Preliminary results from Imaging Busy Week 16

Emanuela Orru' on behalf of

William Cotton, David Cseh, Francesco De Gasperin, Alexander Drabent, Chiara Ferrari, Volker Heesen, Matthias Hoeft, Huib Intema, Neal Jackson, David Jones, Giulia Macario, John McKean, Leah Morabito, Alexander F. Müller, Kiz Natt, Raymond Oonk, Rosita Paladino, Huub Rottgering, Jose Sabater, Cyril Tasse, Carmen Toribio, Valentina Vacca, Ilse Van Bemmel, Alexander Van der Horst, Reinout Van Weeren, Eskil Varenius, Glenn White, Jonathan Zwart, AnnalisaBonafede, Elizabeth Mahony, Chris Riseley, Anna Kapinska, Poppy Martin, Alicia Berciano, Wendy Williams, Fred Dulwich, Benjamin Mort, Maciej Ceglowski, Jonathan Gregson, Jacco Vink, David & Laura Raffety

overview

- Hosted in Leiden at the Lorentz Center@Snellius
- 43 participants
- 3 special guests: M. Wise, M. Mevius, R. Pizzo
- introductory and technical talks
- 5 working groups
- Discussed list of requirements for Lofar Version 2

BLACKOUT

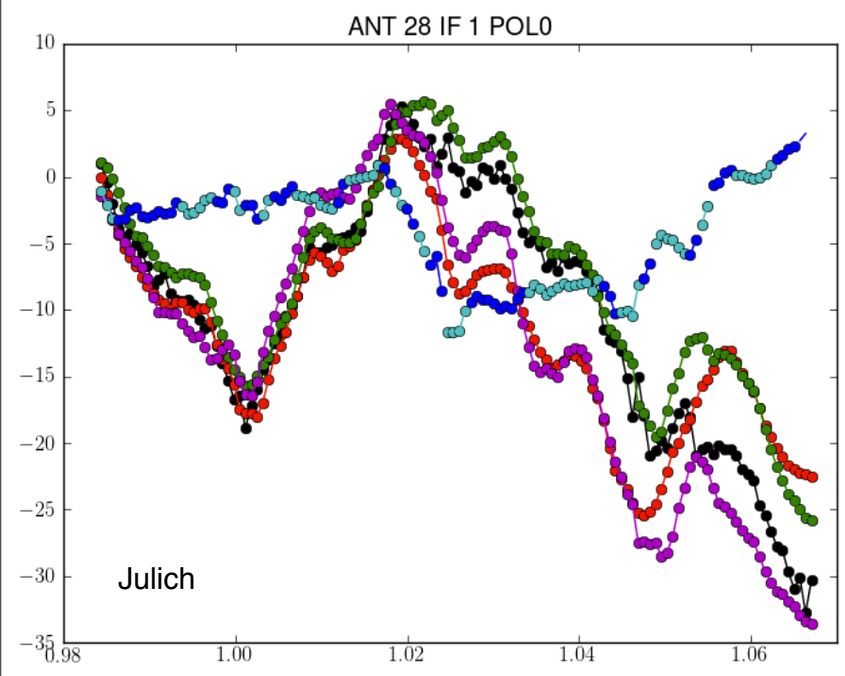
Long baselines

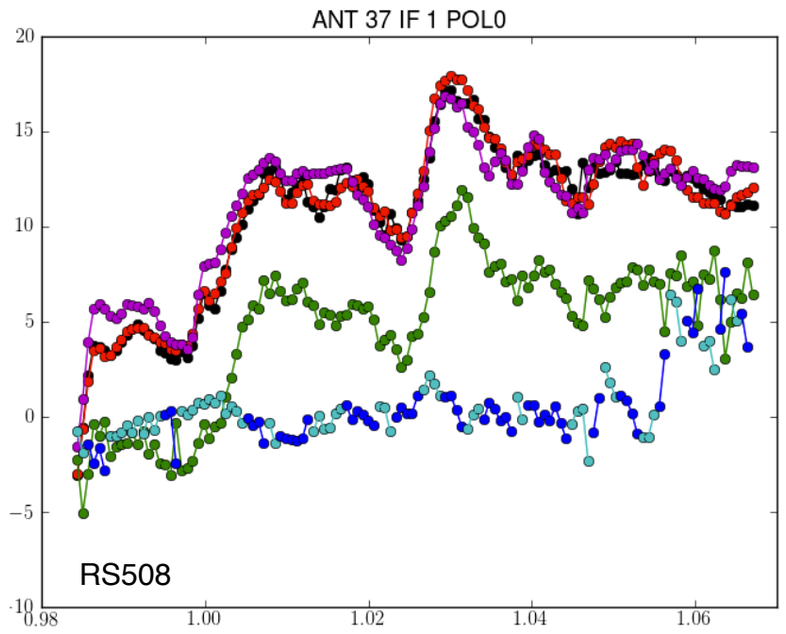
Members: Neal Jackson David Cseh, Eskil Varenius, Alexander Mueller, Adam Deller, Alexander Drabant

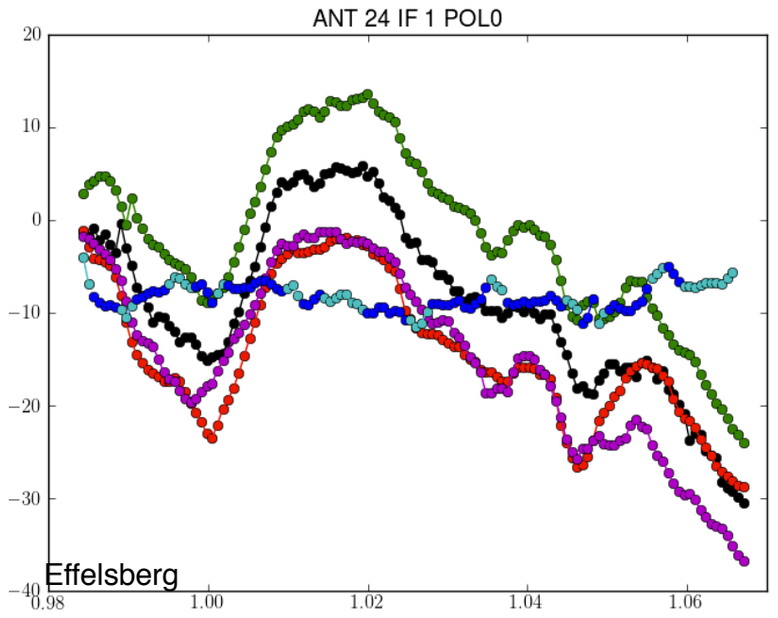
GOAL:

- How faint are the sources that can be calibrated in terms of long-baseline correlated flux?
- What are the characteristics of the ionosphere on long baselines, and in particular
  I. over what angle are phases moderately coherent
  II. over what distance can phases be transferred on long baselines?
- Can we demonstrate phase transfer to an otherwise invisible source?
- The outline of an end-to-end long-baseline pipeline".

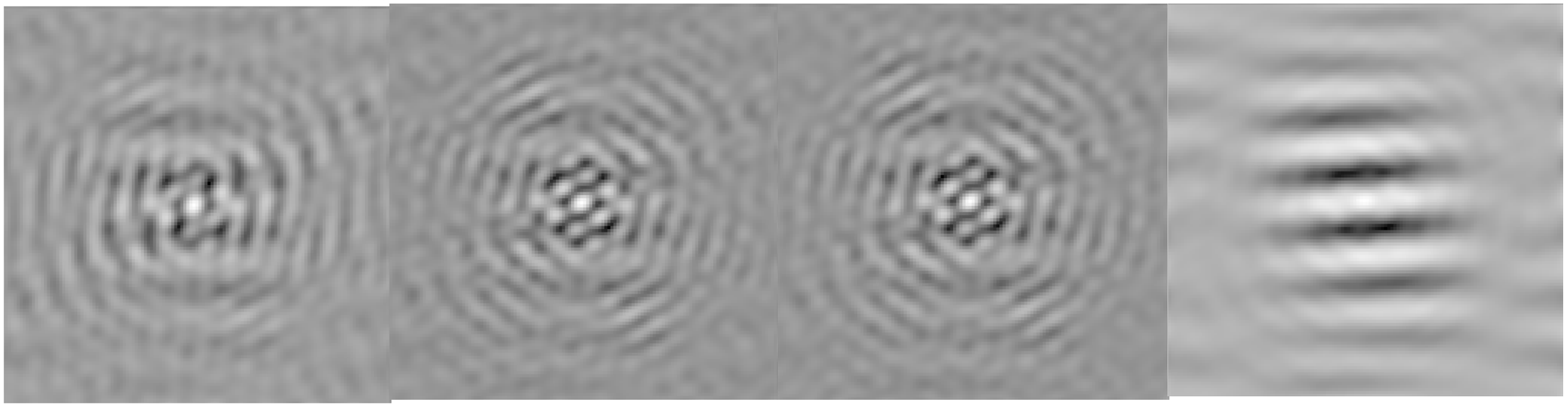
2 DATASET: PSR J0332+5434 and M81/M82 + calibrator

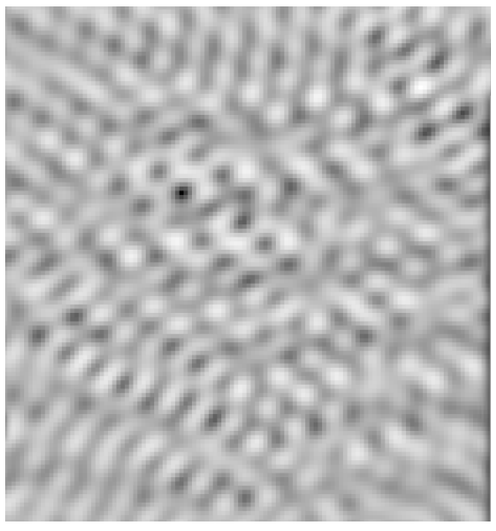






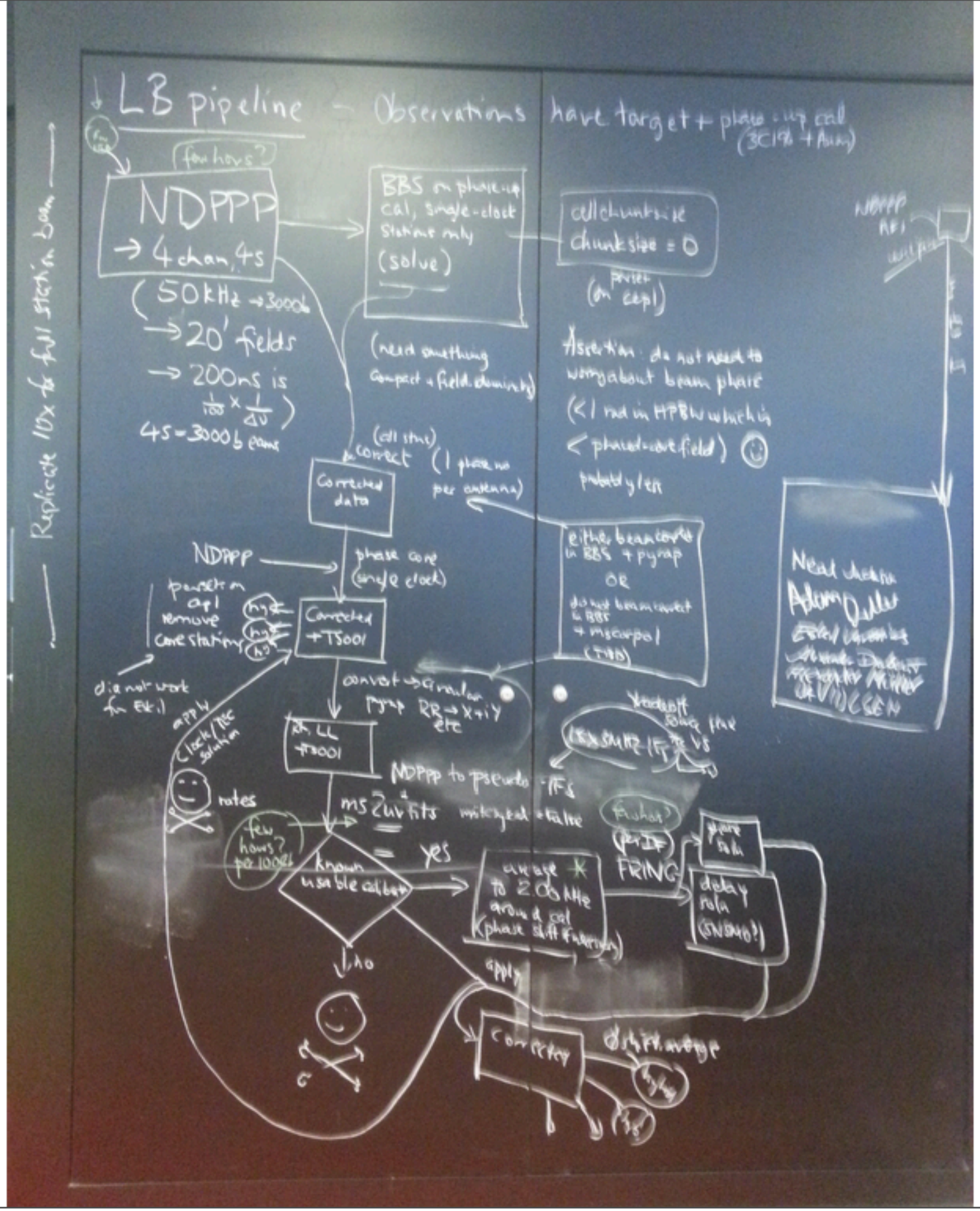
green=strong source, magenta=4C50.11, black=weak source, blue = differential phase PSR vs Strong SRC





0347+5557 with solution transfer
from PSR0332+5434 (just under 3deg)

(Can recover by calibration on 0347+5557)

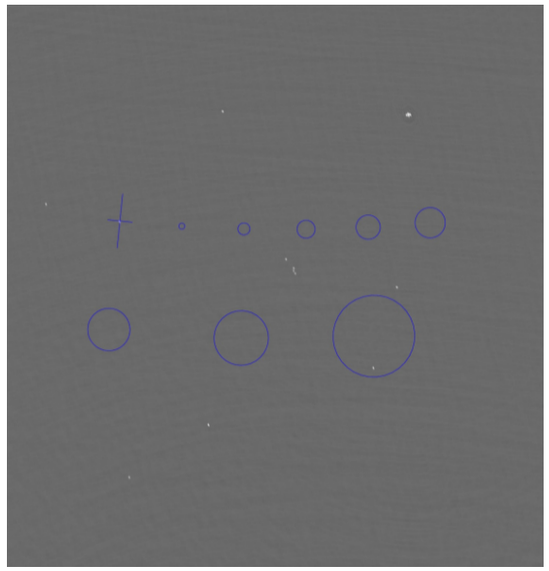

LB pipeline
Observations have target + phase-up cal
(3C196 + Aum)
few hours?
NDPPP
→ 4 chan, 4s
(50kHz → 3000b
→ 20' fields
→ 200ns is
4s = 3000 beams
BBS on phase-up cal, single-clock stations only
(solve)
(need something compact + field dominates)
cellchunksize
chunksize = 0
(on cepl)
Assertion: do not need to worry about beam phase
(<1 rad in HPBW which is < phased-core field)
probably less
(all stns) correct
(1 phase no per antenna)
Corrected data
NDPPP
phase core (single clock)
Corrected + TS001
either beam correct in BBS + pyrap
OR
do not beam correct in BBS + mscorpol
(TBD)
Neal Jackson
Adam Dutler
convert → circular
pyrap RR → X+iY etc
NDPPP to pseudo-IFs
ms2uv fits
= yes
known usable calibrator
average to 2.00 MHz around cal (phase shift fluctuations)
FRING
phase soln
delay soln
apply
correctly
Replicate 10x for full station beam

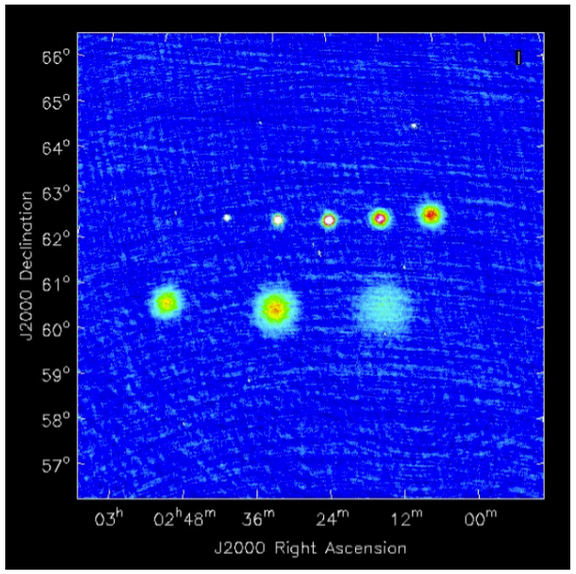
Large scale structures

Members: Glenn White, David Jones, Kiz Natt, Volker Heesen, Jonathan Gregson, Leah Morabito

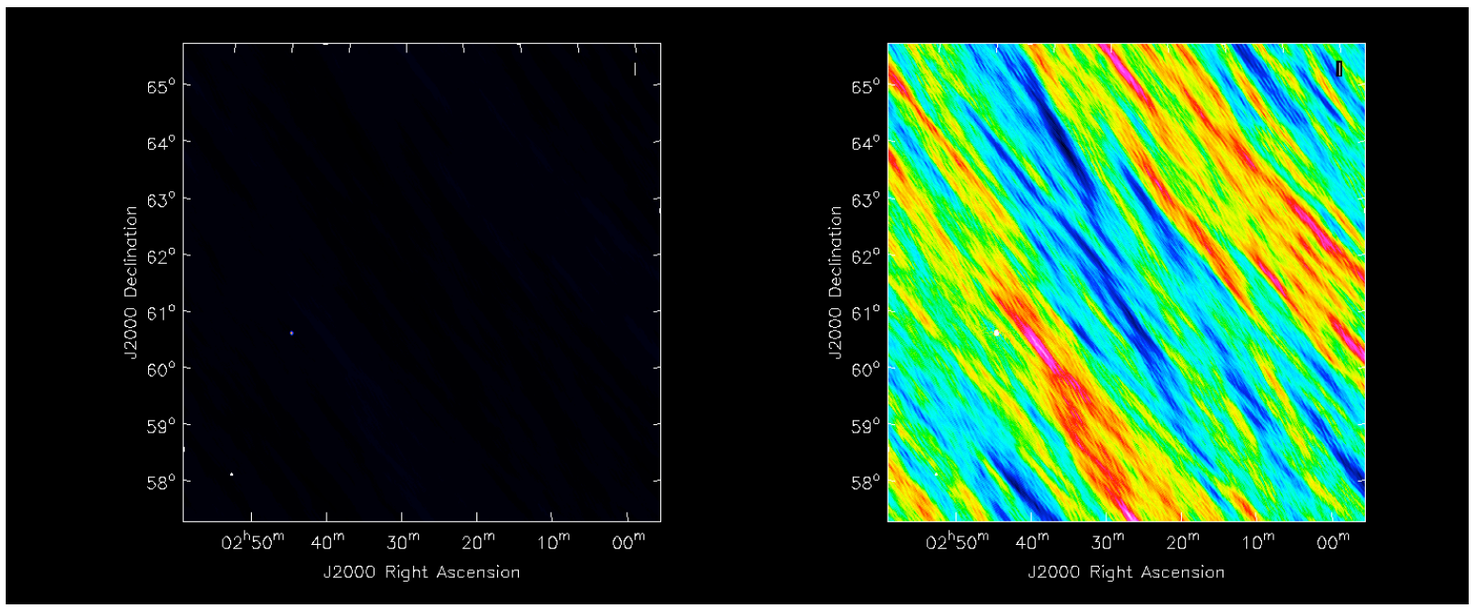
GOAL

- test the effect of demixing on extended emission when sources are close to the A-team.
- how the size of the extended source is affected during the demixing process





1. simulation W3 with/without Ateam
2. demixed when needed
3. imaged with CASA



- work in progress
- came up with clear steps for how to simulate data; these will become a new section for the Cookbook.

Flux recovery

Members: Chiara Ferrari, Giulia Macario, Rosita Paladino, Chris Riseley, Alexander van der Horst

GOAL: test the flux density recovery in images obtained using the OLD and NEW versions of awimager to compare the accuracy of the two versions.

- Test 1 - comparison between source catalogues extracted from two real LOFAR images, obtained with the two versions of awimager using the same parameters

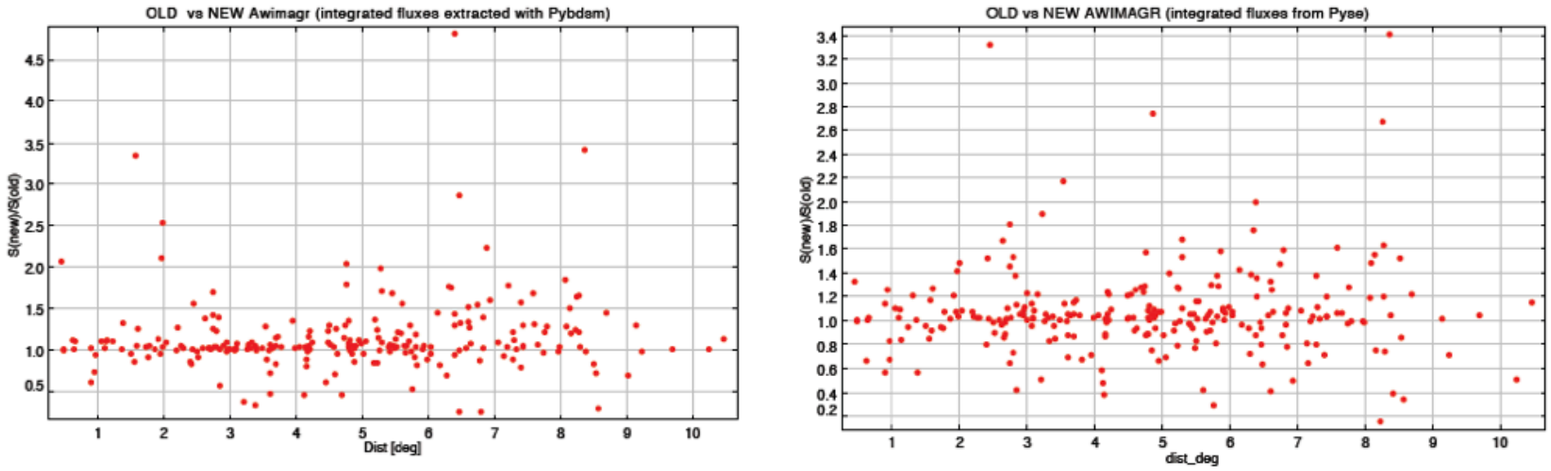


Figure 1: Integrated flux density ratio S_new/S_old versus distance from the field center [degrees]; (left PyBDSM ; right PYSE)

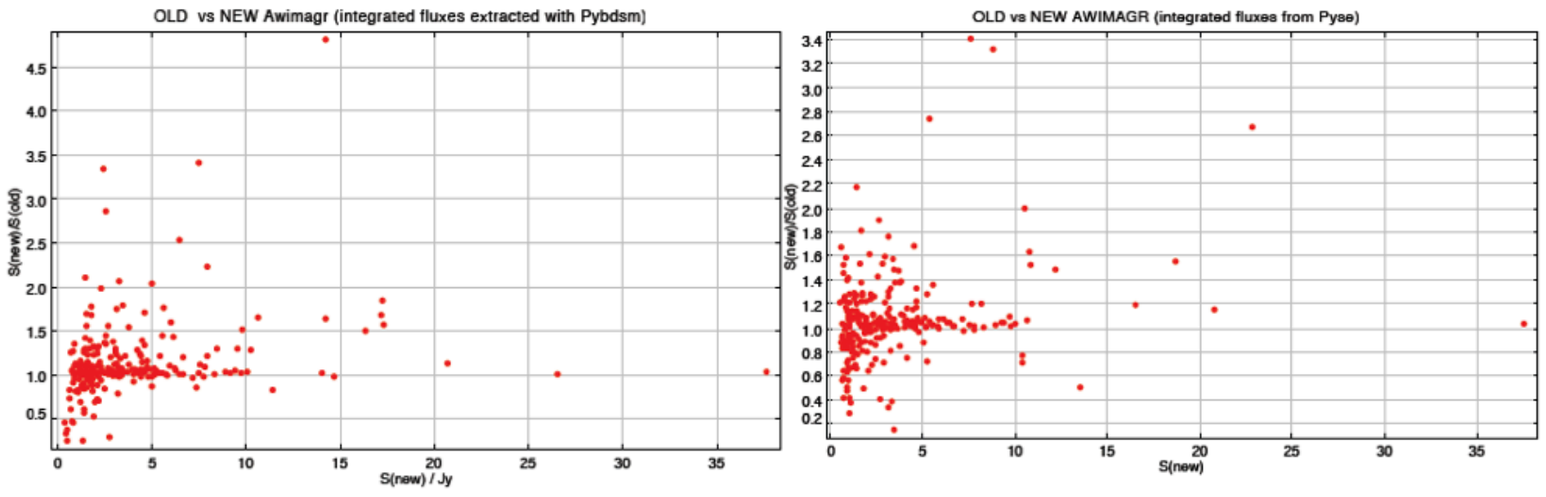
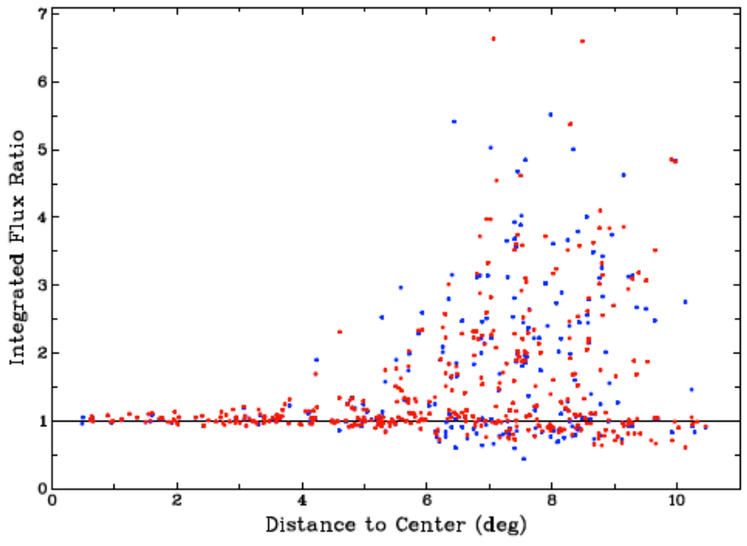
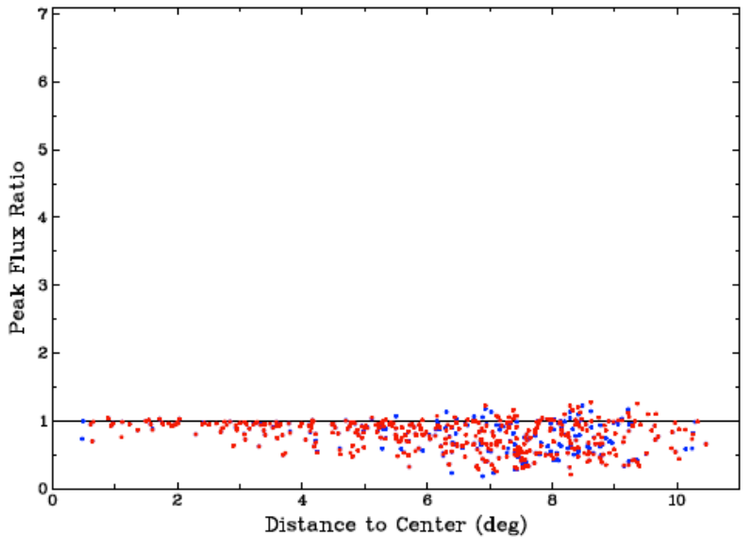


Figure 2: Integrated flux density ratio S_new/S_old versus integrated flux density (S_new [Jy]); (left PyBDSM ; right PYSE)

The two versions of awimager on real LOFAR data seem to produce images with different fluxes. More investigation is needed on the outlier sources to understand the reason of the different fluxes extracted. e.g. version of casacore, future test: e.g. flat noise image to detect and after beam correction to measues...

- Test 2 - comparison between the fluxes extracted from a simulated LOFAR image and the fluxes injected from the model





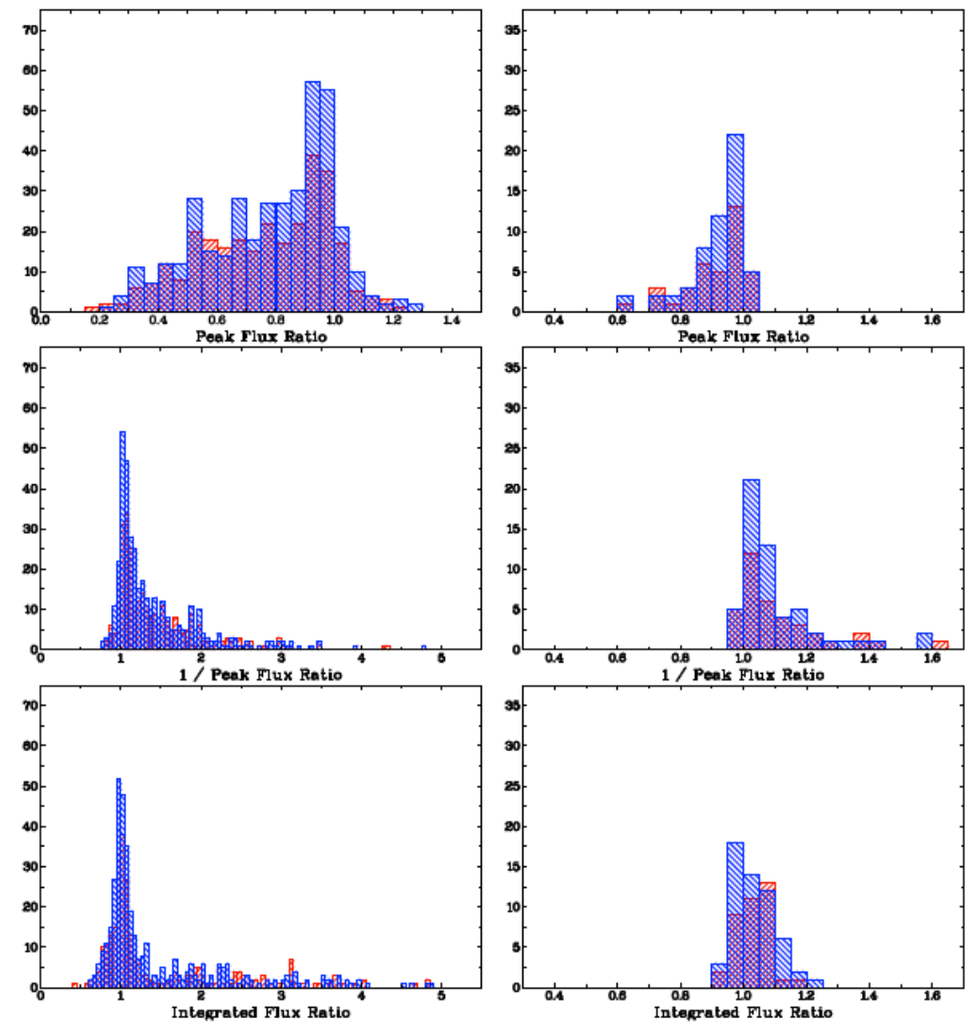


Figure 4: Histograms of peak flux ratio, the inverse of the peak flux ratio, and the integrated flux ratio; left is for all the sources, right for the sources within 3.5 degrees from the image center; red is PyBDSM, blue is PYSE.

The fluxes measured in the image obtained with the new awimager from simulated data are in pretty good agreement with the model fluxes, suggesting that the new awimager performs well in terms of flux recovery, at a level of 20% for the integrated fluxes.

cookbook tutorial

Members: Wendy Williams, Alicia Berciano, Valentina Vacca, Poppy Martin, Maciej Ceglowski, Carmen Toribio

•Improving the text and working on new practical examples:

• People new to LOFAR started with the first Chapters of the Cookbook, providing feedback on any problems encountered, and then progressed to the existing Cygnus A tutorial.

• Those who had already done this worked on testing the new tutorial which includes HBA and LBA data, LBA demixing and imaging with the new AWimager. This tutorial was expanded to include subtraction of a bright source in HBA and subsequent imaging.

• A. Berciano worked on a dataset which has two bright off-centre sources.
This will be written up as a very good example showing different strategies for doing direction-dependent calibration. This will include a very clear description of the use of the different beams in BBS. As such it may either be included in the cookbook
as a new tutorial example or as examples within the BBS chapter of the cookbook.

•A few general cookbook-related suggestions were made by the group:

Files for the different practical examples should be available in a common directory, e.g. /global-data/COOKBOOK/Tutorial

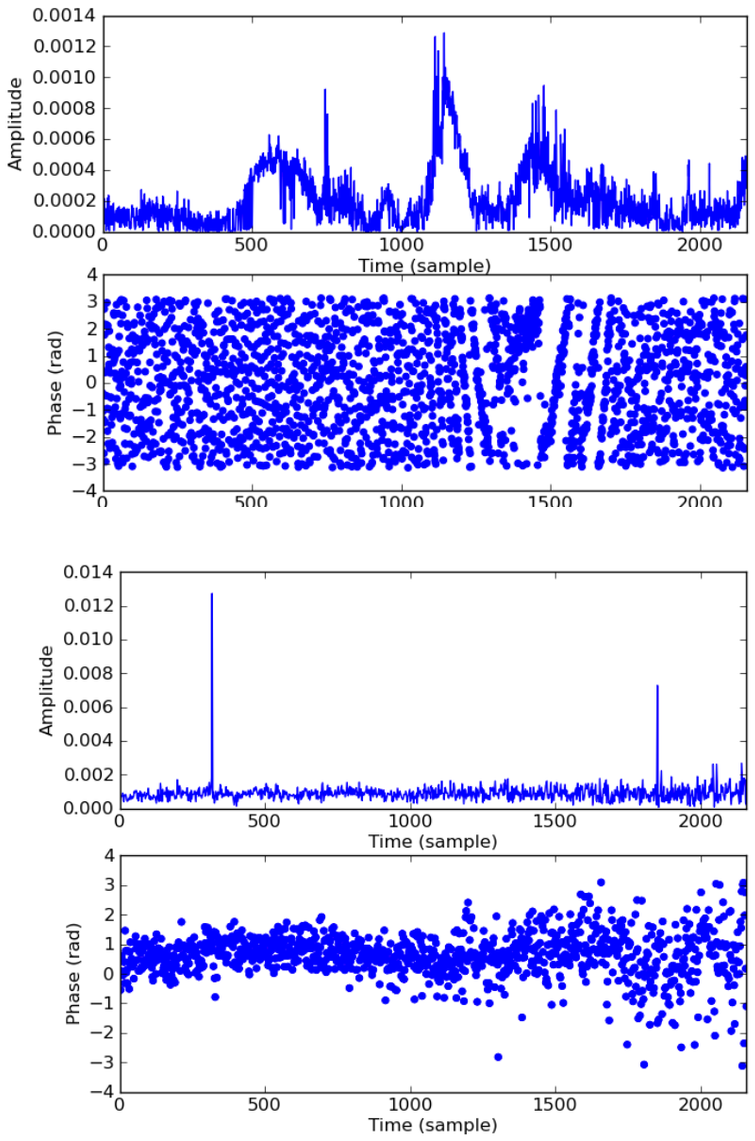
If other working groups have useful science cases, could they be made available as illustrative examples?

a few further useful chapters/appendices to the cookbook may include:
a glossary (J. Zwart started working on this)
a \crib sheet" containing useful numbers, e.g. field-of-view, resolution, max baseline length
a clearer overview of the pipeline

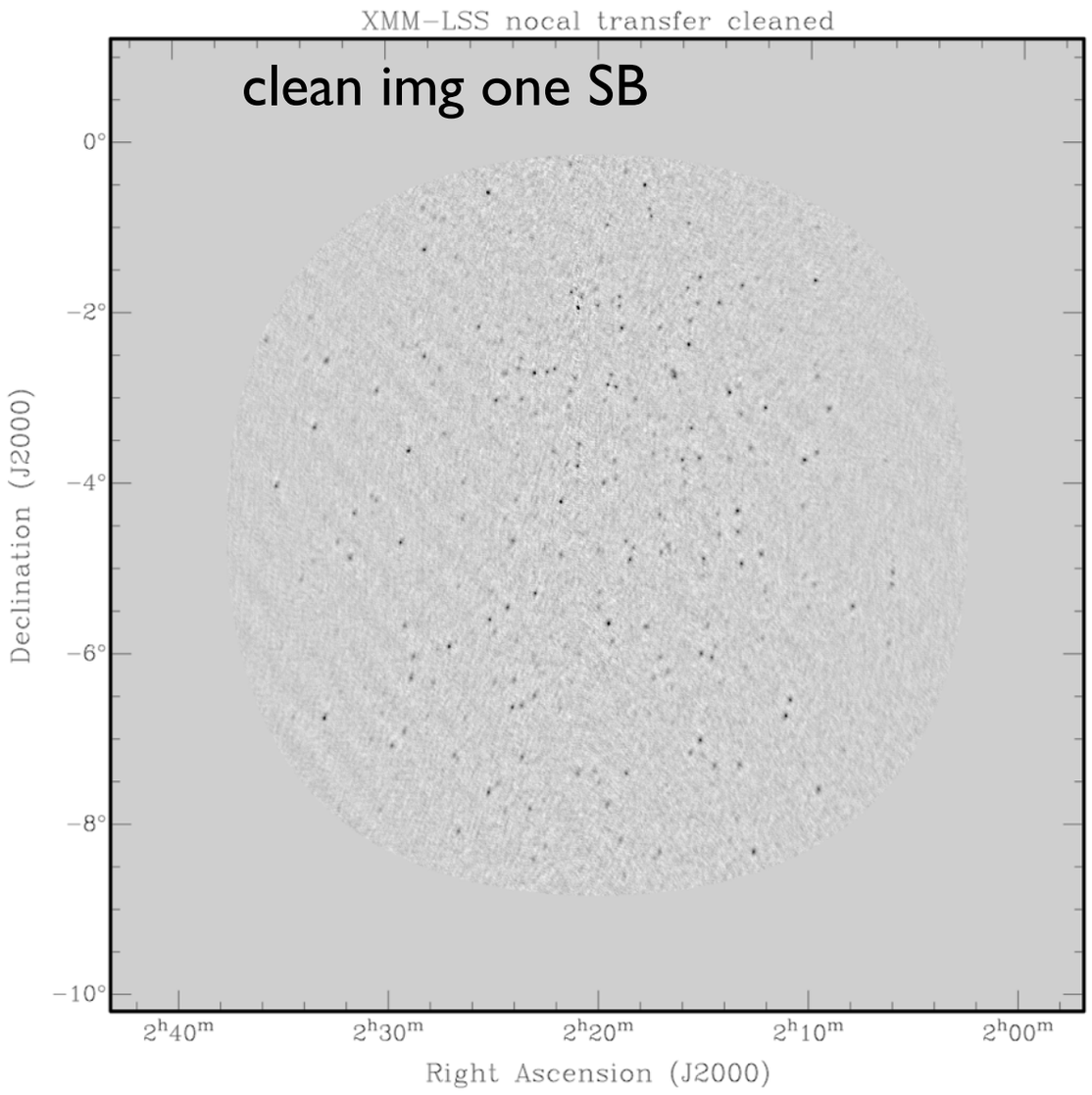
Survey WG deep fields

Members: Kapinska, Mahony, Sabater, Tasse, van Weeren, Williams, Zwart

XMM-LSS field 3hrs HBA dual beam
test LOFAR's capability at low (equatorial) declinations,
validation/verification of a dual-beam simultaneous calibration strategy.



uv-cut at 1000lambda



1. Some RFI missed by pre-processing flagging.

2. Suspected bright radio source on short baselines.

3. Clock-TEC separation fits.

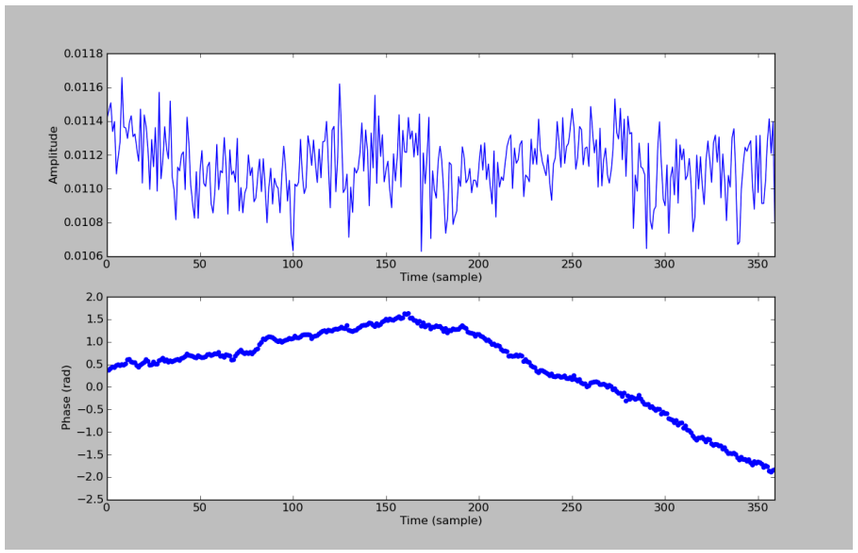
4. Flux scale of science field.

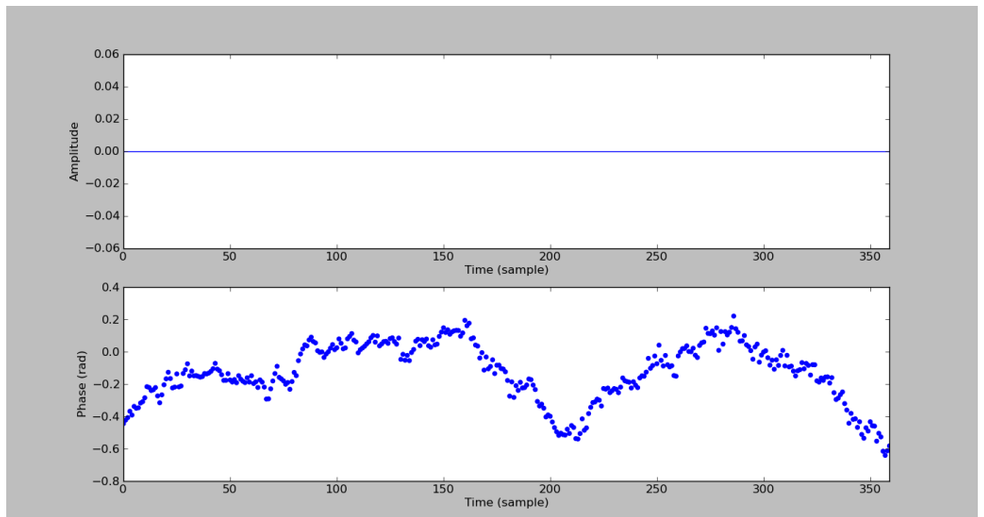
Ionospheric effects

Members: Reinout van Weeren, Annalisa Bonafede, Poppy Martin, Francesco de Gasperin, Ilse van Bemmel, Huib Intema, William Cotton, Fred Dulwich, Benjamin Mort, Alexander Drabant

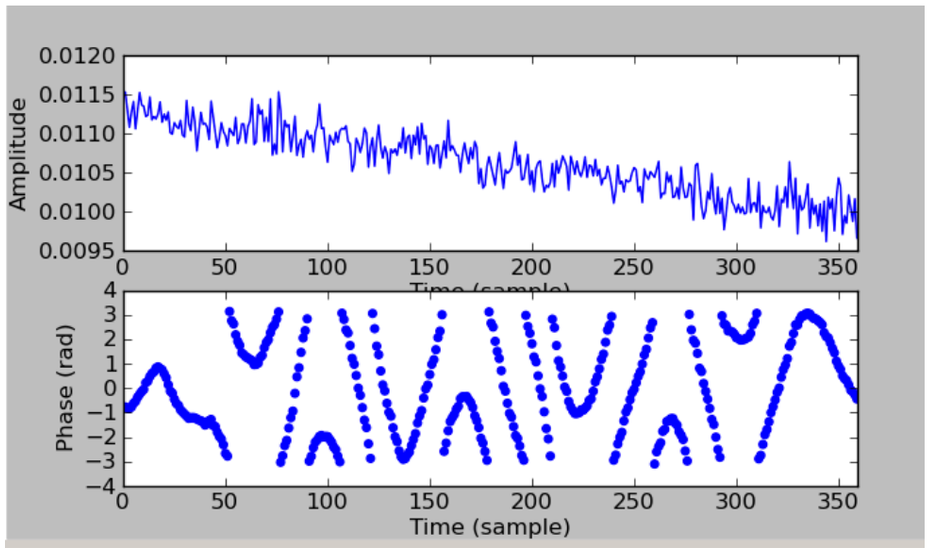
GOAL:

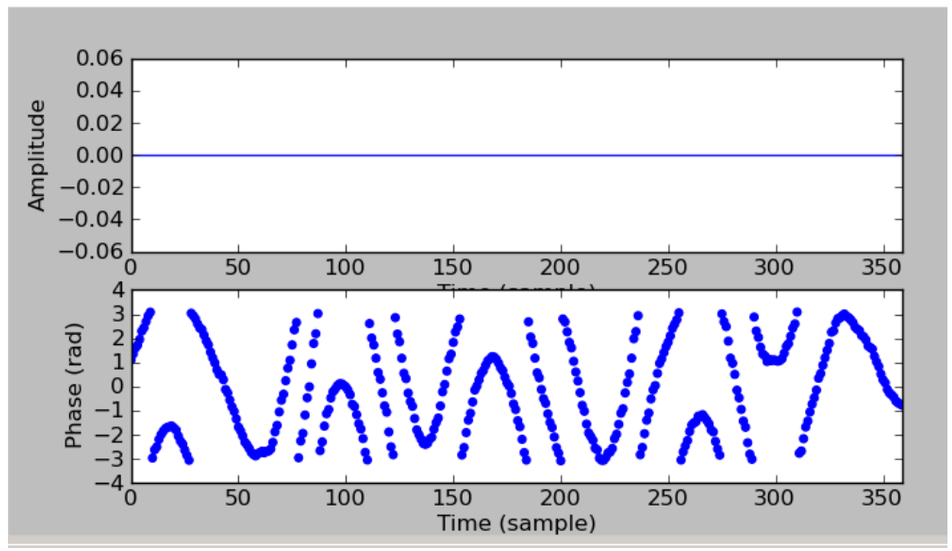
- fit multi-direction ionospheric screen
- work on similutations/data
- apply field calibration and SPAM algorithms to calibrate the ionosphere on lofar data





Annalisa Bonafede





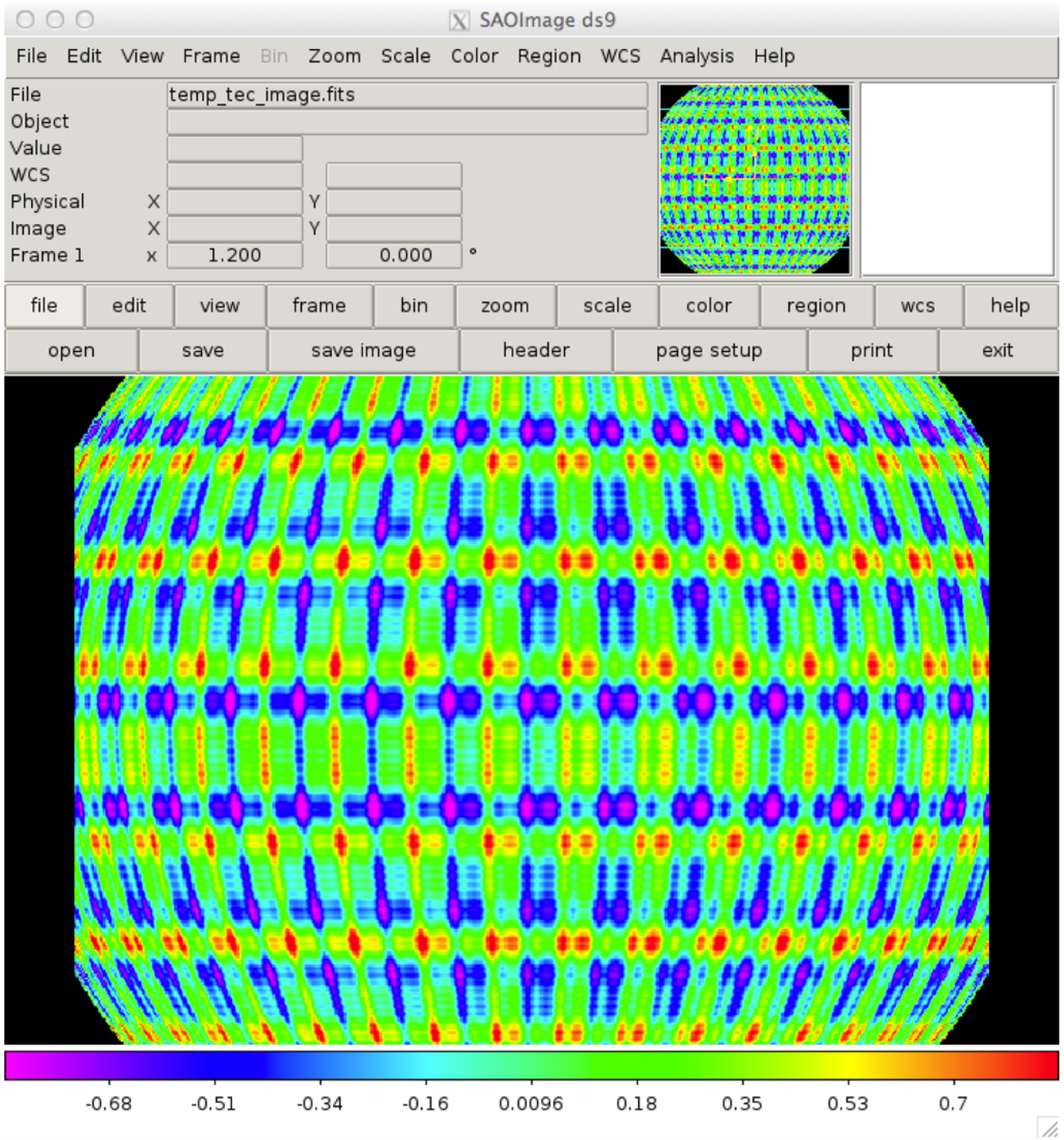
before clock removed

after clock removed

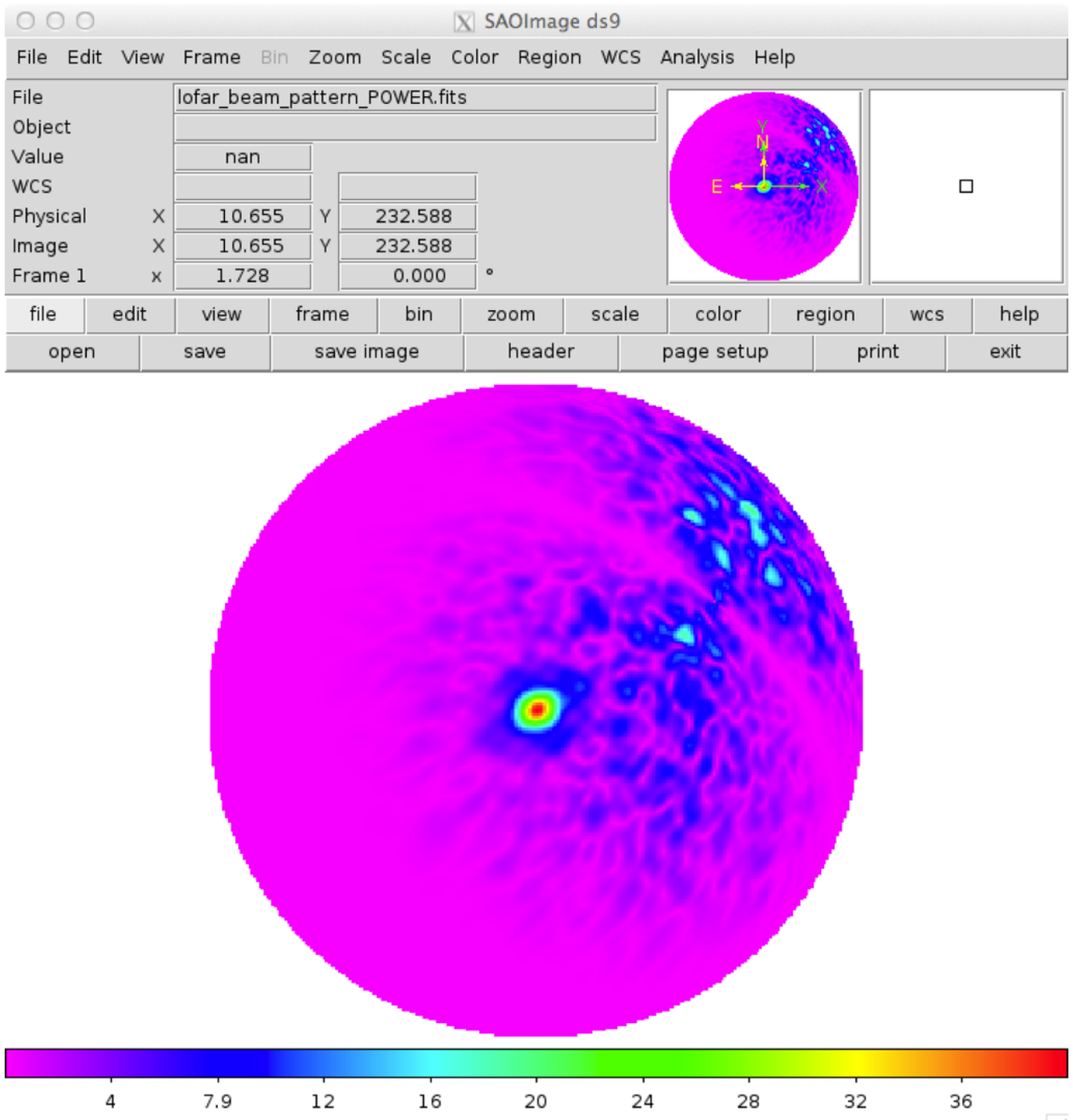
Simulations: OSKAR-2

by Ben Mort and Fred Dulwich in collaboration with Ilse van Bemmel and Maaijke Mevius

MIM (minimum ionospheric model),
initially consist of multiple TID (travelling ionospheric disturbance) components



all-sky station beam response in one polarisation at 75 MHz for the LOFAR LBA core station CS001 for an arbitrary observation direction and time



Field calibration

Members: B. Cotton H. Intema

Using the HBA data of 3C295 where the clock has been removed performed field calibration

conclusion

- 5 working groups...work in progress
- created a requirement list for the next version of the pipelines
- many feedbacks for the RO (cookbook, demix strategy ecc.)