

CITT UPDATE

E. Orru' on behalf of the Calibration and Imaging Tiger Team

OUTLINE

- NDPPP
- imaging
- pre-factor
- factor

BASIC COMPONENTS

Calibration: NDPP and BBS

NDPPP NEW Features:

- ✓ multi-channel solver (multiple solutions within one SB) >> to avoid decorrelation in LBA
- ✓ apply solution in gaincal >> to save one NDPPP step
- ✓ apply Faraday Rotation in NDPPP (needed specially in LBA)
- ✓ solve for common scalar amplitude (solve for scintillation in LBA)
- ✓ multi-frequency TEC solver (needed for bright sources in FACTOR and LBA to increase S/N)
- ✓ Average specifying freq and time resolution

Motivation:

- NDPPP becomes the only software for calibration
- Increased speed and flexibility
- Preparation for calibrating the LBA

Plan

- Replace BBS with NDPPP
- Facilitate the LBA calibration

To DO

- commission multi-frequency solver
- investigate on DDC
- performance

developed by
T.J. Dijkema

BASIC COMPONENTS

Imaging: AWIMAGER and WSClean

- *AWIMAGER2: to be imported in the production LOFAR software
- *AWIMAGER2: High priority multi-channel imaging
- *WSCLEAN: IDG run fine on CEP4. Developed a software layer to tight up on wsclean.
- ✓WSCLEAN: Average element beam correction is produced at the end of the imaging process.
- ✓Baseline dependent averaging implemented in WSclean and now in FACTOR

Plan

- Speed up both imaging algorithms using IDG
- Implement missing features

developed by S. van der Tol & A. Offringa + DOME project

HBA: instrumental calibration >> pre-FACTOR

Calibrator field >> to separates contribution of the instrumental delays from the ionospheric delays

Builded on generic pipeline in the LOFAR pipeline framework.

Calibrate the calibrator, then transfer the gain amplitudes (bandpass), clock delays and phase offsets to the target data

Direction-independent phase calibration of the target

Image and subtract sources.

Products

- data ready to be processes with DDC-selfcal
- the final image before the subtract step high quality adding one non direction independent self-cal loop

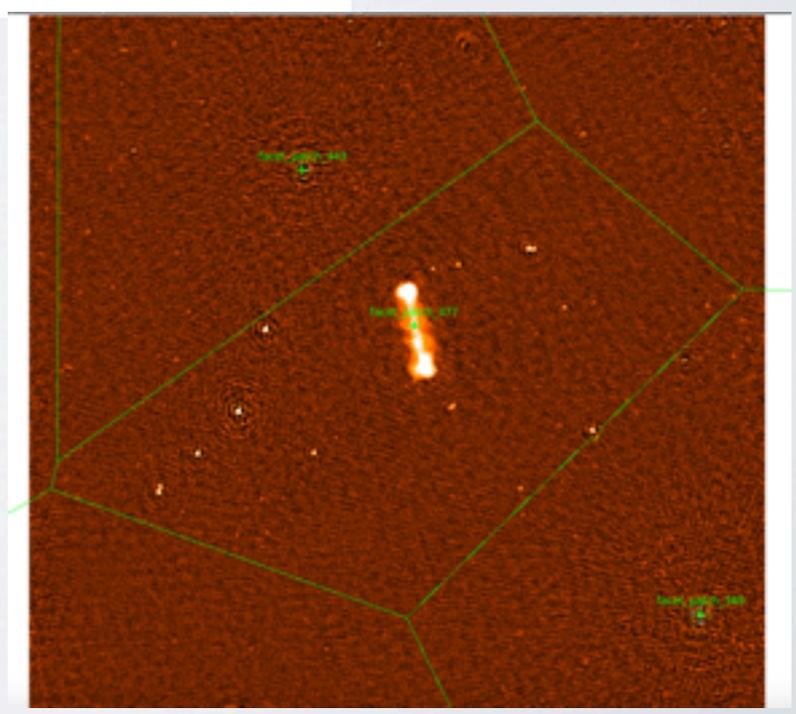
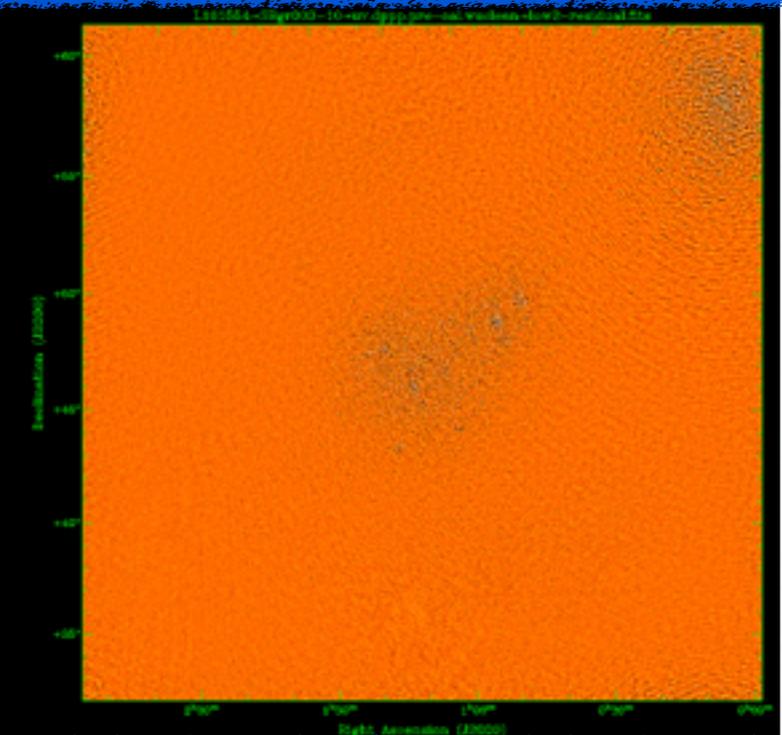
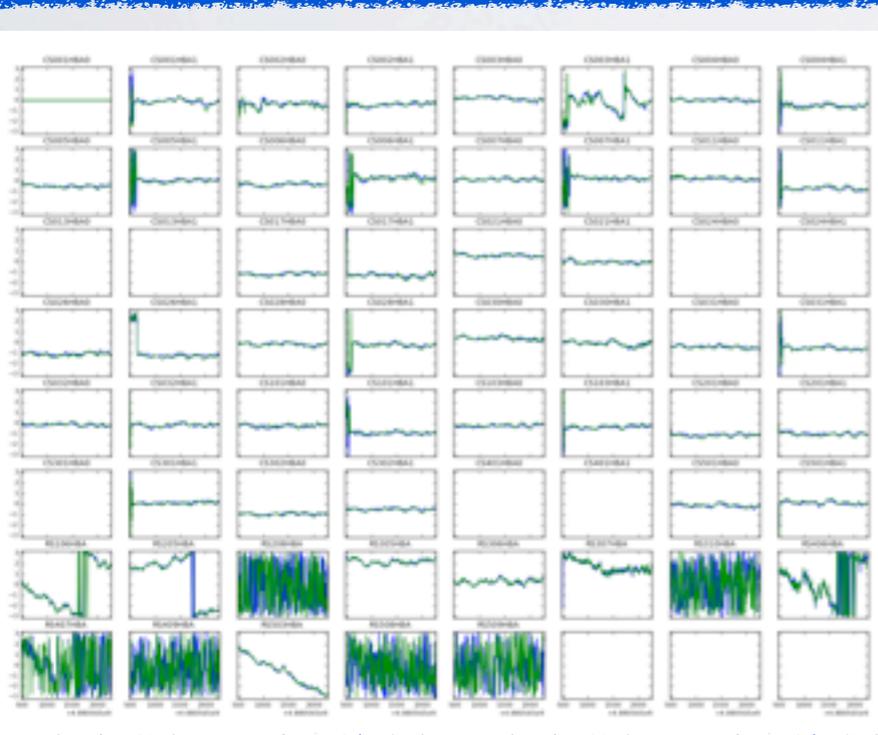
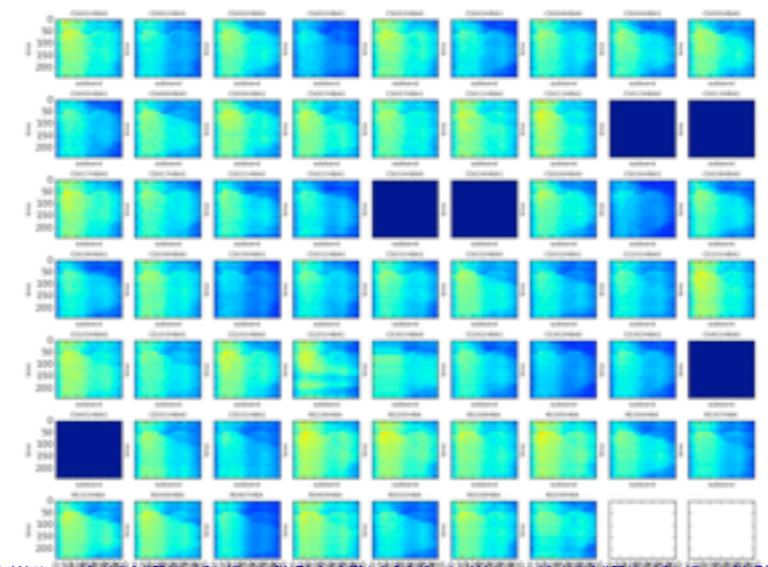
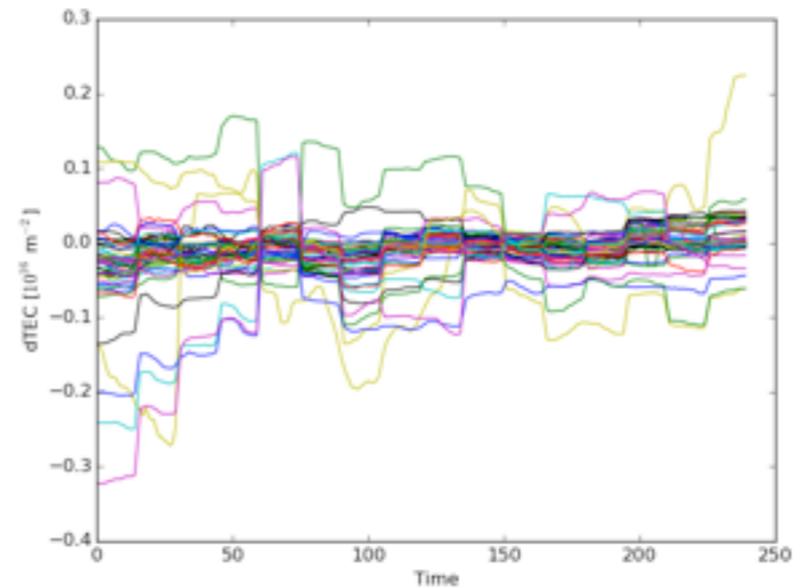
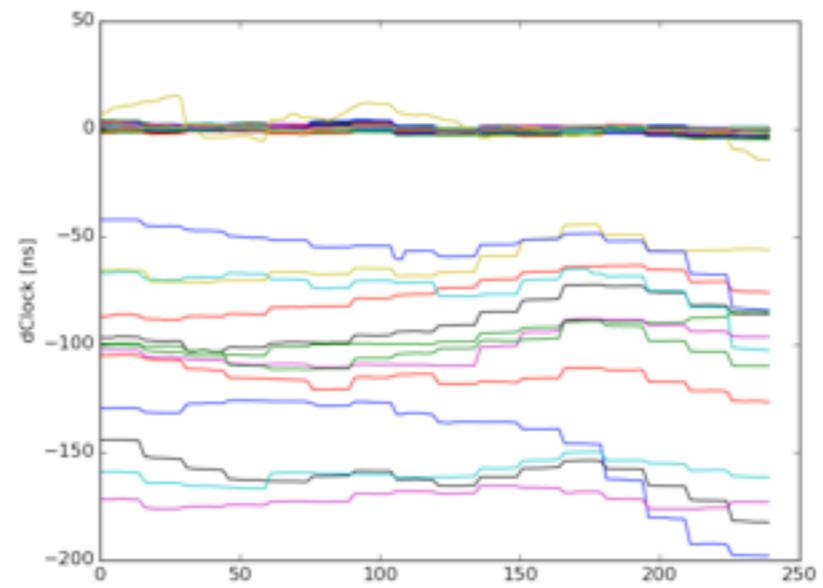
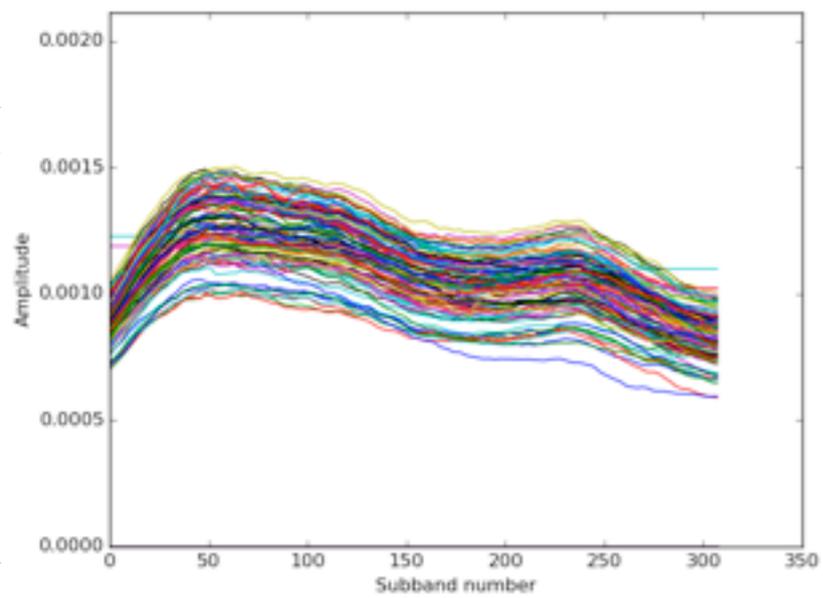
Plan

implement pre-factor in the RO pipeline replacing calibrator, target and imaging pipelines

To DO

1. Release version 2.0 (add RM-extract module (high resolution TEC maps, uses NDDDD for applycal and phase cal solving, use baseline averaging imaging)
2. pilot project for generic pipeline RO
3. full pre-FACTOR implementation in RO
4. Problem with V emission being suppressed

developed by A. Horneffer



HBA: direction dependent self-cal >> FACTOR

Target field >> Factor corrects for direction-dependent effects including ionospheric effects and beam-model errors.

By dividing up the field into many facets and solving for the direction-dependent corrections in each facet using the “peeling”

phase calibration on short time scale >> ionospheric effects
amplitude calibration long time scale >> residual beam errors

Supports interleaved and multi-night datasets as well as continuous observations.

designed to distribute of jobs over multiple nodes of a cluster and for the processing of facets in parallel.

Products

- instrumental-noise limited images (~ 0.1 mJy/beam for an 8-hour observation)
- high-resolution images (~ 5 arcsec FWHM)
- high-fidelity images

Plan

implement a semi-automatic version of FACTOR that users can use for post-processing

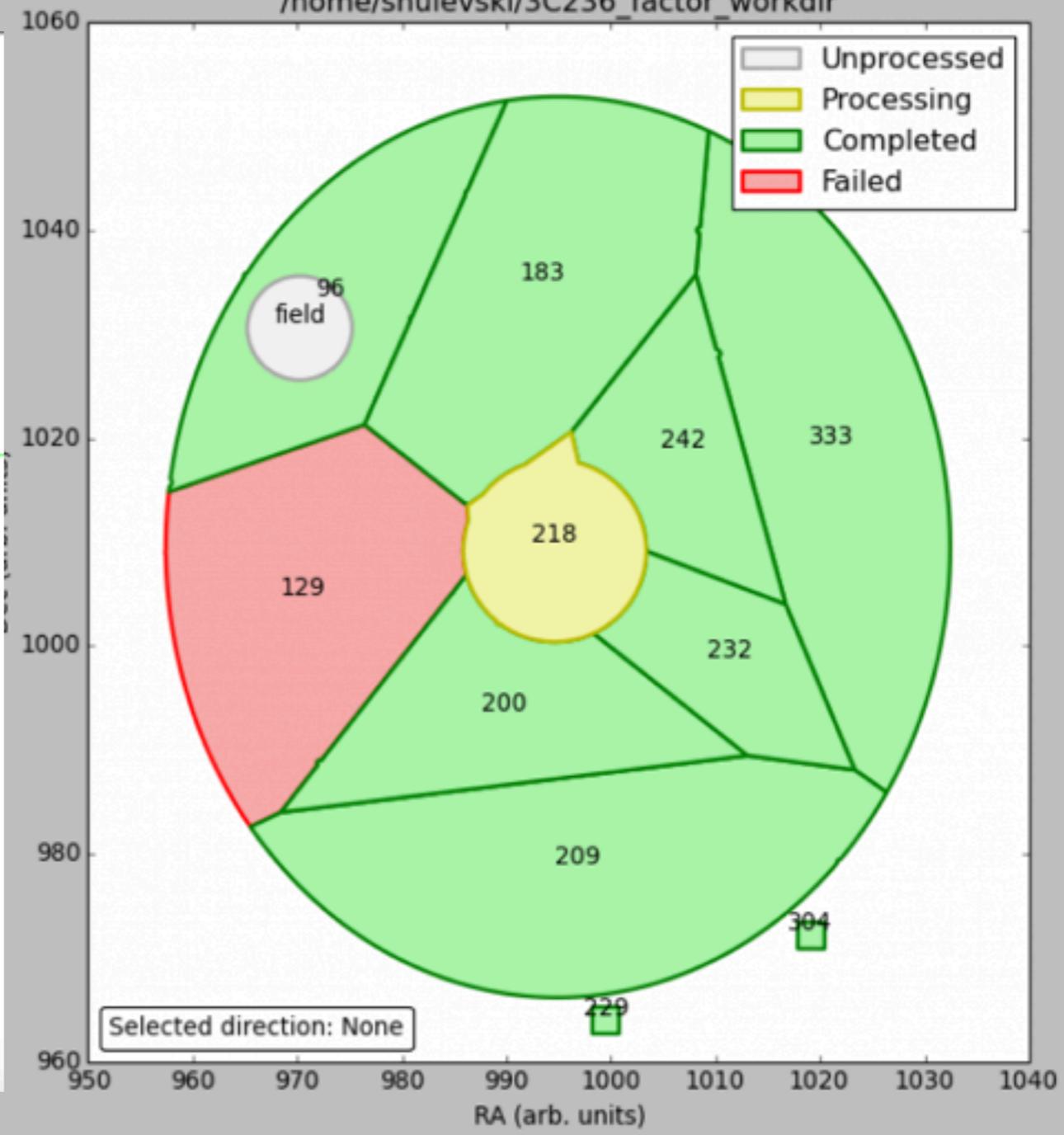
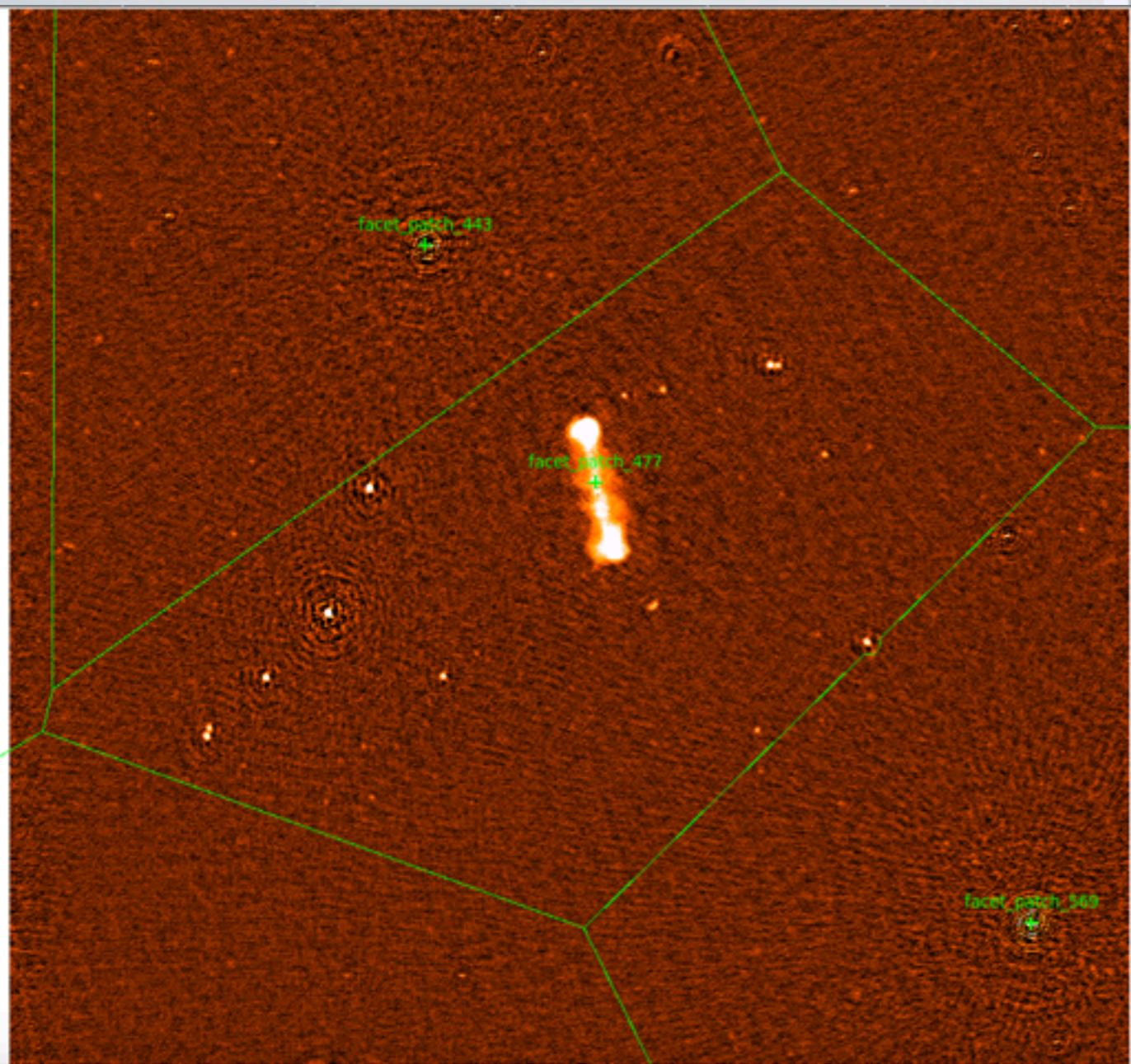
developed by D. Rafferty

Done

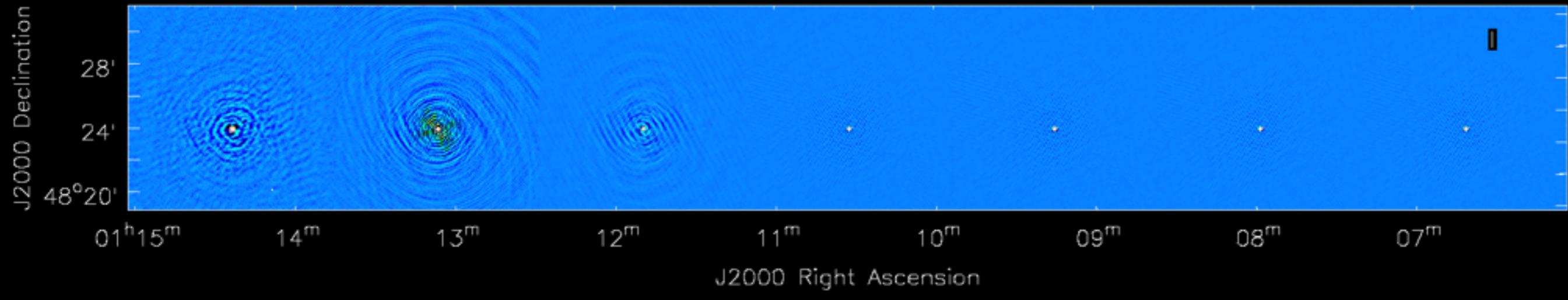
- implemented full frequency solver issues identified during BW being worked at the moment
- improve performance (e.g use NDPPP and baseline averaging imaging `WSClean v1.12a`)

TO DO

- complete the commissioning discuss features for initial release & organization of data-product
- add intelligence (calibrator choice, bad data excision..)



tempimage-raster



LBA

Calibrator field >> to separate contribution of the instrumental delays from the ionospheric delays and calculate bandpass gains
Target field >> fit a TEC screen

- ✓ DFR is solved both for the calibrator and target field.
- ✓ Calibrate the calibrator, then transfer the bandpass clock delays and phase offsets to the target data
- * Direction-dependent calibration of the target solving for the TEC over the all bandwidth for few calibrator sources
- * Fit a TEC screen

Status:

- TEC solver applied to the target field. Seems to treat polarization in a preferential way. Under investigation.
- difficult to understand how to tackle scintillation since it is DDE
- TEC maps might be used as starting point for correction
- Low S/N and high decorrelation complicate the scenario

Plan

Find a calibration procedure for the target field
Work in a close contact with ionospheric physicists

To DO

- TEC solver
- investigate on simultaneous DDC able to solve for TEC and amplitude
- Workshop Leiden 5-7 Oct
 - direction dependent calibration using: KillMS, Sagecal, Factor-LBA
 - ionospheric calibration: CT/separation, screen fitting, modeling
 - pipeline design
 - code implementation, developing of calibration schemes/ideas

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