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update from the

CALIBRATION AND IMAGING

Tiger Team 2

LOFAR Users meeting 23 June 2017

Emanuela Orrù, Tammo Jan Dijkema, David Rafferty, Andreas Horneffer, Tim Shimwell, Aleksandar Shulevski, Francesco De Gasperin, Bas van der Tol, Andre' Offringa, Maaijke Mevius + others

The mission of CITT2

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- The development of pipelines able to produce high fidelity LBA and HBA thermal limited noise images. Make them available to the user community via RO standard processing pipelines.

- Improvement of the efficiency and precision of the basic software packages (calibration and imaging).

We also do:
- Support of users (via email and github issues)

- Maintenance of the software (bug fix, rollout)

- Organisation of busy weeks: commissioning workshops with the added value of knowledge sharing events.

- Involvement in beam model project (setting requirements)

Time line

- Busy Week 25 at Astron 4-8 July 2016

- LBA workshop in Leiden 5-7 October 2016

- Busy Week 27 at Astron 18-21 April 2017

- Busy Week to be planned after the summer break

- Planned End of the project October 2017

Calibration software: DPPP
by T.J. Dijkema

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✓BBS has been replaced by DPPP in all the pipelines (only left for Faraday Rotation).

✓Multi frequency TEC solver

✓Solve for common scalar amplitude

✓Solve for multi-channels

➡ **Multi directional TEC solver (DD solver)**

- Joint work with A. Offringa; DD solver along the lines of Smirnov & Tasse 2015

- being tested (F. de Gasperin) still issues to be addressed

Imaging software: wsclean
by A. Offringa & S. Van der Tol

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- Wsclean has been adopted as the primary imaging software

- Image Domain Gridder (IDG)

  - Speedup of ~10× in gridding and degridding

  - Uses GPUs

  - Works well with A-term / phase screens

- **WSclean + IDG new imaging software under development**

  - Test images on GPUs show same results as WSclean.

  - September ready for commissioning

  - from 1/2 year up to 1 year development of the beam (a-term)

HBA pipelines

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Direction Independent

pre-FACTOR + Initial Subtract

✓ Regular Releases (now 2.02) available on https://github.com/lofar-astron/prefactor

✓ **to implement on RO production system CEP4.** Pilot test successful (thanks Yan Grange)

Direction Dependent

FACTOR

✓ Regular Releases (now 1.3) available on https://github.com/lofar-astron/factor

✓ Standalone software used to produce high quality science images.

✓ **make a decision on which DD software** will be used before implementation on RO production system.

D. Rafferty
A. Horneffer
T. Shimwell et al. in preparation

LBA Pipelines

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Direction Independent

PiLL

✓ Available on https://github.com/lofar-astron/PiLL

✓ Daytime observations showed better results so far

✓ **still rough, optimisation needed**

Direction Dependent

DD solver

✓ DD TEC solver implemented in DPPP

✓ **testing and more development needed**

✓ **Preliminary results showed improvement on the calibration.**

✓ **Development of TEC screens is ongoing.**

F. de Gasperin
T.J. Dijkema
A. Offringa
M. Mevius
A. Drabent et al.

LBA: Results from direction independent calibration
by F. de Gasperin

LOFAR 54MHz

Summary

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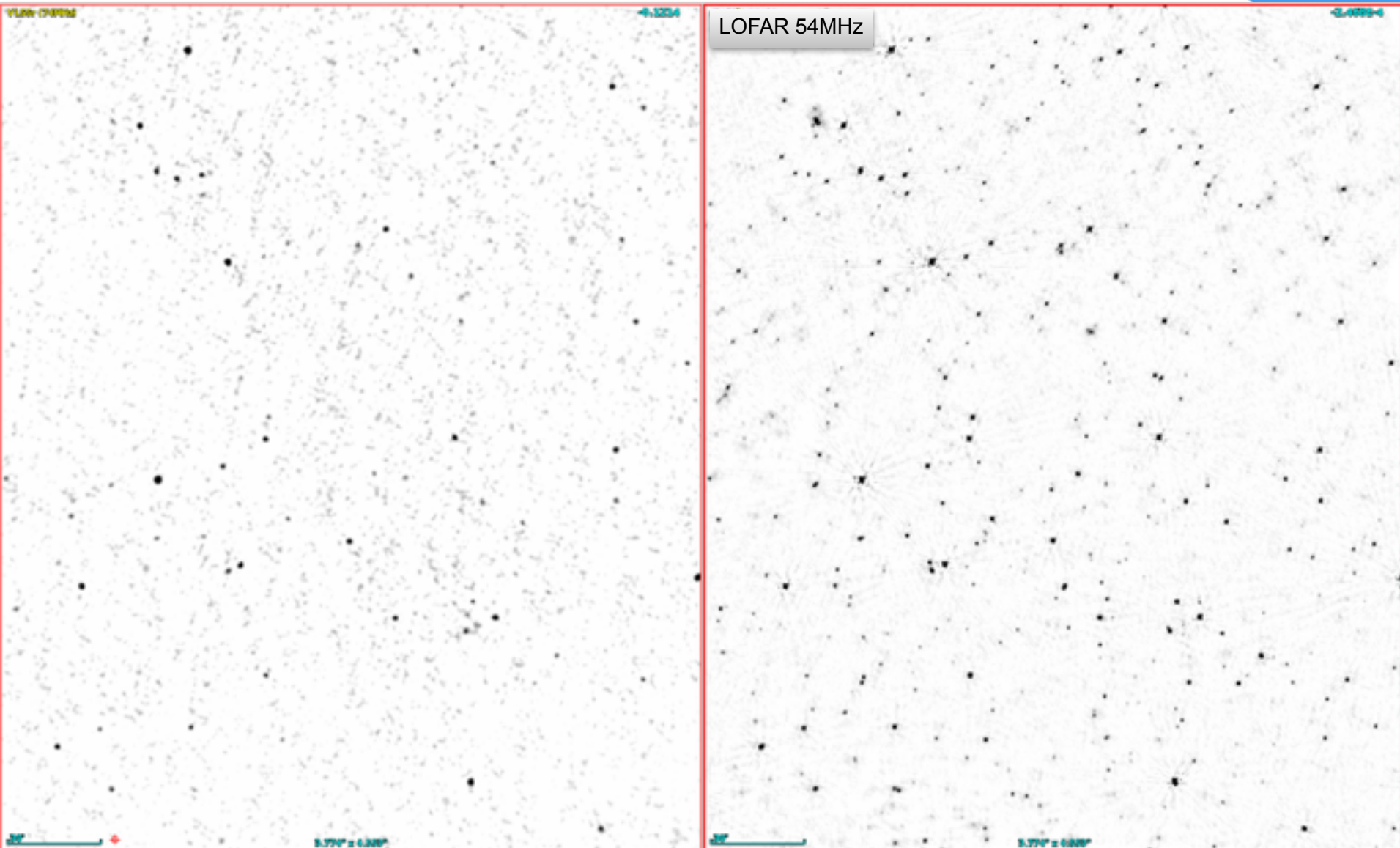
Achievements

- Prefactor is used by many people, and is the software used for direction independent calibration by the LoTSS survey

- FACTOR is being used to achieve thermal noise limited images

- PiLL is the first direction independent LBA pipeline, producing images ~5 times from the thermal noise.

TO do

- **Get pre-FACTOR to users: implement it on RO production pipelines**

- Decide which Direction Dependent software the RO should endorse for production HBA pipelines (FACTOR, DD TEC, KillMS, Sagecal)

- PiLL: optimisation of the code and extensive commissioning

- DD TEC solver: continue tests and development.

- WSclean+IDG continue commissioning + implement a-term

Summary (continued)

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Long term plan

Use the DD calibration software + phase screen fitting algorithm to replace FACTOR for the HBA

CONCERNS:

- Implementation of pre-FACTOR not in the RO software plan for 2017. No expectation could be given.

- No pipeline developer.

- What about maintenance and support of software after hand over?

- On paper CITT2 ends in October 2017. If not continued LBA calibration and more would be further delayed

- Not enough fully dedicated workforce for development, testing & documentation