# s-cubed.physics.ox.ac.uk

# Mosaic imaging with the GMRT

## a users approach

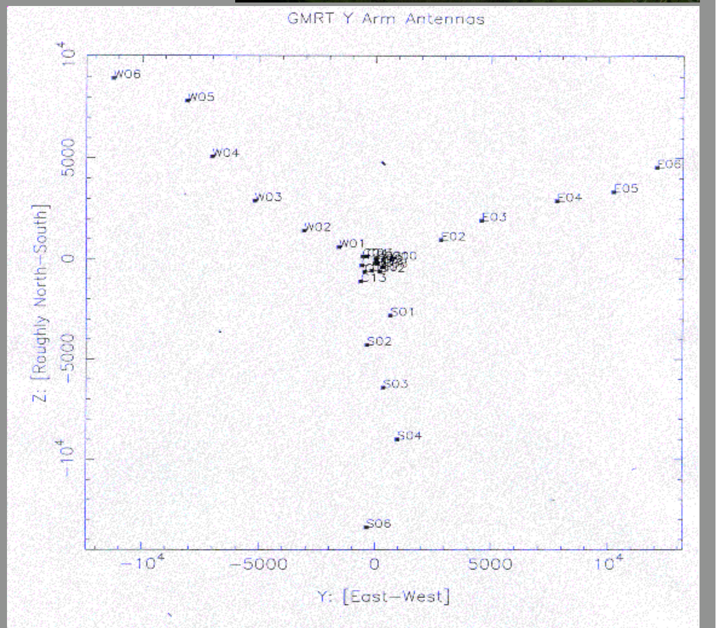

Hans-Rainer Klöckner

Algorithms Oxford 2008

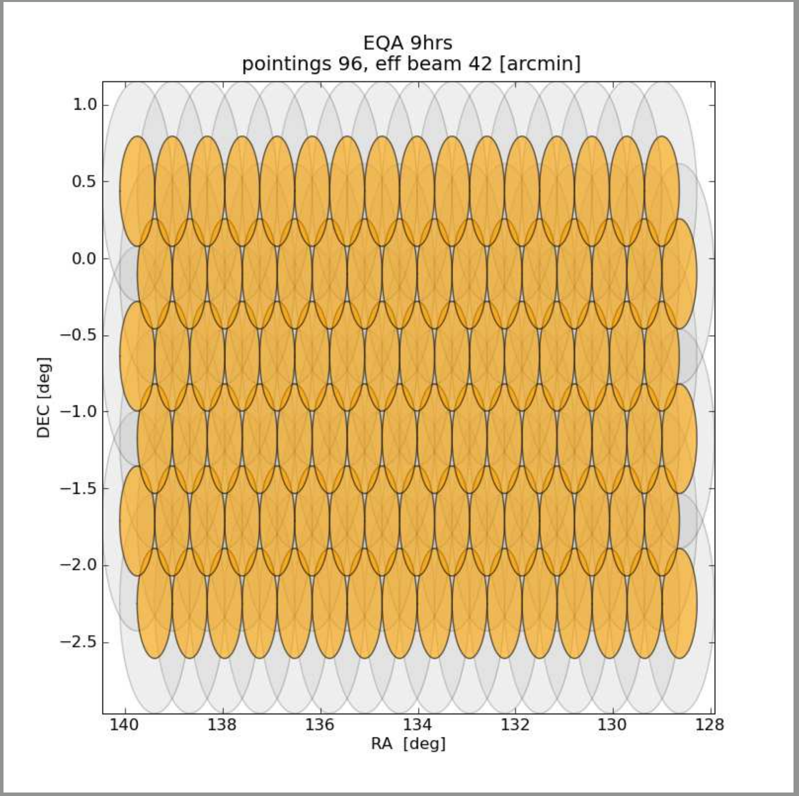
# GMRT

**Giant Metrewave Radio Telescope (GMRT)**
**Khodad located near (2-3 hrs by car) Pune in India:**

- 30 x 45m antennas in a Y-shape = 4% SKA
- baselines ~25.5 km

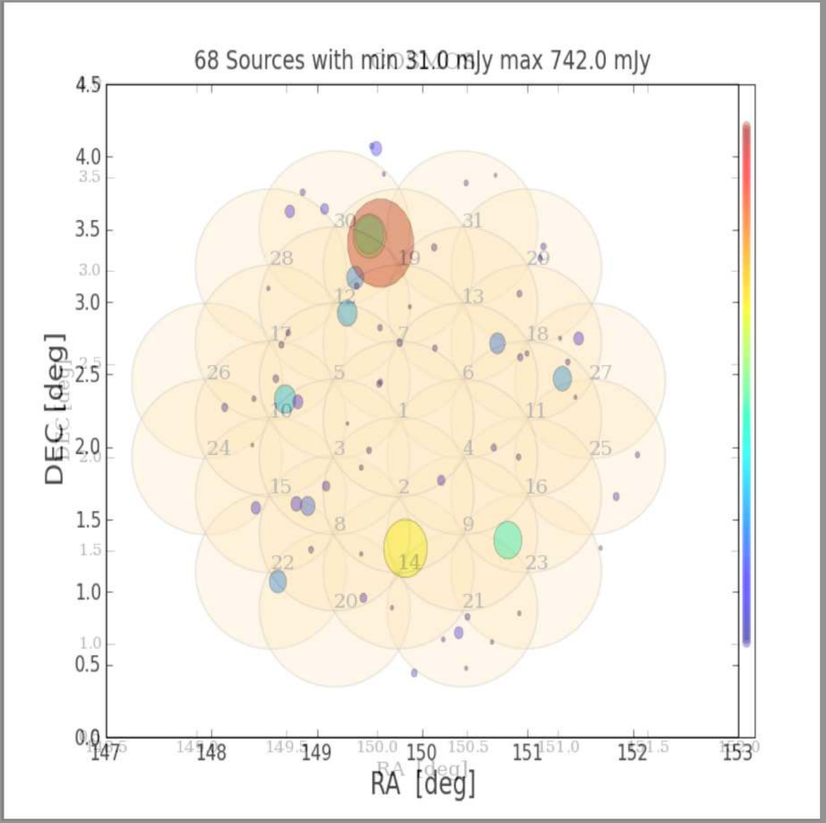



# Surveying




## HPBW

**119' [~230 MHz]**
**85' [~330 MHz]**
**44' [~600 MHz]**
**26' [~1400 MHz]**




**Baseline sensitivity [360 MHz, avg]**

- 60 minutes 1.419570e-03 Jy
- 30 minutes 2.007576e-03 Jy
- 15 minutes 2.839141e-03 Jy
- 7 minutes 4.156077e-03 Jy
- 3 minutes 6.348512e-03 Jy
- 1 minutes 1.099595e-02 Jy

# GMRT - pipeline

**AIPS** (Eric Greisen et al.)

**ParselTongue** (Mark Kettenis)

**EVALUATE - DATA**

**CALIBRATE**

**EVALUATE - DATA**

**SELF- CALIBRATE**

GMRTcalinit.py

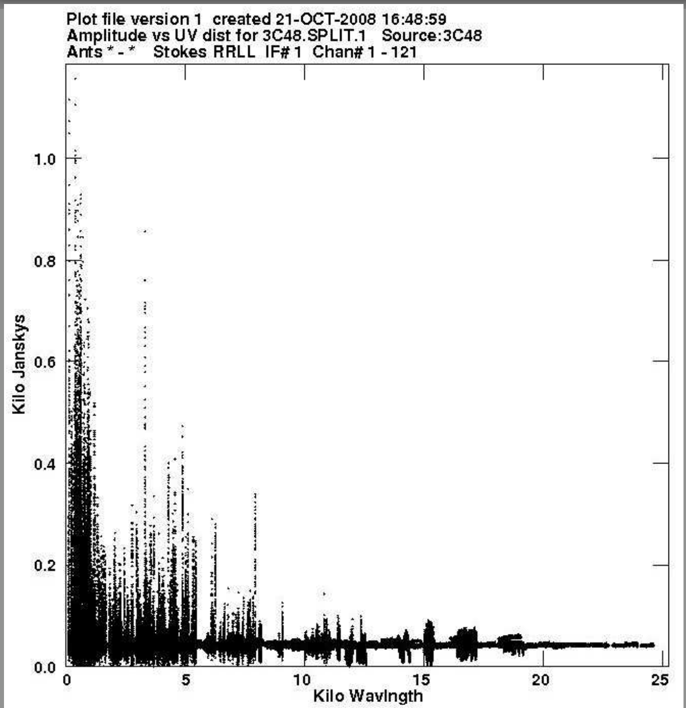
GMRT_CALIB.py
HAND_FLAG.py
GMRT_IMAGER.py

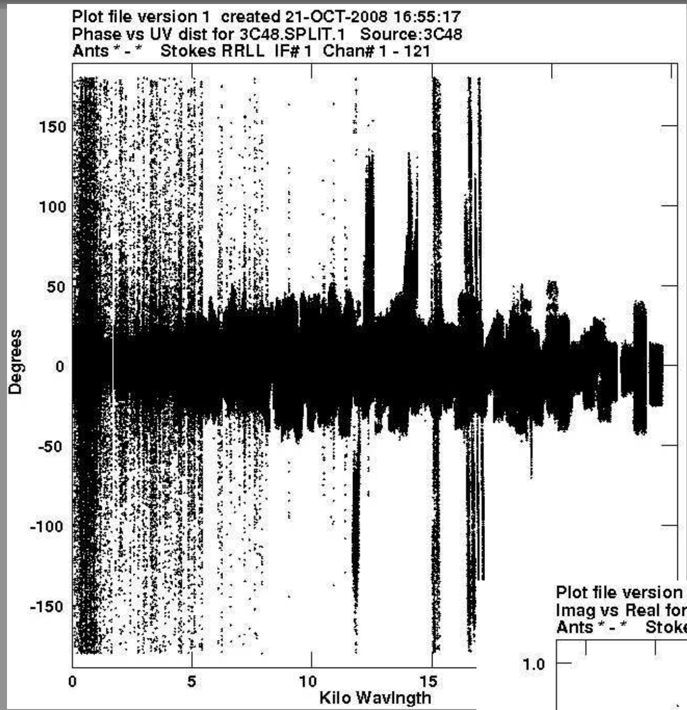
GMRT_FLAGER.py
GMRTdisk.py
GMRTools.py
HAIPStask.py

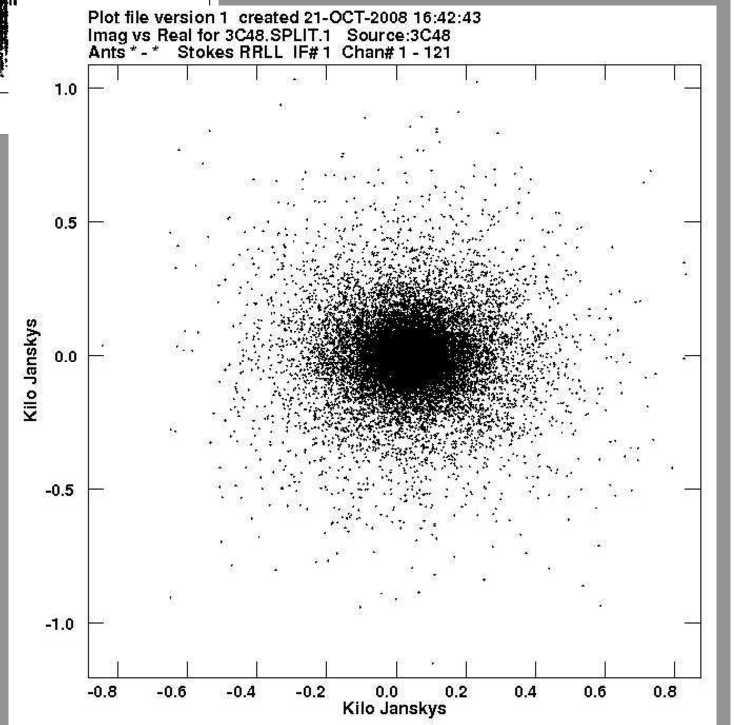
GMRT_MERGER.py
SPECTRA_EXTRACT.py
GMRT_PRTOUTPUT.py

make_run_files.py
makepublic.py
readcata.py

# Evaluate data Phase - calibrator 360 MHz

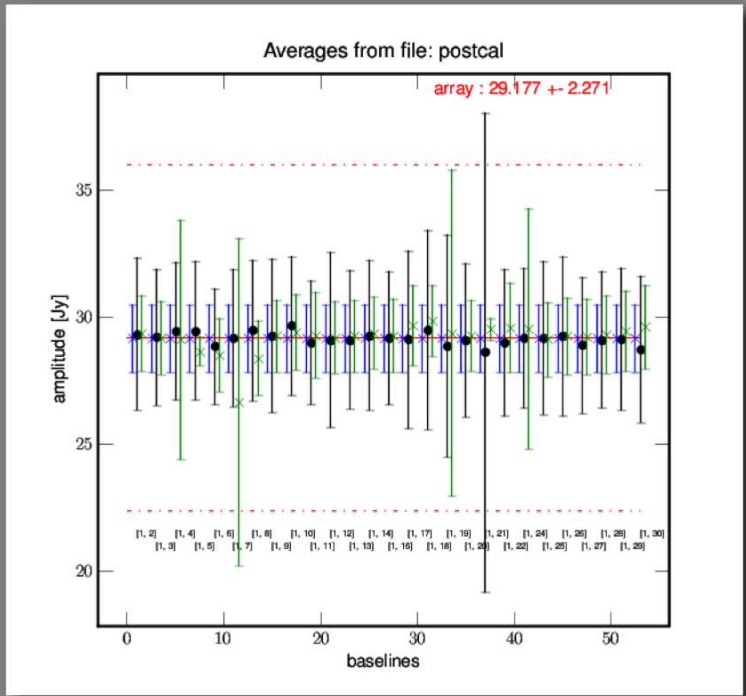


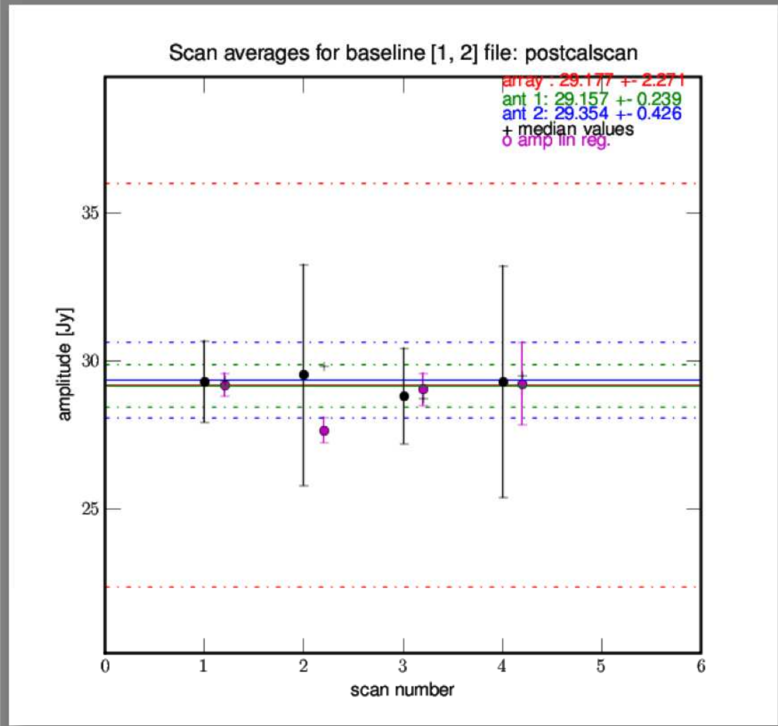



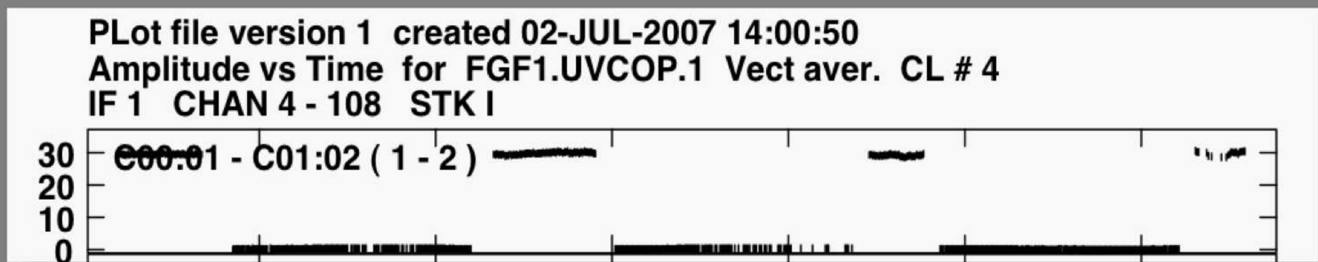



# Flagging - on continuum [phase-calibrator]

Telescope
Baseline
Scan



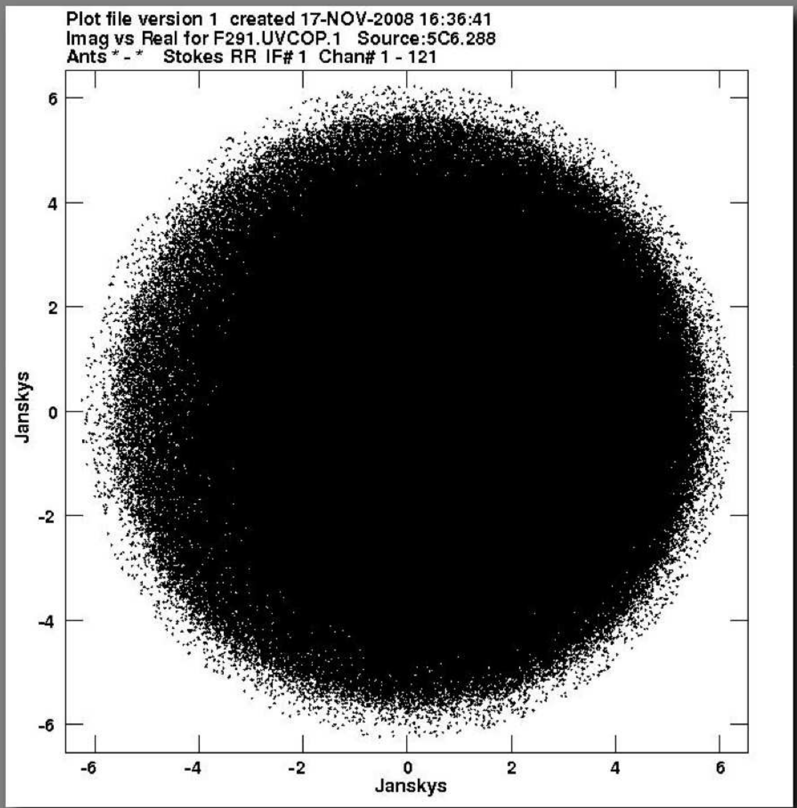



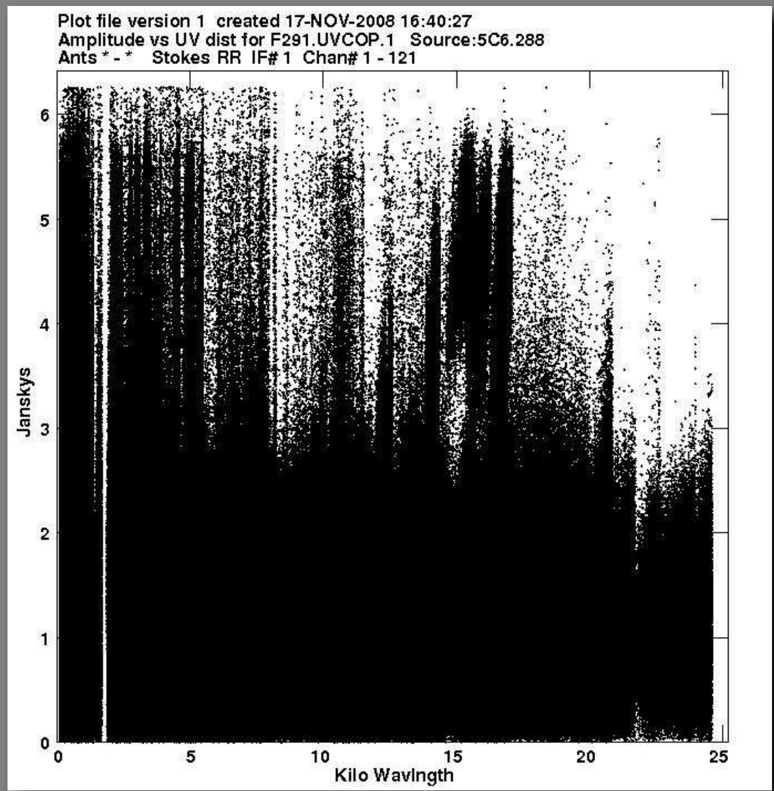
# Flagging - on channels [target] 360 MHz

## Stokes RR

183592 flags; 145739 vis * 121 chan -> 4%

LL is 20 %



# Evaluate data on target

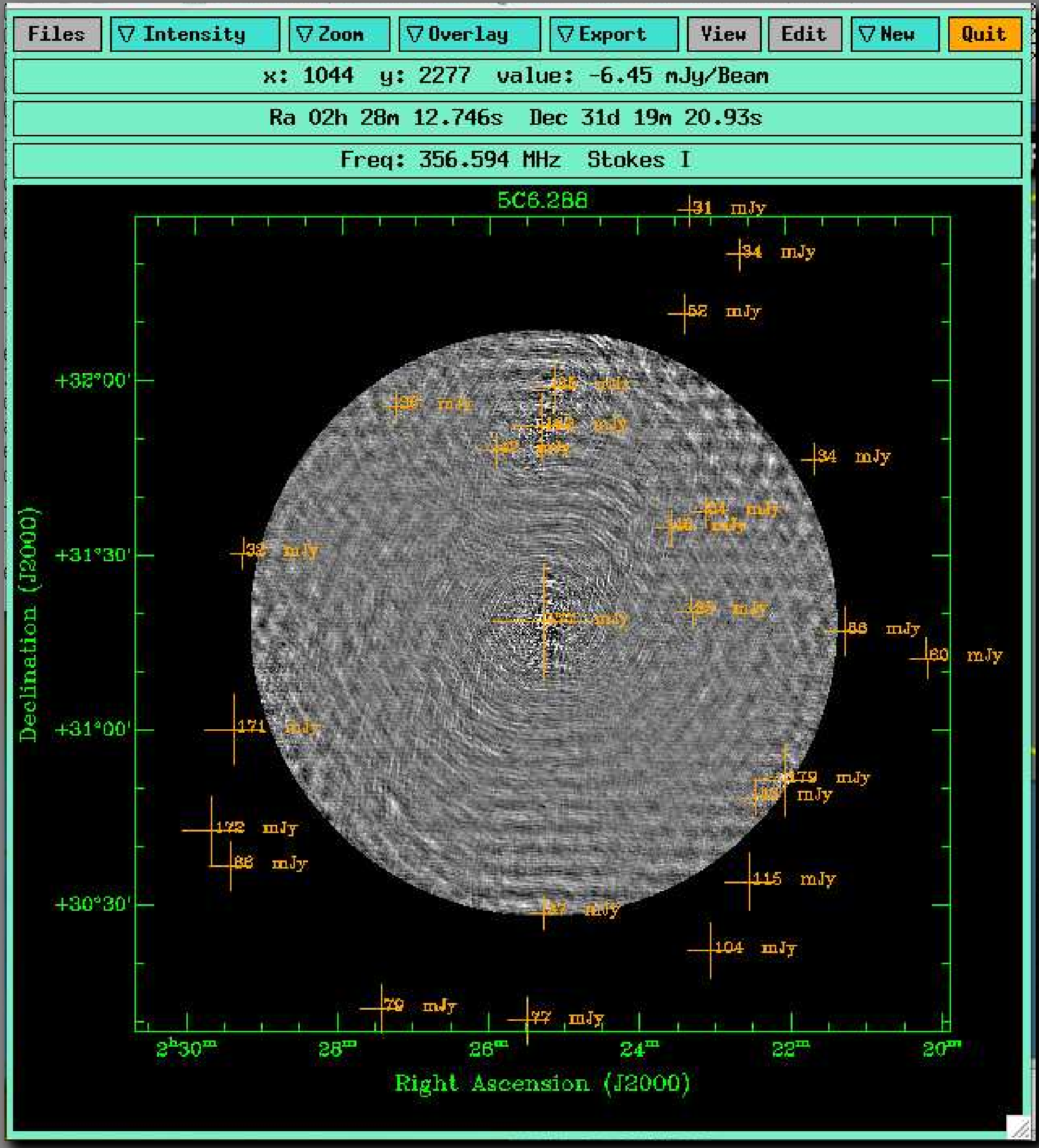
360 MHz

dirty image

multifacet

760 mJy

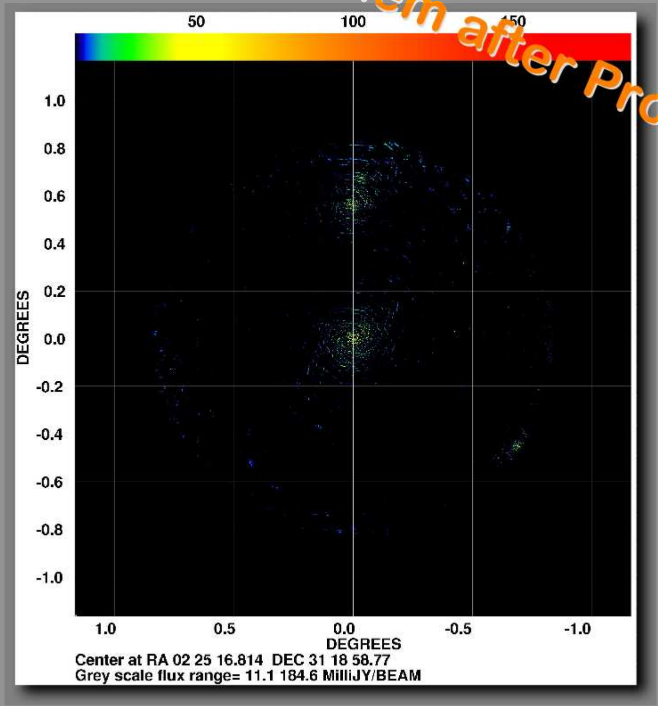
250 d.-rang




careful
baseline sensitivity

# Multifacet selfcalibration

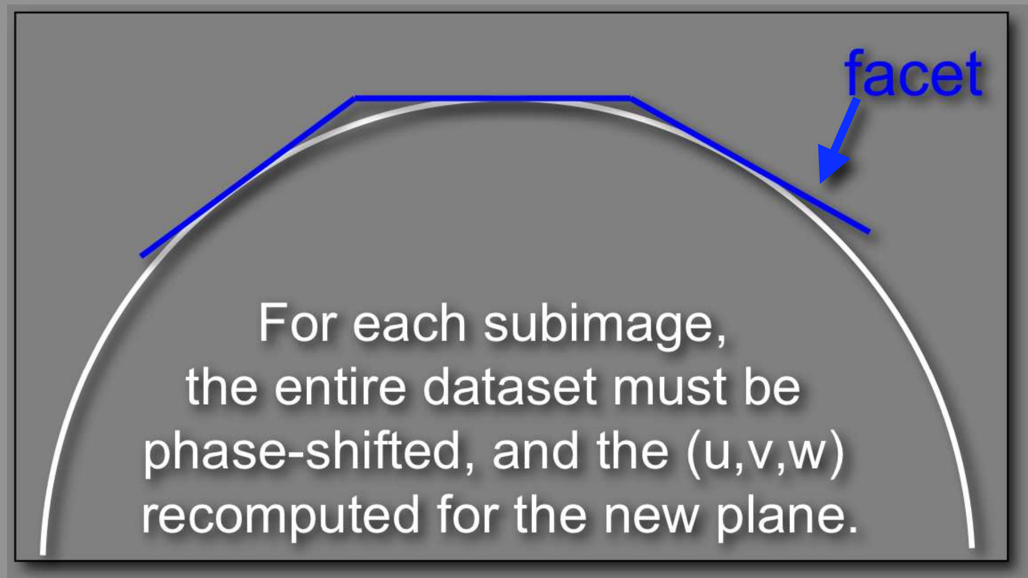
Problem after Problem




FoV ~ 1.3 deg

Iteratively build up a model sky

Faceting with 37 sub images
(e.g. 244 MHz ~200 sub-images)




[see Eric's talk]

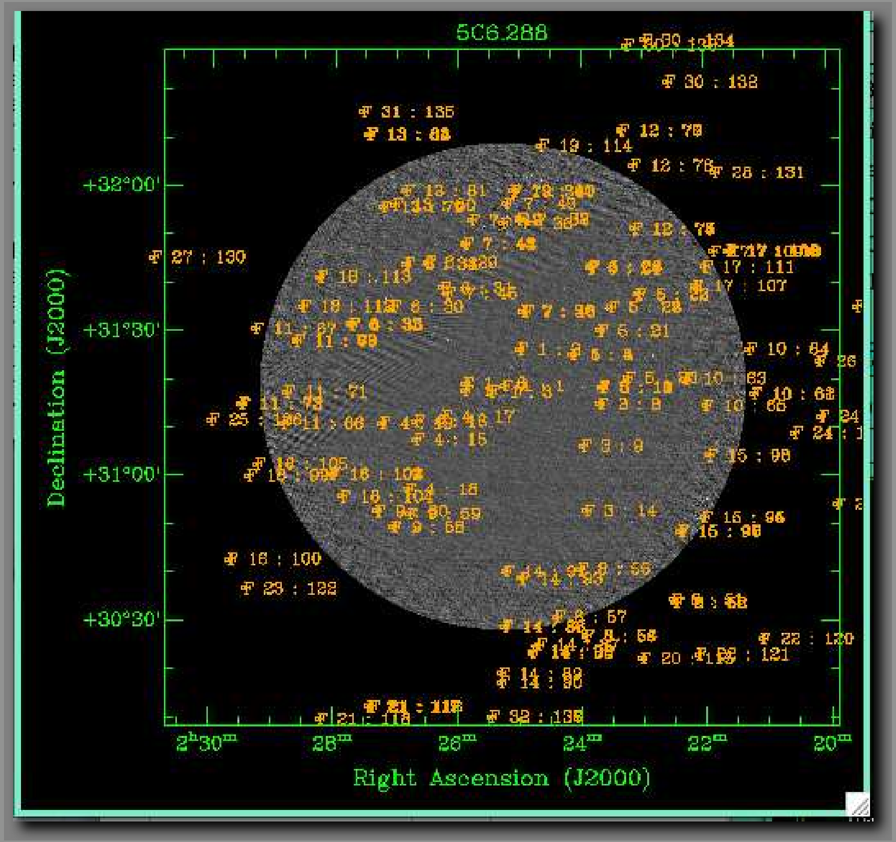
Self-calibration finds antenna gains $g_i$
which minimize the measured visibilities $V_{ij}$ and model visibilities $V^*_{ij}$

# Multifacet selfcalibration

Selfcalibration:
Decrease the number of CC
Decrease the integration time

Caution Baseline sensitivity

Building up a model sky:
Faceting with 37 sub images
global rms
local rms



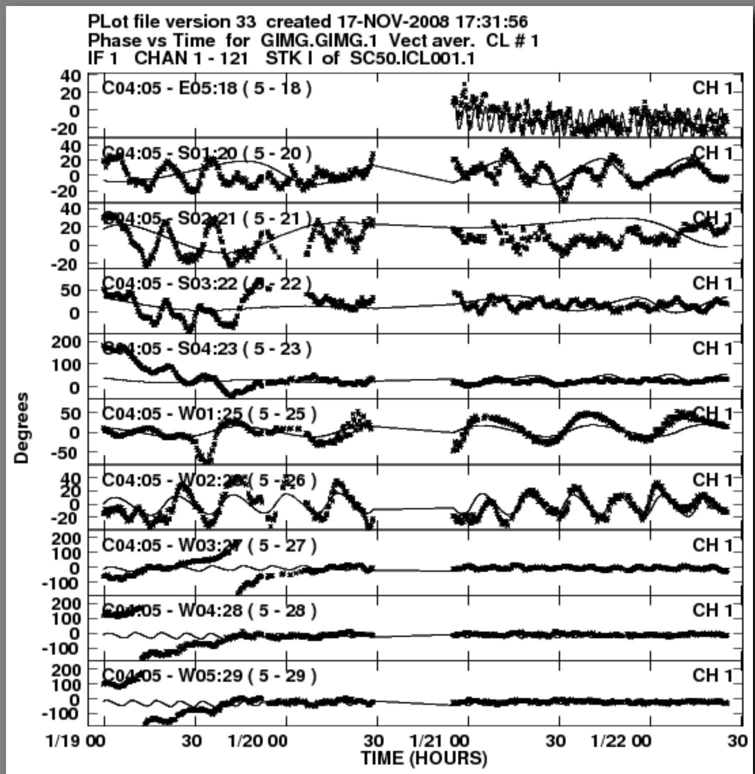

Final sky
147 CC components
137 CC sources

# some output

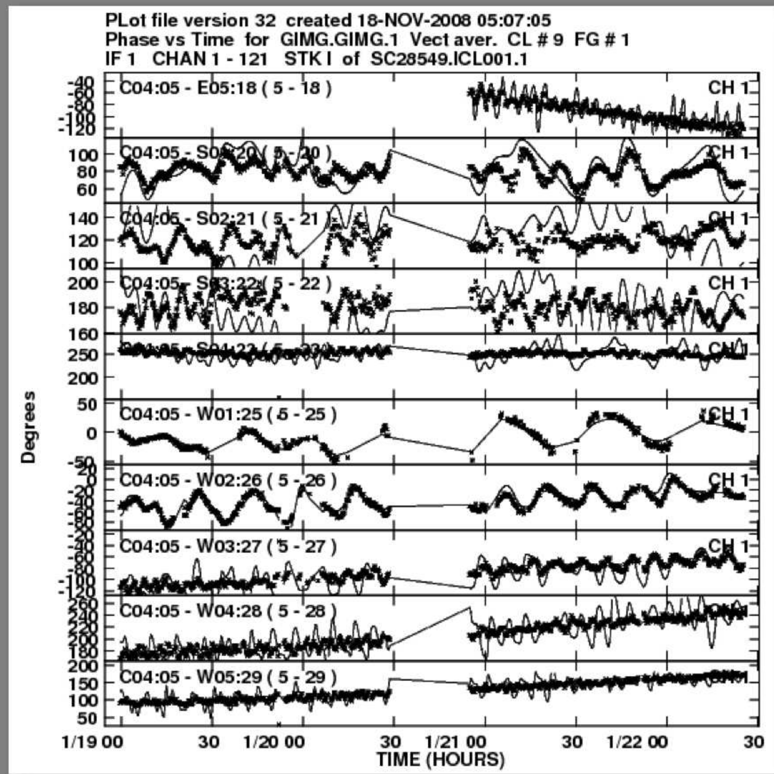
## Iteratively build up a model sky

### Image - select good cc components - phase calibration

1st scal step




final scal step

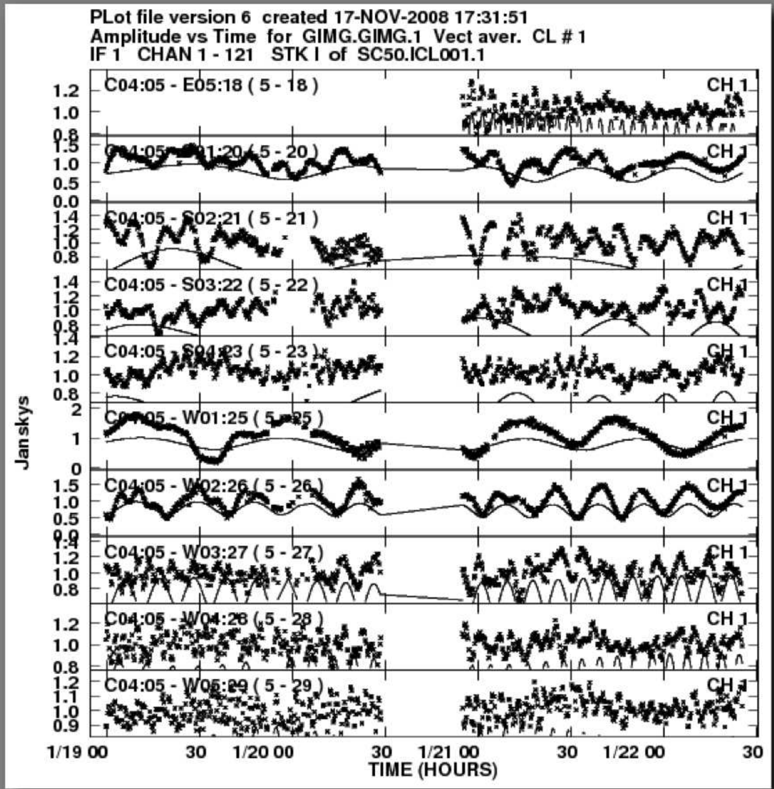


# some output

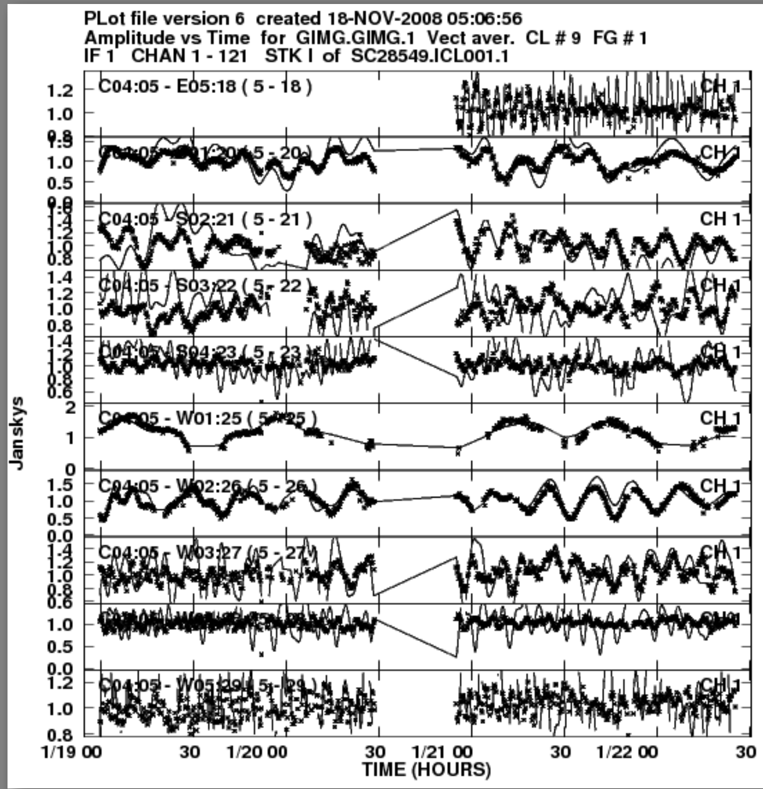
## Iteratively build up a model sky

### Image - select good cc components - amplitude calibration

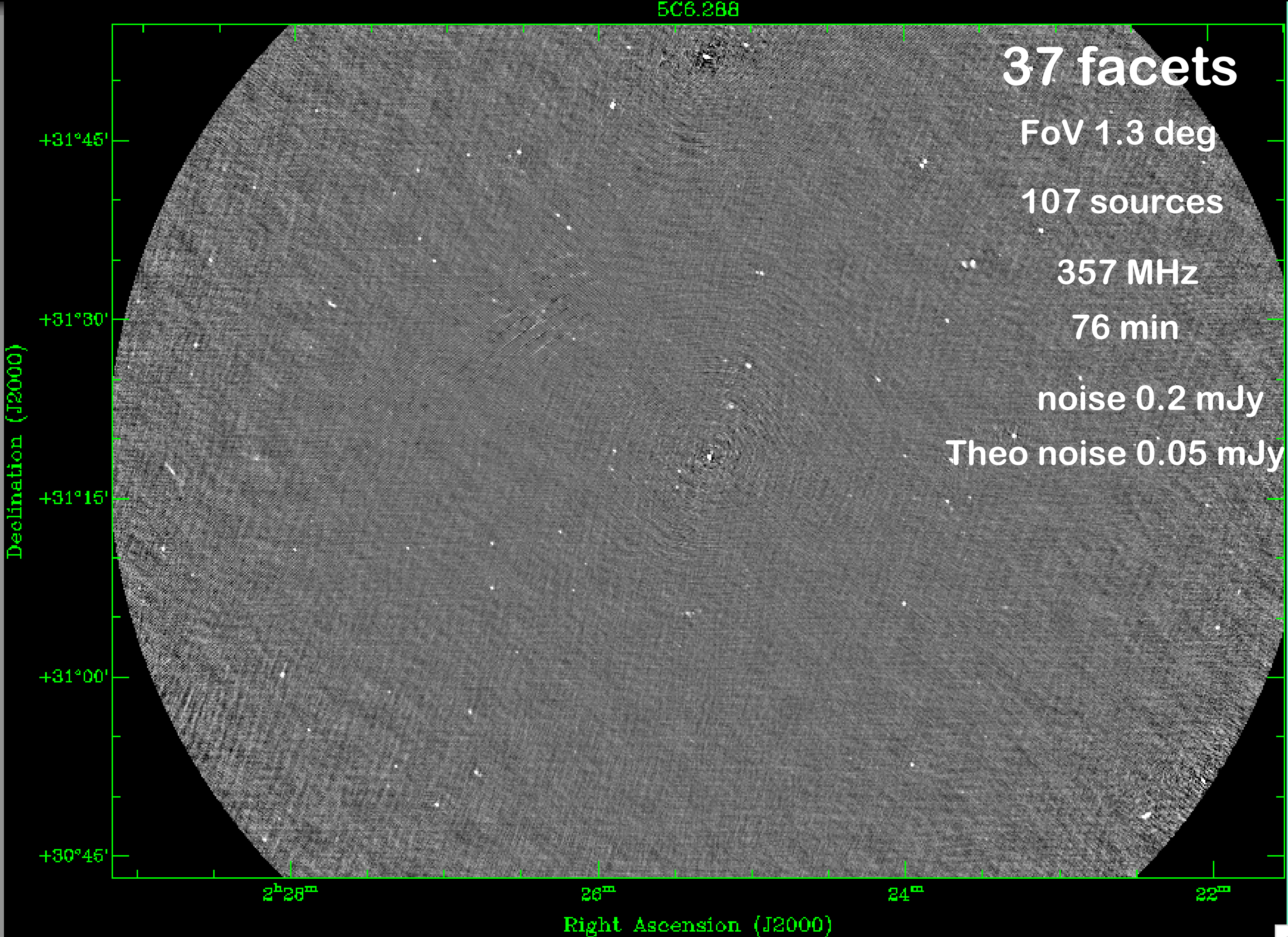
1st scal step




final scal step

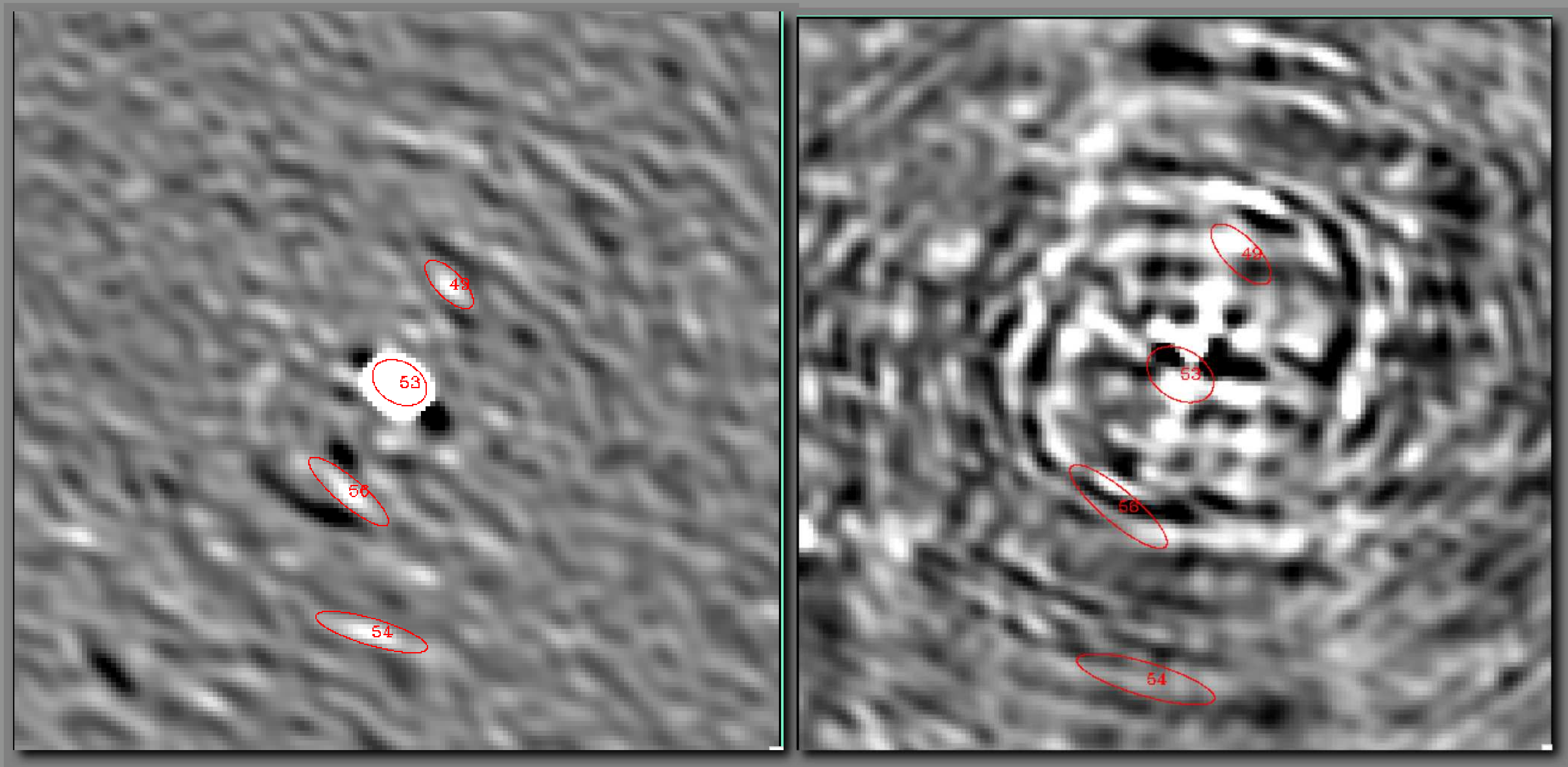


# 5C6.288 z = 2.982

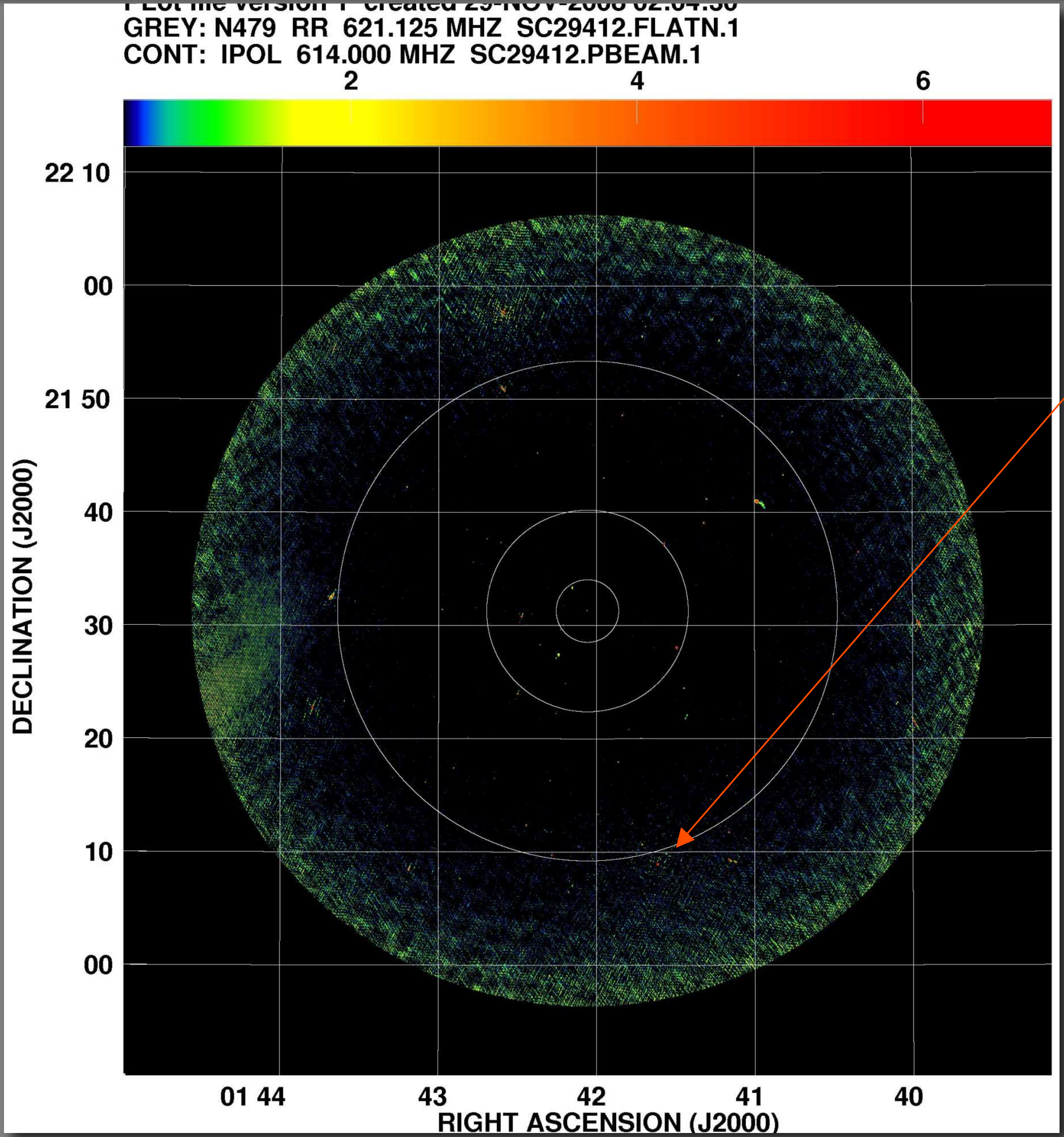


# 5C6.288 3 TTU

## subtract 5 strongest sources



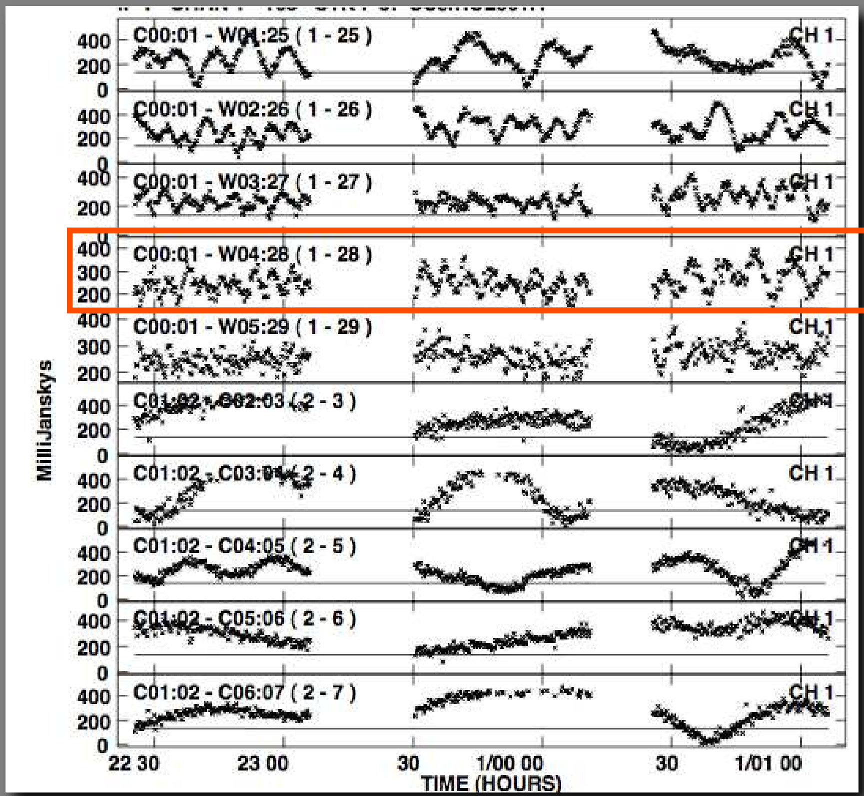
# NGC 479 - a not so easy task 610 MHz




strongest source at 50% of primary beam

# amplitude versus time

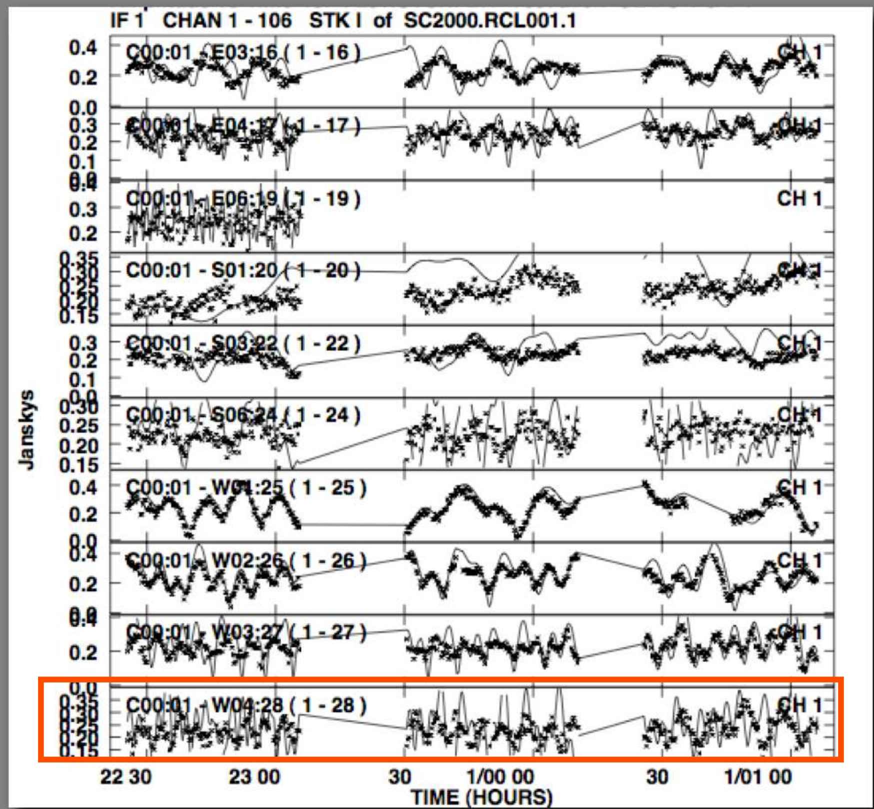
final scal step




Not shift the phase centre

long baselines
can not be calibrated !!!

final scal step




shift the phase centre

# conclusion

- phase variations [~20 deg]
- local to global dynamic range [~200:10000]
- factor of a few of thermal noise (only if !)
- can get away with standard calibration
  if no strong source is in the field

- better analysis tools [closure phase & amplitude, etc.]
- an improved data-base structure