

Imaging, Deconvolution & Image Analysis

II. Practice

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From Calibrated Visibilities to Images: Summary

Fourier Transform and Deconvolution:
The two key issues in imaging.

Stage	Implementation
Calibrated Visibilities	
↓ Fourier Transform	GO UVSTAT, GO UVMAP
Dirty beam & image	
↓ Deconvolution	GO CLEAN
Clean beam & image	
↓ Visualization	GO BIT, GO VIEW
↓ Image analysis	GO NOISE, GO FLUX, GO MOMENTS
Physical information on your source	

Weighting and Tapering: GILDAS implementation

Resolution, point/extended source sensitivity
as a function of
robust threshold or tapering distance.

```
MAPPING> GO UVSTAT WEIGHT
```

Robust	Major (")	Minor (")	PA (deg)	Noise (mJy)	Noise (K)	Sidelobe %	
0.10	0.840	0.527	18.5	0.791	0.044	-16.1	13.9
None	1.271	0.940	155.1	0.406	0.008	-2.7	25.9

I-UV_STAT, Recommended pixel size is 0.080 - 0.264"

```
MAPPING> GO UVSTAT TAPER
```

Taper (m)	Major (")	Minor (")	PA (deg)	Noise (mJy)	Noise (K)	Sidelobe %	
30.00	4.844	3.817	11.9	1.019	0.001	-44.7	14.5
None	1.323	0.967	151.5	0.406	0.008	-12.9	28.7

From Calibrated Visibilities to Images: GILDAS implementation

MAPPING> INPUT UVMAP: display G0 UVMAP control parameters.

Default = 0 \Rightarrow Try something clever.

- Gridding kernel: **CONVOLUTION** (default: 5, *i.e.* spheroidals).
- Data cube setup:
 - First and last data channels to map: **MCOL** (default: 0, *i.e.* all channels).
 - Pixel size: **MAP_CELL** (in arcsec, default: 0, *i.e.* 1/3 to 1/4 synthesized beam).
 - Map size: **MAP_SIZE** (in pixels, default: 0, *i.e.* \sim twice primary beam size).
- Weighting:
 - kind: **WEIGHT_MODE**
(Possibilities: NATURAL/UN. Default: NATURAL).
 - Size of uv plane cell and robust threshold: **UV_CELL**
(Defaults: 7.5 m, 1).
- Tapering: Gaussian taper parameters **UV_TAPER** (in m and degree, default: 0, *i.e.* no tapering).

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Deconvolution: GILDAS Implementation

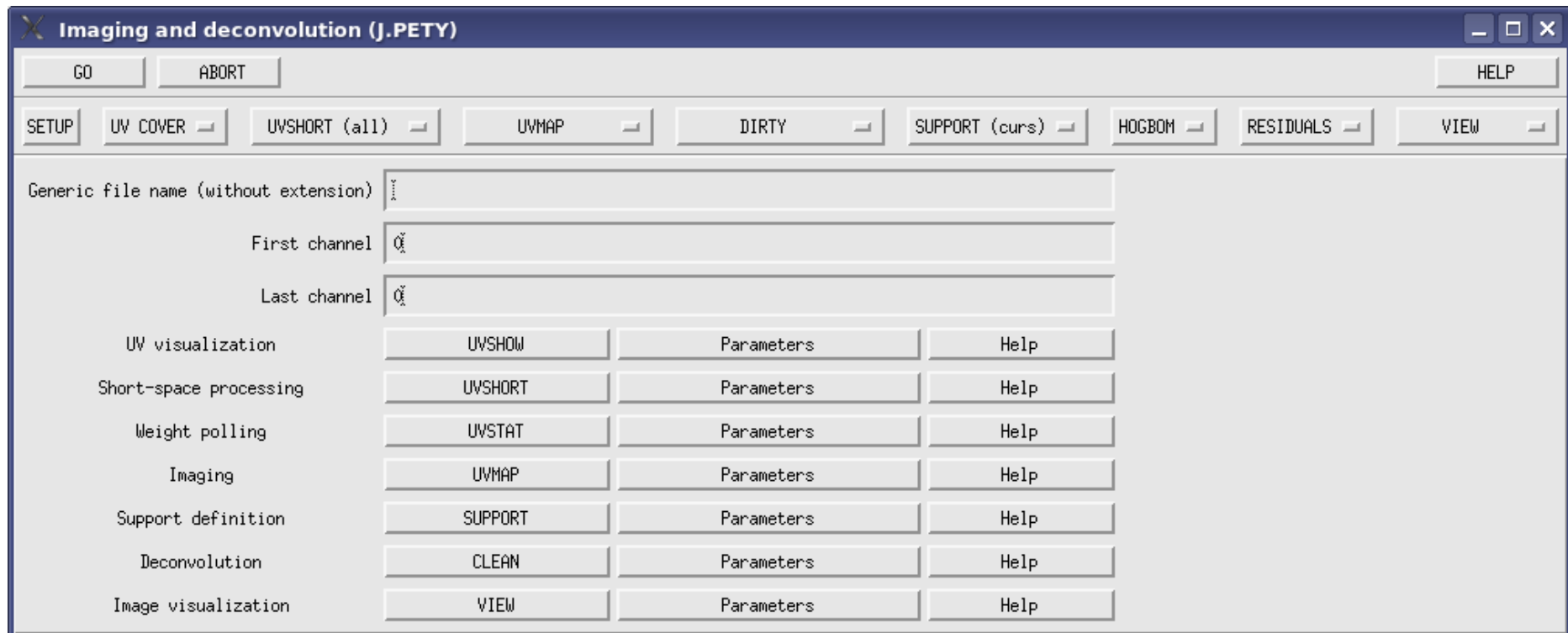
1. MAPPING Command Line

MAPPING> INPUT CLEAN: display CLEAN control parameters.

- Loop gain: **GAIN** (default: 0.2).
- Stopping criterions:
 - Maximum number of iterations: **NITER** (default: 100).
 - Maximum residual amplitude, expressed as fraction of peak intensity: **FRES** (default: 0.05).
 - Maximum residual amplitude, in map units (Jy/Beam): **ARES** (default: 0).
- Support: **BLC** and **TRC** are the Bottom Left Corner and Top Right Corner of a square support in pixel units (default: 0, *i.e.* no support).
- Gaussian clean beam parameters: **MAJOR**, **MINOR**, **ANGLE** (Default: 0, *i.e.* Fit dirty beam).

Deconvolution: GILDAS Implementation

2. MAPPING Window Interface



Typical MAPPING session

Look at the `mapping-tutorial.map` procedure for details.

```
MAPPING> let name 1mm
```

```
MAPPING> go image
```

```
MAPPING> let name 1mm
```

```
MAPPING> go uvcov
```

```
MAPPING> go uvshow
```

```
MAPPING> go uvmap
```

```
MAPPING> go plot beam
```

```
MAPPING> go plot dirty
```

```
MAPPING> go clean
```

```
MAPPING> go plot cct
```

```
MAPPING> go plot res
```

```
MAPPING> go plot clean
```

```
MAPPING> exit
```

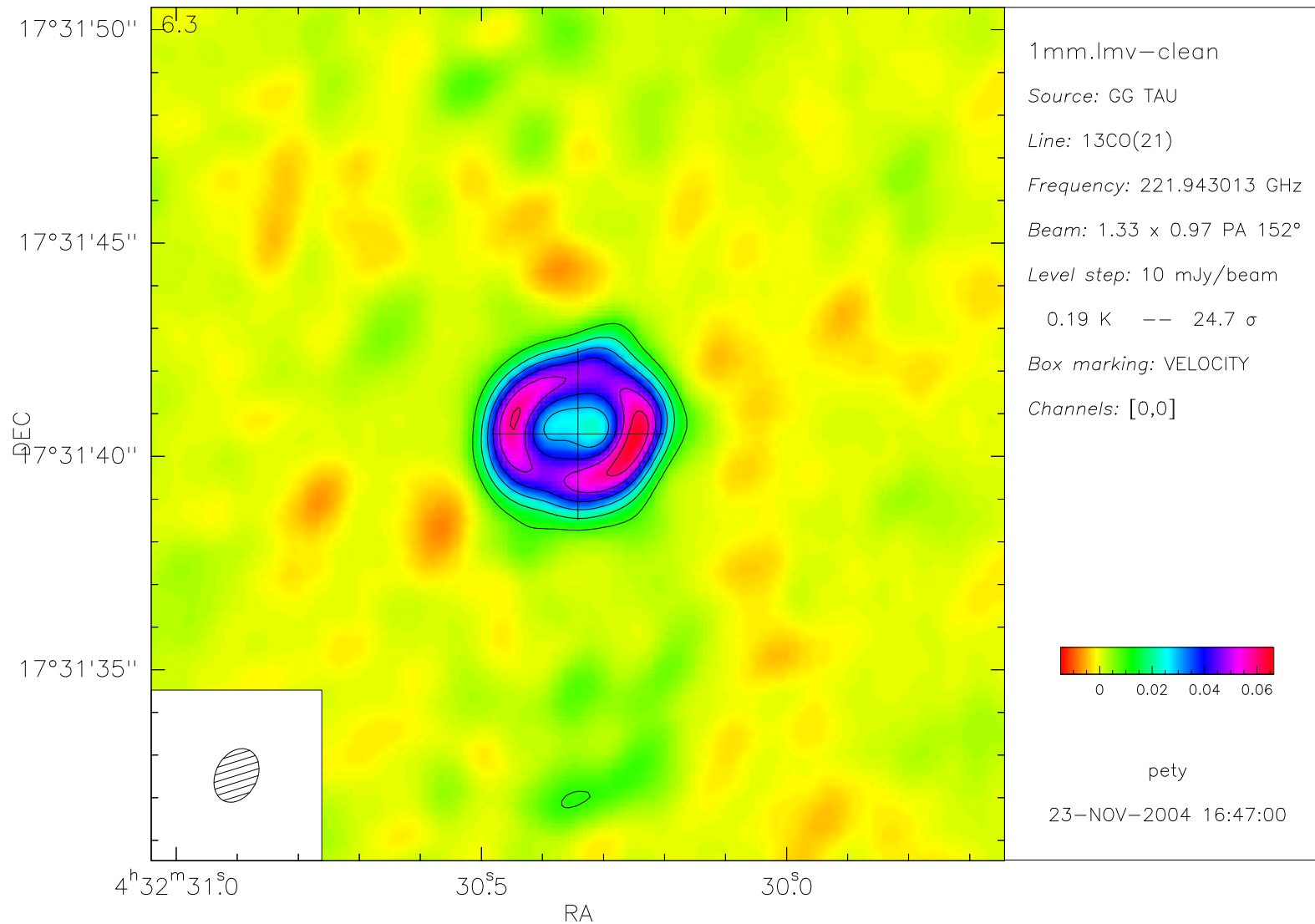

Visualization and Image Analysis

Fourier Transform and Deconvolution:
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Physical information on your source	

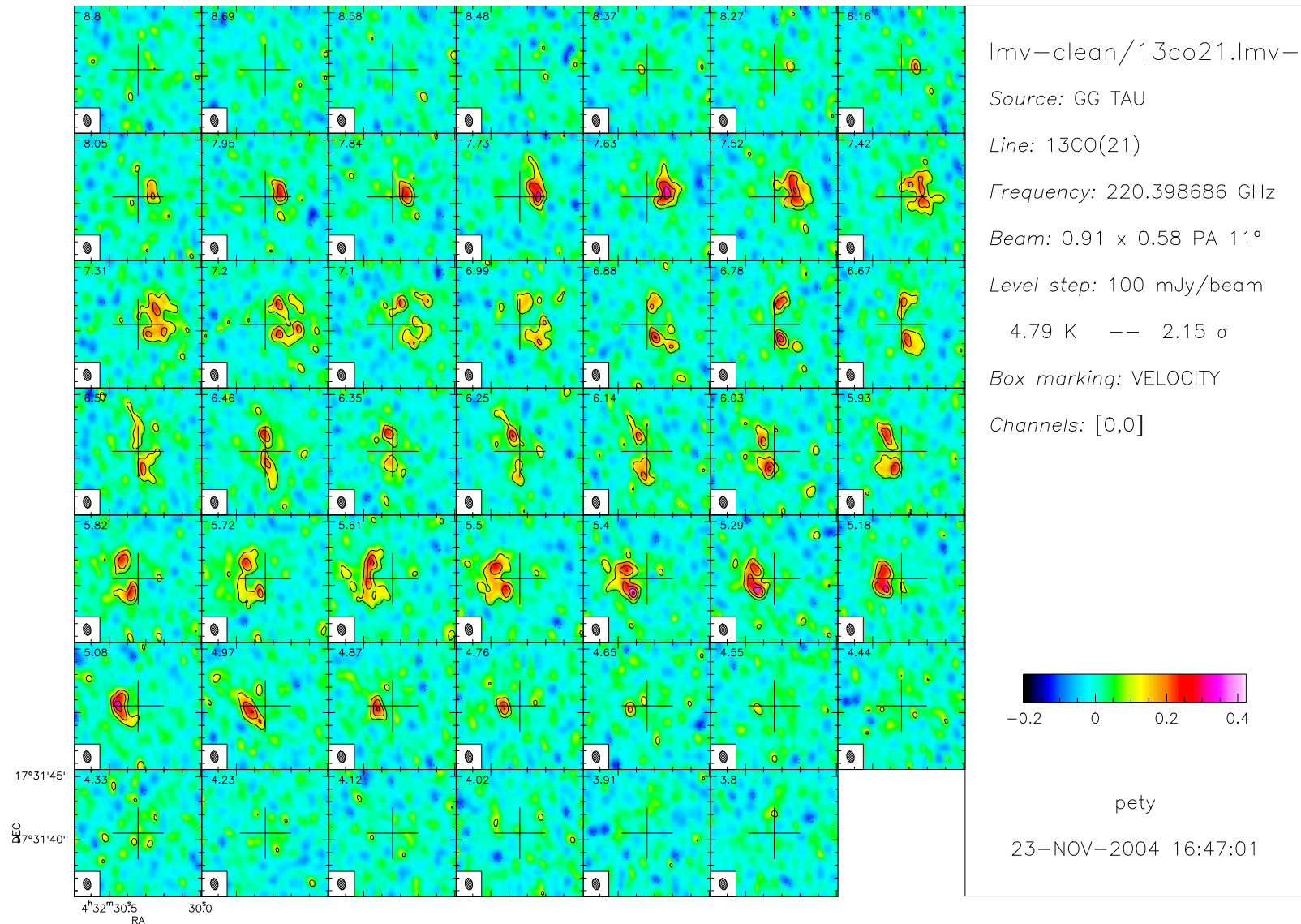
Visualization: I. GO BIT for continuum

```
MAPPING> let name 1mm  
MAPPING> let type lmv-clean  
MAPPING> go bit  
MAPPING> input bit
```



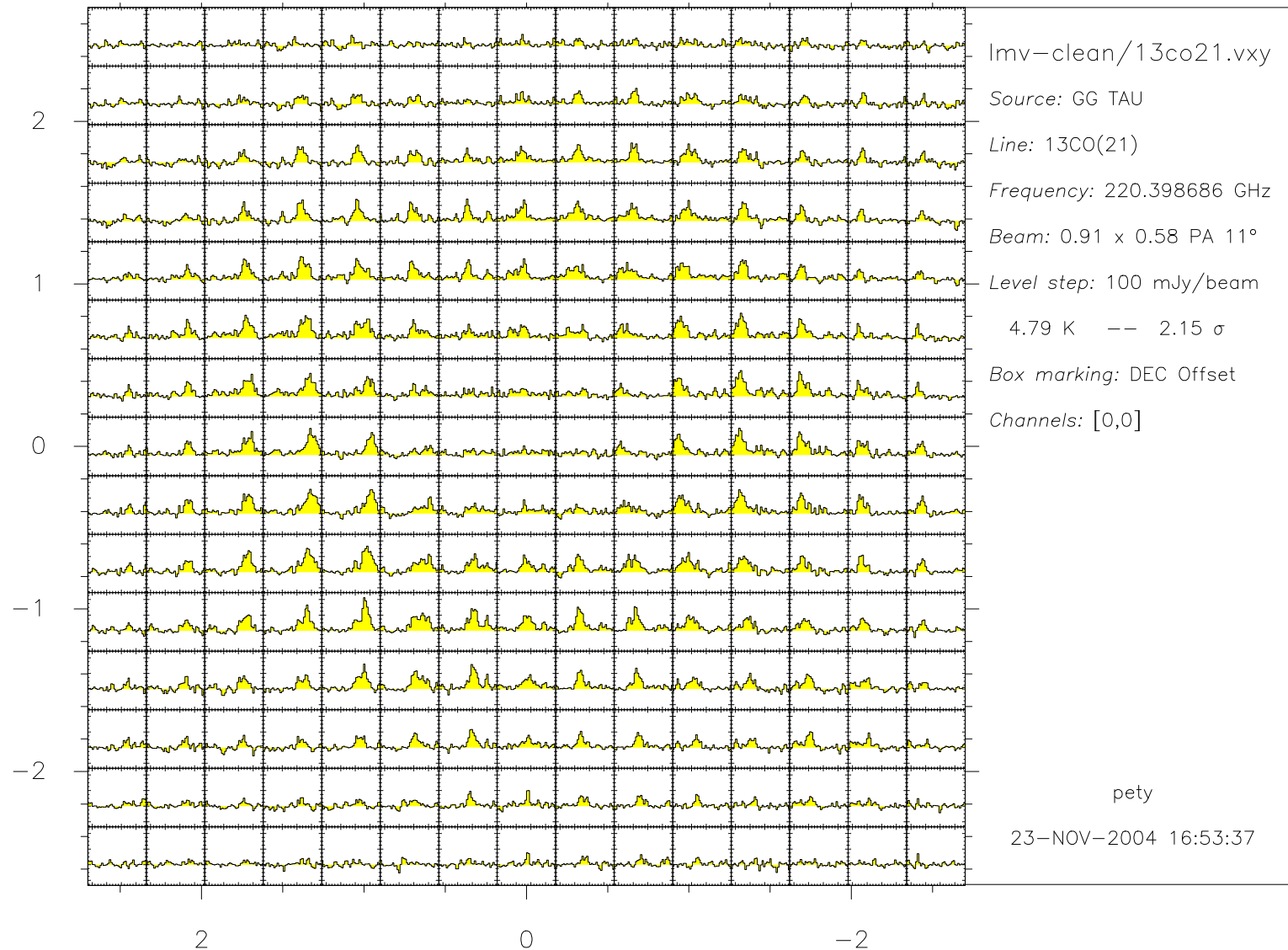
Visualization: II. GO BIT for spectra

```
MAPPING> let name 13co21
MAPPING> let type lmv-clean
MAPPING> go bit
```



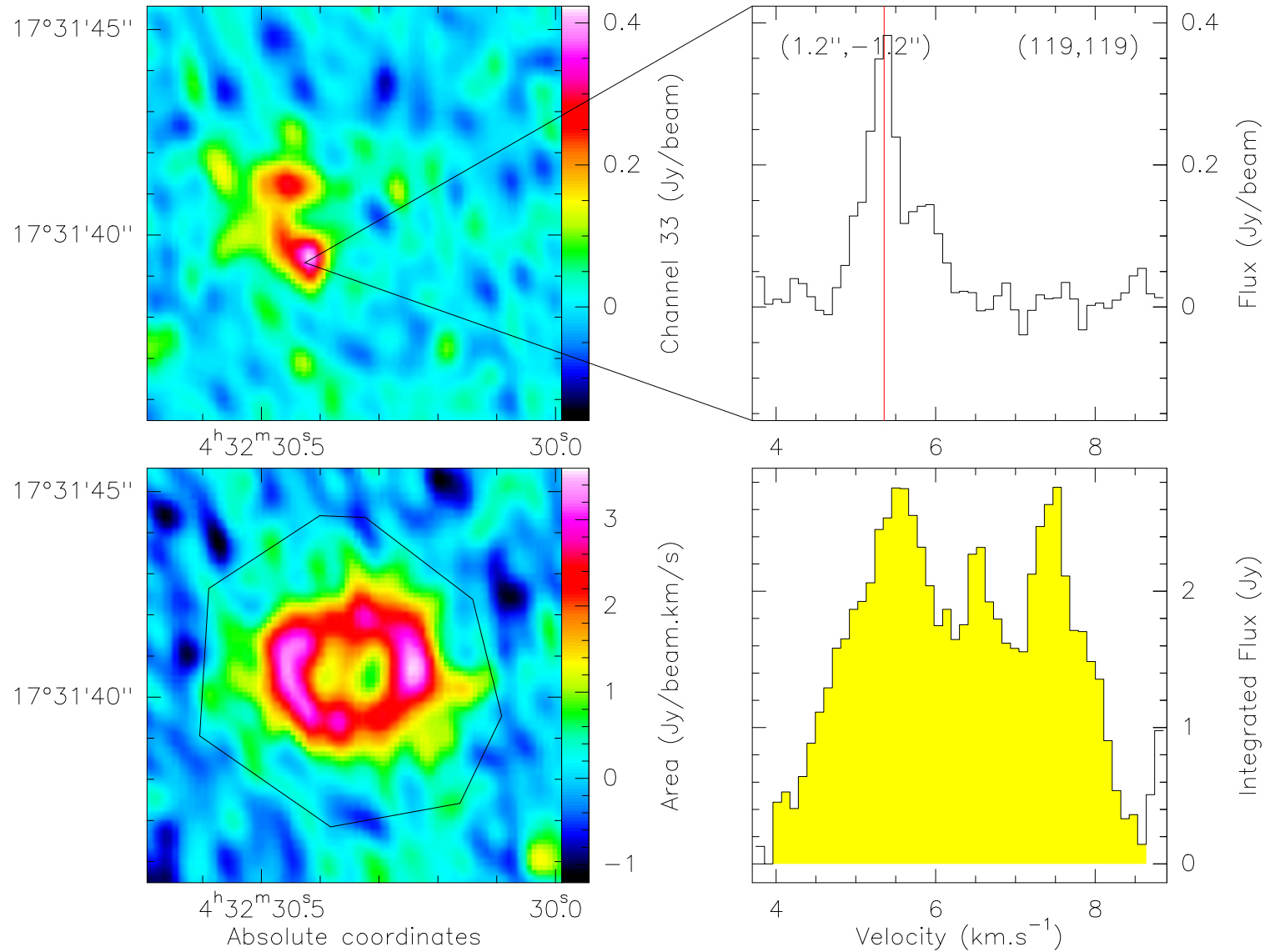
Visualization: III. GO SPECTRUM for spectra

```
MAPPING> let name 13co21  
MAPPING> let type lmv-clean  
MAPPING> go spectrum
```



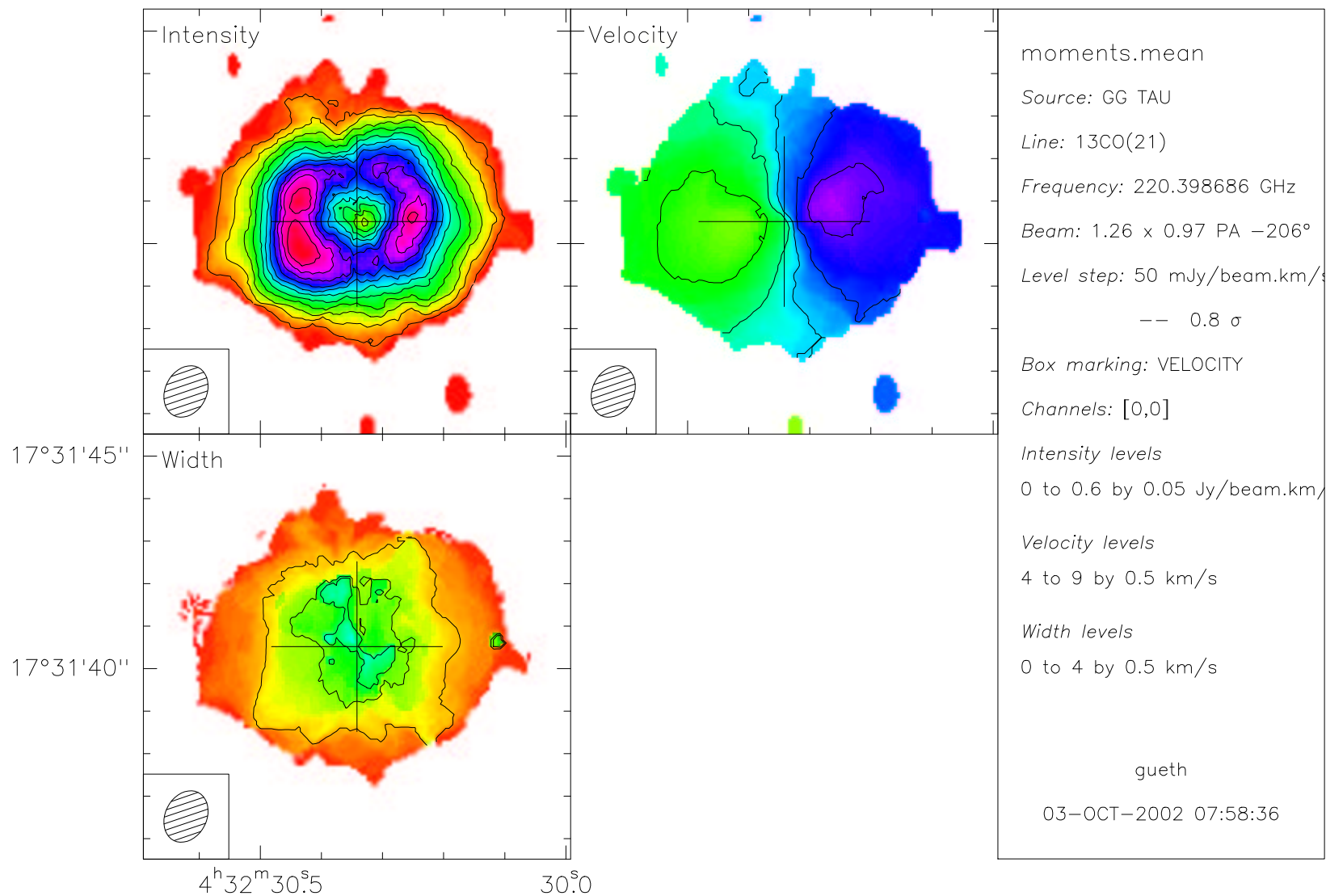
Visualization: IV. GO VIEW for spectra

```
MAPPING> let name 13co21  
MAPPING> let type lmv-clean  
MAPPING> go view
```



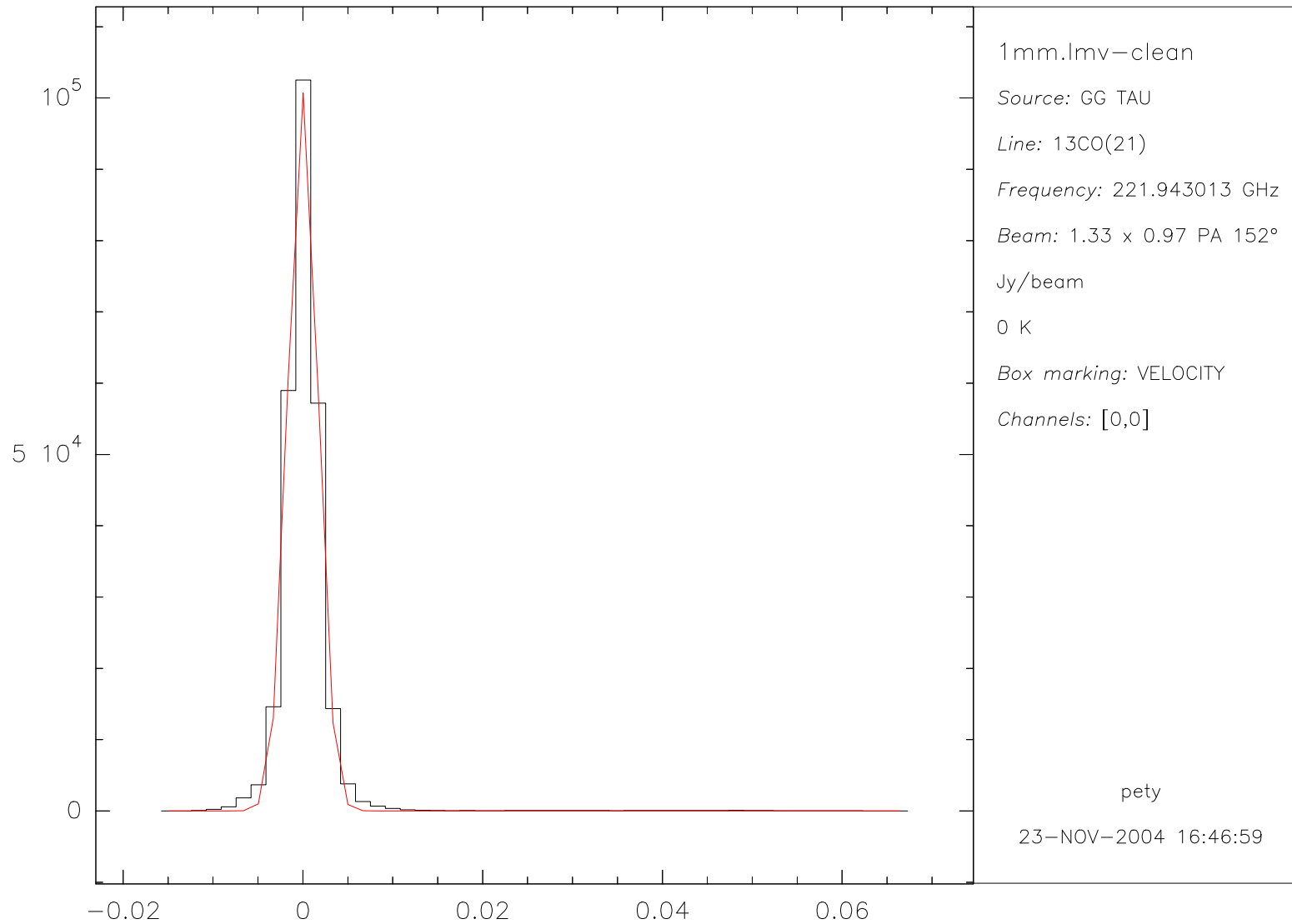
Analysis: I. Moment Estimation with GO MOMENT + GO VELOCITY

```
MAPPING> let name 13co21  
MAPPING> let type lmv-clean  
MAPPING> go moments  
MAPPING> go velocity
```



Analysis: II. Noise Estimation with GO NOISE

```
MAPPING> let name 1mm  
MAPPING> let type lmv-clean  
MAPPING> go noise  
NOISE = 1.6312926E-03 ! Real GLOBAL
```



Analysis: III. Flux Estimation with GO FLUX

```
MAPPING> let name 1mm  
MAPPING> let type lmv-clean  
MAPPING> go bit  
MAPPING> go flux  
Total Flux 461 mJy
```

