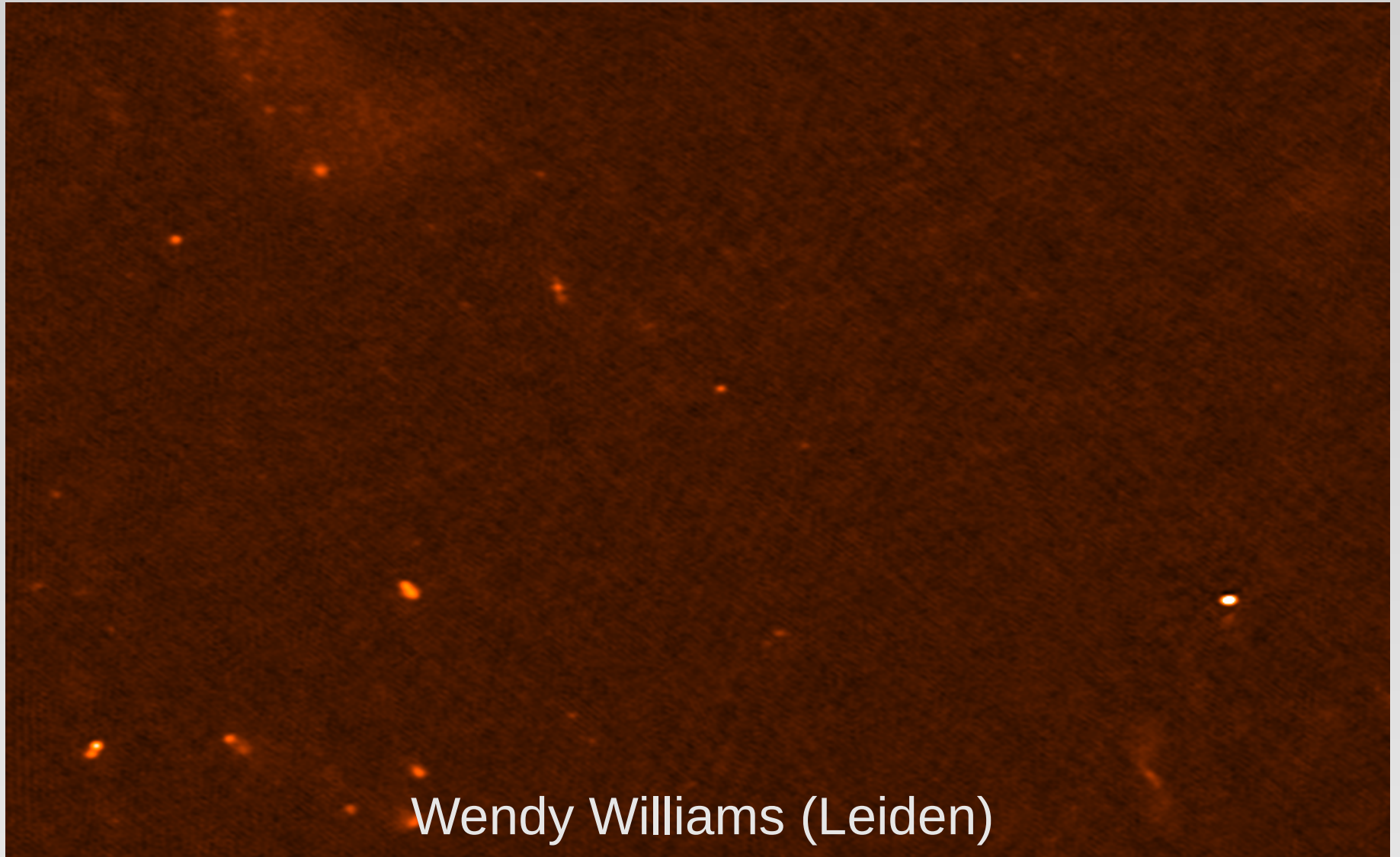


Deep HBA Imaging The Bootes Field



Wendy Williams (Leiden)

The Data

- Cycle 2 – 10 Aug 2014
 - Best of 4 observations
- 10 min bookend calibrator observations
 - 3C196 & 3C295
- 8 hrs
- 366 subbands
- Pre-processing
 - 8ch 2s
- Bootes
 - Dec is +34 deg

Calibrator

- Calibrator
 - Clock
 - Amplitude
 - Phase offset XX-YY

Target

- Basic flagging, Ateam clipping
- Transfer of calibration (clock, amp, phase-offset)
- Average
 - 2ch 8s
- Merge subbands (10subbands – 2MHz bands)
- Take out beam at phase centre
- Single Selfcal (A&P) against best model – “Field selfcal”
- Run FACET scheme

DEGREES OF FREEDOM & SOLUTION TIME INTERVAL

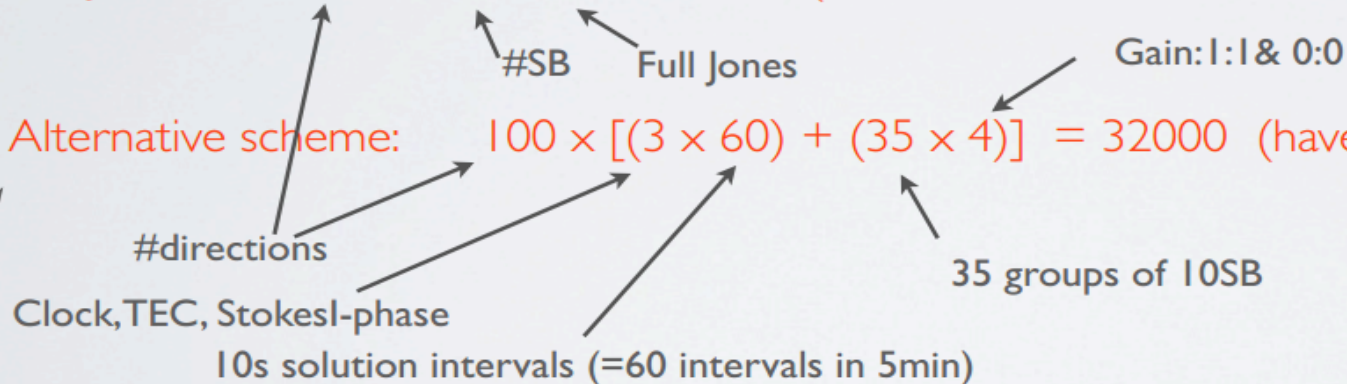
Make use of the fact that:

- only the phases vary on short (10 sec) timescales
- the phases over the entire HBA band can be described with only 3 parameters (phase offset, TEC, clock)
- amplitude solutions for neighboring subbands are almost identical

A typical 5 min block of data (one station)

Full Jones : $100 \times 350 \times 8 = 280000$ (1 solution interval, cannot fully track ionosphere)

Alternative scheme: $100 \times [(3 \times 60) + (35 \times 4)] = 32000$ (have 60 x 10s solutions for ionosphere)

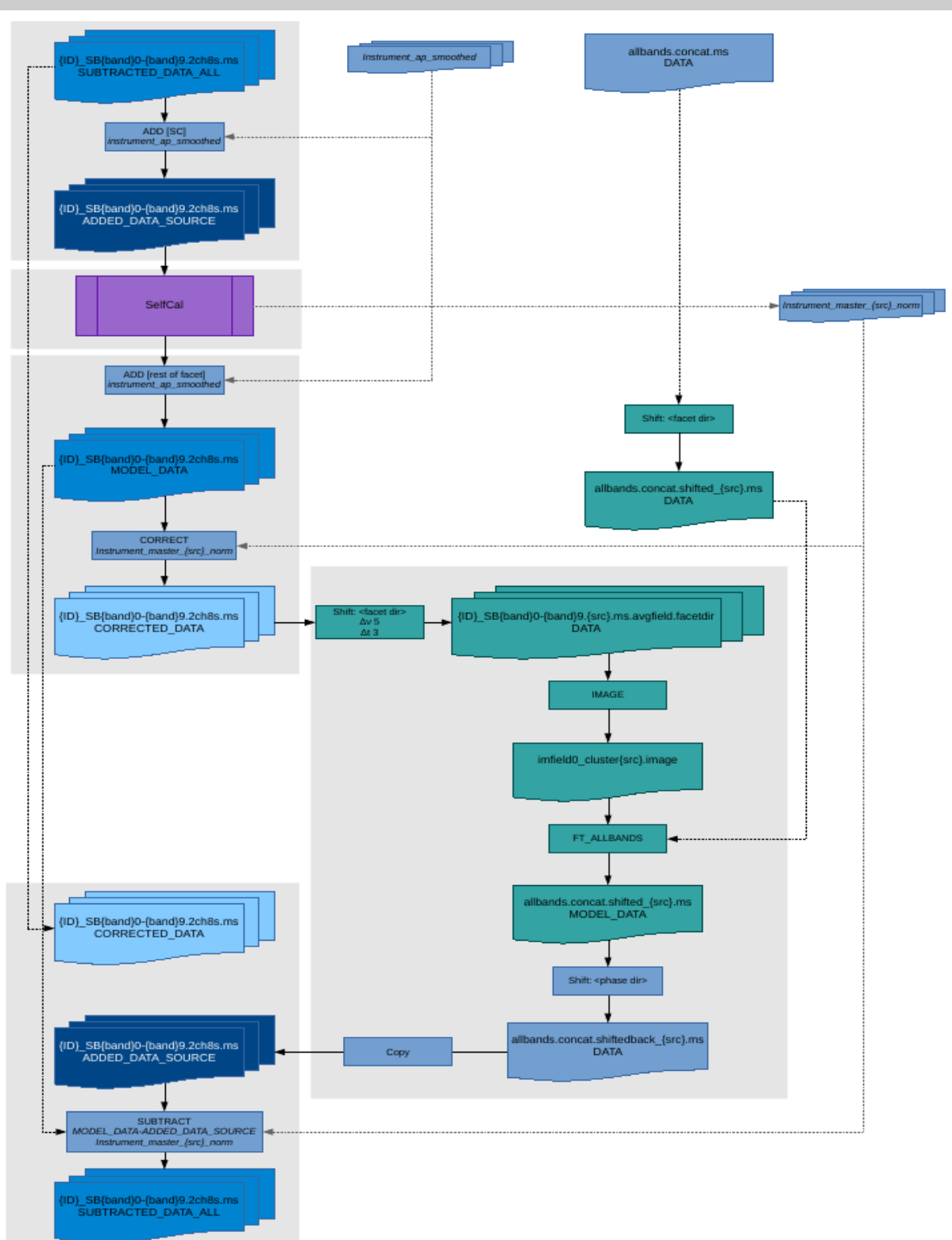


INGREDIENTS:

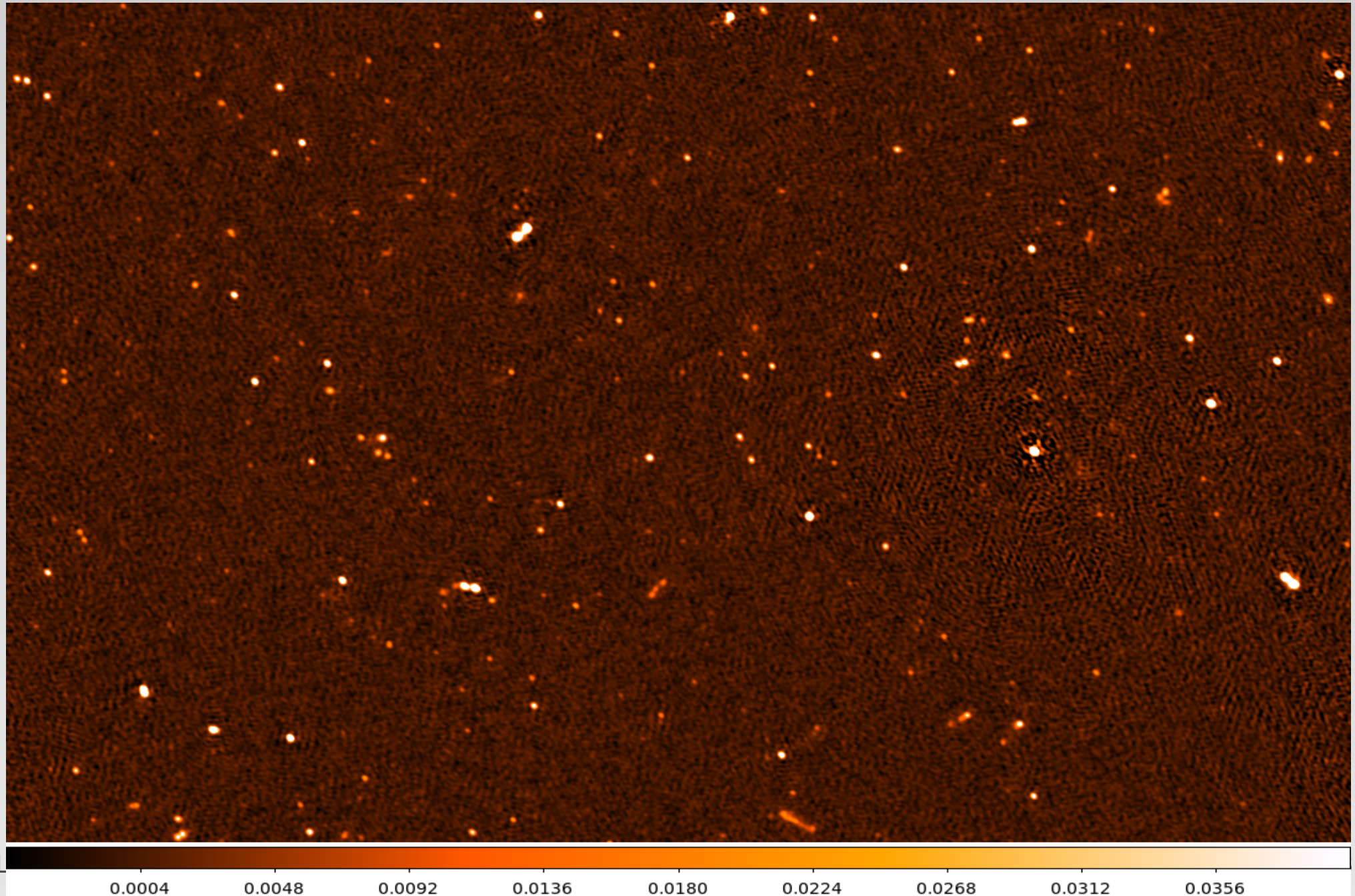
- BBS & NDPPP
- CASAPY
- PyBDSM
- motivated by SPAM & SAGECAL results

From Reinout's talk
LSM 5 Feb 2014

FACET:



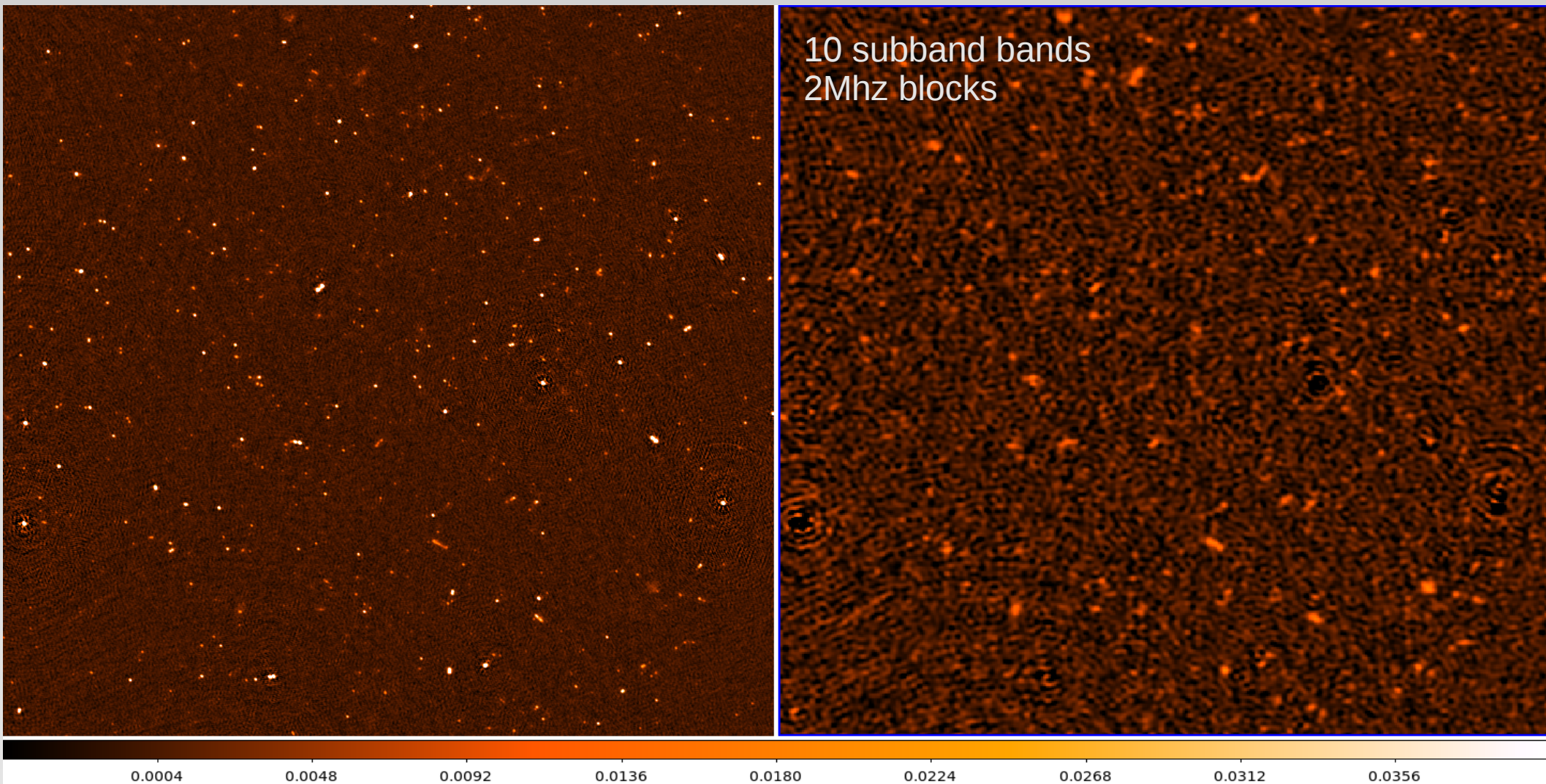
“highres” image – best field selfcal



Prepare 'residual' data

Highres (20")

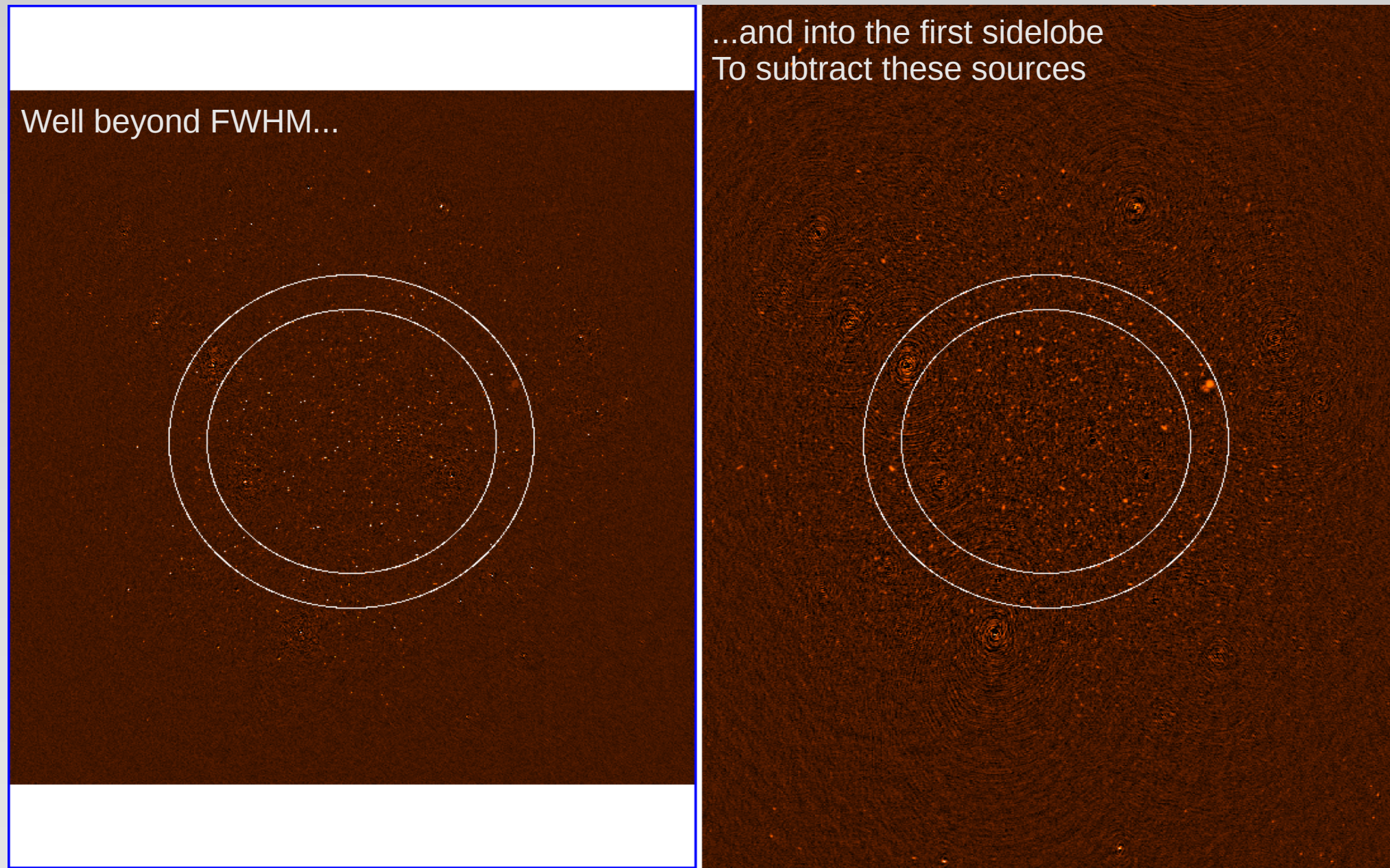
Highres-subtracted Lowres (~3')



Prepare 'residual' data

Well beyond FWHM...

...and into the first sidelobe
To subtract these sources



0.0004

0.0048

0.0092

0.0136

0.0180

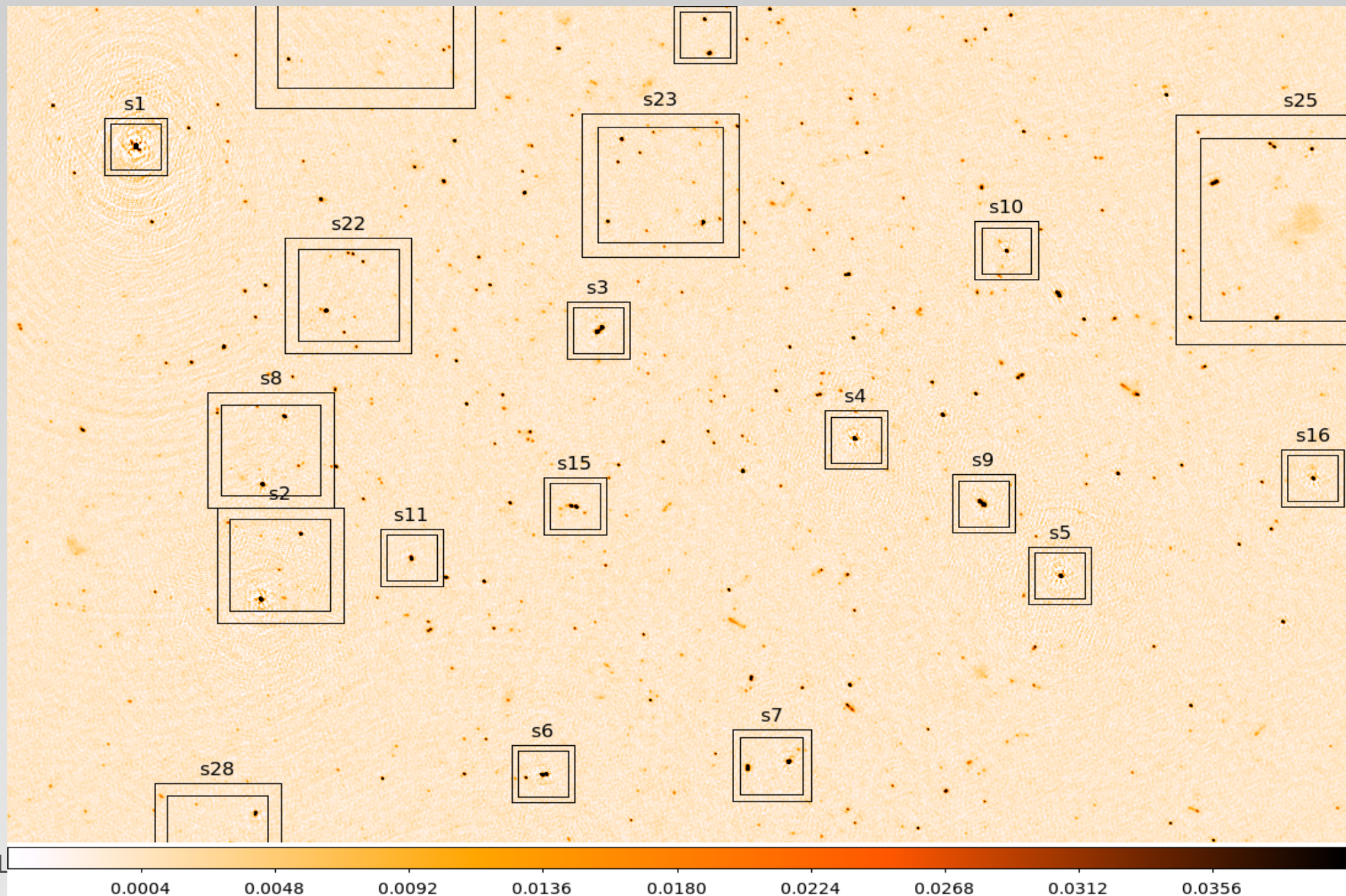
0.0224

0.0268

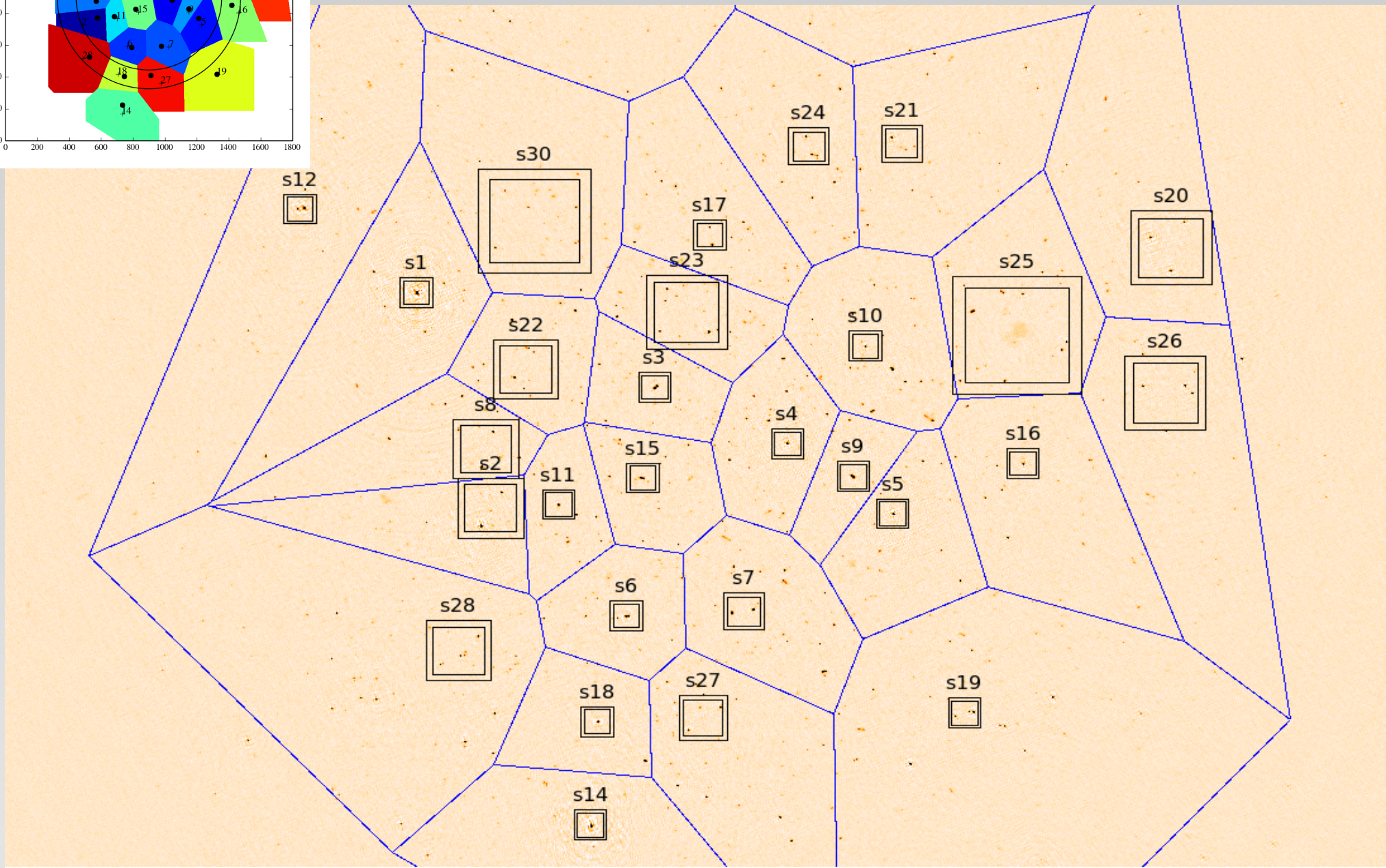
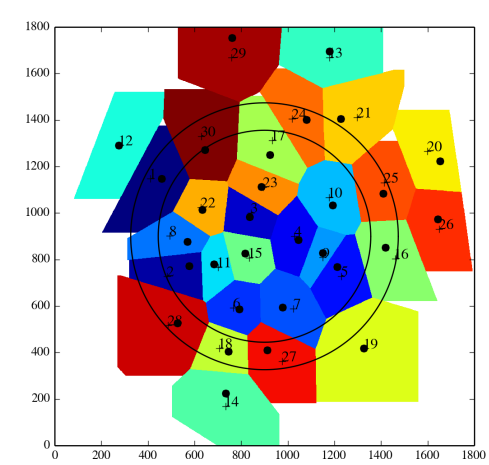
0.0312

0.0356

Set up directions



Tessellation



DDE Selfcal

- Apply field selfcal solutions
 - Image
- $\times 2$ Solve for scalar phase, TEC (in groups of 5-6 bands) using all bands
 - 10s timescales
 - Image & update CC model
- $\times 2$ Solve for slow varying amplitudes in each band (10SB)
 - Pre-Apply “fast” phases
 - 5-20 min timescales
 - Image & update CC model

DDE selfcal

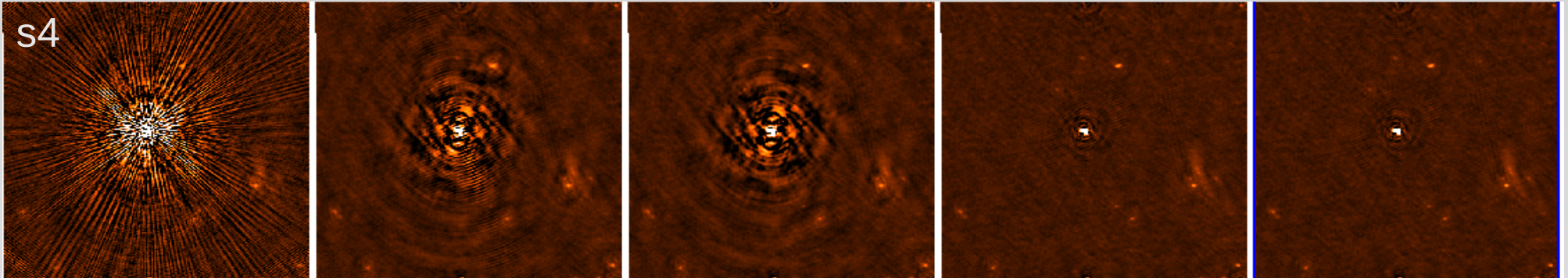
selfcal

10s phases

10s phases

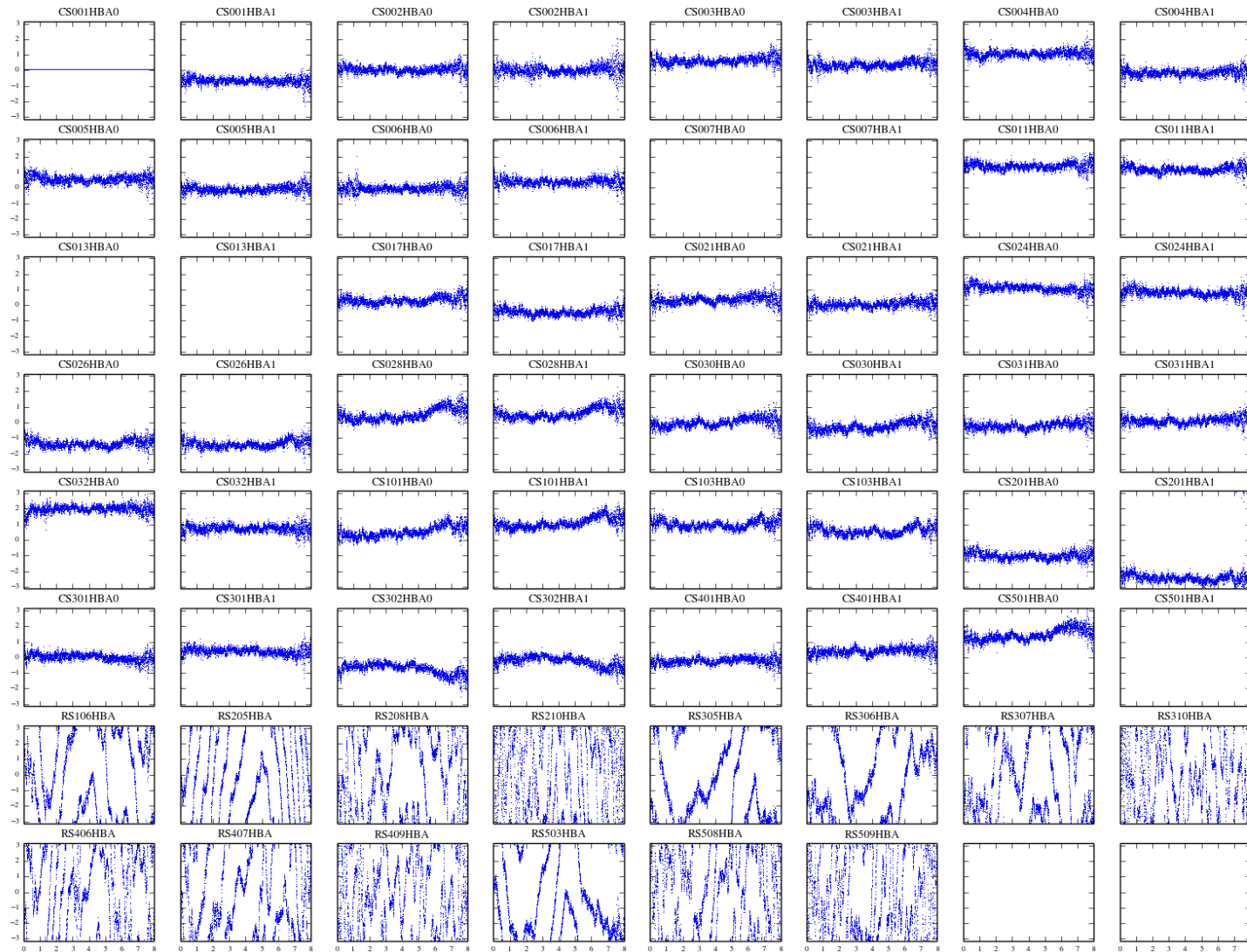
10s phases +
10min amps

10s phases +
10min amps



Solutions

Fast phase



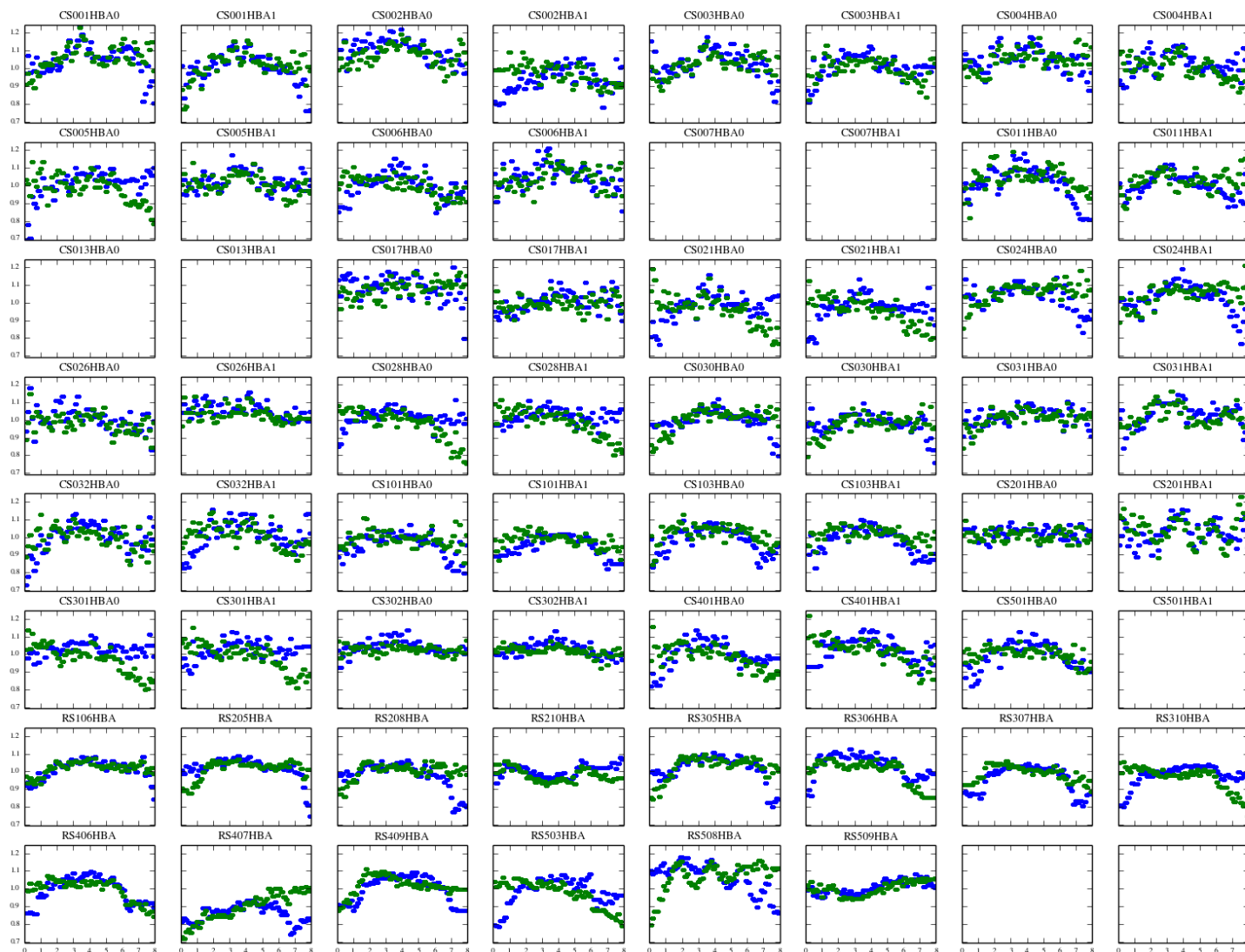
Solutions

Slow phase

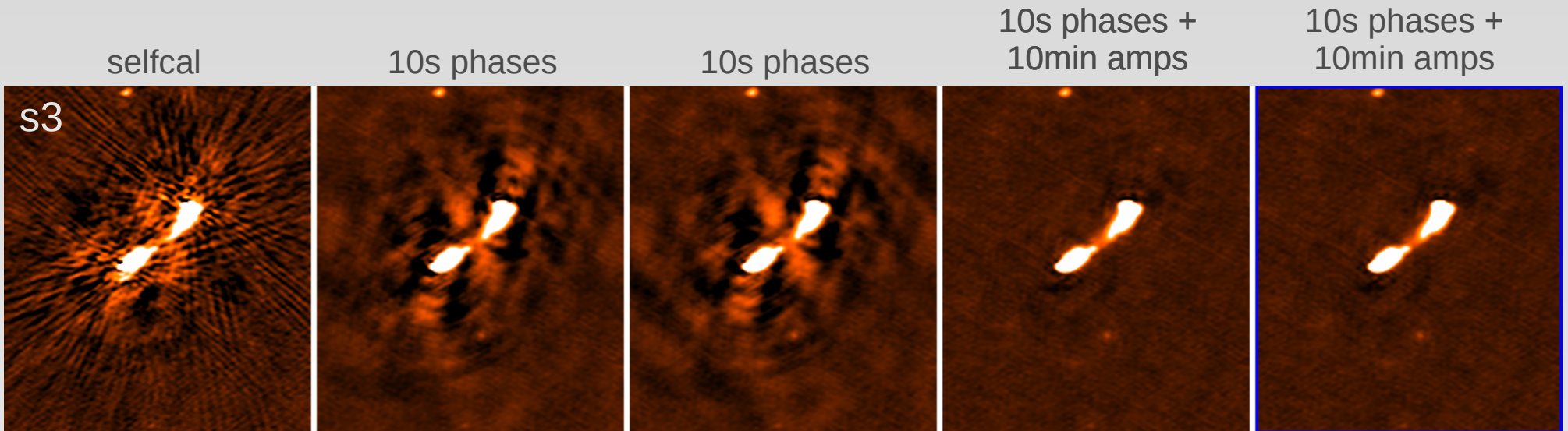
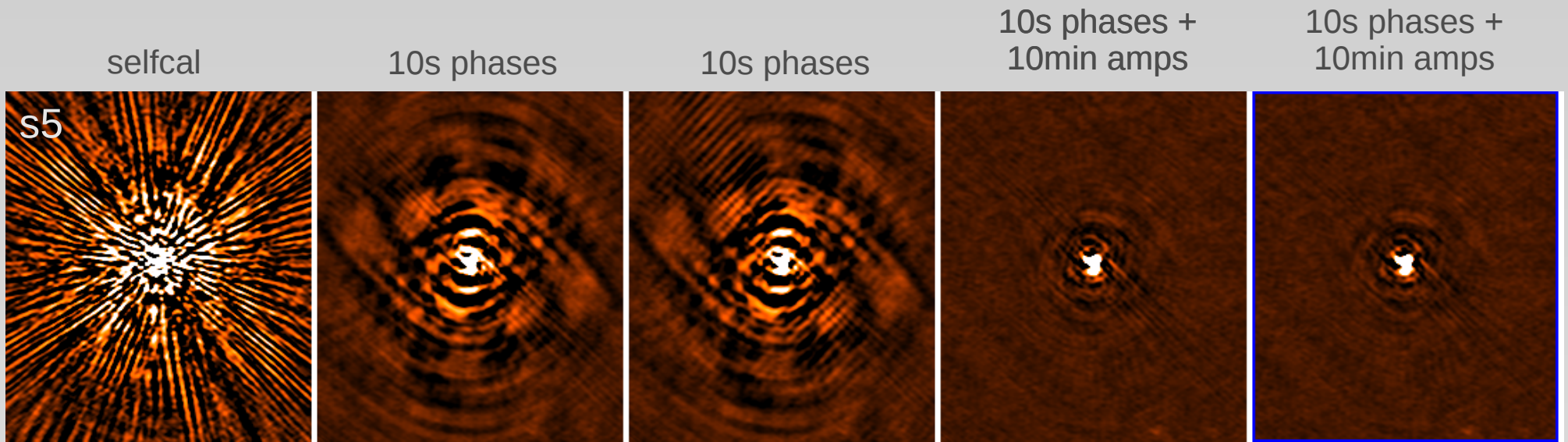


Solutions

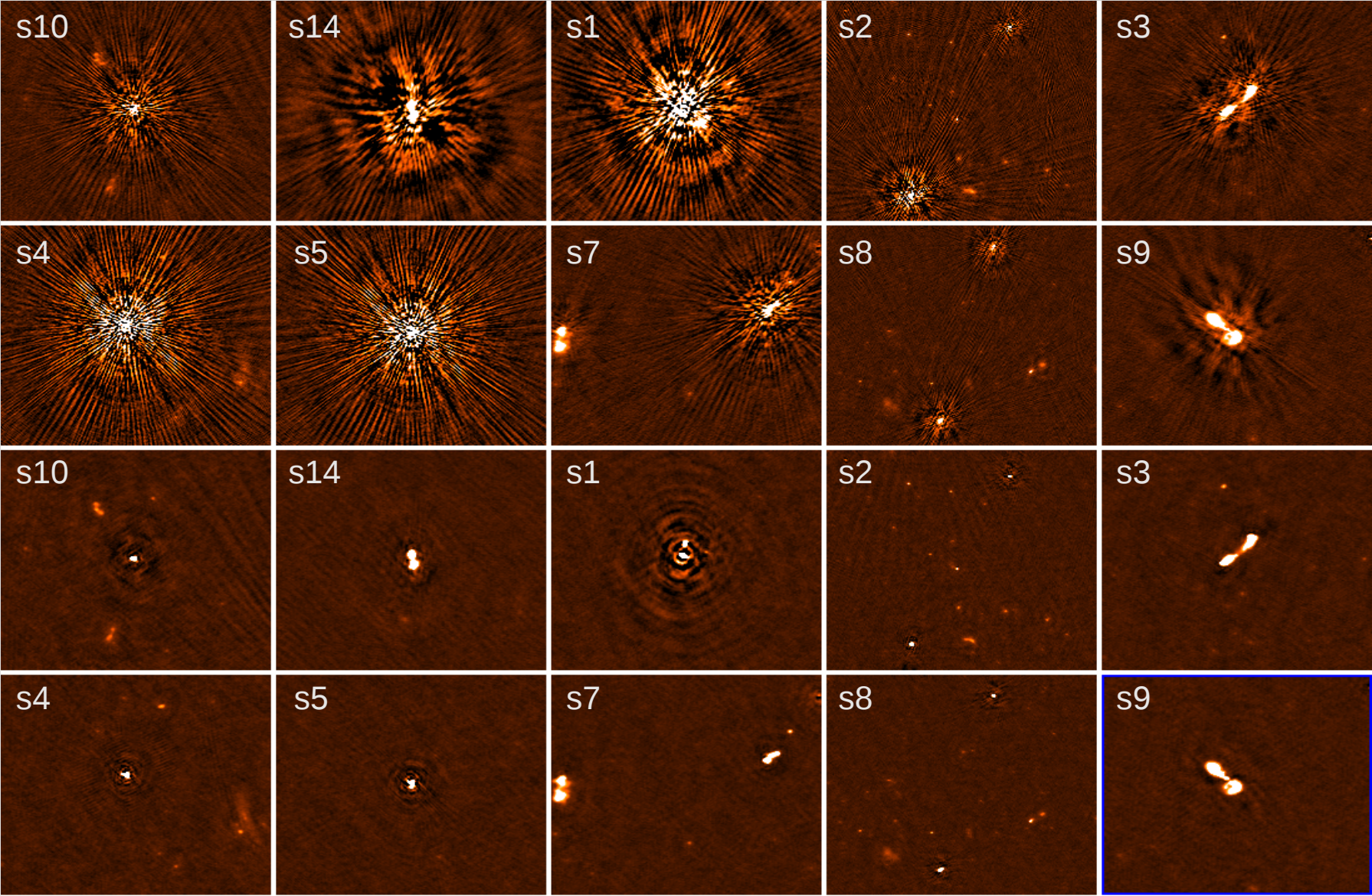
Slow amplitude



DDE selfcal

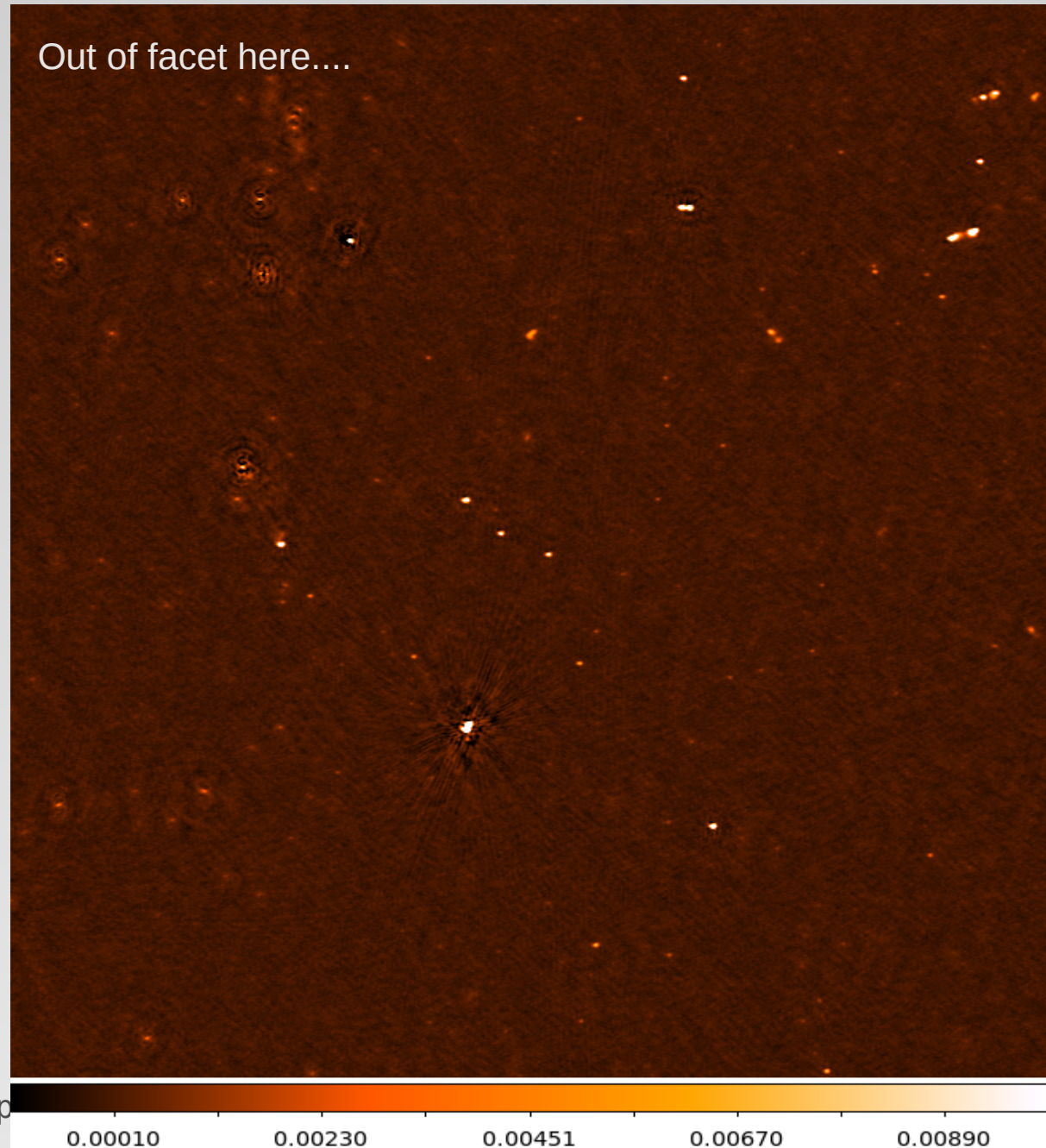


DDE Selfcal Gallery

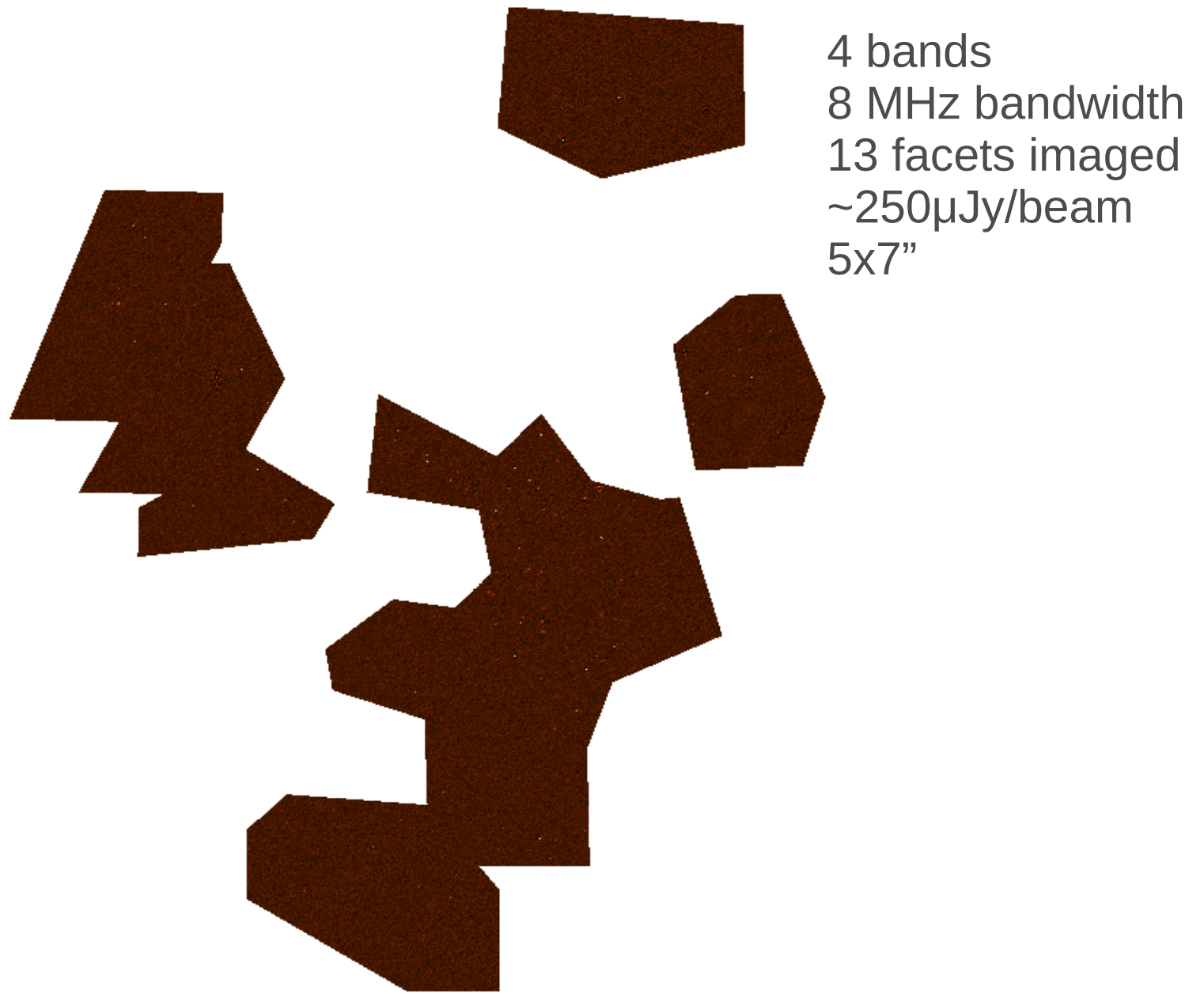


Facet images

- Add back sources in facet
- Image at high resolution
 - $\sim 5\text{-}7''$
 - Cells $1.5''$
 - Npix $\sim 3000\text{-}5000$
- Full bandwidth
 - Multifrequency (nterms)



“Mosaic” the facets



0.00010

0.00119

0.00230

0.00340

0.00451

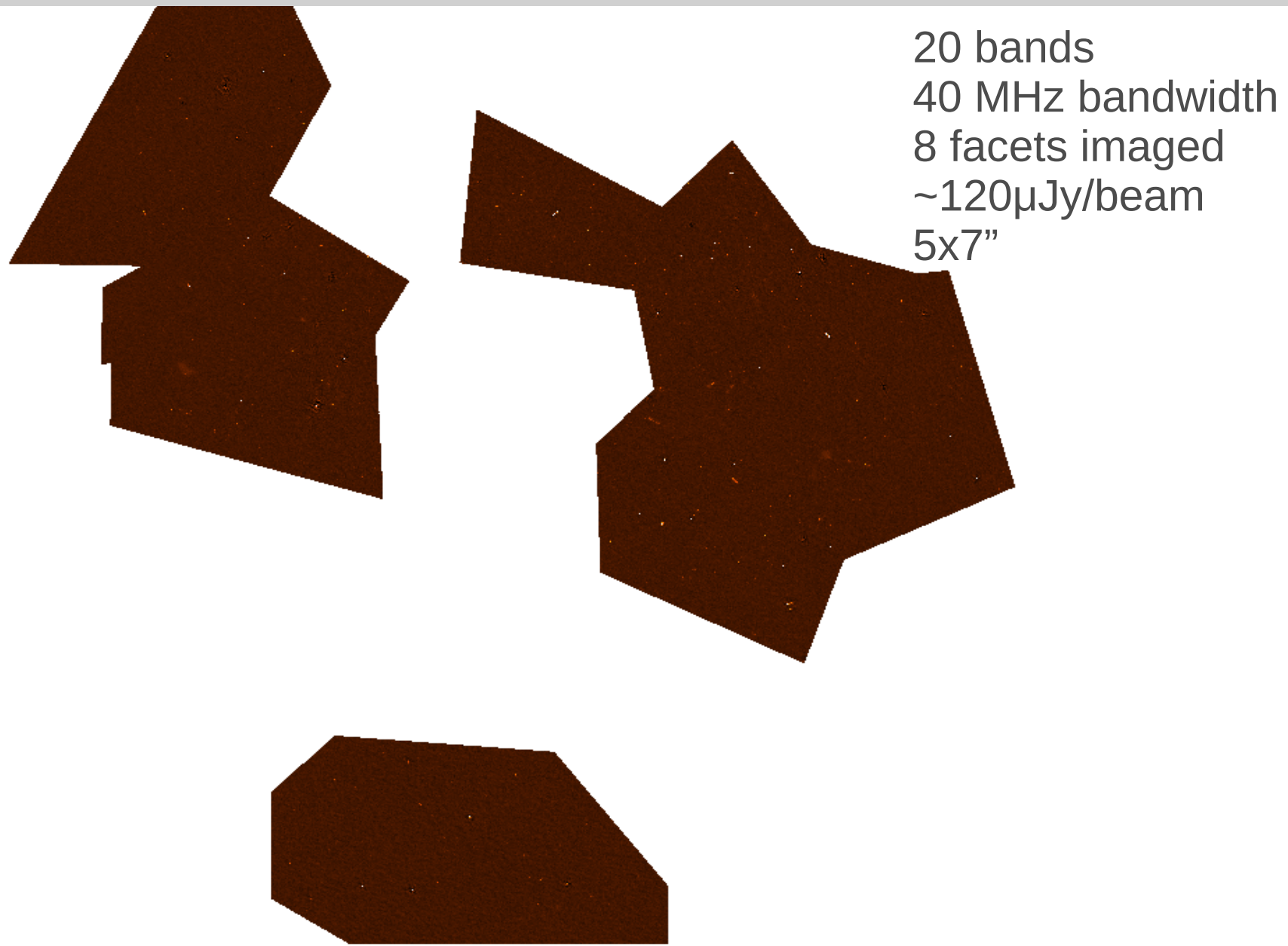
0.00560

0.00670

0.00781

0.00890

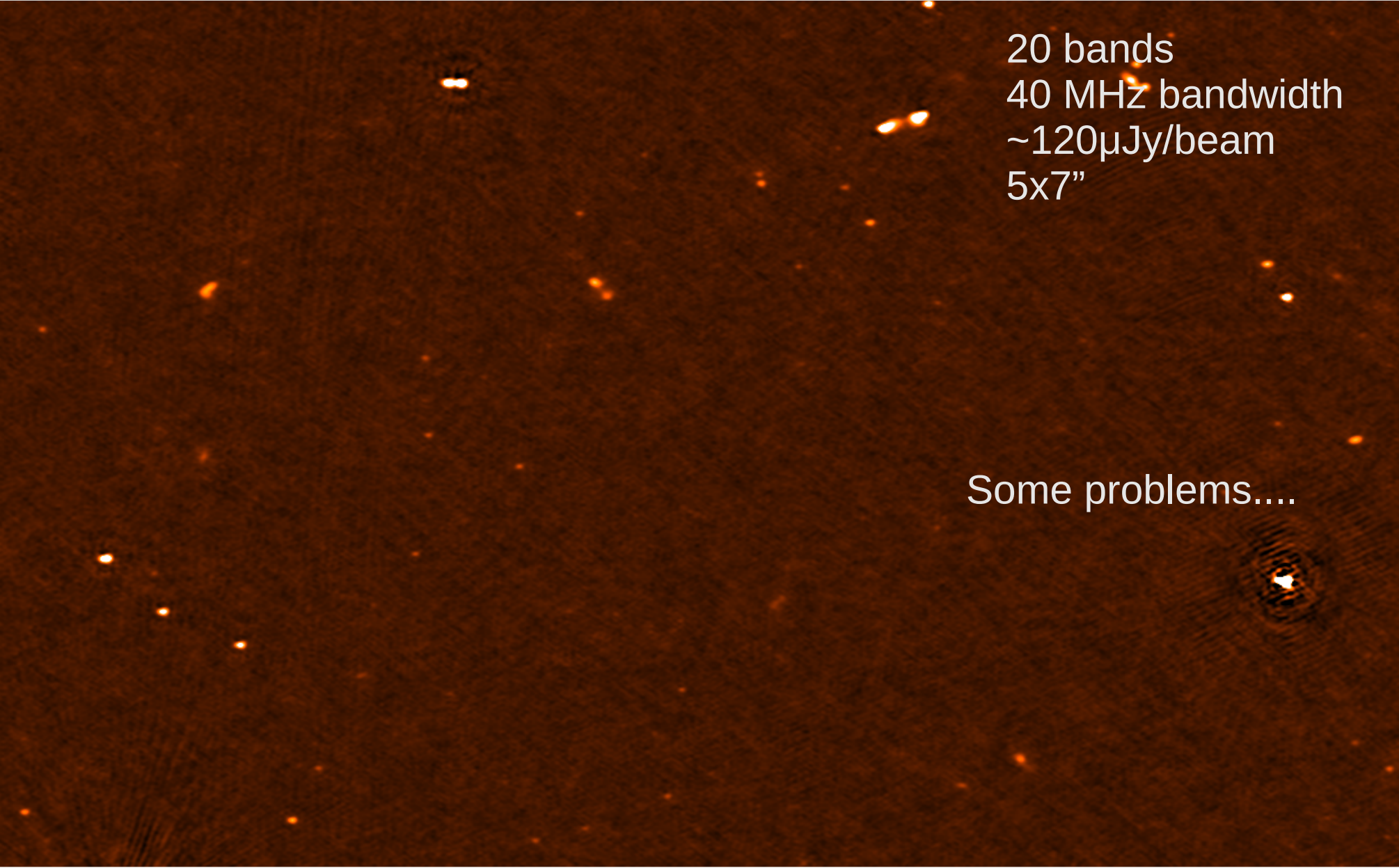
“Mosaic” the facets



Fullres Mosaic

20 bands
40 MHz bandwidth
~120 μ Jy/beam
5x7"

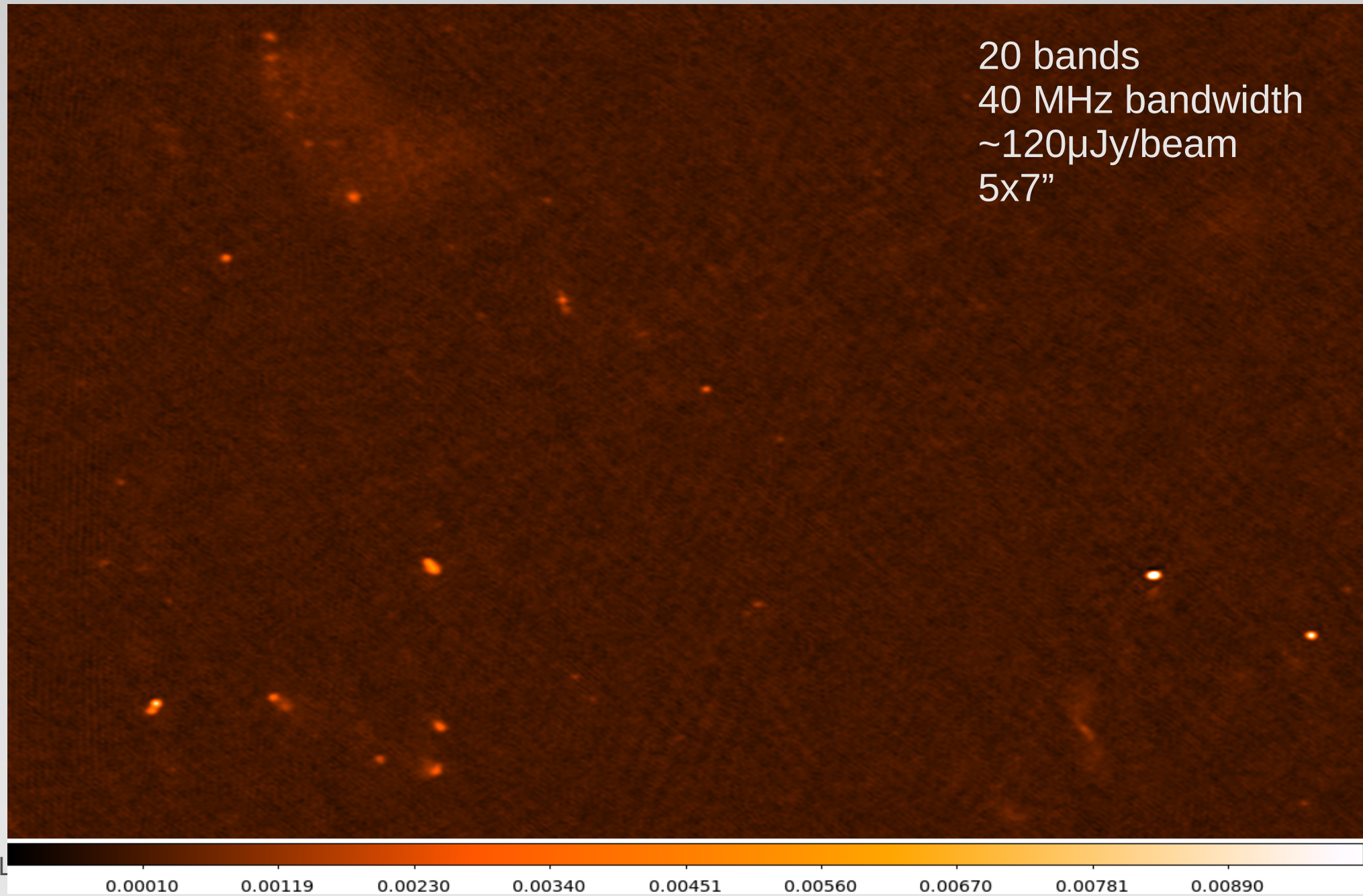
Some problems....



0.00010 0.00119 0.00230 0.00340 0.00451 0.00560 0.00670 0.00781 0.00890

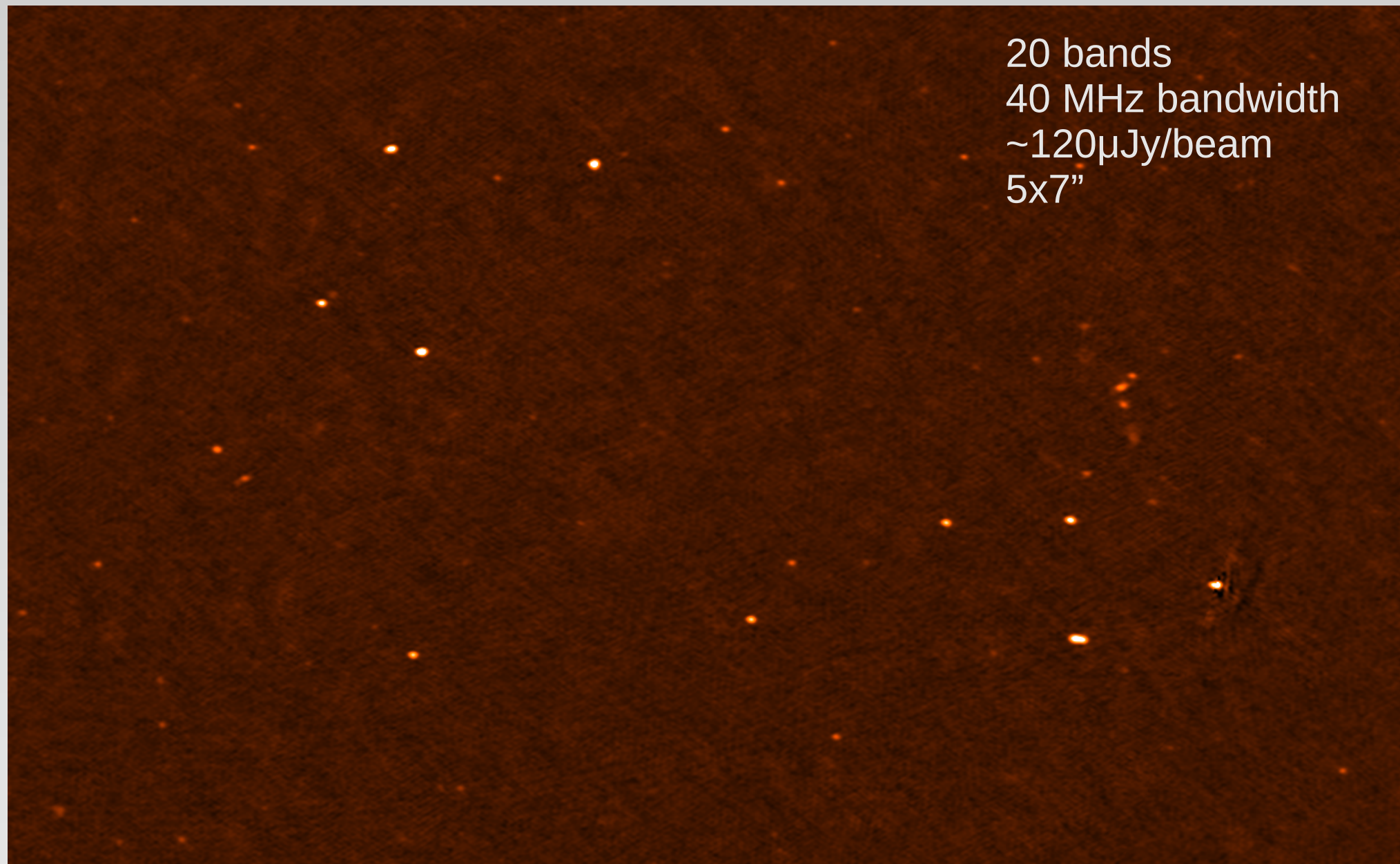
Fullres Mosaic

20 bands
40 MHz bandwidth
~120 μ Jy/beam
5x7"



Fullres Mosaic

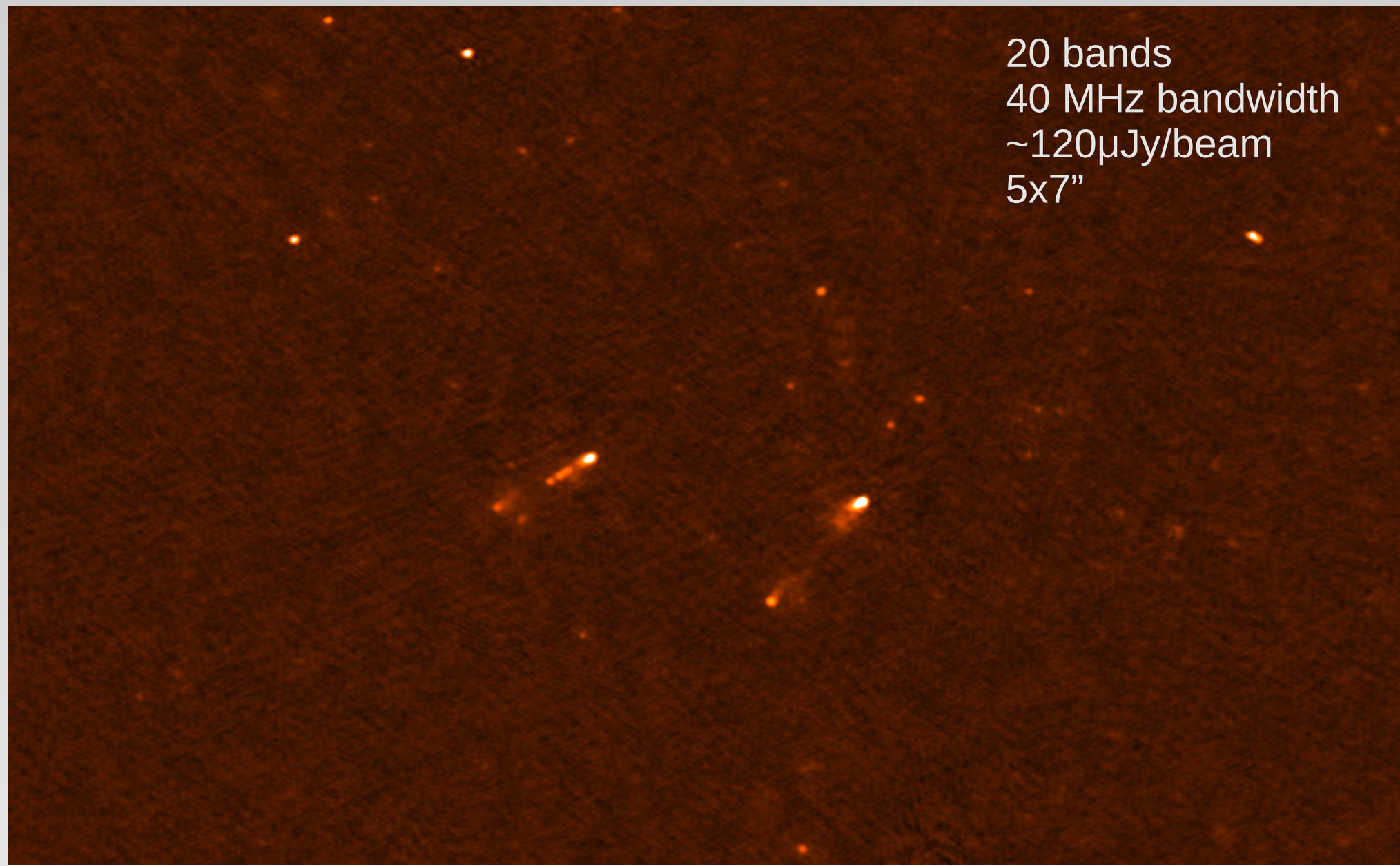
20 bands
40 MHz bandwidth
~120 μ Jy/beam
5x7"



0.00010 0.00119 0.00230 0.00340 0.00451 0.00560 0.00670 0.00781 0.00890

Fullres Mosaic

20 bands
40 MHz bandwidth
~120 μ Jy/beam
5x7"



0.00010

0.00119

0.00230

0.00340

0.00451

0.00560

0.00670

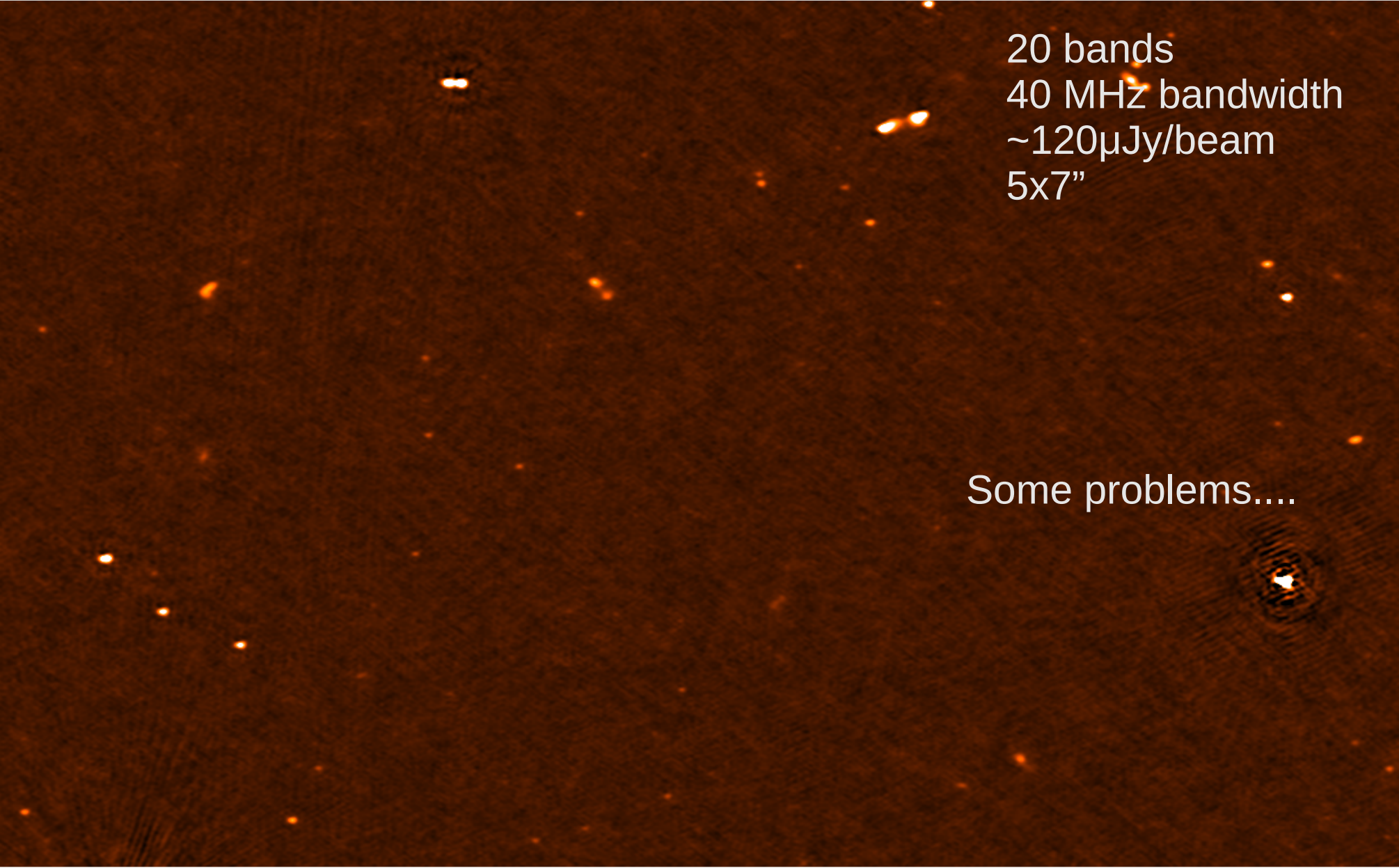
0.00781

0.00890

Fullres Mosaic

20 bands
40 MHz bandwidth
~120 μ Jy/beam
5x7"

Some problems....



0.00010 0.00119 0.00230 0.00340 0.00451 0.00560 0.00670 0.00781 0.00890

More to come...