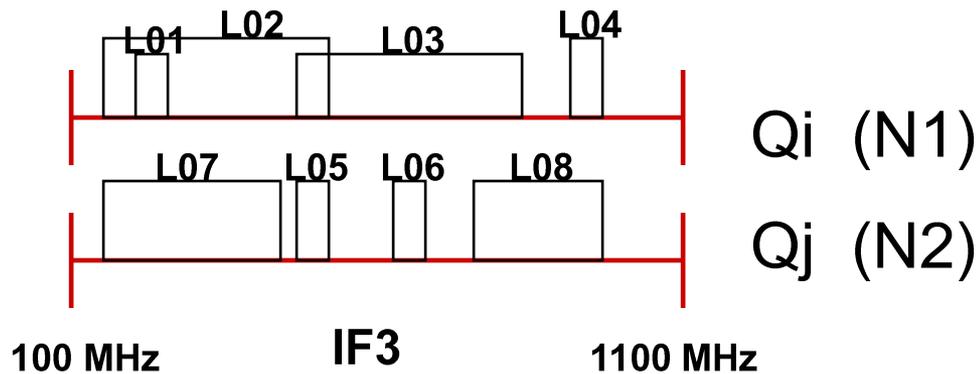
Line parameters

Change line parameter?  Yes

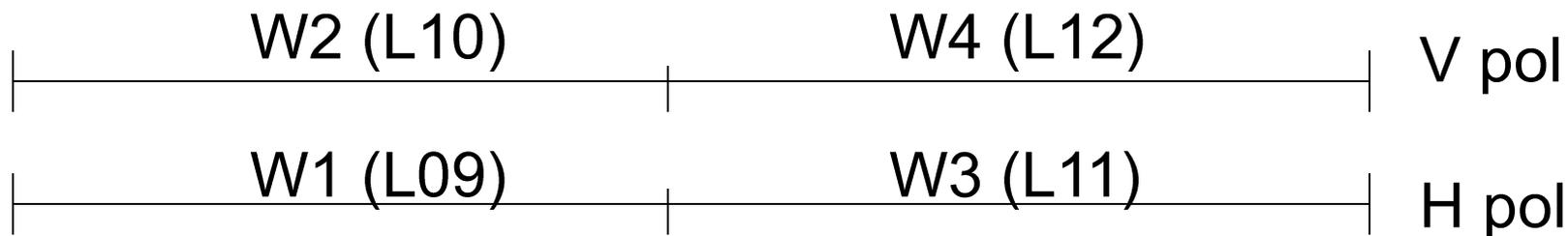
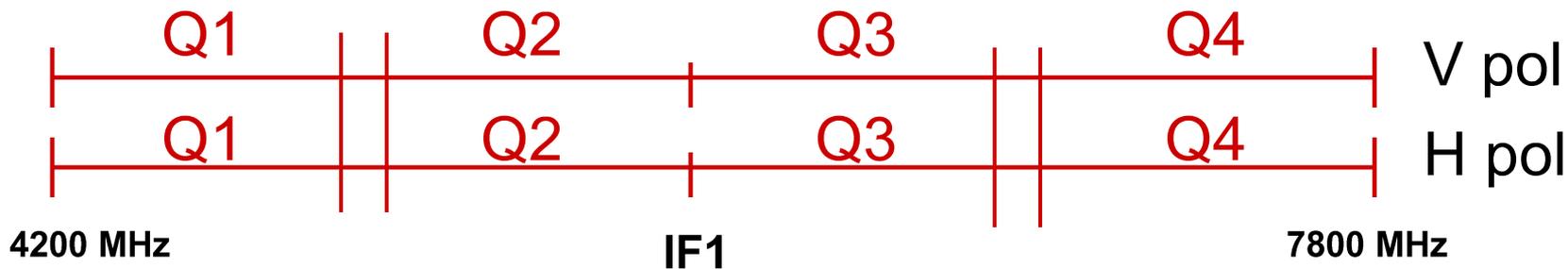
Line Name 29sid

Rest Frequency (MHz) 85759.144

Go Dismiss Help



**Narrow Band Correlator** CONFIG



**Wide Band Correlator** FIXED

# Creating a uv-table; CLIC

Simple UV Table creation

GO ABORT HELP

CREATE THE TABLE

Use atm. phase correction?  Yes

Input Data File Name ? /home/ccarrizq/08-oct-2008-isj8.hpb File

Output UV Table Name ? ~/maps/isj8-co21

New Table?  Yes

Source Name ? MFS-22

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

First and last scan ? 0 10000

Min. Data quality ? AVERAGE Choices

Receiver number ? 3 Choices

Line or Continuum ? LINE Choices

Band Used ? LSB Choices

Use L01 ?  Yes

Use L02 ?  No

Use L03 ?  No

Use L04 ?  No

Use L05 ?  Yes

Use L06 ?  No

Use L07 ?  No

Use L08 ?  No

Change line parameter ?  No

Resample spectral data ?  Yes

Line parameters Line Line parameters Help

Resampling parameters Resampling Resampling parameters Help

Resampling parameters

Resample spectral data ?  Yes

New number of channels 40

New reference channel 20

Velocity at the reference channel -30

New resolution 2

Go Dismiss Help

```
ogdr@iralx0:~/ischool/2010/isa8/reports
File Edit View Terminal Tabs Help
Phases are Degrees Jumpy
Amplitudes are relative to calibrator amplitude
Amplitude Calibration is antenna-based
Amplitudes are expressed in janskys
RF Passband Calibration is applied
RF Passband Calibration is frequency dependent
RF Passband Calibration is antenna-based
RF Passband Calibration from input file
RF Passband Calibration is applied
RF Passband Calibration is frequency dependent
RF Passband Calibration is antenna-based
RF Passband Calibration from input file
Phases are relative to calibrator phase
Phase Calibration is antenna-based
Phase reference is internal (same receiver)

Using real-time atmospheric phase correction, antennas 1 2 3 4 5 6
  (according to validation by STORE CORRECTION)
Using no off-line atmospheric phase correction, antennas 1 2 3 4 5 6

Phases are Degrees Jumpy
Amplitudes are relative to calibrator amplitude
Amplitude Calibration is antenna-based
Amplitudes are expressed in janskys
I-FILE,[6868] Found file /users/PdBdata/ogdr/ischool/2010/isa8/reports/11-apr-2007-isa8.hpb
Offset range : 0.0 to 0.0 and 0.0 to 0.0
Selected data quality is 4 (Average)
I-CLIC_SET,[6868] SWITCHING ON SET AVERAGE SCAN METHOD
Phases are Degrees Jumpy
Amplitudes are relative to calibrator amplitude
Amplitude Calibration is antenna-based
Amplitudes are expressed in janskys
RF Passband Calibration is applied
RF Passband Calibration is frequency dependent
RF Passband Calibration is antenna-based
RF Passband Calibration from input file
Selection is LINE, LSB , L07
All frequencies selected.
I-CLIC, Primary beam size 58.76925 "
W-TABLE,[7537] Spectrum resampling is needed, obs. # 844 Scan 7537
W-TABLE,[7537] Frequency resolutions : 2.500000000000000 -0.858185138199841
W-TABLE,[7537] Reference channels : 13.9744529724121 15.0000000000000
W-TABLE,[7537] Number of channels : 116 30
I-TABLE,[6957] Table parameters for aqgl-sio.uvt:
I-TABLE,[6957] X_LINE = sio X_FREQ = 85759.144 X_VAL1 = 85743.342
I-TABLE,[6957] X_FRES = -0.858 X_VRES = 3.000 X_VOFF = 99.000
I-TABLE,[6957] NCHAN = 30 X_REF1 = 15.0000
I-TABLE,[6957] 5665 visibilities written (out of 5850 possible)
I-TABLE,[6957] Old size 5850 New 5665
CLIC>
```

CLIC

```
ogdr@iralx0:~/ischool/2010/isa8/reports
File Edit View Terminal Tabs Help
RF Passband Calibration is applied
RF Passband Calibration is frequency dependent
RF Passband Calibration is antenna-based
RF Passband Calibration from input file
Phases are relative to calibrator phase
Phase Calibration is antenna-based
Phase reference is internal (same receiver)

Using real-time atmospheric phase correction, antennas 1 2 3 4 5 6
  (according to validation by STORE CORRECTION)
Using no off-line atmospheric phase correction, antennas 1 2 3 4 5 6

Phases are Degrees Jumpy
Amplitudes are relative to calibrator amplitude
Amplitude Calibration is antenna-based
Amplitudes are expressed in janskys
I-FILE,[6868] Found file /users/PdBdata/ogdr/ischool/2010/isa8/reports/11-apr-2007-isa8.hpb
Offset range : 0.0 to 0.0 and 0.0 to 0.0
Selected data quality is 4 (Average)
I-CLIC_SET,[6868] SWITCHING ON SET AVERAGE SCAN METHOD
Phases are Degrees Jumpy
Amplitudes are relative to calibrator amplitude
Amplitude Calibration is antenna-based
Amplitudes are expressed in janskys
RF Passband Calibration is applied
RF Passband Calibration is frequency dependent
RF Passband Calibration is antenna-based
RF Passband Calibration from input file
Selection is LINE, LSB , L07
All frequencies selected.
I-CLIC, Primary beam size 58.76925 "
W-TABLE,[7537] Spectrum resampling is needed, obs. # 844 Scan
W-TABLE,[7537] Frequency resolutions : 2.5000000000000000
W-TABLE,[7537] Reference channels : 13.9744529724121 15
W-TABLE,[7537] Number of channels : 116 30
I-TABLE,[6957] Table parameters for afgl-sio.uvt:
I-TABLE,[6957] X_LINE = sio X_FREQ = 85759.144 X_VAL1 = 85743.342
I-TABLE,[6957] X_FRES = -0.858 X_VRES = 3.000 X_VOFF = 99.000
I-TABLE,[6957] NCHAN = 30 X_REF1 = 15.0000
I-TABLE,[6957] 5665 visibilities written (out of 5850 possible)
I-TABLE,[6957] Old size 5850 New 5665
CLIC> sys
You are logged in on host iralx0.
Tue Oct 5 21:17:51 CEST 2010

Selecting GILDAS version: 27sep (27sep10 02:05 cest), executable tree, x86_64-fedora6-ifort

SIC# lrt *cllic
-rw-r----- 1 ogdr project 534 Oct 5 21:14 afgl-sio.uvt-table.cllic
SIC#
```

CLIC

Easy and faster  
edit table script

```
SIC# lrt *cllic
-rw-r----- 1 ogdr project 534 Oct 5 21:14 afgl-sio.uvt-table.cllic
SIC#
```

The image shows a screenshot of an Emacs editor window titled "isj8-co21-table.clic - emacs@pctcp33.iram.fr". The window contains a CLIC script for CO21 observations. The script includes various settings for observation parameters and a table definition. The status bar at the bottom indicates the current position in the file: "-0:-- isj8-co21-table.clic (Fundamental)--L21--All-----" and shows a message: "Wrote /home/ccarrizo/isj8-co21-table.clic".

```
isj8-co21-table.clic
file in 08-oct-2008-isj8.hpb
set default
set scan 0 10000
set offset 0 0
set receiver 3
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 LSB L01 and L05
find /proc corr /sou MFS-22
table ~/maps/isj8-co21.uvt new /frequency C021 230538 /res 40 20 -30 2 velo
```

-0:-- isj8-co21-table.clic (Fundamental)--L21--All-----  
Wrote /home/ccarrizo/isj8-co21-table.clic

Simple UV Table creation

GO ABORT HELP

CREATE THE TABLE

Use atm. phase correction?  Yes

Input Data File Name ? /home/ccarrizo/24-dec-2008-isj8.hpb File

Output UV Table Name ? ~/maps/isj8-co21

New Table?  No

Source Name ? MFS-22

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

First and last scan ? 0 1000

Min. Data quality ? AVERAGE Choices

Receiver number ? 3 Choices

Line or Continuum ? LINE Choices

Band Used ? LSB Choices

Use L01 ?  Yes

Use L02 ?  No

Use L03 ?  No

Use L04 ?  No

Use L05 ?  Yes

Use L06 ?  No

Use L07 ?  No

Use L08 ?  No

Change line parameter ?  No

Resample spectral data ?  Yes

Line parameters Line Line parameters Help

Resampling parameters Resampling Resampling parameters Help

2<sup>nd</sup> data set

```
isj8-co21-table.clic - emacs@pctcp33.iram.fr
File Edit Options Buffers Tools Help
[Icons]
|
| isj8-co21-table.clic
|
| file in 08-oct-2008-isj8.hpb
|
| set default
| set scan 0 10000
| set offset 0 0
| set receiver 3
| 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 LSB L01 and L05
| find /proc corr /sou MFS-22
|
| table ~/maps/isj8-co21.uvt new /frequency C021 230538 /res 40 20 -30 2 velo
|
| ■
| file in 24-dec-2008-isj8.hpb
|
| set default
| set scan 0 10000
| set offset 0 0
| set receiver 3
| 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 LSB L01 and L05
| find /proc corr /sou MFS-22
|
| table ~/maps/isj8-co21.uvt old /frequency C021 230538 /res 40 20 -30 2 velo
|
| /
|
| -0:-- isj8-co21-table.clic (Fundamental)--L24--A11-----
| X Wrote /home/ccarrizo/isj8-co21-table.clic
```

2<sup>nd</sup> data set

```
isj8-co21-table.clic - emacs@pctcp33.iram.fr
File Edit Options Buffers Tools Help
[Icons]
isj8-co21-table.clic
file in 08-oct-2008-isj8.hpb
set default
set scan 0 10000
set offset 0 0
set receiver 3
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 LSB L01 and L05
find /proc corr /sou MFS-22
table ~/maps/isj8-co21.uvt new /frequency C021 230538 /res 40 20 -30 2 velo
file in 24-dec-2008-isj8.hpb
set phase noatm
set scan 20 350
find /proc corr /sou MFS-22
table
/
-0:-- isj8-co21-table.clic (Fundamental)--L28--A11-----
[X] Wrote /home/ccarrizo/isj8-co21-table.clic
```

```

ccarrizo@pctcp33:~
File Edit View Terminal Tabs Help
CLIC>
CLIC> help table
CLIC\TABLE Name [OLD|NEW
[/RESAMPLE nc ref val ir
[/FREQUENCY name rest-fr
[/NOCHECK [SOURCE|POINTI

This command will create ar
given, the most recently cre
may be OLD (default value i
or NEW to create a new table

The bands and subbands used
TION. The weighting mode car

TABLE /RESAMPLE nc ref val i

Option /RESAMPLE enable
line data). 'nc' is the
ence channel, 'val' t
respect to the rest freq
resolution, 'code' is '
are in velocity units, '

The reference channel th
to the offset 'val'
header or modified by op

Resampling is done by de
channel data. Resampli
Fourier space by cut-off
components, after decor
lator (due to on-line ap
produce frequency char
shapes are:
TBox = a box in delay
Ppar = a parabola in d
FBox = a box in freque
FTri = a triangle in
ter)
The width is the channel
1).

Option /FFT is not recommended when joining together several subbands
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 ac-
cordingly. This rest frequency will correspond to the reference chan-
nel in option RESAMPLE.

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

When processing each scan, CLIC checks whether a number of position
parameters are consistent with those defined in the table header. Op-
tion /NOCHECK allows to switch off this checking. Arguments can be
given to switch off only part of the parameters (SOURCE name, POINTING
direction, PHASE center, EPOCH of coordinates). This option is intend-
ed for building tables with inconsistent parameters (typical exemple
is a different source name...). It is potentially dangerous and is to
be used with caution.

TABLE /DROP n1 n2 --- THIS OPTION IS OBSOLETE

Option /DROP enables to drop the first 'n1' and last 'n2' channels in
each subband of the OLD spectral correlator. For the NEW spectral cor-
relator (data taken since summer 1992), it is replaced by the commands
SET GIBBS and SET DRDP.

TABLE /COMPRESS tmax uvmax

Option /COMPRESS is used to compress the data before writing the
table. This works like the COMPRESS command, but no intermediate
file is written. Very seldom used.

Additional Help Available:
UVTABLE
I-HELP, "table" is also a task, use "HELP TASK table" for more help
CLIC>

```

isj8-co21-table.clic - emacs@pctcp33.iram.fr

File Edit Options Buffers Tools Help

isj8-co21-table.clic

```
file in 08-oct-2008-isj8.hpb
!
set default
set scan 0 10000
set offset 0 0
set receiver 3
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 LSB L01 to L08
find /proc corr /sou MFS-22
!
table ~/maps/isj8-cont.uvt new
```

continuum

-0:-- isj8-co21-table.clic (Fundamental)--L18--All-----

Wrote /home/ccarrizo/isj8-co21-table.clic

```
isj8-co21-table.clic - emacs@pctcp33.iram.fr
File Edit Options Buffers Tools Help
[Icons]
: isj8-co21-table.clic
:
file in 08-oct-2008-isj8.hpb
:
set default
set scan 0 10000
set offset 0 0
set receiver 3
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 LSB L01 to L08 /window 230538-480 230538-20 230538+20 230538+480
find /proc corr /sou MFS-22
!
table ~/maps/isj8-cont.uvt new █

remove line contribution

continuum

-0:-- isj8-co21-table.clic (Fundamental)--L21--A11-----
[X] Wrote /home/ccarrizo/isj8-co21-table.clic
```

```
isj8-co21-table.clic - emacs@pctcp33.iram.fr
File Edit Options Buffers Tools Help
[Icons]
! isj8-co21-table.clic
file in 08-oct-2008-isj8.hpb
!
set default
set scan 0 10000
set receiver 3
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 LSB L01 to L08
!
set offset -8 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-1.uvt new /resa 40 20 -30 2 velo
!
set offset 0 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-2.uvt new /resa 40 20 -30 2 velo
!
set offset +8 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-3.uvt new /resa 40 20 -30 2 velo
!
7
-0:-- isj8-co21-table.clic (Fundamental)--L29--A11-----
[X] Wrote /home/ccarrizo/isj8-co21-table.clic
```

Mosaic

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

```
isj8-co21-table.clic - emacs@pctcp33.iram.fr
File Edit Options Buffers Tools Help
[Icons]

! isj8-co21-table.clic

file in 08-oct-2008-isj8.hpb
!
set default
set scan 0 10000
set receiver 3
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 LSB L01 to L08
!
set offset -8 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-1.uvt new /resa 40 20 -30 2 velo
!
set offset 0 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-2.uvt new /resa 40 20 -30 2 velo
!
set offset +8 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-3.uvt new /resa 40 20 -30 2 velo
!
!
file in 24-dec-2008-isj8.hpb
!
set offset -8 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-1.uvt old /resa 40 20 -30 2 velo
!
set offset 0 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-2.uvt old /resa 40 20 -30 2 velo
!
set offset +8 0
find /proc corr /sou MFS-22
table ~/maps/isj8-co21-3.uvt old /resa 40 20 -30 2 velo
!
!
/
-0:-- isj8-co21-table.clic (Fundamental)--L46--A11-----
X
```

Mosaic

2<sup>nd</sup> data set

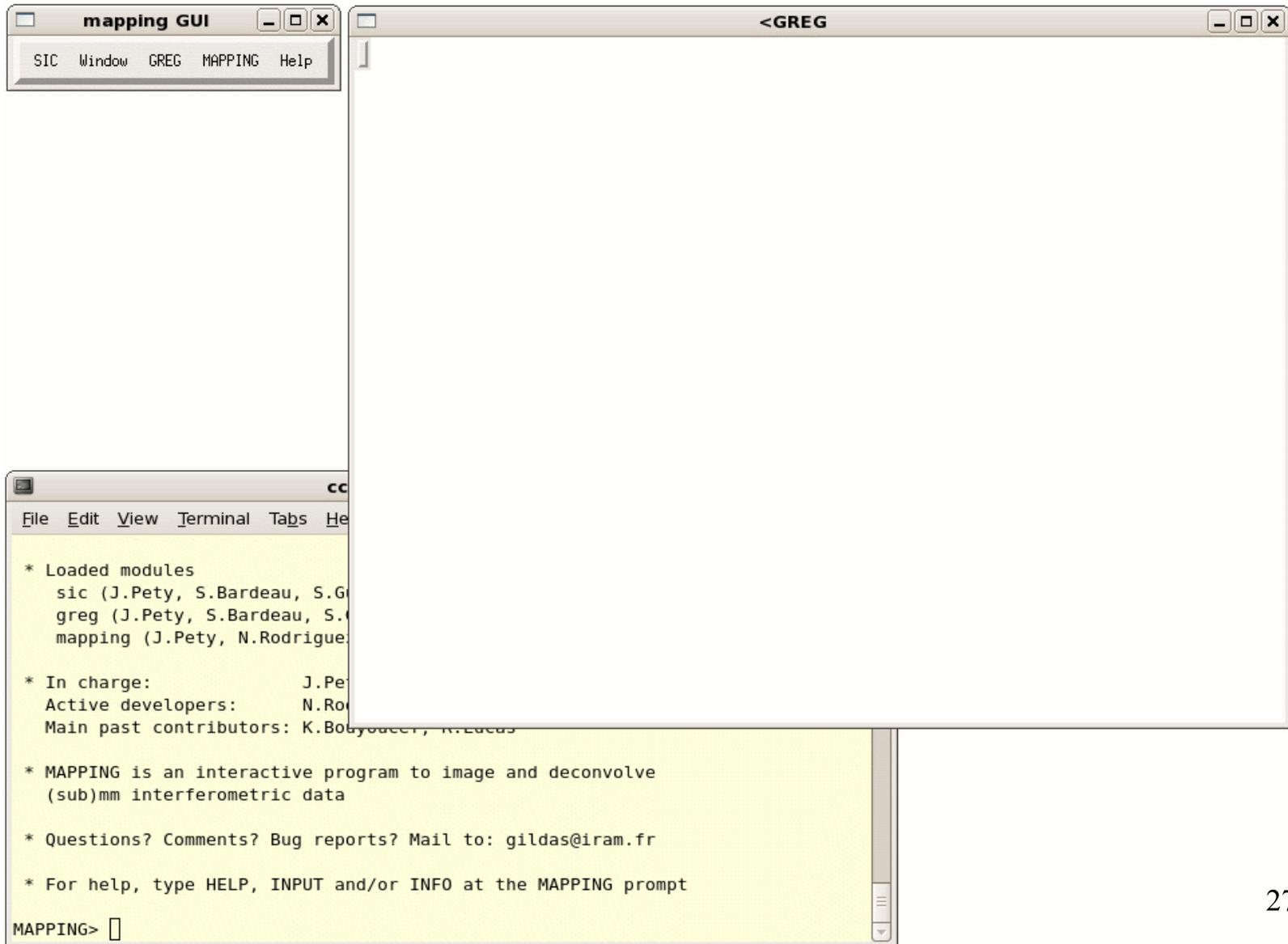
Created “mytable”.uvt, in **CLIC**



Analyze the data, in **MAPPING**

# 1. Data analysis in the $uv$ -plane

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



# Data analysis in the *uv*-plane

The image shows a screenshot of a software interface. At the top, there are two windows. The left window is titled "mapping GUI" and has a menu bar with "SIC", "Window", "GREG", "MAPPING", and "Help". The "MAPPING" menu is open, showing options: "Operations on UV table", "Imaging and Deconvolution", "WIPE Interface", and "ALMA Simulator". The "Operations on UV table" option is circled in red. The right window is titled "<GREG" and is currently empty.

Below the "mapping GUI" window is a terminal window titled "cc". The terminal displays the following text:

```
File Edit View Terminal Tabs Help

* Loaded modules
  sic (J.Pety, S.Bardeau, S.G
  greg (J.Pety, S.Bardeau, S.
  mapping (J.Pety, N.Rodrigue

* In charge:          J.Pe
Active developers:   N.Ro
Main past contributors: K.Boyoucer, N.Lucas

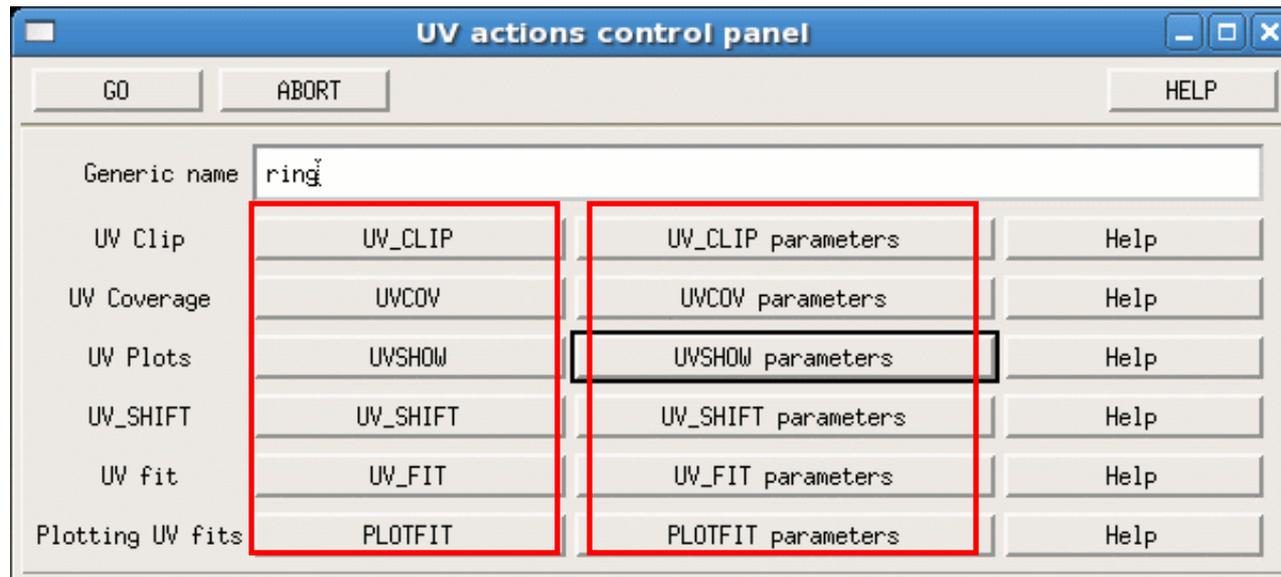
* MAPPING is an interactive program to image and deconvolve
(sub)mm interferometric data

* Questions? Comments? Bug reports? Mail to: gildas@iram.fr

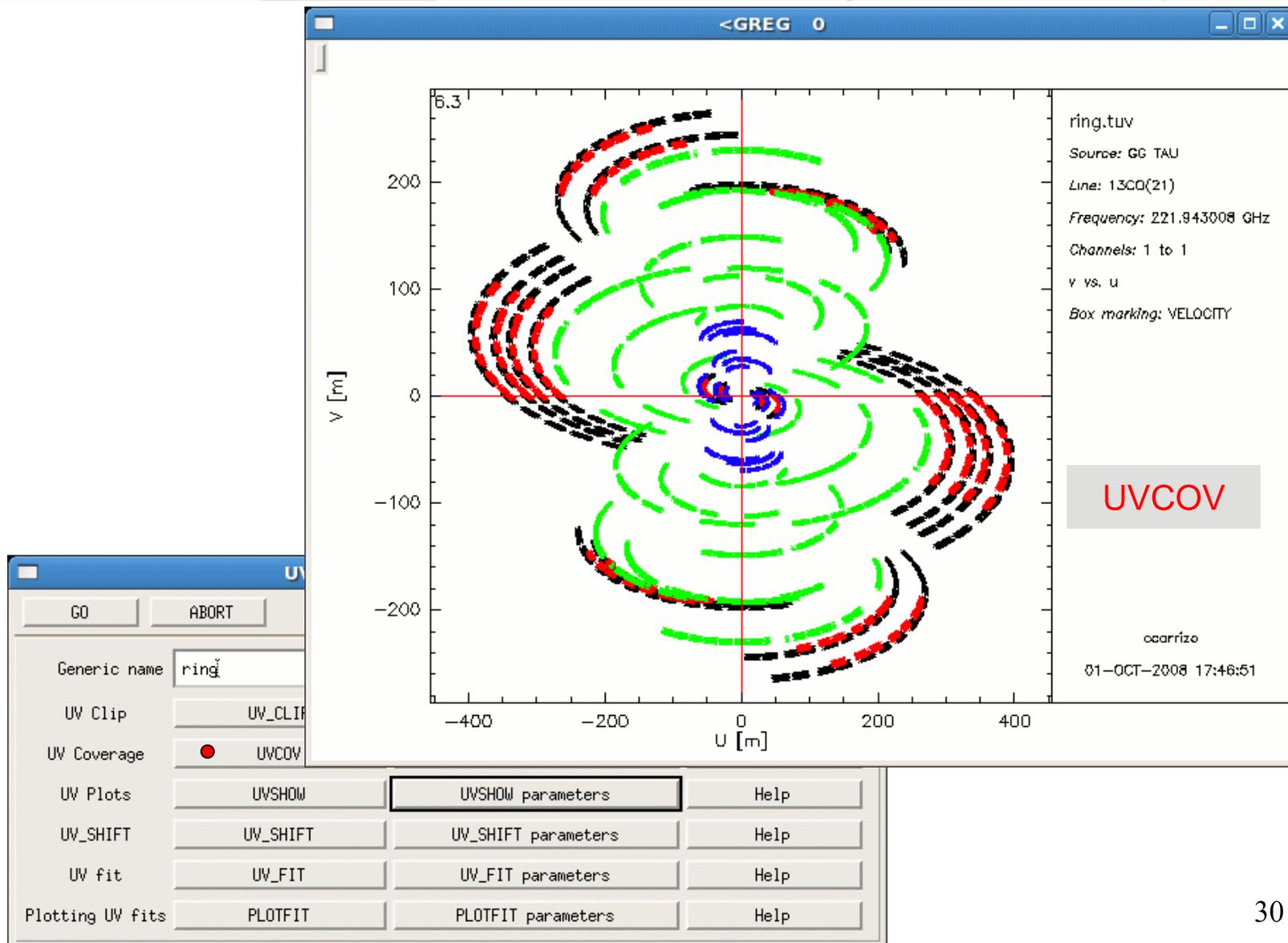
* For help, type HELP, INPUT and/or INFO at the MAPPING prompt

MAPPING> █
```

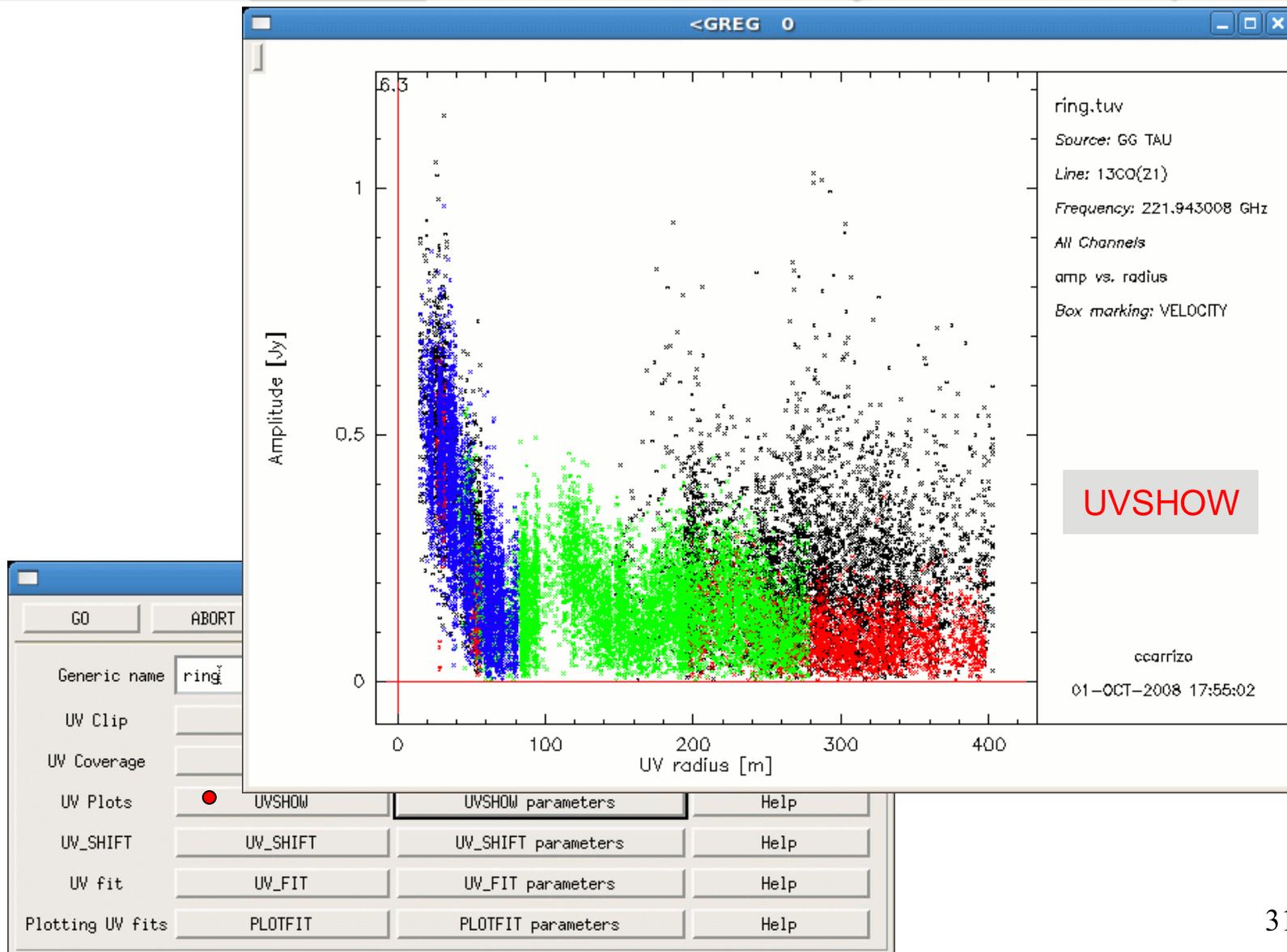
# Data analysis in the *uv*-plane



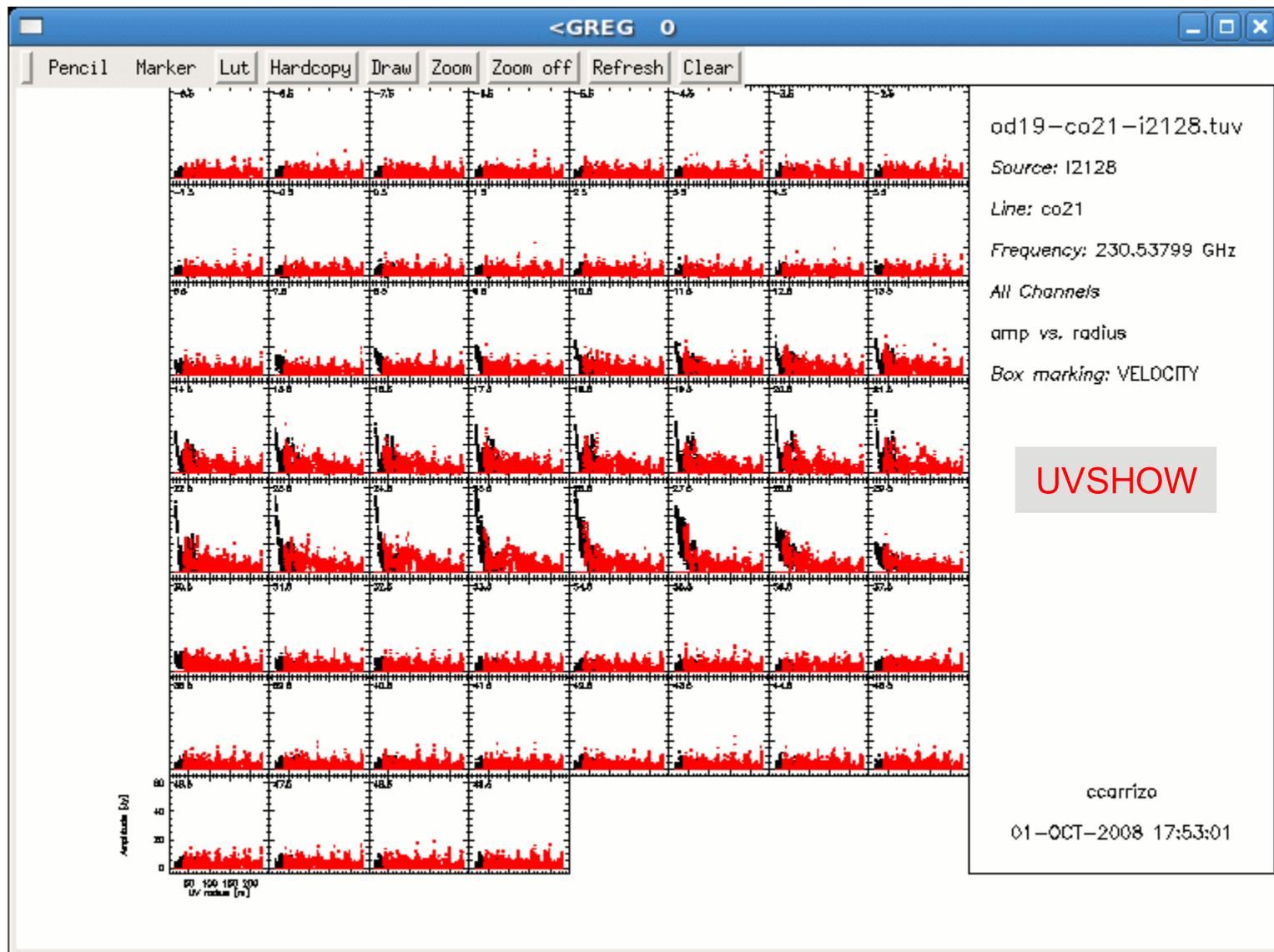
# Data analysis in the *uv*-plane



# Data analysis in the *uv*-plane



# Data analysis in the *uv*-plane



# Data analysis in the *uv*-plane

The image shows a software interface for UV data analysis. The main window is titled "UV actions control panel" and contains several buttons: "SIC", "GO", "ABORT", and "HELP". Below these buttons is a table of actions:

Generic name	ring		
UV Clip	UV_CLIP	UV_CLIP parameters	Help
UV Coverage	UVCOV	UVCOV parameters	Help
UV Plots	UVSHOW	<b>UVSHOW parameters</b>	Help
UV_SHIFT	UV_SHIFT	UV_SHIFT parameters	Help
UV fit	UV_FIT	UV_FIT parameters	Help
Plotting UV fits	PLOTFIT	PLOTFIT parameters	Help

To the right of the control panel is a plot area showing a scatter plot of data points. Text to the right of the plot reads: "ring.tuv", "Source: GG TAU", "Line: 13CO(21)", "Frequency: 221.943008 GHz", "All Channels", "amp vs. radius", and "Box marking: VELOCITY".

Below the control panel is a "UVSHOW parameters" dialog box. It contains the following fields and options:

- Generic name: ring
- X data: radius (with a "Choices" button)
- Y data: amp (with a "Choices" button)
- First channel: 0
- Last channel: 0
- Plot limits: 1
- Plot model fit:  No
- Display zero level?:  Yes
- Use one color per track?:  Yes
- Typical time separating 2 tracks [hrs]: 12
- Marker definition as in the SET MARKER command: 4 1 .1

The "Choices" button for the Y data field is open, showing a list of options: u, v, angle, radius, time, date, scan, number, amp, phase, real, imag, weight.

At the bottom of the dialog box are buttons for "Go", "Dismiss", and "Help".

In the bottom left corner, there is a terminal window with the following text:

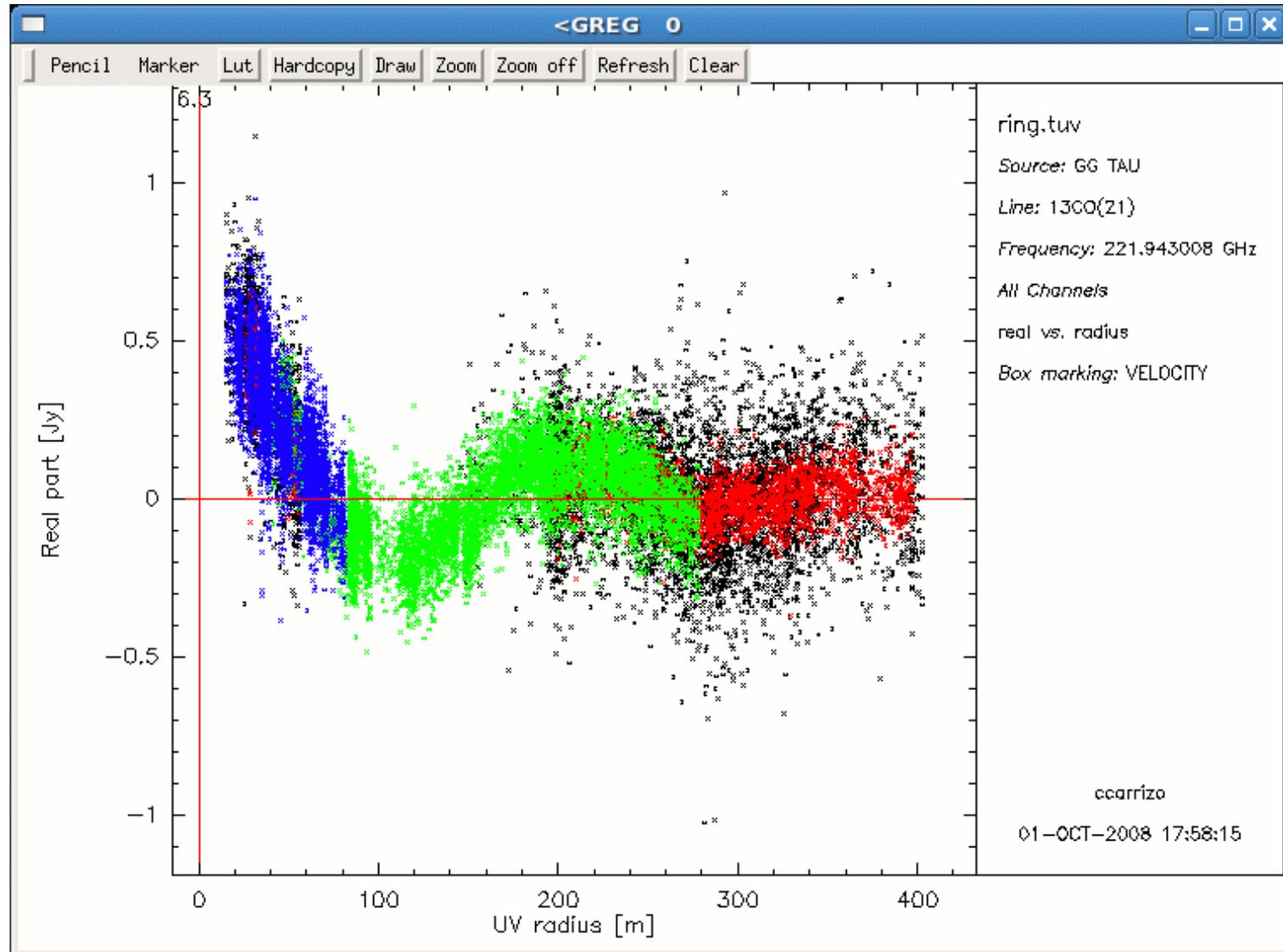
```

File Edit View Terminal
Map size
Map cell
Imaged Area

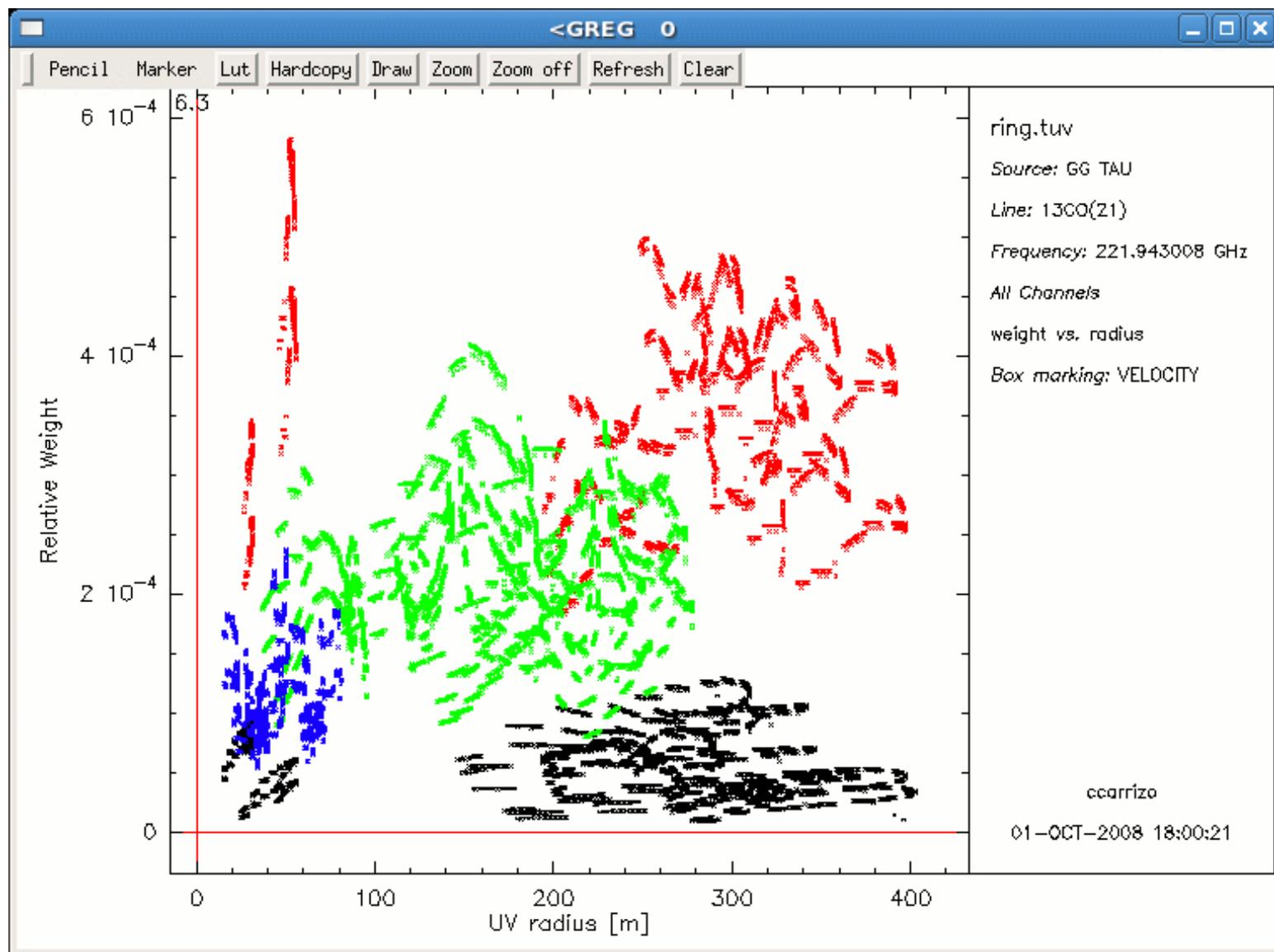
Still to be imaged
Still to be cleaned
I-GDF_RIH, Image file 1
U-GDF_RIH, UVT order :
W-GDF_RHSEC, Absent sec
W-GDF_RHSEC, Absent section
I-GDF_DAMS, Patching old
I-UVSHOW, Finding limits
I-UVSHOW, Number of found

W-UVALL, Obsolescent. Please
MAPPING>
MAPPING>
    
```

# Data analysis in the $uv$ -plane



# Data analysis in the $uv$ -plane



# Data analysis in the *uv*-plane

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 uvshow

MAPPING> input uvshow

Control panel

ring.tuv  
Source: GG TAU  
Line: 13CO(21)  
Frequency: 221.943008 GHz  
All Channels  
amp vs. radius  
Box marking: VELOCITY

Choices  
Choices  
u  
v  
angle  
radius  
time  
date  
scan  
number  
amp  
phase  
real  
imag  
weight

Map size  
Map cell  
Imaged Area

Still to be imaged  
Still to be cleaned  
I-GDF\_RIH, Image file i  
U-GDF\_RIH, UVT order :  
W-GDF\_RHSEC, Absent sec  
W-GDF\_RHSEC, Absent section  
I-GDF\_DAMS, Patching old  
I-UVSHOW, Finding limits  
I-UVSHOW, Number of found

W-UVALL, Obsolescent. Please  
MAPPING>  
MAPPING>

Last channel 0  
Plot limits 1  
Plot model fit  No  
Display zero level?  Yes  
Use one color per track?  Yes  
Typical time separating 2 tracks [hrs] 12  
Marker definition as in the SET MARKER command 4 1 .1

Go Dismiss Help

# Data analysis in the *uv*-plane

**UV actions control panel**

SIC    GO    ABORT    HELP

Generic name: ring

UV Clip	UV_CLIP	UV_CLIP parameters	Help
UV Coverage	UVCOV	UVCOV parameters	Help
UV Plots	UVSHOW	UVSHOW parameters	Help
UV_SHIFT	UV_SHIFT	UV_SHIFT parameters	Help
UV fit	UV_FIT	UV_FIT parameters	Help
Plotting UV fits	PLOTFIT	PLOTFIT parameters	Help

ring.tuv  
 Source: GG TAU  
 Line: 13CO(21)  
 Frequency: 221.943008 GHz  
 All Channels  
 real vs. radius  
 Box marking: VELOCITY

**UV\_SHIFT parameters**

Generic name: ring

Right Ascension: [ ]

Declination: [ ]

Angle from North: [ ]

Go    Dismiss    Help

Map size                    512 x 512 pixels                    512 x 512 pixels

Map cell                    0.14 x 0.14 arcsec                    0.14 x 0.14 arcsec

Imaged Area                    71.7 x 71.7 arcsec

Still to be imaged

Still to be cleaned

I-GDF\_RIH, Image file is [EEEEI to IEEEE]

U-GDF\_RIH, UVT order : UV-DATA    RANDOM

W-GDF\_RHSEC, Absent section NOISE

W-GDF\_RHSEC, Absent section PROPERMOTION

I-GDF\_DAMS, Patching old UV data weights

I-UVSHOW, Finding limits

I-UVSHOW, Number of found tracks: 4

MAPPING> [ ]

01-OCT-2008 18:00:36

400

# Data analysis in the *uv*-plane

The screenshot displays three windows from a software interface:

- mapping GUI**: The main window with a menu bar (SIC, Window, GREG, MAPPING, Help) and a toolbar (Marker, Lut, Hardcopy, Draw, Zoom, Zoom off, Refresh, Clear). A plot area is visible on the right.
- uv\_shift**: A dialog box for configuring UV table shifts. It includes a "GO" button, an "ABORT" button, and a "HELP" button. The "UV table to shift" field contains "ring". The "Offset (YES) or Absolute (NO) position" checkbox is checked. Below are input fields for "Phase center offset (in radians)", "R.A. center", "Declination center", and "Angle".
- Terminal**: A terminal window titled "ccarrizo@pctcp33:~" showing the output of the "uv\_shift" command. The output includes a table of map parameters and a list of actions to be performed.

	Recommended	Used
Map size	512 x 512 pixels	512 x 512 pixels
Map cell	0.14 x 0.14 arcsec	0.14 x 0.14 arcsec
Imaged Area	71.7 x 71.7 arcsec	

```
Still to be imaged
Still to be cleaned
I-GDF_RIH, Image file is [EEEE to IEEE]
U-GDF_RIH, UVT order : UV-DATA    RANDOM
W-GDF_RHSEC, Absent section NOISE
W-GDF_RHSEC, Absent section PROPERMOTION
I-GDF_DAMS, Patching old UV data weights
I-UVSHOW, Finding limits
I-UVSHOW, Number of found tracks: 4
MAPPING> run uv_shift
Waiting ...
```

The terminal window also shows a plot area with the text "rizo" and "01-OCT-2008 18:00:36" and a numerical value "400" on the x-axis.

# Data analysis in the *uv*-plane

The screenshot displays the 'mapping GUI' interface. At the top, there is a menu bar with 'SIC', 'Window', 'GREG', 'MAPPING', and 'Help'. Below the menu bar is a toolbar with buttons for 'Marker', 'Lut', 'Hardcopy', 'Draw', 'Zoom', 'Zoom off', 'Refresh', and 'Clear'. The main window title is '<GREG 0' and the file name is 'ring.tuv'. On the left, the 'UV actions control panel' contains buttons for 'GO' and 'ABORT', and a list of actions: 'Generic name' (ring), 'UV Clip' (UV\_CLIP), 'UV Coverage' (UVCOV), 'UV Plots' (UVSHOW), 'UV\_SHIFT' (UV\_SHIFT), 'UV fit' (UV\_FIT, highlighted with a red box and a red dot), and 'Plotting UV fits' (PLOTFIT). In the foreground, the 'UV\_FIT parameters' dialog box is open, showing fields for 'Generic name' (ring), 'First channel' (0), 'Last channel' (0), 'UV range(min, max) (meters)' (0 800), and 'Number of Functions (1 or 2)' (1). It lists two functions: 'Function 1: ring' and 'Function 2: point'. Each function has a 'Parameters' field (0 0 0 0 0 0 0) and a 'Starting range' field (0 0 0 0 0 0). A 'numb. of starts' field is also present for each function. There are checkboxes for 'Subtract function' (set to 'No'). A 'Choices' list on the right includes 'point', 'c\_gauss', 'e\_gauss', 'c\_disk', 'e\_disk', 'ring', 'exp', 'power-2', 'power-3', and 'u\_ring'. At the bottom of the dialog are 'Go', 'Dismiss', and 'Help' buttons. In the background, a terminal window shows the following text:

```
File Edit View Terminal Tabs He
Map size
Map cell
Imaged Area

Still to be imaged
Still to be cleaned
I-GDF_RIH, Image file is [EEE
U-GDF_RIH, UVT order : UV-DATA
W-GDF_RHSEC, Absent section NO
W-GDF_RHSEC, Absent section PR
I-GDF_DAMS, Patching old UV da
I-UVSHOW, Finding limits
I-UVSHOW, Number of found trac
MAPPING> run uv_shift
Waiting ...
E-SIC, Aborted by user
MAPPING>
MAPPING> []
```

# Data analysis in the *uv*-plane

The image shows a screenshot of a software interface for data analysis. On the left is a window titled "mapping GUI" with a menu bar (SIC, Window, GREG, MAPPING, Help) and a terminal-like display. On the right is a dialog box titled "UV\_FIT parameters".

**mapping GUI**

Variable FUNCT01\$ :

-----

TASK\CHARACTER "Function #1" FUNCT01\$

The type of the distribution required in the fitting process. Currently supported functions are:

- POINT Point source
- E\_GAUSS Elliptical Gaussian source
- C\_GAUSS Circular Gaussian sources
- C\_DISK Circular Disk
- E\_DISK Elliptical Disk (inclined)
- RING Annulus
- EXPO Exponential brightness
- POWER-2  $B = 1/r^2$
- POWER-3  $B = 1/r^3$
- E\_RING Elliptical Annulus (inclined)

Remark: See NF\$ for additional help

Variable PARAM01\$ :

-----

TASK\REAL "Parameters" PARAM01\$[7]

Your guesses as input parameters for the fitting process. Six parameters have to be defined for each function. The parameter list used in the fit is:

- POINT : Offset R.A., Offset Dec, Flux
- E\_GAUSS : Offset R.A., Offset Dec, Flux, Maj. diam., Min. diam., Pos Ang
- C\_GAUSS : Offset R.A., Offset Dec, Flux, Diameter
- C\_DISK : Offset R.A., Offset Dec, Flux, Diameter
- E\_DISK : Offset R.A., Offset Dec, Flux, Maj. diam., Min. diam., Pos Ang
- RING : Offset R.A., Offset Dec, Flux, Inner Diameter, Outer Diameter
- EXPO : Offset R.A., Offset Dec, Flux, Diameter
- POWER-2 : Offset R.A., Offset Dec, Flux, Diameter
- POWER-3 : Offset R.A., Offset Dec, Flux, Diameter
- E\_RING : Offset R.A., Offset Dec, Flux, Inner, Outer, Pos Ang, Ratio

Note that if the guesses are not sufficiently accurate the fit may not converge.

Variable PARAM02\$ :

-----

TASK\REAL "Parameters" PARAM02\$[7]

Dismiss

**UV\_FIT parameters**

Generic name ring

Start channel 0

End channel 0

Radius (meters) 0.800

Channels (1 or 2) 1

Function 1: ring **often needed** Choices

Parameters 0 0 0 0 0 0 0

Fitting range 0 0 0 0 0 0 0

Number of starts 0 0 0 0 0 0 0

Use fit function  No

Function 2: point Choices

Parameters 0 0 0 0 0 0 0

Fitting range 0 0 0 0 0 0 0

Number of starts 0 0 0 0 0 0 0

Use fit function  No

Dismiss Help

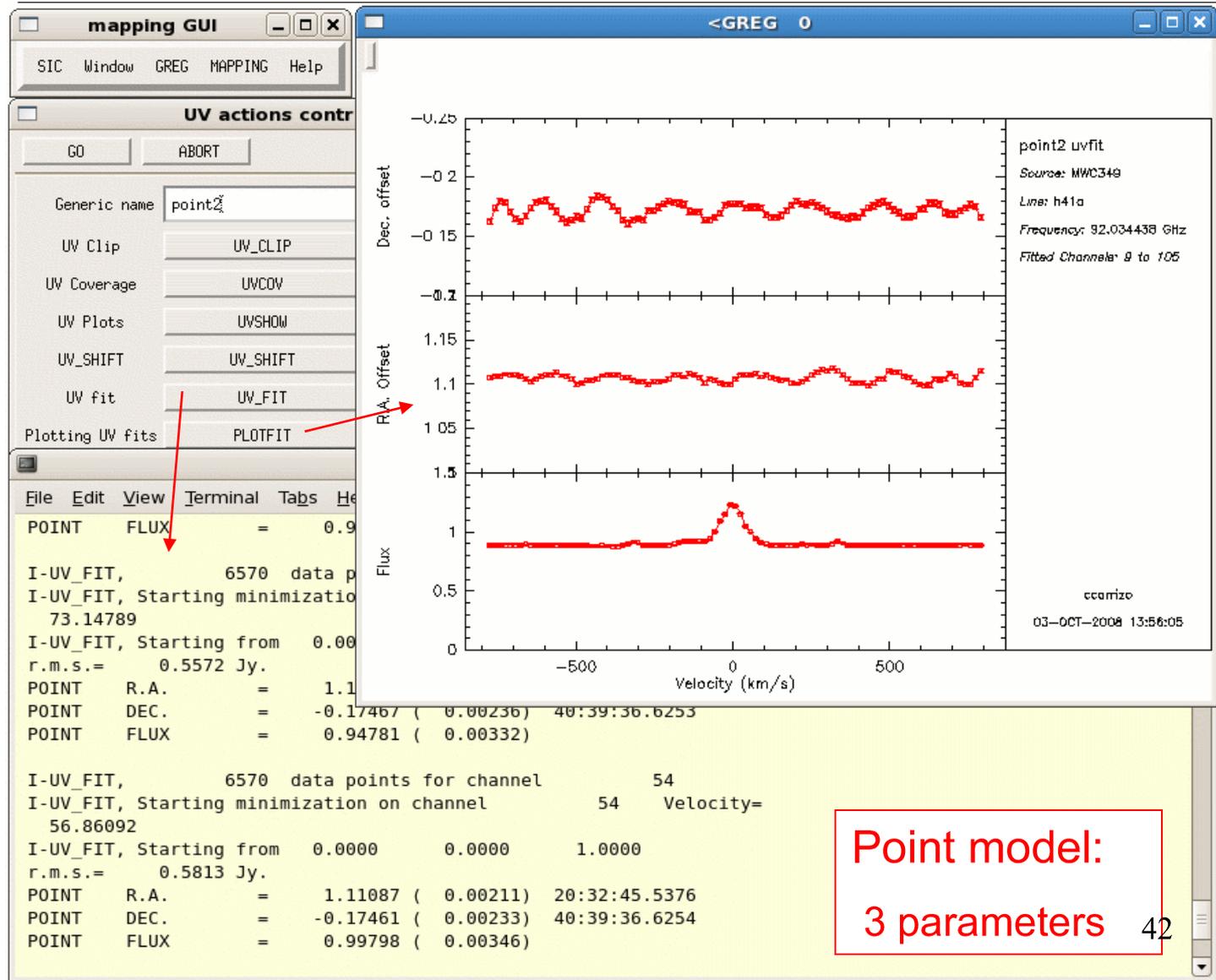
# Data analysis in the *uv*-plane

The image displays three overlapping windows from the MAPPING software interface:

- mapping GUI:** A menu bar with 'SIC', 'Window', 'GREG', 'MAPPING', and 'Help'. Below it are buttons for 'GO' and 'ABORT'. A 'Generic name' field contains 'ring'. A 'Plotting UV fits' section has a red circle next to the 'PLOTFIT' button.
- UV actions control:** A panel with buttons for 'UV\_CLIP', 'UV\_COV', 'UV\_SHOW', 'UV\_SHIFT', and 'UV\_FIT'. The 'PLOTFIT' button is highlighted with a red box.
- PLOTFIT parameters:** A dialog box for configuring the plot. It includes:
  - Generic name: ring
  - Number of fitted functions to be plotted: 1
  - Order in which fitted functions are plotted: 1
  - Number of parameters plotted along x axis: 1 (highlighted with a red box)
  - X Parameter #1: velo \*  $\sigma_1$  (highlighted with a red box)
  - X Parameter #2: freq \*  $\sigma_1$
  - X Parameter #3: channel \*  $\sigma_1$
  - X Parameter #4: ra \*  $\sigma_1$
  - X Parameter #5: dec \*  $\sigma_1$
  - X Parameter #6: flux \*  $\sigma_1$
  - Number of parameters plotted along y axis: 3 (highlighted with a red box)
  - Y Parameter #1: ra \*  $\sigma_1$  (highlighted with a red box)
  - Y Parameter #2: dec \*  $\sigma_1$
  - Y Parameter #3: flux \*  $\sigma_1$  (highlighted with a red box)
  - Y Parameter #4: major \*  $\sigma_1$
  - Y Parameter #5: minor \*  $\sigma_1$
  - Y Parameter #6: angle \*  $\sigma_1$
  - First channel: 0
  - Last channel: 0
  - Plot error bars:  Yes

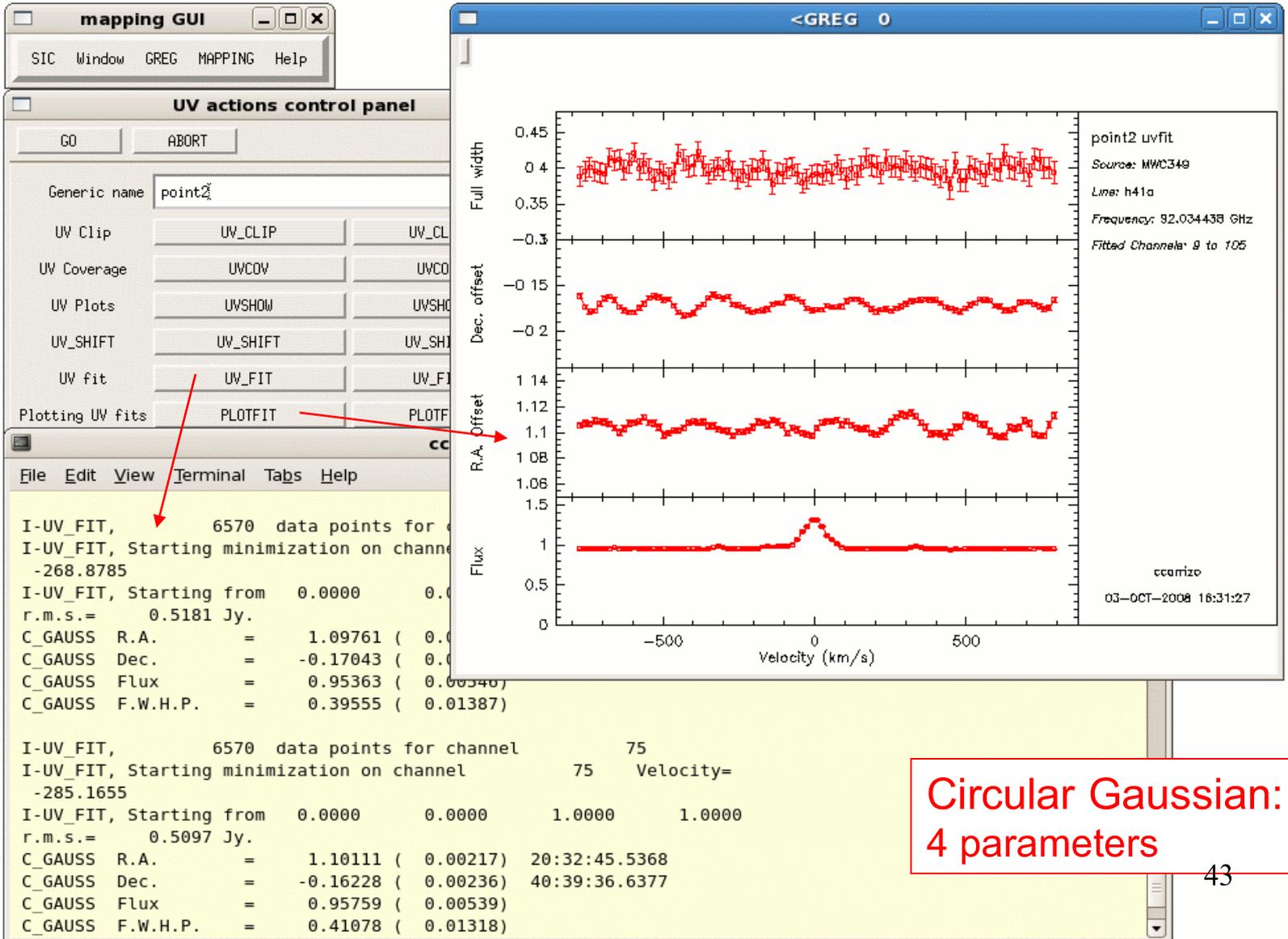
At the bottom of the 'PLOTFIT parameters' window are buttons for 'Go', 'Dismiss', and 'Help'.

# Data analysis in the *uv*-plane

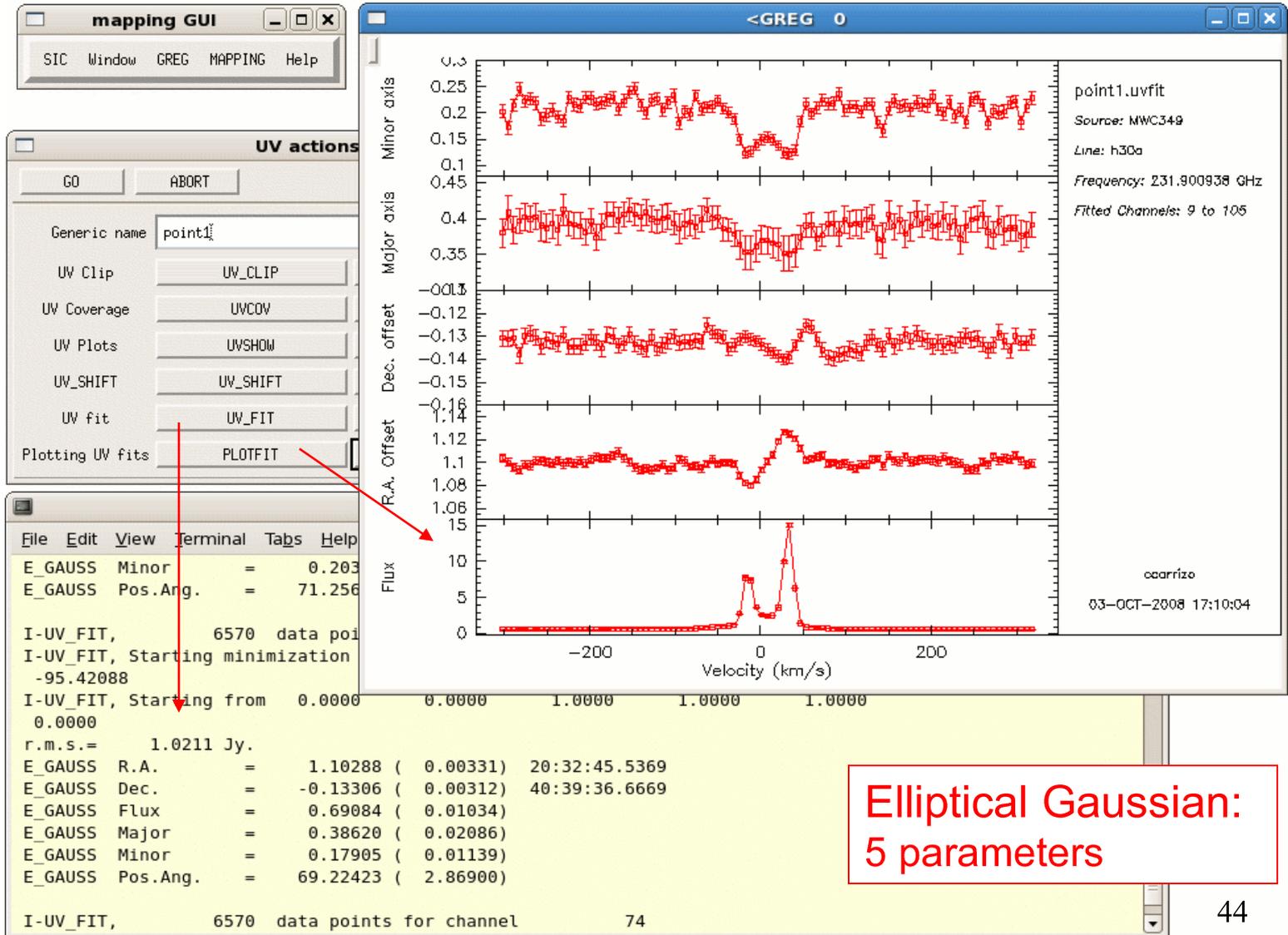


Point model:  
3 parameters 42

# Data analysis in the *uv*-plane

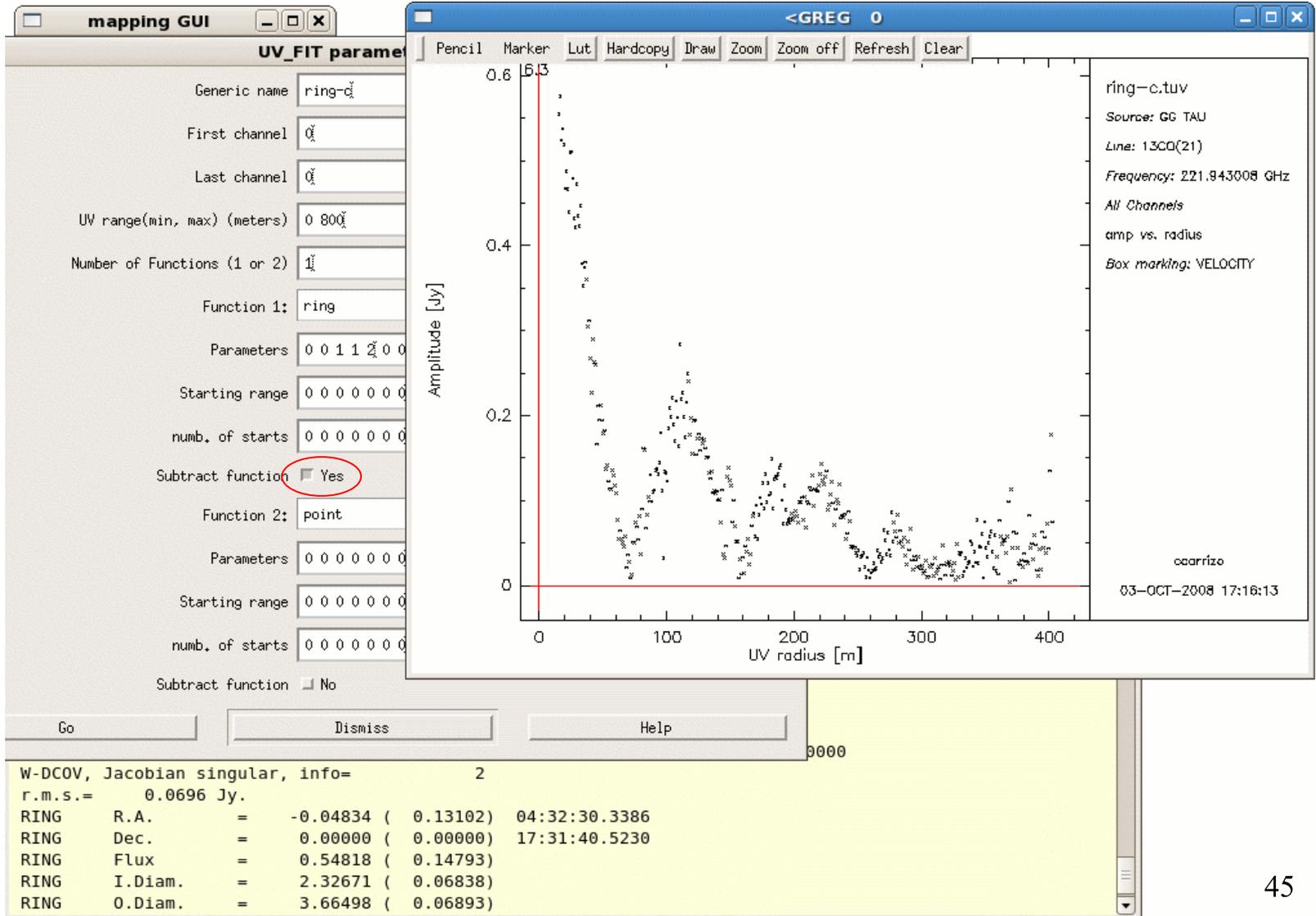


# Data analysis in the *uv*-plane

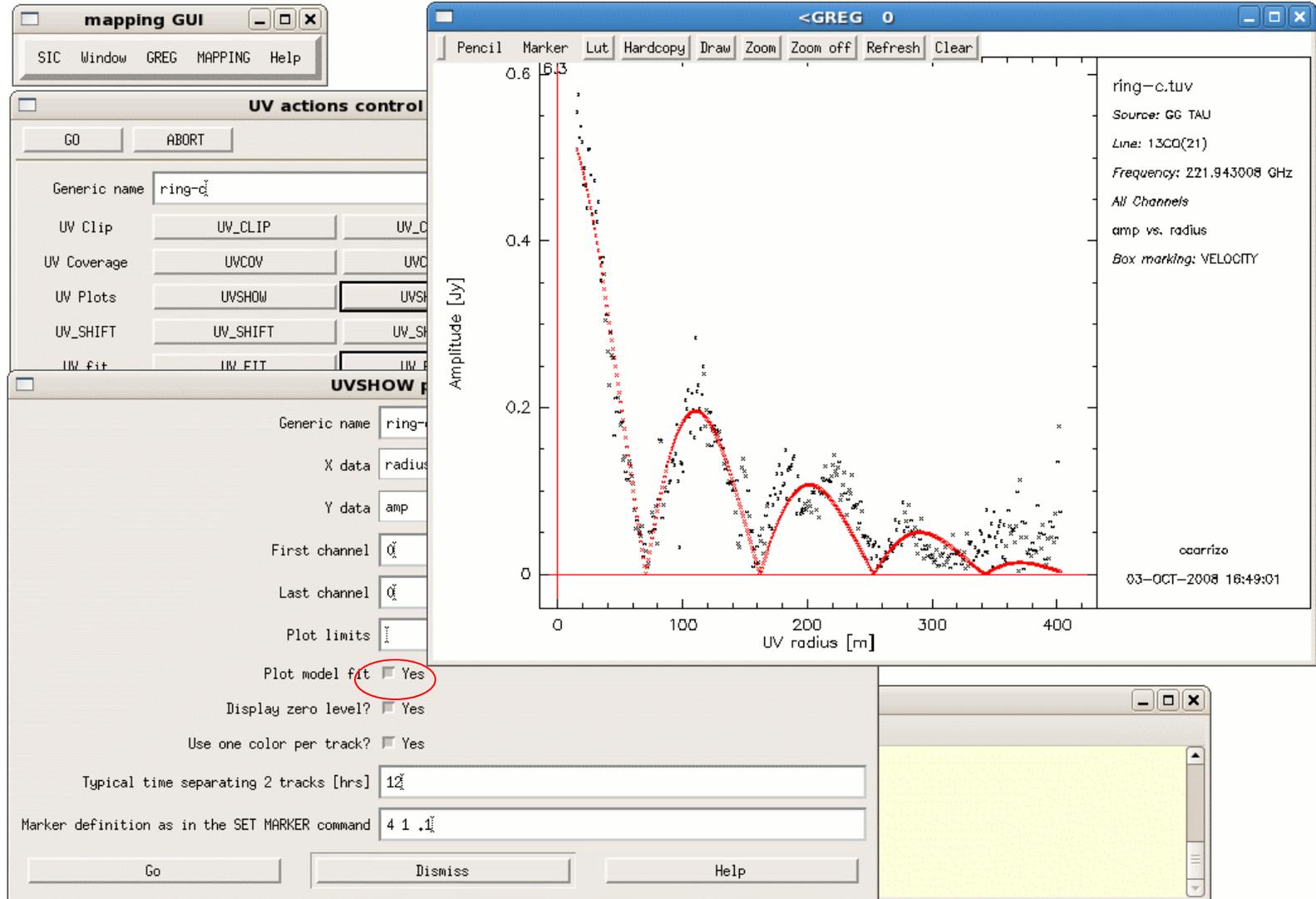


Elliptical Gaussian:  
5 parameters

# Data analysis in the *uv*-plane

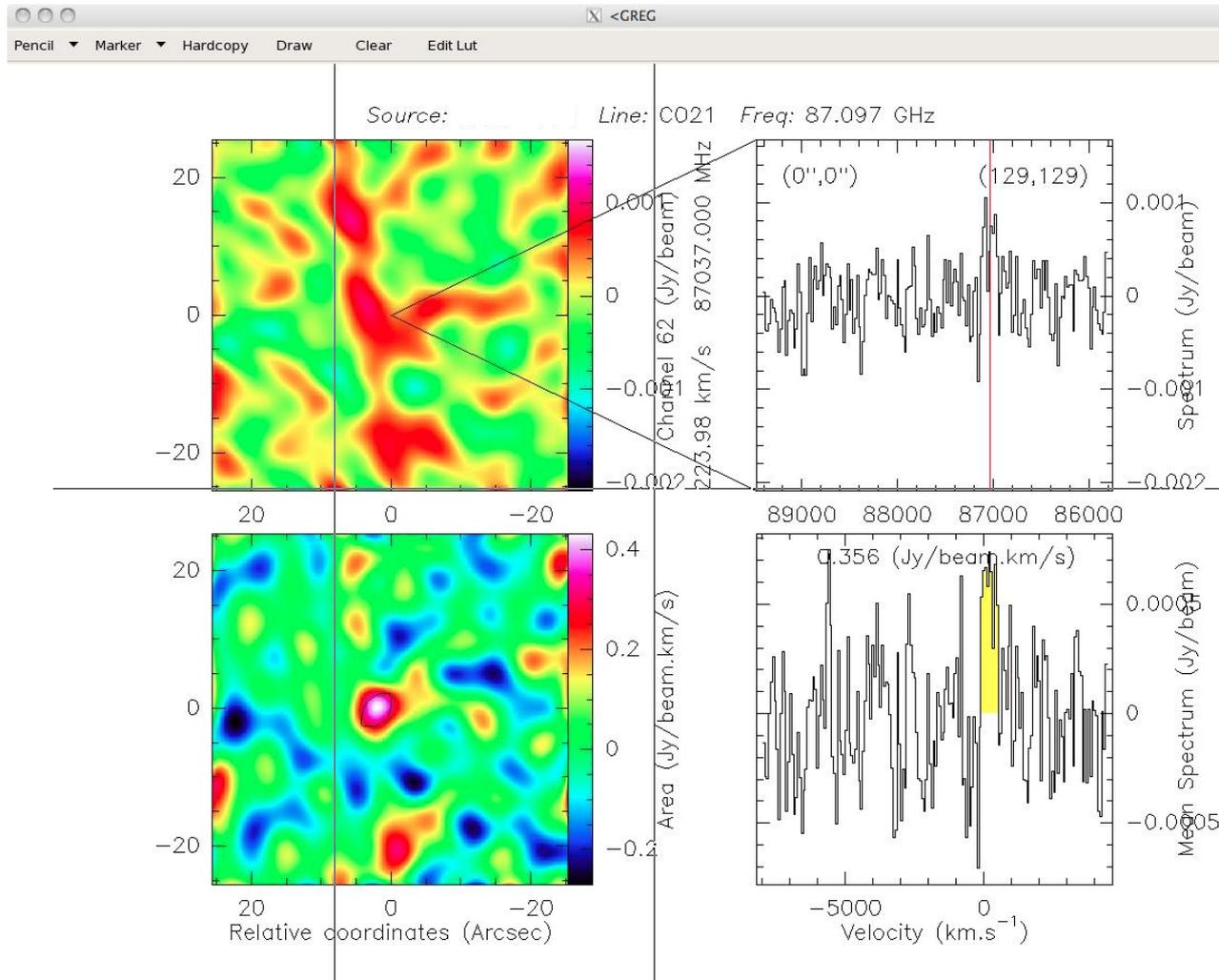


# Data analysis in the *uv*-plane



# Data analysis in the $uv$ -plane

## Example: detection project of distant galaxy (unresolved)



# Data analysis in the *uv*-plane

The image displays a software interface for uv-plane data analysis, consisting of several windows:

- Terminal Window (feruglio@bure5b:~/project/wa45):** Shows the execution of the `uv_fit` task. Key output includes:
  - Map cell:  $1.06 \times 1.06$  arcsec
  - Image Size:  $135.7 \times 135.7$  arcsec
  - Number of found tracks: 6
  - 10273 data points for channel 1
  - Starting minimization on channel 1 with velocity 240.9437
  - Starting from 0.0000, 0.0000, 1.00000E-02
  - r.m.s. = 0.0281 Jy
  - POINT R.A. = 2,08152 ( 0.53213) 10:01:30.5588
  - POINT DEC. = -0,19231 ( 0.49823) 01:54:12.3077
  - POINT FLUX = 0,00066 ( 0,00013)
  - Successful completion of `uv_fit`.
- UV\_FIT parameters Dialog:** Configures the fit parameters:
  - Generic name: `ch57-66-inte`
  - First channel: 0
  - Last channel: 0
  - UV range (min, max) (meters): 0 800
  - Number of Functions (1 or 2): 1
  - Function 1: `point`
  - Parameters: `0 0 0.01 0 0 0 0`
  - Starting range: `0 0 0 0 0 0`
  - numb. of starts: `0 0 0 0 0 0`
  - Subtract function:  Yes
- Scatter Plot (<GREG):** A plot of Amplitude [Jy] versus UV radius [m]. The y-axis ranges from 0 to 0.2, and the x-axis ranges from 0 to 100. A prominent vertical feature is labeled with a value of 240.9 at the top. The plot shows a dense distribution of points with a clear vertical structure.

## MAPPING procedures / tasks

```
MAPPING> go ...  
MAPPING> input ...
```

also

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

# Data analysis in the *uv*-plane

---

```
MAPPING> go ... or run ...
```

```
MAPPING> input ... or 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

The screenshot displays a graphical user interface for data analysis in the  $uv$ -plane. It consists of several windows:

- mapping GUI**: A menu bar with options: SIC, Window, GREG, MAPPING, Help.
- <GREG 0** (top): A window showing a grid of 12 subplots. The x-axis is labeled "UV radius [m]" and the y-axis is labeled "Amplitude [μV]". The subplots show data points in red and green. A toolbar includes: Pencil, Marker, Lut, Hardcopy, Draw, Zoom, Zoom off, Refresh, Clear. Metadata on the right: txcam-co10-1kms.tuv, Source: TXCAM, Line: 12co10, Frequency: 116.271204 GHz, All Channels, amp vs. radius.
- uv\_compress**: A window with buttons GO, ABORT, HELP. Input fields: Input UV table (txcam-co10-1kms.tuv), Output UV table (txcam-co10-4kms.tuv), Number of channels to average (4).
- <GREG 0** (bottom): A window showing a grid of 12 subplots, similar to the top window but with different x-axis labels (e.g., 17.5, 13.5, 9.5, 5.5). Metadata on the right: txcam-co10-4kms.tuv, Source: TXCAM, Line: 12co10, Frequency: 116.271204 GHz, All Channels, amp vs. radius, Box marking: velocity.
- Terminal** (bottom left): A window titled ccarizzo@lo with a menu bar (File, Edit, View, Terminal, Tabs, Help). The terminal output shows: Map cell 1.03, Still to be imaged, Still to be cleaned, W-GDF\_RHSEC, Absent section NOISE, W-GDF\_RHSEC, Absent section PROPERM, I-UVSHOW, Finding limits, I-UVSHOW, Number of found tracks: 3, MAPPING>, MAPPING> go uv\_compress (circled in red), Waiting ..

# Data analysis in the *uv*-plane

The screenshot displays the 'mapping GUI' interface. A dialog box titled 'uv\_circle' is open, showing settings for input/output tables ('ring' and 'ring-c'), and radius parameters (Minimum radius: 0, Maximum radius: 1000, Radius interval: 1). Two windows, '<GREG 0', show plots of Amplitude [Jy] versus UV radius [m]. The top plot is for 'ring.tuv' and the bottom plot is for 'ring-c.tuv'. Both plots show a series of data points with a red vertical line at 6.3 m. The bottom plot also has a red horizontal line at 0 Jy. A terminal window on the left shows the execution of 'uv\_circle' and various status messages. A red oval highlights the 'uv\_circle' command in the terminal.

uv\_a  
uv\_a  
uv\_a  
uv\_a  
uv\_c  
uv\_c

mapping GUI  
SIC Window GREG MAPPING Help

<GREG 0  
ring.tuv  
Source: GG TAU  
Line: 13CO(21)  
Frequency: 221.943008 GHz  
All Channels

uv\_circle  
GO ABORT HELP  
input table ring  
output table ring-c  
Minimum radius (m) 0  
Maximum radius (m) 1000  
Radius interval (m) 1

<GREG 0  
Pencil Marker Lut Hardcopy Draw Zoom Zoom off Refresh Clear  
Amplitude [Jy]  
6.3  
0.8  
0.6  
0.4  
0.2  
0  
0 100 200 300 400  
UV radius [m]

ring-c.tuv  
Source: GG TAU  
Line: 13CO(21)  
Frequency: 221.943008 GHz  
All Channels  
amp vs. radius  
Box marking: velocity  
ccarrizo  
05-OCT-2008 19:28:32

File Edit View Terminal Tab  
Phase center RA and Dec  
Field of view / Largest  
Map size  
Map cell  
Imaged Area  
Still to be imaged  
Still to be cleaned  
I-GDF\_RIH, Image file is  
U-GDF\_RIH, UVT order : UV  
W-GDF\_RHSEC, Absent section  
W-GDF\_RHSEC, Absent section  
I-GDF\_DAMS, Patching old  
I-UVSHOW, Finding limits  
I-UVSHOW, Number of found  
MAPPING> run uv\_circle  
Waiting ...

uv\_cuts  
uv\_mcal  
uv\_sinusphase

# Data analysis in the *uv*-plane

MAPPING> go ... or run ...

MAPPING> input ... or 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

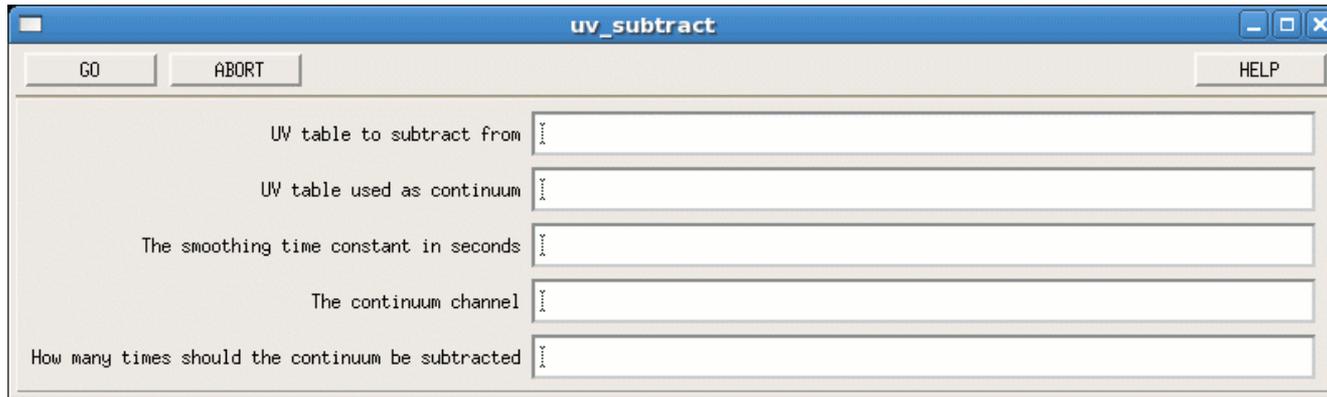
uv\_averag  
uv\_cal  
uv\_ccmoc  
uv\_cct  
uv\_center  
uv\_circle  
uv\_clip



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



To subtract a time-averaged continuum *uv* table

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> go ... or run ...

MAPPING> input ... or help ...

The screenshot shows a dialog box titled "uv\_zero" with a standard Windows-style title bar (minimize, maximize, close buttons). The dialog contains several input fields and buttons. At the top, there are three buttons: "GO", "ABORT", and "HELP". Below these are several input fields with labels: "UV table", "Zero spacing continuum flux", "Include spectral data" (with a "Yes" checkbox), "GREG table from CLASS", "Zero spacing weight", and "Zero spacing calibration factor". The "UV table" and "GREG table from CLASS" fields have "File" buttons next to them, indicating they are file selection fields.

To add a single-dish zero-spacing spectrum

\_solve  
\_sort  
\_splitfield  
\_stat  
\_subtract  
\_table  
\_timeaverage  
\_timebase  
\_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

## $uv$ tables are fully editable

Each visibility contains:

$uv$  table [ visib dimension, # visibilities ]

- $u$  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

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

7 visib. characteristics

- real part
- imaginary part
- weight

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

- real part
- imaginary part
- ...

2<sup>nd</sup> channel

data at 2<sup>nd</sup> channel

3. An inspection of the data in the *uv*-plane is recommended

# (1) Passing directly from hpb → mapping

It may happen...

**MAPPING Window interf**

SIC Window GREG MAPPING Help

**Mapping Control Panel**

GO ABORT

READ

Generic name: chicyg-co21-mer-bad

Image type to show: DIRTY

First channel: 0

Last channel: 0

Mosaic from UV data: MOSAIC

Mapping from UV data: UV\_MAP

Get support: SUPPORT

HOGBOM method: Hogbom

CLARK method: Clark

SDI method: Sdi

MRC method: Mrc

Multiscale method: Multi

Show image: SHOW

**<GREG 0**

chicyg-co21-mer-bad.l

Source: CHICYG

Line: 12CO21

Frequency: 230.53799 GHz

Beam: (no clean beam)

Level step: 200 Jy/beam

Box marking: VELOCITY

Channels: [0,0]

ccarrizo

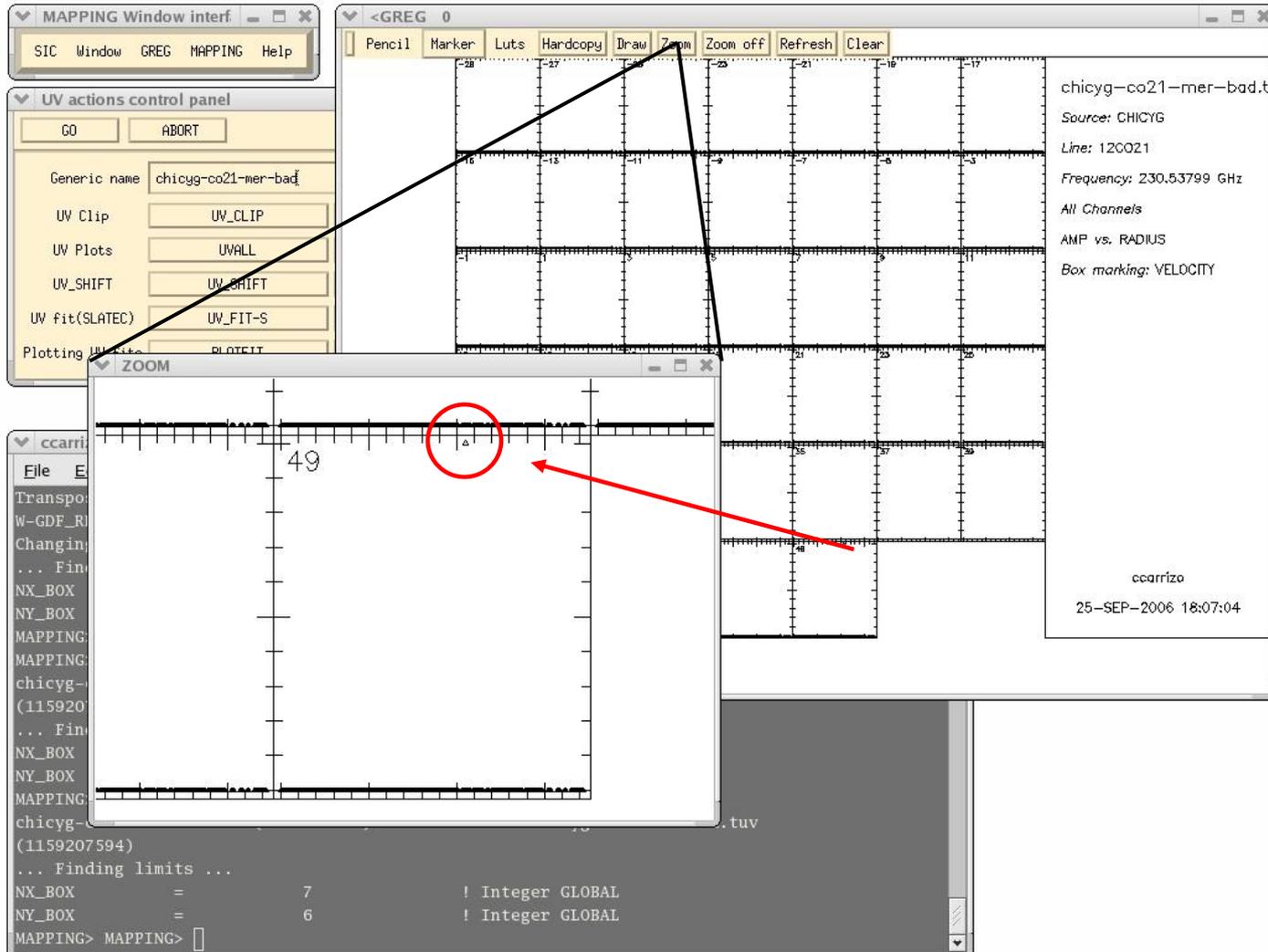
25-SEP-2006 17:55:30

```
I-UVMAP, Creating map file
I-UVMAP, Finished planes 1 to 40 CPU 0.00
I-UVMAP, Finished maps 0.00
S-UVMAP, Successful completion
MAPPING>
I-LEVELS, Contour levels are :
-1400. -1200. -1000. -800.0 -600.0
-400.0 -200.0 200.0 400.0 600.0
800.0 1000. 1200. 1400. 1600.
1800. 2000.
MAPPING>
```

(1)

# Passing directly from hpb → mapping

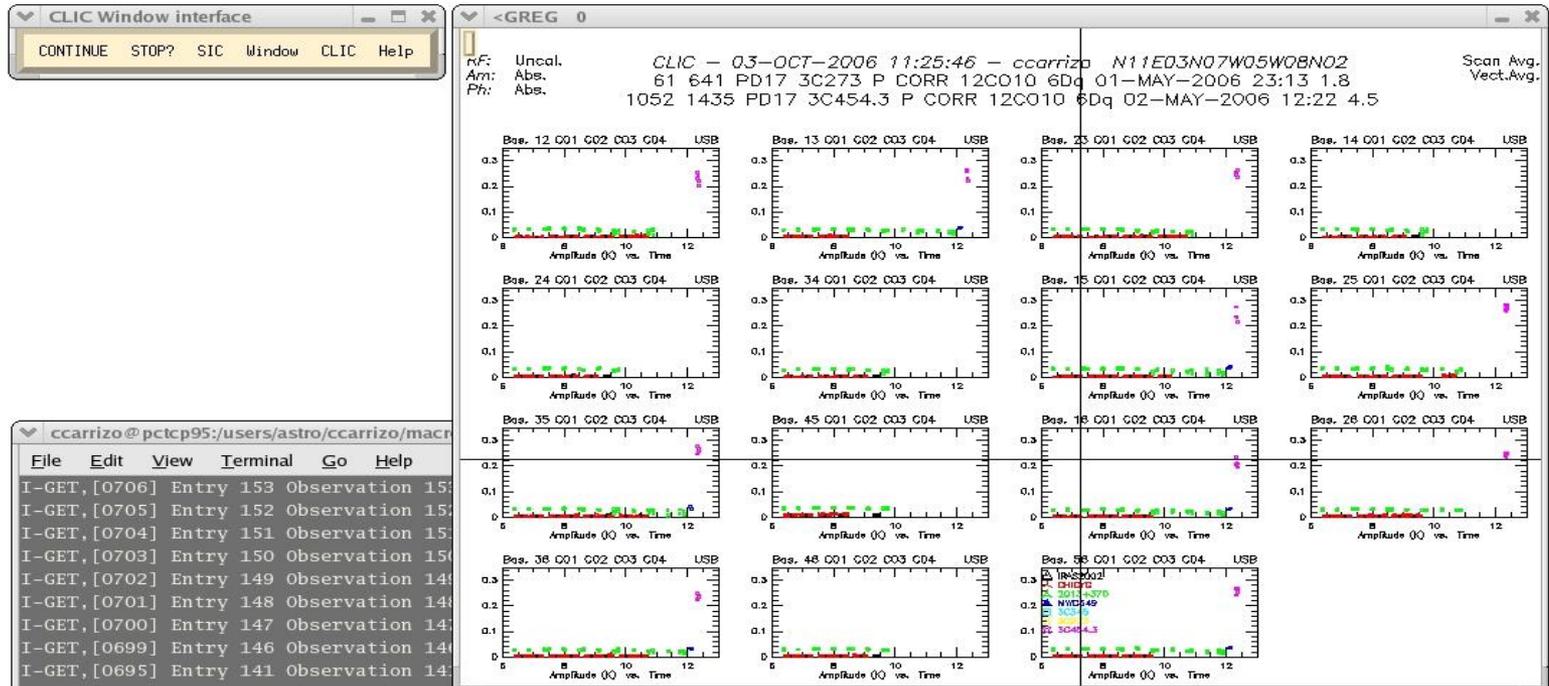
It may happen...



(1)

# Passing directly from hpb → mapping

It may happen... that there remain some wrong visibilities

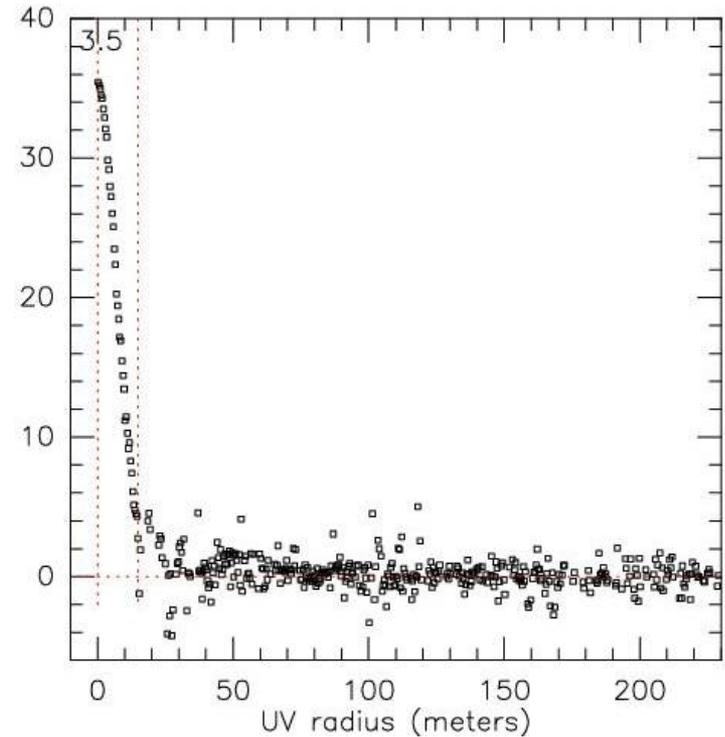
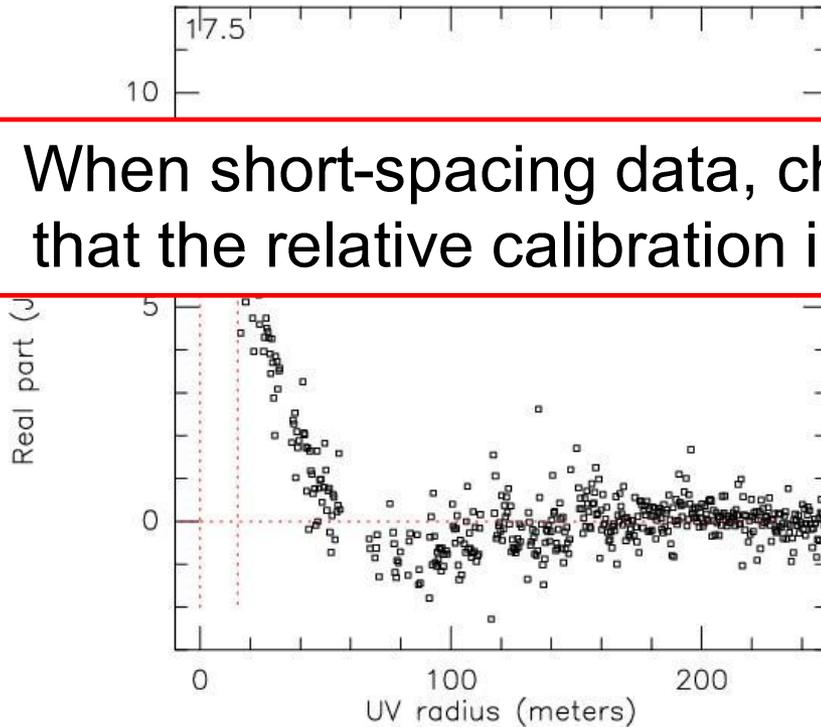


```
CLIC> find /proc corr /sou Betel /rece 2 /scans 1245 1255  
CLIC> store quality 9
```

(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)...

The screenshot displays the GREG software interface for spectral line mapping. It includes several key components:

- <FLUX 0**: A plot showing the flux profile of the source, with a curve rising from 0 and leveling off around 1000.
- <GREG 0**: The main spectral line map window, showing a color-coded intensity map of the source. The map is centered around 32°55'00" and 32°54'00" in J2000 coordinates. A toolbar at the top includes options like Pencil, Marker, Luts, Hardcopy, Draw, Zoom, Zoom off, Refresh, and Clear.
- Parameters Panel**: A control panel on the left with various settings for cleaning and display, including:
  - Beam Patch: 0
  - Clean Beam major axis (sec): 0
  - Clean Beam minor axis (sec): 0
  - Clean Beam PA (deg E from N): 0
  - MOSAIC: Min. weight for search: 0.20000000298023
  - MOSAIC: Min. weight for restore: 0.20000000298023
  - Flux scale for display: 0.100
- Terminal Window**: A terminal window at the bottom left showing the output of the cleaning process:

```
I-CLEAN, Could need 76653 iterations
Allocating 2000 components
Image & Beam planes 1 1
get_clean, before: 0.0000000E+00 0.0000000E+00 0.0000000E+00
I-CLEAN, Beam is 1.67" by 1.23" at PA 81.33 deg.
I-CLEAN, Errors ( 0.01) ( 0.01) ( 0.65)
Map maximum 3.8308 at 257 256
Map minimum 0.24576 at 336 377
I-HOGBOM, Cleaned 89.2 Jy with 2000 clean components
MAPPING>
```
- Plot of Amplitude vs. UV radius**: A plot in the bottom right window titled "gv: Hardcopy GTVIRT metacode on PostScript driver". The y-axis is "Amplitude (Janskya)" ranging from 0 to 80. The x-axis is "UV radius (meters)" ranging from 0 to 150. The plot shows a sharp peak at low UV radius, followed by a noisy tail that decays towards zero.

(3)

# Passing directly from hpb → mapping

Good practice: When cleaning (extended sources) **verify that the flux obtained in the image plane coincides with that at the zero-spacing**

The screenshot displays a radio astronomy software interface with three main components:

- Mapping Control Panel:** A control window with buttons for 'GO', 'ABORT', 'READ', and 'SHOW'. It contains fields for 'Generic name' (chicyg-co21-mer), 'Image type to show' (CLEAN), 'First channel' (0), and 'Last channel' (0). It also lists various mapping methods like Mosaic, UV\_MAP, Hogbon, Clark, SDI, MRC, and Multi.
- Radio Image:** A central window showing a radio image of source CHICYG. The image is a heatmap with a central peak. The axes are labeled with coordinates: 32°55'40" to 32°54'00" on the vertical axis and 0 to 150 on the horizontal axis.
- Plot:** A window titled 'gv: Hardcopy GTVIRT metacode on PostScript driver' showing a plot of 'Amplitude (Janskys)' vs 'UV radius (meters)'. The plot shows a sharp peak at zero spacing, followed by a rapid decay and a noisy baseline.

Metadata for the source CHICYG is displayed on the right side of the image window:

- Source: CHICYG
- Line: 12CO21
- Frequency: 230.53799 GHz
- Beam: 1.67 x 1.23 PA 81°
- Level step: 0.2 Jy/beam
- 2.24 K
- Box marking: VELOCITY
- Channels: [0,0]

Terminal output at the bottom shows the following information:

```
ccarrizo@pctcp95:~/school-cosas
File Edit View Terminal Go Help
Map maximum 3.8308 at 257 256
Map minimum 0.24576 at 336 377
I-HOGBOM, Cleaned 89.2 Jy with 2000 clean components
MAPPING>
I-LEVELS, Contour levels are :
-0.2000 0.2000 0.4000 0.6000 0.8000
1.000 1.200 1.400 1.600 1.800
2.000 2.200 2.400 2.600 2.800
3.000
MAPPING>
```

(3)

# Passing directly from hpb → mapping

If not, it may happen...

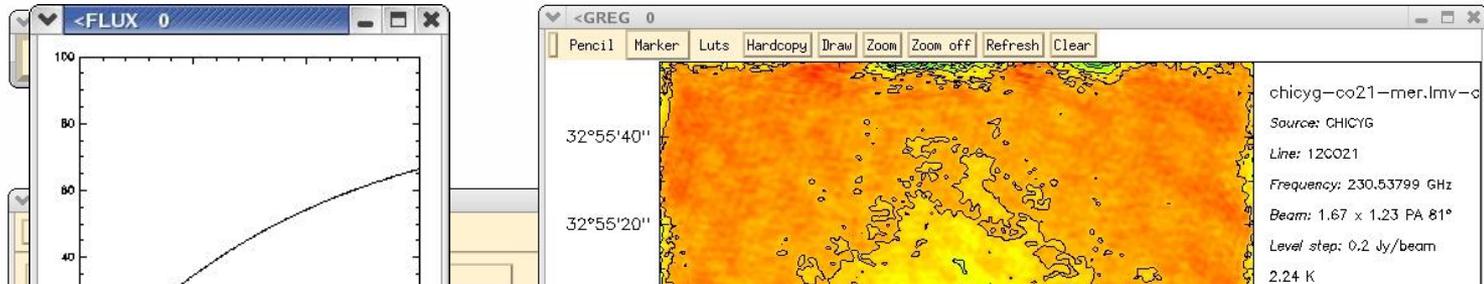
The screenshot displays the MAPPING software interface. At the top left is a small menu bar with 'SIC Window GREG MAPPING Help'. Below it is the 'Mapping Control Panel' with buttons for 'GO' and 'ABORT', and 'READ' and 'SHOW' buttons. The panel contains several input fields and buttons for selecting methods: 'Generic name' (chicyg-co21-mer), 'Image type to show' (DIRTY), 'First channel' (Q), 'Last channel' (Q), 'Mosaic from UV data' (MOSAIC), 'Mapping from UV data' (UV\_MAP), 'Get support' (SUPPORT), 'HOGBOM method' (Hogbom, circled in red), 'CLARK method' (Clark), 'SDI method' (Sdi), 'MRC method' (Mrc), and 'Multiscale method' (Multi). To the right is a window titled '<GREG 0' showing a contour plot of a source. The plot has a color scale from blue (low intensity) to red (high intensity). The plot is labeled with coordinates: 32°55'40" to 32°54'00" on the y-axis and 19h50m35" to 30° on the x-axis. To the right of the plot is a text box with the following information: 'chicyg-co21-mer.lmv', 'Source: CHICYG', 'Line: 12CO21', 'Frequency: 230.53799 GHz', 'Beam: 21.86 x 0 PA 0°', 'Level step: 0.2 Jy/beam', '0 K', 'Box marking: VELOCITY', 'Channels: [0,0]', 'ccarrizo', and '28-SEP-2006 10:55:44'. At the bottom is a terminal window titled 'ccarrizo@pctcp95:~/school-cosas' showing the following commands and output: 'MAPPING>', 'I-LEVELS, Contour levels are:', a table of contour levels, 'MAPPING> reca pol', 'MAPPING> pol chicyg-co21-mer-1.pol /plot', 'MAPPING> cle a', and 'MAPPING> '.

0.2000	0.4000	0.6000	0.8000	1.000
1.200	1.400	1.600	1.800	2.000
2.200	2.400	2.600	2.800	3.000
3.200	3.400	3.600	3.800	

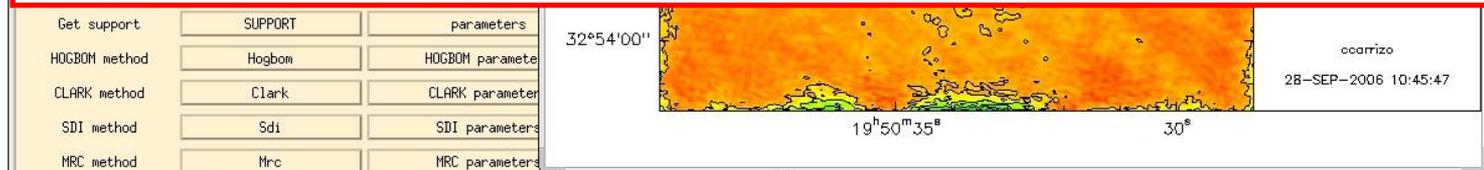
(3)

# Passing directly from hpb → mapping

It may happen...



When cleaning (extended sources)  
verify that the flux obtained in the image plane  
coincides with that at the zero-spacing



```
File Edit View Terminal Go Help
Map maximum 3.8308 at 257 256
Map minimum 0.24576 at 336 377
I-HOGBOM, Cleaned 66.6 Jy with 300 clean components
MAPPING>
I-LEVELS, Contour levels are :
-0.2000 0.2000 0.4000 0.6000 0.8000
 1.000 1.200 1.400 1.600 1.800
 2.000 2.200 2.400 2.600 2.800
 3.000 3.200
MAPPING>
```

## To conclude:

- An inspection of data in the  $uv$ -plane is recommended for all the projects
- A detailed analysis in the  $uv$ -plane: detection, modeling of simple shapes, to check relative calibration, etc...