Report from imaging Busy Week 20

E. Orru'

Aim: to facilitate research & development activities being pursued by the calibration and imaging tiger team.

15 participants
first two days talks and discussions

http://www.lofar.org/operations/doku.php?id=commissioning:imag_busy_week_20

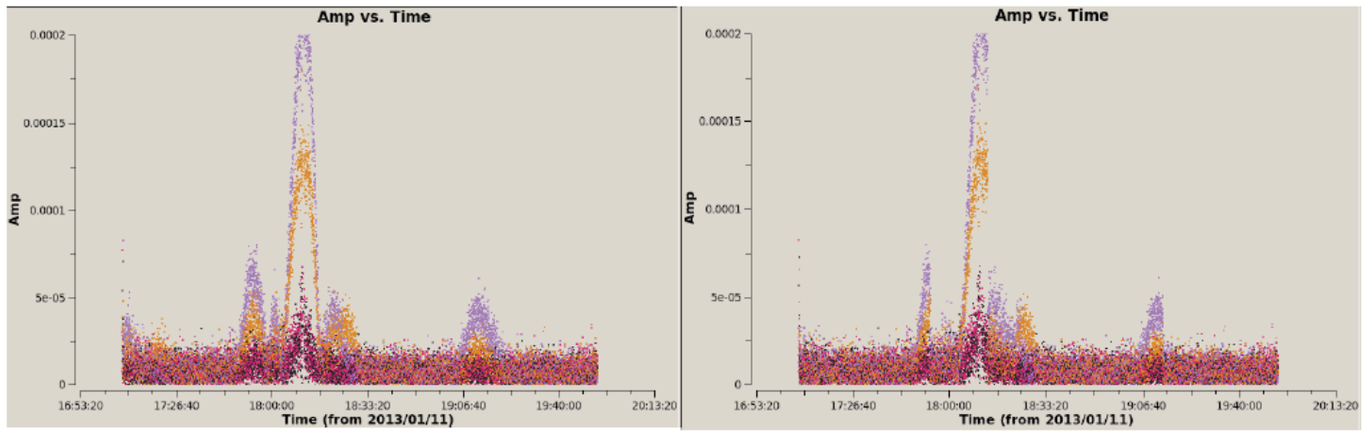
- Smart demix (R. van Weeren, B. Adebahr, J. S. Montes)
- NDPPP and BBS: Beam model libraries, BBS solver vs Stefcal (T. J. Dijkema, A. Drabent, A. Horneffer, L. Morabito)
- AW-Imager Multi scale (B. van der Tol, R. Paladino)
- Phase screen+DDEs (M. Mevius , D. Rafferty, F. de Gasperin, R.van Weeren, B. vd Tol, A. Bonafede, V. Pandey)
- Selfcal (N. Vilchez, C. Toribio, A. Drabent, E. Orru')
- New calibration method using Kalman filter (C. Tasse)

Smart demix

R. van Weeren, B. Adebahr, J. S. Montes

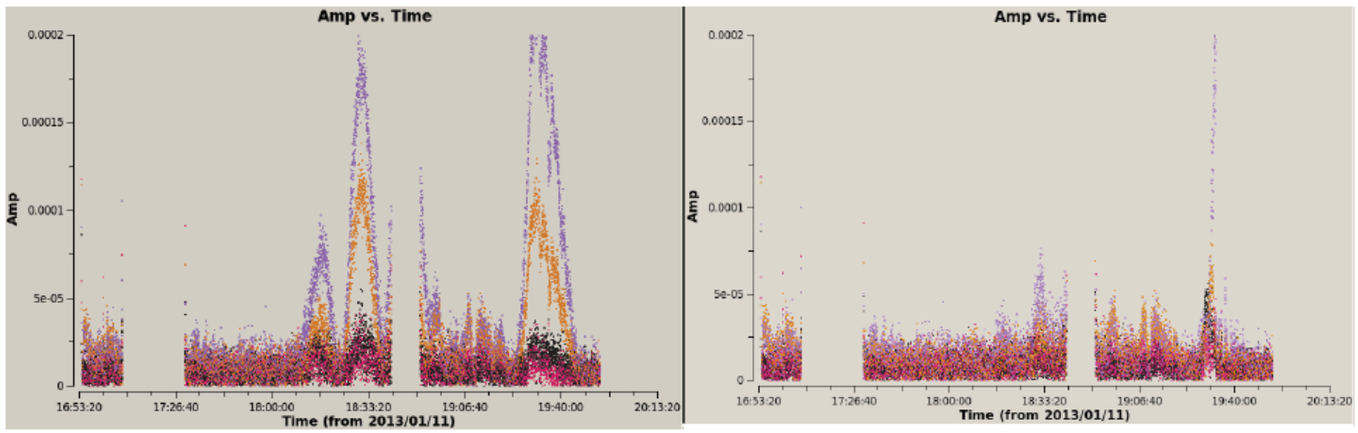
Tested on HBA data

- SmartDemix seems to be stable (no crashes to report)
- SmartDemix seems to have all functionally needed
- need to adjust some of the default parameters
- Mixed results with Ateam subtraction, for some stations (baselines) Ateam signal is clearly removed but NOT in some other cases. This indicates that the predict step of the Ateam is not giving very reliable results. This could very well be the result of the problems with the incorrect flagged tile information which was discovered recently. We conclude that it is important that this gets fixed because the SmartDemix completely relies on the beam model to predict the contribution of the Ateam sources in the sidelobes of the beam.



Before Smart demix

After Smart demix



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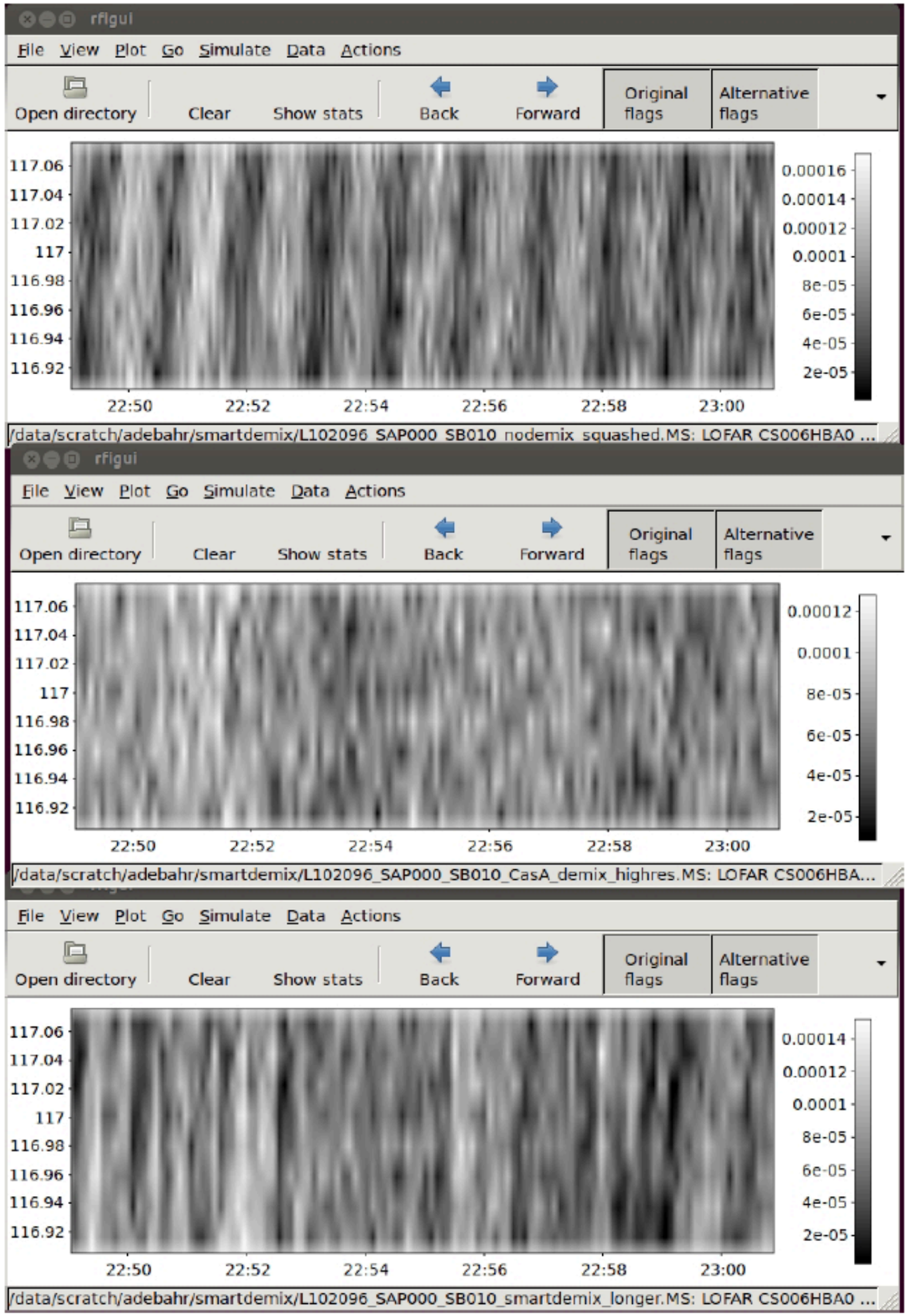


NEXT STEPS:

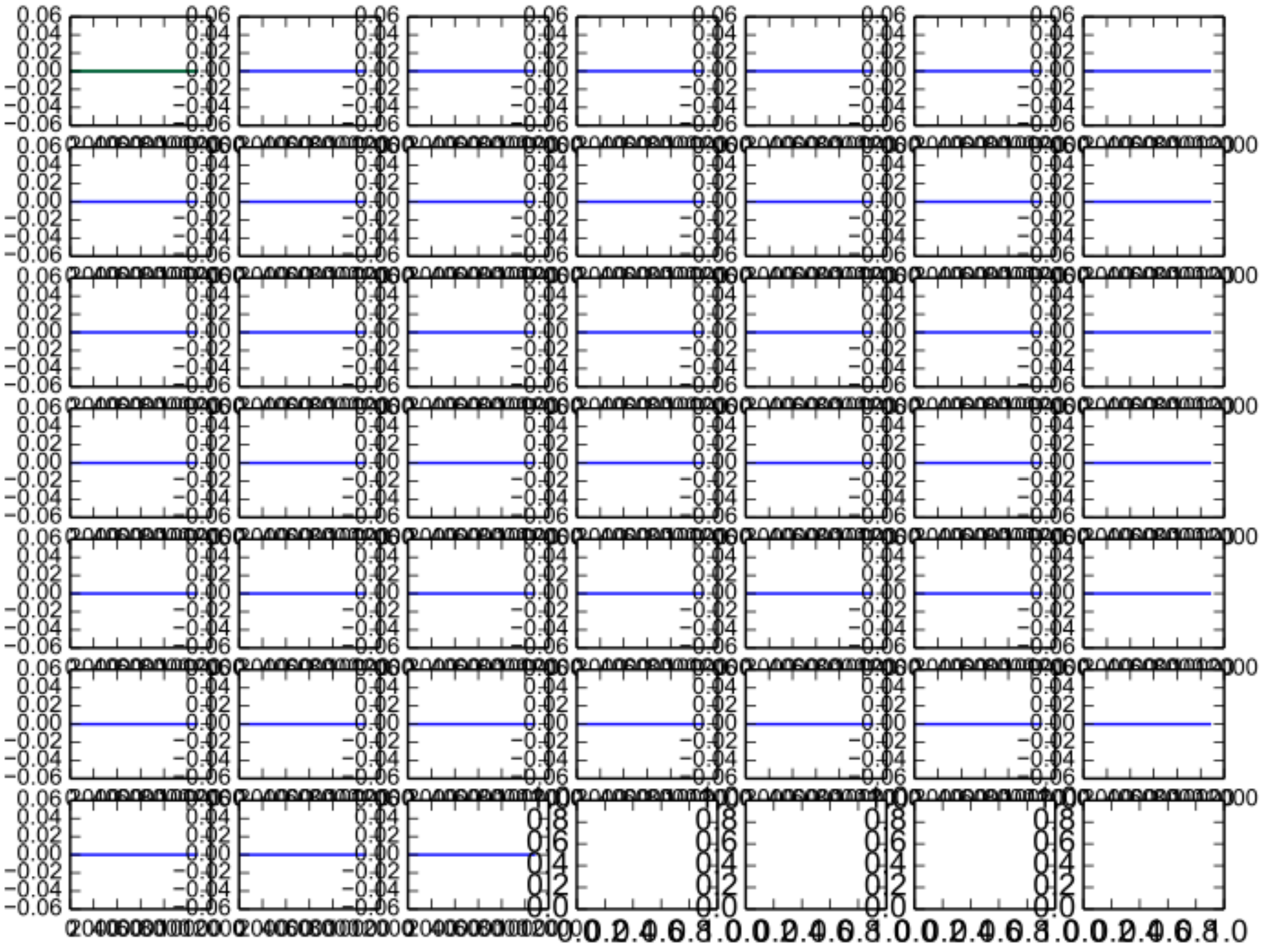
- MOST URGENT: fix the computation of the beam models (correctly taken working tiles into account)
- test on raw (64 channel, 1 sec) data
- test on LBA

BBS/NDPPP

T. J. Dijkema, A. Drabent, A. Horneffer, L. Morabito

- Multithreaded BBS: calibrate-stand-alone now has an extra argument '-t' to specify the number of threads to use in the solving part. Will give speedup on solve dominated problems.
- Beam library: minor differences with old implementation (within 0.1%, so well within the error margin of the beam).
- Calibrate-stand-alone's last argument is now optional.
- Stefcal in NDPPP:
  - Still in development
  - Can calibrate for non directional gains (full Jones or only diagonal)
  - When solving for Gain:0:0, Gain:1:1, supports also phase only
  - Tests show that results are similar to those obtained by BBS
  - Runs a lot faster than BBS (full Jones test by Leah: speedup of factor 4)

Difference in Amplitude Solutions

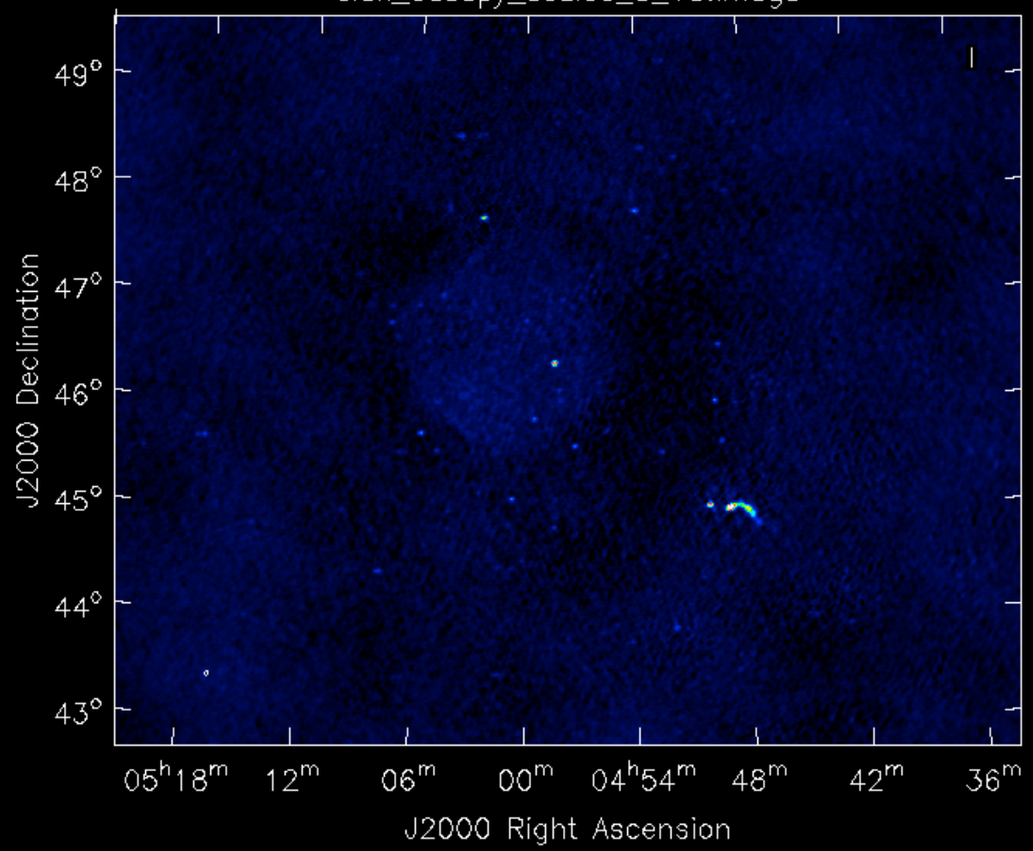


awimager

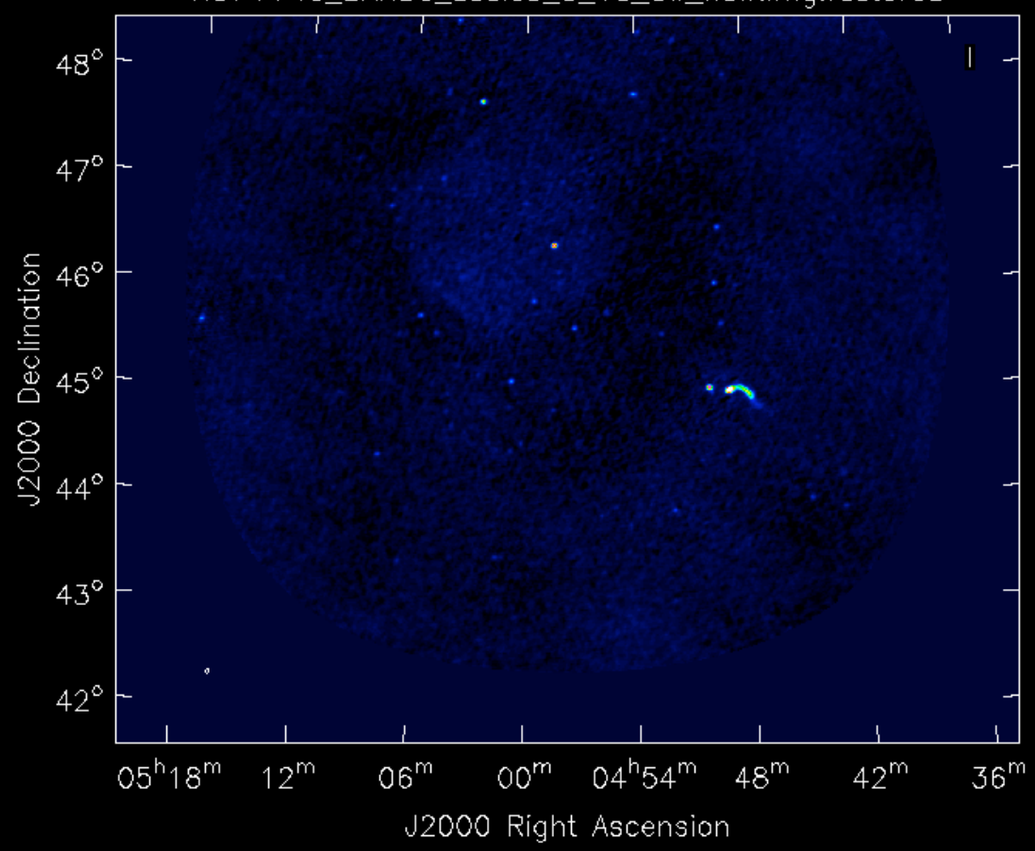
B. van der Tol, R. Paladino

multiscale: It seems to work properly. However some differences have been noticed when using the parameter ApplyBeamCode=3 in combination with the multiscale. Further investigations are ongoing.

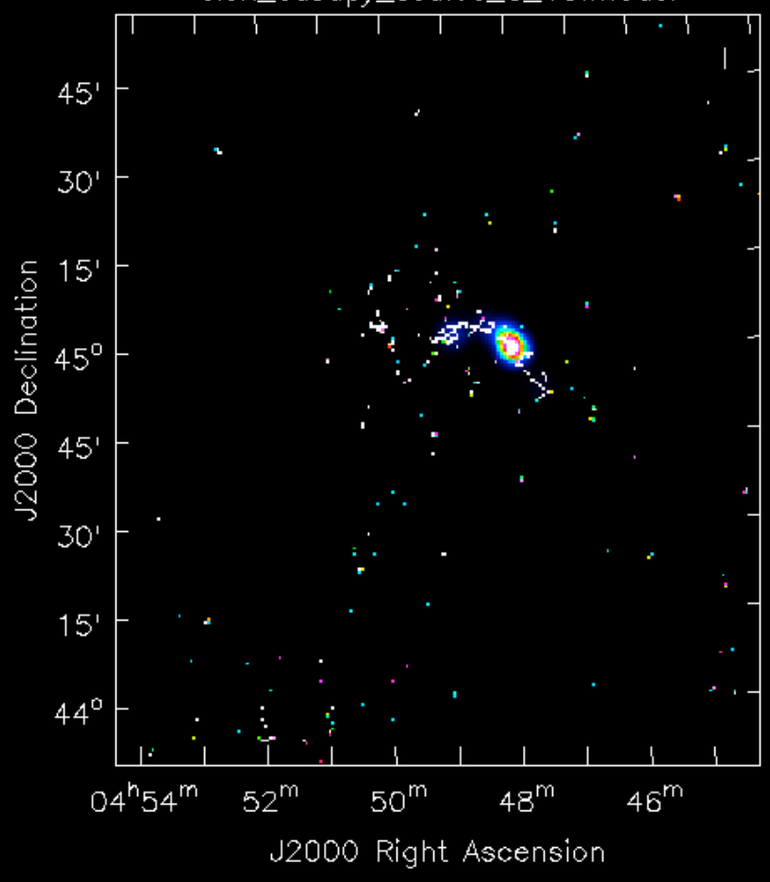
clen_casapy_scale0_3_10.image



H074+46_BAND0_scale0_3_10_aw_new.img.restored



clen_casapy_scale0_3_10.model



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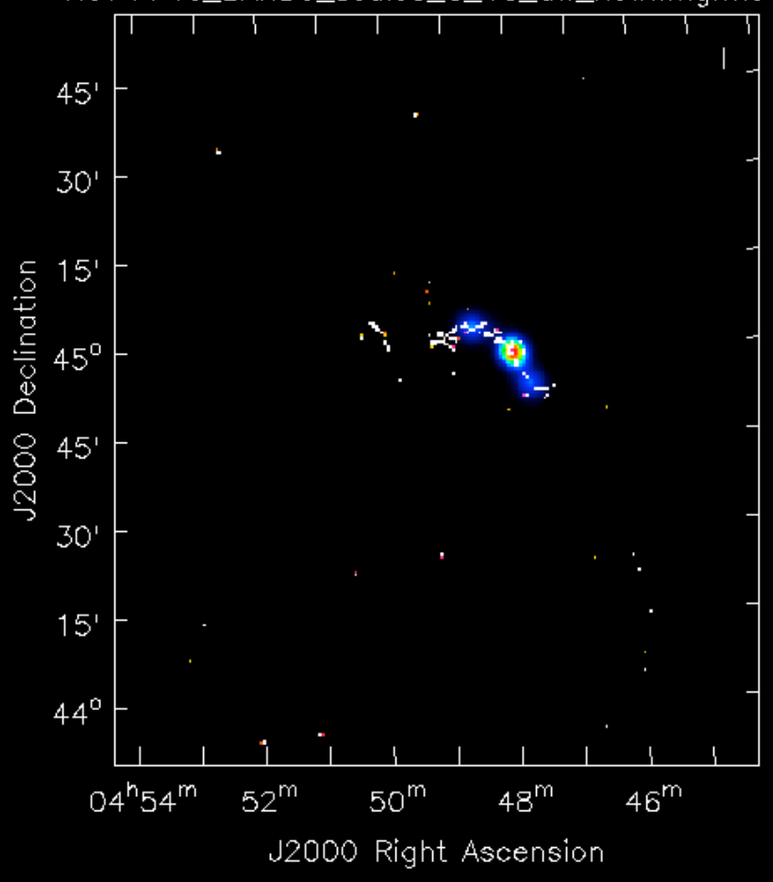
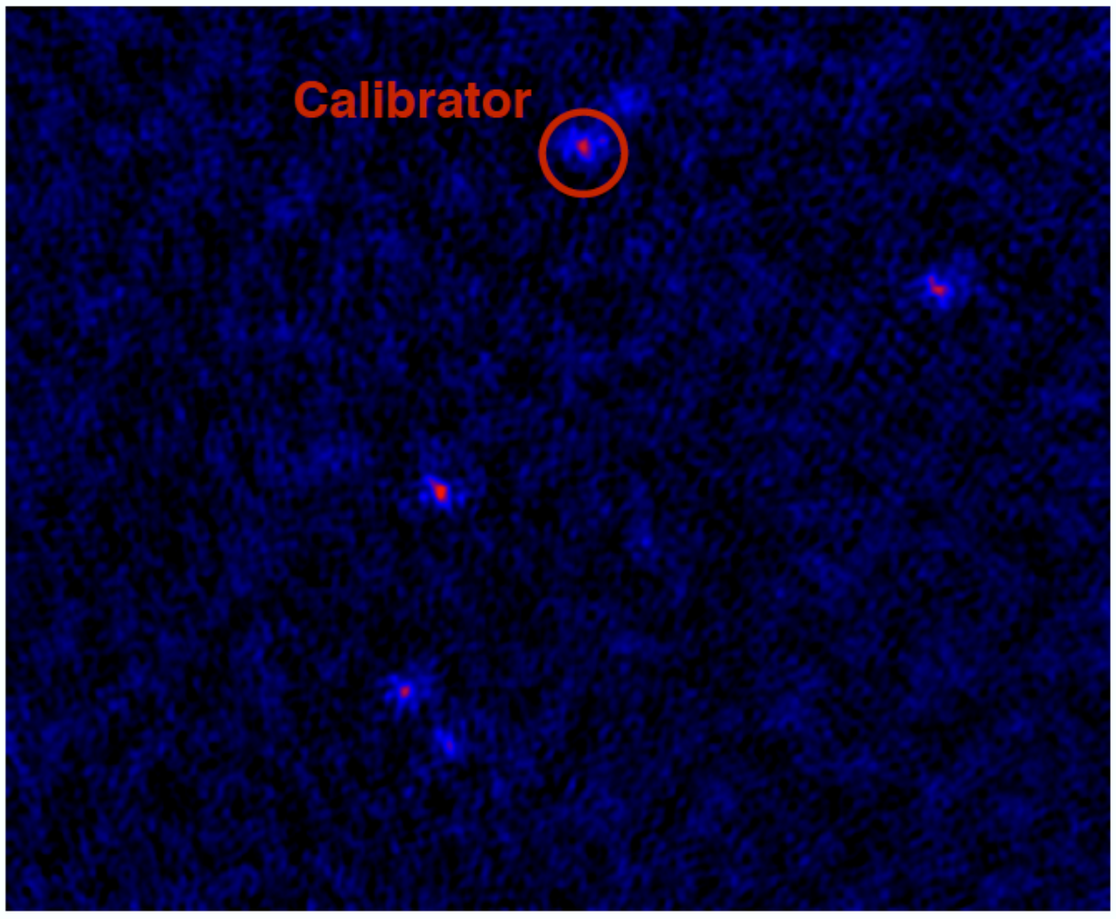


Phase screen

M. Mevius , D. Rafferty, F. de Gasperin, R.van Weeren, B. vd Tol,
A. Bonafede, V. Pandey

LBA

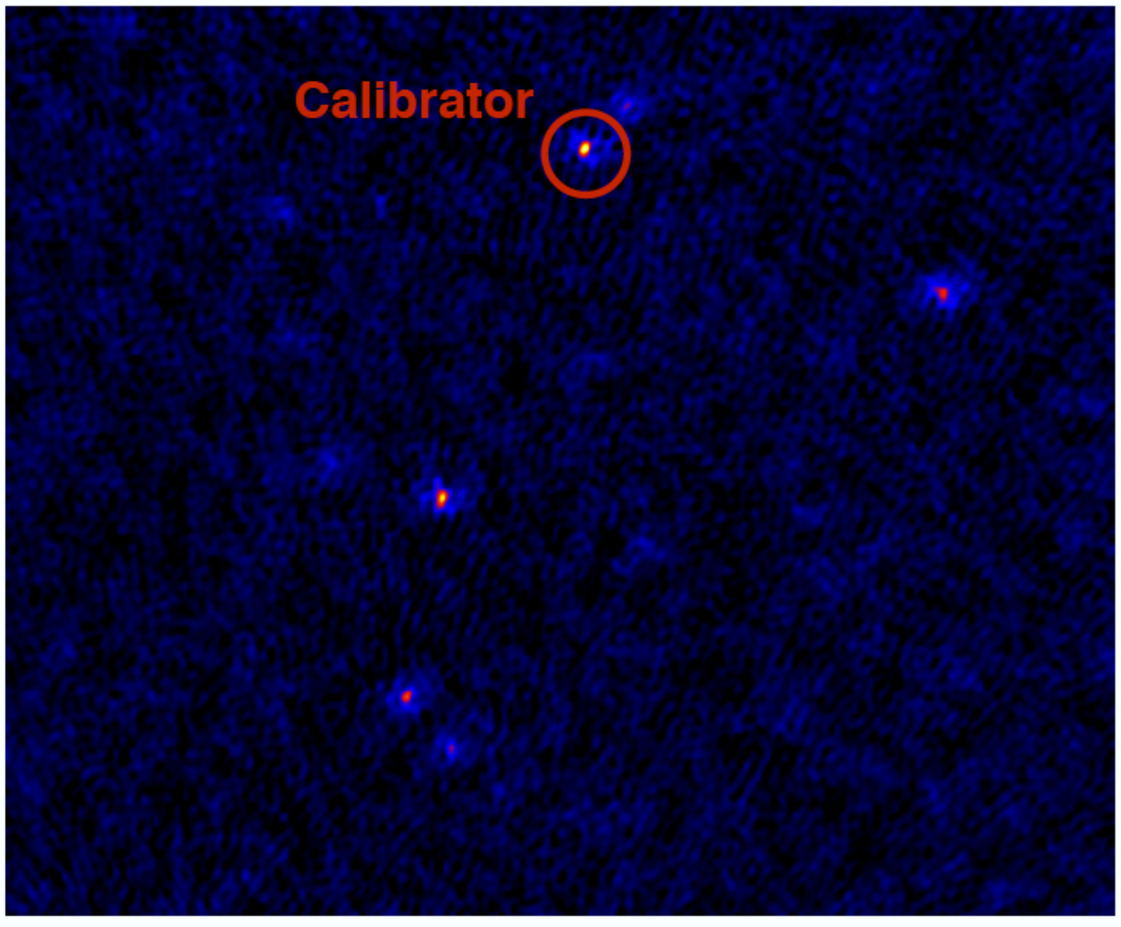
30 MHz Images



Without phase screen

2 deg

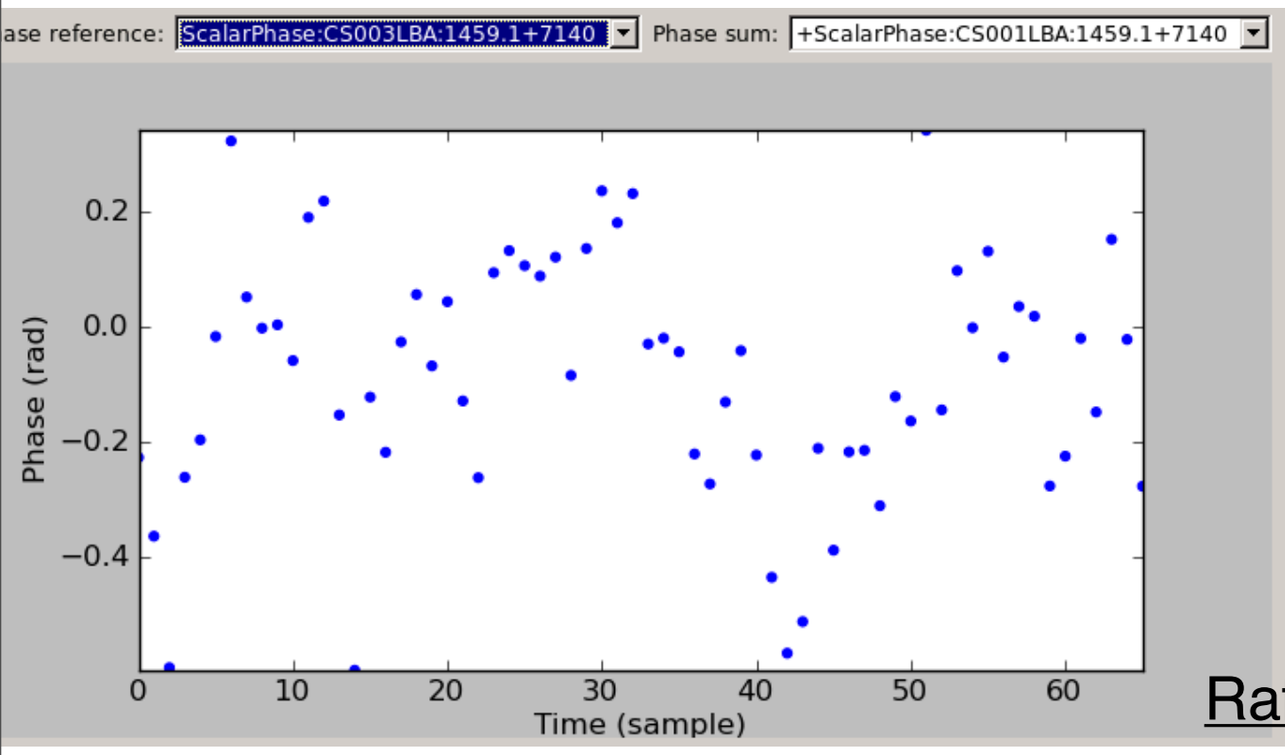
30 MHz Images

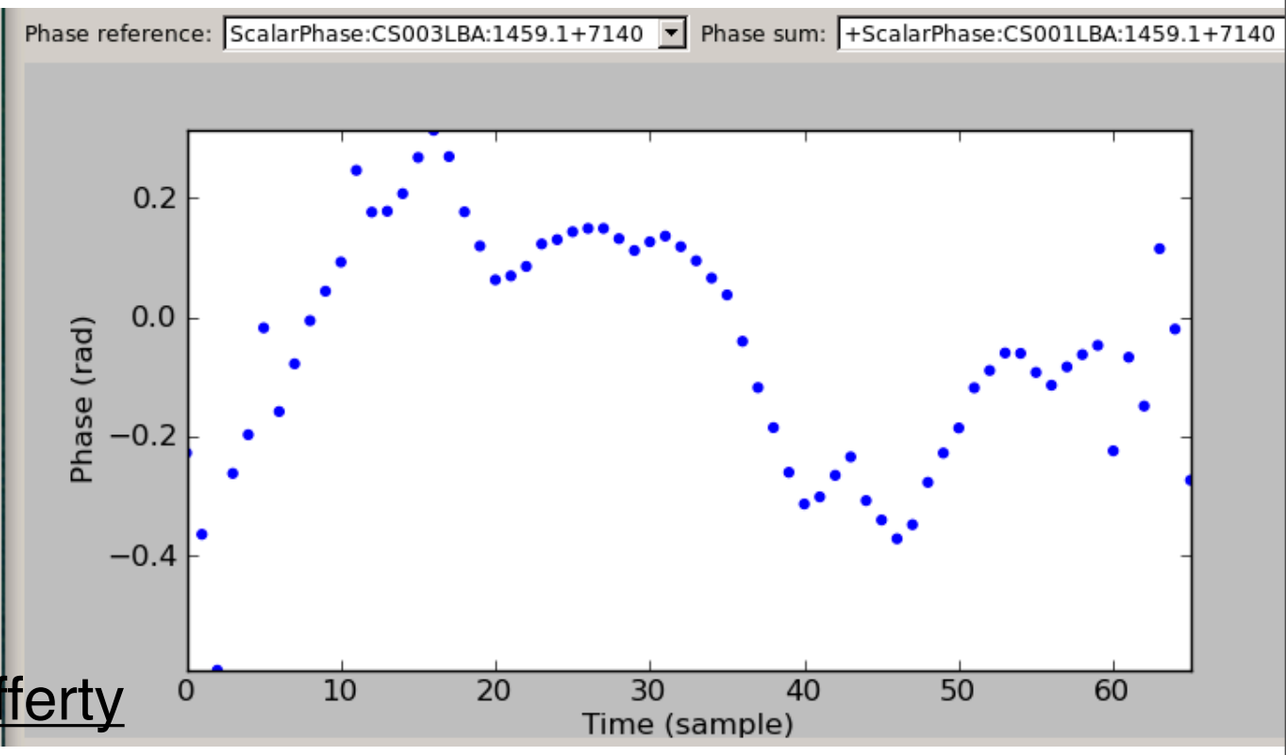


With phase screen

Rafferty

Exploiting the fact that ionospheric effects change on different timescales depending on the baseline length. Is is possible to trick BBS to solve with different solution intervals for each baseline, by multiplying the weights by a Gaussian whose FWHM varies as the square root of the baseline length.



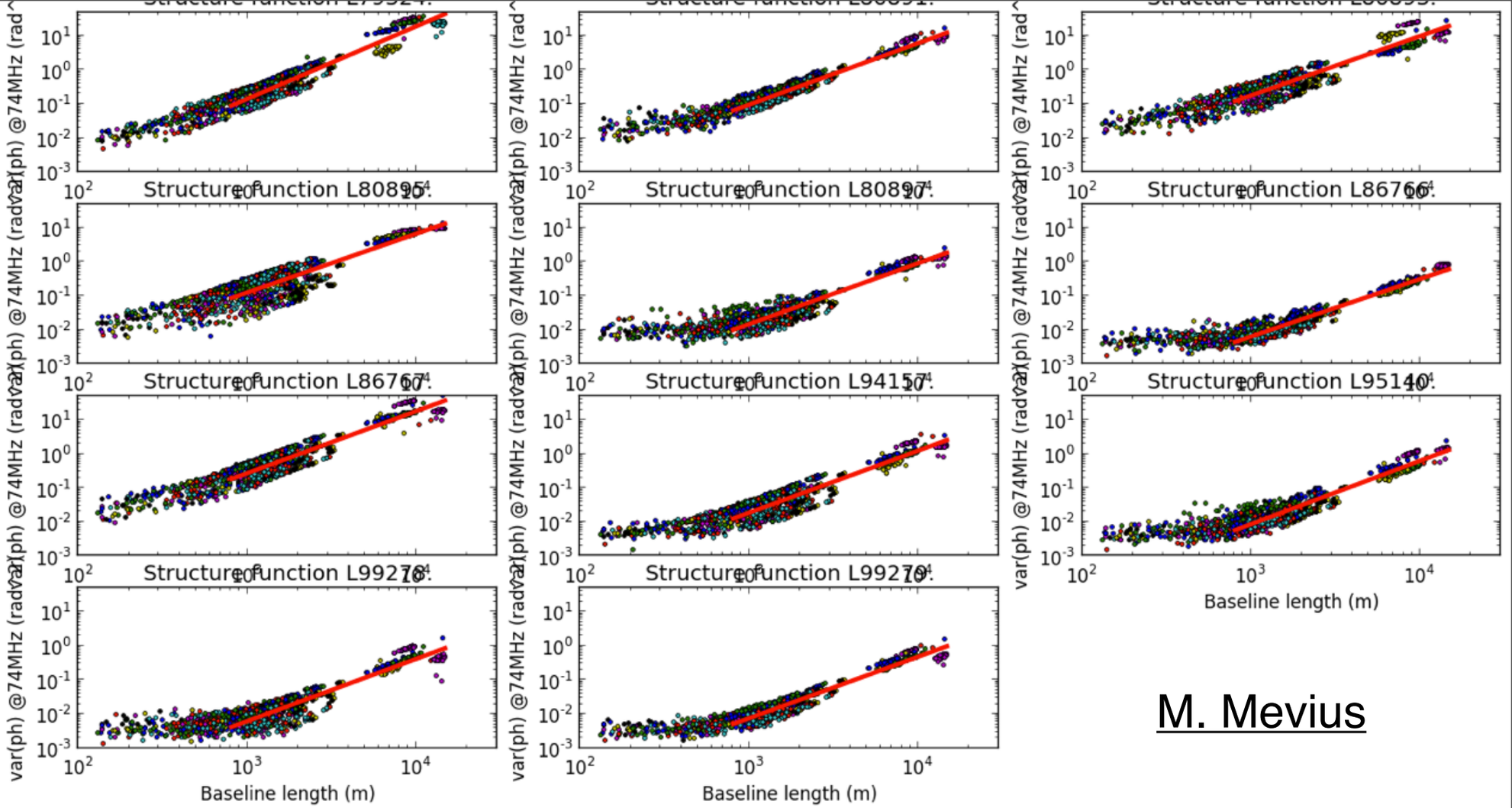


Rafferty

Comparing solutions for one calibrator found in the normal way with those found using Gaussian-weighting scheme (Reinout).

- The SNR of the solutions increases a lot
- The processing time increases (it takes ~5 hours to do one 11-minute snapshot on one core -- so ~20 minutes on 24 cores on CEP2).
- This technique could be used to calibrate on fainter calibrators, and hence have more pierce points to constrain and improve the screen.

HBA



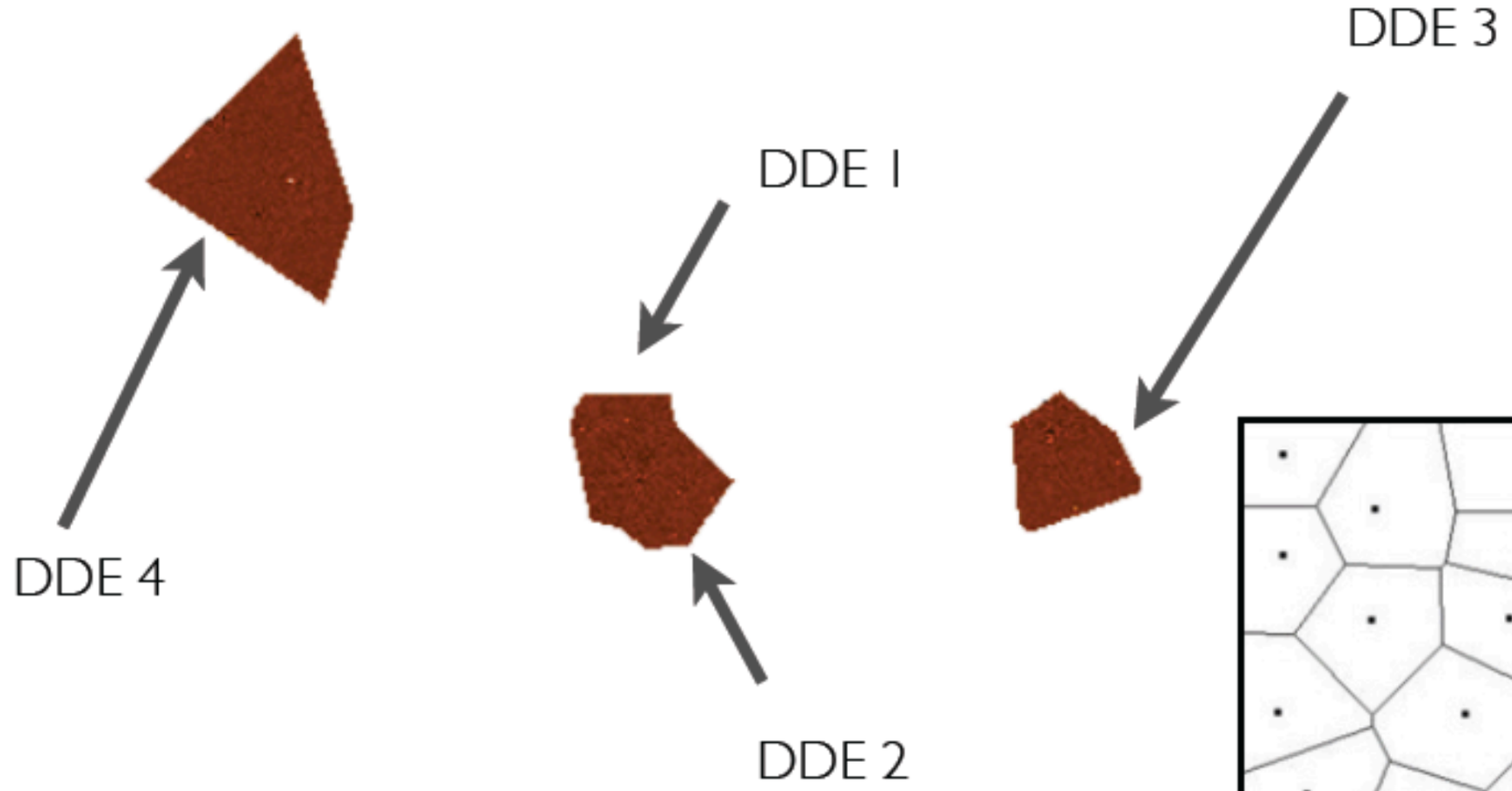
M. Mevius

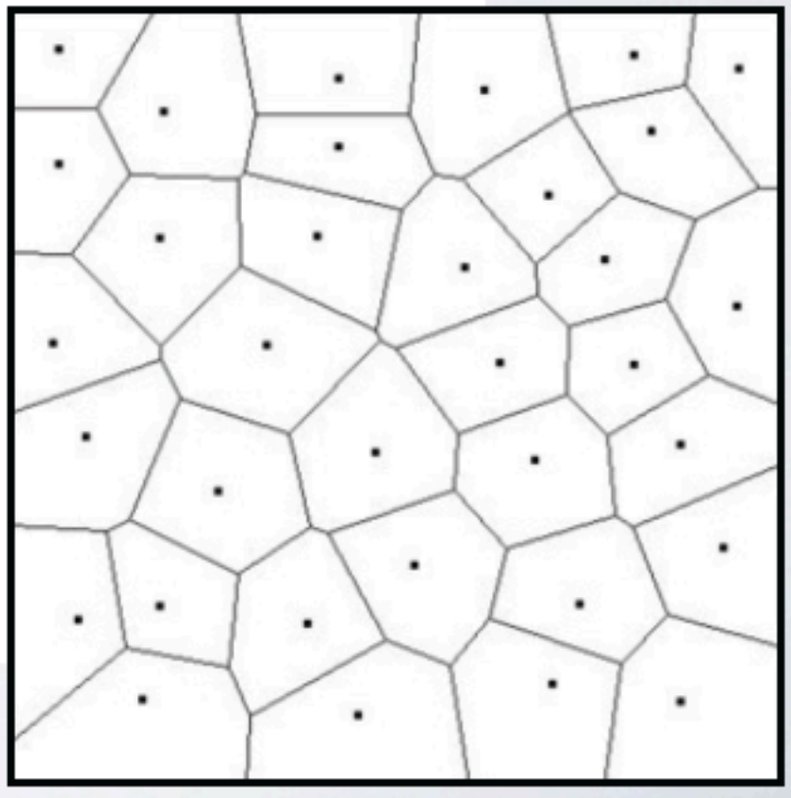
3C196 EoR data of 2012/2013 used for statistical properties of the ionosphere. The structure function of phase difference versus baseline length for different nights, extracted from the fitted TEC on the BBS-phases. The slope a bit larger than expected for Kolmogorov turbulence (5/3). s0 offset, defined as the length where the variance of the phase difference is 1 radian (quiet ionosphere leads to larger values of s0). Next step is to collect DDG for the CS only in a couple of directions and combine those with the full array 3C196 solutions to refine the phasescreen.

Coma: use a phasescreen build up from directional phases in a couple of direction in the field. Clock solutions from the calibrator successfully applied, but phase-only selfcal did not improve the images any further. Next step is to redo the selfcal with an improved stationbeam and include slow varying amplitude calibration if needed.

AFTER 4 DDE/PEELING CALIBRATORS

van Weeren

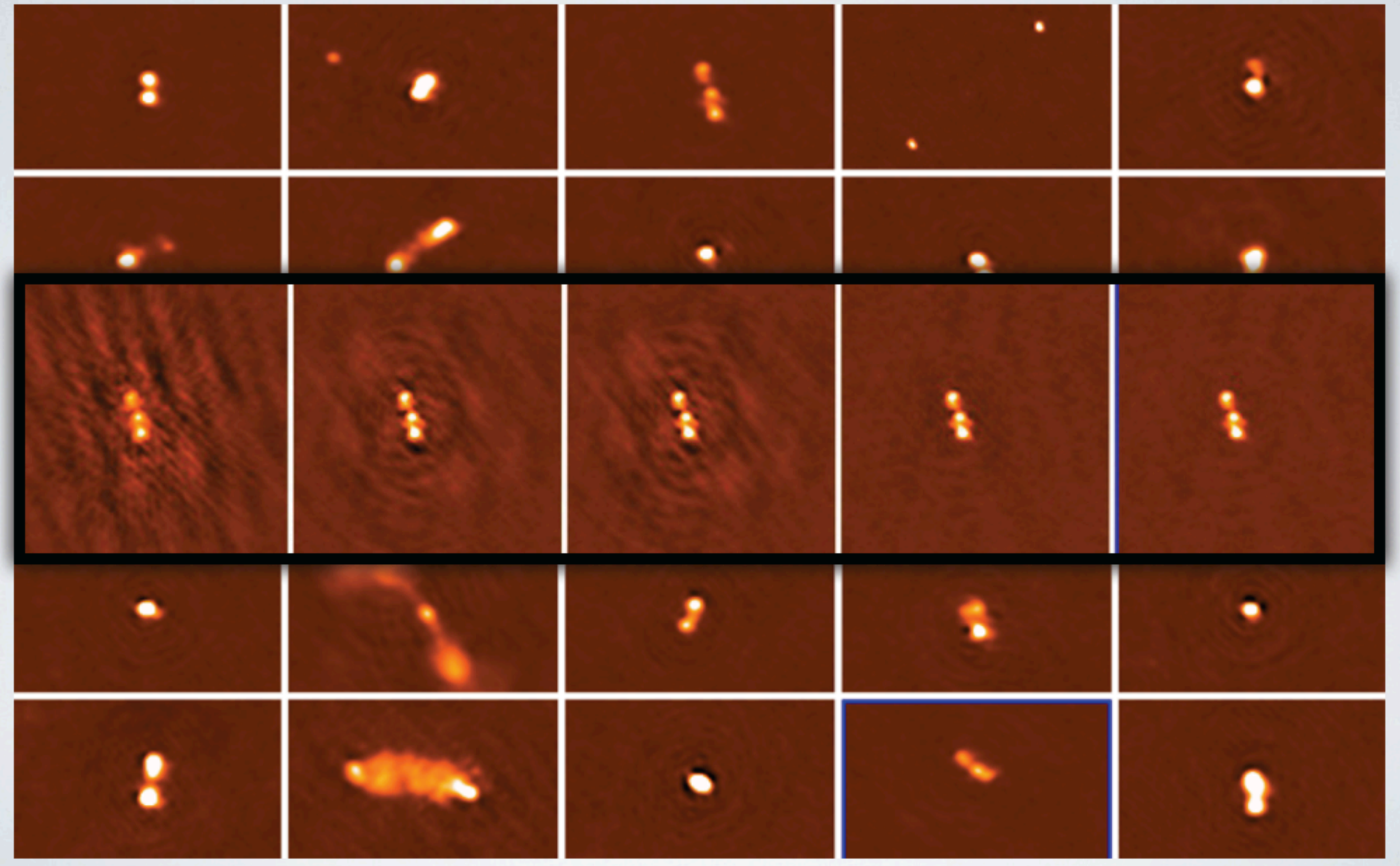




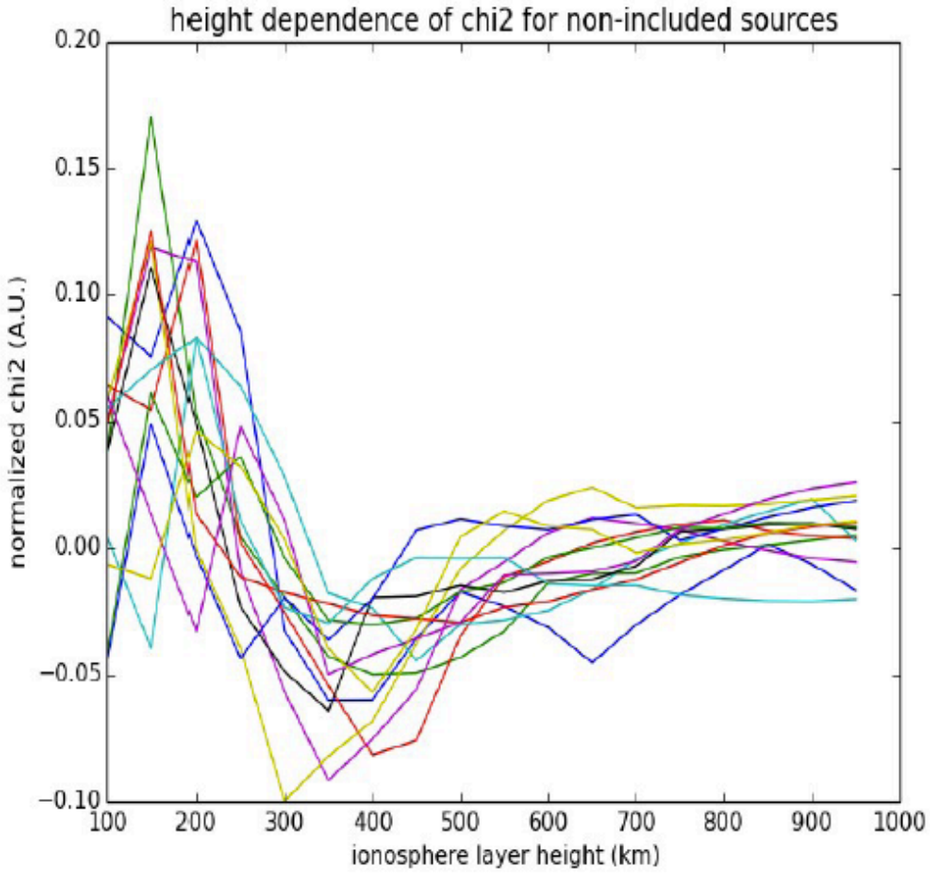
VORONOI TESSELLATION

DDE CALIBRATORS

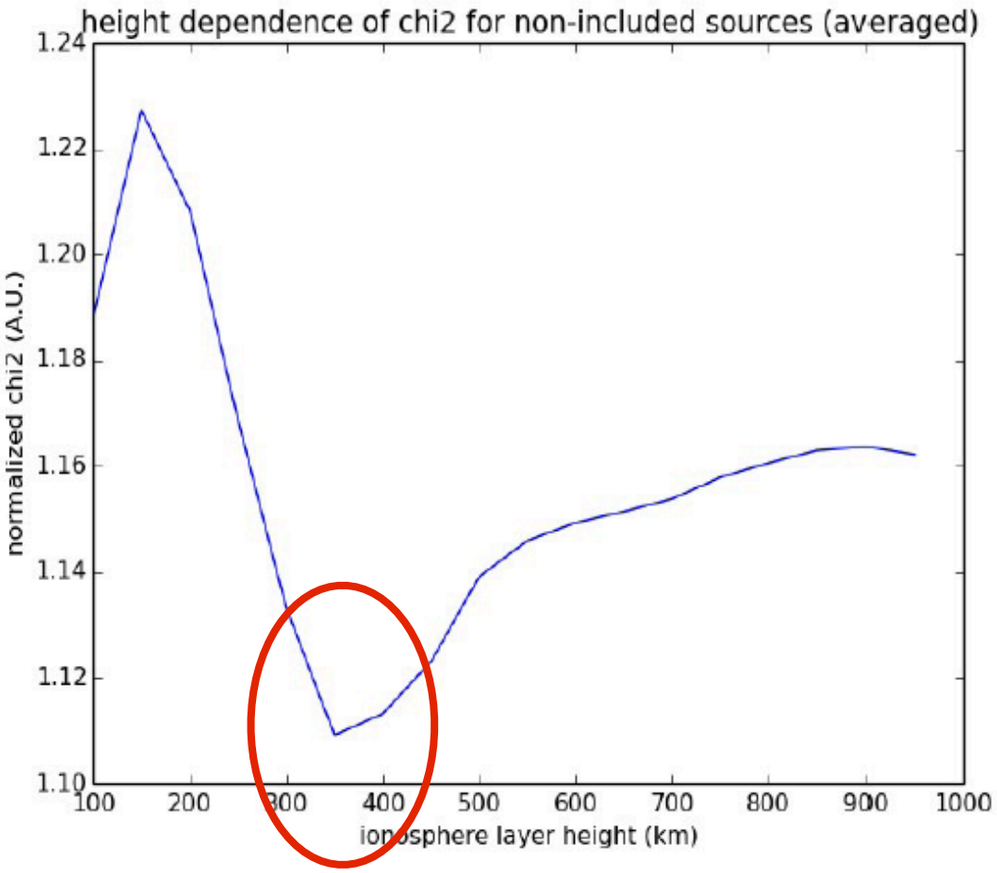
van Weeren



Toothbrush: Reinout produced high time resolution phase solutions in many directions for this field. The phases were used to deduce something about the height and/or thickness of the ionosphere.As a first test of the optimal height of the phasescreen: on 20 consecutive timeslots (times with index 500-520) and heights ranging from 100 to 1000 km with steps of 50 km. The phasescreen was fitted on 24 stations with 25 parameters. In 13 tests we removed each time a different source of the selected 13 sources from the fit and compared how well the interpolated phasescreen reproduces the phases of this particular source, as a function of the phasescreen height.



The variance of the phases



Variance of the average over all sources

M. Mevius

Selfcal

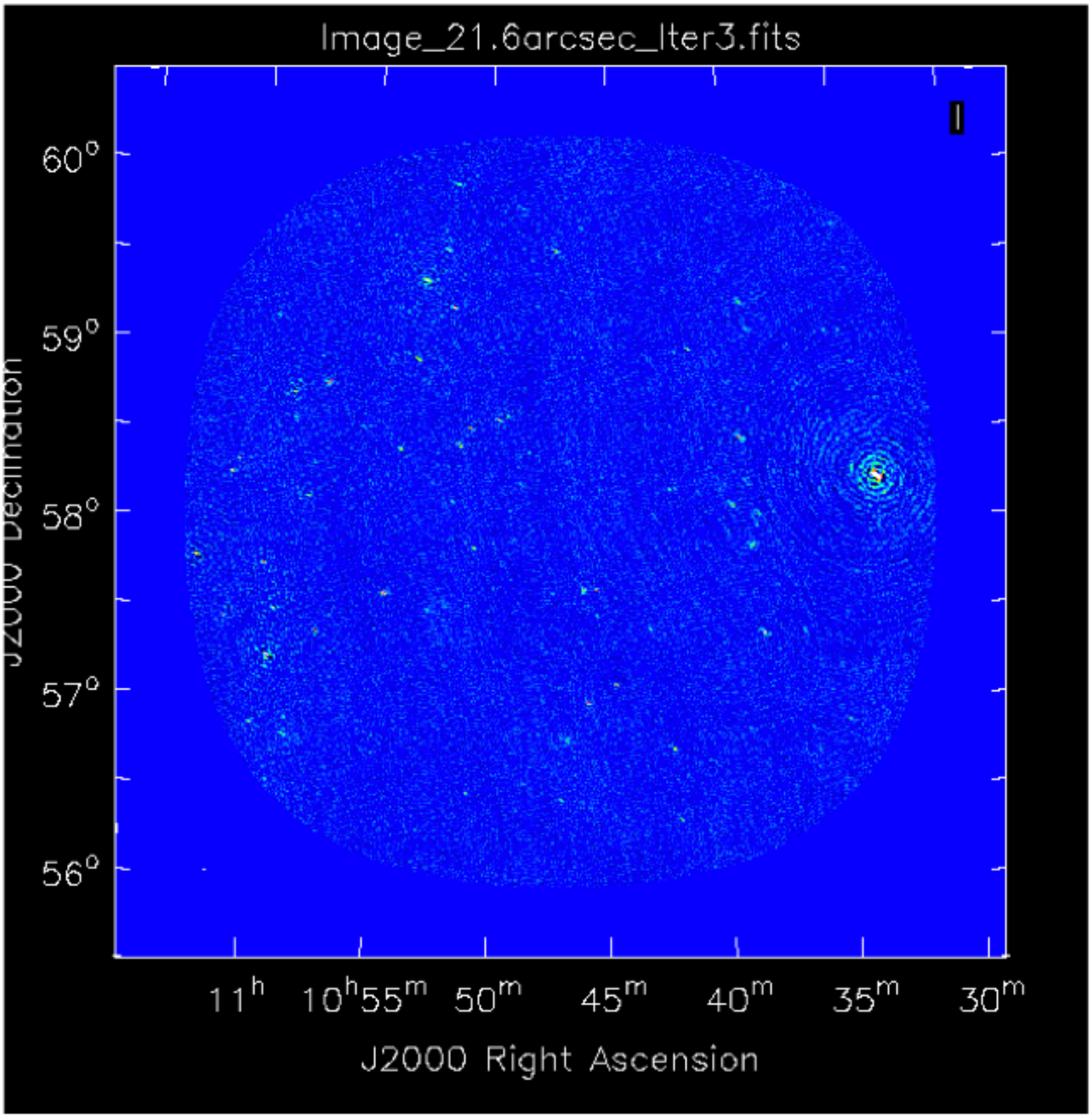
N. Vilchez, C. Toribio, A. Drabent, E. Orru', I. van Bemmel

- test to optimize parameters
- test on LBA data
- test to assess the computational request on CEP2
- investigation of masked methods:

now >> Imaging (AWimager) >> Source extraction (pybdsm)

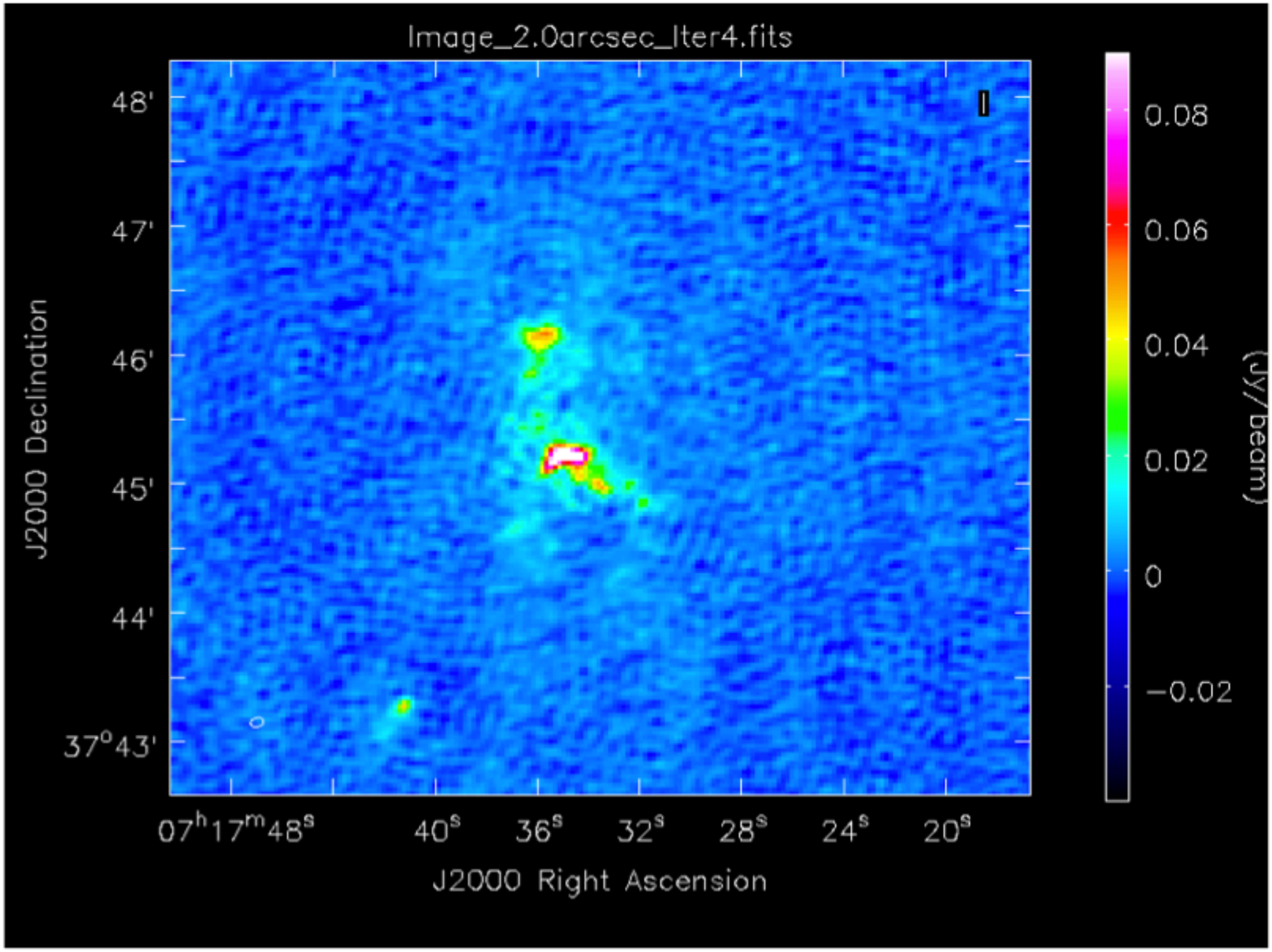
with mask Imaging (AWimager) >> Source extracMon (pybdsm) >> Mask generation >> Imaging (AWimager) using mask >> Do model converted to BBS format

LBA (60 MHz) Lockman Field (Ilse Bemmel):



MACS J0717+3745 (Alexander Drabent):

Iteration 5/5 (not final cycle), 2'' pixel size



Conclusion

- Smart demix
- NDPPP/BBS
- Phase screen - DDEs
- AWimager
- Selfcal

Thank all the participants for the interesting results and stimulating discussions.