NOEMA $uv$-data analysis in practice

Miguel Montargès
(slides available here, only today: http://www.iram.fr/~montarges)
General Picture

image plane

brightness (x,y)

What we want

$\mathcal{F}$

$\mathcal{T}$

$uv$ plane

visibility (u,v)

What we obtain with an interferometer
General Picture

image plane

uv plane

![Graph showing squared visibility vs spatial frequency](image-url)
image plane
brightness \((x,y)\)

\[ \text{Imv}^* \text{ (gdf)} \]

brightness \((x,y)\) \(^{uv}\)

\[ \text{FTT} \quad \text{Cleaning} \]

\[ \text{Gridding} \]

uv plane
visibility \((u,v)\) \(^{instr}\)

Calibration

\[ \text{hpb files} \]

visibility \((u,v)\) \(^{obs}\)

uv-table

\[ \text{IPB data} \]

- 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

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

7 visib. characteristics

- real part for 1\(^{st}\) channel
- imaginary part 1\(^{st}\) channel
- weight 1\(^{st}\) channel

- real part for 2\(^{nd}\) channel
- imaginary part 2\(^{nd}\) 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**

```
* Welcome to CLIC

* Loaded modules
atm
sic (J.Pety, S.Bardeau, S.Guilloteau, E.Bresson)
greg (J.Pety, S.Bardeau, S.Guilloteau, E.Bresson)
ehpop (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.

* 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

---

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 (>2987) of the Plateau de Bure in

CAUTION: backward compatibility with old receivers (<2987) is
still under testing. Please use clic87 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 \textit{uv}-table; CLIC

**Narrow band Corr**

**WideX**
<table>
<thead>
<tr>
<th>Source Name?</th>
<th>HFS-29</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.A. &amp; Dec. Offset (for Horses)?</td>
<td>0 0</td>
</tr>
<tr>
<td>First and last scan?</td>
<td>0 1000</td>
</tr>
<tr>
<td>Min. data quality?</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>Receiver number?</td>
<td>1</td>
</tr>
<tr>
<td>Line or Continuum?</td>
<td>LINE</td>
</tr>
<tr>
<td>Band Used?</td>
<td>LSB</td>
</tr>
</tbody>
</table>

**Narrow 1**

<table>
<thead>
<tr>
<th>Intermediate frequency at correlator input (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE kk</td>
</tr>
</tbody>
</table>

**Narrow 2**

<table>
<thead>
<tr>
<th>Intermediate frequency at correlator input (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE kk</td>
</tr>
</tbody>
</table>

**Line parameters**

- Line Name: 29so2
- Rest Frequency (GHz): 35758.144

**Plot options**

- astro> line + plot
- clic> header /plot
- clic> header

< IF3 units>
Talk of R. Neri yesterday
Creating a uv-table; CLIC
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

Offset range : 0.0 to 0.0 and 0.0 to 0.0
Selected data quality is 4 (Average)
I-CLIC_SET,[6686] 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 , LSB
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 : 2.50600000000000 -0.858185138199841
W-TABLE,[7537] Reference channels : 13.9744529724121 15.0000000000000
W-TABLE,[7537] Number of channels : 116 39
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_REFI = 15.00000
I-TABLE,[6957] 5665 visibilities written (out of 5850 possible)
I-TABLE,[6957] Old size 5850 New 5665

CLIC->
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

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

I-CLIC, Primary beam size 58.75925

W-TABLE,[7537] Spectrum resampling is needed, obs. # 844 Scan
W-TABLE,[7537] Frequency resolutions : 2.50000000000008
W-TABLE,[7537] Reference channels : 13.97452972421 15
W-TABLE,[7537] Number of channels : 116

I-TABLE,[6957] Table parameters for afgl-sio.uvt:
I-TABLE,[6957] X_LINE = 85759.144 X_VAL1 = 85743.542
I-TABLE,[6957] X_FREQ = -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 iraix0.
Tue Oct 5 21:17:51 CEST 2010

Selecting GILDAS version: 27sep (27sep10 02:05 cest), executable tree, x86_64-fedora6-i4fort

SIC# ./rt *cluc
-rw-r--r-- 1 ogdr project 534 Oct 5 21:14 afgl-sio.uvt-table.clic
SIC# []
isj8-co21-table.clic

file in 08-oct-2008-isj8.hpc

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 atmosphere internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on

cpl selection LINE LSB L01 snd L05
find /proc corr /sou MFS-22

table ~/meps/isj8-co21.uvt new /frequency C021 230538 /res 40 20 -30 2 velo
CREATE THE TABLE

Use atm. phase correction? □ Yes
Input Data File Name? /home/ccarrizo/24-dec-2008-isi0x.hpl
Output UV Table Name? /home/isisi0x-coll
Now Table? □ No
Source Name? MFS-22
R.A. & Dec. Offsets (for Mosaics)? 0 0
First and last scan? 0 100000
Min. Data quality? AVERAGE
Receiver number? 5
Line or Continuum? LINE
Band Used? LSB
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

2nd data set
isj8-co21-table.clic

file in 08-oct-2008-isj8.hpbo

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 atmosphere 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.hpbo

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 atmosphere 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
```

2nd data set
isj8-co21-table.clic

file in 08-oct-2008-isj8.hp8

set default
set scan 0 10000
set offset 0 0
set receiver 3
set quality AVERAGE
set weight tags on
set weight calibration on
set phase antenna atmosphere internal relative
set amplitude antenna absolute jansky relative
set rf_passband antenna frequency file on

set selection LINE LS5 L01 and L05
find /proc ccorr /sou MFS-22

table ~/maps/isj8-co21.uvt new /frequency C021 230538 /res 40 20 -30 2 vela

file in 24-dec-2008-isj8.hp8

set phase no twin
set scan 20 350
find /proc ccorr /sou MFS-22

table

0: isj8-co21-table.clic    (Fundamental)=-L28--All-----------------------------
Wrote /home/ccarrizo/isj8-co21-table.clic
CLIC> help table

This command will create an n-dimensional table. 'nc' is the number of bands and subbands used, 'code' is the weighting code, 'code' is the direction code, 'direction' is the phase code, 'direction' is the epoch code. The bands and subbands used in the table are specified by the parameter /RESAMPLE and /FREQUENCY.

TABLE /RESAMPLE [nc ref val] '/' RESAMPLE enables (or disables) the resampling of the input data. 'nc' is the number of bands and subbands to be resampled, 'ref' is the reference frequency, 'val' is the value to be resampled. The resampling is done by dividing the input data by the reference frequency and multiplying it by the value to be resampled.

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 parameters are consistent with those defined in the table header. Option /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 intended for building tables with inconsistent parameters (typically example 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 NULL spectral correlator. For the NEW spectral correlator (data taken since summer 1992), it is replaced by the commands SET GIBBS and SET DROP.

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.
isj8-co21-table.clic

file in 08-oct-2008-isj8.hp

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 LS8 L04 to L08
find /proc corr /sou MFS-22

! table ~/maps/isj8-cont.uvt new

continuum
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

continuum
a table for each offset
"tablename"- "i".uvt
Mosaic

2nd data set

![Image]
Created “mytable”.uvt, in CLIC

Analyze the data, in MAPPING
1. Data analysis in the $uv$-plane
Data analysis in the *uv*-plane; **MAPPING**

*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
Data analysis in the $uv$-plane

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

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

Source: GG TAU
Line: 13CO(21)
Frequency: 221.843008 GHz
Channels: 1 to 1
y vs. u
Box meaning: VELOCITY

Generic name: ring
UV Clip: UV_CLIP
UV Coverage: UV_COV

UV Plots: UV_SHOW, UV_SHIFT, UV_FIT
Plotting UV Fits: PLOTFIT
Data analysis in the uv-plane

ring.tuv
Source: GG TAU
Line: $^{13}$CO$(2_{1})$
Frequency: 221.943008 GHz
All Channels
amp vs. radius
Box marking: VELOCITY

UVSHOW
ccorrizo
01–OCT–2008 17:55:02
Data analysis in the $uv$-plane

od19–co21–i2128.tuv
Source: i2128
Line: co21
Frequency: 230.53799 GHz
All Channels
amp vs. radius
Box marking: VELOCITY

UVSHOW

ccarrizo
01–OCT–2008 17:53:01
Data analysis in the *uv*-plane

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
<th>Parameters</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIC</td>
<td>UV actions control panel</td>
<td>Generic name: ring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UV Clip</td>
<td>UV_CLIP parameters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UV Coverage</td>
<td>UVCOV parameters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UV Plots</td>
<td>UVSHOW parameters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UV_SHIFT</td>
<td>UV_SHIFT parameters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UV fit</td>
<td>UV_FIT parameters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plotting UV fits</td>
<td>PLOTFIT parameters</td>
<td></td>
</tr>
</tbody>
</table>

**UVSHOW parameters**

- **Generic name**: ring
- **X data**: radius
- **Y data**: amp
- **First channel**: \( \theta \)
- **Last channel**: \( \theta \)
- **Plot limits**: \( i \)
- **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 4

**Source**: 66 Tau
**Line**: 1300(21)
**Frequency**: 221.843006 GHz
**All Channels**: amp vs. radius
**Box marking**: VELOCITY
Data analysis in the \textit{uv}-plane

\texttt{ring.tuv}

Source: GG TAU

Line: $13\text{CO}(21)$

Frequency: 221.943008 GHz

All Channels

real vs. radius

Box marking: VELOCITY

ccarrizo

01–OCT–2008 17:58:15
Data analysis in the $uv$-plane

ring.tuv
Source: GG TAU
Line: 1300(21)
Frequency: 221.943008 GHz
All Channels
weight vs. radius
Box marking: VELOCITY

carrizo
01-OCT-2008 18:00:21
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
```

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

Mapping GUI

GREG GUI

UV table to shift

Offset (YES) or Absolute (NO) position

Phase center offset (in radians)

RA, center

Declination center

Angle

ccarrizo@pctcp33:

File Edit View Terminal Tags Help

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

Used
Recommended
Map size: 512 x 512 pixels
Map cell: 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 [EVEI 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 ...
Data analysis in the uv-plane
Data analysis in the \textit{uv}-plane
Data analysis in the uv-plane

Point model: 3 parameters
Data analysis in the uv-plane

Circular Gaussian: 4 parameters
Data analysis in the uv-plane

Elliptical Gaussian: 5 parameters
Data analysis in the uv-plane
Data analysis in the uv-plane

- UV actions control panel
- UVSHOW panel

Graph showing amplitude vs. UV radius with markers and plot settings:
- Generic name: ring-c
- First channel: 1
- Last channel: 200
- Plot model fit: Yes
- Use one color per track: Yes
- Typical time separating 2 tracks [hrs]: 2
- Marker definition as in the SET MARKER command: [41,4]
Data analysis in the uv-plane

Example: detection project of distant galaxy (unresolved)
Data analysis in the **uv-plane**
Data analysis in the $uv$-plane

**MAPPING procedures / tasks**

```
MAPPING> go …
MAPPING> input …
```

also

```
MAPPING> run …
MAPPING> help …
```
# Data analysis in the uv-plane

<table>
<thead>
<tr>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>uv_applyphase</td>
<td>uv_dft</td>
<td>uv_merge</td>
<td>uv_solve</td>
</tr>
<tr>
<td>uv_ascal</td>
<td>uv_extract</td>
<td>uv_mflag</td>
<td>uv_sort</td>
</tr>
<tr>
<td>uv_atm</td>
<td>uv_fidelity</td>
<td>uv_model</td>
<td>uv_splitfield</td>
</tr>
<tr>
<td>uv_average</td>
<td>uv_fit-s</td>
<td>uv_mult</td>
<td>uv_stat</td>
</tr>
<tr>
<td>uv_cal</td>
<td>uv_flag</td>
<td>uv_noise</td>
<td>uv_subtract</td>
</tr>
<tr>
<td>uv_ccmodel</td>
<td>uv_fmodel</td>
<td>uv_observe</td>
<td>uv_table</td>
</tr>
<tr>
<td>uv_cct</td>
<td>uv_gain</td>
<td>uv_pointing</td>
<td>uv_timeaverage</td>
</tr>
<tr>
<td>uv_center</td>
<td>uv_hanning</td>
<td>uv_selfcal</td>
<td>uv_timebase</td>
</tr>
<tr>
<td>uv_circle</td>
<td>uv_hybrid</td>
<td>uv_shift</td>
<td>uv_track</td>
</tr>
<tr>
<td>uv_clip</td>
<td>uv_list</td>
<td>uv_short</td>
<td>uv_track_phase</td>
</tr>
<tr>
<td><strong>uv_compress</strong></td>
<td>uv_map</td>
<td>uv_single</td>
<td>uv_zero</td>
</tr>
<tr>
<td>uv_cuts</td>
<td>uv_mcal</td>
<td>uv_sinusphrase</td>
<td></td>
</tr>
</tbody>
</table>

MAPPING> go ... or run ...
MAPPING> input ... or help ...

50
Data analysis in the uv-plane
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_cal
uv_ccmode
uv_cct
uv_center
uv_circle
uv_clip
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

<table>
<thead>
<tr>
<th>uv_cal</th>
<th>uv_flag</th>
<th>uv_noise</th>
<th>uv_subtract</th>
</tr>
</thead>
<tbody>
<tr>
<td>uv_ccmodel</td>
<td>uv_fmodel</td>
<td>uv_observe</td>
<td>uv_table</td>
</tr>
<tr>
<td>uv_cct</td>
<td>uv_gain</td>
<td>uv_pointing</td>
<td>uv_timeaverage</td>
</tr>
<tr>
<td>uv_center</td>
<td>uv_hanning</td>
<td>uv_selfcal</td>
<td>uv_timebase</td>
</tr>
<tr>
<td>uv_circle</td>
<td>uv_hybrid</td>
<td>uv_shift</td>
<td>uv_track</td>
</tr>
<tr>
<td>uv_clip</td>
<td>uv_list</td>
<td>uv_short</td>
<td>uv_track_phase</td>
</tr>
<tr>
<td>uv_compress</td>
<td>uv_map</td>
<td>uv_single</td>
<td>uv_zero</td>
</tr>
<tr>
<td>uv_cuts</td>
<td>uv_mcal</td>
<td>uv_sinuphase</td>
<td></td>
</tr>
</tbody>
</table>
Data analysis in the uv-plane

MAPPING> go ... or run ...
MAPPING> input ... or help ...

To add a single-dish zero-spacing spectrum

uv_clip  uv_list  uv_short  uv_track_phase
uv_compress  uv_map  uv_single  uv_zero
uv_cuts  uv_mcal  uv_sinuphase
**Data analysis in the uv-plane**

*uv tables are fully editable*

Each visibility contains:

- \( u \) 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

- real part for 2nd channel
- imaginary part
- weight

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

---

**uv table [ visib dimension, # visibilities ]**

visib dimension = 7 + 3 x (# channels)

7 visib. characteristics

mapping> define table aa mytable.uvt write

mapping> let aa[8,2380] 6000

mapping> delete /variable aa

---

data at 2^nd channel

---

56
3. An inspection of the data in the \textit{uv}-plane is recommended
(1) Passing directly from hpb → mapping

It may happen...
Passing directly from hpb → mapping

It may happen...
(1) Passing directly from hpb → mapping

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

```bash
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)…
(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.
(3) Passing directly from hpb → mapping

If not, it may happen…
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
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…